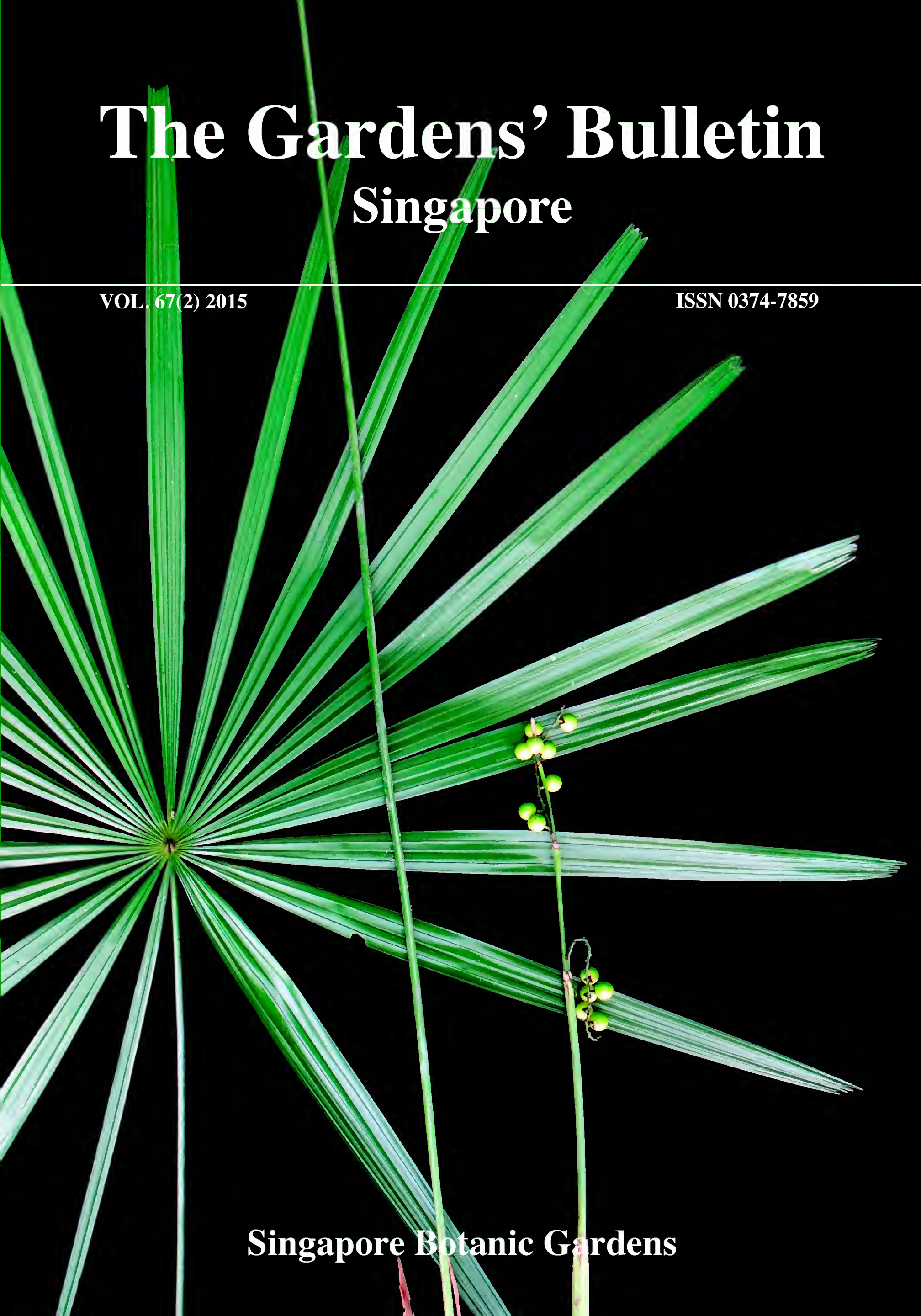
The Gardens' Bulletin
Singapore

VOL. 67(2) 2015 ISSN 0374-7859



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Persson, C. (2000). Phylogeny of Gardenieae (Rubiaceae) based on chloroplast DNA sequences from the *rps* 16 intron and *trn*L(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.

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Front cover picture: *Licuala miriensis* (Photo by K.M. Wong)

The Gardens' Bulletin
Singapore

VOL. 67(2) 2015 **ISSN 0374-7859**

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Date of publication: 23 December 2015

Printed by **Oxford Graphic Printers Pte Ltd**

Gardens' Bulletin Singapore 67(2): 253–259. 2015
doi: 10.3850/S2382581215000204

Cryptocarya nitens (Lauraceae), a new species record for Singapore

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ABSTRACT. *Cryptocarya nitens* (Blume) Koord. & Valeton is newly recorded for Singapore. It was discovered during surveys in Bukit Timah Nature Reserve and the Nee Soon Swamp Forest. A description is given, together with a key based mostly on vegetative characters for all *Cryptocarya* species occurring in Singapore. A short overview of the Lauraceae of Singapore shows that, in total, 57 species belonging to 14 genera have been recorded, of which 47 species in 13 genera are native. *Cryptocarya nitens* is lectotypified in addition to two of its synonyms.

Keywords. *Cryptocarya, Endiandra*

Introduction

Species of the Lauraceae (Laurel Family) are of major ecological and economic importance in Southeast Asia as they comprise a major part of almost any forest in the region. The family is very complex, posing many challenging taxonomic and systematic questions, and for various reasons the identification of species is problematic. Some systematic work has been done, for instance Kostermans (1952, 1957a, 1957b, 1964) wrote a series of papers on various genera or parts of genera during his career, and he also dealt with some aspects of the higher taxonomy. The most recent overview of the family as a whole was by Rohwer (1993). In Eastern Asia and Australasia, only for Peninsular Malaysia (Kochummen, 1989), China (Li Xiwen et al., 2008) and Australia (Le Cussan & Hyland, 2007) are recent treatments available, dealing with all species occurring in their territories. The classification and delimitation of the genera within the Lauraceae has always been problematic. The general framework of characters which has been employed by most authors was first established by Nees von Esenbeck (1836) in his classification of the family. However, the outcome of such a classification can vary greatly, depending upon the weight given to each particular character. Recently, with the help of molecular data, some taxonomic relationships are becoming clearer (Rohwer et al., 2014).

The checklist for Singapore records 57 species of Lauraceae, of which only 47 are native (Chong et al., 2009). This is a high percentage (82%) of native taxa for a plant family as the average for Singapore is 51.3% (Chong et al., 2009). Amongst the native species of Lauraceae, the vast majority have a widespread distribution, occurring also in Peninsular Malaysia and at least one other area, such as Borneo and/or Sumatra. No Lauraceae are restricted to Singapore and only two species found in

Singapore are endemic to the Malay Peninsula (*Actinodaphne malaccensis* Hook.f. and *A. pruinosa* Nees). According to Kochummen (1989) and De Kok (in press I & II), almost all Lauraceae species native to Singapore are found growing in lowland forest and usually also in hill or montane forest, or rarely also in swamp forest in Peninsular Malaysia. Two species are restricted to swamp forest (e.g. *Litsea gracilipes* Hook.f and *Nothaphoebe coriacea* Kosterm.).

Most of the species recorded from Singapore are reported as common in Peninsular Malaysia (Kochummen, 1989; De Kok, in press I, in press II). However, in Singapore, these taxa have been assigned a wide range of of conservation assessments (Fig. 1, column 1), from extinct (ex), critically endangered (ce), endangered (en), vulnerable (vu) to common (co) (Chong et al., 2009). In contrast, those species that are reported to be rare, uncommon or scattered in Peninsular Malaysia have been assigned to a more restricted set of conservation assessments, namely extinct, endangered or critically endangered (Fig. 1, column 2).

Most genera recorded as native in Peninsular Malaysia are also native in Singapore, with three exceptions. The first two are not problematic: *Hexapora* Hook.f. is a monotypic genus endemic to Penang Island; *Cinnadenia* Kosterm. is a genus of two species which is represented in Peninsular Malaysia by only one species from the hill forests of Selangor and Negeri Sembilan. However, the third exception, *Endiandra* R.Br., is curious. It does not seem to be native in Singapore as the two recorded

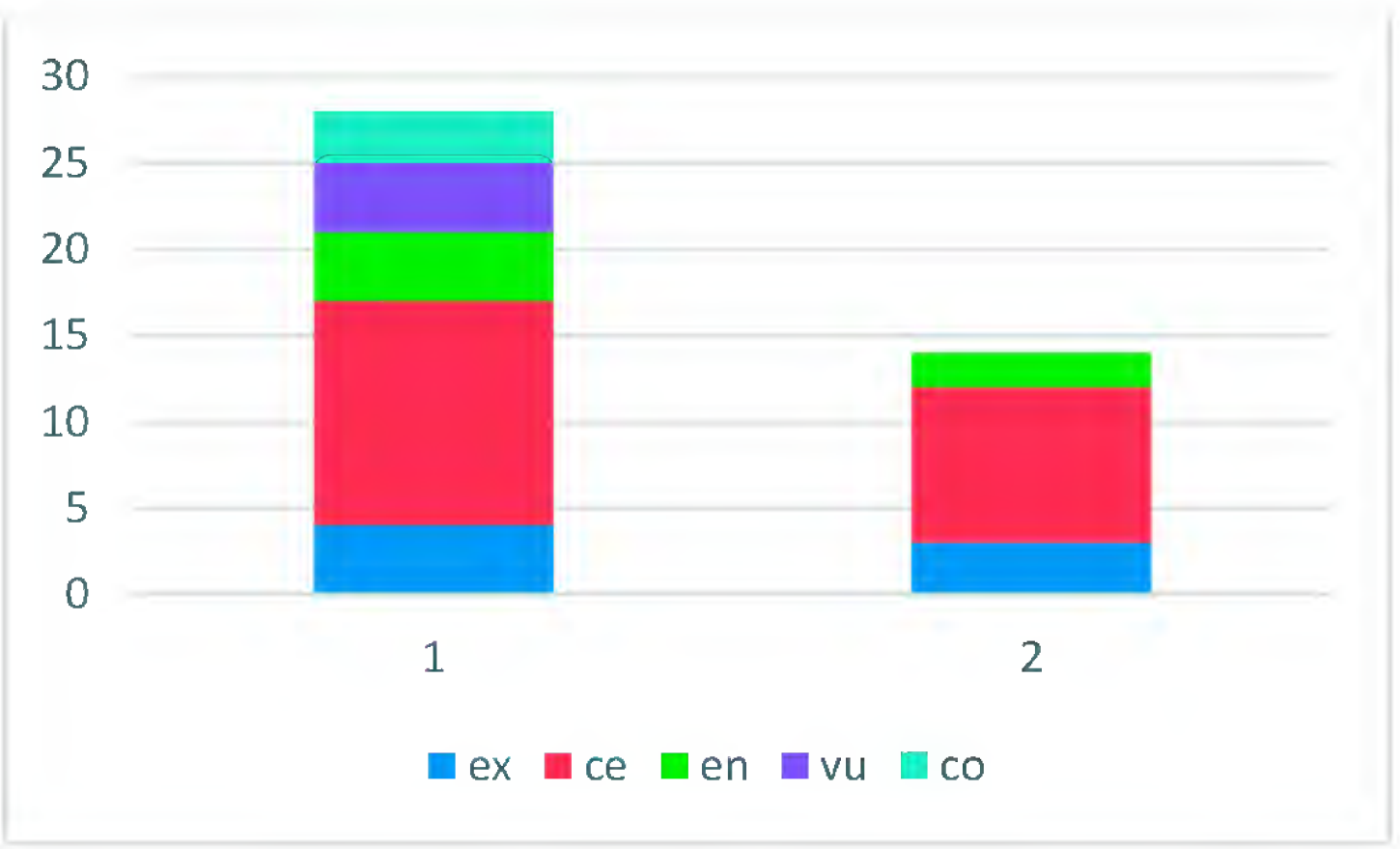

Fig. 1. The conservation status of Lauraceae in Singapore. Column 1 shows the conservation status in Singapore for species that are common in Peninsular Malaysia; Column 2 shows the conservation status in Singapore for those that are rare, scattered or uncommon in Peninsular Malaysia. ex = Extinct, ce = Critically endangered, en = Endangered, vu = Vulnerable, co = Common in Singapore (based on Chong et al., 2009).

species, *Endiandra impressicosta* C.K.Allen and *E. longipedicellata* C.T.White & W.D.Francis, are only known from cultivation and are originally from Australia and New Guinea, not from Peninsular Malaysia (Kochummen, 1989). Of the ten species in this genus that are native to Peninsular Malaysia, most are reported to be rare, with only two (*Endiandra macrophylla* (Blume) Boerl. and *E. maingayi* Hook.f) said to be common in lowland forest (Kochummen, 1989). As stated earlier, species that are considered uncommon in Peninsular Malaysia tend to be (critically) endangered or extinct in Singapore (see Fig. 1, column 2), so the absence of *Endiandra* as a native genus in Singapore is possibly the result of local extinction (before a single specimen could be collected), rather than a natural phenomenon.

New record for Singapore

During my visit to the Herbarium of Singapore Botanic Gardens in May 2015, I was able to confirm the identification of *Cryptocarya nitens* (Blume) Koord. & Valeton, which is a new record for Singapore. This species was collected twice in 2006 from Bukit Timah and more recently, but sterile, from a survey of the Nee Soon Swamp Forest.

Cryptocarya nitens (Blume) Koord. & Valeton, Meded. Lands Plantentuin 68: 220–223 (1904); Kochummen, Tree Fl. Mal. 4: 136 (1989). – *Tetranthera nitens* Blume, Mus. Bot. 1: 375 (1851). – Type: [Indonesia] Java, *Blume* s.n. (lectotype L [L0036214], designated here; isolectotype L [L0036213]). (Fig. 2)

Cryptocarya areolata Gamble, Bull. Misc. Inform. Kew 1910: 144 (1910). – Type: [Peninsular Malaysia] Perak, May 1884, *King's collector 6171* (lectotype K, designated here; isolectotypes BM [BM001124601], L [L0036209, L0036210], P [P02010230], SING [SING0209177, SING0209178]).

Cryptocarya bubongana Gamble, Bull. Misc. Inform. Kew 1910: 144 (1910). – Type: [Peninsular Malaysia] Ulu Bubong, July 1886, *King's collector 10570* (lectotype K [K001084494], designated here; isolectotypes K [K001084495], SING [SING0046590]).

Cryptocarya nativitatis Rendle ex Baker.f. in Andrews, Monogr. Christmas Isl. 187 (1900). Type: [Australia] Christmas Island, Phosphate Hill, 1897, *Andrews 158* (holotype BM [BM000799315]; isotypes BO, K [K000768438], SING [SING0069586].

Trees 8–30 m tall, dbh 15–30 cm. ***Bark*** smooth or scaly, grey-brown, inner bark brownish, wood cream coloured with spicy odour. ***Twigs*** strongly angular when young, velutinous, hairs brown. ***Leaf lamina*** leathery, elliptic to lanceolate, ovate to

obovate (6–)7.5–23 × (2.2–)3.5–10.5 cm, apex acute to acuminate, base cuneate or rounded, slightly unequal; pinnately veined, secondary veins 5–10 pairs, tertiary veins scalariform; upper surface glabrous, sometimes with hairs on midrib and secondary veins, midrib sunken, secondary veins sunken, tertiary veins faint, shiny, (light to yellow) green, drying greenish brown; lower surface glabrous sometimes with hairs on midrib and secondary veins, midrib and secondary veins raised, tertiary veins faint, light blue, pale green, glaucous. ***Petiole*** slender, 10–30 mm long, velutinous. ***Inflorescences*** 10–15 mm long, velutinous, greenish white; bracteoles triangular 0.5–0.6 mm long, caducous. ***Flowers*** pale green to yellow or white, hairs yellowish; perianth tube 1.2–1.6 mm long, velutinous; perianth lobes elliptic to lanceolate, 1.3–1.8 × 0.8–1 mm, apex acute, velutinous, greenish white. ***Stamens*** 1.2–1.6 mm long, hairy, dull greenish yellow, anther bright yellow-orange. ***Ovary*** clavate, 1–1.2 mm, glabrous; style 1.2–1.6 mm long, linear; stigma inconspicuous. ***Fruit*** (dried) globose, 8–16 mm diameter, shallowly ridged, sparsely hairy, black when mature. ***Stalk*** slender when mature.

Distribution. Peninsular Thailand, Malaysia, Singapore, Indonesia (Sumatra and Java), Australia (Christmas Island).

Ecology. Over its general range it is found on riversides in open, mixed (including bamboo) hill to lowland forest, growing on limestone, sandstone and granite, at 0–250 m altitude. In Singapore recorded from swamp forest and along water courses.

Provisional regional IUCN conservation assessment. Least Concern.

Phenology. Flowering from March to October; fruiting from January to November.

Notes. In the original description of *Tetranthera nitens* Blume (1851: 375), only one collection is cited, of which there are two morphologically virtually identical L specimens available for lectotypification. The specimen L0036214 is selected here as lectotype because the label mentions at least some of the additional information cited in the original description, while the other specimens lacks any label data.

In the original description of *Cryptocarya areolata* Gamble (1910: 144), four different collections are cited: *King's collector 6017, 6171, 8630* and *Wray 2456.* Gamble's top set of specimens are housed at K and from these the duplicate of *King's collector 6171* is selected here as the lectotype. It, uniquely amongst the syntypes, has dissected flowers glued on a card with notes in Gamble's handwriting.

In the original description of *Cryptocarya bubongana* Gamble (1910: 144), only one collection is cited: *King's collector 10570.* From the two virtually identical K collections (both morphologically and in label date), one is selected here as the lectotype [K001084494].

This species is easy to distinguish from the other Singaporean *Cryptocarya* species as the under surface of its leaves is glabrous. In all other species have small appressed hairs can be seen with a × 10 hand lens.

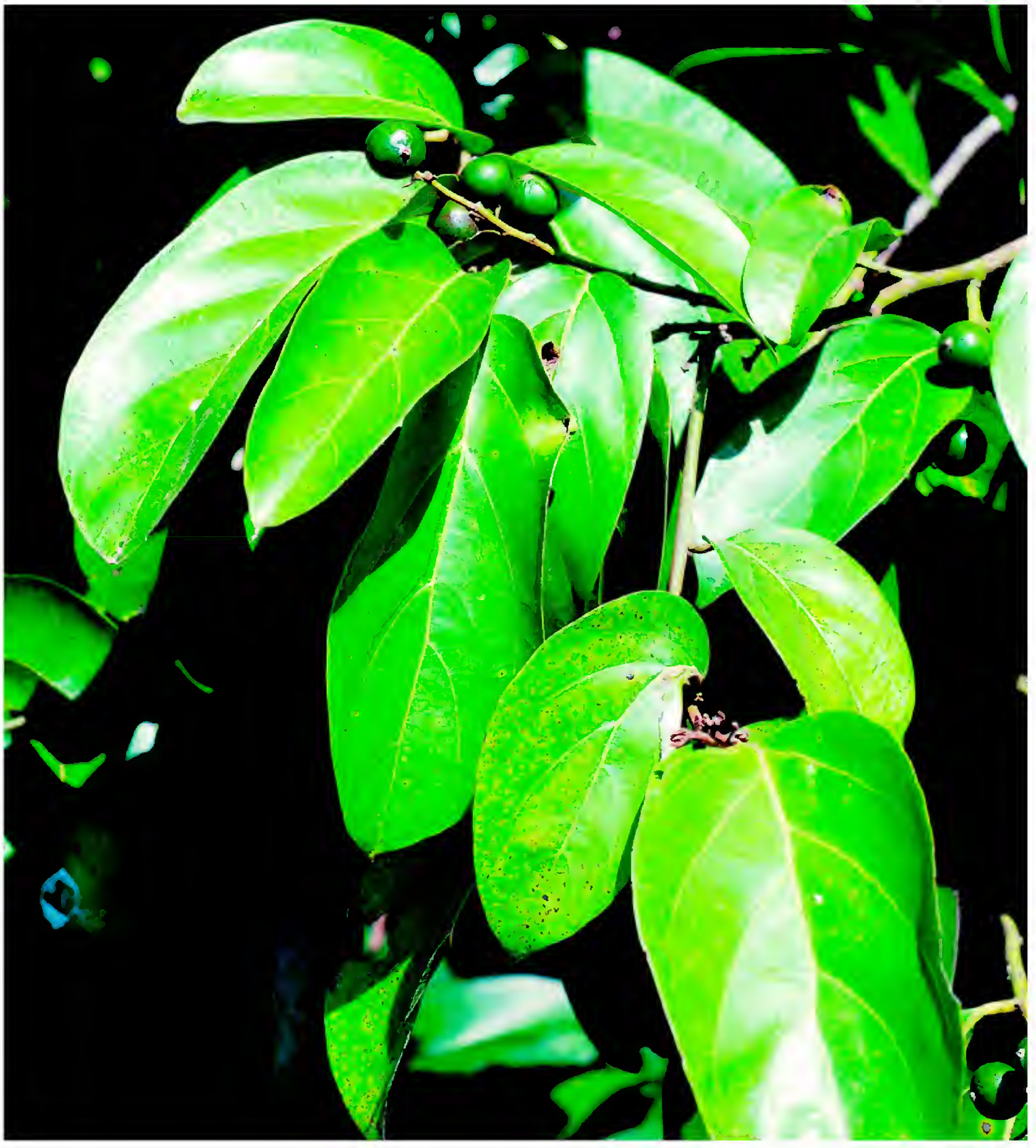

Fig. 2. *Cryptocarya nitens* (Blume) Koord. & Valeton, twig with fruits photographed from the Bogor Botanic Gardens, tree no. XX.B.59. (Photo: Jens Rohwer)

Selected specimens examined. SINGAPORE: Bukit Timah Nature Reserve, Public Utilities Board Catchment, 27 Jun 2006, *Khoo KMS 14* (SING); ibidem, 7 Jul 2006, *Chua CSC 1* (SING).

Key to the *Cryptocarya* species in Singapore based mostly on vegetative characters

1a. Lower surface of mature leaves glabrous apart from veins ..... *C. nitens*
1b. Lower surface of mature leaves sparsely hairy to velutinous 2

2a. Midrib sunken at base on upper leaf surface 3
2b. Midrib raised at base on upper leaf surface 5

3a. Petiole channelled; bracteoles elliptic, < 1 mm long ..... *C. ferrea*
3b. Petiole half terete; bracteoles elliptic to lanceolate or linear, > 1 mm long 4

4a. Leaves leathery; bracteoles elliptic to lanceolate, (1.5–)2–3.5 mm long ..... *C. rugulosa*
4b. Leaves thinly leathery; bracteoles linear, 1.1–1.8 mm long ..... *C. kurzii*

5a. Leaves bullate; petiole swollen ..... *C. griffithiana*
5b. Leaves not or only slightly bullate; petiole slender 6

6a. Leaf base symmetrical, hairs rusty to dark brown (when dried) ..... *C. impressa*
6b. Leaf base slightly oblique, hairs light brown (when dried) ..... *C. malayana*

ACKNOWLEDGEMENTS. This research was supported in 2015 by a Singapore Botanic Gardens Research Fellowship which is gratefully acknowledged. The author is grateful to Dr Helen Fortune-Hopkins who corrected my English, to Dr Jens Rohwer who kindly gave permission to use his pictures, and to the curators of the BM, BO, K, KEP, L and SING herbaria for access to the specimens used in the present study.

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Gardens' Bulletin Singapore 67(2): 261–265. 2015
doi: 10.3850/S2382581215000216

Boesenbergia basispicata (Zingiberaceae), a new record for Peninsular Malaysia

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ABSTRACT. *Boesenbergia basispicata* K.Larsen ex Sirirugsa was recently discovered from a limestone hill in Perak, Peninsular Malaysia. This brings the total number of *Boesenbergia* species in Peninsular Malaysia to 12. A description, colour plates and notes on this species are provided.

Keywords. Limestone, Peninsular Thailand, Perak

Introduction

Boesenbergia Kuntze is a genus of gingers found in tropical Asia. The genus consists of about 80 species ranging from India to China and Southeast Asia (Larsen et al., 1998; Saensouk & Larsen, 2002; Mood et al., 2014). Holttum (1950) published the first comprehensive treatment of the genus in Peninsular Malaysia in which he recognised eight species, namely *Boesenbergia clivalis* (Ridl.) Schltr., *B. curtisii* (Baker) Schltr., *B. flava* Holttum, *B. longipes* (King & Prain ex Ridl.) Schltr., *B. plicata* (Ridl.) Holttum, *B. prainiana* (King ex Baker) Schltr., *B. pulcherrima* (Wall.) Kuntze and *B. rotunda* (L.) Mansf. Among these, *Boesenbergia rotunda* is not considered to be native as only cultivated plants were sighted. Since then, there was no taxonomic work on the genus in Peninsular Malaysia until Lim (2008) named a new species, *Boesenbergia kenali* C.K.Lim, from Kelantan. He also provided a checklist for Peninsular Malaysian *Boesenbergia* in which 11 species were listed. The species newly added to the list included *Boesenbergia lurida* (Ridl.) Loes., which was resurrected from synonymy of *B. plicata* (Ridl.) Holttum, and the rediscovery of *B. minor* (Bak.) Schltr. Recently, a Thai species, *Boesenbergia basispicata* K.Larsen ex Sirirugsa, was discovered in northern Peninsular Malaysia, adding another species to the list.

Boesenbergia basispicata K.Larsen ex Sirirugsa, Nordic J. Bot. 7: 423 (1987); Sirirugsa, Nat. Hist. Bull. Siam Soc. 40: 67 (1992). – TYPE: Thailand, Nakhon Si Thammarat, Kao Luang, in evergreen forest, 300 m, 2 May 1926, *Kerr 15575* (holotype K; isotypes BK, BM). (Fig. 1)

Rhizomatous evergreen herb c. 50 cm tall, 1–(2) leafy shoots per clump. ***Rhizome*** short, not branched, 8–10 mm in diam., light yellow internally, roots tuberous. ***Leafy shoot*** composed of 3–4 leaves, arranged distichously, with no obvious pseudostem; *bladeless sheath* 1–2, to 11 cm long, mottled with red, soon decaying; *leaf sheath* 11.5–15 cm, longitudinally ridged, green mottled sparsely with red, margin thin and broad; *ligule* thin, bilobed, lobes triangular, c. 2 mm long; *petiole* 11.5–15 cm long, deeply channelled; *lamina* ovate to narrowly ovate, largest 25–28 × 10.3–13.5 cm, adaxially green, main veins slightly raised (not plicate), abaxially pale green, tinged red on old leaves, apex acute to attenuate, base oblique and subcordate. ***Inflorescence*** radical, 7.5–9 cm long, mottled with red; *peduncle* 1–3 cm long, covered with sheathing bract; *spike* conical, 6.5–8 cm long, composed of 10–11 distichously arranged overlapping fertile bracts (lowermost bract sterile); *fertile bracts* 22–28 × c. 10 mm, elliptic, boat-shaped, glabrous, apex acute, margin incurved, each bract supporting single flower; *bracteole* 17–20 mm long, shorter than bract, cylindrical, open to the base, glabrous, apex acute. ***Flower*** 4–5 cm long, white except the variegation on labellum; *calyx* c. 5 mm long, tubular, glabrous, apex truncate, sometimes with a slight incision; *floral tube* 30–35 mm long, slender, c. 1 mm in diam. at base, widening to 2 mm distally, glabrous externally and internally; *corolla lobes* c. 13 × 4–6 mm, elliptic, membranous, apex obtuse, margin incurved but not overlapping, dorsal lobe with hooded apex; *androecial tube* c. 1 cm long, sparsely hairy internally; *labellum* c. 18 × 17 mm, saccate, suborbicular, abaxially sparsely hairy, white, centrally yellow mottled with red, the yellow extending as 2 bands to apical, ending c. 5 mm before touching the apex, apical area chilli-red, slight pinkish tinge on both sides, apex wrinkled and deflexed, margin entire; *lateral staminodes* c. 10 × 5 mm, broadly elliptic, sparsely hairy abaxially, apex broadly acute. ***Stamen*** c. 7 mm long, with sparse glandular hairs abaxially; *filament* c. 2 mm long; *anther* c. 6 mm long, without anther-crest, anther thecae dehiscing longitudinally. ***Ovary*** obovoid, c. 3 mm long, glabrous, unilocular, free-basal placentation in mature flowers; *style* c. 46 mm long, filiform, glabrous, stigma less than 0.5 mm long, club-shaped, glabrous, ostiole transverse, without cilia, face upwards; *epigynous glands* 2, c. 5 mm long, filiform. ***Fruit*** c. 10 × 5 mm, ellipsoid, glabrous, wall thin and translucent (dehiscence not observed); *seeds* ellipsoid, c. 7 × 2 mm, arillate, aril white, laciniate.

Additional specimens examined: PENINSULAR MALAYSIA: **Perak:** Hulu Perak, Belukar Semang Forest Reserve, Bukit Telor Ayam 1, limestone hill area, 15 Nov 2011, *Mohd. Hairul et al. FRI 72405* (KEP); Tanah Hitam, limestone hill next to Rahman Plantation, 372 m altitude, 5°35.80' N 101°00.09' E, 17 Jul 2012, *Sam FRI 68937* (KEP).

Habitat and ecology. Herbaceous vegetation on karst limestone substrate, surrounded by regenerating lowland evergreen rainforest. The plants were found on two small limestone outcrops covered with thick vegetation. They were seen growing in the crevices and ledges on the outcrop, about 10 m above the ground. These narrow pockets contained thick humus supporting the growth of herbaceous plants such as *Boesenbergia basispicata*, aroids (*Arisaema fimbriatum* Mast.), gesneriads (*Damrongia*

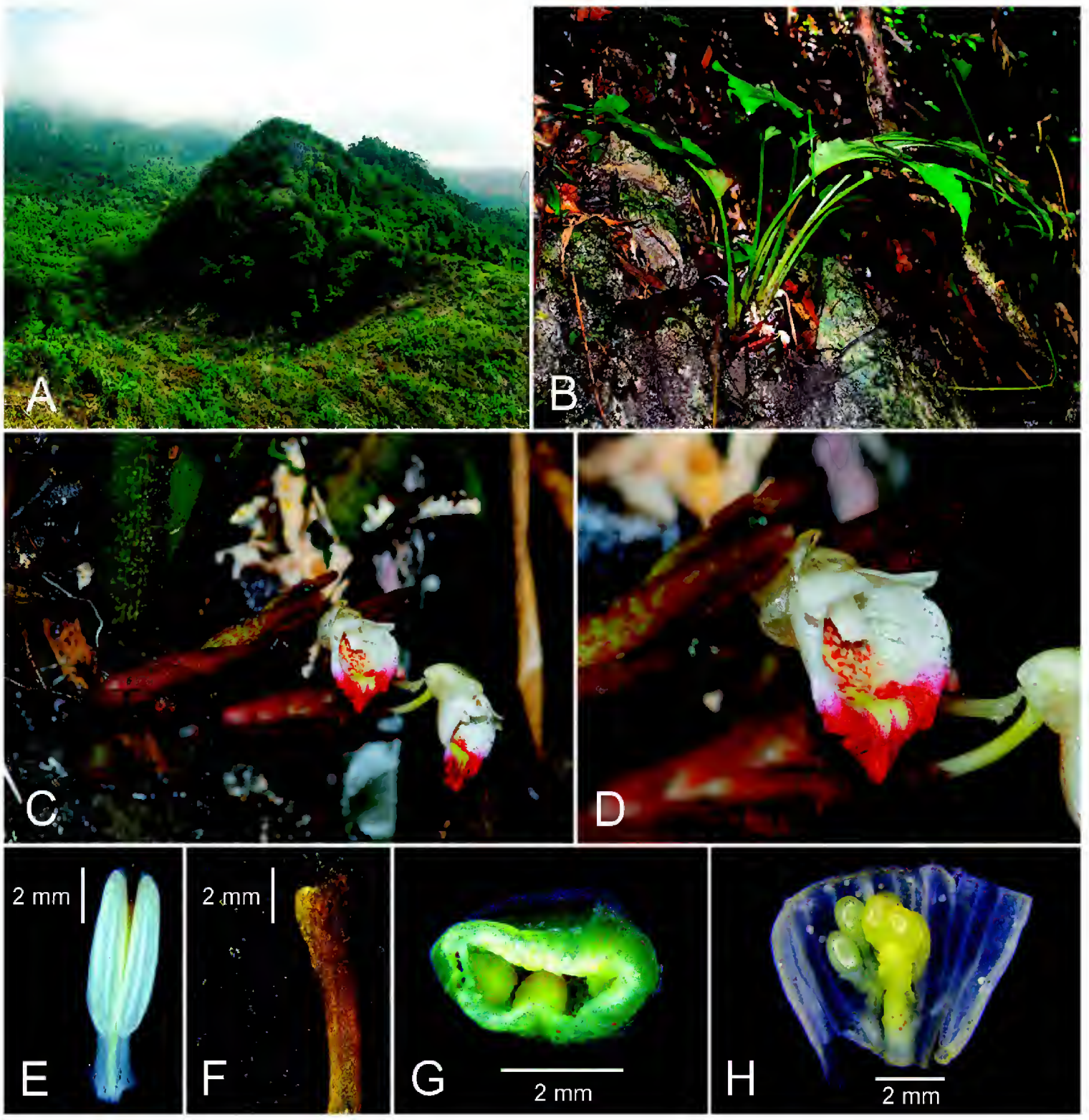

Fig. 1. *Boesenbergia basispicata* K.Larsen ex *Sirirugsa*. **A.** The limestone outcrop where the plants were found, adjacent land has been cleared for planting rubber trees. **B.** Plant clinging onto the limestone cliff face. **C.** Radical inflorescences. **D.** Flower. **E.** The dehisced anther thecae. **F.** Stigma. **G.** The cross section of ovary. **H.** Free-basal placentation. (Photos: Y.Y. Sam)

lacunosa (Hook.f.) D.J.Middleton & A.Weber, *Epithema saxatile* Blume, *Microchirita rupestris* (Ridl.) A.Weber & Rafidah, *Paraboea verticillata* (Ridl.) B.L.Burtt), ferns and lycophytes (*Adiantum malesianum* Ghatak, *Pyrrosia penangiana* Holttum, *Selaginella frondosa* Warb.). This is the first report of *Boesenbergia basispicata* growing on a limestone substrate. In Southern Thailand, the plants are often found on damp slopes (Sirirugsa, 1992) and also near streams on sandstone with thick leaf litter (Mood, pers. comm.) in lowland evergreen forest.

The population of *Boesenbergia basispicata* at Belukar Semang Forest Reserve is potentially threatened by disturbance. Firstly, the Forest Reserve may suffer from encroachment through illegal land clearance, since it is now adjacent to a rubber plantation and thereby more accessible. Secondly, the land clearance for the adjoining rubber plantation has adversely affected the environment as the humidity and temperature have become less favourable to understorey plants like *Boesenbergia basispicata*.

Distribution. Peninsular Thailand and Peninsular Malaysia.

Notes. *Boesenbergia basispicata* was first discovered in Nakhon Si Thammarat and Trang Provinces, Peninsular Thailand (Sirirugsa, 1987) and later in the southernmost province of Narathiwat (Sirirugsa, 1992). It is one of only around eight species of *Boesenbergia* with an inflorescence emerging directly from the rhizome; most species produce a terminal inflorescence. In Peninsular Malaysia, *Boesenbergia basispicata* is the first species recorded with a radical inflorescence and this makes it easy to distinguish from the other species with a terminal inflorescences, especially from the otherwise similar *B. prainiana*.

In general, the plants at Belukar Semang Forest Reserve fit Sirirugsa's descriptions but differ in the ovate to narrowly ovate laminas with subcordate bases, whereas the Thai plants have oblong laminas with obtuse or cuneate to decurrent bases, the broader laminas (10.3–13.5 vs 4–9.5 cm), longer peduncles (1–3 vs 0.5 cm) and floral tubes (30–35 vs 25 mm) and smaller fruits (c. 10 × 5 mm vs c. 7 × 2 mm). A reviewer also noted that pseudostems have been observed in Thai populations. Another marked difference observed in the Peninsular Malaysian plant is its unilocular ovary with free-basal placentation in contrast to the incompletely trilocular ovary in Siriruga's account.

ACKNOWLEDGEMENTS. This study is supported by the 'Documentation and Inventory of Flora Malaysia' Project under the Ministry of Natural Resources and Environment's Tenth Malaysian Plan. The author would like to thank Dr Ruth Kiew and Dr R.C.K. Chung, for their comments and suggestions on the manuscript, and Mohd. Hairul Mohd. Amin and Angan Atan, for their assistance in the field.

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Gardens' Bulletin Singapore 67(2): 267–274. 2015
doi: 10.3850/S2382581215000228

Schizostachyum kuisingii, a new species of bamboo (Poaceae: Bambusoideae) from Peninsular Malaysia

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ABSTRACT. *Schizostachyum kuisingii* K.M.Wong is a new species of bamboo from Peninsular Malaysia, distinguished from closely related species from adjacent areas in Indonesia, such as *Schizostachyum castaneum* Widjaja, *Schizostachyum lutescens* Widjaja and *Schizostachyum mampouw* Widjaja, by the hairs of the culm internode, glabrescent foliage leaves, leaf ligule form, a palea longer than the lemma and the presence of two lodicules in the flower.

Keywords. Bambuseae, Malay Peninsula, Malesia, Melocanninae, taxonomy

Introduction

Of some 60 bamboo species in 14 genera documented for Peninsular Malaysia (Wong, 1995), 11 are classified in *Schizostachyum* Nees. This paper describes a hitherto unknown *Schizostachyum* species that Mr Tan Kui Sing brought me to see in Johor state in Peninsular Malaysia in 2008, during a period when we were gathering bamboos to represent a special living collection for Peninsular Malaysia. We have subsequently been able to study the literature and specimens pertaining to the *Schizostachyum* diversity in Southeast Asia, with the conclusion that this bamboo is new to science. Herbarium acronyms used here follow Thiers (continuously updated).

Schizostachyum bamboos

Schizostachyum and allied genera, such as *Melocanna* Trin., *Cephalostachyum* Munro, *Pseudostachyum* Munro, *Teinostachyum* Munro, *Neohouzeaua* A.Camus, *Dendrochloa* C.E.Parkinson and *Leptocanna* L.C.Chia & H.L.Fung, belong to the Melocanninae subtribe of the Bambuseae (BPG, 2012; Kellogg, 2015). Whereas *Melocanna* has always been easy to distinguish based on its long-necked sympodial rhizomes and fleshy fruit pericarp, the relationships of the other genera mentioned here have been contentious (Holttum, 1946, 1956). Otherwise the genera of Melocanninae generally share a number of conspicuous characters: a branch complement of many slender subequal branches developing from a single branch bud, and a glabrous ovary with a rigid hollow attenuating upward extension of the ovary apex (analogous to a stylar structure and often just simply called the 'style') connecting with the stigmas

(Holttum, 1956); also there is a conspicuous white-waxy ring just below each culm node (Wong, 1995).

Holttum (1946) had suggested that *Schizostachyum* might include *Cephalostachyum*, *Teinostachyum* and *Pseudostachyum* because the number of flowers per pseudospikelet and fusion of filaments may not be stable distinguishing characters. Later, Holttum (1956) added *Neohouzeaua* to his broad concept of *Schizostachyum*. Although limited-sampling molecular phylogenetic investigations have yet to clearly resolve their generic positions, *Pseudostachyum* seems to be a distinct lineage (Yang et al., 2007). Although Xia (1993) recognised *Cephalostachyum* and *Pseudostachyum* as distinct genera, he also deemed it is practical to include *Dendrochloa, Leptocanna, Neohouzeaua* and *Teinostachyum* within *Schizostachyum*. From the molecular analyses of Yang et al. (2007), it seems likely that *Cephalostachyum* may be heterogeneous, with its type species *C. capitatum* Munro and an alliance including *C. latifolium* Munro (syn. *C. fuchsianum* Gamble) and *C. pallidum* Munro forming one possible generic entity, and others like *C. pergracile* Munro and *C. virgatum* (Munro) Kurz being more closely allied to a group of *Schizostachyum* species including *S. brachycladum* (Kurz) Kurz and *S. zollingeri* Steud. As it stands, too little is known about comparative pseudospikelet and floral structure for this group of genera and it is premature still to speculate if differences such as keeled or convolute palea, 2 versus 3 stigmas, presence of glumes and number of flowers will correlate with clades recognised from molecular analyses, when these eventually benefit from sufficient taxon sampling that includes nomenclatural types.

The consensus seems to be that *Melocanna*, *Pseudostachyum* and *Cephalostachyum* could be distinguished from *Schizostachyum*, and the last could probably include *Dendrochloa, Leptocanna, Neohouzeaua* and *Teinostachyum*, as well as some species currently placed in *Cephalostachyum* (such as *C. pergracile* and *C. virgatum*). The present new species is consistent with the type of *Schizostachyum*, *S. blumei* Nees, in having slender 1-flowered pseudospikelets that terminate with a rachilla extension bearing a terminal vestigial flower, absence of glumes, convolute paleas with 2 long-pointed tips and 3 stigmas. It differs from the type and many other species of the genus in consistently having two lodicules (the type species does not have lodicules, whereas a number of others have three, although variable numbers are sometimes encountered).

The new species

Schizostachyum kuisingii K.M.Wong, **sp. nov.**

Schizostachyum kuisingii is similar to *S. castaneum* Widjaja, *S. lutescens* Widjaja and *S. mampouw* Widjaja in having an erect clump habit, narrowly triangular to ovate-lanceolate culm-sheath blades that are at first erect, and generally small culm-sheath auricles with fine bristles on their margin. It differs from these three species in having glabrescent leaf blades (the other species have persistently hairy leaf blades), minutely serrate-ciliate leaf ligules (the other species have entire-glabrous leaf ligules), and two

lodicules in its flower (*S. lutescens* and *S. mampouw* do not have lodicules; the flowers of *S. castaneum* are not known). – TYPE: Peninsular Malaysia, Johor, Bekok, old logging track past Kampung Tomoh and c. 10 km before the Selai gateway to Endau-Rompin State Park, 26 November 2008, *K.M. Wong, Y.W. Low, Zulkapli Ibrahim & K.S. Tan WKM 2896* (holotype SING; isotypes K, KLU). (Fig. 1–3)

Medium-size clumping bamboo to 18 m high, erect to slightly arching outward. ***Culms*** plain green, 2.5–5.5 cm diameter; mid-culm internodes to 40–45 cm long, with scattered appressed pale hairs all over and a white-waxy zone below each node; branches many at each node, slender and subequal, arising from a single branch bud. ***Culm sheaths*** light green, with loose irritant stiff chestnut-brown hairs all over the back; auricles low rim-like, c. 1 mm high, dark purplish black, with pale brown bristles 14–22 mm long on the margin; ligule with a 1–1.5 mm high rim-like base with 2–3(–6) mm long bristles on the margin; blade narrowly triangular to ovate-lanceolate, erect in the more basal sheaths, and erect becoming patent to reflexed at mid-culm or higher, dark green. ***Foliage leaves*** 8–32 cm long, (1.4–)2.3–3.6 cm broad, adaxial surface glabrous, abaxial surface sparsely pale minute-hairy becoming glabrescent; auricles rounded to elongate lobes extending free of the sheath margin, 0.5–2 mm long bearing bristles 2–5 mm long on their margin; ligules 1 mm high, minutely serrate-ciliate. ***Pseudospikelets*** green, very slender, only 1–1.5 mm diameter, 10–14 mm long, 1-flowered with a rachilla extension 7–12 mm long bearing a terminal vestigial flower; basal bracts subtending prophyllate buds 2–3, each 5-veined, the back with very sparse short hairs. ***Flower*** with lemma 10–11 mm long, 9-veined, apical cusp 1 mm long, glabrous; palea 12–18 mm long, 9-veined, apex bifid with cusps 2–2.5 mm long, glabrous; lodicules 2, obovate to oblanceolate, 2.5–3.5 mm long, 0.5–1.5 mm wide, with ciliate margin; stamens 6, filaments free; anthers 4–5 mm long, apex blunt, maroon; ovary ovoid, c. 1 mm long, glabrous; style to 13–19 mm long, exserted c. 4 mm in the mature flower, rigid, glabrous, white; stigmas 3, hairy, white.

Etymology. This new species honours Mr Tan Kui Sing, an experienced horticulturist with wide interests in exploring the native Malaysian flora for novel candidate species in tropical landscaping. He brought the existence of this new species to the attention of the author.

Provisional IUCN conservation assessment. As far as is known, this species exists only in the village at Bekok, Johor, Peninsular Malaysia. In spite of its novelty, its status as an indigenous Malaysian bamboo is doubtful, as with a suite of other bamboo species known only in cultivation or in association with human settlements, which Holttum (1958) referred to as "village bamboos". Because only one locality has been documented, it seems appropriate to consider this species as "Data Deficient" in conservation terms (IUCN, 2012).

Notes. Besides the key differences from its close congeners, *Schizostachyum castaneum*, *S. lutescens* and *S. mampouw* (Widjaja, 1997), noted in the diagnosis above, there

Fig. 1. Habit of *Schizostachyum kuisingii* K.M.Wong. (Photo: K.M. Wong)

Fig. 2. Key vegetative characteristics of *Schizostachyum kuisingii* K.M.Wong. **A.** Detail of culm sheath showing loose brown hairs, spreading blade and bristly, dark rim-like auricles; culm internode with a covering of appressed white hairs, and a pale waxy zone just below the node. **B.** Branch complement with a cluster of many slender subequal branches developing from a solitary branch bud. **C.** Detail of leaf sheaths showing pale-bristly auricles. **D.** Pseudospikelet clusters. (Photos: K.M. Wong)

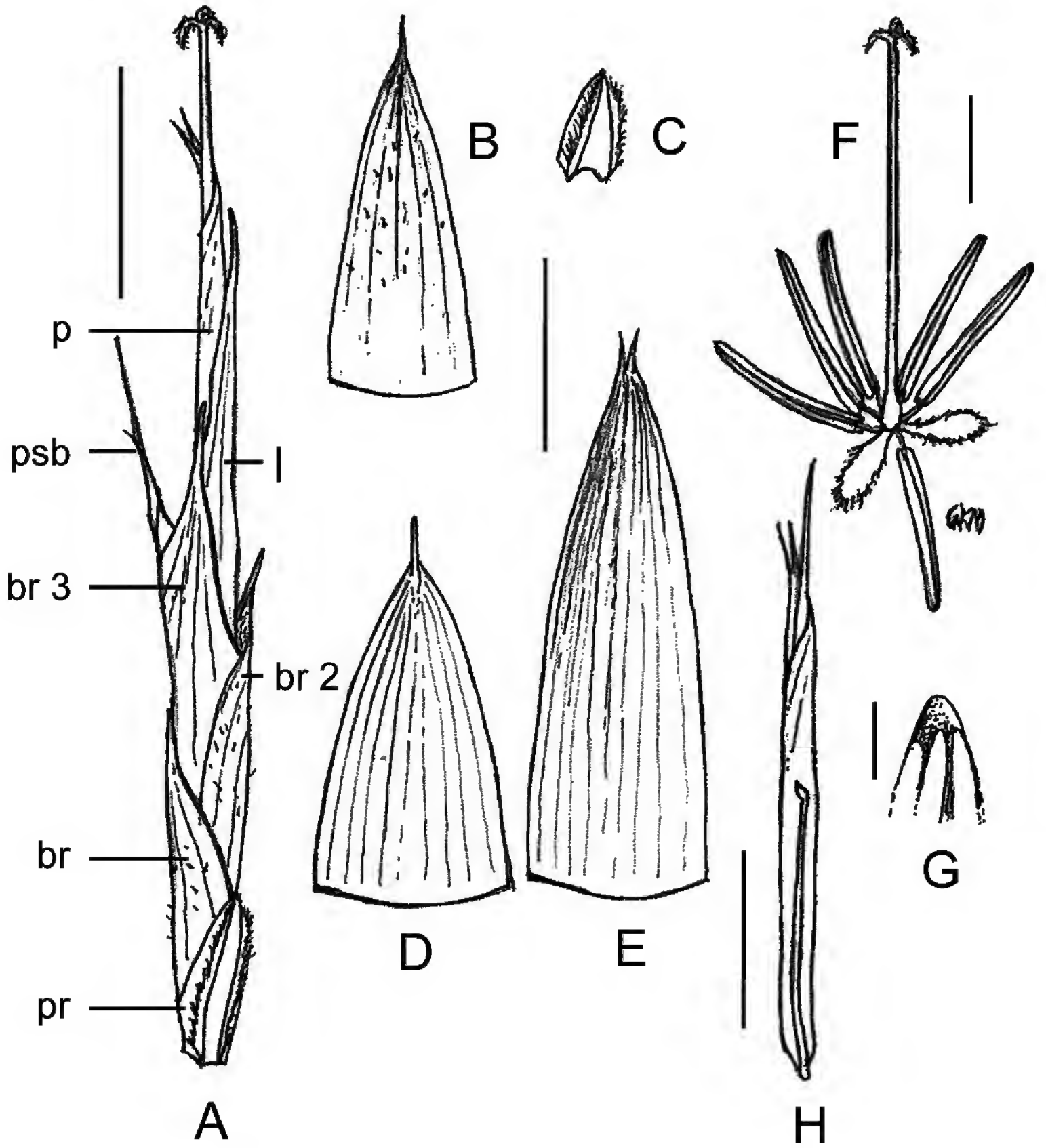

Fig. 3. *Schizostachyum kuisingii* K.M.Wong, pseudospikelet and flower structure. **A.** Pseudospikelet with (from base) prophyll (pr), three bracts subtending prophyllate buds (br, br 2, br 3), a pseudospikelet branch (psb) developing from the bud subtended by br3, the lemma (l) and palea (p) of the perfect flower with its protruding stiff style and stigmas. **B.** Bract. **C.** Prophyllate bud. **D.** Lemma. **E.** Apically bicuspidate palea. **F.** Gynoecium with a stiff style, with six free stamens and two lodicules. **G.** Detail of blunt anther apex. **H.** Perfect flower with lemma removed, revealing a slender rachilla extension with a terminal vestigial flower. Scale bars represent 5 mm except for G (1 mm). Drawn by the author from *WKM 2896* (SING).

Table 1. *Schizostachyum kuisingii* K.M.Wong compared with closely related species. A dash indicates feature not known for a particular species. The description of "hairy" ovaries in various Indonesian species such as *S. lutescens* Widjaja and *S. mampouw* Widjaja (Widjaja, 1997) is probably erroneous, as the species known to the present author (including *S. kuisingii*) and described by others have invariably smooth (glabrous) ovaries and fruits.

	S. kuisingii	***S. castaneum***	***S. lutescens***	***S. mampouw***
Midculm internode length (diameter) (cm)	40–55 (2.5–5.5)	45–70 (4.5–6)	45–60 (2–4)	30–60 (2.5–3)
Hair type on internode surface	*White appressed hairs only*	White and brown hairs	White hairs and scattered brown hairs	—
Hair type on back of culm sheaths	Dense chestnut-brown hairs	Dense chestnut-brown hairs	Chestnut-brown hairs	*White to brown hairs*
Culm-sheath auricles	Low rim only 1 mm high, bristles 14–22 mm long	*Low lobes to 2 mm high*, bristles 4–11 mm long	—	Low rim 1–2 mm high, bristles 14 mm long
Culm-sheath ligules	1–1.5 mm high base, bristles 2–3 mm long, at times to 6 mm long	1 mm high base, *denticulate (small 1 mm teeth)*	—	1 mm high base, bristles 2–3 mm long
Culm-sheath blade	Narrowly triangular to ovate-lanceolate, *erect then patent to reflexed*	Narrowly triangular to ovate-lanceolate, erect	—	Narrowly triangular to ovate-lanceolate, erect
Lower surface of foliage leaves	Sparsely pale minute-hairy, *glabrescent*	Hairy	Sparsely hairy	Sparsely hairy
Leaf sheath ligules	*Minutely serrate-ciliate*, 1 mm high	Entire, glabrous, 1 mm high	Entire, glabrous, 1 mm high	Entire, glabrous, 1 mm high
Lemma length, hairiness	10–11 mm (shorter than palea), glabrous	—	c. 12 mm (*longer than palea*), glabrous	9–10 mm (shorter than palea), glabrous
Palea length, hairiness	12–18 mm, glabrous	—	c. 9 mm, glabrous	10–15 mm, glabrous
Lodicules	*2*	—	0	0
Anther colour	*Maroon*	—	Yellow	Yellow

are further distinctions (Table 1). *Schizostachyum kuisingii* culm internodes have only white appressed hairs, whereas those of *S. castaneum* and *S. lutescens* have a mixture of white and brown hairs (those of *S. mampouw* have not been documented). *Schizostachyum castaneum* also differs from *S. kuisingii* and *S. mampouw* in having small lobe-like culm-sheath auricles (instead of rim-like auricles) and denticulate culm-sheath ligules (instead of bristly ligules). In addition, *Schizostachyum lutescens* differs from *S. kuisingii* and *S. mampouw* by its lemmas longer than the paleas (in the other two species, the lemmas are shorter than the paleas). *Schizostachyum kuisingii* has maroon anthers, whereas *S. lutescens* and *S. mampouw* have yellow anthers.

ACKNOWLEDGEMENTS. I am grateful to Y.W. Low and Zulkapli Ibrahim for assistance in the field. Permission to examine *Schizostachyum* material in the BO herbarium is gratefully acknowledged. Dr Soejatmi Dransfield kindly looked over the material of this species in providing additional verification of its novelty.

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Gardens' Bulletin Singapore 67(2): 275–287. 2015
doi: 10.3850/S238258121500023X

Novitates Bruneienses, 4. New records in the Araliaceae, Araucariaceae, Arecaceae, Fagaceae, Musaceae and Thymelaeaceae

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ABSTRACT. *Aralia merrillii* C.B.Shang (Araliaceae), *Agathis lenticula* de Laub. (Araucariaceae), *Licuala collina* Saw and *L. miriensis* Saw (Arecaceae), *Lithocarpus bullatus* Hatus. ex Soepadmo and *L. hallieri* (Seemen) A.Camus (Fagaceae), *Musa lawitiensis* var. *suratii* (Argent) Häkkinen (Musaceae) and *Aquilaria microcarpa* Baill. (Thymelaeaceae) are newly recorded for the Brunei flora.

Keywords. Angiosperms, Borneo, Brunei Darussalam, conservation, gymnosperms

Introduction

The *Botanical Survey of Brunei Darussalam* is a collaborative programme between the Government of Brunei Darussalam and the National Parks Board, Singapore, in which the Ministry of Industry and Primary Resources and the Forestry Department in Brunei partner the Singapore Botanic Gardens to continue botanical exploration and documentation in Brunei. In this fourth instalment of the series dedicated to reporting the scientific results of this collaboration, we record eight plant species new for the Brunei flora, in six different families. The baseline data, to assess whether a taxon is a new record or not, comes from Coode et al. (1996) and later taxonomic works in the particular groups. Conservation assessments for the species presented in this paper are based on IUCN (2012), adopted with a regional focus on Brunei. Herbaria acronyms of herbarium specimens examined follow Thiers (continuously updated).

New records for Brunei

ARALIACEAE
Aralia merrillii C.B.Shang, J. Nanjing Inst. Forest. 1985(2): 28 (1985). – *Aralia scandens* (Merr.) Ha, Novosti Sist. Vyssh. Rast. 11: 229 (1974), *nom. illeg.* non *A. scandens* Poir, Encycl. Suppl. 1: 419 (1811). – *Acanthophora scandens* Merr., Philipp.

J. Sci., C. 13: 316 (1918). – TYPE: Philippines, Mindanao, Lake Lanao, Camp Keithley, 1 October 1906, *M.S. Clemens 752* (holotype PNH, destroyed; isotype A [A00067728]). (Fig. 1)

Specimen examined. BRUNEI: **Temburong:** Ulu Temburong National Park, steep slope at LP 58, 1000 m asl, 6 Aug 2014, *Wong & Jangarun WKM 3363* (BRUN, SING).

This thorny scrambling-climbing species is known from the Malay Peninsula to the Philippines and Sulawesi, and in Borneo has been recorded on Mt Kinabalu (Philipson, 1979; Beaman et al., 2001). The tripinnate leaves, up to 1.5 m long, and large panicle, with the flowers or fruits in ultimate umbels, are distinctive. Besides that, *Aralia merrillii* is also the only *Aralia* species in Malesia to have a scrambling-climbing liana habit (Philipson, 1979). This species belongs to the section *Aralia* L. sect. *Dimorphanthus* (Miq.) Miq., for which the presence of prickles is a synapomorphy (Wen, 2004).

Provisional IUCN conservation assessment. Data Deficient (DD) (IUCN, 2012) for Brunei as this is the only collection known thus far. Its typical occurrence is disturbed or fringe habitats in montane localities, with the documented occurrence in the inner mountainous region of the Ulu Temburong National Park. Field observations are badly needed for a better understanding of its conservation status in Brunei.

ARAUCARIACEAE

Agathis lenticula de Laub., Blumea 25(2): 537 (1979). – TYPE: Sabah, Mt. Kinabalu, Park Headquarters, 9 August 1978, *de Laubenfels P619* (holotype L; isotypes A [A00022582], K, RSA [RSA0000051], SAN, US [US00345172]). (Fig. 2)

Specimen examined. BRUNEI: **Temburong:** Ulu Temburong National Park, ridge W of LP 58, 1000 m asl, 6 Aug 2014, *Wong & Jangarun WKM 3303* (BRUN, SING).

This stately conifer was previously known only for the Crocker Range, including Mount Kinabalu, in Sabah, and is by no means rare on the ridges in this part of the Ulu Temburong National Park. It is not expected to occur in the Tutong and Belait districts because of the generally lower terrain there. The glaucous foliage, including somewhat asymmetric leaf with acute apex and base, as well as short-pedunculate male cones, are distinctive (Yii, 1995).

Provisional IUCN conservation assessment. Data Deficient (DD) (IUCN, 2012) for Brunei as this is the first and only collection recorded so far. As the montane ridges of the Ulu Temburong National Park are little explored, more specialised collections and detailed field observations of the taxon are badly needed for a better understanding of its conservation status in Brunei. Besides that, the species occurs within the Ulu Temburong National Park, and there are no imminent threats known to be present.

Fig. 1. *Aralia merrillii* C.B.Shang (Araliaceae), *Wong & Jangarun WKM 3363*. (Photo: K.M. Wong)

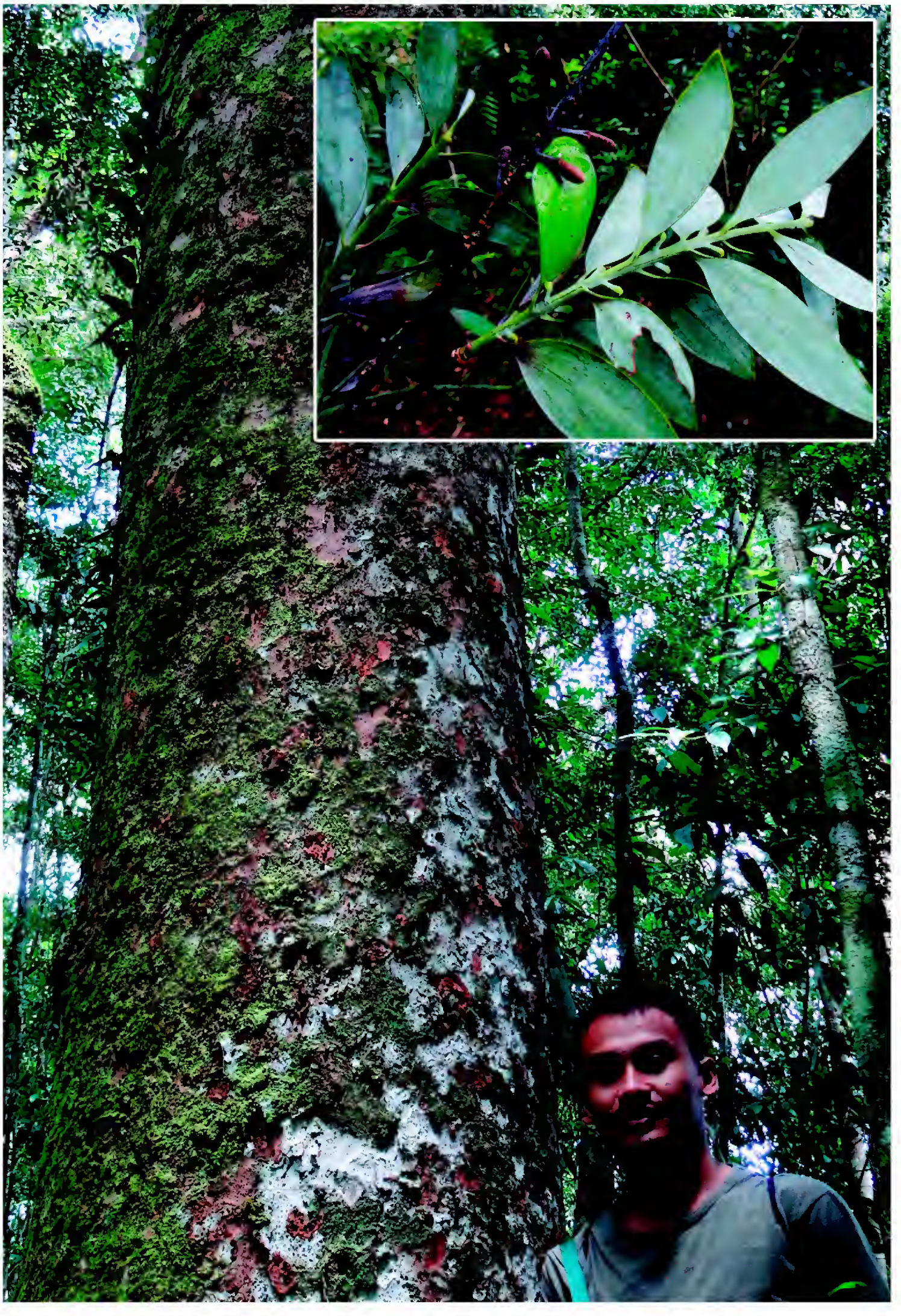

Fig. 2. *Agathis lenticula* de Laub. (Araucariaceae), the characteristic columnar bole with scaly-dippled bark and (inset) glaucous leaves and male cones. *Wong & Jangarun WKM 3303.* (Photos: K.M. Wong)

ARECACEAE

Licuala collina Saw, Kew Bull. 67(4): 599 (2012). – TYPE: Malaysia, Sarawak, Tama Abu Range, Bario, 1250 m, 6 November 1989, *Dayang Awa & Lee S 51191* (holotype K; isotype SAR). (Fig. 3A)

Specimens examined. BRUNEI: **Belait:** Sukang, Labi Hills Forest Reserve, east of LP Ukur 16, 100 m asl, 24 Aug 1997, *Niga BRUN 18698* (BRUN); Ulu Buau, Kampong Buau, 8 Mar 1999, *Ariffin BRUN 19100* (BRUN). **Temburong:** Ulu Temburong National Park, ridge E of LP 58, c. 1000 m asl, 8 Aug 2014, *Wong & Jangarun WKM 3329* (BRUN, SING).

This was recorded as a lower montane forest palm and also with one occurrence in *kerangas* forest at 100 m asl (Saw, 2012). It is now also recorded at the lower elevation in Brunei in riparian Mixed Dipterocarp Forest. It would appear to have a general occurrence in the highland areas on the Setap Shale formation of Brunei and NE Sarawak and adjacent lower elevations.

This is a usually solitary palmlet 0.5–1.5 m high. The inflorescence is typically short, with a single partial inflorescence (unbranched or with few branches), without peduncular or rachis bracts. There are 3–5 leaf segments (in Sarawak 4–10 recorded), with the central segment broader and distinctly bifid, and frequently one of the halves further bearing a narrow division.

Provisional IUCN conservation assessment. Data Deficient (DD) (IUCN, 2012) for Brunei as the species is only recorded three times. However, all known Brunei populations exist within protected areas, namely, the Ulu Temburong National Park and Forest Reserves where disturbances are now curtailed. Meanwhile in Sarawak, *Licuala collina* has been categorised as Vulnerable (VU) by Saw (2012).

Licuala miriensis Saw, Kew Bull. 67(4): 628 (2012). – TYPE: Malaysia, Sarawak, Miri, Riam Road, 15 m, 3 December 1962, *Au S 16794* (holotype SAR; isotypes K, L). (Fig. 3B–D)

Specimen examined. BRUNEI: **Belait:** Lumut, Sungai Liang, Bukit Agis-Agis, 24 Dec 2003, *Ariffin BRUN 20467* (BRUN); Andulau Forest Reserve, Compartment 18, 13 Aug 2014, *Wong, Ariffin & Jangarun WKM 3392* (BRUN, SING).

This species was previously recorded only for the Miri-Lambir and Bintulu areas in Sarawak (Saw, 2012). The two collections here record it for Brunei for the first time.

It is a distinctive, elegant, slender-stemmed understorey palm to 1.5–2 m high with c. 20 narrow segments per leaf. Although Saw (2012) records 46 species of *Licuala* for Borneo, a number remain known only from scanty material, including the present species, which was diagnosed as having an inflorescence specimen "with proximal portion broken off" and peduncle, prophyll and peduncular bracts unknown. In the key provided in Saw (2012), *Licuala miriensis* is diagnosed through the lead

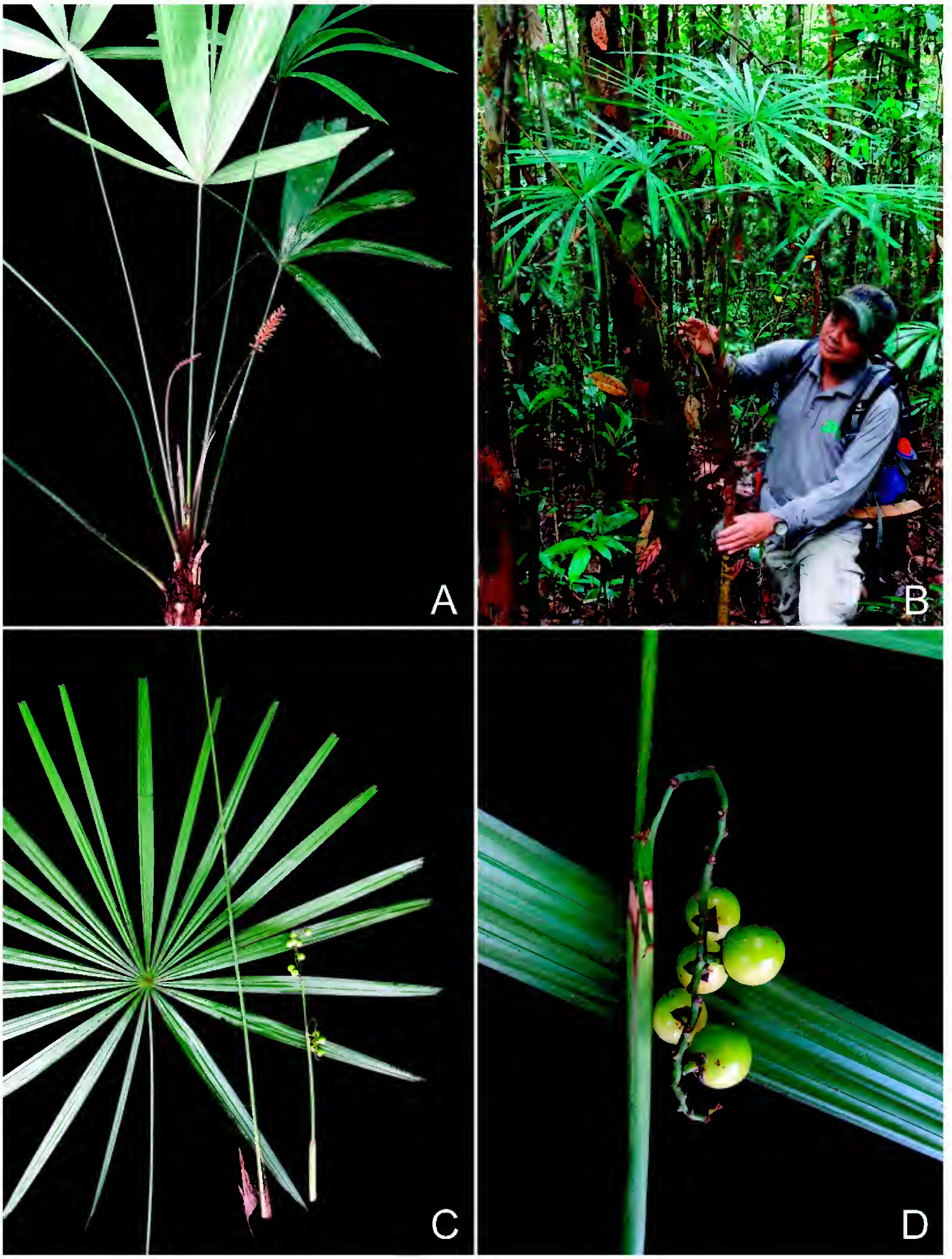

Fig. 3. New *Licuala* records. **A.** *Licuala collina* Saw. *Wong & Jangarun WKM 3329*. **B–D.** *Licuala miriensis* Saw. *Wong, Ariffin & Jangarun WKM 3392*. **B.** Habit. **C.** (from left) Leaf blade, lower portion of petiole, infructescence. **D.** Detail of partial infructescence. (Photos: K.M. Wong)

in couplet 2 giving "All partial inflorescences spicate…" and, indeed, adopting this character helps derive the identity of the Brunei material as this species. However, as the Brunei material demonstrates, the other lead in couplet 2 ("Proximal partial inflorescence branched…") should have been the correct grouping because that partial inflorescence does have a solitary branch to 4 cm long (*WKM 3392*). This character is sometimes easily missed, including in *BRUN 20467* where that branch has broken off and the remaining partial inflorescence looks spicate. [Following what should have been the correct lead for this species in this key, however, one arrives at the cluster of *L. atrovirens* Saw, *L. mukahensis* Saw, *L. cordata* var. *ashtonii* Saw and *L. maculata* Saw, species that differ in many characteristics from *L. miriensis*. Incidentally, the couplets 19 and 20 should have their numbers interchanged so as to match the correct character-states.]

Slight discrepancies remain between the Brunei material and the description in Saw (2012). The Brunei material has thin-membraneous to papery calyx lobes and corolla lobes, both in fresh (fruiting) and dried material, whereas the available description states that the calyx is "membranous… becoming thick" and the corolla is "fleshy becoming very thick in fruiting specimen". These are, however, minor differences that probably point simply to some variation present.

This extremely elegant *Licuala* deserves introduction into horticulture although, where we were able to observe this in Brunei, it is a solitary palm occurring with very low frequency in very moist shaded understorey conditions, and probably also slow-growing. It is not known how this species might adapt and respond to an increased light regime.

Provisional IUCN conservation assessment. Data Deficient (DD) (IUCN, 2012) for Brunei as the species is only known from two localities so far. However, this status needs reassessment for a better understanding of its conservation status in Brunei, as more botanical explorations are made. Meanwhile, its probable status in Sarawak is considered to be Endangered (EN A2c) (Saw, 2012).

FAGACEAE

Lithocarpus bullatus Hatus. ex Soepadmo, Reinwardtia 8: 223 (1970). – TYPE: Borneo, Sabah, Mt. Kinabalu, 15 April 1933, *J. & M.S. Clemens 32715* (holotype BO; isotypes A [A00033959], BM [BM000951969], K [K000832515], L, NY [NY00248587], UC). (Fig. 4A)

Specimen examined. BRUNEI: **Temburong:** Ulu Temburong National Park, ridge E of LP 58, c. 1000 m asl, 8 Aug 2014, *Wong WKM 3323* (BRUN, SING).

The type of this species is *J. & M.S. Clemens 32715* from Mount Nungkok, a minor peak of the Kinabalu massif, at 1200–1500 m elevation in lower montane forest (Soepadmo, 1970). It is a Bornean endemic not uncommon in lower to upper montane forest to 3000 m on Mount Kinabalu and the Crocker Range in Sabah, and has also

Fig. 4. New *Lithocarpus* records. **A.** *Lithocarpus bullatus* Hatus. ex Soepadmo. *Wong WKM 3323*. **B.** *Lithocarpus hallieri* (Seemen) A.Camus. *Wong & Jangarun WKM 3295*. (Photos: K.M. Wong)

been recorded for the Mulu National Park (Sarawak), in Kalimantan (Indonesian Borneo), as well as on ultramafic soil in Beluran (Sabah) (Soepadmo et al., 2000). In Brunei, it is locally common in the hills around 1000 m in southern Temburong. The strongly bullate leaves are highly distinctive and no other *Lithocarpus* species approaches in this character.

Provisional IUCN conservation assessment. Least Concern (LC) (IUCN, 2012) for Brunei as there are good populations well within national parks, including the Ulu Temburong National Park.

Lithocarpus hallieri (Seemen) A.Camus, Riviera Sci. 18: 40 (1932). – TYPE: Borneo, Kalimantan, Mt. Lianggagang, *Hallier 2655* (holotype BO; isotype L). (Fig. 4B)

Specimen examined. BRUNEI: **Temburong:** Ulu Temburong National Park, ridge W of LP 58, 1000 m asl, 6 Aug 2014, *Wong & Jangarun WKM 3295* (BRUN, SING).

This Bornean endemic tree is generally known for the other Bornean states and can be common in some localities, such as Ranau in Sabah.

The specimens were collected from a medium-sized tree to 35 m tall and 60 cm diameter. The acorns have cupules enveloping most of the nut and are large, the size of

a fist (to 12 cm long, 10 cm diameter), obovoid and woody, with 5–7 distinct lamellae. The nut itself is c. 5 cm diameter.

Provisional IUCN conservation assessment. Data Deficient (DD) (IUCN, 2012) for Brunei as there is just a single collection, although several trees were seen on the ridges around the collection site. However, this status requires reassessment for a better understanding of its conservation status in Brunei, as more botanical explorations are made, especially to the largely inaccessible hills at the Brunei-Sarawak (Malaysia) border.

MUSACEAE

Musa lawitiensis Nasution & Supard. var. ***suratii*** (Argent) Häkkinen, Adansonia 28(1): 60 (2006). – *Musa suratii* Argent, Gard. Bull. Singapore 52: 203 (2000). – TYPE: Sabah, Tenom, Kallang, 8 September 1989, *Surat & Lamb 268/89* (holotype SAN; isotype E). (Fig. 5)

Specimens examined. BRUNEI: **Temburong:** Amo, Ulu Temburong National Park, Temburong river just downstream from Kuala Machang, true left bank, old landslip, 4°32'09"N 115°12'13"E, 100 m asl, 17 May 2014, *Lee et al. SL 1018* (BRUN, SING, IBSC), 18 May 2014, *Wong et al. WKM 3274* (BRUN, SING).

Borneo, well within the centre of diversity for bananas, has 13 known species excluding the introduced *Musa textilis* Nee (Häkkinen, 2006). For Brunei, Coode et al. (1996) recorded only *Musa borneensis* Becc. (*Hotta 13877*), *M. campestris* Becc. (*Bernstein 225*, *Coode 6792*, *Cowley 14*, *Hotta 12460*, *Johns 6800*), and *M. tuberculata* M.Hotta (*Hotta 13878*), as well as the widely cultivated *M. textilis* (*Hotta 13017*).

Musa lawitiensis Nasution & Supardiyono, endemic to Borneo, has four varieties (Häkkinen, 2006). *Musa lawitiensis* var. *lawitiensis* is known in W Kalimantan (Bentuan Karimun National Park) and Sarawak's Kapit Division; *M. lawitiensis* var. *kapitensis* and *M. lawitiensis* var. *sarawakensis* so far only from Sarawak's Kapit Division; and *M. lawitiensis* var. *suratii* from SW Sabah (Tenom), W Sarawak (Lubok Antu) and now Brunei (Temburong). Argent (2000), when publishing the original description of *Musa suratii* Argent, noted that this taxon was "clump forming" with suckers "vertical in young clumps but becoming angled outwards in the larger older clumps". He aptly described the plant looking "from a distance more like a *Heliconia* than a *Musa* as, in addition to the very slender habit, the leaves although actually spirally arranged are displayed more or less distichously in a single plane". Where we collected this plant beside the Temburong River, a small population of plants were seen with pseudostems typically inclined towards the river, so that the lower leaves were inserted spirally but more apical leaves assumed a pseudo-distichous arrangement: the sheaths showed spiral insertion clearly but the petioles oriented the leaf blades into essentially two rows, so that the banana had the habit of a large ginger from a distance. This habit would seem to adapt the plant to a good display of leaf surface on a steep earth bank.

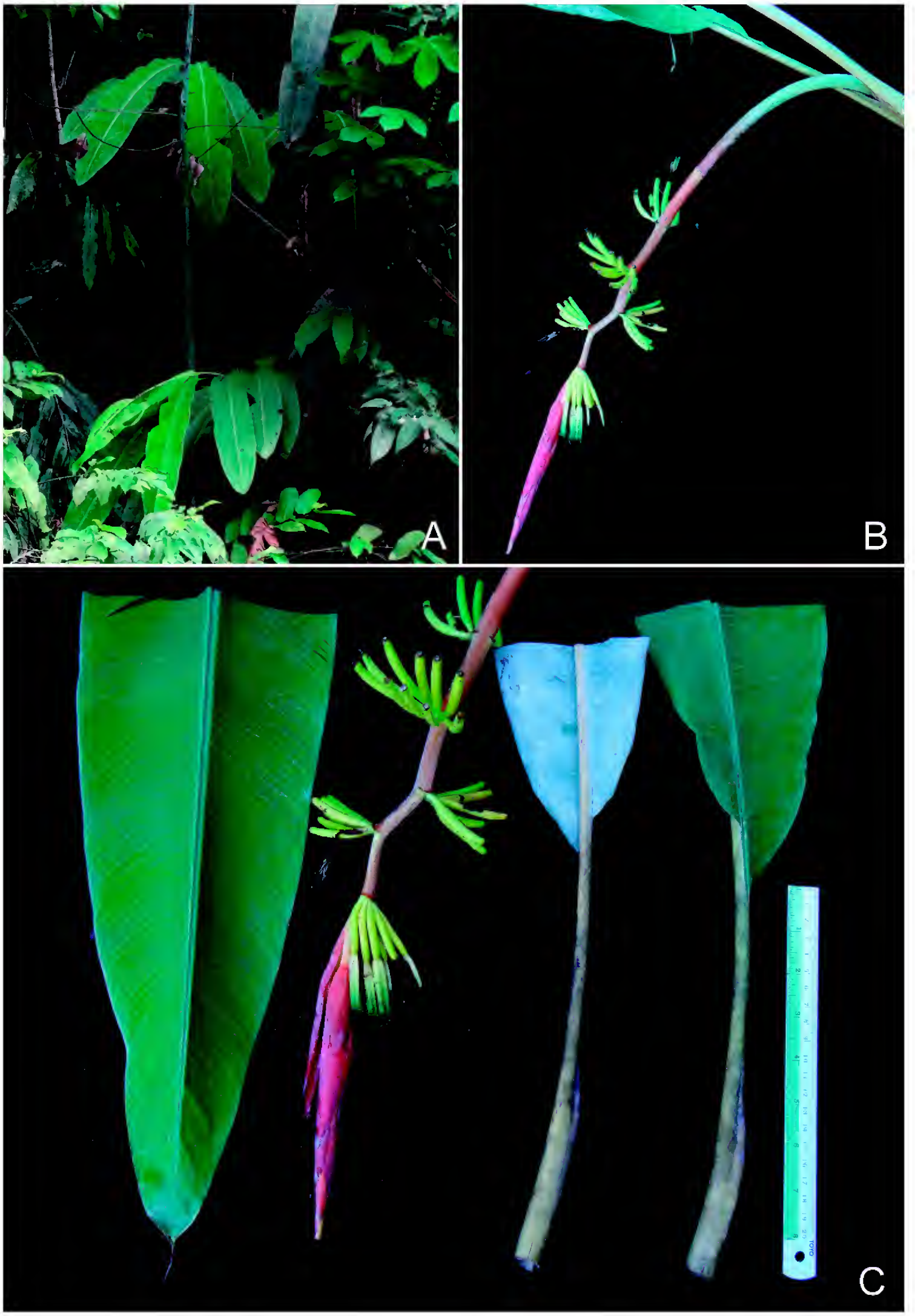

Fig. 5. *Musa lawitiensis var. suratii* (Argent) Häkkinen. *Wong et al. WKM 3274*. **A.** Habit. **B.** Downarched inflorescence with slender fruits. **C.** Characteristics of the leaf blade and inflorescence tip. (Photos: K.M. Wong)

In the field, the leaning habit of this small slender banana (c. 3.5–4 m tall), with the narrow pseudo-distichous leaves that are richly waxy on their lower (abaxial) leaf surfaces, a horizontal to arching inflorescence, small slender fruits (c. 10 cm long, c. 1.2 cm diameter), and very slender, orange-pink male bud with a sharp apex, are highly distinctive. The seeds are tuberculate, characteristic of *Musa* section *Callimusa*, and as many as 300 were counted for one fruit.

Provisional IUCN conservation assessment. Data Deficient (DD) (IUCN, 2012) for Brunei as the species is only known from the Ulu Temburong National Park, represented by two collections made on the same botanical fieldwork. Further field observations will contribute to a better understanding of its conservation status in Brunei.

THYMELAEACEAE

Aquilaria microcarpa Baill., Adansonia 11: 304 (1875). – TYPE: Borneo, Sarawak, 1872, *Beccari PB 2886* (holotype FI [FI008102]; isotypes G [G00190871], L [L0010148], M [M0145881], NY [NY00386214], P [P00650666], S [S-G-553]). (Fig. 6)

Specimens examined. BRUNEI: **Belait:** Bukit Sawat, Jalan Meranking, 26 Jul 1997, *Ogata Og-B 519* (BRUN); Kampong Merangking, 20 Dec 1994, *Suhaili BRUN 16407* (BRUN); ibidem, 23 Jul 1999, *Joffre BRUN 18367* (BRUN); Kampong Singap, Jalan Singap-Bukit, 24 Jun 1997, *Said BRUN 18496* (BRUN); Sungai Liang, Arboretum, 7 Aug 1996, *Clayton BRUN 16578* (BRUN); ibidem, 19 Aug 1997, *Ariffin BRUN 18643* (BRUN). **Brunei-Muara:** Kilanas, Jalan Dadap waterfall, 16 Jun 1998, *Noor Azam BRUN 18854* (BRUN). **Temburong:** Batu Apoi, 23 Apr 1935, *Zainal KEP 30376* (BRUN, KEP); Bukit Patoi, 1959, *Ashton Voucher 3689* (BRUN); Kuala Belalong, 15 May 2014, *Lee et al. SL 974* (BRUN, SING). **Tutong:** Rambai, Ulu Sungai Tutong, Ulu Sungai Medit, 14 Aug 2009, *Yusop BRUN 22684* (BRUN, K, KEP, L, SAN, SAR, SING); Tasik Merimbun, Bang Oncom, 19 Nov 1992, *Bernstein JHB 358* (BRUN); Bukit Tangan, 16 Sep 2000, *Suzuki K 13261* (BRUN, KAG).

An early checklist by Hasan & Ashton (1964) listed *Aquilaria malaccensis* Lamk., which, although recorded for N and E Borneo (Hou, 1960), does not seem to be present in Brunei. The later checklist by Coode et al. (1996) confirmed the presence in Brunei of *Aquilaria beccariana* Tiegh. but left *Bernstein JHB 358* (leafy twig only) unidentified. *Aquilaria microcarpa* is now verified by a number of collections of both flowering and fruiting specimens: the perianth is bell-shaped with lobes less than or equal the tube length and the fruit is subcordate and up to c. 1.5 cm long only (*A. beccariana* has floral tubes much longer than the lobes, and a longer obovoid fruit). Furthermore, its leaves dry olive to medium brown, whereas those of *Aquilaria beccariana* dry a pale golden brown. The latter species is more typical of *kerangas*, peatswamp and riverine (alluvial) forests in Mixed Dipterocarp Forest, whereas *Aquilaria microcarpa* is more generally recorded from Mixed Dipterocarp Forest on sandy clays.

Fig. 6. *Aquilaria microcarpa* Baill. Flowering leafy branch. *Lee et al. SL 974.* (Photo: K.M. Wong)

Provisional IUCN conservation assessment. Least Concern (LC) (IUCN, 2001) for Brunei as the species is reasonably well collected with populations existing in the Ulu Temburong National Park, and other Forest Reserves and conservation areas, where logging is not permitted.

ACKNOWLEDGEMENTS. The Ministry of Industry and Primary Resources and the Forestry Department, Brunei Darussalam, and the National Parks Board and Botanic Gardens, Singapore, supported this work as part of their collaboration for *A Botanical Survey of Brunei Darussalam*. Field coordination and logistics were assisted through Noralinda binti Haji Ibrahim, Roslinah binti Haji Mohsin (Forestry Department), Watu bin Awok, Jangarun anak Eri and Azlan bin Pandai (BRUN); Serena Lee and Paul Parusuraman Athen (SING). We are grateful to the keepers and curators of the BO, BRUN, SAN, SAR and SING herbaria for facilitating study of specimens in their care. Specimen images were also accessed in Global Plants (continuously updated).

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Gardens' Bulletin Singapore 67(2): 289–296. 2015
doi: 10.3850/S2382581215000241

Three new species of *Loxocarpus* (Gesneriaceae) from Sarawak, Borneo

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ABSTRACT. Three new species, *Loxocarpus burttii* T.L.Yao, *Loxocarpus littoralis* T.L.Yao and *Loxocarpus segelamensis* T.L.Yao are described from Sarawak, Malaysia.

Keywords. Borneo, Gesneriaceae, *Loxocarpus*, new species, Sarawak

Introduction

Loxocarpus R.Br. is a small genus consisting of 20 species distributed in Sumatra, Peninsular Thailand, Peninsular Malaysia and Borneo. The genus was previously included in *Henckelia* Spreng. (Weber & Burtt, 1998; Banka & Kiew, 2009) but was reinstated by Middleton et al. (2013) based on earlier phylogenetic studies (Weber et al., 2011). The species of *Loxocarpus* from Peninsular Malaysia were revised (as *Henckelia* sect. *Loxocarpus*) by Banka & Kiew (2009), although since then Yao et al. (2012) have described a new species from Kelantan. *Loxocarpus* is most diverse in Borneo, represented by nine species, and here a further three species are described.

All new species described here have a relatively long capsule (10–17.5 mm long). *Loxocarpus* was principally characterised by a short plagiocarpic capsule less than 10 mm long (Banka & Kiew, 2009). However, molecular phylogenetic studies (Yao, 2012) support the inclusion of several long-capsuled species which had been placed in *Didymocarpus* Wall. and *Henckelia*.

Loxocarpus burttii and *L. segelamensis* belong to the 'saintpaulioid' morphological group (Yao, 2012) which is confined to Borneo. Species in this group resemble *Saintpaulia* H.Wendl. (Gesneriaceae) and are characterised by their flat-faced corolla with a pair of exposed stamens. The short campanulate corolla with deltoid lobes observed in *L. littoralis* is shared with *L. argenteus* B.L.Burtt and *L. pauzii* T.L.Yao. All three new species are known only from a single locality each and *L. segelamensis* and *L. littoralis* are represented only by the type specimen.

New species

Loxocarpus burttii T.L.Yao, **sp. nov.**
This species is similar to *Loxocarpus verbeniflos* (C.B.Clarke) B.L.Burtt in its

relatively long capsules (10–12 mm long vs 9–20 mm long) and its usually ovate or elliptic lamina, but differs in its buff trichomes (not silvery) and adpressed trichomes along the petiole (vs spreading in *L. verbeniflos*). – TYPE: Borneo, Sarawak, Miri District, Lambir Hills National Park, below Bkt. Lambir, sandstone cliff, c. 1500 feet, 24 September 1978, *Burtt B11597* (holotype E; isotypes KEP, SAR). (Fig. 1, 2)

Rosulate herb with numerous crowded leaves. ***Rootstock*** woody, 2–4(–9.5) cm long, 4–6 mm thick; trichomes buff, adpressed, dense; adventitious roots long, wiry. ***Petiole*** base of withered leaves persistent. ***Stem*** lacking or distinctive, 1–2 cm long. ***Leaves*** alternate, crowded at the top; trichomes dense, buff, adpressed on petiole, equally dense on lamina above and beneath. ***Petiole*** relatively thick, (0.8–)2.8–3.8 cm long, 0.7–1.1 mm diam., grooved above; longest petiole about equal in length to the lamina. ***Lamina*** dark green above, paler beneath, moderately thick, ovate or elliptic or obovate, (2.5–)3.3–4.1 × (0.8–)1.3–1.5 cm; base cuneate, equal, margin entire or undulate, apex acute or blunt; midrib and veins obscure above, inconspicuous beneath, lateral veins 3 pairs. ***Inflorescence*** axillary, a reduced cyme with a single flower; trichomes buff, eglandular, shaggy, dense on peduncle and bracts; mixed with shorter glandular trichomes on pedicel. ***Peduncle*** slender, 4.5–6.5 cm long; bracts narrowly lanceolate, c. 1.5 × 0.3 mm, apex blunt; pedicel 0.5–0.9 mm long. ***Flower*** trichomes buff and eglandular, shaggy and dense on the outer surface of the calyx, less dense, shorter and erect on the outer surface of the corolla; dense on the ovary. ***Calyx*** green, upper lip 3-lobed, lower lip 2-lobed; lower lobes larger than the upper lobes, tube c. 0.6 mm long, c. 1 mm wide, lobes deltoid, apex acute, c. 1.4 mm long, base c. 0.5 mm wide. ***Corolla*** mauve, flat-faced, tube very short, c. 0.6 mm long, c. 1.1 mm wide; upper lip with 2 lobes c. 2.5 × 2.5 mm, lower lip with 2 lateral lobes c. 2.3 × 2 mm and a median lobe c. 3 × 2.3 mm; lateral and median lobes oblong. ***Fertile stamens*** 2, yellow; anthers projecting beyond corolla tube, exposed; filaments straight, thickened in distal half, c. 2.2 mm long; anthers coherent only at the ventral tip, kidney-shaped, c. 1.7 × 0.7 mm; staminodes 3, club-shaped. ***Nectary*** absent. ***Ovary*** narrowly conical or slightly oblique, c. 1.8 mm long, c. 1 mm wide; style curved upwards near the stigma, c. 3 mm long; stigma capitate, exposed. ***Capsule*** long slender conical, 10–12 mm long, 1.1–1.4 mm wide, style c. 1.5 mm long, sub-persistent; valves straight, splitting dorsally to form a trough; trichomes a mix of eglandular and glandular trichomes, adpressed to erect. ***Seeds*** not seen.

Distribution. Borneo, Sarawak, known only from Lambir FR, Bukit Lambir.

Habitat. Hill forest at c. 460 m asl. On sandstone cliffs or on acidic sandy soil.

Etymology. This species is named after the collector of the type, B.L. Burtt (1913–2008), a British botanist who collected extensively and is well known for his contributions to the taxonomy of the Old World Gesneriaceae.

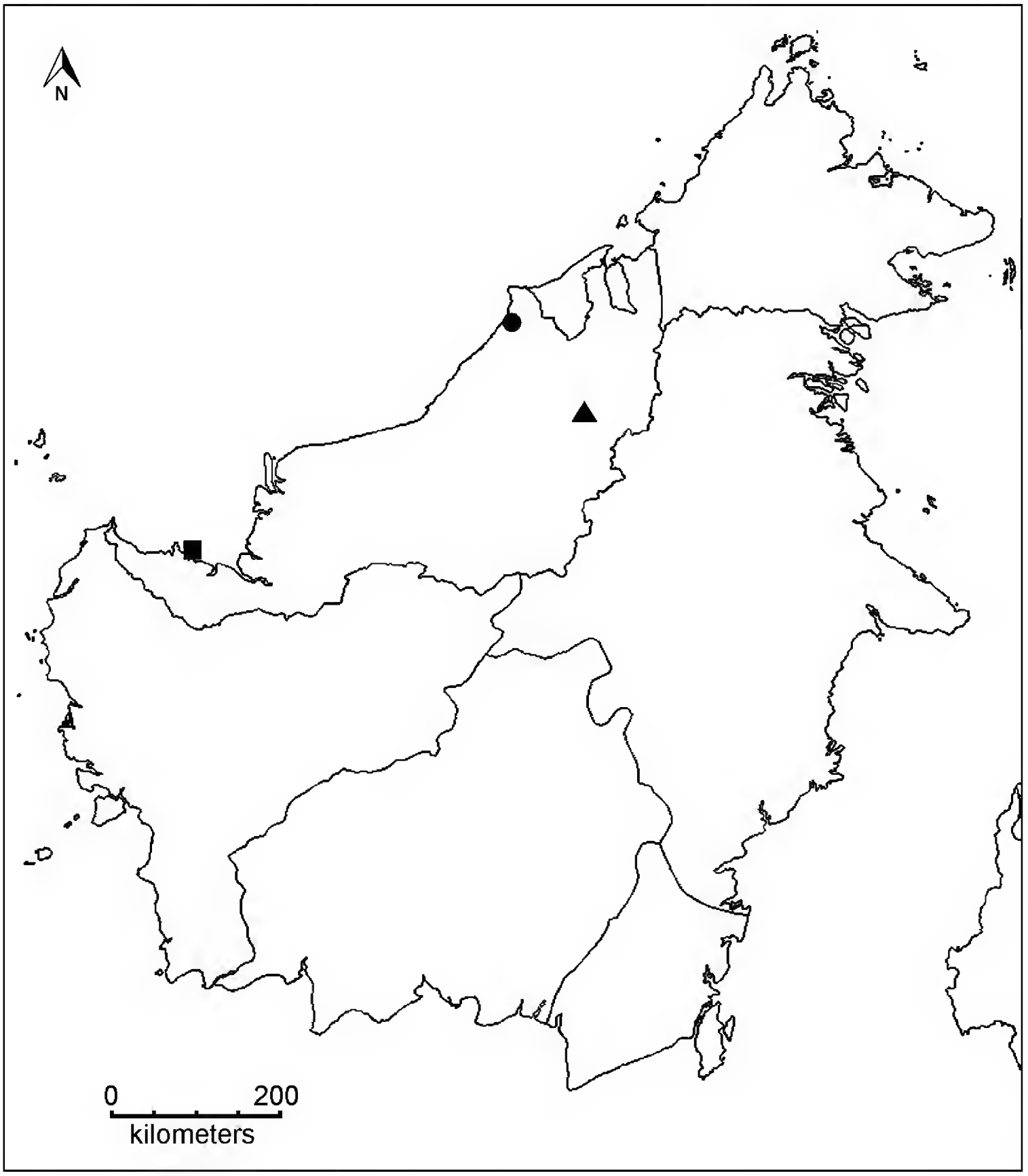

Fig. 1. Distribution map of *Loxocarpus burttii* T.L.Yao (●), *L. littoralis* T.L.Yao (■) and *L. segelamensis* T.L.Yao (▲).

Additional specimens examined. MALAYSIA: **Sarawak:** Bukit Lambir, 23 Oct 1993, *Ali & La Frankie AI 191* (SING [SING106370]); ibidem, 25 Oct 1993, *Ali & La Frankie AI 192* (SING [SING106371]); ibidem, 2 Nov 1976, *Ilias & Yeo S.38365* (K, KEP [KEP60951], SAR).

Note. A handwritten annotation by Burtt on the folder of the specimen selected here as the holotype mentioned that it is possibly a new species and listed *S.38365* as conspecific.

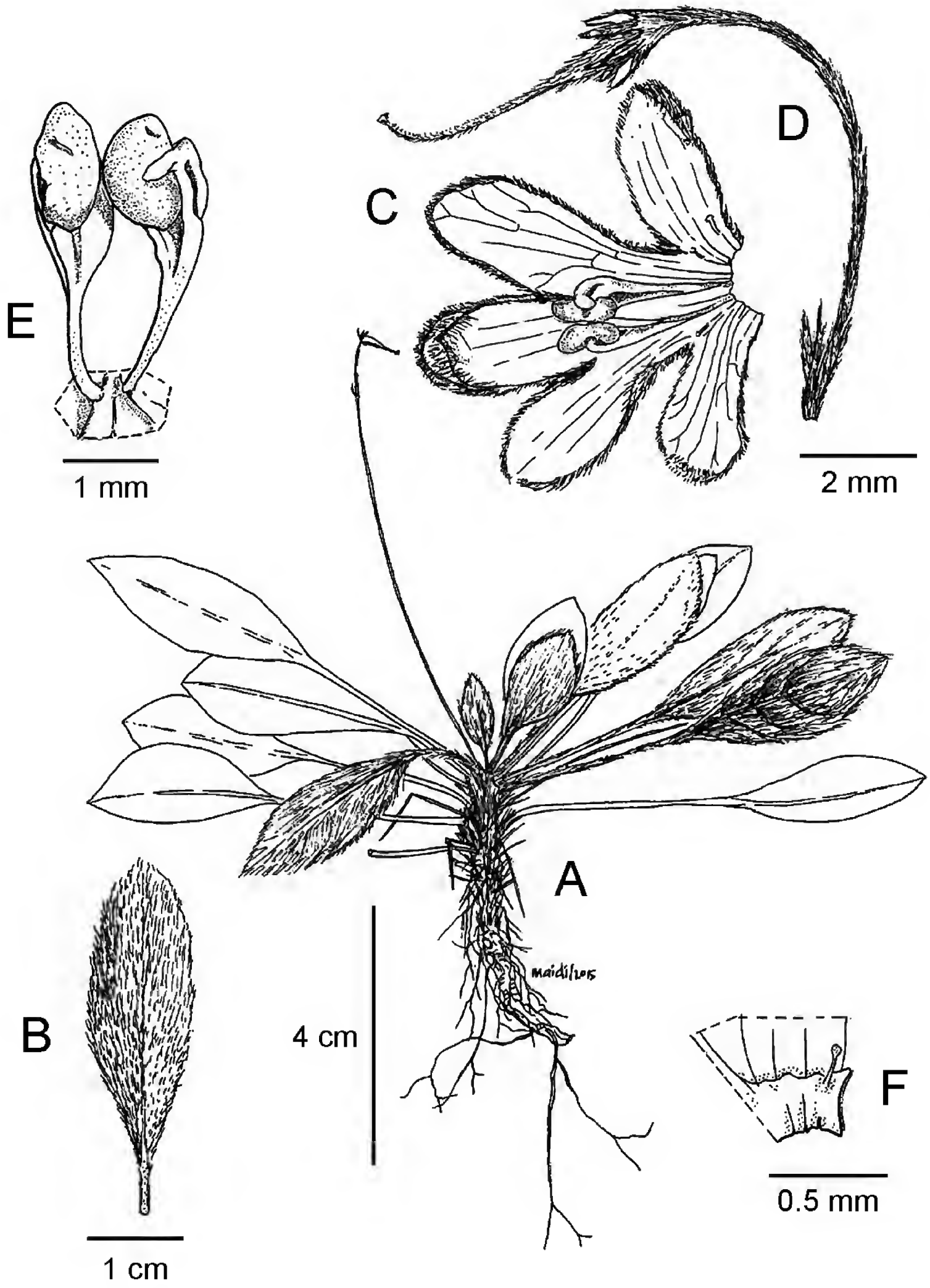

Fig. 2. *Loxocarpus burttii* T.L.Yao. **A.** Habit. **B.** Leaf. **C.** Corolla opened to show stamens. **D.** Bracts, calyx, ovary, style and stigma. **E.** Stamens. **F.** Staminode. Drawn by N. Mohamad Aidil from (A, B) *Burtt B11597,* and (C–F) *Ilias & Yeo S.38365*.

Loxocarpus littoralis T.L.Yao, **sp. nov.**
This species has a relatively long capsule similar to that of *Loxocarpus violoides* (C.B.Clarke) T.L.Yao (17 mm long vs 15–30 mm long) but differs in the dense spreading woolly trichomes on the lamina upper surface (not thin adpressed), grooved upper surface of the petiole (not terete), deltoid corolla lobes (not oblong) and conical capsule (not cylindric). – TYPE: Borneo, Sarawak, Kuching District, Tanjung Po, in deep shade on dripping wet rocks near the sea, 5 October 1955, *Brooke 10614* (holotype L [L645488]). (Fig. 1)

Rosulate herb. ***Rootstock*** woody, to 1 cm long, c. 3 mm thick or lacking; rootstock with buff trichomes; adventitious roots long, wiry. ***Petiole*** base of withered leaves caducous. ***Stem*** lacking. ***Leaves*** alternate, crowded at the top of the rootstock; trichomes buff, woolly and shaggy, dense on lamina above and less dense beneath. ***Petiole*** slender, c. 2 cm long, c. 1 mm thick, grooved above; longest petiole shorter than the lamina. ***Lamina*** moderately thick, ovate or broadly ovate, c. 2.5 × 1.7 cm; base cuneate or rounded, equal, margin shallowly serrate, apex blunt; midrib and veins obscure above, distinct beneath, lateral veins 3 pairs. ***Inflorescence*** axillary, a reduced cyme with a single flower; trichomes buff, shiny. ***Peduncle*** slender, c. 5 cm long; bracts narrowly lanceolate, c. 3 × 0.5 mm, apex acute; pedicel c. 3 mm long. ***Flower:*** corolla violet, tube short with deeply dissected lobes; upper lip with 2 upper lobes, lower lip with 2 lateral lobes and a median lobe; upper lobes smaller, lateral and median lobes larger, lobes recurved, deltoid. ***Capsule*** long, slender conical, c. 17 mm long, c. 2.5 mm wide; valves straight, splitting dorsally to form a trough. ***Seeds*** not seen.

Distribution. Borneo, Sarawak, known only from the type specimen from Tanjung Po (Bako NP).

Habitat. On dripping wet rocks near the sea in deep shade.

Etymology. It is named for its seashore habitat.

Note. There is only one fully opened flower on the type specimen which I decided not to dissect, thus preventing a fuller description of the calyx and corolla lobes. More material is needed.

Loxocarpus segelamensis T.L.Yao, **sp. nov.**
This species is similar to *Loxocarpus violoides* in the relatively long capsule (17.5 mm vs 15–30 mm long) and in the ovate laminas, but differs in its buff trichomes (not silvery), the longer lamina (c. 7.4 cm long vs up to 5.5 cm), and the presence of c. 10 inflorescences in flower at any one time, with each inflorescence bearing 3–7 flowers (vs 1–2 inflorescences per plant, bearing 1 or rarely 2 flowers). – TYPE. Borneo, Sarawak, Marudi District, Baram, Sungai Segelam, around Long Selatong Lepo Ga', on rocky ridge, 24 July 1977, *Chin 2797* (holotype KLU [KLU29970]). (Fig. 1, 3)

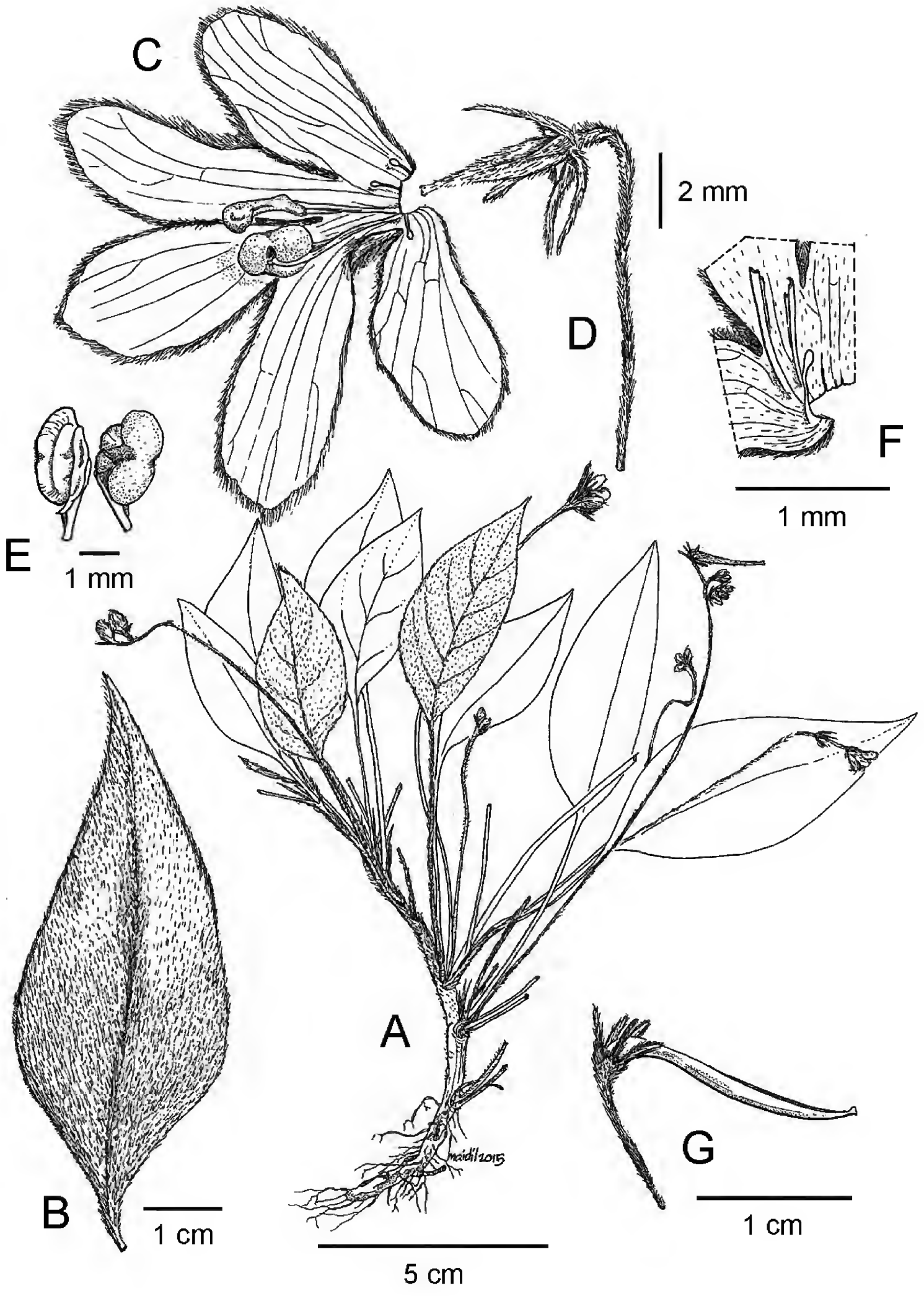

Fig. 3. *Loxocarpus segelamensis* T.L.Yao. **A.** Habit. **B.** Leaf. **C.** Corolla opened to show stamens. **D.** Calyx, ovary, style and stigma. **E.** Anthers. **F.** Staminode. **G.** Capsule. Drawn by N. Mohamad Aidil, all from *Chin 2797*.

Creeping herb with buff, shiny trichomes, stem decumbent. ***Rootstock*** c. 6 cm long, c. 2 mm thick; trichomes adpressed, dense; adventitious roots wiry. ***Petiole*** base of withered leaves persistent. ***Erect stem*** distinct, c. 8 cm long. ***Leaves*** alternate, below well-spaced, crowded at the top; trichomes adpressed, dense on petiole, on lamina above and beneath dense. ***Petiole*** slender, c. 6 cm long, terete; longest petiole about equal in length to the lamina. ***Lamina*** dark green above, paler beneath, thin, ovate, c. 7.4 × 2.9 cm; base cuneate, equal, margin finely serrulate, apex acuminate or acute; midrib and veins obscure above, distinct beneath, lateral veins 4(–5) pairs, lowermost pair arising from lamina base. ***Inflorescences*** axillary, a reduced cyme with a single flower or once branched, c. 10 per plant, flowers 3–7; trichomes eglandular, adpressed on peduncle, bracts and pedicel. ***Peduncle*** slender, 10.5–11.5 cm long; bracts linear, c. 4.4 × 0.4 mm, apex acuminate; pedicel to 1.2 mm long. ***Flower*** trichomes eglandular, adpressed on calyx, outer surface of the corolla and ovary, dense. ***Calyx*** green, upper lip 3-lobed, lower lip 2-lobed; lower lobes larger than the upper lobes, tube c. 1 mm long, c. 1.9 mm wide, lobes linear-lanceolate, apex thickened, blunt, c. 3.9 mm long, base c. 1 mm wide. ***Corolla*** pale blue, flat-faced, tube very short, c. 1.8 mm long, c. 2.9 mm wide; upper lip with 2 lobes c. 7 × 3.8 mm, divided to the base, lower lip with 2 lateral lobes, c. 5.6 × 3.5 mm and a median lobe c. 4.8 × 3 mm, lobes deeply divided; lateral and median lobes oblong. ***Fertile stamens*** 2, yellow; anthers projecting beyond the corolla tube, exposed; filaments straight, thickened in the distal half, c. 4.5 mm long; anthers coherent only at the ventral tip, kidney-shaped, c. 2.5 × 1.4 mm; staminodes 3, the two lateral club-shaped, the central a minute protrusion. ***Nectary*** absent. ***Ovary*** conical, slightly oblique, c. 2.8 mm long, c. 1.8 mm wide; style straight, c. 2.3 mm long; stigma capitate, exposed. ***Capsule*** slender cylindric, c. 17.5 mm long, c. 1.9 mm wide, style sub-persistent; valves straight, splitting dorsally to form a trough; trichomes eglandular, adpressed, dense. ***Seeds*** not seen.

Distribution. Borneo, Sarawak, known only from the type specimen from Ulu Long Selatong.

Habitat. On rocky ridge.

Etymology. It is named for its type locality, Sungai Segelam.

ACKNOWLEDGEMENTS. These new species were discovered during the course of my studies for a Master of Science degree at the University of Malaya, Kuala Lumpur, Malaysia. I am grateful to R. Kiew (KEP) and N.W. Haron (University of Malaya) for their guidance throughout my study. I thank the Training Committee of the Forest Research Institute Malaysia for sponsoring my study for the first two years, and the Institute of Research Management and Monitoring, University of Malaya for the provision of a research grant (PS173-2008B). I gratefully acknowledge the curators at E, K, KEP, KLU, L, SAN, SAR, SING and SNP for granting me permission to examine specimens in their care. I thank R. Kiew, D.J. Middleton and an anonymous reviewer for their constructive comments on the manuscript.

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Gardens' Bulletin Singapore 67(2): 297–303. 2015
doi: 10.3850/S2382581215000253

Studies on *Begonia* (Begoniaceae) of the Moluccas II: a new species from Seram, Indonesia

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ABSTRACT. A new species of *Begonia* L., *Begonia galeolepis* Ardi & D.C.Thomas, is described from Seram, Maluku province, Indonesia. The species is endemic to Seram and belongs to *Begonia* section *Petermannia*. An identification key to the seven *Begonia* species known from the Moluccas is provided.

Keywords. *Begonia galeolepis*, Maluku Islands, Manusela National Park

Introduction

Our understanding of the *Begonia* L. flora of the Moluccas (also known as the Maluku Islands), an archipelago within Indonesia located between the islands of Sulawesi and New Guinea, is very limited because of the paucity of herbarium collections from the region and a lack of alpha-taxonomic baseline work on eastern Malesian *Begonia*. *The Begonia Resource Centre* (Hughes et al., 2015) comprises records of only 138 Moluccan *Begonia* specimens, most of which are not identified to species level, and the rest belonging to six species (Ardi et al., 2014; see identification key to the Moluccan species below).

Recent expeditions by Bali Botanic Garden, and a joint expedition between Bogor Botanic Gardens and Fairchild Tropical Botanic Gardens to major islands of the Moluccas (Halmahera, Seram and Ternate), have brought to light material of several *Begonia* species that do not conform with any species previously reported from the archipelago. Three endemic species have recently been described (Wiriadinata, 2012; Ardi et al., 2014) from material collected on Halmahera, the largest island of the Moluccas, raising the total number of Moluccan species to six (Ardi et al., 2014). From the second largest island, Seram, Hughes (2008) reported only a single species, *Begonia brachybotrys* Merr. & L.M.Perry. This species belongs to the *Begonia rieckei* Warb. species complex, which shows a wide distribution east of Wallace's Line. However, given (i) Seram's substantial area (c. 17,100 km^2) and topographical heterogeneity, (ii) the presence of diverse and suitable ecosystems including lowland rain forests and limestone hills, as well as (iii) the species-richness and prevalence of narrow endemics in *Begonia* (Hughes & Hollingsworth, 2008), this is likely to be an underestimation.

Hughes (2008) already noted that even the very limited herbarium material indicated that a number of species remain to be described from the archipelago.

A new species is described below from material collected on Seram and cultivated in Bali Botanic Garden and Bogor Botanic Gardens. The species is very distinct because of the presence of unusual appressed, fleshy and branched red scales on the stems and leaves (Fig. 1, 2). In common with the majority of Moluccan species, it belongs to *Begonia* sect. *Petermannia* (Klotzsch) A.DC., which is distinguished by protogynous inflorescences, two-flowered female inflorescences or solitary female flowers, three-locular ovaries with axile placentation and bilamellate placentae, fruits with equal or subequal wings, and anthers with unilaterally positioned slits (Doorenbos et al., 1998). All available *Begonia* specimens from BO, E, K, L and SING have been consulted, and hence it must be assumed, at least until more intensive collecting reveals otherwise, that this species has a restricted range and is endemic to Seram (Fig. 3).

Begonia galeolepis Ardi & D.C.Thomas § *Petermannia*, **sp. nov.**
Species resembling *Begonia holosericeoïdes* Ardi & D.C.Thomas in the creeping habit and leaf shape, but differs consistently by the shorter peduncles of the female inflorescences (up to 5 mm long), the sparse to moderately dense indumentum of fleshy, branched, appressed red scales on stems, petioles and abaxial leaf lamina veins, and the very long pedicels of male flowers (up to 11 cm). In contrast, in *Begonia holosericeoides* the peduncles of the female inflorescences are 1.1–3.5 cm long, the petioles and stems show a dense indumentum of branched pinkish hairs, and the pedicels of the male flowers are 1.5–4 cm long. – TYPE: Indonesia, Seram, Manusela National Park, cultivated in Bogor Botanic Gardens, 19 May 2015 (voucher made from cultivated material), *Wisnu Ardi 102* (holotype BO; isotypes Herbarium of Bali Botanic Garden, KRB, SING) (Fig. 1–3).

Perennial, monoecious herbs, stems initially semi-erect, but prostrate and creeping in older plants, rooting at the nodes when in contact with the substrate, up to c. 40 cm long; stems, primary veins on the abaxial stipule surfaces, petioles, and primary and secondary veins on the abaxial leaf lamina surfaces with sparse to moderately dense indumentum of multicellular, fleshy, appressed, red scales up to 6 × 4 mm, the larger ones branched in the distal part, and all above-ground vegetative parts with microscopic glandular hairs. ***Stem*** branched; internodes 0.8–5.5 cm long, up to 1 cm in diameter, terete, green. ***Leaves*** alternate; *stipules* persistent, 1.8–2.5 × 1–2 cm, ovate to triangular, acuminate, setose, seta to 16 mm long, margin entire and sometimes slightly revolute, green to reddish with small paler spots, translucent at the margins; *petioles* c. 7–22 cm long, adaxially deeply channelled, with red scales forming a ring at the petiole-lamina transition; *lamina* basifixed, 16–23.8 × 12.5–17.2 cm, very asymmetric, broadly ovate to suborbicular, base cordate and lobes not or sometimes slightly overlapping, apex shortly acuminate, margin distantly dentate, the teeth bristle-pointed, adaxial surface shiny reddish dark green with bright green veins, glabrous, abaxial surface pale reddish green, primary veins 7–9, actinodromus, secondary veins craspedodromus. ***Inflorescences*** protogynous; female inflorescences 1–2-flowered,

one node basal to male inflorescences, peduncles up to 5 mm long; male inflorescences composed of 2–3 monochasial partial inflorescences, each monochasium with 2–4 flowers; *bracts* ovate to elliptic, 10–20 × 7–10 mm, green to red, with an abaxially prominent midrib and a sparse indumentum. ***Male flowers:*** pedicels 4–11 cm long, glabrous or glabrescent; *tepals* 2, broadly ovate, 9–18 × 11–15 mm, base slightly cordate, margin entire, apex rounded, white or white tinged with pink at the margin, abaxially sparsely hairy; *androecium* of 45–51 stamens, yellow, filaments 1–2 mm long, slightly fused at the very base, anthers 1–1.5 mm long, obovate, dehiscing through unilaterally positioned slits c. ½ as long as the anthers. ***Female flowers:*** pedicels 1.5–4 cm long, sparsely hairy, green–reddish; *tepals* 5(–6), white tinged with pink, unequal, the outer four larger, 9–15 × 6–11 mm, obovate, the inner one smaller, 6–15 × 4–5 mm, obovate, abaxially sparsely hairy to glabrescent; *ovary* obovoid, c. 10–15 × 6–8 mm (excluding the wings), green, glabrous or sometimes sparsely hairy, locules 3, placentation axile, placentae bilamellate, wings 3, red, base slightly rounded or cuneate, apex truncate, style basally fused, 3-branched, each stylodium bifurcate in the stigmatic region, stigmatic surface a spirally twisted papillose band, orange. ***Fruits*** on up to 5 cm long pedicels, seed bearing part obovoid, up to c. 17 × 10 mm (excluding the wings), sparsely hairy, dehiscent, splitting along the wing attachment, wing shape as for ovary, up to 11 mm at the widest point (subapically). ***Seeds*** unknown.

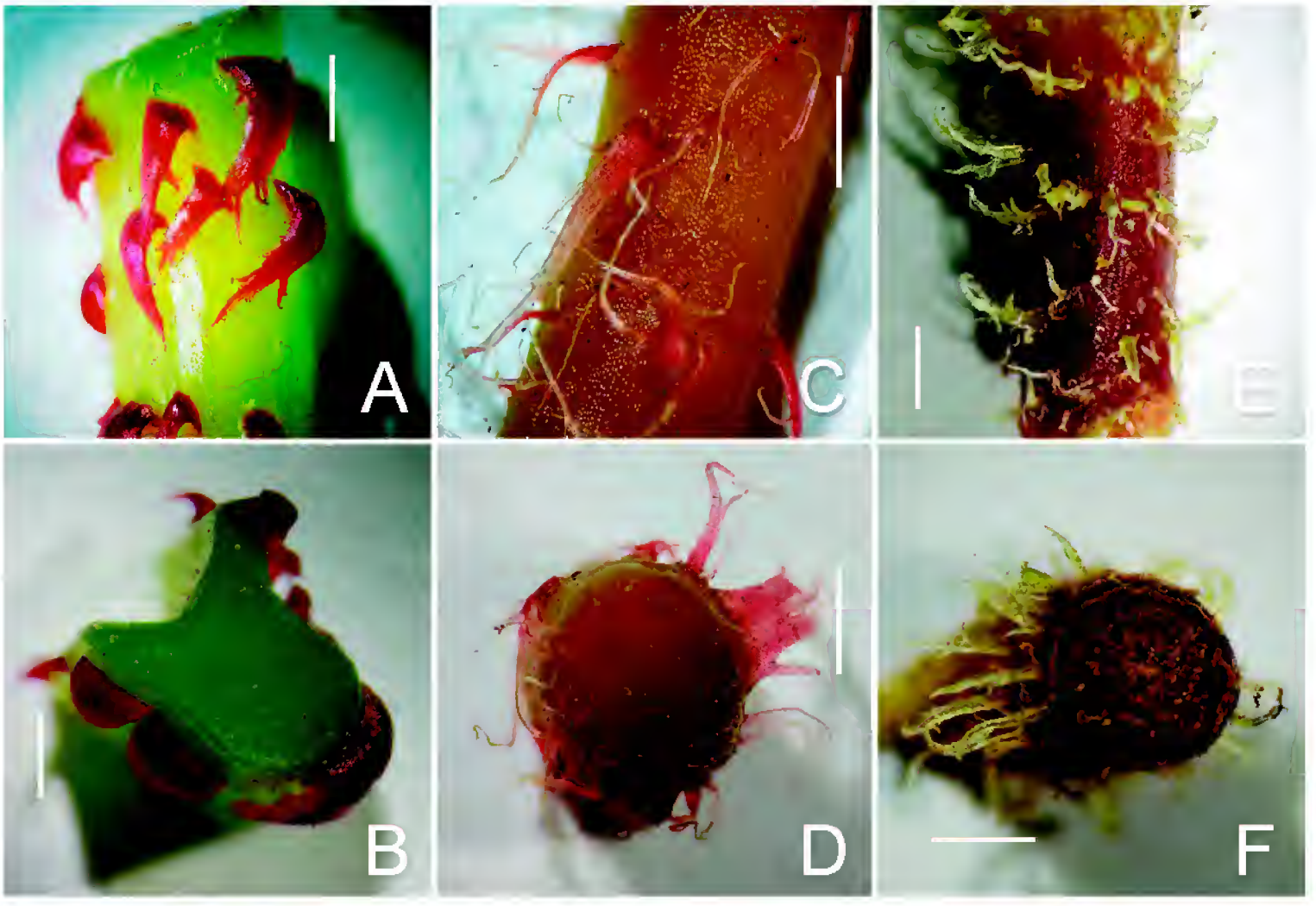

Fig. 1. Branched trichomes and scales in *Begonia* sect. *Petermannia*. **A–B.** *Begonia galeolepis* Ardi & D.C.Thomas, appressed, branched red scales. **C–D.** *Begonia holosericeoides* Ardi & D.C.Thomas, branched trichomes. **E–F.** *Begonia ozotothrix* D.C.Thomas, branched trichomes. Scale bars: A–F = 2 mm. (Photos: Wisnu H. Ardi)

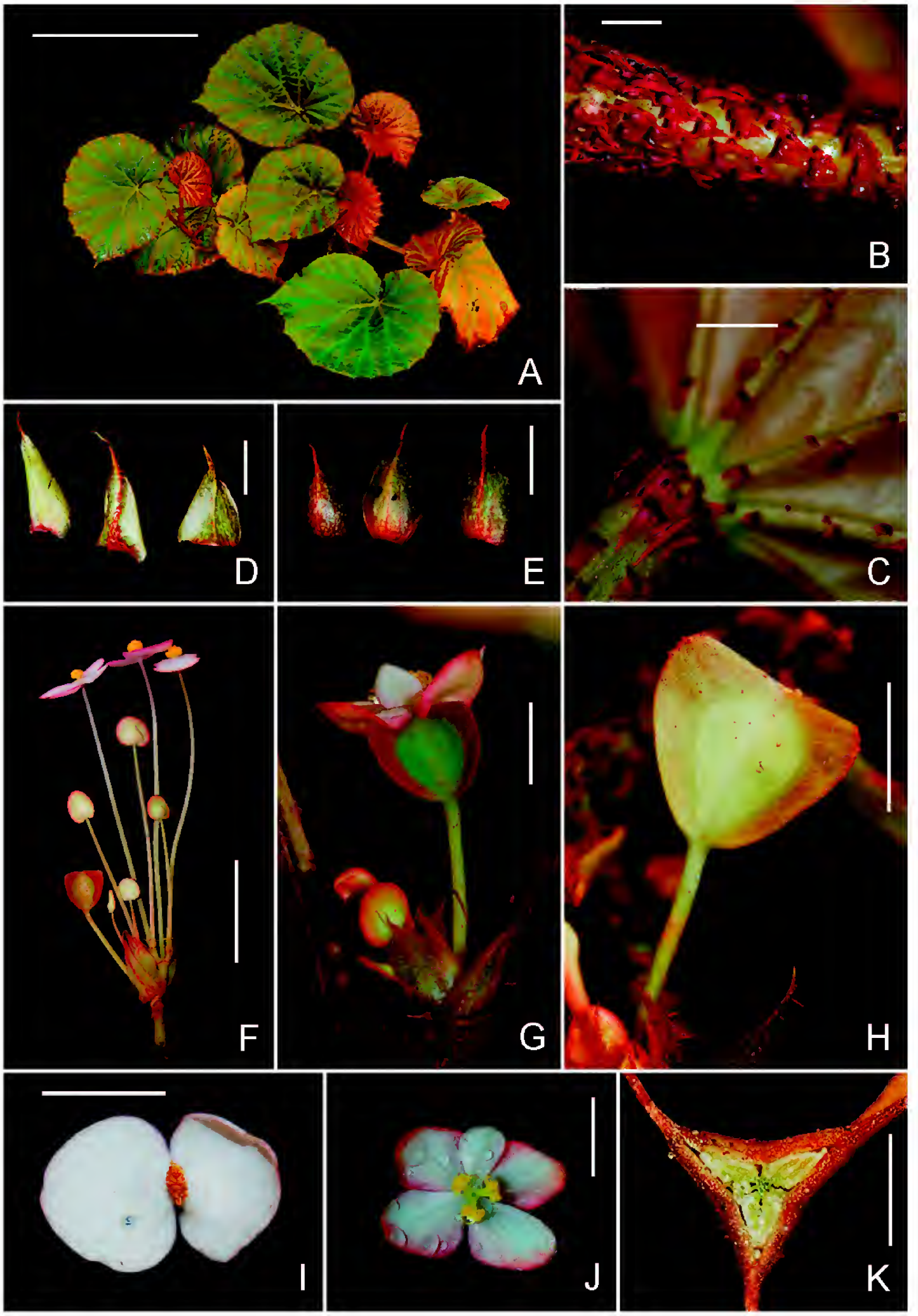

Fig. 2. *Begonia galeolepis* Ardi & D.C.Thomas. **A.** Growth habit in cultivation. **B.** Red scales on stem. **C.** Red scales on the petiole and abaxial leaf surface. **D.** Stipules. **E.** Bracts. **F.** Male inflorescence. **G.** Female inflorescence. **H.** Fruit. **I.** Male flowers. **J.** Female flower. **K.** Cross-section of ovary showing placentation. Scale bars: A = 20 cm, B, C, K = 5 mm, D, E, G–J = 1 cm, F = 4 cm. (Photos: Wisnu H. Ardi)

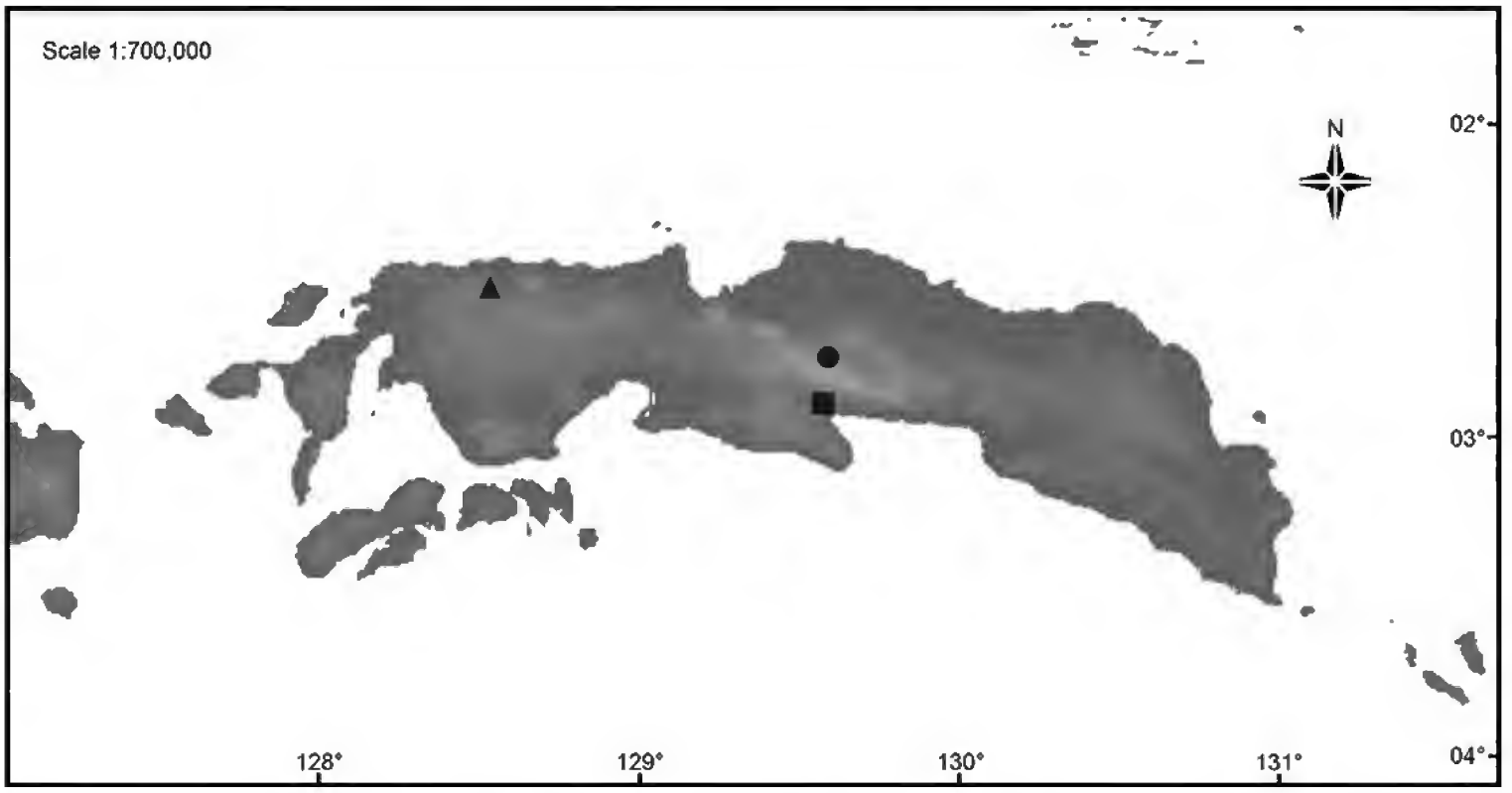

Fig. 3. Distribution of *Begonia galeolepis* Ardi & D.C.Thomas. Collection sites are indicated by a circle (Manusela National Park), a square (Japoetih) and a triangle (Buria). Specimen location information was georeferenced using the GeoNames geographical database at http://www.geonames.org/.

Habitat. Primary lowland rainforest, growing on vertical moist limestone walls, at river embankment, in half-shade to fully sun-exposed, at c. 20 m altitude.

Distribution. Endemic to Seram, Maluku Province, Indonesia. Locally common.

Etymology. The specific ephithet is derived from the classical greek ("γαλεος" [*galeos*]= dogfish, small shark, and "λεπις" [lepis]= scale) and refers to the fleshy red scales on the petioles and stems, whose shape resembles shark scales (Fig. 1).

Notes. *Begonia galeolepis* is distinct within section *Petermannia* by a combination of several characters such as the creeping stem, the characteristic red scales on stems and leaves, few-flowered monochasial male inflorescences, and the very long pedicels of the male flowers (up to 11 cm long). Branched hairs are rare in Asian *Begonia*, and have been only described from two other species in section *Petermannia*, *Begonia holosericeoides* Ardi & D.C.Thomas from Halmahera (Ardi et al, 2014) and *B. ozotothrix* D.C.Thomas from Sulawesi (Thomas et al., 2009). The branched hairs of *Begonia ozotothix* are much smaller, white and translucent and rounded in cross-section, and the hairs of *B. holosericeoides* are thinner, pinkish and show filiform apices in comparison to the thick, appressed red scales of *B. galeolepis* (Fig. 1). These scales rather resemble hairs found at the lamina-petiole transition in the Sumatran species *Begonia sublobata* Jack which, however, is otherwise morphologically dissimilar and belongs to section *Reichenheimia* (Hughes & Girmansyah, 2011). Similar hairs

are also found in some species of the American *Begonia* section *Gireoudia* (e.g. *B. heracleifolia* Cham. & Schltdl.), which is only very distantly related to Asian *Begonia* (Moonlight et al., 2015).

Provisional IUCN conservation assessment. Data deficient (DD). *Begonia galeolepis* is known from only five collections from five locations (Batoe Keye, G. Buria, Japoetih-Pileana, Manusela National Park, and W. Kasoe), two of which (Batoe Keye and W. Kasoe) could not be georeferenced with certainty (Fig. 3). This indicates that the species used to have a wide distribution on Seram. However, two of the collection sites, Buria and Japoetih, have been almost completely converted for human habitation and agriculture. The third collection site is in a legally protected area, Manusela National Park, where no signs of major anthropogenic disturbance were noticed. Further exploration is required to assess the species' current range on the island.

Additional specimens examined. INDONESIA: **Seram:** 18 Sep 1917, *L.M.R. Rutten 114* (BO); W. Kasoe, West Ceram, 28 Aug 1918, *L.M.R. Rutten 1607* (BO); Japoetih-Pileana, 27 Oct 1937, *P.J. Eyma 1811* (AA, BO); Batoe Keye, 29 Dec 1937, *P.J. Eyma 2474* (BO); G. Buria, Kec. Taniwel, 8 Dec 1984, *Ramlanto 310* (BO); cultivated in Bali Botanic Garden from vegetative material collected in Manusela National Park, 27 Apr 2011 (voucher made from cultivated material), *W.H. Ardi 61* (BO).

Identification key to the *Begonia* species of the Moluccas

1a. Plants erect 2
1b. Plants creeping 3

2a. Leaves broadly ovate; female flowers with 2–5 tepals; male flowers with 2 tepals, anther connectives not projecting at apex ..... *B. rieckei* complex
2b. Leaves oblong, elliptic or broadly elliptic; female flowers with 6 tepals; male flowers with 4 tepals, anther connectives projecting at apex ..... *B. aptera*

3a. Leaf apex acuminate 4
3b. Leaf apex rounded 6

4a. Adaxial leaf surface densely hirsute with red hairs ..... *B. sageaensis*
4b. Adaxial leaf surface glabrous 5

5a. Stems and petioles with sparse to moderately dense indumentum of fleshy, appressed and branched red scales; female inflorescence peduncles up to c. 5 mm long; male flower pedicels up to 11 cm long ..... *B. galeolepis*
5b. Stems and petioles with dense indumentum of branched pinkish trichomes with filiform apices; female inflorescence peduncles up to 3.5 cm long; male flower pedicels up to c. 4 cm long ..... *B. holosericeoides*

6a. Male flowers with two tepals; female inflorescence peduncles 2–3 mm long; ovary densely hairy ..... *B. holosericea*
6b. Male flowers with four tepals; female inflorescence peduncles c. 1 mm long; ovary glabrous or glabrescent ..... *B. aketajawensis*

ACKNOWLEDGEMENTS. The authors would like to express gratitude to the Seram Expedition team from Kebun Raya Bali (I Made Ardhaka, Kadek Erosi Undaharta, and I Gede Tirta) for giving permission to use their materials, to the curators of A, B, BM, BO, CEB, E, K, L and SING for allowing us access to herbarium material, and to two anonymous reviewers and David Middleton for their constructive comments. WA's work was supported by a Singapore Botanic Gardens' Research Fellowship, which is gratefully acknowledged.

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Gardens' Bulletin Singapore 67(2): 305–307. 2015
doi: 10.3850/S2382581215000265

A new typification of *Hoya zollingeriana* (Apocynaceae, Asclepiadoideae)

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ABSTRACT. The typification of *Hoya zollingeriana* Miq. is discussed and a lectotype is selected from the original material. An earlier typification was based on a specimen belonging to a different taxon and is rejected.

Keywords. *Eriostemma*, *Hoya diversifolia*, Java, lectotype, neotype

Introduction

In the recently established online journal 'Hoya New' [http://www.rare-hoyas.com/publication.htm], *Hoya zollingeriana* Miq. was combined in *Eriostemma zollingerianum* (Miq.) Kloppenb. and typified (Kloppenburg, 2014). The combination is unnecessary as *Eriostemma* (Schltr.) Kloppenb. & Gilding (Kloppenburg & Gilding, 2001) is a genus that has been shown to be genetically and morphologically indistinguishable from *Hoya* R.Br. in all recently published phylogenies of the genus (Wanntorp et al., 2006a, 2006b; Wanntorp, 2007; Wanntorp & Forster, 2007; Wanntorp & Kunze, 2009; Wanntorp et al., 2011; Rodda & Ercole, 2014; Rodda et al., 2014; Wanntorp et al., 2014). *Eriostemma* is currently recognised at sectional level (*Hoya* sect. *Eriostemma* Schltr.). The species included in *Hoya* sect. *Eriostemma* are characterised by a terrestrial habit, large flowers (>3 cm across, often much larger), a prominently stalked staminal corona, club-shaped or clavate pollinia without pellucid margins, and large follicles with a thick spongy pericarp. Regardless of the taxonomic status of *Eriostemma*, the identity of *Hoya zollingeriana* needs to be ascertained as, since its publication, it has rarely appeared in the taxonomic literature. I have been able to find only two authors who cite the name: Koorders (1912: 100), who accepted the species even though he didn't examine any type material, and Backer & Bakhuizen van den Brink (1965: 269), who considered it to be a synonym of *Hoya diversifolia* Blume. Kloppenburg (2014) stated that 'Since no holotype species [sic] has previously been designated for this species: I hereby designate #12615 (BO) as the holotype'. That specimen is later indicated as *Miquel 12615* and a low-resolution photograph of the sheet, obtained before it was re-mounted in 1999, is also published. If that specimen is indeed original material for *Hoya zollingeriana* then Kloppenburg's paper can be considered to be an effective lectotypification following ICN Art. 9.9 (McNeill et al.,

2012) due to need to correct holotype to lectotype. In August 2014, I examined all *Hoya* specimens at BO and noted that the specimen indicated by Kloppenburg (2014) as *Miquel 12615* is instead *Teysmann 12615,* an undated sterile specimen collected in Sulawesi that I tentatively identify as *Hoya excavata* Teijsm. & Binn. *Teysmann 12615* is not amongst the materials cited by Miquel (1857: 518) in the publication of *Hoya zollingeriana* and, therefore, it cannot be the lectotype of the name. If there is no extant original material, and again applying Art. 9.9 of the ICN (McNeill et al., 2012), then the typification by Kloppenburg (2014) could possibly count as an effective neotypification. Given that Kloppenburg (2014) does not indicate whether he has made a thorough search for all original material of *Hoya zollingeriana,* I have examined herbarium specimens of *Hoya* at BO, BM, CGE, G, E, FI, K and P (herbarium codes from Thiers [continuously updated]) in an attempt to locate possible original material and verify whether Kloppenburg's (2014) effective neotypification should stand or not.

Lectotypification of *Hoya zollingeriana*

Hoya zollingeriana Miq., Fl. Ned. Ind. 2: 518 (1857) [20 Aug 1857]. – *Eriostemma zollingerianum* (Miq.) Kloppenb., Hoya New 3(1): 6 (2014) [27 Sep 2014] [epublished]. – TYPE: Indonesia, Java, bij Lalaei, Mei, *Zollinger, H.* s.n. (lectotype P [P05029459], designated here). = ***Hoya diversifolia*** Blume

Notes. Hoya zollingeriana was based on a Zollinger collection indicated only as 'Java, bij Lalaei, Mei' (Miquel, 1857). Zollinger's duplicates can be found in many herbaria, with significant sets at BO, CGE, G, K, LE, P. However, Zollinger's private set was lent to Miquel, who used it for his *Flora van Nederlandsch Indië* (Miquel, 1857), and is now incorporated into P (Van Steenis-Kruseman, 1950). In P I found a specimen (barcode P05029459, https://science.mnhn.fr/institution/mnhn/collection/p/item/p05029459) labelled *Hoya zollingeriana* in Miquel's handwriting. This is the only original material of the taxon that has been found. It is a well-preserved fertile specimen that can be identified as *Hoya diversifolia* Blume, a species also described from Java and widespread in East and Southeast Asia. Backer & Bakhuizen van den Brink (1965: 269) already previously synonymised *Hoya zollingeriana* under *H. diversifolia,* a decision I can confirm.

ACKNOWLEDGEMENTS. This research received support from the National Parks Board (Singapore) that sponsored herbarium visits in Asia and Europe. I thank the curators of BO, BM, CGE, G, E, FI, K and P herbaria for allowing access and/or for providing high quality images of herbarium specimens and, in particular, Dr Sovanmoly Hul (P) who sent a high quality scan of the lectotype of *Hoya zollingeriana.* An anonymous reviewer and Dr David Middleton, Editor of Gardens' Bulletin Singapore, are thanked for suggesting improvements to this manuscript.

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Gardens' Bulletin Singapore 67(2): 309–350. 2015
doi: 10.3850/S2382581215000277

A revision of *Cryptocarya* (Lauraceae) from Thailand and Indochina

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ABSTRACT. A revision of the species of *Cryptocarya* R.Br. (Lauraceae) from Thailand and Indochina (Laos, Cambodia and Vietnam) is presented, comprising a key to species, full descriptions, distribution maps, provisional IUCN conservation assessments, ecological information and ethno-botanical notes where appropriate. In this treatment, 16 species are recognised, one species name is validated (*Cryptocarya globularia* Kosterm. ex de Kok), nineteen names are lectotypified and nine names are placed into synonymy for the first time. Using standard IUCN criteria, most species are considered to be Least Concern, one is assessed as Data Deficient (*C. globularia*), and six are Endangered (*Cryptocarya chanthaburiensis* Kosterm., *Cryptocarya hainanensis* Merr., *Cryptocarya laotica* (Gagnep.) Kosterm., *Cryptocarya pallens* Kosterm., *Cryptocarya pustulata* Kosterm. and *Cryptocarya sublanuginosa* Kosterm.).

Keywords. Cambodia, *Cryptocarya*, Laos, taxonomy, Thailand, Vietnam

Introduction

Cryptocarya R.Br. occurs throughout the tropics (with the exception of central Africa) and has its centre of diversity in Southeast Asia. The total number of species is estimated to be between 200 and 250. The classification of the genera within the Lauraceae has always been problematic. The general framework of characters which have been employed by most authors was first established by Nees von Esenbeck (1836) in his classification of the family. However, the outcomes of such a classification can vary greatly, depending upon the weightage given to each particular character. Recently, with the help of molecular data, some taxonomic relationships are becoming clearer (Rohwer et al., 2014). *Cryptocarya* is now placed in the *Cryptocarya* group together with *Beilschmiedia* Nees and *Endiandra* R.Br. as one of the early divergent clades within the family (Rohwer, 2000; Rohwer et al., 2014). The genus has never been revised in full, but a number of important modern regional treatments exist. The Australian taxa were revised by Hyland (Hyland, 1989; Le Cussan & Hyland, 2007), who recognised 47 species, of which 38–39 (80–82%) were considered to be endemic to Australia. The Chinese taxa have been revised by Li Xiwen et al. (2008), who recognised 21 species, of which 15 (71%) are endemic to China. In Brazil, 13 species are recognised, of which 11 (85%) are endemic (De Moraes, 2007), and amongst the 17 taxa currently recognised from Peninsular Malaysia, only three (c. 18 %) are

endemic (De Kok, in press). The genus has never previously been revised for Thailand and is not even mentioned for Thailand by Suvatti (1978). In his *Flore Générale de L'Indo-Chine*, Lecomte (1914) only recognised five species (*Cryptocarya caesia* Blume (now *Cryptocarya ferrea* Blume), *C. lenticellata* Lecomte (now *C. concinna* Hance), *C. ferrea*, *C. oblongifolia* Blume and *C. ochracea* Lecomte (both now *C. ferrea*)), although 17 were recorded in the most recent checklist for Vietnam (Lê, 2003: 82–85). In this account, 16 species are recognised from Thailand and Indochina (Laos, Cambodia and Vietnam), with 13 recorded from Thailand, 10 from Vietnam, 8 from Laos and 5 from Cambodia. The numbers of endemic taxa per country are very low, only two from Thailand and one from Vietnam. The number of endemic species for the region as a whole is six, which is c. 37 % of the total.

Distribution within Thailand and Indochina

The species distribution patterns within Thailand and Indochina are interesting. A distinct set of species (*Cryptocarya kurzii* Hook.f., *C. nitens* (Blume) Koord. & Valeton and *C. rugulosa* Hook.f.) occurs only in Peninsular Thailand but are then also found in Peninsular Malaysia. Some of them are common in Peninsular Malaysia but are represented by only a few specimens in Thailand: for instance *Cryptocarya rugulosa* is only known from one specimen, while *C. nitens* is known from just two. A different set of species occurs in northern Thailand, northern Vietnam and northern Laos and then usually also in southern China (*Cryptocarya concinna* and *C. hainanensis* Merr.). In contrast, a few taxa (*Cryptocarya amygdalina* Nees, *C. densiflora* Blume, *C. impressa* Miq. and, to some extent, *C. diversifolia* Blume and *C. ferrea*) bridge the gap between, on the one hand, northern Thailand and northern Indochina, and on the other, Peninsular Thailand and Malaysia. These species tend to be very widespread and in one case occurs all the way to Australia (*Cryptocarya densiflora*).

A small group of species are endemic to the region (*Cryptocarya chanthaburiensis* Kosterm., *C. globularia* Kosterm. ex de Kok, *C. laotica* (Gagnep.) Kosterm., *C. pallens* Kosterm., *C. pustulata* Kosterm. and *C. sublanuginosa* Kosterm.). Most occur in eastern Thailand, Cambodia, southern Laos and southern Vietnam, which together form an area that is considered to be under-collected (Parnell et al., 2003; Marsh et al., 2009), while the others occur either in northern Vietnam (*Cryptocarya globularia*) or northern and central Thailand (*C. pallens*). Most of these taxa are represented in herbaria by very few specimens, which has made revising their taxonomy and the production of an identification key very difficult. This applies in particular to those taxa for which flowers (*Cryptocarya globularia*) or fruits (*C. pustulata*) are lacking in the herbaria consulted. This small number of collections also means that based on the area of occupancy alone, all these endemic taxa have been assessed as Endangered according to IUCN standards (IUCN, 2012; see http://geocat.kew.org).

A distinct group of species, characterised by markedly long bracteoles, is common in Peninsular Malaysia (see discussion of morphology in De Kok (in press)) but is almost entirely absent from the present study area. The only exception is

Cryptocarya rugulosa, which is mainly a species from the Sunda Plateau that only just gets across the border into Peninsular Thailand.

In conclusion, the *Cryptocarya* flora of the region studied here is dominated in the south by species which are common in Peninsular Malaysia and other areas of the Sunda Plateau, while in the north it is dominated by species that also occur in southern China. Very little overlap occurs between these two groups. A significant number of endemic species is found only in the region comprising southern Laos, eastern Thailand, Cambodia and southern Vietnam.

Material and Methods

This study is based mainly on observations of specimens from the following herbaria: A, BISH, BKF, BM, BO, C, CAS, E, GH, IBK, K, KEP, L, MEL, MO, MPU, NY, P, PE, RUPP and SING.

In the descriptions that follow:

i) All characters and measurements are from mature material, unless indicated otherwise;

ii) All collections of *Cryptocarya* from Indochina and Thailand seen by the author are cited;

iii) Selected specimens of Indo-Chinese and Thai taxa from outside the present area are cited only when this material contributed to the taxonomic descriptions, except for material cited in De Kok (in press);

iv) All synonyms of *Cryptocarya* taxa from Indochina and Thailand are included. Synonyms from outside the area are included only in those cases where type material has been seen by the author;

v) In the descriptions the indumentum is characterised as: 'glabrous' when the underlying surface is without any hairs or with just a few occasional hairs; 'sparsely hairy' when it is showing more underlying surface than hairs; 'densely hairy' when showing less underlying surface than hairs; and 'velutinous' when the underlying surface is completely covered with hairs;

vi) Petioles and fruit stalks are sometimes described as swollen. This means not that they are necessary thicker, but that over the length of the structure from the base the width increases and then decreases near the apex, giving the whole structure a swollen appearance;

vii) Scans of type material, where seen, were accessed at http://plants.jstor.org on 20 October 2014;

viii) For the provisional IUCN conservation assessments, all Extents of Occurrence (EOO) and Areas of Occupancy (AOO) were calculated using http://geocat.kew.org on 21 October 2014.

Taxonomic treatment

Cryptocarya R.Br., Prod. Fl. Holl. 402 (1810), **nom. cons.**; Gamble, J. Asiatic Soc. Bengal. 75: 37–51 (1912); Ridl., Fl. Malay Pen. 3: 76–82 (1924); H.Liou, Laurac. Chine & Indo-Chine 95–102 (1932); Kosterm., Meded. Bot. Herb. Utrecht 42: 557 (1937); Kosterm., Reinwardtia 4: 243–244 (1957); Kosterm., Reinwardtia 8: 21–196 (1970); Kochummen, Tree Fl. Malaya 4: 132–138 (1989); B.Hyland, Austral. Syst. Bot. 2: 162–213 (1989); Rohwer, Fam. Gen. Vasc. Pl. 2: 366–391 (1993); van der Werff & H.G.Richt., Ann. Miss. Bot. Gard. 83: 409–418 (1996); van der Werff, Blumea 46: 134 (2001); Le Cussan & B.Hyland, Fl. Austral. 2: 140–178 (2007); P.L.R.de Moraes, ABC Taxa 3: 1–191 (2007). – TYPE SPECIES: *Cryptocarya glaucescens* R.Br. (lectotypified by Kostermans, Notul. Syst. (Paris) 8: 112 (1939)).

Caryodaphne Blume ex Nees, Syst. Laurac. 225 (1836). – TYPE SPECIES: *Caryodaphne laevigata* (Blume) Nees, Syst. Laurac. 227 (1836) (= *Cryptocarya laevigata* Blume) (lectotypified by Kostermans, J. Sci. Res. (Jakarta) 1: 122 (1952)).

Pseudocryptocarya Teschn., Bot. Jahrb. Syst. 58: 411–413 (1923). – TYPE SPECIES: *Pseudocryptocarya pauciflora* (K.Schum. & Lauterb.) Teschn., Bot. Jahrb. Syst. 58: 411–413 (1923) (= *Cryptocarya laevigata* Blume).

Kerrdora Gagnep., Notul. Syst. (Paris) 14: 31 (1950). – TYPE SPECIES: *Kerrdora laotica* Gagnep., Notul. Syst. (Paris) 14: 31 (1950). (= *Cryptocarya laotica* (Gagnep.) Kosterm.).

Shrubs to trees, evergreen. ***Bud*** scales few. ***Leaves*** alternate or rarely (sub)opposite (not in this region), pinnately veined, rarely triplinerved. ***Inflorescence*** type 3 (using terminology of Van der Werff, 2001), axillary, involucral bracts absent, bracteoles triangular, linear to elliptic or orbicular, usually caducous during flowering. ***Flowers*** bisexual, small; perianth lobes 6, isomorphic, caducous, tube turbinate or ovoid, persistent, constricted at top after flowering. ***Stamens*** 9, inserted on throat of perianth tube, in 1st and 2nd rows introrse, glandless; in 3rd row extrorse, with glands at base; anthers 2-locular; staminodes 3, shortly stalked, glandless; ovary sessile, free during flowering, enveloped by perianth tube; style linear; stigma small or inconspicuous. ***Fruit*** drupe-like, wholly enveloped by fleshy or hard, dilated perianth tube, but leaving a ring like aperture at apex. ***Stalk*** sometimes swollen when mature.

Distribution. About 200–250 species, pan-tropical except for central Africa. In this revision 16 species are recorded from Thailand and Indochina.

Use. The wood of many species is used as a light hardwood.

Key to the species
(This key works best for young flowering material, fruiting material is often difficult to name with any degree of certainty)

1a. Leaves triplinerved ..... *C. densiflora*
1b. Leaves pinnately veined 2

2a. Mature lower leaf surface glabrous, except on veins 3
2b. Mature lower leaf surface sparsely hairy to velutinous 8

3a. Young twigs with dark brown hairs; mature fruit globose, smooth or faintly ridged, sparsely hairy (occurring in Peninsular Thailand only) ..... *C. nitens*
3b. Young twigs with whitish to yellowish brown hairs; mature fruit narrowly ellipsoid, ellipsoid or ovoid, smooth to ribbed, glabrous or sometimes with a few hairs at apex (occurring throughout the region) 4

4a. Leaves papery 5
4b. Leaves leathery 6

5a. Twigs densely tomentose; upper surface of leaves sparsely hairy, midrib more densely hairy; bracteoles ≤ 0.5 mm long, caducous; mature fruit (dried) obovoid, 12-ribbed ..... *C. concinna*
5b. Twigs sparsely hairy; upper surface of leaves glabrous with a few hairs on the midrib; bracteoles ≥ 4 mm long, persistent; mature fruit (dried) ellipsoid, smooth ..... *C. laotica*

6a. Tertiary veins scalariform; petiole 6–20 mm long, slender to swollen when mature; mature fruits smooth, stalk strongly swollen (currently only known from Thailand) ..... *C. amygdalina*
6b. Tertiary veins reticulate to scalariform; petiole 5–15 mm long, slender or only slightly swollen when mature; mature fruits smooth or ridged, stalk slender to only slightly swollen (known from Cambodia, Laos, Vietnam and southeastern Thailand) 7

7a. Tertiary veins scalariform on lower surface; petiole 5–8 mm long; mature fruits (dried) globose, smooth with some faint ridges ..... *C. hainanensis*
7b. Tertiary veins reticulate to scalariform on lower surface; petiole 8–15 mm long; mature fruit (dried) ellipsoid, smooth ..... *C. sublanuginosa*

8a. Midrib raised or flattened at base on upper leaf surface 9
8b. Midrib sunken at base on upper leaf surface 10

9a. Upper leaf surface bullate, apex emarginate to acuminate; mature fruit with pronounced or faint ridges ..... *C. diversifolia*

9b. Upper leaf surface slightly bullate, apex long acuminate; mature fruit smooth .... *C. impressa*

10a. Perianth lobes velutinous to densely hairy (hairiness of perianth tube and petals lobes similar); twigs and inflorescences with yellowish to brown hairs; bracteoles elliptical, < 1 mm long, seldom persistent; fruit (dried) ovoid to ellipsoid, sometimes obovoid, stalks swollen when mature ..... *C. ferrea*
10b. Perianth lobes sparsely hairy (clear difference in hairiness between the perianth tube and the petals lobes) or specimens in fruit 11

11a. Bracteoles 1–3.5 mm long 12
11b. Bracteoles < 1 mm long 15

12a. Mature fruit globose, 17–18 mm diameter, finely and sparsely hairy at apex, stalk not or hardly swollen when mature ..... *C. globularia*
12b. Mature fruit ellipsoid, < 13 mm diameter, glabrous, stalk not swollen to swollen when mature 13

13a. Leaves leathery; bracteoles elliptic to lanceolate, (1.5–)2–3.5 mm long; perianth tube 1.2–2 mm long; fruit stalk swollen when mature (occurring in Peninsular Thailand) ..... *C. rugulosa*
13b. Leaves thinly leathery; bracteoles linear, 1–2.5 mm long; perianth tube 0.8–1.5 mm long; stalk sometimes swollen when mature 14

14a. Leaf base asymmetric in more than 50% of mature leaves; fruit 11–15 mm long, stalk not or slightly swollen when mature (occurring in east Thailand and southern Indochina) ..... *C. chanthaburiensis*
14b. Leaf base symmetric in most mature leaves (> 75%); fruit 18–21 mm long, stalk swollen when mature (occurring in Peninsular Thailand) ..... *C. kurzii*

15a. Leaves with tertiary veins irregularly reticulate; bracteoles triangular .... *C. concinna*
15b. Leaves with tertiary veins scalariform; bracteoles round or elliptic to linear 16

16a. Petiole channelled, velutinous; perianth lobes velutinous outside, lobes 1–1.6 mm wide ..... *C. ferrea*
16b. Petiole half-terete, glabrous to velutinous; perianth lobes sparsely hairy outside; lobes 0.6–1.5 mm wide 17

17a. Twigs and petioles with dark brown hairs; bracteoles round, caducous; perianth lobes 0.8–0.9 mm wide ..... *C. pallens*
17b. Twigs and petioles with yellowish hairs; bracteoles elliptic to linear, often persistent; perianth lobes 0.6–1.5 mm wide ..... *C. pustulata*

1. *Cryptocarya amygdalina* Nees in Wallich, Pl. Asiatic Rar. 2: 69 (1831); Kosterm., Bibliogr. Laurac. 384 (1964); H.W.Li et al., Fl. China 7: 250–251 (2008). – *Laurus amygdalina* Buch.-Ham. ex Wall., Numer. List 2585 (1830), nom. nud. – TYPE: [India?] Datgong, 26 March 1809, [*Herb. Hamilton, Wallich Cat. 2585*] (lectotype K-W [K001116509], designated here; isolectotype E [E00393147]). (Fig. 1)

Trees 4.5–25 m tall, dbh 10–30 cm. ***Bark*** smooth to rough, reddish or pale or greyish brown; wood brownish to yellow, sometimes smelling of lavender. ***Twigs*** smooth to slightly longitudinally ridged, glabrous but sparsely hairy when young, hairs whitish to reddish or yellowish. ***Leaf lamina*** leathery, lanceolate to elliptic, 4–21 × (1.7–)2.5–11 cm, apex emarginate to acuminate, base cuneate to almost rounded, slightly asymmetric; pinnately veined, secondary veins 5–10 pairs, straight but curved near margin, tertiary veins scalariform; upper surface glabrous with few hairs on major veins, midrib sunken, secondary veins sunken, tertiary veins faint to inconspicuous, bright to deep green, shiny; lower surface glabrous with few hairs on midrib and major veins, midrib raised, secondary veins raised, tertiary veins distinct, glaucous, grey-brown. ***Petiole*** 6–20 mm long, slender to swollen, half-terete, glabrous to sparsely hairy, hairs yellowish to reddish. ***Inflorescences*** 5–14 cm long, densely to sparsely hairy, hairs yellowish to reddish; bracteoles triangular to round, 0.5–1.7 mm long, caducous. ***Flowers*** scented, hairs yellow; perianth tube 1–1.3 mm long, velutinous to sparsely hairy; perianth lobes narrowly ovate to elliptic, 1.3–2 × 0.8–1.2 mm, apex round to acute, sparsely hairy, pale green to light yellow. ***Stamens*** 0.4–0.5 mm long, hairy, cream, anthers yellow. ***Ovary*** 1–1.1 × c. 0.6 mm, glabrous or sparsely hairy at apex; style c. 1 mm long, glabrous, stigma inconspicuous. ***Fruit*** (dried) ellipsoid or narrowly ellipsoid, 19–40 × 9–15 mm, glabrous, smooth, yellow-red to black when mature. ***Stalk*** red, strongly swollen when mature.

Distribution. Southern China, northeastern India and the Andaman Islands, Bhutan, Myanmar, Thailand, Peninsular Malaysia, Indonesia (Sumatra) (see Fig. 1).

Ecology. Growing in primary and secondary evergreen broad-leaved or mixed deciduous lowland to hill forests, sometimes along rivers, at 50–1525 m altitude.

Phenology. Flowering from February to July (October); fruiting from March to November (December).

Provisional IUCN conservation assessment. Least Concern.

Selected additional specimens examined. THAILAND: **Chiang Mai:** Doi Suthep, 26 Apr 1958, *Sørensen et al. 3048* (K [2 sheets]). **Phrae:** between Ban Nam Krai and Pha Tuem, 16 Apr 1970, *Smitinand & Cheke 10817* [*BKF 46511*] (K, P). **Surat Thani:** Phanom district, Khlong Phanom National Park, Khao Sok River, 23 Mar 2005, *Gardner et al. ST 1718* (KEP).

Notes. In the original description of this species only one collection was cited (Nees von Esenbeck, 1831: 69) of which there are two specimens available for lectotypification,

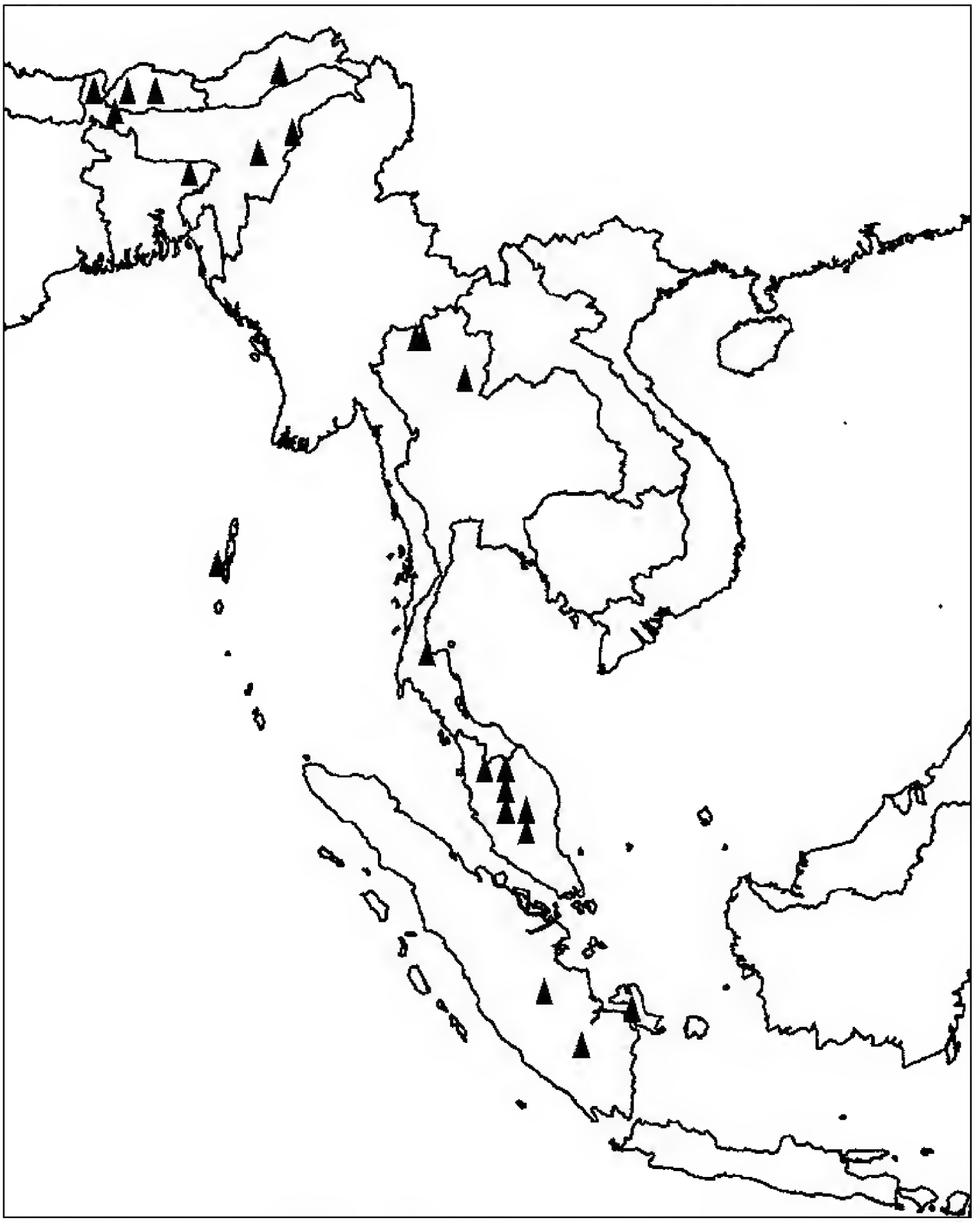

Fig. 1. Distribution of *Cryptocarya amygdalina* Nees (▲).

one at E and one in K-W. The specimen in the Wallich herbarium at K-W is selected here as the lectotype.

2. *Cryptocarya chanthaburiensis* Kosterm., Nat. Hist. Bull. Siam Soc. 25: 33 (1975[‘1974’]). – TYPE: Thailand, ‘Chanthaburi’ [now in Trat], Khao Kuap, 27

December 1929, *Kerr 17846* (holotype K [K000734460]; isotypes BK [BK257960], BM [BM001124606], C [C10013568]). (Fig. 2)

Cryptocarya ferrea var. *grandiflora* Lecomte, Fl. Indo-Chine 5: 148 (1914); Kosterm., Bibliogr. Laurac. 399 (1964); T.C.Lê, Checklist Pl. Sp. Vietnam 85 (2003). – TYPE: [Laos] Mekong, Paklai, 1866–1868, *Thorel* s.n. (lectotype P [P02010425], designated here; isolectotypes K [K000734461], P [P02010426, P02010428]).

Cryptocarya oblongifolia auct. non Blume: Lecomte., Fl. Indo-Chine 5: 146 (1914); H.Liou, Laurac. Chine & Indo-Chine 101 (1932); Kosterm., Bibliogr. Laurac. 423 (1964); T.C.Lê, Checklist Pl. Sp. Vietnam 85 (2003).

Tree or shrub 2–13 m tall, dbh up to 15 cm. ***Twigs*** velutinous when young, becoming almost glabrous later, hairs yellow. ***Leaf lamina*** (thinly) leathery, elliptic to lanceolate, 5.5–19 × 2.6–4.6 cm, apex round to acuminate, base cuneate or rounded, symmetric to asymmetric; pinnately veined, secondary veins 5–9 pairs, tertiary veins scalariform; upper surface glabrous to very sparsely hairy, midrib sunken at base, hairy, secondary veins sunken, tertiary veins inconspicuous, dull or shiny; lower surface sparsely hairy, midrib raised, secondary veins raised, tertiary veins distinct, hairs yellow. ***Petiole*** 8–15 mm long, slightly swollen or not, half-terete, velutinous, hairs yellowish, appressed. ***Inflorescences*** 6.5–9 cm long, velutinous; bracteoles linear 1–2.5 mm long. ***Flowers*** with yellowish hairs; perianth tube 1–1.5 mm long, velutinous; perianth lobes elliptic, 1.2–1.8 × 0.6–1.1 mm, sparsely hairy, apex rounded to acute. ***Stamens*** 1.5–2 mm long, densely hairy at base. ***Ovary*** clavate, c. 2 mm long; style c. 0.5 mm long, linear; stigma inconspicuous. ***Fruit*** (dried) ovoid to ellipsoid, 11–15 × 8–10 mm, smooth, glabrous, black when mature. ***Stalk*** not or only slightly swollen when mature.

Distribution. Southeastern Thailand, Laos, Cambodia, southern and central Vietnam, including the island of Phú Quốc (see Fig. 2).

Ecology. Along margins of evergreen forests or in bamboo thickets, 250–600 m altitude.

Phenology. Flowering from December to February; fruiting from November to February.

Provisional IUCN conservation assessment. Endangered (EN B2ab(ii,iii)). This species is known from a small number of collections from Indochina and Thailand. An analysis of the Extent of Occurrence (EOO) gives a conservation assessment of Least Concern, but an analysis of the Area of Occupancy (AOO) gives the assessment of Endangered. Given the small area of occupancy and the intensive logging and landscape modification that has occurred in the last 50 years, it must be considered to be endangered.

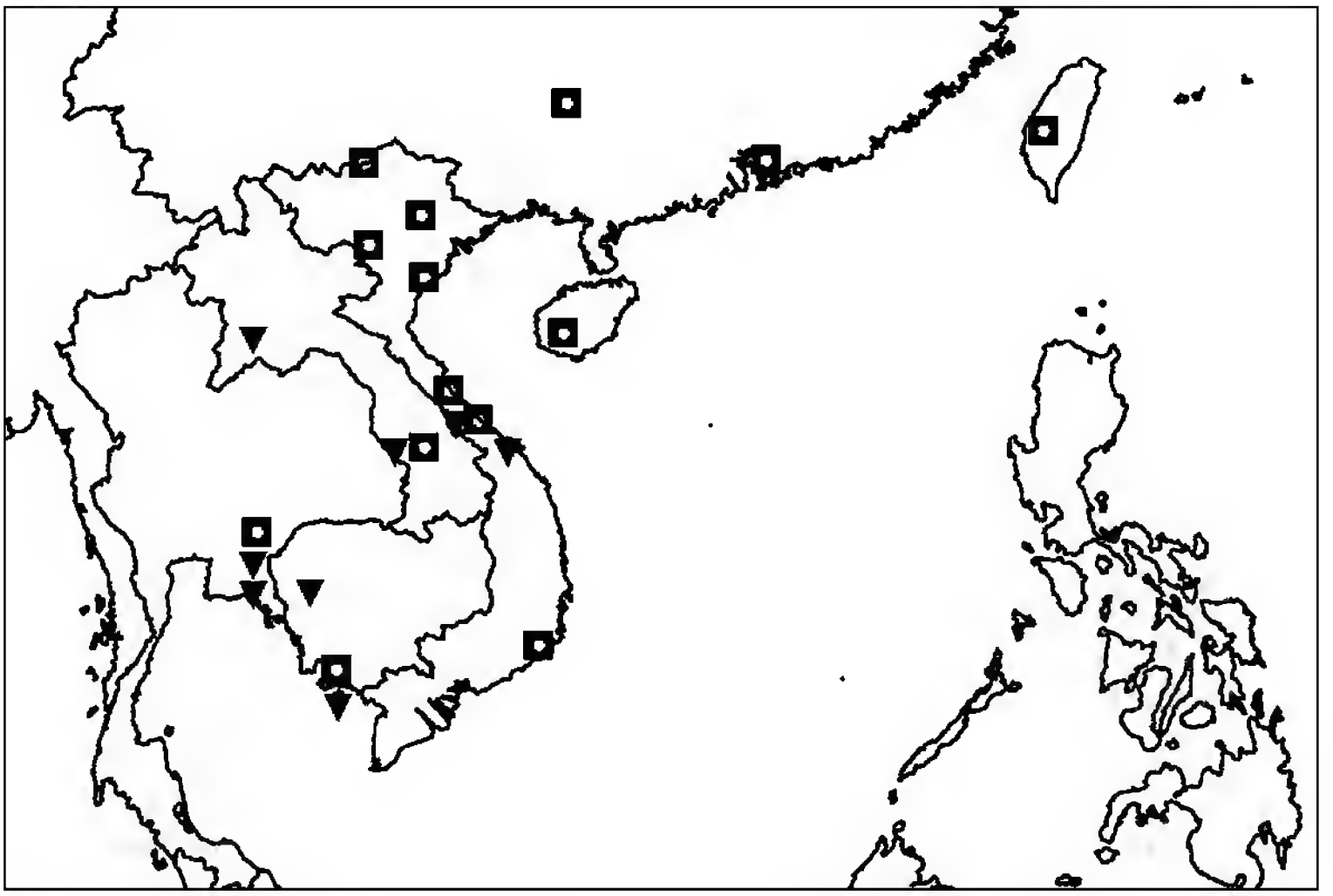

Fig. 2. Distribution of *Cryptocarya chanthaburiensis* Kosterm. (▼) and *Cryptocarya concinna* Hance (◘).

Additional specimens examined. VIETNAM: **An Giang:** Arboretum de Trambom, 11 Nov 1922, *Poilane 164* (P). **Đà Nẵng:** Ba Na, 3 Dec 1923, *Poilane 9034* (K, P [2 sheets]); Ba Na, 21 Jul 1930, *Poilane 17927* (P). **Kiên Giang:** Phú Quốc, Feb 1874, *Li Pi [Pierre] 1432* (BM [2 sheets], BO [10 sheets], K [3 sheets], P [2 sheets]). **Quảng Trị:** Làng Khoai, 10 Jan 1932, *Poilane 19930* (P). CAMBODIA: **Pursat:** Veal Veng District, some 250 m east of military headquarters, 16 Feb 2000, *Eanghourt 46* (K, RUPP). **Unknown province:** Expedition du Mekong, Lacoine, 1866–1868, *Thorel* s.n. (P [2 sheets]); Expedition du Mekong, 1866–1868, *Thorel* s.n. (P [2 sheets]). LAOS: **Savannakhet:** près de Bauthat, 12 km de Savannakhet, 26 Jun 1929, *Poilane 16328* (P). THAILAND: **Chanthaburi:** Krat district, Khao Kuap, 23 Dec 1929, *Kerr 17712* (BM, K, P). **Chon Buri:** Si Racha, Nong Nam Khio, 10 Nov 1926, *Collins 1421* (K).

Notes. Kostermans wrote the name 'Cryptocarya petelotii' on a herbarium sheet (*Poilane 19930*) of this species but the name was never published. This invalid name was taken up in *An Illustrated Flora of Vietnam* (Hộ, 1999: 380) and in the *Checklist of Plant Species of Vietnam* (Lê, 2003: 85), again without the name being validly published.

In the original description of *Cryptocarya ferrea* var. *grandiflora*, Lecomte (1914: 148) only cites one collection for which there are three P and one K specimens available for lectotypification. The specimen P02010425 is selected here as the lectotype.

This species is morphologically very similar to *Cryptocarya ferrea*, from which it differs in having longer (> 1 mm long) and linear bracteoles, whereas the bracteoles of *C. ferrea* are shorter (< 1 mm) and elliptical. In addition, the fruits stalks are not or only slightly swollen when mature in *Cryptocarya chanthaburiensis*, whereas they are swollen when mature in *C. ferrea*.

3. *Cryptocarya concinna* Hance, J. Bot. 20: 79 (1882); H.Liou, Laurac. Chine & Indo-Chine 101 (1932); P.H.Hộ, Ill. Fl. Vietnam 1: 376 (1999); T.C.Lê, Checklist Pl. Sp. Vietnam 82 (2003); H.W.Li et al., Fl. China 7: 252 (2008). – TYPE: [China] Hong-Kong, Wong-Nei-Chung, 23 August 1880, *Ford 21748* (holotype BM [BM000950881]; isotypes A [A00041350], K [K000763886, K000768389]). (Fig. 2)

Cryptocarya lenticellata Lecomte, Notul. Syst. (Paris) 2: 333 (1913); H.Liou, Laurac. Chine & Indo-Chine 99–100 (1932); T.C.Lê, Checklist Pl. Sp. Vietnam 83 (2003); H.W.Li et al., Fl. China 7: 252 (2008). – TYPE: [Vietnam] Tonkin, Forêts du Mont Bavi, August 1887, *Balansa 2412* (lectotype P [P02010201], designated here; isolectotypes BO [2 sheets], K [K000734468], P [P02010199, P02010200]).

Cryptocarya microcarpa F.N.Wei, Guihaia 15: 210 (1995); H.W.Li et al., Fl. China 7: 252 (2008). – TYPE: China, Guangxi, Huanjiang County, Mulun Village, Hong Tong Valley, 14 August 1994, *Mulun exped. M 0193* (holotype IBK [IBK00190178]).

Tree 4–25 m tall, dbh 10–40 cm. ***Bark*** grey or brownish, wood brown. ***Twigs*** grey-brown, finely striate, densely tomentose, hairs yellowish brown. ***Leaf lamina*** papery, elliptic-oblong or oblong, (3–)5–13 × (1.5–)2–3(–6) cm, apex obtuse, acute or shortly acuminate, base cuneate, often unequal; pinnately veined, secondary veins 4–7 pairs, tertiary veins irregularly reticulate; upper surface sparsely hairy, more densely so on midrib, midrib sunken at base, secondary veins sunken, tertiary veins conspicuous, green-yellow in young leaves, shiny; lower surface glabrous to sparsely hairy, midrib raised, secondary veins raised, tertiary veins conspicuous. ***Petiole*** 4–10 mm long, slender to slightly swollen, half-terete, sparsely hairy, wrinkled. Inflorescences 2–12 cm long, sparsely hairy to velutinous, indumentum often very patchy; bracteoles triangular, 0.2–0.5 mm long, caducous. ***Flowers*** green to yellow or white, fragrant, hairs yellowish; perianth tube 1–1.5 mm, velutinous; perianth lobes oblong, 1.2–2 × 1–1.5 mm, apex round to acute, sparsely hairy. ***Stamens*** 1–1.5 mm long, hairy at base; anthers oblong, 0.8–1 mm. ***Ovary*** clavate; style c. 0.5 mm long; stigma inconspicuous. ***Fruit*** obovoid, 15–22 × 5–11.5 mm, glabrous, 12-ribbed, black or blue-black when mature. ***Fruit stalk*** not swollen when mature.

Distribution. Southern China, eastern Thailand, Laos, Cambodia, Vietnam (see Fig. 2).

Ecology. Evergreen broad-leaved forests, from 550–1200 m altitude.

Phenology. Flowering from March to August; fruiting from June to December.

Vernacular names. *Cay Mot*, *Re Dâp* or *Co San Coc* (Vietnamese); *Co puin linh* (*Muong*); *Ko mi ham* (Laotian).

Provisional IUCN Conservation Assessment. Least Concern.

Use. The wood is finely grained, heavy and durable, and is used for furniture or house construction.

Selected additional specimens examined. CHINA: **Hainan:** 17 Oct 1933, *Liang 63456* (K, P); Ching Mai District, Mei Maan, 25 Sep 1932, *Lei 17* (K, P); Hung Mo Shan, 12 Aug 1929, *Tsang & Fung (688) 18222* (P). **Guangdong:** Tinghushan, 1978, *Chow 78133* (K); Tinghushan, 1978, *Chow 78130* (K). **Fujian:** Yeuping Cave, 12 Aug 1924, *Chung 2994* (K). TAIWAN: **Locality unknown:** 26 Nov 1918, *Wilson 11115* (K).
VIETNAM: **Hà Tây:** Massif du Tam Dao, Aug 1931, *Pételot 5360* (P); Massif du Tam Dao, Aug 1931, *Pételot 5361* (P); Bavi, Vallée de Lankok, Massif du Tam Dao, 2 Dec 1888, *Balansa 2397* (P). **Lào Cai:** Cha-pa [Sa Pa], Massif de Nui Bien, 7 Sep 1926, *Poilane 13181* (K, P [2 sheets]). **Nghệ An:** De Vinh, Ké Nhe, Sep 1917, *Chevalier 38162* (P [2 sheets]). **Nha Trang:** Massif du Hôn Bâ, 22 Sep 1918, *Chevalier 38680* (P [5 sheets]). **Hòa Bình:** *Service forestier du Tonkin* s.n. (P). **Quảng Trị:** Massif du Doug, 5 Jul 1924, *Poilane 11203* (P [2 sheets]). **Locality unknown:** Forest de Vien-yen, Dec 1918, *Chevalier 39613* (P [2 sheets]); Hâu Phuc, 20 Jan 1923, *Butreau 53* (P).
LAOS: **Savannakhet:** 20 km de la route de Savannakhet à Quảng Trị, 28 Jan 1925, *Poilane 11665* (P). **Locality unknown:** Fau Meia, Nea Hani Firo, 15 Sep 1920, *Poilane 1865* (P [2 sheets]).
CAMBODIA: **Kampot:** Mont de l'Éléphant, 1 Aug 1919, *Chevalier 349* (P [2 sheets]).
THAILAND: **Nakhon Ratchasima:** National Park, 20 Dec 1962, *Phengkhlai 598* (K).
INDOCHINA: **Locality unknown:** *Schmid 1808* (P).

Notes. In the original description of *Cryptocarya lenticellata* Lecomte (1913: 333), only one collection is cited for which there are three P, two BO and one K specimen available for lectotypification. The specimen P02010201 is selected here as the lectotype.

4. *Cryptocarya densiflora* Blume, Bijdr. 556 (1856['1852']); Gamble, J. Asiatic Soc. Bengal. 75: 39–40 (1912); Ridl., Fl. Malay Pen. 3: 77 (1924); H.Liou, Laurac. Chine & Indo-Chine 98 (1932); Kosterm., Bibliogr. Laurac. 395–396 (1964); Kochummen, Tree Fl. Mal. 4: 134 (1989); P.H.Hộ, Ill. Fl. Vietnam 1: 377 (1999); H.W.Li et al., Fl. China 7: 248–249 (2008); Le Cussan & B.Hyland, Fl. Austral. 2: 157 (2007). – *Caryodaphne densiflora* (Blume) Nees, Syst. Laurac. 228–230 (1836). – TYPE: [Indonesia, Java] Mt. Salak, *Blume* s.n. (lectotype L [L0036111], designated here; isolectotypes L [L0036101, L0036102, L0036103, L0036104, L0036105, L0036107, L0036112), U [U0002692], NY [NY00355062, NY00355063, NY00355064]). (Fig. 3)

Cryptocarya fleuryi A.Chev. ex H.Liou, Laurac. Chine & Indo-Chine 98 (1932); Kosterm., Bull. Bot. Surv. India 10: 287 (1968); T.C.Lê, Checklist Pl. Sp. Vietnam 83 (2003). – TYPE: [Vietnam] Sud Annam, Nha Trang Prov., Massif du Hôn Bâ, 28–31 August 1918, *Chevalier 38863* (lectotype P [P02009912], designated here; isolectotypes P [P02009911], MO [MO1295102]), **synon. nov.**

Cryptocarya annamensis C.K.Allen, J. Arnold Arbor. 23: 459–460 (1942); P.H.Hộ, Ill. Fl. Vietnam 1: 376 (1999). – TYPE: [Vietnam] French Indochina, Annam, Station Agricole de Blao Prov., de Haut Donaï, *Poilane 22294* (holotype P [P00745435]; isotypes A [A00041362, A0041363, A00041364], BM [BM000950884], K [K000734455], L [L0036060], P [P00745436], US [US00099476]), **synon. nov.**

Cryptocarya oligoneura Kosterm., Nat. Hist. Bull. Siam Soc. 25: 34 (1975['1974']). – TYPE: Peninsular Thailand, Nakhon Si Thammarat, 4 May 1955, *Thaworn 258* (holotype C [C10011742]), **synon. nov.**

Tree, rarely a shrub, 3–20 m tall, dbh 5–35 cm. ***Bark*** (dark) grey to (reddish) brown or black, smooth or dippled, aromatic when crushed, wood (pale) yellow to white. Twigs sparsely hairy, longitudinally ridged. ***Leaf lamina*** leathery, elliptic to oblong, 7–21 × 3.2–14 cm, apex long-acuminate, base rounded to cuneate; triplinerved; secondary veins 2–3 pairs, pinnate, running up to ¾ of leaf length towards the apex, tertiary veins scalariform; upper surface glabrous, midrib and secondary veins sunken, tertiary veins faint or inconspicuous, dark to yellowish green, young leaves white-green, crushed leaves aromatic; lower surface glabrous to sparsely hairy, midrib and secondary venation raised, reticulations distinctly visible, usually glaucous. ***Petiole*** slender, 10–16 mm long, channelled, glabrous to sparsely hairy. ***Inflorescences*** 2.5–8 cm long, densely hairy, hairs brown to pale yellow; bracteoles triangular, 0.5–1 mm long, caducous. ***Flowers*** white to (creamy-greenish) yellow to brownish; perianth tube 1.2–1.6 mm long, densely hairy; perianth lobes elliptic, 2–3 × 1–1.4 mm, apex acute, densely hairy. ***Stamens*** 1.4–2.8 mm long. ***Ovary*** clavate, c. 2 mm; style c. 1 mm long, linear; stigma inconspicuous. ***Fruit*** (dried) (depressed) globose to ellipsoid, 12–20 × 16–20 mm, glabrous, smooth or with 12 shallow longitudinal ridges and/or warty, dark purplish or (bluish) black when mature. ***Stalk*** slender to only slightly swollen when mature.

Distribution. Southern China, Laos, Cambodia, Vietnam, Thailand, Malaysia (including Sarawak and Sabah), Brunei, Indonesia (Kalimantan, Sumatra, Java, Sulawesi, Lesser Sunda Islands (Flores and Sumbawa), the Moluccas (Aru Islands) and Papua), Philippines, Papua New Guinea, northeastern Australia (see Fig. 3).

Ecology. Common in primary and secondary forests, sometimes along rivers, in peat swamps or *kerangas* forest. Soil: limestone, sandstone, granite or ultra-basic rock derived soils or sandy loam or clay soils, at 0–1600 m altitude.

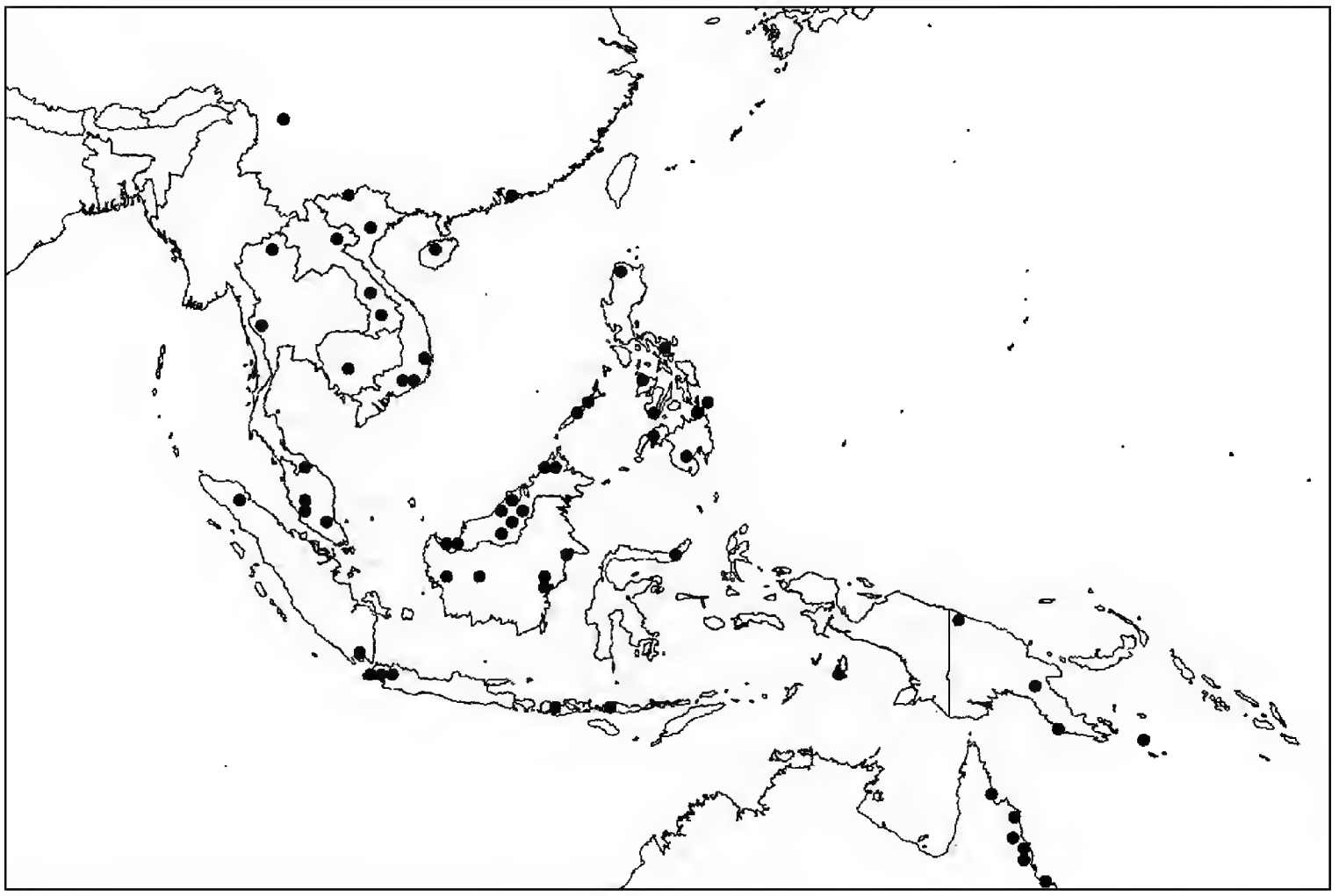

Fig. 3. Distribution of *Cryptocarya densiflora* Blume (●).

Phenology. Flowering in January to July (October); fruiting in April to November.

Vernacular names. *Cà đuối hoa* (Vietnamese); *Cây com* (*Muong*); *Kokhé* (Laotian).

Provisional IUCN conservation assessment. Least Concern.

Use. The wood is used for house construction and furniture making in China and for boats in Indochina.

Selected additional specimens examined. VIETNAM: **Hòa Bình:** Lũng Vân, Tân Lạc, 27 Jan 1931, *Poilane 18951* (P [2 sheets]). **Lào Cai:** Cha-pa, Cho-bo, 14 Aug 1926, *Poilane 12934* (P [3 sheets]); 31 Jan 1943, *Pételot 8579* (P); Feb 1931, *Pételot 5358* (P [4 sheets]); Aug 1935, *Pételot 5445* (P [2 sheets]). **Lâm Đồng:** Bảo Lộc, Haut Donai, 22 Jan 1933, *Poilane 21763* (P, SING); Haut Donai, 3 Feb 1933, *Poilane 21809* (P [2 sheets]); Haut Donai, Station Agricole de Blao, 11 May 1933, *Poilane 22483* (P [2 sheets]); Blao, Sam Dong, 5 Apr 1953, *Schmid* s.n. (P). **Locality unknown:** Tonkin et Annam, 26 Jan 1931, *Poilane 18917* (K, P).
LAOS: **Champassack:** Plateau des Bolovens, près de la Station Agricole, 20 Nov 1938, *Poilane 28489* (P [2 sheets]); Plateau des Bolovens, entre Muong Bok Kao et Phong Thani, 5 Oct 1928, *Poilane 15845* (P [3 sheets]). **Huaphan:** Sam Neua, 9 Oct 1920, *Poilane 2026* (K, P [2 sheets]). **Saravane:** Sommet du Pou Set, 24 Oct 1928, *Poilane 16128* (P [2 sheets]).
CAMBODIA: **Kampong Cham:** 23 Jan 1939, *Poilane 28804* (P [4 sheets]).
THAILAND: **Chiang Mai:** Chieng Saen, 25 Mar 1921, *Kerr 5133* (BM, K); Fang, 21 Feb 1969, *Van Beusekom & Phengklai 2661* (K, P). **Narathiwat:** Sungei Kolok, Nikom Waeng, 25

Feb 1974, *Larsen & Larsen 32603* (K). **Kanchanaburi:** Kao Ri Yai, 2 Feb 1933, *Kerr 10409* (BM, K); Thong Pha Phum, Pilok, 25 Jan 2009, *Middleton et al. 4785* (K).
INDOCHINA: **Locality unknown:** north du Tonkin et du Laos, 10 Dec 1925, *Poilane 25054* (K, P).

Notes. The oldest name of this species is *Laurus triplinervia* Reinw. ex Blume, but a combination in *Cryptocarya* would be too similar to the well-known *Cryptocarya triplinervis* R.Br. In line with the ICN (McNeill et al., 2012), and in particular article 53.3, example 11, I am retaining the second oldest name.

The name *Cryptocarya densiflora* is based on two gatherings, each with several duplicates (Mt. Salak, *Blume* s.n. L0036101, L0036102, L0036103, L0036104, L0036105, L0036107, L0036111, L0036112, U0002692, NY00355062, NY00355063, NY00355064) and on the collection: '*Ki-tjetja*' *Reinward* s.n. (BO, L0036108, L0036109, L0036110). The duplicate in L of Mt. Salak, *Blume* s.n. (L0036111) is selected here as the lectotype.

In the original description of *Cryptocarya fleuryi* A.Chev. ex H.Liou (1932: 98) only one collection is cited for which there are two P and one MO specimens available for lectotypification. The specimen P02009912 is selected here as lectotype.

This is one of a very few species of *Cryptocarya* which can easily be identified without using a key. The combination of triplinerved leaves, with the major veins not joining at apex and which dry pale yellowish/reddish brown with a clearly paler under surface, is a unique combination of characters for this species in Thailand and Indochina.

5. *Cryptocarya diversifolia* Blume, Mus. Bot. 1 (1851). – TYPE: [Indonesia] Insulae Sumatra, in Provincia Palembang, 1834, *Pretorius* s.n. (lectotype K [K000768453], designated here; isolectotypes NY [NY00581223], U [U0002715, U0002716]). (Fig. 4)

Cryptocarya crassinervia Miq., Fl. Ned. Ind. 1: 924 *(*1858); Gamble, J. Asiatic Soc. Bengal. 75: 41–42 (1912); Ridl., Fl. Malay Pen. 3: 78 (1924); Kochummen, Tree Fl. Mal. 4: 133–134 (1989). – *Cryptocarya griffithiana* var. *crassinervia* (Miq.) Ng, Gard. Bull. Singapore 57: 67 (2005). – TYPE: [Indonesia] Sumatra, Fort de Kock, *Teysmann* s.n. *[1007 HB]* (lectotype L [L0036097], designated here; isolectotypes BO, L [L0036098]), **synon. nov.**

Cryptocarya infectoria (Blume) Miq., Fl. Ned. Ind. 1: 924 *(*1858); Kochummen, Tree Fl. Mal. 4: 135 (1989); P.H.Hộ, Ill. Fl. Vietnam 1: 378 (1999); T.C.Lê, Checklist Pl. Sp. Vietnam 84 (2003). – *Cylicodaphne infectoria* Blume, *Mus. Bot. 2:* 11 (1856 ['1852']). – TYPE: [Indonesia] Archipelago Indico, *Waitz* s.n. (lectotype L [L0036159], designated here; isolectotypes L [L0036157, L0036158]).

Cryptocarya obtusifolia Merr., Philipp. J. Sci. 21: 344 (1922), *nom. illeg*. (non *Cryptocarya obtusifolia* Meisn., Prodr. 15: 508 (1864)); Kosterm., Reinwardtia 7:

312 (1968); P.H.Hộ, Ill. Fl. Vietnam 1: 379 (1999); T.C.Lê, Checklist Pl. Sp. Vietnam 84 (2003); H.W.Li et al., Fl. China 7: 253 (2008). – *Cryptocarya impressinervia* H.W.Li, Acta Phytotax. Sin. 17: 70 (1979); H.W.Li et al., Fl. China 7: 253 (2008). – TYPE: China, Hainan, Ng Chi Leng, 21 December 1921, *McClure 8581* (lectotype CAS [CAS0033144], designated here; isolectotypes A [A00041359, A00041360], K [K000768393], MO [MO1889406], NY [NY00581220, NY00581221], P [P02010336]), **synon. nov.**

Cryptocarya lecomtei Kosterm., Nat. Hist. Bull. Siam Soc. 25: 34 (1975 ['1974']). – TYPE: Thailand, Chanthaburi [now in Chon Buri], Si Racha, 17 January 1946, *Nakkarn 206* (holotype C [C10011743]), **synon. nov.**

Trees 3–23(–33) m tall, dbh 5–40 cm. ***Bark*** scaly to smooth, brownish to black, inner bark reddish brown; wood pale yellow, aromatic. ***Twigs*** stout, longitudinally ridged, velutinous, hairs yellowish to reddish brown. ***Leaf lamina*** thickly leathery, elliptic to lanceolate, 6–32 × (4.5–)8–15 cm, apex emarginate to rounded or acuminate, base cuneate to rounded, clearly to slightly asymmetric; pinnately veined, secondary veins 5–12 pairs, tertiary veins scalariform; upper surface bullate, glabrous except for velvet midrib and secondary veins, midrib raised at base, secondary veins sunken, curving and joining near margin, tertiary veins clear to inconspicuous, dark green, metallically shiny; lower surface velutinous, midrib raised, secondary veins raised, tertiary veins distinct, sparsely to densely hairy, bluish green to silvery grey, glaucous. ***Petiole*** 7–27 mm long, swollen, velutinous, half-terete or shallowly channelled, longitudinally ridged. Inflorescences 4–16 cm long, longitudinally ridged, velutinous, hairs yellowish to reddish; bracteoles triangular to linear, 1–3 mm long, caducous. ***Flowers*** greenish white to (yellowish) brown; perianth tube velutinous, 2–2.4 mm long; perianth lobes elliptic to lanceolate, 3.7–4.4 × 1.5–1.8 mm, apex acute, densely hairy, greenish. ***Stamens*** 2.6–3.2 mm long, hairy. ***Fruit*** (dried) globose to ellipsoid, 20–27 × 13–16 mm, distinct to faintly ridged, sparsely hairy to glabrous, black when mature, smelling of resin. ***Stalk*** slender when mature.

Distribution. India (Andaman Islands), China (Hainan), Vietnam, Thailand, Malaysia (including Sarawak and Sabah), Brunei, Indonesia (Kalimantan and Sumatra) (see Fig. 4).

Ecology. Primary and secondary forest, sometimes in swamps, at 0–1000 m altitude.

Phenology. Flowering in (May) July to November; fruiting from January to August.

Provisional IUCN conservation assessment. Least Concern.

Selected additional specimens examined. VIETNAM: **Biên Hòa:** 18 Oct 1931, *Poilane 19972* (K). **Hà Tây:** Mont Bavi, 1888, *Balansa 2396* (P [2 sheets]).
THAILAND: **Phetchaburi:** Kaeng Krachan National Park, near top of Khao Panoen Thung,

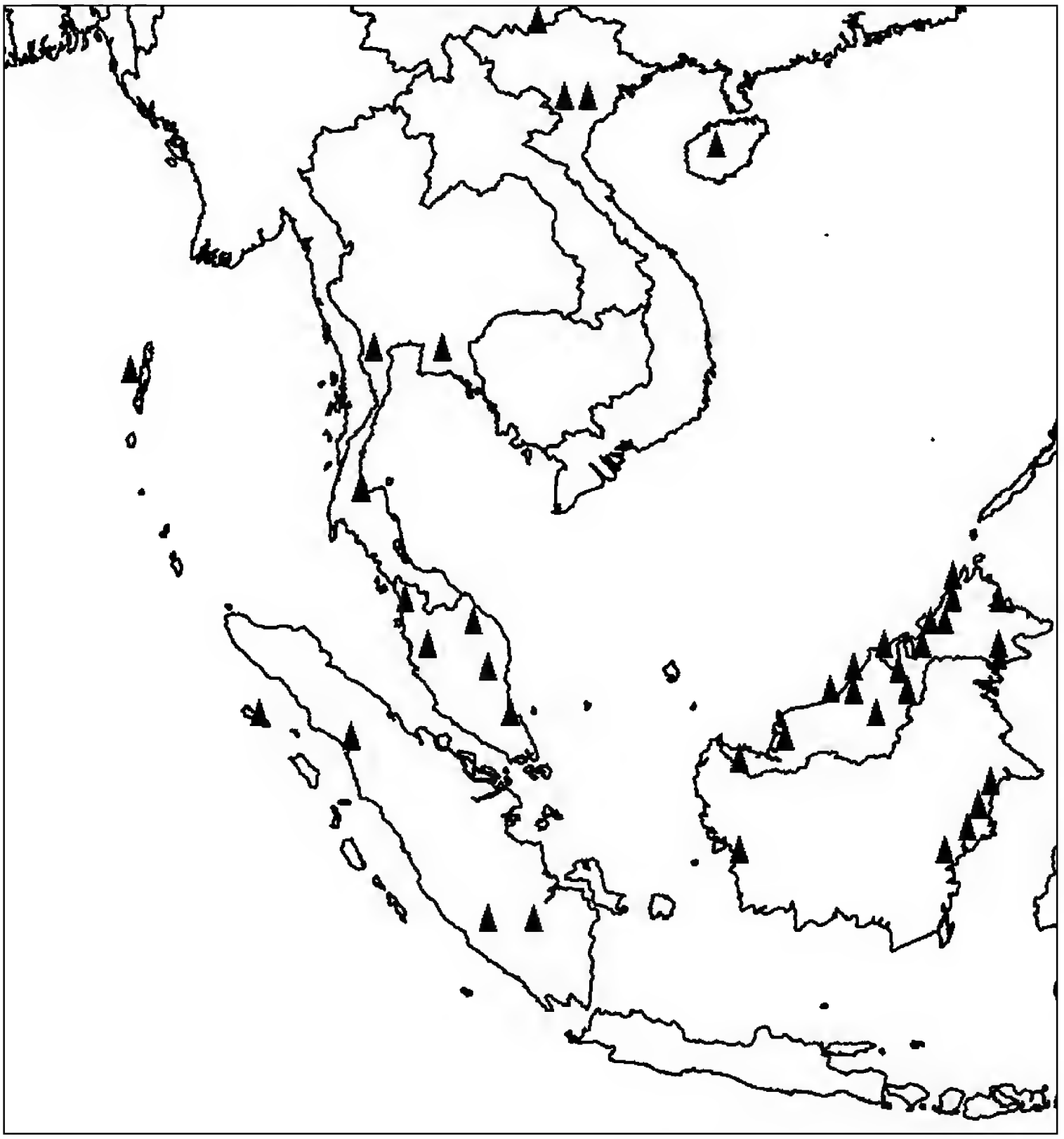

Fig. 4. Distribution of *Cryptocarya diversifolia* Blume (▲).

26 Jan 2005, *Williams 1101* (K, KEP). **Surat Thani:** Phanom district, Khlong Phanom National Park, 8 May 2006, *Gardner & Sidisunthorn ST 2698* (KEP).

Notes. Four specimens are available for lectotypification of this name (two at L (formerly U), one at K, and one at NY). The specimen at K has flowers and bracteoles attached to the inflorescence and is therefore selected here as the lectotype.

In the original description of *Cryptocarya crassinervia* Miq. (Miquel, 1858: 924), he only cites one collection for which there are two L and one BO specimens available for lectotypification. The specimen L0036097 is selected here as lectotype.

In the original description of *Cylicodaphne infectoria* Blume (Blume, 1856:

11), he only cites one collection for which there are three L specimens available for lectotypification. The specimen L0036159 is selected here as lectotype.

As the original type material in Manila was destroyed at the end of the Second World War, a lectotype needs to be selected for *Cryptocarya obtusifolia* Merr. In the original description of *Cryptocarya obtusifolia*, Merrill (1922: 344) cites one collection for which there are numerous specimens available for lectotypification. The specimen in CAS0033144 was verified by himself, so it is selected here as the lectotype.

This species is recognised as a variety of *Cryptocarya griffithiana* by Ng (2005: 67–68). In the present work, *Cryptocarya diversifolia* and *C. griffithiana* are recognised as separate species, as they differ with regard to inflorescence bract length (≤ 4 mm long as opposed to ≥ 5 mm long), mature fruit surface texture and the amount of swelling of the fruit stalk.

6. *Cryptocarya ferrea* Blume, Bijdr. 557 (['1852'] 1856); Gamble, J. Asiatic Soc. Bengal. 75: 45–46 (1912); Ridl., Fl. Malay Pen. 3: 79 (1924); H.Liou, Laurac. Chine & Indo-Chine 101 (1932); Kosterm., Bibliogr. Laurac. 399 (1964); Kochummen, Tree Fl. Mal. 4: 134 (1989); P.H.Hộ, Ill. Fl. Vietnam 1: 377 (1999); Ng, Gard. Bull. Singapore 57: 64–67 (2005). – TYPE: [Indonesia, Java] Cheribon Province, Mt. Tjerimai, October, *Blume* s.n. (lectotype L [L0036127], designated here; isolectotypes BO, L [L0036128]). (Fig. 5)

Cryptocarya oblongifolia Blume, Bijdr. 557 (1856['1852']); Kosterm. Bibliogr. Laurac. 423 (1964); P.H.Hộ, Ill. Fl. Vietnam 1: 379 (1999). – *Cryptocarya ferrea* var. *oblongifolia* (Blume) Meisn., Prodr. 15: 70 (1864). – TYPE: [Indonesia, Java] Buitenzorg Prov., Bantam, Tjanjor, October–December, *Blume* s.n. (lectotype L [L0036137], designated here; isolectotypes BO, GH [GH00041376], K [K000768429], L [L0036131, L0036132, L0036133, L0036134, L0036135, L0036136), NY [NY00355071, NY00355072, NY00355073], U [U0002707]).

Cryptocarya ochracea Lecomte, Notul. Syst. (Paris) 2: 333–334 (1913); Lecomte, Fl. Indo-Chine 5: 145 (1914); Kosterm., Bibliogr. Laurac. 425 (1964); P.H.Hộ, Ill. Fl. Vietnam 1: 379 (1999); T.C.Lê, Checklist Pl. Sp. Vietnam 85 (2003). – TYPE: [Vietnam] Cochinchine, Bien Hòa Prov. Song-Lu, February 1877, *Pierre 1620* (lectotype P [P00745428], designated here; isolectotypes A [A00041365], BM [BM001124604], K [2 sheets], MPU [MPU018667], P [P00745427, P00745429, P00745430]).

Cryptocarya caesia auct. non Blume: Lecomte, Fl. Indo-Chine 5: 146 (1914); Kosterm., Bibliogr. Laurac. 390 (1964); T.C.Lê, Checklist Pl. Sp. Vietnam 82 (2003).

Cryptocarya albiramea Kosterm., Nat. Hist. Bull. Siam Soc. 25: 33 (1975 ['1974']). – TYPE: Peninsular Thailand, Krabi, Tambon Khao Phanom, 2 April 1930, *Kerr 18815* (holotype K; isotypes BM, BO), **synon. nov.**

Shrubs or trees (2–)8–22 m tall, dbh 5–40 cm. ***Bark*** grey to reddish brown, smooth to finely scaled, wood white to yellowish. ***Twigs*** smooth to angular, velutinous when young, almost glabrous when mature; hairs yellowish to brown, appressed. ***Leaf lamina*** leathery, narrowly elliptic to oblong or lanceolate, 6–20 × 2–9 cm, apex blunt to acuminate, base cuneate to rounded, sometimes slightly oblique; pinnately veined, secondary veins 4–14 pairs, tertiary veins scalariform; upper surface glabrous with sparsely to densely hairy midrib and major veins, midrib and secondary veins sunken, tertiary veins sunken to inconspicuous, light to dark green, young leaf red, glossy; lower surface sparsely hairy with denser patches along and on veins, hairs yellowish to brown, midrib and secondary veins raised, tertiary veins inconspicuous to distinct, glaucous, grey-green. ***Petiole*** 6–20 mm long, slender to slightly swollen, half-terete to channelled, velutinous; hairs yellowish, appressed. ***Inflorescences*** 1.5–20 cm long, velutinous when flowering to almost glabrous when in fruit, greenish yellow to cream; bracteoles elliptical, < 1 mm long, seldom persistent. ***Flowers*** pale green to pale yellow, hairs yellowish; perianth tube 0.9–1.6 mm long, velutinous; perianth lobes elliptic, 1.5–2.5 × 1–1.6 mm, apex round to acute, velutinous to sparsely hairy. Stamens 1.3–1.7 mm long, densely hairy. ***Ovary*** clavate, c. 0.6 mm; style c. 1 mm long, linear; stigma inconspicuous. ***Fruit*** (dried) ovoid to ellipsoid, sometime obovoid, 11–28(–35) × 7–17.5 mm, glabrous, smooth to obscurely ridged, apex with a narrow ring like aperture, black when mature. ***Stalks*** swollen when mature.

Distribution. Southern Vietnam, Cambodia, Laos, Thailand, Malaysia (including Sabah but not yet recorded from Sarawak), Singapore, Philippines, Indonesia (Kalimantan, Sulawesi, Sumatra and Java) (see Fig. 5).

Ecology. Growing in rainforest, sometimes in peat swamps or bamboo forests, from 30–1200 m altitude.

Phenology. Flowering from December to September; fruiting from (December) January to April.

Vernacular names. *Cou Kirp* (Vietnamese); *Kril dam* or *Sma Krâbei* (Khmer); *May ky guan* (Laotian).

Provisional IUCN conservation assessment. Least Concern.

Selected additional specimens examined. VIETNAM: **Biên Hòa:** Định Quán, 47 km de la route nr 20, 20 Nov 1932, *Poilane 21401* (P). **Kiên Giang:** Phú Quốc, 30 Dec 1919, *Poilane 878* (P [3 sheets]).
LAOS: **Savannakhet:** Bassin du Sè-Moun, 1875–1877, *Voyage du Harmand, no. 76* (P [3 sheets]).
CAMBODIA: **Kampong Cham:** 18 Jul 1930, *Béjaud 823* (P [2 sheets]). **Kampot:** Sihanoukville, 24 Jan 1966, *Vidal 5042* (P); Nord du Kampot, 3 Feb 1928, *Poilane 14615* (BM, P [2 sheets], SING). **Locality unknown:** 1877, *Harmand (Pierre) 3179* (P [3 sheets]).
THAILAND: **Chumphon:** Lang Suan District, Pang Wan, 15 Feb 1927, *Kerr 11955* (BM,

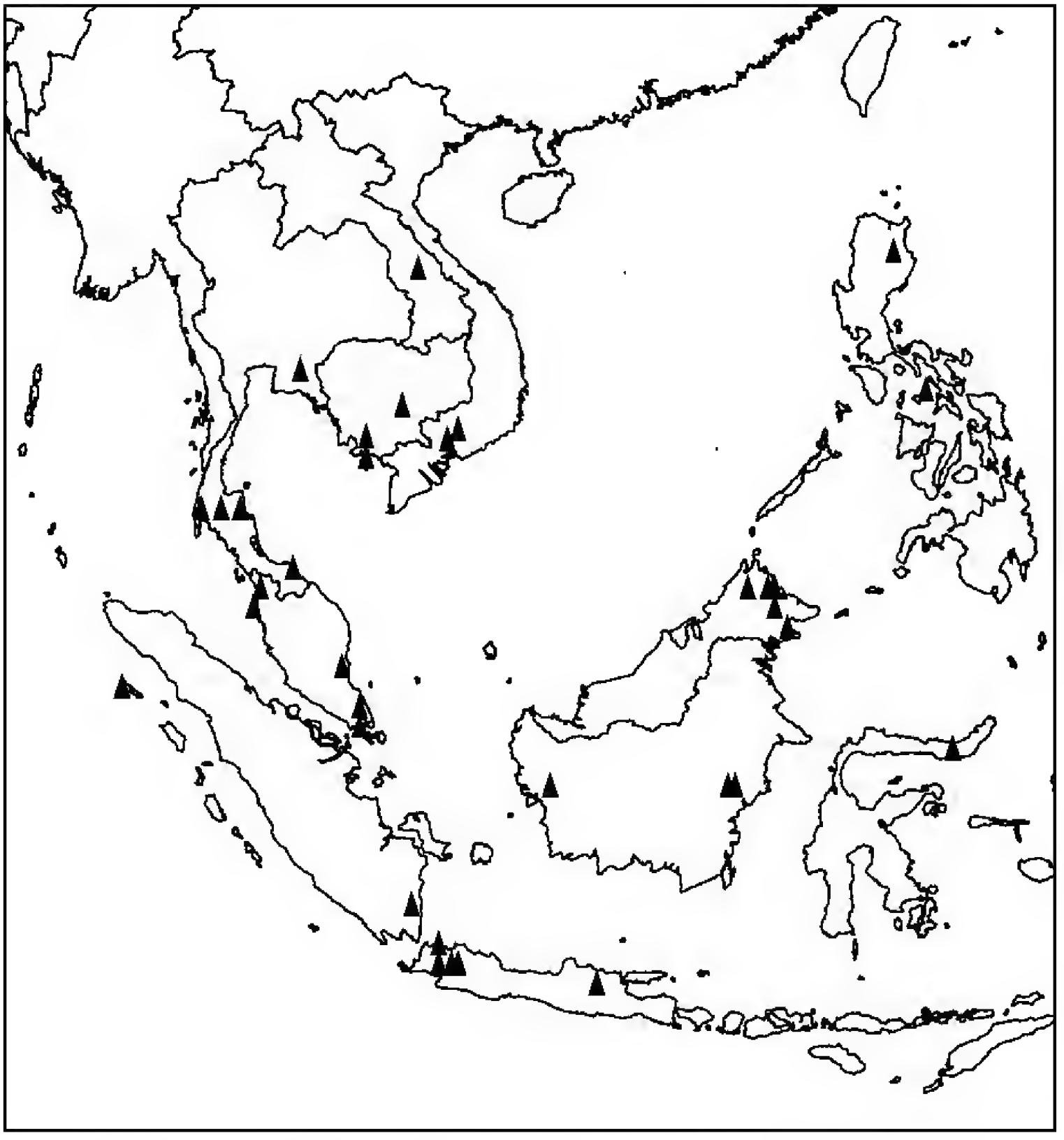

Fig. 5. Distribution of *Cryptocarya ferrea* Blume (▲).

K). **Pattani:** Bukit Pattani, 25 Jan 1931, *Put 3632* (BM, BO, K, P). **Prachuap Khiri Khan:** Khao Tao near Hua Him, 18 Sep 1918, *Kerr 16020* (BM, K). **Surat Thani:** Phanom District, Khao Sok National Park, 2006, *Middleton 3993* (K); Phanom District, Khao Sok National Park, nature trail north of headquarters, 24 Mar 2005, *Gardner et at. ST 1733* (K, KEP). INDOCHINA: **Locality unknown:** *Voyage du Harmand* s.n. (P).

Notes. There are several Blume gatherings available at L and BO for the lectotypification of *Cryptocarya ferrea* Blume. The L0036127 specimen, clearly mentioning the original collection site and including two inflorescences with mature flowers, is selected as a lectotype here.

In the original description of *Cryptocarya oblongifolia* Blume (Blume, 1856: 557), only one collection is cited for which there are numerous specimens available for lectotypification. The specimen L0036137 is selected here as lectotype.

In the original description of *Cryptocarya ochracea* Lecomte (Lecomte, 1913: 333), only one collection is cited. For the lectotypification of this name there are four specimens available at P, two at K and one each at A, BM and MPU. The specimen P00745428 is selected here as the lectotype.

This species is often difficult to distinguish from *Cryptocarya kurzii* and *C. rugulosa* when specimens are in fruit. Table 1 sets out the differences between their flowers and vegetative characters.

7. *Cryptocarya globularia* Kosterm. ex de Kok, **sp. nov.**
Cryptocarya globularia differs from the closely related *Cryptocarya chanthaburiensis* in having mature fruit which are globose rather than ovoid to ellipsoid and which are also much larger (17–19 × 16.5–18.7 mm, rather than 11–15 × 8–10 mm in *C. chanthaburiensis*) and which are sparsely hairy rather than glabrous. – TYPE: [Vietnam] Tonkin, May 1887, Environs de Tu-Phap, *Balansa 2413* (holotype P [P02010448]; isotype K (photograph at BO)). (Fig. 6, 7)

Tree 5–6 m tall, dbh 12–20 cm. ***Twigs*** in cross-section angular and velutinous when young, smooth and glabrescent when old; hairs yellow, erect. ***Leaf lamina*** leathery, elliptic to oblong, 7.6–12 × 4–6.7 cm, apex slightly emarginate to short acuminate, base cuneate to rounded, symmetric to asymmetric; pinnately veined, secondary veins 7–9 pairs, tertiary veins scalariform; upper surface glabrous except for the midrib, secondary veins sunken, tertiary veins and reticulations sunken; lower surface sparsely hairy, midrib and secondary veins strongly raised, tertiary veins and reticulations strongly raised, glaucous. ***Petiole*** 8–12 mm long, slender, half-terete, glabrous to velutinous; hairs yellow, short. ***Inflorescences*** 6–10 cm long, glabrous to velutinous; bracteoles linear, 1–2.5 mm long. ***Flowers*** unknown. ***Fruit*** (dried) globose, 17–19 × 16.5–18.7 mm, sparsely hairy, smooth, shiny, black when mature. ***Stalk*** not or hardly swollen when mature.

Distribution. Northern Vietnam (see Fig. 7). Only known from the type.

Ecology. Lowland.

Phenology. Flowering unknown; fruiting in May.

Provisional IUCN conservation assessment: Data Deficient (DD). This species is only known from one collection which was collected in 1887 in a part of Vietnam which has seen significant reductions in forest cover. More fieldwork is needed to establish the extent of the remaining population(s) and their current threats. This species is therefore classified as Data Deficient.

Table 1. Morphological differences between *Cryptocarya ferrea* Blume, *C. kurzii* Hook.f. and *C. rugulosa* Hook.f. Fruiting specimens of these species are often impossible to name satisfactorily.

	C. ferrea	***C. kurzii***	***C. rugulosa***
Petiole when young	Channelled, velutinous	Half-terete, glabrous to velutinous	Half-terete, velutinous
Bracteoles	Elliptical, < 1 mm long	Linear, 1.1–1.8 mm long	Elliptic to lanceolate, (1.5–)2–3.5 mm long
Outer surface of flowers	Velutinous	Sparsely hairy	Sparsely hairy

Notes. The name of this species has not previously been validly published. Kostermans wrote the name on two duplicates, one at P and one at K. The name has not subsequently been used by other authors. The fruits are reported to be eaten by birds.

8. *Cryptocarya hainanensis* Merr., Philipp. J. Sci. 21: 343–344 (1922); H.Liou, Laurac. Chine & Indo-Chine 100–101 (1932); Kosterm., Bibliogr. Laurac. 405–406 (1964); P.H.Hộ, Ill. Fl. Vietnam 1: 377 (1999); T.C.Lê, Checklist Pl. Sp. Vietnam 83 (2003); H.W.Li et al. Fl. China 7: 251 (2008). – TYPE: China, Hainan, Five Finger Mountain, Ng Chi Leng, 20 December 1921, *McClure 8707* (lectotype CAS [CAS0033142], designated here; isolectotypes A [A00041352], BISH [BISH1006120], K, MO [MO1889407], P [P02010435]). (Fig. 7)

Cryptocarya rolletii H.Wang & H.Zhu, Guihaia 19: 197 (1999); H.W.Li et al., Fl. China 7: 251 (2008). – TYPE: China, Yunnan, Jingong, Mengsoon, 16 April 1997, *Wang et al. MS 125* (holotype HITBC (not seen); isotype IBK [IBK00190189]).

Cryptocarya hainanensis forma *grandifolia* H.Liou, Laurac. Chine & Indo-Chine 100–101 (1932); T.C.Lê, Checklist Pl. Sp. Vietnam 83 (2003). – TYPE: [Vietnam] Annam, Thanh Hóa Prov., Phong Y, 15 July 1920, *Poilane 1632* (holotype P [P02010434]; isotypes P [P02010436, P02010435], SING [SING0209180]).

Tree 7–20 m tall, dbh 25–35 cm. ***Bark*** smooth, brownish, wood yellow. ***Twigs*** smooth to slightly longitudinally ridged, sparsely hairy to glabrous, hairs whitish. ***Leaf lamina*** leathery, lanceolate to oblong-lanceolate, 8.5–18.5 × 2.5–7 cm, apex acuminate to long acuminate, base cuneate, slightly asymmetric; pinnately veined, secondary veins 5–7 pairs, tertiary veins reticulate; upper surface glabrous with few hairs on main secondary veins, midrib sunken at base, secondary veins sunken, tertiary veins inconspicuous, greenish, shiny; lower surface glabrous with few hairs on midrib and

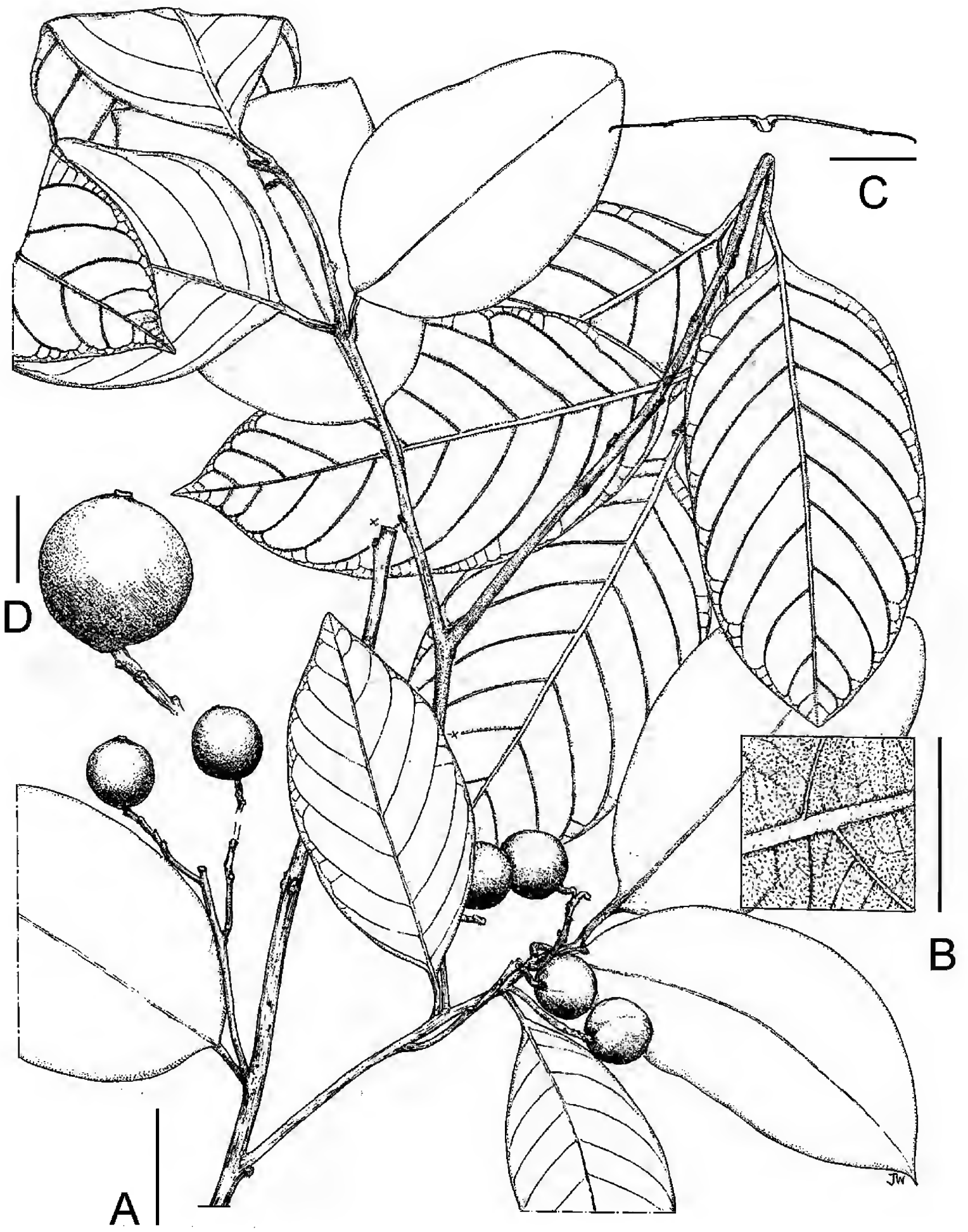

Fig. 6. *Cryptocarya globularia* Kosterm. ex de Kok. **A.** Habit. **B.** Detail of indumentum on lower leaf surface. **C.** Cross-section of leaf showing elevation of veins. **D.** Fruit and stalk. Scale bars A = 3 cm; B, C, D = 1 cm. Drawn by Juliet Beentje from *Balansa 2413*.

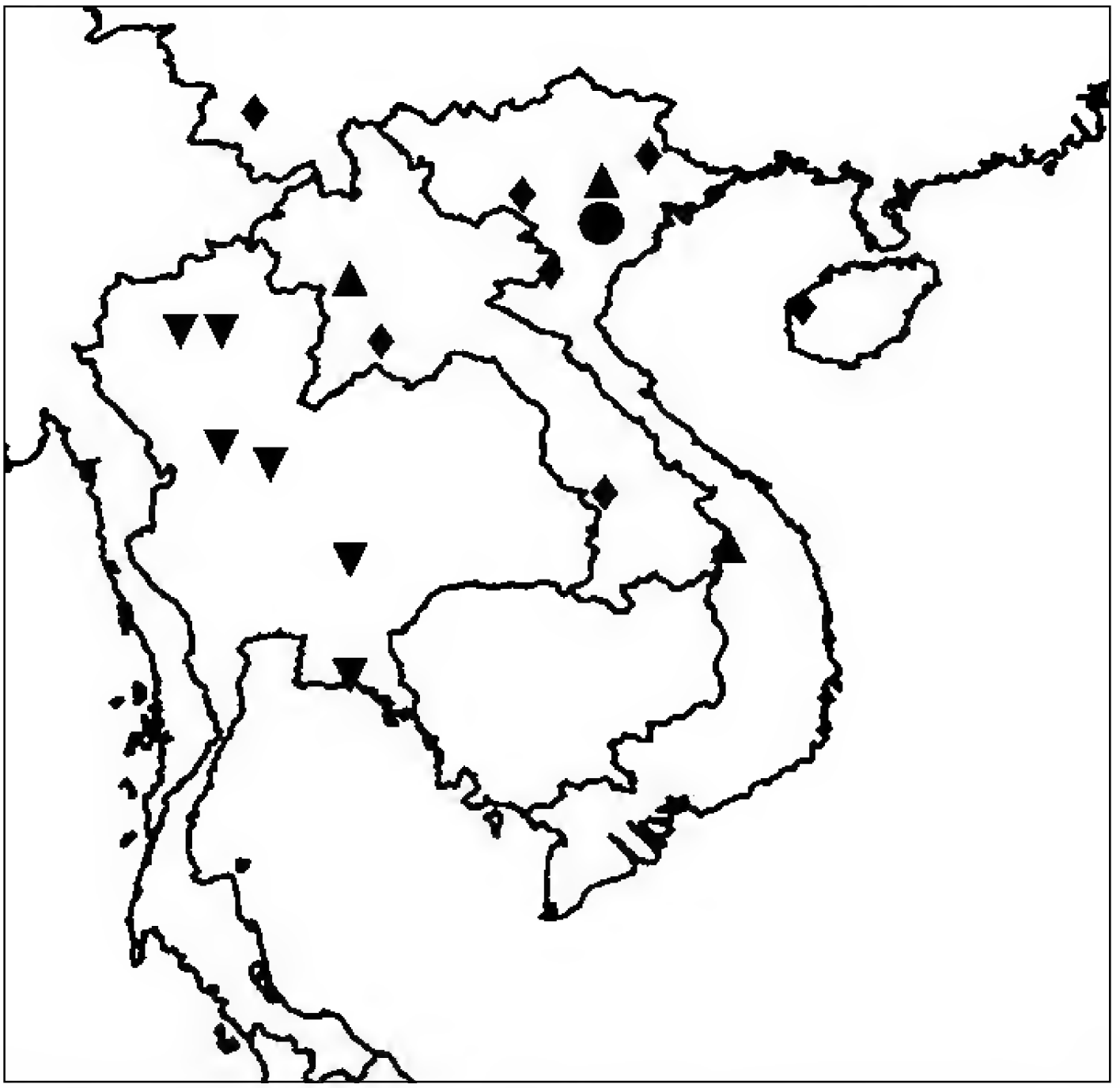

Fig. 7. Distribution of *Cryptocarya laotica* (Gagnep.) Kosterm. (▲), *C. hainanensis* Merr. (♦), *C. pallens* Kosterm. (▼) and *C. globularia* Kosterm. ex de Kok (●).

main secondary veins, midrib raised, secondary veins raised, tertiary veins distinct. ***Petiole*** 5–8 mm long, slender to slightly swollen, half-terete, glabrous to very sparsely hairy, hairs yellowish to reddish. ***Inflorescences*** 3–10 cm long, densely hairy, hairs yellowish brown; bracteoles lanceolate-linear, c. 1 mm long. ***Flowers*** with perianth tube c. 1 mm long, velutinous; perianth lobes broadly ovate, c. 1 mm long, apex acute, velutinous. ***Stamens*** < 1 mm long, hairy at base. ***Ovary*** ovoid, c. 0.7 mm, style c. 0.7 mm long, stigma capitate. ***Fruit*** globose, 14–30 × 13–21 mm, smooth with some faint ridges, glabrous or sometimes with a few hairs at apex, shiny, black or blackish blue when mature. ***Stalk*** slightly swollen when mature.

Distribution. Southern China, Laos, Vietnam (see Fig. 7).

Ecology. Evergreen broad-leaved forests; 470–1600 m altitude, sometimes on limestone.

Phenology. Flowering from January to April; fruiting from April to November.

Vernacular name. *Cay gin* (Vietnamese).

Provisional IUCN Conservation Assessment. Endangered (EN B2ab(ii,iii)). This species is known from a small number of collections from China and Indochina. An analysis of the Extent of Occurrence (EOO) gives a conservation assessment of Least Concern, but an analysis of the Area of Occupancy (AOO) gives an assessment of Endangered. Given the small area of occupancy and the fact that intensive logging and landscape modification have occurred since some of these collections were made, this species must be considered to be endangered.

Selected additional specimens examined. VIETNAM: **Lạng Són:** Entre Dong Mô et Van-Linh, 16 Dec 1940, *Pételot 6692* (P [2 sheets]). **Ninh Bình:** Cúc Phương National Park, 15 Mar 2000, *Loc et al. P 10021* (P); Cúc Phương National Park, 20 Nov 2000, *Cuong et al. NMC 1267* (P). **Quảng Bình:** Ban Kil, 80 km de la route col 7, Vallée du Sôug Gá, 27 Jan 1932, *Poilane 19953* (P). **Đà Nẵng:** Liên Chiêu près de Tourane, 17 Aug 1923, *Poilane 7583* (K, P [2 sheets]).
LAOS: **Champasak:** Phou, 3 Mar 1922, *Poilane 20310* (P). **Vientiane:** Pu Tat, Viengchan, 21 Apr 1932, *Kerr 21183* (BM, K [2 sheets], P).
INDOCHINA: **Locality unknown:** *Schmid 1821* (P).

Notes. As the original type material in Manila was destroyed at the end of the second world war, a lectotype needs to be selected. In the original description of *Cryptocarya hainanensis* Merr., Merrill (1922: 343) cites only one collection for which there are numerous specimens available for lectotypification. The specimen in CAS (CAS0033142) was verified by himself, so it is selected here as the lectotype.

This species is very similar to *Cryptocarya impressa* from which it differs mainly in having a bigger fruit, a lower leaf surface that is glabrous (apart from a few hairs on the veins), and a midrib that is sunken at base on the upper surface of the leaves. It is also similar to *Cryptocarya globularia*, from which it differs in having leaves that are glabrous (apart from a few hairs on the veins) and mainly glabrous fruits (see Table 2).

9. *Cryptocarya impressa* Miq., Fl. Ned. Ind. 1: 923–924 *(*1858); Gamble, J. Asiatic Soc. Bengal. 75: 42–43 (1912); Ridl., Fl. Malay Pen. 3: 78 (1924); Kochummen, Tree Fl. Mal. 4: 135 (1989). – TYPE: [Indonesia] Sumatra, Payo Kombo, *'Mohdang apie ape' Teysmann 1005* (lectotype U [U0002696], designated here; isolectotype BO). (Fig. 8)

Cryptocarya impressa var. *tonkinensis* Lecomte ex H.Liou, Laurac. Chine & Indo-Chine 99 (1932); P.H.Hộ, Ill. Fl. Vietnam 1: 377 (1999); T.C.Lê, Checklist Pl. Sp. Vietnam 83–84 (2003). – TYPE: [Vietnam] Tonkin, Prov. De Phú Cho, reserve forestiere de Chân-Mong, 21–22 April 1914, *Fleury 30111* (lectotype P [P02010233], designated here; isolectotype P [P02010089]), **synon. nov.**

Trees 10–33 m tall, dbh 25–45 cm. ***Bark*** smooth to finely fissured, grey to reddish brown. ***Twigs*** velutinous; hairs erect, rusty brown. ***Leaf lamina*** leathery, elliptic to narrowly obovate, 6–19 × 3–8 cm, apex long-acuminate, base cuneate; pinnately veined, secondary veins 5–9 pairs, tertiary veins scalariform; hairs erect, dark brown; upper surface slightly bullate, glabrous to sparsely hairy, veins velutinous, midrib slightly raised at base, secondary veins sunken, tertiary veins sunken, dark green; lower surface densely hairy, veins velutinous, midrib and secondary veins raised, tertiary veins and reticulations prominently raised, bluish grey, glaucous. ***Petiole*** slender, 5–15 mm long, velutinous, half-terete to shallowly channelled, smooth. Inflorescences 3–13 cm long, velutinous, hairs light rusty brown; bracteoles linear, 2.5–3.8 mm long, velutinous, caducous. ***Flowers*** yellow, hairs reddish; perianth tube 0.7–1.4 mm long, velutinous to sparsely hairy; perianth lobes elliptic, 1.2–2 × 0.9–1.2 mm, apex acute, velutinous. ***Stamens*** 1.1–1.5 mm long, densely hairy. ***Ovary*** clavate, c. 2 mm; style c. 1 mm long, linear; stigma inconspicuous. ***Fruit*** (dried) globose to ovoid, 15–16 × 10–15 mm, glabrous, smooth, blue when mature. ***Stalk*** slender when mature.

Distribution. Vietnam, Laos, Peninsular Malaysia and Sarawak, Singapore, Indonesia (Sumatra) (see Fig. 8).

Ecology. Forest and swamps at 150–900 m altitude. Sometimes over shale.

Phenology. Flowering from May to September; fruiting from April to July.

Vernacular name. *Cay hoang mang* (Vietnamese).

Provisional IUCN conservation assessment. Least Concern.

Use. The timber is used in road construction.

Selected additional specimens examined. VIETNAM: **Hà Tây:** Col d'Chilao, Massif du Lam Dao, 8 Aug 1933, *Poilane 22834* (P [2 sheets]). **Ninh Bình:** Cúc Phuong National Park, 27 Oct 2000, *Cuong et al. NMC 1202* (K, P). **Đà Nẵng:** Col du Nuages, près Tourane, 28 Aug 1923, *Poilane 7784* (P).
LAOS: **Luangprabang:** Phou Phung, 1 Mar 1932, *Poilane 20241* (BM, K, P, SING). INDOCHINA: **Locality unknown:** *Chevalier* s.n. (P).

Notes. Two different Teysmann gatherings are mentioned in the original description of *Cryptocarya impressa* (Miquel, 1858). Of those, only one has a collection number and of this collection there are specimens at U, now L, and BO respectively which are available for lectotypification. As Miquel was based at U, the specimen U0002696 is selected here as the lectotype.

After studying the type material of *Cryptocarya impressa* var. *tonkinensis* Lecomte ex H.Liou at P, and given the information from the original description (as the P material no longer has any fruits), it appears that this is a small-leaved version

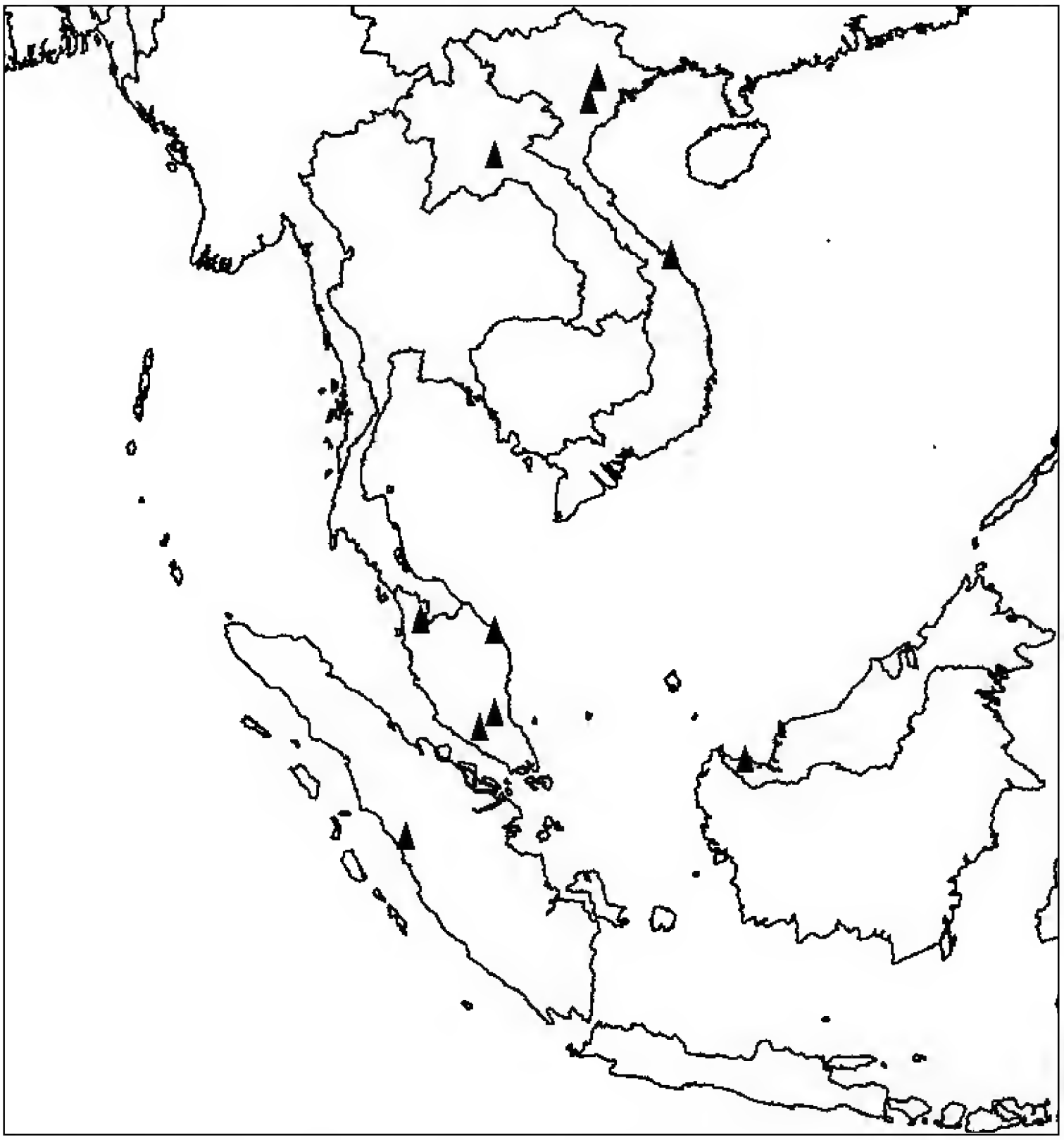

Fig. 8. Distribution of *Cryptocarya impressa* Miq. (▲).

of *C. impressa* with a young fruit. In the original description of this name, Liou Ho (1932: 99) cites only one collection. For the lectotypification of this name there are two specimens available at P. The specimen P02010233 is selected here as the lectotype.

This species seems to be absent from Thailand, southern Vietnam and Cambodia, although it is common in Peninsular Malaysia, Laos and northern Vietnam. This may be a result of the undercollection of this genus in the region.

10. *Cryptocarya kurzii* Hook.f., Fl. Brit. India 5: 119 (1886); Gamble, J. Asiatic Soc. Bengal. 75: 48–49 (1912); Ridl., Fl. Malay Pen. 3: 80 (1924); Kochummen, Tree Fl.

Table 2. Differences between *Cryptocarya chanthaburiensis* Kosterm., *C. hainanensis* Merr., *C. impressa* Miq. and *C. globularia* Kosterm. ex de Kok.

	C. chanthaburiensis	***C. hainanensis***	***C. impressa***	***C. globularia***
Under surface of leaf	Sparsely hairy to almost glabrous	Glabrous	Densely hairy	Sparsely hairy
Midrib at base on the upper surface	Sunken	Sunken	Raised or flattened	Sunken
Indumentum on fruit	Glabrous	Glabrous or sometimes with a few hairs at apex	Glabrous	Sparsely hairy
Fruit shape and size (in mm)	Ovoid to ellipsoid, 11–15 × 8–10	Globose, 14–30 × 13–21	Globose to ovoid, 15–16 × 10–15	Globose, 17–19 × 16.5–18

Mal. 4: 135 – 136 (1989); Ng, Gard. Bull. Singapore 57: 64–67 (2005). – *Cryptocarya wightiana* var. *griffithii* Meisn., Prodr. 15: 70 (1864). – TYPE: [Myanmar] Tenasserim, Mergui, *Griffith 1142 [Kew Distribution 4274]* (lectotype K [K000768400], designated here). (Fig. 9)

Shrubs or trees 2.5–30 m tall, dbh 10–25 cm. ***Bark*** smooth to slightly scaly, grey-black to reddish brown, wood yellow to pinkish white. ***Twigs*** velutinous when young, becoming more glabrous when older, hairs yellow to brown. ***Leaf lamina*** thinly leathery, elliptic to lanceolate, 5–18 × 2.2–6.5 cm, apex round to acuminate, base cuneate or rounded, symmetrical; pinnately veined, secondary veins 4–9 pairs, tertiary veins scalariform; upper surface glabrous, except hairs on midrib, midrib sunken, secondary veins sunken, tertiary veins inconspicuous, bright to darkish green, young leaves salmon pink, dull or shiny; lower surface sparsely hairy to almost glabrous, hairs yellow, midrib and secondary veins raised, tertiary veins faint below, silvery to greenish grey or bluish. ***Petiole*** slender to slightly swollen, 10–13 mm long, half-terete, glabrous to velutinous, hairs yellowish, appressed. ***Inflorescences*** 3–12 cm long, velutinous to sparsely hairy, greenish yellow; bracteoles linear 1.4–1.8 mm long, caducous. ***Flowers*** pale yellow to yellowish brown or pale greenish yellow, hairs yellowish; perianth tube 0.8–1.2 mm long, velutinous to sparsely hairy; perianth lobes elliptic, 1.6–1.8 × 0.8–1.3 mm, apex round to acute, sparsely hairy. ***Stamens*** 1.2–1.4 mm long, densely hairy. ***Ovary*** clavate, c. 0.6 mm; style c. 1 mm long, linear; stigma inconspicuous. ***Fruit*** (dried) ovoid to ellipsoid, 18–21 × 10–15 mm, smooth, glabrous

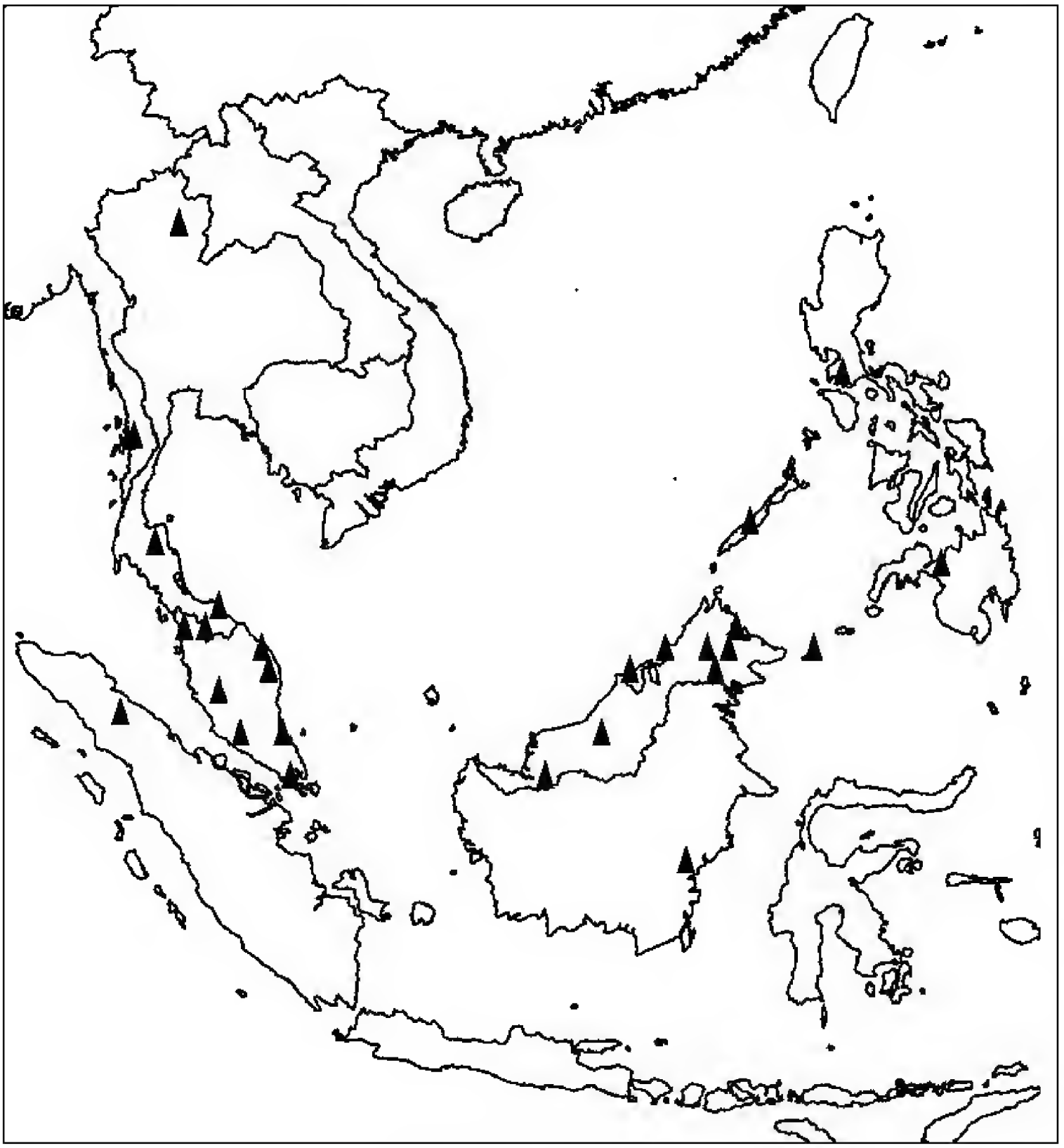

Fig. 9. Distribution of *Cryptocarya kurzii* Hook.f. (▲).

when mature, sparsely hairy when young, apex with a wide ring-like aperture, purple blue or black when mature. Stalk swollen when mature, up to 3.3 mm in diameter.

Distribution. Southern Myanmar, Thailand, Malaysia (including Sabah and Sarawak), Singapore, Brunei, Indonesia (Kalimantan and Sumatra), Philippines (see Fig. 9).

Ecology. Growing in primary to secondary forests, often in wet localities, at 0–610 m altitude. Sometimes over granite.

Phenology. Flowering from August to May; fruiting from July to May.

Vernacular name. *Hu ban bai leg* (Thai).

Provisional IUCN conservation assessment. Least Concern.

Selected additional specimens examined. THAILAND: **Phangnga:** Nai Chong, 11 May 1973, *Geesink & Santisuk 5356* (K). **Nan:** Pua, Doi Phu Kha National Park, 14 Nov 2001, *Srisanga 2245* (SING). **Narathiwat:** Kok Dan Peat Swamp Forest, 17 Feb 1984, *Niyomdham 786* (K). **Satun:** La-ngu District, Tarutao National Park, 18 Feb 2005, *Gardner et al. ST 1556* (K, KEP). **Trang:** Khao Chong, 15 Apr 1969, *Phusomsaeng 154* (K, P). **Yala:** Than To, Ban Chulaphon Phatthana, 13 Feb 2004, *Middleton 3046* (K).

Notes. Hooker (1886: 119) bases this name on the description of *Cryptocarya wightiana* var. *griffithii* Meisn. (Meissner, 1864: 70). In this earlier description two specimens are cited: Tenasserim, Mergui, *Griffith 1142 [Kew Distribution 4274]*) and Canarâ, *Stocks* s.n. (v.s. in Hooker herbarium). Meissner (1864: 70) states that he had not seen the later specimen, and Hooker himself does not mention it in his description. I could not find the *Stocks* specimen in K under the obvious names. Given that a lectotype should be chosen, I select the *Griffith 1142 [Kew Distribution 4274]*) here as the lectotype as it is the only one that I know still to be extant.

11. ***Cryptocarya laotica*** (Gagnep.) Kosterm., Bull. Bot. Surv. India 10: 287 (1968); P.H.Hộ, Ill. Fl. Vietnam 1: 378 (1999); T.C.Lê, Checklist Pl. Sp. Vietnam 84 (2003). – *Kerrdora laotica* Gagnep., Notul. Syst. (Paris) 14: 31 (1950). – TYPE: Laos, Muang-awn, Chieng-kwang, 6 April 1932, *Kerr 20939* (lectotype P [P00745432], designated here; isolectotypes BM [BM000950885], K [2 sheets]). (Fig. 7)

Tree 1.8–9 m tall, dbh up to 30 cm. ***Twigs*** angular, finely striate, sparsely hairy, hairs yellowish brown. ***Leaf lamina*** papery, elliptic to (narrowly) lanceolate, 7–18 × 1.2–6 cm, apex obtuse to acuminate, base cuneate, rarely asymmetric; pinnately veined, secondary veins 6–8 pairs, tertiary veins reticulate; upper surface glabrous except for a few hairs on the midrib and main secondary veins, midrib sunken at base, secondary veins sunken or rarely raised, tertiary veins faint; lower surface glabrous, midrib raised, secondary veins raised, tertiary veins conspicuous. ***Petiole*** 3–10 mm, wrinkled, slender to slightly swollen, half-terete, sparsely hairy, hairs yellowish. ***Inflorescences*** 1.5–6 cm long, densely hairy to velutinous; bracteoles triangular, 4–7.5 mm long, persistent. ***Flowers*** with yellowish hairs; perianth tube 0.5–1.5 mm long, velutinous; perianth lobes elliptic, 1.8–2 × 1–1.1 mm, apex acute, sparsely hairy. ***Stamens*** 1–1.5 mm long, densely hairy. ***Ovary*** clavate, c. 1.5 mm long; style c. 1 mm long; stigma inconspicuous. ***Fruit*** (dried) ellipsoid, 13–17 × 7–10 mm, smooth, glabrous. ***Stalk*** not or slightly swollen when mature.

Distribution. Laos, central Thailand, northern and central Vietnam (see Fig. 7).

Ecology. Evergreen broad-leaved forests over granite-derived soils, at about 900–2000 m altitude.

Phenology. Flowering from November to April; fruiting from December to May.

Provisional IUCN conservation assessment. Endangered (EN B2ab(ii,iii)). This species is known from a small number of collections from Indochina. An analysis of the Extent of Occurrence (EOO) give a conservation assessment of Least Concern, but an analysis of the Area of Occupancy (AOO) gives an assessment of Endangered. Given its small area of occupancy and that intensive logging and landscape modification has occurred since most of the collections were made, it must be considered endangered.

Additional specimens studied. VIETNAM: **Bắc Giang:** Route du Hanoi à Lang Son, Mar 1933, *Pételot 5245* (P [2 sheets]); ibidem, 10 Dec 1946, *Poilane 32686* (P). **Kon Tum:** Massif du Ngok Guga, près de Đắk Tô, 27 Nov 1946, *Poilane 35663* (P).
THAILAND: **Tak:** Muang sub district, Taksin Maharat National Park, *Pooma et al. 3941* (KEP).

Notes. This species is distinctive by having reticulate tertiary venation which is prominent on the glabrous underside of the leaves. In Indochina and Thailand, it shares this character only with *Cryptocarya concinna* and some specimens of *C. sublanuginosa*, although the character is more common in Peninsular Malaysia (De Kok, in press).

12. *Cryptocarya nitens* (Blume) Koord. & Valeton, Meded. Lands Plantentuin 68: 220–223 (1904); Kochummen, Tree Fl. Mal. 4: 136 (1989). – *Tetranthera nitens* Blume, Mus. Bot. 1: 375 (1851). – TYPE: [Indonesia] Java, *Blume* s.n. (lectotype L [L0036214], designated by De Kok (2015); isolectotype L [L0036213]). (Fig. 10)

Trees 8–30 m tall, dbh 15–30 cm. ***Bark*** smooth or scaly, grey-brown, inner bark brownish, wood cream coloured with spicy odour. ***Twigs*** strongly angular when young, velutinous, hairs brown. ***Leaf lamina*** leathery, elliptic to lanceolate, ovate to obovate (6–)7.5–23 × (2.2–)3.5–10.5 cm, apex acute to acuminate, base cuneate or rounded, slightly unequal; pinnately veined, secondary veins 5–10 pairs, tertiary veins scalariform; upper surface glabrous sometimes with hairs on midrib and secondary veins, midrib sunken, secondary veins sunken, tertiary veins faint, shiny, (light to yellow) green, drying greenish brown; lower surface glabrous sometimes with hairs on midrib and secondary veins, midrib and secondary veins raised, tertiary veins faint, pale green, glaucous. ***Petiole*** slender, 10–30 mm long, velutinous. ***Inflorescences*** 10–15 mm long, velutinous, greenish white; bracteoles triangular 0.5–0.6 mm long, caducous. ***Flowers*** pale green to yellow or white, hairs yellowish; perianth tube 1.2–1.6 mm long, velutinous; perianth lobes elliptic to lanceolate, 1.3–1.8 × 0.8–1 mm, apex acute, velutinous, greenish white. ***Stamens*** 1.2–1.6 mm long, hairy, dull greenish yellow, anther bright yellow orange. ***Ovary*** clavate, 1–1.2 mm, glabrous; style 1.2–1.6 mm long, linear; stigma inconspicuous. ***Fruit*** (dried) globose, 8–16 mm diameter, shallowly ridged, sparsely hairy, black when mature. ***Stalk*** slender when mature.

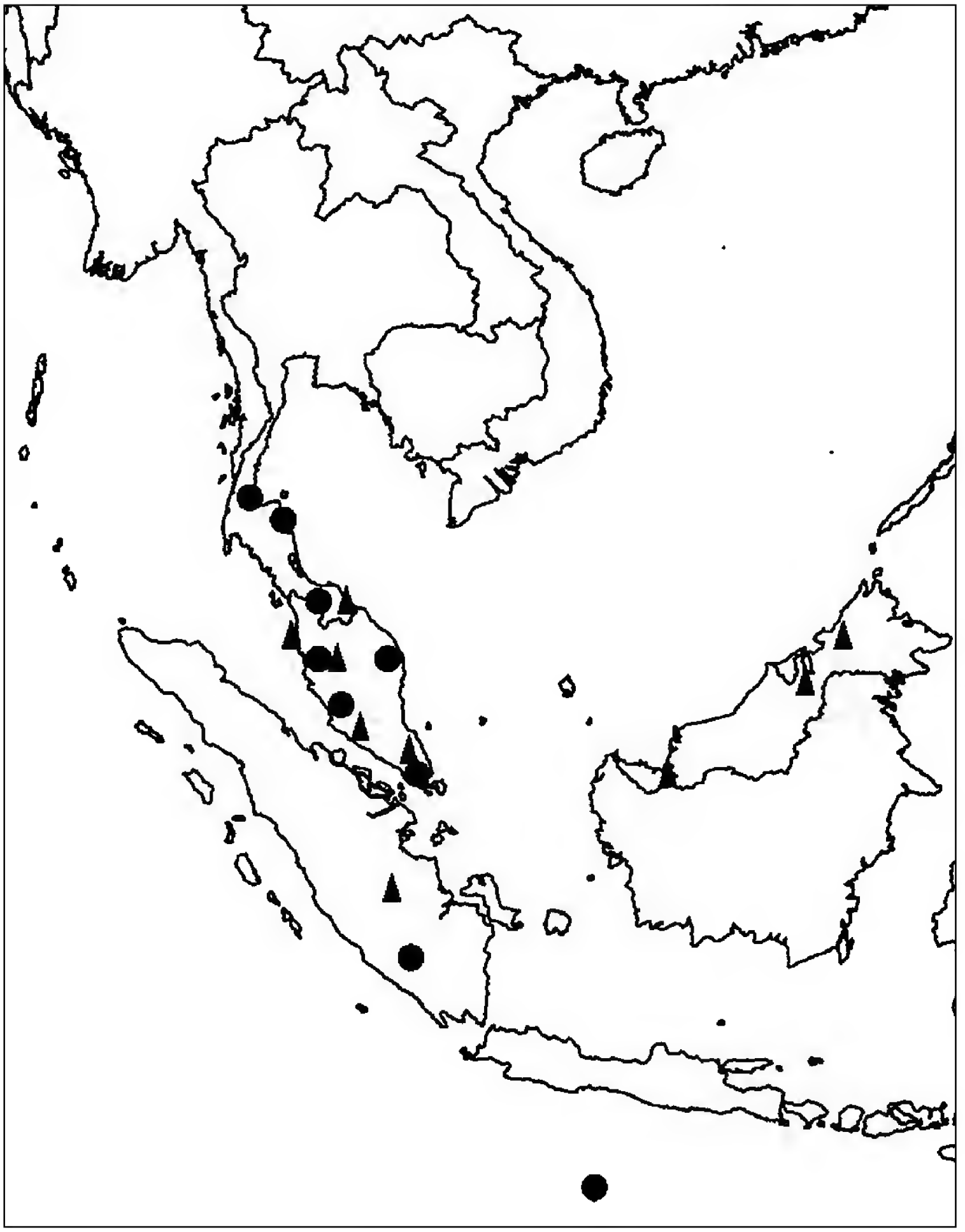

Fig. 10. Distribution of *Cryptocarya nitens* (Blume) Koord. & Valeton (•) and *C. rugulosa* Hook.f. (▲).

Distribution. Peninsular Thailand, Malaysia, Singapore, Indonesia (Sumatra and Java), Australia (Christmas Island) (see Fig. 10).

Ecology. Riversides in open mixed (including bamboo) hill to lowland forest, growing on limestone, sandstone and granite, at 0–250 m altitude.

Phenology. Flowering from March to October; fruiting from January to November.

Provisional IUCN conservation assessment. Least Concern.

Selected additional specimens examined. THAILAND: **Nakhon Si Thammarat:** Tha Sala, Khao Luang National Park, *Gardner & Tippayasri ST 1660* (KEP). **Ranong:** Muang Len, 13 Jan 1966, *Hansen & Smitinand 11941* (K). **Yala:** Than To, Ban Chulaphon Phatthana, 9 Feb 2004, *Middleton 2875* (K).

Notes. See De Kok (2015) for additional information on this species.

13. *Cryptocarya pallens* Kosterm., Nat. Hist. Bull. Siam Soc. 25: 34–35 (1975 ['1974']). – TYPE: Northern Thailand, Chiang Mai, Doi Angka [Doi Inthanon], Mae Ka Pak drainage, 24 April 1931, *Put 3767* (holotype K; isotypes BM [BM001124603], BO, P [P00745426]). (Fig. 7)

Cryptocarya shoreifolia Kosterm., Nat. Hist. Bull. Siam Soc. 25: 36 (1975 ['1974']), as *'shoreaefolia'*. – TYPE: Thailand, Phitsanulok, Tung Salaëng Luang, 15 February 1964, *Hansen et al. 11178* (holotype BKF (not seen); isotypes C [C10013574, C10013575], K, L), **synon. nov.**

Tree 7–20 m tall. ***Twigs*** striate, dark brown, covered with short, erect hairs. ***Leaf lamina*** leathery, lanceolate to elliptic, 6–16(–24) × 2.2–5.8(–8) cm, apex emarginate to acuminate, base cuneate, symmetric to slightly asymmetric; pinnately veined, secondary veins 5–8(–14) pairs, tertiary veins scalariform; upper surface glabrous except for a few erect hairs on midrib, midrib sunken at base, secondary veins sunken, tertiary veins and reticulations sunken or inconspicuous; lower surface sparsely hairy with hairs erect, midrib raised, secondary veins raised, tertiary veins and reticulations prominently raised, glaucous. ***Petiole*** 9–15 mm long, slender or only slightly swollen, smooth, half-terete to channelled, sparsely to densely hairy, hairs rusty brown to pale yellowish. ***Inflorescences*** 3–8 cm long, velutinous to sparsely hairy, hairs yellow; bracteoles round, 0.1–0.2 mm long, caducous. ***Flowers*** with perianth tube 0.9–1.3 mm long, velutinous; perianth lobes lanceolate, 1.1–1.7 × 0.8–0.9 mm, apex acute, sparsely hairy, sometimes velutinous. ***Stamens*** 1–1.5 mm long, hairy at base. ***Ovary*** clavate, c. 1 mm long; style c. 1 mm long, linear; stigma inconspicuous. ***Fruit*** (dried) ellipsoid, 13.5–22 × 6.7–13 mm, smooth or with faint ridges, glabrous, deep violet when mature. ***Stalk*** not or slightly swollen when mature.

Distribution. Northern to central Thailand (see Fig. 7).

Ecology. Evergreen forest, between 200–1350 m altitude.

Phenology. Flowering from January to April; fruiting from January to June.

Vernacular names. *Mãk Ki Ai* or *Salawt* (Thai).

Provisional IUCN conservation assessment. Endangered (EN B2ab(ii,iii)). This species is known from a small number of collections from Thailand. An analysis of the Extent of Occurrence (EOO) give a conservation assessment of Least Concern, but an analysis of the Area of Occupancy (AOO) gives an assessment of Endangered. Given the small area of occupancy and that intensive logging and landscape modification has occurred since the collections were made, it must be considered to be endangered.

Additional specimens examined. THAILAND: **Chanthaburi:** Kao Sabap, 5 Jan 1930, *Kerr 17963* (BM, K). **Chiang Mai:** Mê Kā Pak drainage, 9 Jun 1939, *Garrett 1146* (K [2 sheets], P); Pang Tawn, 29 Apr 1931, *Put 3814* (BM, K [2 sheets], P). **Lampang:** Chê Saun, 1921, *Kerr 4747* (BM, K), 31 Jan 1921, *Kerr 4746* (BM, K). **Nakhon Ratchasima:** Pak Thong Chai, 26 Apr 1968, *Phengnaren & Smitinand 647* (K). **Petchabun:** Kao Keo Kang, Dan Sai, 10 Apr 1922, *Kerr 5791* (BM, K [2 sheets], P) and *5791A* (BM, K).

14. *Cryptocarya pustulata* Kosterm., Nat. Hist. Bull. Siam Soc. 25: 35 (1975 ['1974']). – TYPE: Thailand, Chanthaburi, 27 February 1956, *Sangkhachand 615* (lectotype C [C10013570], designated here; isolectotype C [C10013569]). (Fig. 11)

Tree 1.6–15 m tall, dbh 15–20 cm. ***Twigs*** smooth to slightly longitudinally ridged, velutinous when young, sparsely hairy to glabrous when mature, hairs yellowish. ***Leaf lamina*** leathery to membranous, lanceolate, sometimes obovate, 9–23 × 2–7.5 cm, apex round to acuminate, base rounded to slightly cuneate, slightly asymmetric; pinnately veined, secondary veins 6–10 pairs, tertiary veins scalariform; upper surface glabrous with few hairs on midrib and main secondary veins, midrib and main secondary veins sunken, tertiary veins visible; lower surface sparsely hairy, midrib raised, secondary veins curving and raised, tertiary veins visible, glaucous. ***Petiole*** 6–13 mm long, slightly swollen, half-terete to channelled, velutinous to glabrous when more mature, hairs yellowish. Inflorescences 1.8–12 cm long, velutinous to sparsely hairy; bracteoles elliptic to linear, < 1 mm long, often persistent. ***Flowers*** yellow, scented, hairs yellowish; perianth tube 0.3–2 mm long, velutinous; perianth lobes elliptic, 0.6–1.3 × 0.6–1.5 mm, densely to sparsely hairy, apex acute. ***Stamens*** 1–1.3 mm long, hairy. ***Ovary*** clavate, glabrous; style c. 1 mm long, linear; stigma inconspicuous. ***Fruit*** (dried young fruits only) ellipsoid when very young, becoming more globose when older, smooth, hairy, glabrescent when older. ***Stalk*** in mature state unknown.

Distribution. Southeastern and northern Peninsular Thailand (see Fig. 11).

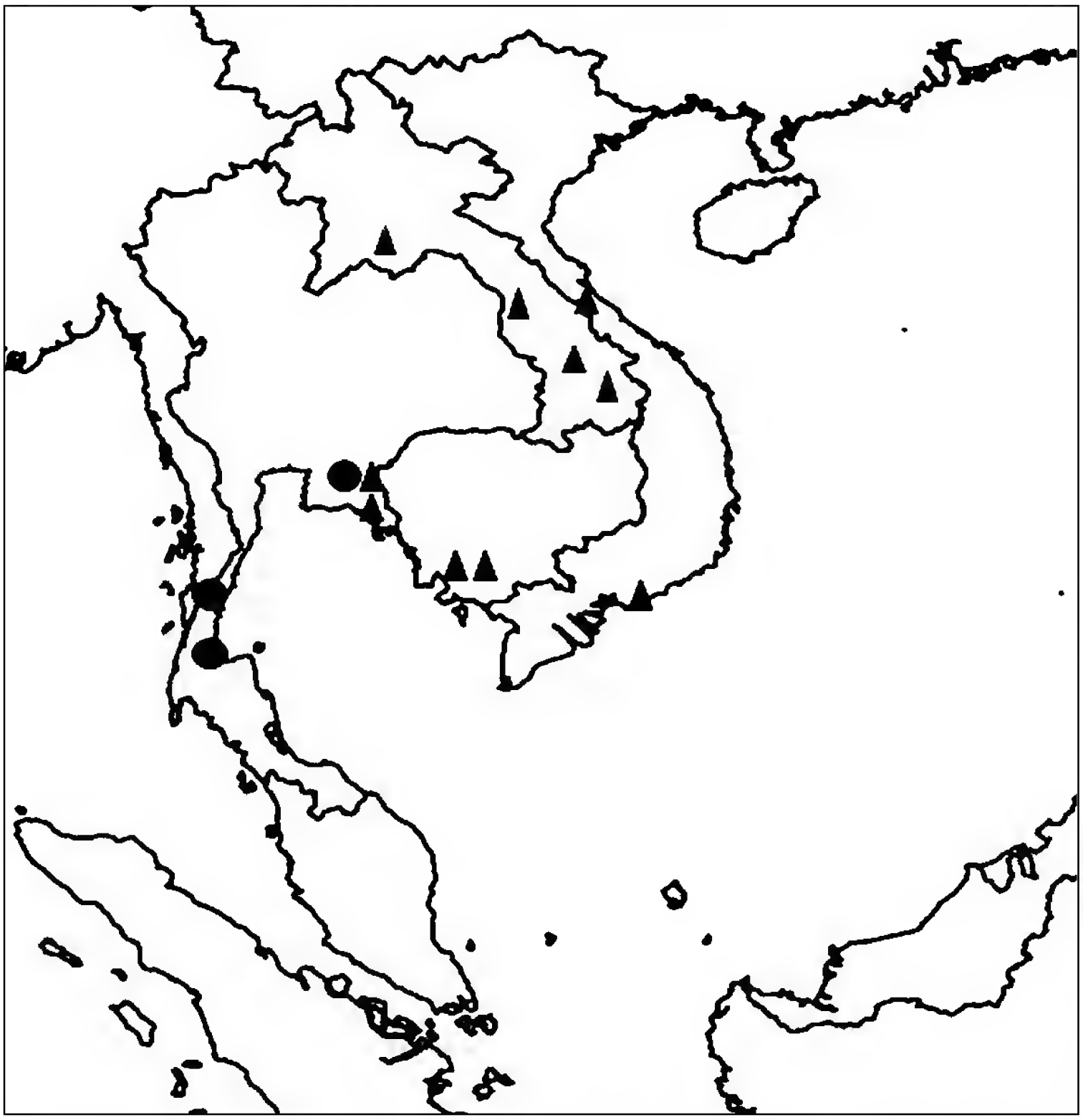

Fig. 11. Distribution of *Cryptocarya pustulata* Kosterm. (●) and *C. sublanuginosa* Kosterm. (▲).

Ecology. Growing in evergreen lowland forest or in bamboo forest, sometimes along river banks, at 150–1300 m altitude.

Phenology. Flowering from February to March; fruiting starting in April.

Vernacular name. *Mang Kat* (Thai).

Provisional IUCN conservation assessment: Endangered (EN B2ab(ii,iii)). This species is only known from seven collections, made between 1926 and 1956. An analysis of the Extent of Occurrence (EOO) give a conservation assessment of Near

Threated, but an analysis of the Area of Occupancy (AOO) gives the assessment of Endangered. As this part of Thailand has seen significant reduction in forest cover, and given the small area of occupancy, this species must be considered to be endangered.

Additional specimens examined. THAILAND: **Surat Thani:** Pak Sai, 31 Mar 1927, *Kerr 12496* (BM, K, P); Kaw Zao, 15 Apr 1927, *Kerr 12749* (BM [2 sheets]), *Kerr 12744* (BM [2 sheets]); ibidem, 18 Apr 1927, *Kerr* s.n. (BM); ibidem, 31 Dec 1926, *Kerr 11200* (BM [2 sheets], SING). **Chumphon:** Pato District, Lars Quan, 27 Feb 1927, *Kerr 12144* (BO, BM, K, P).

Notes. The fruits are only known from very immature collections. They are hairy and ellipsoid at first but very soon become glabrous and globose. They have no ridges during this process and the stalk is not swollen when young.

In the original description, Kostermans (1975: 35) did not distinguish which of the two sheets at C is the holotype of this name. I have therefore selected the specimen C10013570 as the lectotype.

15. ***Cryptocarya rugulosa*** Hook.f., Fl. Brit. India 5: 118 (1886); Gamble, J. Asiatic Soc. Bengal. 75: 43–44 (1912); Ridl., Fl. Malay Pen. 3: 78–79 (1924); Kochummen, Tree Fl. Mal., 4: 136 (1989). – TYPE: [Malaysia] Malacca, 26 June 1867, *Maingay 1262* (lectotype K [K001084564], designated here; isolectotypes GH [GH00041377], K [K001084565]). (Fig. 10)

Trees (3–)12–40 m tall, dbh 25–35 cm. ***Bark*** smooth to dippled and/or scaly, reddish-brown; wood (pale) yellow white to brown, aromatic. ***Twigs*** round in cross-section or slightly angular, velutinous when young, flaking off in patches when old, hairs yellowish. ***Leaf lamina*** leathery, elliptic to lanceolate or ovate, 4–14(–20) × 2–5(–6.5) cm, apex round to (long) acuminate, base cuneate, even to slightly oblique; pinnately veined, secondary veins 3–13 pairs, tertiary veins scalariform; upper surface glabrous with sparsely to densely hairy midrib, hairs yellowish, midrib sunken, secondary veins sunken, tertiary veins sunken or inconspicuous, glossy, dark green, young leaves red; lower surface sparsely hairy, veins densely hairy, hairs yellowish-reddish, secondary and tertiary veins raised, grey green, faintly glaucous. ***Petiole*** slender to slightly swollen, 7–15 mm long, half-terete, velutinous, hairs yellowish. ***Inflorescences*** 1.5–10 cm long, velutinous to densely hairy, hairs brown to yellowish; bracteoles elliptic to lanceolate, (1.5–)2–3.5 mm long, persistent. ***Flowers*** yellowish brown to pale yellow; perianth tube 1.2–2 mm long, velutinous; perianth lobes elliptic, 1.2–2 × 1–1.3 mm, sparsely hairy, apex acute. ***Stamens*** 1.2–1.5 mm long. ***Ovary*** clavate, 1–1.2 mm; style 1–1.2 mm long. ***Fruit*** (dried) ellipsoid to obovoid or ovoid, 17–26 × 9.5–15.5 mm, smooth or with faint ridges, glabrous with sometimes some hairs at apex, apex with a wide ring-like aperture, purple to black when mature. ***Stalk*** swollen when mature.

Distribution. Peninsular Thailand, Malaysia (including Sabah and Sarawak), Indonesia (Sumatra) (see Fig. 10).

Ecology. Growing in primary or secondary forests, often in peat swamps or in sandy soil, sometimes over shale, ultrabasic or granite, at 15–650 m altitude,

Phenology. Flowering from January to March (July); fruiting all year around.

Provisional IUCN conservation assessment. Least Concern.

Selected additional specimens examined. THAILAND: **Narathiwat:** freshwater swamp-forest south of Narathiwat, 9 Mar 1974, *Larsen & Larsen 33126* (K).

Notes. The type material '*Malacca, 26 June 1867, Maingay 1262*' at Kew contains two sheets. The specimen on the first sheet has both flowers and fruits, whereas the specimen on the second sheet does not have flowers and only one immature fruit. The specimen on the first sheet (K001084564) is selected here as the lectotype.

16. *Cryptocarya sublanuginosa* Kosterm., Nat. Hist. Bull. Siam Soc. 25 (1975['1974']) 36. – TYPE: Laos, Viengchan [Vientiane], Muang Ban, 28 April 1932, *Kerr 21285* (holotype K; isotypes BM [BM001124602], BO, P [P02010455]). (Fig. 11)

Tree 8–15 m tall, dbh 10–20 cm. ***Bark*** brown. ***Twigs*** striate, densely hairy when young, glabrous when mature; hairs erect, yellowish. ***Leaf lamina*** leathery, lanceolate to rarely elliptic or ovate, 5–20 × 1.4–6.6 cm, apex acute to shortly acuminate, base cuneate, symmetric to asymmetric; pinnately veined, secondary veins 6–10 pairs, straight but curved near margin, tertiary veins scalariform to reticulate; upper surface glabrous with a few hairs on midrib, midrib sunken at base, secondary veins sunken or inconspicuous, tertiary veins faint to inconspicuous; lower surface glabrous except for occasional hairs along major veins, midrib and secondary veins with a few hairs, midrib and secondary veins raised, tertiary veins distinct, glaucous. ***Petiole*** 8–15 mm long, slender to slightly swollen, half-terete, densely hairy to sparsely hairy. ***Inflorescences*** 6–14 cm long, velutinous to sparsely hairy; bracteoles linear, 1–2.5 mm long. ***Flowers*** with white to yellowish hairs; perianth tube 0.8–1 mm long, velutinous to sparsely hairy; perianth lobes elliptic, 1.8–2 × 0.8–1 mm, apex acute, velutinous to sparsely hairy. ***Stamens*** 1.2–2 mm long, densely hairy. ***Ovary*** clavate, c. 1.5 mm; style c. 1 mm long, linear; stigma inconspicuous. ***Fruit*** (dried) ellipsoid, 8.5–18 × 6.4–10.5 mm, smooth, glabrous, black when mature. ***Stalk*** not swollen when mature.

Distribution. Southeastern Thailand, Cambodia, Laos, Vietnam (see Fig. 11).

Ecology. Growing in forest on clay soil at 25–200(–1000) m altitude.

Phenology. Flowering from January to April; fruiting from November to January.

Vernacular names. *Cây mông gà* (Vietnamese); *Mbây Ky Quan* (Laotian).

Provisional IUCN Conservation Assessment. Endangered (EN B2ab(ii,iii)). This species is known from a small number of collections from Indochina. An analysis of the Extent of Occurrence (EOO) give a conservation assessment of Least Concern, but an analysis of the Area of Occupancy (AOO) gives an assessment of Endangered. Given the small area of occupancy and that intensive logging and landscape modification has occurred since the collections were made, it must be considered to be endangered.

Additional specimens examined. VIETNAM: **Bà Rịa-Vũng Tàu:** Montibus ad Baria Galicea, 1867, *Pierre 3598* (BO, BM, K, P). **An Giang:** Arboretum de Trambom, 9 Dec 1922, *Poilane 174* (P); ibidem, 18 Mar 1931, *Poilane 19139* (P [5 sheets]). **Quảng Trị:** Massif de Dôug Ché, 21 May 1924, *Poilane 10503* (P [2 sheets]).
CAMBODIA: **Kampot:** Mont de l'Éléphant, 16 Aug 1919, *Poilane 377* (K, P). **Locality unknown:** Mulu Prey, Jan 1876, *Harmand 268 [Pierre 3178]* (BM, K).
LAOS: **Attapeu:** Bassin d'Attapeu, 18751877, *Harmand 1287* (BO, P [2 sheets]). **Savannakhet:** 20 km de la route de Savannakhet à Quâug Tri, 21 Jan 1925, *Poilane 11714* (P); 28 Jan 1925, *Poilane 11797* (BO, P); Bassin du Sè-Moun, 1875–1877, *Harmand 268* (P [3 sheets]).
THAILAND: **Chon Buri:** Sriracha Forest, 6 Apr 1923, *Collins 865* (K); ibidem, 23 Nov 1927, *Collins 1975* (BM, K).

Dubious names

Cryptocarya godefroyana

On the sheet of *Godefroy-Lebeuf 287* (Cambodia, 'Sud Ouest du Grand Lac') housed at Kew, Kostermans attached an identification slip in 1972 with the name 'Cryptocarya godefroyana'. As far as I have been able to determine, this name has never been validly published. This is not unknown for unpublished names to be found on Kostermans's identification slips. The specimen is sterile and does not resemble any known *Cryptocarya* from the region. One other suggestion written on the specimen, in an older hand than Kostermans's, is *Roydsia* Roxb., now a synonym of *Stixis* Lour. After checking specimens in Kew's herbarium, this identification was also rejected. I do not believe that this specimen represents a *Cryptocarya* and it most likely belongs to a different genus in the Lauraceae.

Excluded names

Cryptocarya chinensis (Hance) Hemsl., J. Linn. Soc., Bot. 26: 370 (1891); P.H.Hộ, Ill. Fl. Vietnam 1: 376 (1999); T.C.Lê, Checklist Pl. Sp. Vietnam 82 (2003); H.W.Li et al. Fl. China 7: 249 (2008). – *Beilschmiedia chinensis* Hance, J. Bot. 20: 79–80 (1882).[China] Hong-Kong, Valle Su-kun-pu, May 1881, *Ford (Herb. Propr.) 21705* (holotype BM (not seen); isotype MO [MO1889412]).

This species is endemic to southern China (Guangdong, Guangxi, Hainan, Sichuan and Taiwan). It was also reported to occur in Vietnam (Hộ, 1999: 376; Lê, 2003: 82), but I could not find any specimens to support this claim. The species is morphologically very close to *Cryptocarya densiflora*, from which it differs in having a smaller fruit that is clearly 12–15 ribbed, a leaf blade that is smaller and narrower, and glabrous twigs and petioles.

Cryptocarya chingii W.C.Cheng, Contr. Biol. Lab. Sci. Soc. China., Bot. Ser. 10: 111–113 (1936); P.H.Hộ, Ill. Fl. Vietnam 1: 376 (1999); T.C.Lê, Checklist Pl. Sp. Vietnam 82 (2003). – TYPE: [China] Cherriang, Shunshi, south of Ping Yang, 10 July 1924, *Ching 2055* (holotype PE; isotypes BO, E [E00386424], P [P02010170], US [US00099482]).

This species has been recorded for Vietnam (Hộ, 1999: 376; Lê, 2003: 82). However, I have not seen any material from Vietnam to support this, although, given its distribution in southern China, it may occur in northern Vietnam.

Cryptocarya cuneata Blume, Bijdr. 558 (1826); T.C.Lê, Checklist Pl. Sp. Vietnam 85 (2003). = ***Dehaasia cuneata*** (Blume) Blume, Rumphia 1: 164, t. 46 (1837). – TYPE: [Indonesia, Java] Nusae Kambaugae, November, *Blume s.n* .(type L (**L0036313**)).

Cryptocarya maclurei Merr., Philipp. J. Sci. 21: 344 (1922); H.Liou, Laurac. Chine & Indo-Chine 99 (1932); P.H.Hộ, Ill. Fl. Vietnam 1: 378 (1999); T.C.Lê, Checklist Pl. Sp. Vietnam 84 (2003). – TYPE: China, Hainan, Ng Chi Leng, 22 Dec 1921, *McClure 8508* (holotype PNH (not seen, presumably destroyed); isotypes A [A00041357, A00041358], BISH [BISH1006122], K [K000768391], MO [MO1889405], NY [NY00355052], P [P02010366]).

This species has been recorded from Vietnam (Liou Ho, 1932: 99; Hộ, 1999: 378; Lê, 2003: 84). However, I have compared the Vietnamese material supposedly belonging to this species with Chinese specimens of *Cryptocarya maclurei*, including the type material, and I have come to the conclusion that the Vietnamese specimens are better placed in *Cryptocarya sublanuginosa*.

Cryptocarya metcalfiana C.K.Allen, J. Arnold Arbor. 23: 457–458 (1942); P.H.Hộ Ill. Fl. Vietnam 1: 378 (1999); T.C.Lê, Checklist Pl. Sp. Vietnam 84 (2003). – TYPE: [China] Hainan, Chim Shan, Fan Maan, Ts'uen & vicinity, Ling Shui (ling-tui) District, 3–20 May 1932, *Fung 20087* (holotype NY [NY00581230]; isotypes A [A00041356], E [E00386408], BO, K [K000768392], MO [MO1889403], P [P02010176], US [US00956269, US00099512]).

In the past, this species was considered to be endemic to Hainan Island in southern China. More recently it has also been reported from Vietnam (Lê, 2003: 84). However, I could not find any specimens supporting this claim. *Cryptocarya metcalfiana* is morphological very close to *C. concinna*, but differs from it in having a longer inflorescence (> 10 cm long versus < 8 cm long) and glabrous leaves (versus leaves sparsely hairy in *C. concinna*).

Cryptocarya merrilliana C.K.Allen, J. Arnold Arbor. 23: 456–457 (1942); T.C.Lê, Checklist Pl. Sp. Vietnam 82 (2003); H.W.Li et al., Fl. China 7: 253 (2008). – TYPE: [China] Hainan, Kumyum, *Lau 27635* (holotype A (not seen); isotypes IBK, MO [MO255232]).

This species has been recorded for Vietnam (Lê, 2003: 82). However, I have not seen any material from Vietnam to support this, although, given its distribution in southern China, it may occur in northern Vietnam.

Cryptocarya obovata R.Br., Prod. Fl. Holl. 402 (1810); P.H.Hộ, Ill. Fl. Vietnam 1: 379 (1999); T.C.Lê, Checklist Pl. Sp. Vietnam 85 (2003). – TYPE: [Australia] New South Wales, Port Jackson–Hunter River, *Brown 3016* (holotype BM [BM000838232]).

This species is endemic to Queensland and New South Wales in Australia (Le Cussan & Hyland, 2007: 170). It was reported to occur in Vietnam by Lê (2003: 84) but I could not find any specimens supporting this claim.

ACKNOWLEDGEMENTS. The author is grateful to the curators of A, BISH, BKF, BM, BO, C, CAS, E, GH, IBK, K, KEP, L, MEL, MO, MPU, NY, P, PE, RUPP and SING herbaria for access to and/or loan of specimens used in the present study. The drawing of *Cryptocarya globularia* was made by Juliet Beentje. I am very grateful to Helen Hopkins for checking my English and for the comments of two anonymous reviewers. This research received support from the SYNTHESYS Project (http://www.synthesys.info/), which is financed by the European Community Research Infrastructure Action under the FP7 "Capacities Program." This work was also supported in 2015 by a Visiting Research Fellowship at FRIM and a Research Fellowship at the Singapore Botanic Gardens, which are gratefully acknowledged.

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Gardens' Bulletin Singapore 67(2): 351–355. 2015
doi: 10.3850/S2382581215000289

Newmania sessilanthera (Zingiberaceae): a new species from Vietnam

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ABSTRACT. *Newmania sessilanthera* Lưu & Škorničk., a new species from Phú Yên province in central Vietnam, is described and illustrated here. Notes on this species, the third described to date, and a new key to the species of *Newmania* N.S.Lý & Škorničk. are provided.

Keywords. Conservation, Phú Yên province, species key

Introduction

Newmania N.S.Lý & Škorničk., containing the two species *N. serpens* N.S.Lý & Škorničk. and *N. orthostachys* N.S.Lý & Škorničk. from Quảng Ngãi province in central Vietnam, was only recently described (Leong-Škorničková et al., 2011). Here we describe and illustrate a third species from Phú Yên province, central Vietnam.

Newmania sessilanthera Lưu & Škorničk., **sp. nov.**
Similar to *Newmania orthostachys* N.S.Lý & Škorničk. in general appearance and the upright inflorescence with spikes composed of condensed bracts, but differing in the thin and plicate leaf blades, the deeply bilobed purple labellum with a bright red base and white margins basally (incision $^1/_2$–$^4/_5$ of the total length of the labellum), and the stamen with no filament (vs. smooth non-plicate leaf blades, purple labellum with prominent white lines and incision $^1/_4$–$^1/_3$ of the total length, and the stamen with a well-developed filament). – TYPE: Vietnam, Phú Yên province, Sông Hinh district, Buôn Kít village, Sông Hinh Forest Enterprise, 269 m asl, 12°49'51.87"N 108°53'56.88"E, 25 June 2014, *Lưu Hồng Trường, Trần Giỏi, Đỗ Cao Trí PY29* (holotype SGN; isotypes SGN, SING, VNMN). (Fig. 1)

Terrestial herb to 80 cm tall, with 2–3 leafy shoots per rhizome, 3–6 cm apart. ***Rhizome*** subterranean, branched, 8–12 mm in diam., light brown externally, cream internally, aromatic. ***Leafy shoot*** slender, leafless for about 30–55 cm above the base, with 6–13 distichously arranged leaves; *leafless sheaths* 3–5, tubular in basal $^{3}/_{4}$–$^{4}/_{5}$ (lowermost 1–2 sheaths short and almost open), greenish or with reddish brown tinge, glabrous, becoming brown and papery with age; *ligule* 7–10 mm long, obscurely bilobed (sometimes nearly entire at the top of leafy shoot), green, turning brown and papery with age, glabrous; *petiole* thick (pulvinous), c. 2–6 mm long, 3–4 mm broad, light green, glabrous; *lamina* elliptic to weakly obovate, 10–20 × 4–6.5 cm, uppermost two to three leaves smaller, thin, visibly plicate, green and glossy above, lighter beneath, glabrous on both sides, base cuneate to attenuate, apex acute, often ending in a small sharp mucro (c. 1 mm), margin entire. ***Inflorescence*** arising from the rhizome at the base of the leafy shoot, about 2 inflorescences per rhizome, spikes condensed, erect, narrowly ovate, 7–10 cm long, with 7–10 flowers, opening in succession from base to top; *peduncle* 2–3 cm long, 4–5 mm in diam., sheathing bracts 3–20 mm long, 3–12 mm wide, cream white with dark red-purple reticulate pattern, glabrous, apex obtuse, sometimes ending in a small mucro; *fertile bracts* subtending a single flower, spirally arranged, overlapping each other by $^{2}/_{3}$–$^{3}/_{4}$ of their length, ovate, 25–47 × 20–27 mm, open to base, cream white to pale ochraceous with dark red-purple reticulate pattern, glabrous, apex obtuse, sometimes ending in a small mucro; *bracteoles* one per flower, 18–24 × 10–13 mm, open to the base, semi-translucent, tinged with dark red-purple reticulate pattern, glabrous. ***Flower*** 8–9 cm long; *calyx* tubular, c. 12 mm long, 1.8 mm in diam., unilaterally slit 9–10 mm, semi-translucent white with slight red-purple tinge, glabrous, apex obtuse; *floral tube* cylindrical, 6.2–7.3 cm long and c. 1.5 in diam., pure white, glabrous; *dorsal corolla lobe* elliptic, c. 17 × 7 mm, concave, pure white with translucent lines, glabrous, sharply mucronate at apex (c. 1.5 mm); *lateral corolla lobes* narrowly elliptic, 15–16 × 5 mm, pure white with translucent lines, glabrous; *lateral staminodes* petaloid, obovate, 16–17 × 7–7.5 mm, pure white, glabrous; *labellum* broadly ovate, 21–23 × 13–14 mm at broadest point, deeply bilobed, glabrous, slit between lobes about $^{1}/_{2}$–$^{4}/_{5}$ of the length of the labellum, marginally reflexed, basally white, with bright red patch in the middle, centrally purple, lighter purple towards margins and apex. ***Stamen*** 6 mm long, entirely glabrous; *filament* absent; *anther* c. 6 × 1.8 mm, connective tissue pure white, glabrous; *anther crest* absent; *thecae* 6 mm long, straw coloured to yellow, dehiscing longitudinally along entire length, glabrous; pollen cream to pale yellow. ***Style*** white, glabrous; *stigma* narrowly cup-shaped c. 1 mm long, c. 0.4 mm in diam., semi-translucent white; *ostiole* facing more or less upwards, ciliate. ***Epigynous glands*** absent. ***Ovary*** c. 2.5 × 2 mm, white, glabrous, trilocular, placentation axile, with ovules along entire axis. ***Fruit*** an ovoid to ellipsoid capsule, c. 19 × 13 mm (not yet fully ripe) with persistent calyx, semi-translucent cream coloured, glabrous, 7–10 seeds. ***Seeds*** obovoid, bluntly angular, 8–11 × 3–4 mm, pink-red (not fully ripe), shortly hairy, shiny; *aril* whitish translucent, irregularly laciniate, c. 8 mm long, lobes 2.5–5 mm long. — All measurements based on living flowering material from which the type and additional two collections were made.

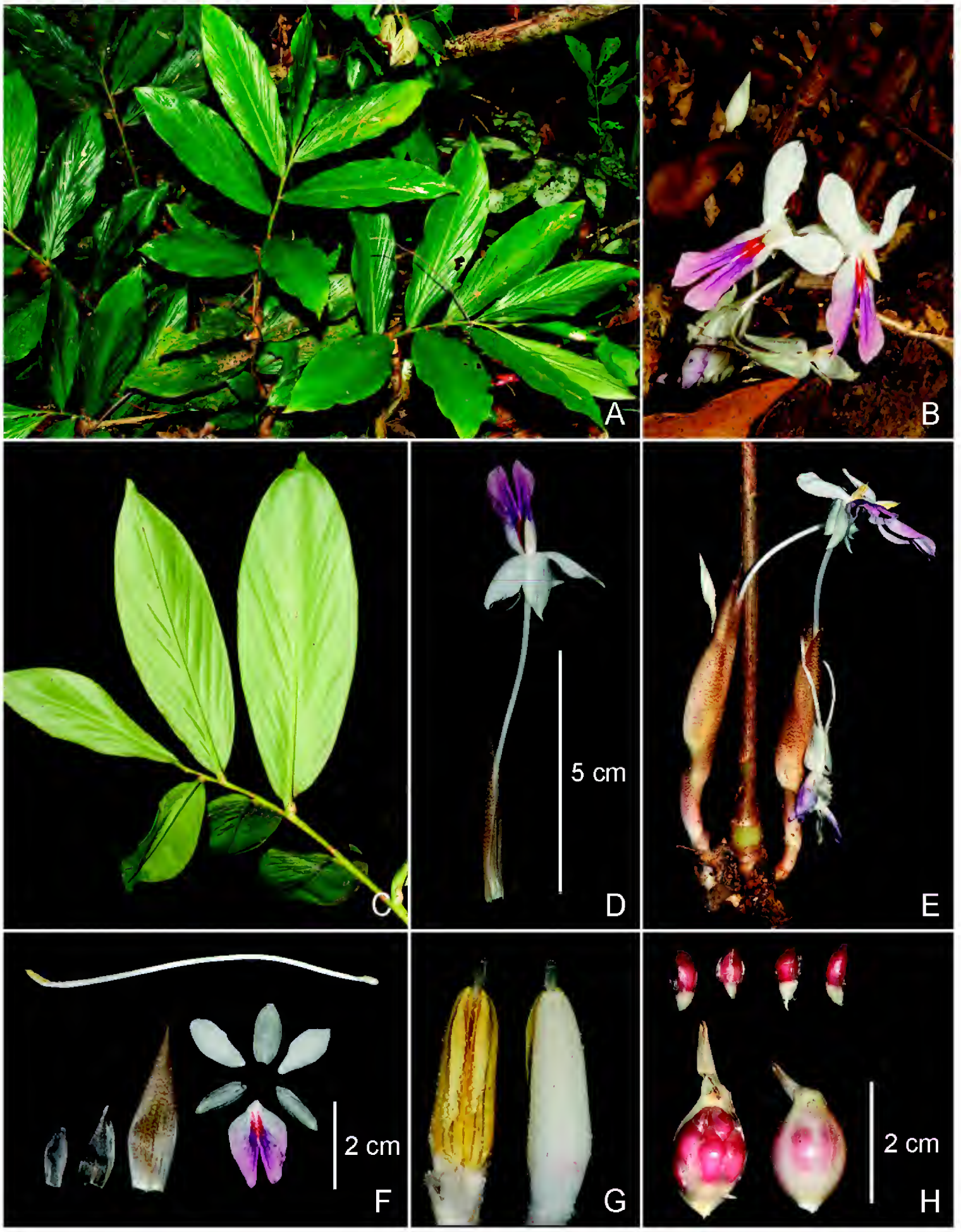

Fig. 1. *Newmania sessilanthera* Lưu & Škorničk. **A.** Habit. **B.** Flowers. **C.** Leaves (abaxially). **D.** Flower enclosed in bract. **E.** Base of leafy shoot with inflorescences. **F.** Flower dissection, from left: calyx (slit open); bracteole; bract; corolla lobes, labellum and staminodes; ovary, floral tube and stamen (on top). **G.** Detail of anther from front and back. **H.** Fruit and seeds. From type *Lưu Hồng Trường, Trần Giỏi, Đỗ Cao Trí PY29* (Photos: Lưu Hồng Trường)

Additional specimens examined. VIETNAM: **Phú Yên:** Tây Hòa district, Hòa Thịnh ward, Mỹ Lâm village, Suối Liếp Forest Enterprise, 151 m asl, 12°52'24"N 109°14'09"E, 6 Aug 2015, *Nguyễn Lê Xuân Bách, Hoàng Thanh Trường PY507* (SGN, SING); ibidem, 12°51'09"N 109°13'03"E, 340 m asl, 9 Aug 2015, *Nguyễn Lê Xuân Bách, Hoàng Thanh Trường PY636* (SGN, SING).

Distribution. So far the species has been collected from three localities in Sông Hinh and Tây Hòa districts, all in Phú Yên province in central Vietnam.

Habitat and phenology. Understorey of lowland evergreen tropical forests, growing on moist soils on granite and along streams. Flowering occurs from June to August, followed by fruiting which likely extends to September or early October.

Etymology. The specific epithet reflects the lack of the filament in this species.

Provisional IUCN conservation assessment. Endangered (EN B1ab(iii)). So far three localities, each with fewer than 100 scattered individuals, have been observed. The known EOO is currently slightly less than 100 km^2 but there is enough suitable habitat in the vicinity that it is likely the real EOO is more than 100 km^2 but certainly less than 5000 km^2. The type locality is adjacent to agricultural land, recently established from cleared forest. Further deforestation may occur posing a threat to the population. The other two populations are within large forested areas with no obvious threats.

Notes. Newmania, now with three species, remains endemic to central Vietnam, although preliminary studies from various researchers suggest further species extending throughout the Annamite mountain range to southern Vietnam. *Newmania* species seem to be steno-endemic and, therefore, susceptible to any rapid habitat changes. This has implications for any conservation effort.

The lack of a filament in *Newmania sessilanthera* differentiates it readily from the other two currently known species. Additional differences from *Newmania orthostachys* are outlined above in the diagnosis. It is somewhat similar to *Newmania serpens* by the presence of a striking red patch on the purple and white labellum, but differs by its erect inflorescences composed of compact spikes (vs. inflorescence prostrate on the ground with more or less lax spikes).

Key to *Newmania*

1a. Inflorescence prostrate on the ground; with more or less lax spikes ..... *N. serpens*
1b. Inflorescence more or less erect; spikes condensed 2

2a. Lamina thick and smooth; labellum purple with prominent white lines, bilobed with incision ¼–⅓ of the total labellum length; filament well-developed, 7–11 mm long ..... *N. orthostachys*

2b. Lamina thin, visibly plicate; labellum purple with bright red base and white margins basally, bilobed with incision ½–⅘ of the total labellum length; filament absent ..... *N. sessilanthera*

ACKNOWLEDGEMENTS. The new species was discovered during the implementation of the project "Databasing the biodiversity in Phú Yên province (Phase 1 – Forest biodiversity database)" funded by Phú Yên Provincial Department of Natural Resource and Environment/ Agency of Environment Protection in 2014–2015. The authors are grateful to the managers and staff of local forest enterprises and forest protection departments in the province, especially Mr Nguyễn Văn Toàn, Mr Trần Duy Tấn, Mr Phạm Ngọc Minh, Mr Phan Duy Linh, Mr Trần Ngọc Tiên and Mr Nguyễn Hữu Khánh for their support during the fieldwork. We especially thank Mr Nguyễn Như Thức, Ms Lê Đào An Xuân, Mr Trần Trung Trực, Mr Trần Giỏi and Dr Nguyễn Thành Mến for their kind cooperation. The research of the second author is funded by National Parks Board, Singapore, and the Czech Science Foundation, GAČR (grant no. 14-13541S).

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Gardens' Bulletin Singapore 67(2): 357–360. 2015
doi: 10.3850/S2382581215000290

A few last words on Far Eastern Dipterocarps

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ABSTRACT. Three additions to the Dipterocarpaceae are presented. Recent collections from southern Vietnam have finally revealed the identity of *Dipterocarpus condorensis* Pierre, necessitating reduction of *D. caudatus* Foxw. and nomenclatural adjustment of its subspecies; an unexpected novelty, *Dipterocarpus pseudocornutus* P.S.Ashton, is described from Tawi-Tawi, SW Philippines; while a new lower montane point endemic, *Vatica palongensis* P.S. Ashton, is reported from West Kalimantan.

Keywords. *Dipterocarpus*, Kalimantan, Philippines, *Vatica*, Vietnam

Introduction

Although my 1982 *Flora Malesiana* account has held remarkably well, there has been a continuing trickle of novelties, as witnessed by the two new *Shorea* Roxb. ex Gaertn.f. species and one new *Hopea* Roxb. species in the *Tree Flora of Sabah and Sarawak*, that richest of dipterocarp provinces (Ashton, 2004); and new discoveries in the genus most easy to miss, *Vatica* L., from Peninsular Malaysia (Saw, 2002; Symington, 2004; Chua et al., submitted). The following further novelties have arisen while curating the Dipterocarpoideae held at the herbarium of the Royal Botanic Gardens, Kew. Notable has been the discovery of an isotype of *Dipterocarpus condorensis* Pierre, the Paris duplicate of which I have not had the opportunity to examine as it had been misplaced in the cabinets.

Dipterocarpus condorensis resolved

Dipterocarpus condorensis Pierre, Fl. For. Cochinch. 3, 14: Pl.214 (1889); Smitinand, Vidal & Hộ, Fl. Cambodge, Laos & Viêtnam 25: 10 (1990). – TYPE: Vietnam, Pulau Condor, *Pierre* s.n. (lectotype K [K000671095], designated here).

Dipterocarpus condorensis subsp. ***condorensis***
Dipterocarpus caudatus Foxw., Philipp. J. Sci., C 13: 177 (1918); Ashton, Gard. Bull. Singapore 31: 8 (1978); Ashton, Fl. Males., Ser. 1, Spermat. 9: 305 (1982); Ashton,

Tree Fl. Sabah & Sarawak 5: 94 (2004). – TYPE: Philippines, Luzon, Camarines Prov., Barrio Hibatac, *Alvarez FB 21193* (lectotype K, designated by Ashton (1978)).

Dipterocarpus condorensis subsp. ***penangianus*** (Foxw.) P.S.Ashton & Lưu, **comb. nov.** – *Dipterocarpus penangianus* Foxw., Malayan Forest Rec. 10: 72 (1932); Symington, Malayan Forest Rec. 16: 185 (1943); Ashton, Gard. Bull. Singapore 31: 8 (1963); Ashton, Man. Dipt. Brunei 43 (1964). – *Dipterocarpus caudatus* subsp. *penangianus* (Foxw.) P.S.Ashton, Gard. Bull. Singapore 31: 8 (1978); Ashton, Fl. Males., Ser. 1, Spermat. 9: 305 (1982); Ashton, PROSEA 5, 1: 174 (1993); Coode et al., Checkl. Fl. Pl. Gymnosperms Brunei Darussalam 68 (1996); Newman et al., Man. Males. Dipts., Philippines 66 (1996); Newman, Borneo Medium-Heavy Hardwoods 80 (1998); Ashton, Tree Fl. Sabah & Sarawak 5: 97 (2004). – TYPE: Peninsular Malaysia, Penang, Mt. Olivia, *Haniff SFN 3484* (holotype SING; isotype K).

Dipterocarpus caudatus auct. non Foxw.: Symington, Foresters' Man. Dipt. 364 (2004).

Additional specimens examined. VIETNAM: **Bà Rịa-Vũng Tàu:** Bình Châu-Phước Bửu Nature Reserve, branchlets with flowers and with young fruit, fallen ripe fruit, *Lưu Hồng Trường 23, 24, 25* (K).

Notes. The identity of *Dipterocarpus condorensis* Pierre has remained a mystery for more than a century. It is based solely on fallen fruit, from the isolated Vietnamese island of Pulau Condor (Cộn Dấo) in the South China Sea, which do not closely match any Indo-Chinese species. I failed to find the presumed type, in the Paris herbarium, when preparing my account for *Flora Malesiana* (Ashton, 1982). Smitinand et al. (1990), in the *Flore du Cambodge, du Laos et du Viêtnam,* provided no description, merely quoting that of Pierre along with the number 5511 provided in Pierre's original description, implying that they also failed to find the type in Paris where two of the authors prepared the account. The Paris collection, furthermore, appears not to have been photographed. The entry under the name *Dipterocarpus condorensis* on the Paris herbarium website, barcode P05454280, consists only of notes on scraps of paper attached to a herbarium sheet, possibly in Pierre's hand, including a drawing of a dissected mature embryo which appears to be the draft of that in Pierre's plate. It is dated 1876, but unnumbered. There is a collection at Kew which, although not numbered by Pierre, bears the name and a description in Pierre's hand matching part of his protologue description. I formerly assumed it to represent abnormal fruit of the most similar Indo-Chinese species, *Dipterocarpus turbinatus* Gaertn.f., and named it accordingly. The fruit, however, differs from those of that species notably in its subspherical rather than ellipsoid-fusiform calyx tube, and shorter, to 6 cm versus to 13 cm long calyx lobes. The conundrum has now been resolved by Lưu Hồng Trường, who has collected material in flower, young and ripe fruit from Vũng Tàu on the southern Vietnamese coast, of a species not previously known from Indo-China. The fruit are an exact and diagnostic match for *Dipterocarpus condorensis* but the material

as a whole matches the type subspecies of *Dipterocarpus caudatus* Foxw. from the Philippines. A further taxon is thus added to those which are confined to the Philippines and Indochina, including southernmost coastal China. Among dipterocarps, these include *Dipterocarpus alatus* Roxb. & G.Don, and *Vatica mangachapoi* Blanco. In this case, though, there remains an overland link, *Dipterocarpus condorensis* subsp. *penangianus,* of coastal forests in Peninsular Malaysia and Northwest Borneo, which penetrates inland only in Ulu Temburong, Brunei, thus forming a link to those species which do occur in Indo-Burma, Peninsular Malaysia and the Philippines, but which are rare in northern Borneo except in the extreme west and north-east, notably *Anisoptera costata* Korth., *Dipterocarpus hasseltii* Blume and *Shorea guiso* (Blanco) Blume.

New Malesian Dipterocarpaceae

Dipterocarpus pseudocornutus P.S.Ashton, **sp. nov.**
Dipterocarpus cornutus superficie similis, alae calycis in fructu congeste contorto prominente differt. – TYPE: Philippines, Tawi-Tawi, Seratang Languyan, *F.J.M. Gaerlan & E.C. Sagcal PPI 10209* (holotype K).

Tree. Young parts densely shortly evenly buff pubescent, raceme and petiole persistently so; leaf blade beneath buff lanate. ***Bud*** not seen. ***Twig*** c. 5 mm diam. apically, stout, somewhat compressed. ***Leaf blade*** coriaceous, corrugate, ovate, 8–15(–21) × 4–8(–11) cm, apex subacute, base obtuse to narrowly subcordate; petiole 3–5 cm long, c. 3 mm diam. ***Raceme*** to 15 cm long, hardly branched. ***Flower*** bud to 2 cm long; calyx tube 12 × 8 mm, ellipsoid with intricately folded wings to 6 mm wide; stamens c. 30, anthers 4 mm long at anthesis, lorate, with 4 mm filiform appendages. ***Fruit*** unknown.

Notes. This extraordinary collection, from islands populated by the Moro people and long thought deforested, was apparently found in a patch of degraded forest. Had it been without flowers, it would have likely been claimed as a major extension of the range of *Dipterocarpus cornutus* Dyer, a species of Peninsular Malaysia and the slightly seasonal northern Sumatra and south-eastern and southern Borneo. The densely intricately folded wings of the calyx either implies that this character is evolutionarily plastic, or that this new taxon is allied to others which bound the South China Sea: *Dipterocarpus lamellatus* Hook.f., of SW Sabah and Brunei, *D. lowii* Hook.f., which follows the expanded Riau Pocket excepting Simeulue (Ashton, 2014), and *D. intricatus* Dyer, of southernmost Indo-China.

Vatica palungensis P.S.Ashton, **sp. nov.**
Similar to *Vatica oblongifolia* Hook.f., especially to *V. oblongifolia* subsp. *selakoensis* P.S.Ashton, and to *V. dulitensis* Symington, but with terete twigs (vs compressed), a sparse buff indumentum (vs dense vinous), and 8–10 pairs of secondary veins (versus ≥ 10). – TYPE: Indonesia, Kalimantan Barat, Ketapang, Gunung Palung National

Park, Lower montane *kerangas* forest over granite, 665 m, *T.G. Laman, I.A. Rachman, & E. Mirmanto TL 772* (holotype K; isotype A).

Young parts sparsely rugose grey-brown pubescent. ***Twig*** c. 2 mm diam. at first, terete. ***Leaf blade*** coriaceous, drying pale grey-brown above, ocherous beneath, narrowly elliptic-ovate to elliptic-obovate, 7–15 × 3–6 cm, acumen to 1 cm long, broad, base obtuse; veins 8–10 pairs, ascending, raised on both surfaces, more so beneath; petiole 8–15 mm long, 1.5 mm diam., slender. ***Raceme*** short. ***Flowers*** unknown. ***Fruit*** to 10 mm diam., globose, rugulose; sepals to 3 × 2.5 mm, obtuse, becoming reflexed.

Additional specimens examined. INDONESIA: **Kalimantan Barat:** Ketapang, Gunung Palung National Park, Lower montane *kerangas* forest over granite, 705 m, *T.G. Laman, I.A. Rachman, & E. Mirmanto TL 1374* (K, A), ibidem, 1000 m, fallen leaves and fruit, *P.S. Ashton* s.n. (A).

Notes. Superficially a member of the endemic Borneo species group around the widespread *Vatica oblongifolia* Hook.f. which share a short powdery vinous indumentum. The present species differs from others notably in its tomentum. As in so many groups of sister dipterocarps, these species are particularly well represented in the north-west. At present a point endemic, this novelty also shares the narrow range and high habitat specificity of several of the others.

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Gardens' Bulletin Singapore 67(2): 361–386. 2015
doi: 10.3850/S2382581215000307

A contribution to the systematics of *Xylopia* (Annonaceae) in Southeast Asia

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ABSTRACT. Herbarium and field study of *Xylopia* L. (Annonaceae) for the *Flora of Peninsular Malaysia* and the *Flora of Thailand* projects has clarified regional diversity patterns within this ecologically significant lowland rainforest genus. Two species groups represented within Southeast Asian floras are delineated, one centred on *Xylopia ferruginea* (Hook.f. & Thomson) Baill. and the other on *Xylopia malayana* Hook.f. & Thomson. In the *Xylopia ferruginea* group, a new species, *Xylopia erythrodactyla* D.M.Johnson & N.A.Murray, is distinguished from *X. ferruginea*, and a new combination, *Xylopia sumatrana* (Miq.) D.M.Johnson & N.A.Murray, is proposed, based on an earlier name for the species currently known as *Xylopia stenopetala* Oliv. In the *Xylopia malayana* group, review of the species *Xylopia elliptica* Maingay ex Hook.f. & Thomson resulted in the recognition of three additional species: *Xylopia platycarpa* D.M.Johnson & N.A.Murray, from southern Thailand and northwestern Peninsular Malaysia, *Xylopia ngii* D.M.Johnson & N.A.Murray, from Peninsular Malaysia, Sumatra and Borneo, and *Xylopia heterotricha* D.M.Johnson & N.A.Murray, from Sumatra and Borneo. The taxon *Xylopia malayana* Hook.f. & Thomson var. *obscura* Kochummen is placed in synonymy under *Xylopia elliptica* sensu stricto. *Xylopia fusca* Maingay ex Hook.f. & Thomson var. *sessiliflora* Kochummen & Whitmore is distinguished from *Xylopia fusca*, and raised to species status as *Xylopia sessiliflora* (Kochummen & Whitmore) D.M.Johnson & N.A.Murray. We recognise 23 *Xylopia* species in the Sundaic region of Southeast Asia, and provide evidence that additional collecting and taxonomic analysis in the region is needed.

Keywords. Annonaceae, biogeography, Borneo, Malay Peninsula, Sumatra, Sundaland, Thailand, *Xylopia*

Introduction

The Annonaceae, a flowering plant family of 2500 species, including the economically important soursop, custard apple and ylang-ylang, is widespread across the tropics. The family is most diverse, and ecologically most significant, in tropical Asia, where it is represented by c. 40 genera and 800 species. In southeastern Asia it is one of the dominant families in lowland wet forests. Corlett & Turner (1997) determined that Annonaceae ranked fourth in species-richness among flowering plant families in Singapore; Appanah et al. (1993) found that Annonaceae ranked first in species diversity among lianas of Malaysian forests. In long-term ecological plots in Southeast

Asia Annonaceae usually rank among the top ten tree families in both number of individuals and number of species, though not in basal area (see examples in Losos & Leigh, 2004).

The genus *Xylopia* L., the only pantropical genus in the family, comprises 180–200 species of trees and shrubs worldwide. The highest concentration of species in Southeast Asia occurs in the Sundaic region extending from the Kra Isthmus in southern Thailand to Wallace's Line, a region of high diversity for many plant taxa. Xylopias are distinctive among the Annonaceae in their cone-shaped buds, elongate, aromatic flowers, and dehiscent fruits with seeds bearing arils or fleshy seed coats. In West Africa the peppery fruits of *Xylopia aethiopica* (Dunal) A.Rich. have long been used as a spice (Dunal, 1817; Burkill, 1985) and are sold commercially. Despite its significance, the genus has never been monographed.

In preparing keys and descriptions of the genus *Xylopia* (Annonaceae) for the *Flora of Peninsular Malaysia* and *Flora of Thailand* projects we had the opportunity to study material in herbaria with important holdings for the region as well as to observe several species in the field. At the beginning of our study 13 *Xylopia* taxa were known from Peninsular Malaysia, Singapore and Thailand combined (Sinclair, 1953, 1955; Kochummen et al., 1970; Kochummen, 1972a, 1972b; Chalermglin, 2001; Gardner et al., 2015).

Analysis of morphological and preliminary molecular data (Stull et al., 2011; Thomas et al., 2015; Stull et al., in prep.) has shown that the Southeast Asian species of *Xylopia* fall into two groups, one including *Xylopia ferruginea* (Hook.f. & Thomson) Baill. and a second including *Xylopia malayana* Hook.f. & Thomson, each with their respective allies. Our study revealed a much greater diversity of species than previously recognised in both groups. To document this diversity, and reconcile it with the previously existing taxonomy and nomenclature for the genus, the following paper is presented. A full treatment, including keys and distribution maps, is forthcoming.

Conservation assessments using IUCN (2012) criteria are not included in this account as more data are required for these than we currently have available. Although historical EOOs and AOOs can be calculated, we are conscious that many of the collections have been made in lowland forest areas that have suffered from rapid deforestation. In these cases the Population Reduction (A) criterion would be more appropriate, as has been used for many dipterocarp species (IUCN, 2014), but again we would require more on-the-ground knowledge than we currently have.

Xylopia ferruginea group

The *Xylopia ferruginea* group is characterised by stilt roots, relatively long (5–19 mm) flower pedicels, a flat receptacle lacking a staminal cone (Fig. 2K), flat narrowly oblong stamens with a tongue-shaped apex to the anther connective (Fig. 2J), stigmas studded with small papillae (Fig. 2I), and rugose seeds (Fig. 2C–D). In addition, most species of the *Xylopia ferruginea* group have relatively numerous (up to 20) linear and somewhat torulose monocarps.

Study of the group resulted in demarcation of a new species, and recognition of an earlier name for an existing species.

Xylopia erythrodactyla D.M.Johnson & N.A.Murray, **sp. nov.**
Species resembling *Xylopia ferruginea* in the rusty pubescence of the leaves and flowers and the long narrow monocarps, but differing consistently in the more densely pubescent and thicker leaves, thicker pedicels (1.3–2.5 mm), longer sepals (4.8–7.9 mm), broader outer petals (3–3.7 mm wide at the midpoint) and narrowly oblong and weakly torulose monocarps 7.5–10.7 cm long and 0.6–1.1 cm wide. In contrast, in *Xylopia ferruginea* the pedicels are 1–1.3 mm thick, the sepals are 3–5.5 mm long, the outer petals are 2–2.2 mm wide at the midpoint, and the monocarps are linear, strongly torulose, 6.2–11.6 cm long and 0.4–0.6 cm wide. – TYPE: Malaysia, Sarawak, Teluk Bandung, Santubong, 1st Division, 18 September 1984 (fr), *Awa & Ismawi S.47080* (holotype KEP; isotypes ASU, K, L, SAR). (Fig. 1, 2)

Tree up to 30 m tall, dbh up to 75 cm, bole smooth with stilt roots at the base; secondary branches drooping. ***Bark*** smooth, light brown, brown tinged with red, brick-red, or orange, very finely fissured. ***Twigs*** light grey to brown, eventually dark grey, densely ferruginous-pubescent/velutinous, eventually glabrate. ***Leaf*** with larger blades 12.4–26 cm long, 3.9–7 cm wide, subcoriaceous to coriaceous, strongly discolorous, oblanceolate, oblong-oblanceolate, or narrowly elliptic, base rounded to cuneate and short-decurrent, apex short-acuminate, the acumen 2–7 mm long, glabrous adaxially, densely ferruginous-pubescent, the pubescence especially pronounced along the midrib, secondary veins, and larger higher-order veins abaxially; midrib impressed adaxially, raised abaxially; secondary veins 11–14 per side, diverging at 50–60° from the midrib, brochidodromous, these and higher-order veins indistinct adaxially, strongly raised abaxially; petiole 5–12 mm long, deeply canaliculate (margins nearly meeting), pubescent. ***Inflorescences*** axillary or from axils of fallen leaves, 1–3-flowered, densely ferruginous-pubescent; peduncles 1–2 per axil, 2 mm long; pedicels 2 per peduncle, 7–14 mm long, 1.6–2.5 mm thick; bract 1, attached ⅓–½ distance from base of pedicel, 2.9–3 mm long, ovate, apex acute to obtuse; buds linear-lanceolate, sometimes somewhat falciform and slightly twisted, apex obtuse. ***Sepals*** ⅛–¼-connate, 4–7.9 mm long, 4–5.3 mm wide, coriaceous, broadly ovate to triangular, apex acute to acuminate, occasionally obtuse, pubescent along margins and at apex adaxially, ferruginous-pubescent abaxially. ***Petals*** pale yellow to white *in vivo*; outer petals curving outward at anthesis, 38–45 mm long, 4–5.3 mm wide at base, 3–3.7 mm wide at midpoint, linear-lanceolate, obtuse, densely grey-puberulent adaxially, densely ferruginous-pubescent abaxially; inner petals erect at anthesis, 32–40 mm long, c. 3.5 mm wide at base, c. 1.3 mm wide at midpoint, linear, densely grey-puberulent on both surfaces except for glabrous concave base. ***Stamens*** up to 77, 2.7–3.5 mm long, narrowly oblong, often setose along edges of anther locules, apex of connective 0.4–0.6 mm long, oblong, densely long-papillate, filament 0.3–0.5 mm long, glabrous; staminal cone absent; outer staminodes c. 18, c. 2.7 mm long,

Fig. 1. *Xylopia erythrodactyla* D.M.Johnson & N.A.Murray. **A.** Two leaves, abaxial view. **B.** Flower bud and abaxial view of monocarp, the latter showing beginning dehiscence with single seed visible. **C.** Single monocarp in lateral view, resting on adaxial surface of a leaf. (Photos: N.A. Murray)

oblanceolate, flat, apex obtuse. ***Carpels*** 16–20; ovaries 1.5–2.5 mm long, narrowly oblong, densely ferruginous-pubescent with hairs obscuring lower portion of stigmas; stigmas loosely connivent, c. 2.2 mm long, dark, with a few scattered hairs and studded with amber-coloured papillae. ***Torus*** flat, c. 3.4 mm in diameter. ***Pedicel of fruit*** 11–20 mm long, 4–7 mm thick, pubescent; torus of fruit c. 8 mm high, 9–14 mm in diam., depressed-globose, sparsely pubescent to glabrate. ***Monocarps*** red with brown tomentum *in vivo*, up to 20 per fruit, 5.5–10.7 cm long, 0.6–1.1 cm wide and thick, linear to narrowly oblong, weakly torulose, terete in cross-section, apex rostrate, the beak 2.5–9 mm long, base contracted into a stipe 8–10 mm long, 3.5–4 mm thick, longitudinally wrinkled, ferruginous-pubescent to glabrate; pericarp 1.7 mm thick. ***Seeds*** in a single row, parallel to long axis of monocarp, 6–12 per monocarp, 7.2–8.8 mm long, 5.5–5.6 mm wide, 4.7–5.1 mm thick, ellipsoid, elliptic in cross section, dark brown, rugose, flattened or a little concave at micropylar end, rounded at chalazal end, raphe and antiraphe distinctly raised; aril and aril plate absent.

Distribution. Occurs in Terengganu in northeastern Peninsular Malaysia, and on the northern coast of the island of Borneo in Sarawak (East Malaysia) and in Brunei. Considering its restricted habitat and the pace of development in Sarawak, this species

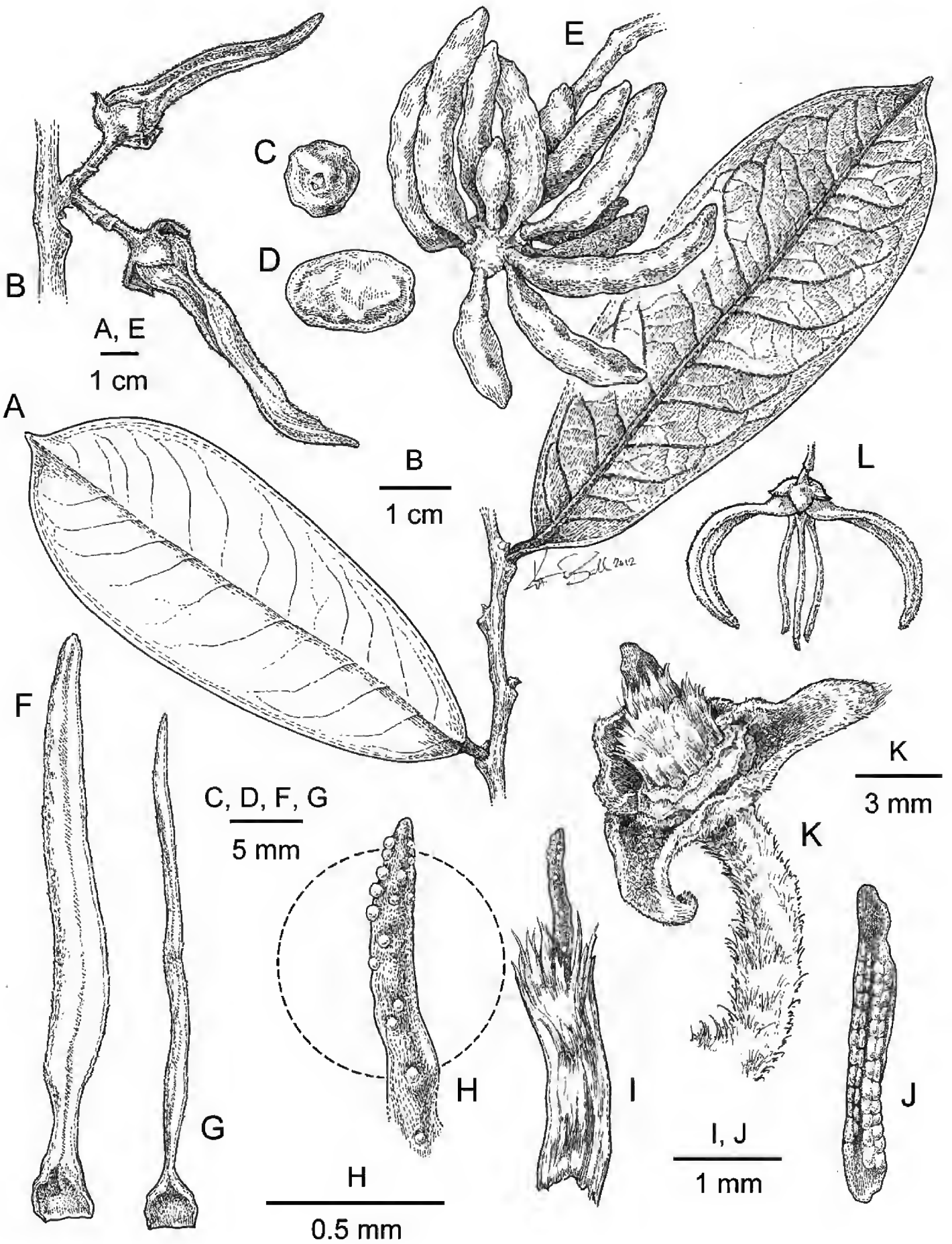

Fig. 2. *Xylopia erythrodactyla* D.M.Johnson & N.A.Murray. **A.** Habit. **B.** Inflorescence with flower buds, side view. **C.** Seed, view of micropylar end. **D.** Seed, side view. **E.** Fruit. **F.** Outer petal, adaxial view. **G.** Inner petal, adaxial view. **H.** Stigma apex. **I.** Carpel. **J.** Stamen. **K.** Close-up of flower with petals and stamens removed, to show sepals, carpels and torus. **L.** Schematic side view of flower at anthesis, one outer petal removed. Drawn by Kate Ball from (A) *Awa & Ismawi S.47080*, ASU; (B) *Sibat ak Luang S.24502*, L; (C–E) *Chew & Kiah SFN.40982*, A; (F, G, K) *Zehnder S.16803*, A; (H–J) *Rogstad 704*, A; and (L) field sketch.

may be more vulnerable than it appears from the collecting data.

Ecology. The bulk of the Sarawak and Brunei collections have come from either lowland peat swamp forest or heath (*kerangas*) forest (terminology following Saw, 2010). The collection localities in Terengganu are all from lowland dipterocarp forest, as are several in Sarawak. In general, however, the ecological range of this species is much narrower than that of *Xylopia ferruginea*. Elevational range is sea level to 250 m, with one collection from Terengganu from c. 800 m.

Phenology. The species shows two distinct flowering and fruiting periods throughout its distribution: flowers have been collected in late March and May–July, and then again in November–December, while fruits have been collected from February to July and also from September to December.

Local name. *Ako* (Sarawak: *Bojeng bin Sitam 9319*, *Zainuddin bin Bolhassan S.11941*).

Etymology. The species is named for the red and finger-like monocarps (Fig. 1B–C), which are thicker and less torulose than those of its congener *Xylopia ferruginea*.

Additional specimens examined. MALAYSIA: **Peninsular: Terengganu:** 18th mile, Jalan Kelantan, 31 Mar 1957 (fr), *Chiew & Kiah SFN 40982* (A, K, L [4 sheets], M, SING [2 sheets]); Pulau Redang, Pasir Mah Kapit, 300 m, 5 Mar 1989 (fr), *Saw FRI 36487* (A, K, KEP, L, SAR, SING); near Kampong Gong Nangka, Marang, 6 Jul 1953 (st), *Sinclair & Kiah bin Salleh SFN 39837* (L, SING [3 sheets]); 19th mile Kuala Trengganu Besut road, 15 Nov 1954 (st), *Sinclair & Kiah bin Salleh 40473* (L, SING); 18th mile Kuala Trengganu-Besut Road (west side), 7 Sep 1955 (young fr), *Sinclair & Kiah bin Salleh SFN 40748* (A, K, L, SING [2 sheets]); Ulu S. Loh below E face G. Mandi Angin, 2300 ft., 13 Jul 1968 (fr), *Whitmore FRI 12144* (K, KEP, L); **Borneo: Sarawak:** Telok Asam, Bako N. P., 4 Jun 1963 (fl), *Ashton S.17913* (A, ASU, K, KEP, L, SAR, SING); Ulu Kenyana, Mukah, 20 Oct 1963 (young fr), *Ashton S.19488* (A, K, KEP, L, SAR, SING); Kuching, Setapok F.R., 24 Jul 1957 (fl), *Bojeng bin Sitam 9319* (BO, K, L, SAR, SING); G. Pueh F.R., June 1956 (st), *Brunig S.6369* (SING); Selang F.R., Feb 1956 (st), *Brunig S.7225* (SING); long path from Tg. Po to Telok Kruim, Bako National Park, Kuching, 1st div., 15 m, 16 May 1980 (fr), *Ching S.42286* (K, KEP, L, SAR); Ulu Sungai Pasir Biawak, Lundu, Kuching, 8 Apr 1997 (fr), *Jamree et al. S.76728* (K, KEP, L, SAR); Kem Permai, Santubong, 29 Jun 1992 (fr), *Othman et al. S.65133* (KEP, L); Sampadi F.R. (near road), 25th mile, Bau/Lundu Road, 1st Division, 750 ft, 28 Jun 1968 (fl), *Paie S.26915* (K [2 sheets], L, SAR, SING); Bako National Park, just above mangrove swamp at open area on slope at start of Jalan Lintang, 6 Dec 1981, *Rogstad 703* (A fr), *704* (A fl); Nyabau Catchment area, Bintulu, 4th Division, 300 ft, 11 Jun 1966 (fl), *Sibat ak Luang S.24502* (BO, KEP, L, SAR, SING); Kuching, 100' alt., Setapok F.R., 15 Nov 1957 (fr), *Yacup 8939* (K, L, SAR, SING); Bintulu, Similajau F.R., 17 Nov 1959 (fl), *Zainuddin bin Bolhassan S.11941* (K, L, SAR, SING); Kuching, Sg. Teruntum, Sarawak Mangrove Reserve, 27 May 1962 (fl), *Zehnder S.16803* (A, K, L, SAR, SING). BRUNEI: Andulau F.R., 18 Sep 1957 (st), *Ashton BRUN 560* (L, SING); Belait District, Ulu Sungai Badas, 28 Mar 1989 (fl), *Nangkat NN105* (A, AAU, K, L, SAR, SING); Belait District, Lumut Hills, 30 Mar 1968 (st), *van Niel 4454* (L); Ulu Badas, Andulau Stateland, Sg. Liang, Belait (Labi Rd. 10 km), 25 Jun 1996 (fl), *Ogata et al. Og-B203* (L).

Notes. Trees of this species were observed in Bako National Park in June of 2003, where the plants were frequent along the edge of dipterocarp forest on a slope bordering mangroves. At this site there were many seedlings and saplings present; flowers or fruits were only found on individuals exceeding 15 m in height. The petals of fallen flowers were sweetly scented, the scent reminiscent of *Gardenia* (Rubiaceae). At anthesis the outer petals were widely spread while the inner petals were more or less erect (Fig. 2L). Dehiscing monocarps, gathered from the ground at this locality, were photographed (Fig. 1B).

The dried seeds, when soaked, become tan in colour, revealing a sarcotesta c. 0.2 mm thick, which may be somewhat incomplete at the chalazal end. The sarcotesta breaks away in chunks from the woody layer of the seed coat underneath, often with patches of the woody coat adhering to it.

The type description of *Xylopia altissima* Boerl., based on a specimen collected by Teysmann on the island of Lingga (Boerlage, 1899), suggests the new species in its emphasis on the dense tomentum of the abaxial leaf surface, but Boerlage (p. 203) also emphasised the strongly reticulate leaves ("venis tenuibus in nervos transversis et reticulatis pertensa") with acuminate apices. These features are frequent in Sumatran specimens of *Xylopia ferruginea* s.s., which in general have larger and broader leaves than those of Peninsular Malaysian and Bornean plants, as well as a tendency toward a subcordate rather than truncate leaf base. These leaf features do not occur in *Xylopia erythrodactyla*.

Two sterile specimens found in the herbarium at M bear leaves resembling those of *Xylopia erythrodactyla*. The specimens were collected from a plant grown in the Bogor Botanic Garden. The provenance of the plants is not certain, but "Borneo" is written in pencil on one of the sheets. The actual labels give the following information: Hort. Bogor. IV B 18, 2 May 1895, *Spelta* [?] *s.n.* (M [2 sheets], as "Sapotacea Sambas v. d. Horst" on one sheet, "Columnifera?" on the other). Duplicates of these specimens were not seen at L or BO; the catalogue by Dakkus (1957) did not show any listings under either the names or the number.

Xylopia sumatrana (Miq.) D.M.Johnson & N.A.Murray, **comb. nov.** – *Unona sumatrana* Miq., Fl. Ned. Ind., Eerste bijv. 3: 377 (1861). – *Xylopia malayana* Hook.f. & Thomson var. *macrocarpa* Boerl., Icon. Bogor. 1(2): 123 (1899). – TYPE: Indonesia, Sumatra occid. in prov. Priaman, *Diepenhorst* s.n. (holotype U).

Xylopia stenopetala Oliv., Hook. Icon. Pl. 21: t. 1563 (1887). – TYPE: Malaysia, Penang, Government Hill, 600 ft, June 1886, *Curtis 857* (lectotype K, designated by Turner (2011); isolectotype SING).

Distribution. Peninsular Malaysia, Sumatra, Borneo, Philippines (Mindanao).

Additional specimens examined (representative specimens). MALAYSIA: **Peninsular: Pahang:** Frasers Hill at the lower gate, 3000' alt, 29 May 1968 (fl, fr), *Ng FRI 6172* (A, K, SING); G.

Benom Game Reserve, Ulu Krau, 1800' alt, 22 Apr 1967 (fl), *Yusoff KEP 99124* (A, K, SING); **Penang:** Tunnel road, Penang Hill, 2200 ft, 28 May 1938 (fr), *Henderson SFN 21425* (SING [2 sheets]); **Selangor:** Kepong, F.R. Inst., 50th mile, Gap Road, 15 April 1990 (fl), *Kochummen FRI 29090* (A, K, SAR); Ulu Gombak F.R., 1800 ft alt, 18 Jan 1966 (fr), *Kochummen FRI 80497* (A, K, SING); **Borneo: Sabah:** Lamag District, close to exit stream of Gunong Lotung, lake Inarat, 1200 ft, 21 May 1976 (fl), *Cockburn SAN 83321* (K, L, SAR, SING); Tawau Dist., Mile 26, Apas Rd, 120 ft, 25 Jun 1959 (fr), *Meijer SAN 19321* (K, L, SING); **Sarawak:** Pk in Kuching, Dec 1892 (fl), *Haviland =10[?]* (BM, L, MO, SING); Perkulen Ampat, b.p.m.d. (fl, fr), *Haviland 142/10 [A.13.9]* (SAR, SING); Bkt. Lobang, Punung Lusong, Sg. Linau, Belaga, 7th division, 470 m, 14 Jun 1979 (fr), *Lee S.39802* (ASU, K, L, SAR); path from Kpg. Seropak to Bungoh Range, Bau, secondary forest on hillside, c. 1000 ft, 29 Nov 1969 (fl), *Paie & Mamit S.29584* (A, K, L, SAR, SING).

INDONESIA: **Borneo: East Kalimantan:** Meratus, 5230 area PT. ITCI, Kenangan Balikpapan, 70 m, 27 Sep 1992 (fr), *Ambriansyah A. A:611* (A, K, L); PT. ITCI, road Kenangan to G. Meratus, than to Basecamp Birawa, km 52, 500 m, 28 Mar 1995 (fl), *Kessler et al. P.K.949* (A, K); E Kutei, Sangkulirang subdivision, Sg. Susuk region, 10 m, 26 Jun 1951 (fl), *Kostermans 5456* (A, BM, K, L [2 sheets], SING); **West Kalimantan:** G. Bentuang area, 5–10 km N of Masa village, 150 km NE of Pontianak, steep ridge above Semawang River, 00°52'N, 110°26'E, 50 m, 23 Jun 1989 (fl, fr), *Burley et al. 2823* (A [2 sheets], F, K, L, MO, NY [2 sheets], SING); **Sumatra: Aceh:** Gunung Leuser Nature Reserve, Gunung Bandahara c. 6 km NE of Kampung Seldok (Alas Valley), c. 25 km N of Kutatjane, c. 800–1000 m alt, 20 Mar 1975 (fl, fr), *de Wilde & de Wilde-Duyfjes 15599* (K [2 sheets], MO, US); **North Sumatra:** East Coast, vicinity of Loemban Ria, Asahan, 5 Feb–12 Apr 1934 (st), *Rahmat si Boeea 8096* (A, MICH, US); East Coast, Asahan NE of Tamuan Delok and W of Salabat, 500 m, 15 Jun–9 Jul 1936 (fl), *Rahmat si Boeea 9269* (A [2 sheets], K, L, MICH, NY, US, W).

PHILIPPINES: **Mindanao: Surigao Sur:** Manobo District, PICOP Bislig, Apr 1976 (fl), *Rojo 325* (MO).

Notes. The type specimen of *Unona sumatrana* Miq. from the Utrecht herbarium (now housed at L) includes two separate branches, one with a fruit attached, and the other with two small leaves. The two leaves are slightly obovate-oblong, one 6.5 cm long and 3 cm wide and the other 3.9 cm long and 2.3 cm wide. The leaves are retuse at the apex and broadly cuneate and decurrent at the base. The fruit shows the distinctive characteristics of *Xylopia stenopetala*: there are two monocarps and a portion of a third on the specimen, none of them fully mature. The intact monocarps are narrowly oblong, one 6.8 cm long and 0.8 cm wide and slightly torulose, sparsely pubescent, with about 7 seeds arranged in a single row. The monocarps are acute at the apex and taper to a stipe c. 8 mm long. The monocarps are borne on a pedicel 10 mm long and 4.3 mm thick, and a torus 11 mm in diameter, 8 mm high, and depressed-globose in shape.

Although the name *Unona sumatrana* was reduced to a variety of *Xylopia malayana* by Boerlage (1899), and placed in synonymy under *X. malayana* by Turner (2011), the fruit on the type specimen of *Unona sumatrana* clearly distinguishes it from *X. malayana*: the narrow monocarps have up to 7 seeds (seeds usually 3 or fewer per monocarp in *X. malayana*), and, at 6.8 cm in length, are already longer than those found in *X. malayana* (which never exceed 4 cm in length).

The type of the name *Unona sumatrana* from 1861 was thus found to represent the same species as *Xylopia stenopetala* from 1887 and the earlier name must take precedence. This name is not to be confused with *Xylopicrum sumatranum* (Miq.) Kuntze, Revis. Gen. Pl. 8, 1891, which is based on *Parartabotrys sumatranus* Miq., now considered a taxonomic synonym of *Xylopia malayana* (Sinclair, 1955; Turner, 2011).

Xylopia sumatrana has been collected in Peninsular Malaysia in the states of Pahang, Penang and Selangor, and on the islands of Sumatra, Borneo, and Mindanao (Philippines), where it is found at elevations of 50–1000 m, the widest elevational range of any Asian species of *Xylopia*.

***Xylopia malayana* group**

Members of the *Xylopia malayana* group lack stilt roots (with the exception of *Xylopia sessiliflora* treated below), the flower pedicels are 5 mm long or less, the receptacle bears a distinct but low and irregularly laciniate staminal cone formed from the connate bases of the filaments, the stamens are clavate with a transversely flattened apex to the anther connective, the stigmas lack papillae, and the seeds are smooth. Within this group the monocarps tend to be relatively few in number (ten or fewer, but see *Xylopia heterotricha* below) and relatively broad and oblong.

Species of the *Xylopia malayana* group are distinctive and well circumscribed with the exception of *X. elliptica* and *X. malayana*. We found that the primary source of taxonomic difficulty with these two species stemmed from the inclusion of multiple distinct taxa under the name *Xylopia elliptica*. The simplest route to clarification is to retrace the taxonomic history of that species.

Hooker & Thomson (1872: 86) originally based *Xylopia elliptica* on a single Maingay collection from Malacca. The protologue, reproduced verbatim below, shows that the diagnosis emphasised the glabrous branches, the small elliptic, obtuse, membranous, glabrous leaves and the solitary flowers:

> 14. **X. elliptica**, *Maingay mss.*; branches glabrous, leaves small elliptic obtuse membranous glabrous, tip rounded, nerves faint reticulate, flowers small solitary erect pubescent, sepals subacute united to the middle, ovaries 1–3.
>
> Malacca, *Maingay*.
>
> A lofty tree; trunk thick; branches glabrous, almost black; branchlets pubescent. *Leaves* 1 ½–2 by 1 ¼–1 ½ in., base obtuse or acute, pale on both surfaces, browner beneath; petiole ¼ in., puberulous. *Flowers* ½–¾ in., slender; peduncle half as long or shorter, and calyx rusty-pubescent; bratcs [sic] median, minute. *Petals* pale brown-tomentose; outer linear-subulate, from a rather broad base, concave; inner trigonous, base excavated. *Stamens* minute. *Ovaries* sunk in the deeply urceolate torus, hidden amongst long white hairs; ovules 4–6.

The circumscription of the species was enlarged by King (1892), who identified two additional specimens, *Wray 3194* from Perak and *Curtis 2482* from Penang, as belonging to this species. The latter specimen in particular departed from Hooker and

Thomson's protologue, however, in having distinctly pubescent leaves and multiple flowers per inflorescence borne on longer pedicels. Ridley (1922) subsequently maintained King's concept of the species intact. Sinclair (1955) identified four additional specimens as *Xylopia elliptica*: *Awang 42444* from Kedah, *Wray 3562* from Perak, *20309*, without collector's name, from Pahang, and *Yeob 5037* from Selangor. Sinclair stressed the significance of the pubescence of twigs and leaves as a characteristic important in distinguishing this species from the otherwise similar *Xylopia malayana*, and apparently on this basis identified a number of specimens of *Xylopia* from Sarawak and Sabah in various herbarium collections as belonging to *X. elliptica*.

It has become clear from re-examination of these specimens, plus study of a wider range of material than was available to these authors, that *Xylopia elliptica* in the sense of Sinclair is a mixture of four very distinctive species. The concept adopted here is one of *Xylopia elliptica* in a restricted sense, and the recognition of three previously undescribed species to accommodate the variants.

Xylopia elliptica Maingay ex Hook.f. & Thomson, Fl. Brit. India 1: 86 (1872). – *Xylopicrum ellipticum* (Maingay ex Hook.f. & Thomson) Kuntze, Revis. Gen. Pl. 1: 8 (1891). – TYPE: Malaysia, Malacca, 9 May 1867, *Maingay 2376* [Kew Distribution no. 82] (lectotype K [2 sheets, barcode nos. K000574709, K000574712], designated by Turner (2011); second-step lectotype, designated here: K000574709; isotype CAL).

Xylopia malayana var. *obscura* Kochummen, Gard. Bull. Singapore 26(1): 49 (1972). – TYPE: Malaysia, Terengganu, Gunong Padang Expedition, Ulu Brang, camp 1 nr. K. Lallang, 1000' alt, 15 September 1969 (fl, fr), *Whitmore 12594* (holotype KEP; isotypes A, K, L, SING).

Distribution. Peninsular Malaysia. Although it has been collected from four states in Peninsular Malaysia, *Xylopia elliptica* is known from only eight collections, all from forests below 300 m in elevation.

Additional specimens examined. MALAYSIA: **Peninsular: Johor:** Compt 10, Rengam F.R., 14 Nov 1966 (fl), *Kochummen FRI 2188* (A, K, KEP, L, SING); Compt 34, Gunong Arang F.R., 13 Sep 1969 (fr), *Kochummen FRI 2761* (K, KEP, L); Keluang, 20 Nov 1990 (fl, fr), *Teo & Remy KL 3968* (KLU); Hutan Simpan Endau, 23 Oct 1997 (fl), *Teo & Tetu KL 4951* (KEP); **Pahang:** Chini Forest Reserve, 11 Dec 2008 (fl), *Khairil bin Mahmoud et al.* s.n. (UKMB); without definite locality [Raub, according to Sinclair (1955)], collector unknown, *KEP 20309* (KEP).

Notes. *Xylopia elliptica* in the sense of its type applies to relatively small-leaved plants with glabrous to sparsely pubescent leaves, inflorescences of a single flower, and relatively short petals. This same circumscription also includes the taxon *Xylopia malayana* var. *obscura*. *Xylopia elliptica* in this restricted sense is endemic to Peninsular Malaysia, where it is infrequent in lowland forests up to an elevation of 300 meters in Johor, Melaka, Pahang, and Terengganu. The report of *Xylopia elliptica* for southern

Thailand in Gardner et al. (2015) is based upon a misidentified specimen of *Xylopia pierrei* Hance; the southern Thailand population of *X. pierrei* is disjunct from the main distribution of the species in eastern Thailand, Cambodia, and Vietnam.

The detached fruit on the sheet of *KEP 20309* does not look like a fruit of Annonaceae, Sinclair's determination of the specimen notwithstanding, but the leaves of the collection possibly represent this species.

Turner (2011) designated the specimens K000574709 and K000574712 at K as lectotypes of the name *Xylopia elliptica*. Both sheets include leafy twigs and flowers. Hand-written descriptive notes that are incorporated into the protologue are present on K000574709, and it is therefore designated as a second-step lectotype as permitted by Article 9.17 of the ICN (McNeill et al., 2012). The sheet K000574712 does not bear these notes.

Xylopia platycarpa D.M.Johnson & N.A.Murray, **sp. nov.**
Resembling *Xylopia vielana* by its pubescent leaves with a broadly cuneate to rounded base, but differing in the longer and narrower petals often curled at the apices and the flat monocarps that are white and marked with fine red veins. – TYPE: Thailand, Trang Province, Yanta Khao District, Peninsular Botanic Garden (Thung Khai), near office, 07°28′N 99°38′E, 25 m, 7 July 2005 (fl, fr), *Gardner et al. ST1882* (holotype L; isotypes BKF, L) (Fig. 3A–D, Fig. 4A–G)

Tree up to 22 m tall, dbh up to 48 cm. ***Bark*** orange to pale brown, flaking. ***Twigs*** brown or grey to blackish brown, eventually lenticellate, pubescent; double-branching occasional. ***Leaf*** with larger blades 6.5–9.4 cm long, 2.4–4.1 cm wide, chartaceous to subcoriaceous, lanceolate to oblong-lanceolate, elliptic-lanceolate, or ovate, base broadly cuneate to rounded-truncate, apex acute to obtuse, pubescent but becoming glabrate adaxially, pubescent abaxially; midrib slightly impressed adaxially, raised abaxially; secondary veins 7–12 per side, diverging at 45–50° from the midrib, brochidodromous, these and higher-order veins indistinct to slightly raised adaxially, indistinct or slightly raised abaxially; petiole 6–8 mm long, shallowly canaliculate, pubescent. ***Inflorescences*** axillary, 1–3-flowered, dusty yellow-pubescent; peduncles 1 or sometimes 2 per axil, 1.5–4 mm long; pedicels 1 or 2 per peduncle, 1–4.2 mm long, bracts 2, the uppermost just below the calyx, 1.7–2.3 mm long; buds linear and sometimes falcate, apex acute. ***Sepals*** ⅓–⅔ connate, 2–3 mm long, c. 3.1 mm wide, coriaceous, ovate to broadly triangular, apex acute, pubescent. ***Petals*** pale yellow *in vivo*; outer petals 20.6–28 mm long, 2–3.1 mm wide at base, 0.8–1.5 mm wide at midpoint, linear, apex acute, sometimes curling at the tips, densely puberulent except for glabrous base; inner petals 16.5–22.3 mm long, 1.5–2 mm wide at base, 0.7–0.8 mm wide at midpoint, linear, apex acute, flat at base except for two slightly thickened areas along the margin, densely puberulent except for glabrous base. ***Stamens*** c. 70, 1.2–1.4 mm long, narrowly oblong to clavate, apex of anther connectives 0.2–0.3 mm long, bluntly conical to subglobose, puberulent; staminal cone c. 0.6 mm high, 1.4–2 mm in diameter, low, jagged; outer staminodes 1.2–1.5 mm long, oblong, flat, apex

obtuse to acute; inner staminodes c. 0.8 mm long, narrowly oblong. ***Carpels*** 3–5; ovaries 0.6–0.8 mm long, lanceolate to narrowly oblong, pubescent; stigmas connivent, 1.5–1.8 mm long, black, shiny, with a few hairs at apex but otherwise glabrous. ***Torus*** flat, 2.2–2.5 mm in diameter. ***Pedicel of fruit*** 3–5.5 mm long, 1–2 mm thick; torus of fruit 1–1.5 mm high, 3 mm in diameter. ***Monocarps*** cream-coloured with fine dull red veining outside, bright red inside *in vivo*, up to 4 per fruit, up to 5.2 cm long, c. 0.8 cm wide, c. 0.5 cm thick, oblong and slightly falcate, flattened-ellipsoid in cross section, apex forming a beak c. 5 mm long, base contracted into a narrow stipe 8–14 mm long, 1–1.5 mm wide, strongly rugose, sparsely pubescent to glabrate; pericarp c. 0.5 mm thick. ***Seeds*** arranged in a single row, oblique to long axis of monocarp, up to 3 per monocarp, grey *in vivo*, 7.9–8.3 mm long, 6.2–6.7 mm wide, 4.7–4.8 mm thick, broadly ellipsoid, elliptic to semicircular in cross section, smooth, flat on micropylar end, rounded on chalazal end, sarcotesta translucent, black layers of seed coat visible underneath; aril forming a fleshy crown-like ring around the micropyle, c. 2.8 mm high, c. 4 mm in diameter.

Distribution. Restricted to a small area of southern Thailand and northwestern Peninsular Malaysia.

Ecology. All localities are in lowland evergreen forest.

Phenology. Flowers in July and August, fruit collected in July.

Local name. *Kerangi lotong* (Kedah: *Awang 42444*).

Etymology. The species is named for its unusually flattened and beanlike monocarps.

Additional specimens examined. MALAYSIA: **Peninsular: Kedah:** Perangin Forest Reserve, 30 Jul 1938 (fl), *Awang 42444* ([Sinclair cites specimen at K, but this was not found in July 2014], KEP); **Penang:** Sungei Penang, Aug 1890 (fl), *Curtis 2482* (BM, CAL (Sinclair, 1955), K, SING [2 sheets], US).

Notes. *Xylopia platycarpa* stands apart from other Asian species of the genus by its uniquely flattened cream-coloured monocarps with red veining. It occupies a very narrow distribution in northwestern Peninsular Malaysia and southern Thailand. At present this species is only known from three localities and has not been collected from Peninsular Malaysia since 1938. Its biogeography is unusual, in that the distribution of the species crosses the Kangar-Pattani Line, which has been widely recognised as a prominent botanical transition line on the Malay Peninsula (Woodruff, 2003).

The new species most closely resembles *Xylopia vielana* of northeastern Thailand, Laos, Cambodia, Vietnam and southern China by virtue of its persistently pubescent twigs and chartaceous, pubescent, acute to obtuse leaves. It has been identified as that species in a recent floristic work (Gardner et al., 2015), but *Xylopia platycarpa* has, in addition to the uniquely flattened pallid monocarps, longer completely pale yellow petals (16.5–26 mm long) that tend to curl at the apices. The petals of *Xylopia vielana*,

in contrast, are only 11–14 mm long, do not curl at the apex, and are flushed with red or purple at the base.

The Curtis specimen, cited here as belonging to *Xylopia platycarpa*, was identified by King (1892), Ridley (1922), and Sinclair (1955) as *Xylopia elliptica*, but we found that it differs from the type of that name by its distinctly pubescent twigs and leaves, the leaves lanceolate rather than elliptic in shape, and the tendency to have multiple flowers per leaf axil, these often borne on a relatively long common peduncle (Fig. 4B). The *Awang* specimen, also cited under *Xylopia elliptica* by Sinclair (1955), shares these same features, and in fact Sinclair used relative lengths of peduncle and pedicel as a way to distinguish *X. malayana* and *X. elliptica*: pedicel longer than peduncle in *X. malayana*, and peduncle longer than pedicel in *X. elliptica*. This pattern of long peduncles and relatively short pedicels however, was never seen in specimens of *Xylopia elliptica* s.s. in our study.

Xylopia ngii D.M.Johnson & N.A.Murray, **sp. nov.**
Species differing from *Xylopia malayana* in the narrowly acuminate to caudate apex of the leaf, the sepals only 2–2.9 mm long and sparsely pale brown pubescent with acute to apiculate apices, the outer petals longer and narrower (up to 34 mm long and 0.7–1.6 mm wide at the midpoint), the larger monocarps 3.1–6.4 cm long with pericarp 2–4 mm thick and sessile or broadly short-stipitate, and 8–12 seeds per monocarp, the seeds 14–18 mm long. – TYPE: Malaysia, Sabah, Tawau, Cpt. A., sub-cpt. 13, Bombay Burmah T. C. Licence Area, Kalabakan, 30 mi WNW of Tawau, 350 ft, 30 April 1954 (fr, A & L sheets also have flowers), *Wood A 3454* (holotype A; isotypes K, L, SING). (Fig. 3E–F, Fig. 4O–V)

Tree up to 40 m tall, dbh up to 60 cm, with a clear bole up to 30 m and steep buttresses up to 5 m high and 1 m wide. ***Bark*** brown to reddish brown, somewhat scaly, sapwood yellow to cream-yellow. ***Twigs*** dark brown to brownish grey, eventually lenticellate, glabrous or finely but sparsely pubescent and soon glabrate; double-branching occasional. ***Leaf*** with larger blades 6.5–10.9 cm long, 2.4–4.8 cm wide, chartaceous or occasionally subcoriaceous, slightly discolorous, elliptic, ovate, oblong-elliptic, or elliptic-oblanceolate, base cuneate, sometimes obliquely or broadly so, apex narrowly acuminate to caudate, the acumen 3.5–14 mm long, often deflexed to one side when pressed, glabrous adaxially, glabrous or sparsely pubescent abaxially; midrib impressed adaxially, raised abaxially, secondary veins 7–12 per side, diverging at 60–75° from the midrib, weakly brochidodromous; secondary and higher-order veins slightly raised adaxially, slightly raised to raised abaxially; petiole 4–9 mm long, shallowly canaliculate, transversely wrinkled, glabrous or sparsely pubescent. ***Inflorescences*** axillary or from the axils of fallen leaves, occasionally axillary on expanding axillary shoots, 1–5-flowered, pale brown pubescent; peduncles 1–2 per axil, 1–2 mm long or lacking; pedicels 1–3 per peduncle, 1.7–7 mm long, bracts 2, the lower at about the midpoint of the pedicel and the upper subtending the sepals, upper bract larger than lower bract, 1.6–2.4 mm long, 2.1–2.8 mm wide, clasping, semicircular; buds linear,

apex obtuse or acute. ***Sepals*** ⅓–½-connate, 2–2.9 mm long, 2–2.8 mm wide, coriaceous, ovate-triangular, acute to apiculate, pale brown appressed-pubescent abaxially. ***Petals*** yellow-green to greenish white *in vivo*; outer petals 13.5–34.2 mm long, 1.9–2.5 mm wide at base, 1–1.6 mm wide at midpoint, linear, flat adaxially, longitudinally ridged abaxially, densely puberulent on both surfaces except for glabrous base; inner petals 17.2–29 mm long, 1.8–1.9 mm wide at base, 0.7–0.8 mm wide at midpoint, linear to filiform, shallowly concave at base, acute at the apex, longitudinally ridged and densely puberulent on both surfaces. ***Stamens*** 26–29 (including staminodes), 1.5–1.7 mm long, clavate to narrowly oblong, apex of anther connectives c. 0.4 mm long, oblong to conical, obtuse, densely papillate, filament 0.3 mm long; staminal cone c. 0.3 mm high, c. 1.1 mm in diam., a low ring surrounding the bases of the ovaries; outer staminodes 7–8, narrowly oblong to clavate, flat, apex acute, glabrous. ***Carpels*** 3–4; ovaries 1–1.2 mm long, narrowly oblong, pubescent; stigmas somewhat connivent, 1.3 mm long, barely exceeding tops of stamens, clavate, glabrous. ***Torus*** c. 1.3 mm in diameter. ***Pedicel of fruit*** 3–20 mm long, 4.5–10 mm thick at midpoint; torus of fruit 6–17 mm in diameter, 4–9 mm high. ***Monocarps*** greenish brown to brown, dehiscing when mature to reveal a bright pink endocarp *in vivo*, up to 4 per fruit, 3.1–6.4 cm long, 2.5–3.5 cm wide, 2–2.7 cm thick, oblong, ellipsoid, ovoid, or nearly globose, apex rounded, base sessile or contracted into a stipe 3–5 mm long and c. 7 mm thick, dark brown to black, blotched with lighter-coloured corky spots, glabrate or with a few scattered hairs; pericarp 2–4 mm thick. ***Seeds*** lying in two short partially overlapping rows, transverse to long axis of monocarp, 8–12 per monocarp, light green *in vivo*, 14–18 mm long, 10.3 mm wide, 8–8.1 mm thick, more or less ellipsoid, narrowly oblong to cuneiform in cross section, smooth, dark grey with white crusty patches, flat across micropylar end, chalazal end rounded; micropyle encircled by a rough irregular aril plate.

Distribution. Occurs in Peninsular Malaysia, East Malaysia (Sarawak and Sabah), and Indonesia (Riau Province of Sumatra and Central Kalimantan, East Kalimantan, and West Kalimantan Provinces of Borneo).

Ecology. Mixed lowland dipterocarp forest and sometimes secondary forest, from sea level up to 300 m.

Phenology. This species has been collected in flower in January, March–May, and November; fruits have been collected February–April, June–September, and November–December.

Local names. *Djangkang*, *djerendjang* (East Kalimantan), *medang* (name also commonly used for various Lauraceae), *ngkurari* (West Kalimantan: *de Jong 439*), *podjeng* (East Kalimantan: *Kostermans 10205*).

Etymology. With pleasure we name this distinctive species in honour of Dr Francis Ng, former Deputy Director General of the Forest Research Institute of Malaysia

and recipient of the 2009 David Fairchild Medal for Plant Exploration. Dr Ng has contributed to knowledge of the flora of the region through a large body of work, including the *Tree Flora of Malaya* and his study of the family Ebenaceae. Through his studies of the seeds and seedlings of Southeast Asian forest trees (Ng, 1991; Ng & Mat Asri Ngah Sanah, 1991) Dr Ng obtained valuable seedling data for the new species.

Additional specimens examined. MALAYSIA. **Peninsular: Negeri Sembilan.** Pasoh F.R., Plot 2 at the slope near the Percolation Pits and Lateral Flow, Pasoh, Kuala Pilah, 1 Mar 1977 [presumably had a fruit, as there is a seedling specimen attached], *Mat Asri FRI 25722* (KEP); Pasoh Forest Research Station, Ecology Plot No. 1, tree no. 1325, 6 Oct 1983 (st), *Mat Salleh & Normalawati KMS 40* (SING); Pasoh Forest Reserve, 50 ha Long-term Ecological Research Plot, 2°58′N 102°18′E, 20 Feb 1988 (fr), *LaFrankie 2758* (KEP); **Pahang:** Ulu Sg. Kepong, Gua Peningat, 15 Jul 1970 (fl buds), *Burgess FRI 19047* (KEP, L); **Perak:** "Upper Perak," May 1889 (fl), *Wray 3562* (K, SING); **Selangor:** Bernam River State Land, 28 Jul 1920 (fr), *Yeob 5037* ([Sinclair cites duplicate at K, but not found July 2014], KEP); **Terengganu:** Mandi Angin Exped., S. Loh nr. Kuala Datok, 5 Jul 1968 (fl), *Whitmore FRI 8965* (K, KEP, L); **Borneo: Sabah:** Tawau District, Jalan Kuala Apas, 31 May 1961 (fr), *Bakar SAN 17302* (L); Sandakan District, Leila F.R., 18 Apr 1962 (fl), *D.B. & J.S. SAN 34713* (K, SING); Sipitang District, Mesapol, 1 Jul 1962 (young fr), *Mikil SAN 27180* (L [2 sheets]); Tawau District, ch. 5 Jalan from MI.15 1/2 Quain Hill Road, c. 100 ft, 15 Jun 1964 (fr), *Pereira SAN 44208* (K, SING); Keningau District, Sook-Tulid road mile 7¼, 3000 ft, 27 May 1965 (fl), *Sadau SAN 49574* (L [2 sheets], SING); Tawau, mi 10 1/2 on road through Apas Forest Reserve (10 mi E of Tawau), 300 ft, 7 Nov 1955, *Wood SAN 17182* (A + sep. carpol., L, SING); **Sarawak:** Without definite locality, without date, *Beccari 1578* (FI-W, K), *Beccari 1579* (FI-W, K).
INDONESIA. **Borneo: Central Kalimantan.** Sintang HPH km 70 W of camp of main (new) logging road, 0°51′54″S [given as 00°51′33.6″ S on one sheet] 112°13′30″E [given as 112°13′29.9″E on one sheet], 120 m, 17 Apr 1994 (fl, fr), *Mahyar et al. 990* (A, K, L, SAR, SING); **East Kalimantan:** Wanariset research area, Rd Samboja-Semoi, km 2 Rintis B. Baru, 01°S, 117°E, 50 m, 3 Aug 1991 (fr), *Ambri & Arifin W801* (A, BO, K, L); Bukit Soeharto area off km 65 Balikpapan-Samarinda, 50 m, 20 Nov 1993 (fl), *Ambri & Arifin A.A.891* (A, BO, K, L); Wanariset, Rintis Baru, Plot Matthijs, 01°S, 117°E, 50 m, 29 Jan 1992 (fl), *Ambri & Arifin W1007* (A, K, L [2 sheets], MO); Sg. Wain region N of Balikpapan (fl), *Kostermans 4488* (L, SING); Mentawir region, N of Balikpapan, 20 m, Sep 1950 (st, fr on L & SING sheets), *Kostermans 4512* (BO, K, L, SING); Loa Djanan, W of Samarinda, 30 m, 15 Apr 1952 (fl), *Kostermans 6451* (A, K); island Nunukan (northern part), 100 m, 2 Dec 1953 (fr), *Kostermans 8895* (A, BO, K, L, SING); Balikpapan distr., nr village Mentawirlow, 3 Mar 1955 (st), *Kostermans 10154* (L, NY, SING); East Kutei, Loa Djanan region along road Balikpapan. Samarinda, km 25, 15 Mar 1955 (fl), *Kostermans 10205* (L); E Kutei, Sg Tiram, 40 m, 15 Apr 1952 (fl), *Kostermans bb.35023* (A, K); East Kutai Reserve, vicinity of Sengata and Mentoko Rivers, altitude below 300 m, 0°30′N, 117°20′E, 15 Apr 1978, *Leighton 154* (L); Z.O. Afd. V. Borneo, Boeloengan, Noekoekan (Boschtuin), 18 May 1939 (st), *Neth. Ind. For. Service bb.29395* (A, L); **West Kalimantan:** Kabupaten Sanggau, 10 Aug 1993 (fr), *de Jong 439* (L, NY); Melawi, Tjatit, B. Gontuk, c. 180 m, 3 Mar 1939 (fl), *Netherlands Indies Forest Service bb.27013* (A, BISH, K, L, NY, SING); Melawi, B. Ulu, Borusepan, 275 m, 23 Jul 1939 (young fr), *Neth. Indies For. Service bb.29037* (L, SING). **Sumatra: Riau:** Indragiri, the uplands, Danau Mengkuang, 21 Apr 1939 (young fr), *Buwalda 6633* (A, K, L, SING); Riouw en Ond. Indrag. Bovenlanden, Danau Mengkuang, 21 Apr 1939 (young fr), *Netherlands Indies Forest Service bb.27571* (A, K, L, NY).

Notes. Material of this species is usually identified in herbarium collections as *Xylopia malayana*, but *X. ngii* differs consistently from that species in its smaller (2–2.9 mm long) sepals sparsely covered with pale brown pubescence and the longer (13.5–34.2 mm) and narrower (1–1.6 mm wide at the midpoint) outer petals. In *Xylopia malayana* the sepals are 2.7–4 mm long and densely covered with rusty pubescence, and the outer petals are 13.5–20 mm long and 1.5–2 mm wide at the midpoint. The leaves of *Xylopia ngii* have a characteristic narrow acumen, which is often bent to the side in pressed specimens, rather than the gradually acuminate tip seen in the leaves of *X. malayana*, which tends to press flat; the bending of the leaf apex in *X. ngii* is the result of the fact that its leaf midrib is usually curved downward towards the apex. The most striking difference between the two species, however, is in the fruits and seeds: the monocarps of *Xylopia ngii* are 3.1–6.4 cm long, 2.5–3.5 cm wide, sessile or broadly short-stipitate with a stipe 3–5 mm long and c. 7 mm thick and a pericarp 2–4 mm thick, each monocarp containing 8–12 seeds 14–18 mm long. In *Xylopia malayana* the monocarps are 1.9–3.9 cm long, 0.9–1.7 cm wide, distinctly stipitate with a narrow stipe 2.5–7 mm long, and with a pericarp 0.3–0.5 mm thick, each monocarp containing up to 3 seeds 7.5–8 mm long. In fruit *Xylopia ngii* can only be confused with *X. dehiscens* (Blanco) Merr., a species of the Philippines and northern Borneo, which has a blunt leaf apex and a fruit drying black and without the corky blotches of *X. ngii*.

Part of the difficulty in separating *Xylopia ngii* from *X. malayana* and other congeners has been the fact that the flowers and fruits of the species are rarely collected together. Thus the type collection and the specimen *Mahyar et al. 990* have played a critical role in our delimitation of the species. While the taxonomic confusion has been principally with *Xylopia malayana*, specimens of this species have also been confused with *X. elliptica* and even with *X. fusca* Maingay ex Hook.f. & Thomson: the specimens *Wray 3562* and *Yeob 5037* were identified as *X. elliptica* by Sinclair (1955), the specimens *Ambriansyah & Arifin AA 891*, *Ambriansyah & Arifin W 801*, and *Ambriansyah & Arifin W 1007* were identified as *X. malayana* in Sidiyasa et al. (1999). Turner (2014) determined the collections *Mikil SAN 27180* and *Pereira SAN 44208* as *Xylopia malayana*, and *Sadau SAN 49574* as *X. fusca*. *Xylopia ngii* was illustrated in LaFrankie (2010: 100, reproduced in Fig. 3F here), where it was called *Xylopia fusca*.

The descriptions of seedlings of "*Xylopia malayana*" in Ng (1991) and Ng & Mat Asri Ngah Sanah (1991) are based on this species. A seedling specimen is attached to the KEP sheet of the collection *Mat Asri FRI 25722*, the apparent original seed source for the seedling studies.

In the Pasoh Forest Reserve an individual of *Xylopia ngii*, tree #414079, was c. 40 m tall with a dbh of 43.9 cm, with steep buttresses at its base (Fig. 3E). The tree was growing on some of the highest ground in the plot (Manokaran et al., 1992).

Xylopia heterotricha D.M.Johnson & N.A.Murray, **sp. nov.**

Species differing from its congeners by the twig pubescence consisting of a mixture of acicular hyaline spreading hairs 0.5–0.7 mm long and curling appressed yellow-brown

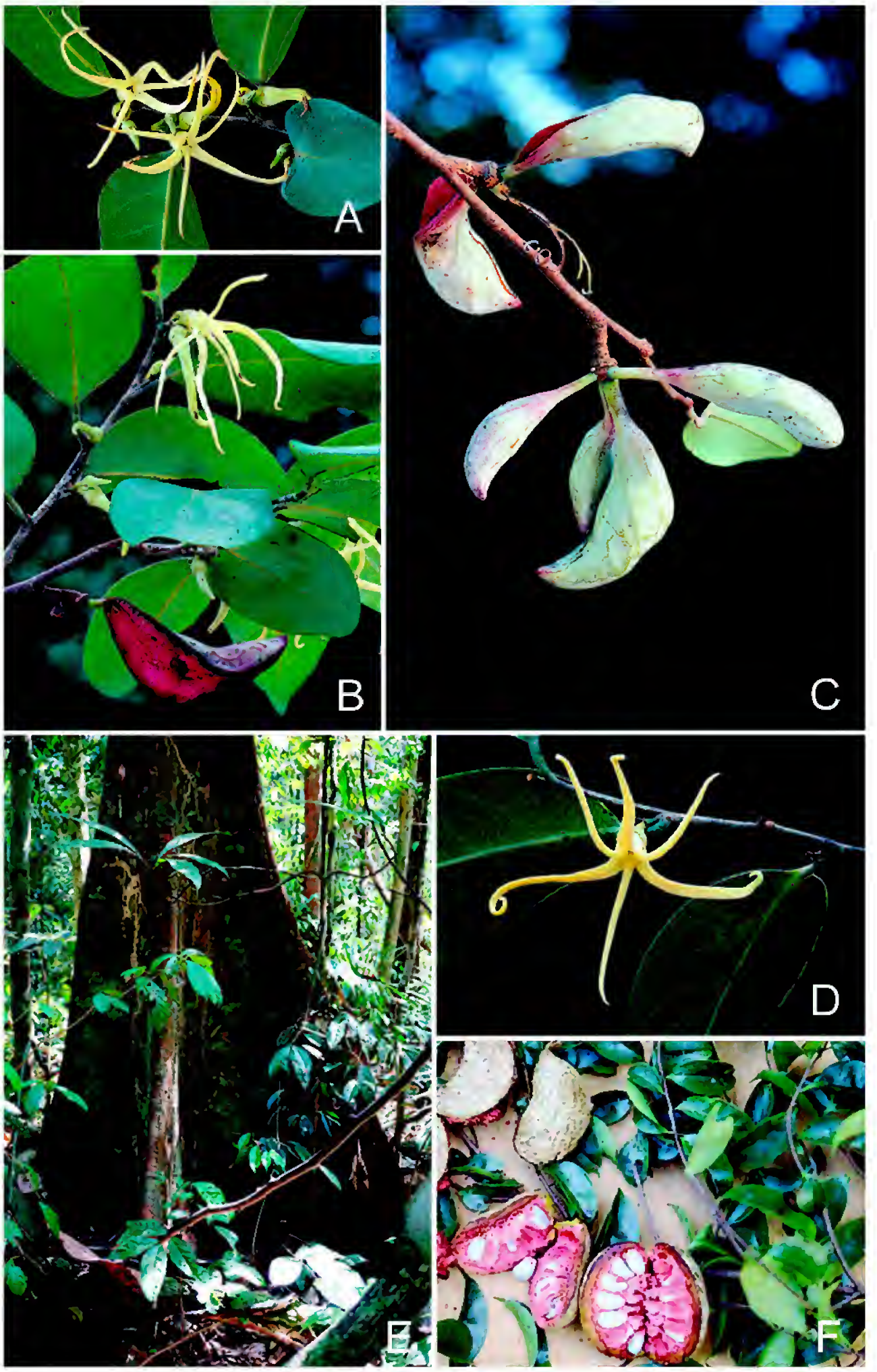

Fig. 3. A–D: *Xylopia platycarpa* D.M.Johnson & N.A.Murray. **A.** Two open flowers and a single bud. **B.** Open flowers and a single dehisced monocarp. **C.** Monocarps of two fruits, the uppermost ones in the photograph just beginning to dehisce. **D.** Single open flower, showing curled ends of petals. E–F: *Xylopia ngii* D.M.Johnson & N.A.Murray. **E.** Base of tree #414079, Pasoh Forest Reserve, showing the prominent buttresses and absence of stilt roots. **F.** Dehisced monocarps and leafy branches. (Photos: A–D: S. Gardner; E: N.A. Murray; F: J. LaFrankie)

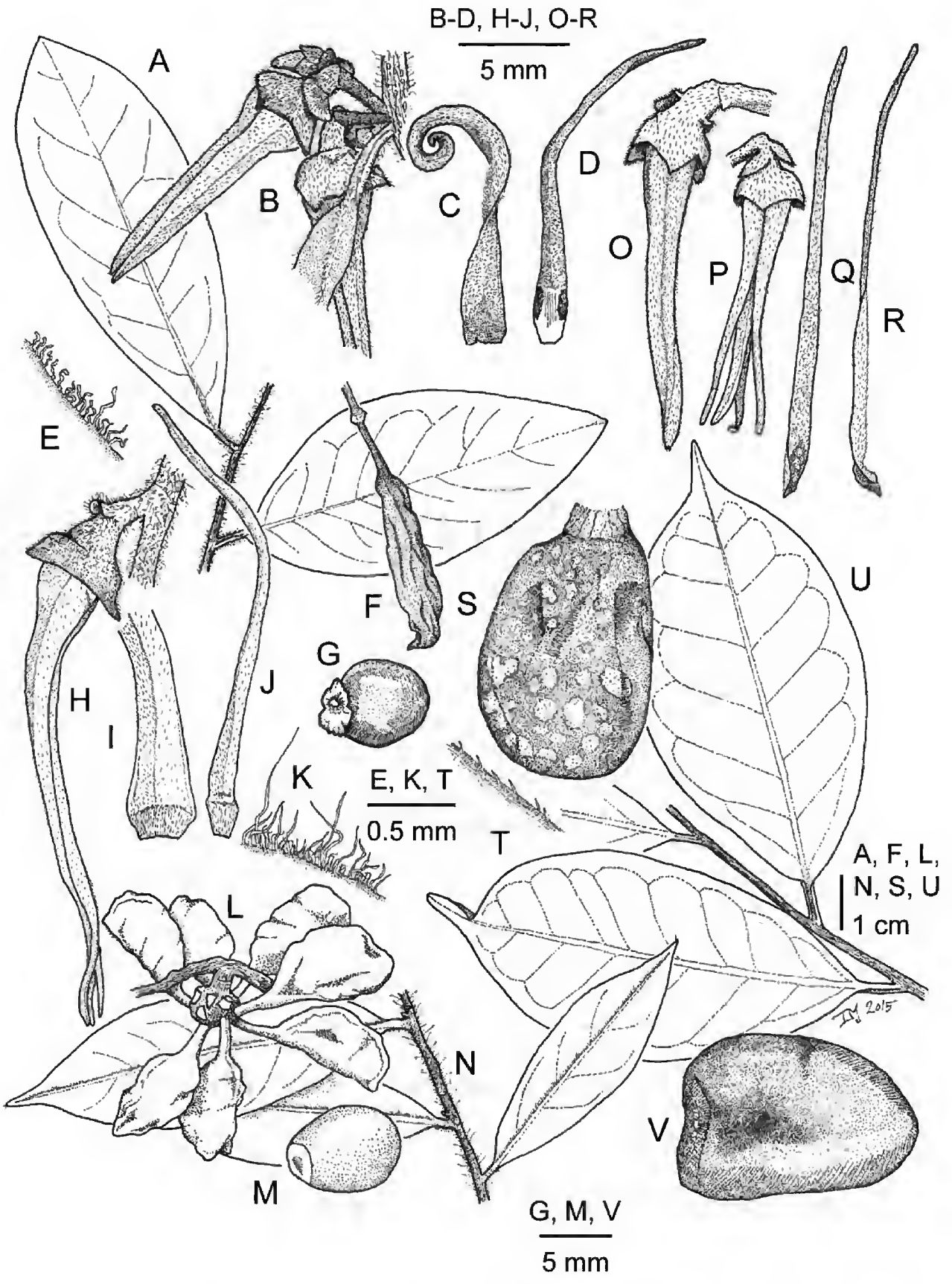

Fig. 4. A–G. *Xylopia platycarpa* D.M.Johnson & N.A.Murray. **A.** Habit. **B.** Inflorescence. **C.** Outer petal, adaxial view. **D.** Inner petal, adaxial view. **E.** Profile view of twig indument. **F.** Monocarp, lateral view. **G.** Seed, lateral view. **H–N.** *Xylopia heterotricha* D.M.Johnson & N.A.Murray. **H.** Flower bud, lateral view. **I.** Base of outer petal, adaxial view. **J.** Inner petal, adaxial view. **K.** Profile view of twig indument. **L.** Fruit. **M.** Seed, lateral view. **N.** Habit. **O–V.** *Xylopia ngii* D.M.Johnson & N.A.Murray. **O, P.** Flower buds, lateral view. **Q.** Outer petal, oblique adaxial view. **R.** Inner petal, adaxial view (twisted toward apex). **S.** Monocarp, lateral view. **T.** Profile view of twig indument. **U.** Habit. **V.** Seed, lateral view. Drawn by D.M. Johnson from (A, C, D, F, G) *Gardner ST1882*, L; (B, E) *Curtis 2482*, K; (H) *Puasa 4550*, KEP; (I, J, N) *Puasa 4550*, A; (K) *McDonald & Ismael 3526*, A; (L, M) *Ambri & Arifin W602*, A; (O, S, T) *Wood SAN A 3454*, A; (P) *Ambri & Arifin W1007*, MO; (Q, R) *Ambri & Arifin AA891*, A; (U) *Mahyar et al. 990*, SING; (V) spirit collection gathered beneath tree #414079 in Pasoh Forest Reserve.

hairs 0.1–0.2 mm long, the latter often persisting on leafless twigs. It differs from *Xylopia elliptica* in addition in having the leaf blades persistently pubescent abaxially, the petals 28–47 mm long (versus 5.5–10 mm long) and the monocarps up to 17, stipitate (stipes 7–10 mm long) and distinctly pubescent at maturity (versus monocarps 1–2, short-stipitate (stipes 1.5–3.5 mm long) and glabrate). – TYPE: Malaysia, Sabah, Sandakan, Bettotan, 27 March 1935 (fl), *Puasa 4550* (holotype KEP; isotypes A, K, L, SING, US). (Fig. 4H–N)

Tree up to 36 m tall, dbh up to 48 cm, with a clear bole up to 26 m, occasionally with buttresses up to 1.5 m high. ***Bark*** light grey, rarely white, yellowish green, or dark brown, smooth. ***Twigs*** dark brown, densely pubescent, the pubescence consisting of a mixture of acicular hyaline spreading hairs 0.5–0.7 mm long and curling appressed yellow-brown hairs 0.1–0.2 mm long, the latter often persisting on leafless twigs; double-branching occasional. ***Leaf*** with larger blades 7.9–10.2 cm long, 2.4–3.7 cm wide, chartaceous, often mottled adaxially when dried, narrowly elliptic to oblong, base cuneate, apex acuminate, the acumen 8.5–18 mm long, punctate and glabrous adaxially except for the densely hispid-pubescent midrib, pubescent with loosely appressed hairs abaxially; midrib plane adaxially, raised abaxially; secondary veins 9–13 per side, diverging at 45–60° from the midrib, weakly brochidodromous, secondary and higher-order veins slightly raised adaxially, slightly raised to raised abaxially; petiole 2.5–3 mm long, deeply canaliculate, pubescent. ***Inflorescences*** axillary or from the axils of fallen leaves, 1-flowered, brownish to yellowish pubescent; peduncles absent; pedicels 4.5–5.5 mm long, bracts 2, the lower bract attached at or below the midpoint and the upper bract attached to distal half of pedicel, upper bract 3 mm long, ovate, acute; buds linear, apex acute. ***Sepals*** ½-connate, 3–4 mm long, coriaceous, broadly ovate, apex acute, acuminate, or caudate, brown-pubescent abaxially. ***Petals*** white to yellow *in vivo*; outer petals 28–47 mm long, c. 2.5 mm wide at base, 1–1.2 mm wide at midpoint, linear, flat adaxially, longitudinally ridged abaxially, apex acute, densely puberulent on both surfaces except for glabrous base; inner petals 30–36 mm long, 1.6–1.7 mm wide at base, c. 0.8 mm wide at midpoint, filiform, apex acute, longitudinally ridged and densely puberulent on both surfaces. ***Stamens*** 65–74, 1.8–1.9 mm long, clavate to narrowly oblong, apex of anther connectives 0.4–0.5 mm long, bluntly conical, densely papillate, filament 0.3–0.4 mm long; staminal cone barely visible, a low ring surrounding the bases of the ovaries; staminodes 16–19, c. 2 mm long, narrowly elliptic, narrowly oblong or oblanceolate, glabrous. ***Carpels*** 17–18, ovaries c. 0.8 mm long, oblong, densely pubescent; stigmas more or less connivent, c. 1.2 mm long, linear, dark, glabrous or occasionally with a tuft of hairs at the apex. ***Torus*** flat or a little concave beneath the carpels, c. 3.2 mm in diameter. ***Pedicel of fruit*** 3–14 mm long, 4.5–10 mm thick at midpoint; torus of fruit 4–9 mm high, 6–17 mm in diameter. ***Monocarps*** light green to glaucous green, dehiscing when mature to reveal a bright red endocarp *in vivo*, up to 17 per fruit, 2.8–3.6 cm long, 1.1–1.4 cm wide, 1.2–1.3 cm thick, oblong to ellipsoid, roughly circular in cross section, apex rounded, base contracted into a stipe 7–10 mm long and 2.8–3.5 mm thick, irregularly sunken but raised into a longitudinal ridge along the abaxial

midline, pubescent; pericarp 0.3–0.5 mm thick. ***Seeds*** arranged in two irregular rows, perpendicular to long axis of monocarp, 5–6 per monocarp, grey-white to purple *in vivo*, 7.1–7.6 mm long, 5.3–5.9 mm wide, 4.6–4.9 mm thick, broadly ellipsoid, elliptic in cross section, smooth, obliquely flattened at micropylar end, rounded at chalazal end, sarcotesta evident after soaking as a thin pale yellow layer over dark brown seed coat layers; aril plate surrounding micropyle 3.2–3.3 mm long, 2.7–3 mm wide, a flat ring, white.

Distribution. Occurs in East Malaysia (Sarawak and Sabah), and Indonesia (Bangka Belitung, Bengkulu and South Sumatra Provinces of Sumatra and neighbouring islands, and Central Kalimantan and East Kalimantan Provinces on Borneo).

Ecology. Lowland primary and mixed dipterocarp forest, often on hilltops or ridges, occasionally in riparian or logged over and secondary forest, in one case in forest consisting of "pole-sized dipterocarps." It has been collected on granitic sand, sandstone, and red clay at 50–500 m. Associates at one site were species of *Aporosa* Blume, *Dipterocarpus* C.F.Gaertn., *Eugenia* L., *Hopea* Roxb. and *Shorea* Roxb. ex C.F.Gaertn.

Phenology. Flowers collected in March–May and July–October; fruits collected in January, April–July and September–October.

Local names. *Banetan koening* (Sumatra: *Endert 176 E.1[8 or P].886*), *banetan poetih* (Sumatra: *Boschproefstation nr. F or T971*), *banitan* (Billiton: *van Rossum 46*), *banitan gadang* (Sumatra: *Dumas 1527*), *banitan laki* (Bangka: *Andong 111*), *bebanditan* (East Kalimantan: *Ambri & Arifin AA7*), *karai* (Sabah: *Maidin 3056*), *karai batu* (Sabah: *Puasa 4550*), *miwi* (East Kalimantan: *Kostermans 6634*), *pisang-pisang* (Sabah: *Ong SAN 120806*, *Wood SAN A 4819*; NOTE: this is a widely used common name for Annonaceae generally), *sebúkau* (Sarawak: *Jacobs 5409*), *usaj* (Bangka: *Kostermans & Anta 223*).

Etymology. Named for the twig pubescence, which consists of a mixture of two different types of trichomes: longer erect straight trichomes and shorter curled and more appressed trichomes.

Additional specimens examined. MALAYSIA: **Borneo: Sabah:** Kuala Penyu (Beaufort), Kepayan, 30 May 1968 (fr), *Binideh 55770* (K, KEP, L, SAR); Sabah, Nabawan District, Sg. Pingas-Maitland area, 23 May 1986 (fl), *Fidilis Krispinus SAN 115831* (K, KEP); Sandakan 87.5 Hap Seng logging, 24 Jun 1976 (fr), *Leopold & Taha SAN 83551* (K, L [2 sheets]); Beluran District, Bidu-Bidu F.R., 21 Jul 1990 (fr), *Madani SAN 128873* (K, KEP); Marotai, 8 Apr 1933 (fl), *Maidin [B.N.B. 3056]* (A, K); Lahad Datu dist., Diwats, Kennedy Bay Co. area, 60' alt, 9 Jun 1961 (fr), *Muin Chai SAN 25078* (K, L); Tawau District, Sepulut Research Plot, 13 Aug 1987 (fr), *Ong SAN 120806* (K, KEP, L); Tiulon, Nabawan, 600 ft, 16 Sep 1976 (fr), *Tarmiji & Dewol SAN 84191* (K, L, SAR, SING); mi. 61 Telupid Road, 20 m alt, 4 Jul 1980 (fr), *Termiji*

Arshid SAN 92570 (K, KEP, L, SAR); Lahad Datu District, Cpt. 6, North Borneo Timber Co., Concession Area, Kretam, 22 May 1954 (fr), *Wood SAN A 4819* (A, L, SING); Sandakan Cpt. 16, Sepilok Forest Reserve 15 mi W of Sandakan, 30 Apr 1955 (fl), *Wood & Charington 16318* (A, KEP, L, SING); **Sarawak:** 3rd Division, Kapit District, Belaga subdistrict, left bank of Rajang River c. 10 km below Belaga, Segaham Range near Belaga airfield, 2°40′N 113°50′E, <500 m, 3 Sep 1958 (fr), *Jacobs 5409* (K, L, SAR, US), 7 Sep 1958 (fl), *Jacobs 5453* (K, L, SAR, SING, US); Ulu Sg. Semawat Belaga, 7th Division, 23 Oct 1981 (young fr), *Othman et al. S.43397* (ASU, L, SAR).

INDONESIA: **Sumatra: Bangka Belitung:** Bangka, Lobok Besar, 5 m, 14 Sep 1949 (st), *Andong 111* (L [2 sheets]); Ond. Luid. Bangka, 20 m, 16 Apr 1927 (st), *Boschproefstation bb.11299 [Mohamad Oetei 149]* (A); Lobok-besar, SE Bangka, 30 Aug 1949 (fl), *Kostermans & Anta 223* (A, K, L, NY, SING); Lobok-besar, G. Pading, 100 m, 30 Sep 1949 (fl), *Kostermans & Anta 1012* (A, K, L, SING); Billiton, s.d. (fl), *van Rossum 46* (L [2 sheets]); **Bengkulu:** Lais, Talang Benal, 250 m, 20 Mar 1925 (st), *Idris 5/bb.8858* (A); **South Sumatra:** Res. Palembang ond. Afd. Lemakang Ilir, 75 m, 8 Sep 1924 (fl), *Boschproefstation nr. F or T 971* (L); Palembang, Rawas, 27 Apr 1917 (st), *Dumas 1527* (L); Res. Palembang, ond. Afd. Banjoeasin en Koeboestreken, 25 m, 6 Feb 1920 (fl), *Endert 176 E.1[8 or P].886* (L [2 sheets]); Banjoeasin en Koeboestreken, 16 Nov 1915 (fr), *Grashoff 828 p.p.* (L); **Borneo: Central Kalimantan:** Samba, 1994–1995 cutting blocks of PT Handiyani, 0°43′16.7″S 112°50′34.2″E, 340 m, 24 Jan 1995 (fr), *Jarvie & Ruskandi 5229* (A, KEP, L); P. B. U. base camp and environs, Trail Jalang Nancy, 16 Jun 1990 (fl, fr), *Ridsdale PBU55* (L [2 sheets]); **East Kalimantan:** Sepaku PT ITCI, Kenangan, Balikpapan, 30 Oct 1990 (fl), *Ambri & Arifin AA7* (A, K, L); Wanariset, Wanariset Research I area, off km 35, Wanariset-semoi Road, 70 m, 16 Jan 1991 (fr), *Ambri & Arifin W602* (A, K, L); Bulungan, Nunukan, Boschtuin, 8 May 1939 (fl), *Netherlands Indies Forest Service bb.29395* (A, L, SING); Loa Djanan, W of Samarinda, 30 m, 27 Apr 1952 (fr), *Kostermans 6634* (A, BO, K, L, SING); Boeloengan, Kabiran, G. Simendoeroel, 5 Aug 1927 (st), *Zwaan bb.11722* (A); Pujungan Dist., Kayan-Mentirang Nature Reserve on Bahau River at or to 3 km above confluence with Gong Biou River towards Long Alango, 02°50′N 115°50′E, 6 Jul 1992 (fr), *McDonald & Ismail 3526* (A, F, L, SING); West Kutei, 20 Mar 1932 (st), *Netherlands Indies Forest Service bb.16521* (A, L); Kutei, 15 Jul 1957, *Schut K.22* (BO, K, L, SING); Sungai Wain Protected Forest of km 15 Balikpapan-Samarinda, 50 m, 11 Jan 1992 (fr), *Sidiyasa et al. 818* (A, K, L).

Notes. *Xylopia heterotricha* is distinctive because of the unusual character of the twig pubescence, which consists of a mixture of long light-coloured acicular hairs and short brown curled hairs. The leaf blades are relatively small and oblong, often with a blotchy mottled appearance to the adaxial leaf blade surface when dried. The petals are very long, approaching in length those of *Xylopia magna* Maingay ex Hook.f. & Thomson from Peninsular Malaysia, Singapore and Borneo. The number of carpels and monocarps is exceptional for the *Xylopia malayana* group, reaching up to 18: the more typical number for species in this group is fewer than 7, rarely up to ten (Keng & Heaslett, 1973); The monocarps are superficially similar to those of *Xylopia malayana* in being persistently pubescent and distinctly stipitate, but are usually wrinkled or puckered when dry and never obliquely striate as in the monocarps of *Xylopia malayana*.

Previous reports of *Xylopia elliptica* from Borneo (e.g., Sinclair, in litt.; Turner, 2011, 2014) all refer to *X. heterotricha*.

Xylopia sessiliflora (Kochummen & Whitmore) D.M.Johnson & N.A.Murray, **comb. nov.** – *Xylopia fusca* var. *sessiliflora* Kochummen & Whitmore, Fed. Mus. J. 13: 135 (1970 ['1968']). – TYPE: Malaysia, Negeri Sembilan, Kuala Pilah, Pasoh F.R., Compt. No. 14, 19 February 1927, *Mohd. Yatim bin Aseh, Forester, for Serting KEP 62984* (holotype KEP).

Distribution. Peninsular Malaysia. Known from only five collections, each from a different state in Peninsular Malaysia. Last collected in 1972.

Additional specimens examined. MALAYSIA: **Peninsular: Johor:** E Johore, Sungai Kaya, 15 Mar 1937 (fl), *Kiah SFN 32403* (A, BKF, K, KEP, SING); **Melaka:** Without definite locality, without date (fl), *Herb. Cantley 5842* (SING); **Pahang:** Tasek Bera FR, 22 Jul 1972 (fl), *Chan FRI 16942* (A, K, KEP, L, SAR, SING); **Perak:** Without definite locality, without date (bud), *Wray 3194* (CAL (Sinclair, 1955), SING [2 sheets]).

Notes. The combination of dense appressed pubescence of the abaxial leaf surfaces and twigs and the very short flower pedicels readily distinguishes *Xylopia sessiliflora* from all other Peninsular Malaysian *Xylopia* species. *Xylopia sessiliflora* differs from *X. fusca* of the *Xylopia ferruginea* group in a number of significant ways. The leaf indument is silvery grey rather than golden, the leaf blades are lanceolate, ovate, or elliptic and usually acuminate at the apex, rather than oblong and obtuse, rounded, or rarely short-acuminate at the apex, the pedicel is only 2–3.4 mm long as opposed to 5–10 mm long, the calyx is only ¼-connate rather than ½–⅔-connate, the petals are up to 44 mm long rather than only up to 26 mm long, and there are 8–10 rather than 3–5 carpels. The paratype *Kiah SFN 32403* had been identified by Sinclair (1955) as *Xylopia malayana*. To confuse things further, this specimen was identified in turn as both *Xylopia elliptica* and *X. malayana* in the same publication by Corner (1978).

The fruit of this species is not yet known, and may provide additional characters for distinguishing it from other *Xylopia* species in the Pasoh Reserve and elsewhere. According to Kochummen (1997), trees of this species in the Pasoh Reserve have stilt roots, the only similarity with *Xylopia fusca* and other members of the *X. ferruginea* group.

Four specimens were cited in the protologue of *Xylopia fusca* var. *sessiliflora*. In addition to the type and *Kiah SFN 32403* already discussed, these two were cited: Johor: Labis F.R., *KEP 105267* and Kedah: Gunong Inas F.R., *KEP 104789*. The latter two specimens are sterile; the Kedah specimen definitely does not look like other material of this species, and the Johor specimen is not determinable.

Conclusion

A clearer understanding of regional patterns of distribution of the 23 *Xylopia* species occurring in the Sundaic region of Southeast Asia is now possible. Six species are widespread across the Malay Peninsula, Sumatra and Borneo: *Xylopia caudata* Wall.

ex Hook.f. & Thomson, *X. ferruginea*, *X. fusca*, *X. malayana*, *X. ngii* and *X. sumatrana*. *Xylopia* does not occur on Java. Two species are shared between the Malay Peninsula and Sumatra: *X. dicarpa* Hook.f. & Thomson and *X. oxyantha* (Wall. ex Hook.f. & Thomson) Hook.f. & Thomson. Two species are shared between the Malay Peninsula and Borneo: *Xylopia erythrodactyla* and *X. magna*. *Xylopia magna* was previously known only from the Malay Peninsula; the following specimen represents the first record of that species for Borneo: Malaysia, Sarawak, logging area, Bukit Tubeh, Tebedu, Serian, 23 Jun 1996 (fr), *Jamree et al. S.73290* (KEP). *Xylopia heterotricha* is shared between Sumatra and Borneo.

Xylopia elliptica, *X. platycarpa*, *X. sessiliflora* and *X. subdehiscens* (King) J. Sincl. are known only from the Malay Peninsula, and *Xylopia coriifolia* Ridl., *X. kuchingensis* I.M.Turner & D.M.Johnson, *X. mucronata* Boerl., *X. orestera* I.M.Turner & D.M.Johnson and *X. pulchella* Ridl. are unique to Borneo. There is no species currently known to be endemic to Sumatra.

Sundaic species with distributions extending outside of the region include *Xylopia densifolia* Elmer and *X. dehiscens* (Blanco) Merr., which occur in Borneo and the Philippines. *Xylopia pierrei,* occurring in Thailand, Cambodia, and Vietnam, just reaches the Malay Peninsula. *Xylopia vielana* is the only species in Thailand that does not occur in the Sundaic region, its distribution extending instead from northeastern Thailand into Vietnam and southern China. With the notable exception of the Malay Peninsula endemics mentioned above, all of which belong to the *Xylopia malayana* group, the *X. ferruginea* group and the *X. malayana* group exhibit strongly similar biogeographic patterns in the region.

Some of the rarer species of *Xylopia* in the area may be simply under-collected. Several species are large trees more than 40 meters in height, and this, coupled with sparseness of individuals in populations, may cause them to be overlooked. Some lowland evergreen rainforest xylopias may, however, exist only in small fragmented relict populations of the Sundaland lowland evergreen forests that contracted into refugia following the last glacial maximum (Cannon et al., 2009). This explanation accords well with the extraordinary diversity of the genus found at sites such as the Pasoh Reserve, where in 2014 we verified the occurrence of seven *Xylopia* species in or near the Pasoh permanent 50-hectare research plot (Manokaran et al., 1992). While the Pasoh plot is known as an area of high diversity, seven *Xylopia* species within such a small area is unequalled in our field experience with the genus.

The intensive inventories of lowland rainforest plots in southeastern Asia (see Losos & Leigh, 2004) have documented that Annonaceae are a vital component of these forests and that *Xylopia* species are invariably a substantial component of that Annonaceae diversity (Manokaran et al., 1992; Lee et al., 2002). Data from these research plots can begin to give us a measure of population structure for many species, including those of *Xylopia*, but only if species-level identification can be reliably established. It is hoped that this contribution toward clarification of *Xylopia* taxonomy in the region will enable stronger cross-comparisons among these long-term plots. Our results make clear, however, that further collecting and taxonomic analysis of the Malay Peninsula flora is still critically needed.

ACKNOWLEDGEMENTS. We thank the Singapore Botanic Gardens and the Forest Research Institute Malaysia (FRIM) for their vital support of our project. The Singapore Botanic Gardens provided critical financial support in the form of SBG Research Fellowships, and we were generously supported at FRIM as FRIM Fellows, funded by the Ministry of Science, Technology and Innovation, Malaysia (MOSTI) under the "Flora of Peninsular Malaysia project" (01-04-01-000 Khas) and "Documentation & Inventory of Flora of Malaysia project," based at Forest Research Institute Malaysia. In Singapore we received kind assistance from Edmund Chia, Bazilah Ibrahim, Nura Bte Abdul Karim, Joseph Lai, Samantha Lai, Serena Lee, Michael Leong, Paul Leong, Jana Leong-Škorničková, Low Yee Wen, Shawn Lum, David Middleton, Michele Rodda, Benito Tan, Nigel Taylor, Elango Velautham, Craig Williams, and Winnie Wong. We express our appreciation for assistance in Malaysia from Saw Leng Guan, Richard C.K. Chung, Mohamed A. Latiff, Ruth Kiew, Ummul Nazrah Abdul Rahman, Yao Tze Leong, Rafidah Abdul Rahman, Avelinah Julius, Norsham Suhaina Yaakob, Ming Yee Chew and Ong Poh Tek. Sabbatical leave support from Ohio Wesleyan University is gratefully acknowledged, as is financial support from the TEW Presidential Discretionary fund at Ohio Wesleyan, which supported our further herbarium work at L and K. Additional funding to support herbarium work at L was provided by Naturalis Biodiversity Centre in Leiden kindly arranged by Erik Smets. At Kew we were hosted by David Goyder and the Drylands Africa team and received assistance from Ian Turner. For providing key photographs of two of the new *Xylopia* species to help illustrate this paper we thank Simon Gardner and James LaFrankie. Kate Ball provided the excellent pen and ink rendering of *Xylopia erythrodactyla*. For assistance with preparation of the figures for publication we thank Sara Stuntz, Doug Thompson and Emily Gattozzi. We thank the two anonymous reviewers for suggesting improvements to the manuscript. Finally, we thank curators of the following herbaria for making specimens available to us either by loan or during our visits: A, AAU, ASU, BISH, BKF, BM, BO, K, KEP, KLU, L, M, MICH, MO, NY, SAR, SING, U, UKMB, US.

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doi: 10.3850/S2382581215000319

Studies in Southeast Asian *Melastoma* (Melastomataceae), 1. Morphological variation in *Melastoma malabathricum* and notes on rheophytic taxa and interspecific hybridisation in the genus

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ABSTRACT. Morphological variation in the widespread Indo-Pacific *Melastoma malabathricum* L. is discussed, as well as the possibility of hybridisation or introgression with other species. Hypanthium indumentum is a reliable character to diagnose the group and species. Five rheophytic taxa, including four distinctive species and a variant of the widespread *M. malabathricum*, which are superficially alike because of their stenophyllous leaf form, are enumerated for Southeast Asia and a key is provided for their identification. *Melastoma kahayanense* K.M.Wong from Borneo is described for the first time and the Sumatran *Melastoma stenophyllum* Merr. is considered a distinct species and not synonymous to *M. malabathricum*. Various putative hybrids or introgression products involving *M. malabathricum* are identified.

Keywords. Brunei, identification key, indumentum, introgression, Kalimantan, Malesia, morphology, Sarawak, Sumatra, taxonomy, variation

Introduction

The most recent revision of *Melastoma* L. by Meyer (2001) included 22 species, of which an overwhelming 18 were considered to have ranges within or including Malesia. Of these, eight species are listed for the Malay Peninsula and nine species for Borneo. Nevertheless this appears to be very incomplete because collections that were apparently not consulted include new taxa characterised by distinctive forms of hypanthium indumentum (see Wong & Low, 2015). In addition Meyer adopted wide species concepts for a number of taxa without much clarification and which sometimes appeared to be inconsistent. This series presents various discussions and taxonomic changes, including the description of new or overlooked taxa. We begin with a commentary on the fundamental significance of the hypanthium indumentum type and variation within *Melastoma malabathricum* L., the type species. Based on this and other characters, distinct Southeast Asian rheophytic species are then distinguished from a rheophytic form of *Melastoma malabathricum*. Finally, the evidence for interspecific hybridisation in the genus is reviewed and putative hybrids between *Melastoma malabathricum* and other species in Malesia are identified.

Hypanthium indumentum type a reliable distinguishing character

Species with distinctive types of hypanthium indumentum consistently differ in other morphological characters, ecology or distribution (Naudin, 1850; Cogniaux, 1891; Li, 1944). The main hypanthium indumentum types documented for *Melastoma* include bristles (filiform or terete, hair-like indumentum, as in *M. molle* Wall. ex Ridl. or *M. sanguineum*) (Fig. 1A, B) or scales (visibly flat even under ×10 magnification, usually triangular to ovate or lanceolate (= narrowly ovate) indumentum, as in *M. imbricatum* Wall. ex C.B.Clarke or *M. malabathricum*) (Fig. 1C, D–J), or sometimes penicillate emergences (outgrowths of hypanthium tissue that bear bristles on their edges or at their tips, as in the trans-oceanic vicariants *M. beccarianum* Cogn. and *M. saigonense* (Kuntze) Merr.; Cogniaux, 1891; Hansen, 1977; Meyer, 2001) (Fig. 1P, Q). Thus far, the scales documented are mainly triangular to ovate or lanceolate flat scales with irregularly and shallowly serrate margins (e.g., *Melastoma malabathricum*, *M. normale, M. stenophyllum* Merr.) (Fig. 1D–L), or subulate-subentire (e.g., *M. ariffinii* K.M.Wong) (Fig. 1N), or deeply divided nearly to base forming several linear segments (e.g., *M. ashtonii* K.M.Wong) (Fig. 1O) (Wong & Low, 2015).

Variation in *Melastoma malabathricum*

"On account of the great variation among the plants which must be identified as *M. malabathricum* in the wide sense, no satisfactory classification of them has been proposed." – E.J.H. Corner, *Gardens' Bulletin Straits Settlements* 10: 300 (1939).

Melastoma malabathricum was lectotypified by Bremer in Jarvis et al. (1993: 65). The lectotype is *Herb. Hermann*, Vol. 1: 55, No. 171, Ceylon in the Natural History Museum, London (BM). There are two elements numbered "171". One is a leafy twig without flowers (barcode BM000621418) and is found on the same sheet together with another separate leafy twig bearing an open flower (barcode BM000621419). Both these elements are ostensibly conspecific. They have twigs covered in appressed ovate, triangular and broad-lanceolate scales, the margins of which have short irregular serrations. The flower has a hypanthium clothed and completely hidden in overlapping, flat, narrowly triangular to lanceolate scales (length typically three times or more the width), also with irregular and shallow marginal serrations. All these character-states are also found together in most of the material attributable to this species from India through Malesia (Fig. 1D–J), into northern Australia and the Pacific region, where indeed leaf size and shape, number of flowers in an inflorescence, and flower size appear to vary continuously without any significant morphological gap that could be used to justify taxonomic division. Hypanthium scale dimensions are less variable and, although the hypanthium scales of material from Sri Lanka (Ceylon) (Fig. 1D, 2A) are merely half the width of the largest hypanthium scales found in Malesian material (Fig. 1E–I, 2C), there are intermediate sizes between these extremes, and the smaller scale sizes occur also in Malesia (Fig. 1E, F, G, J).

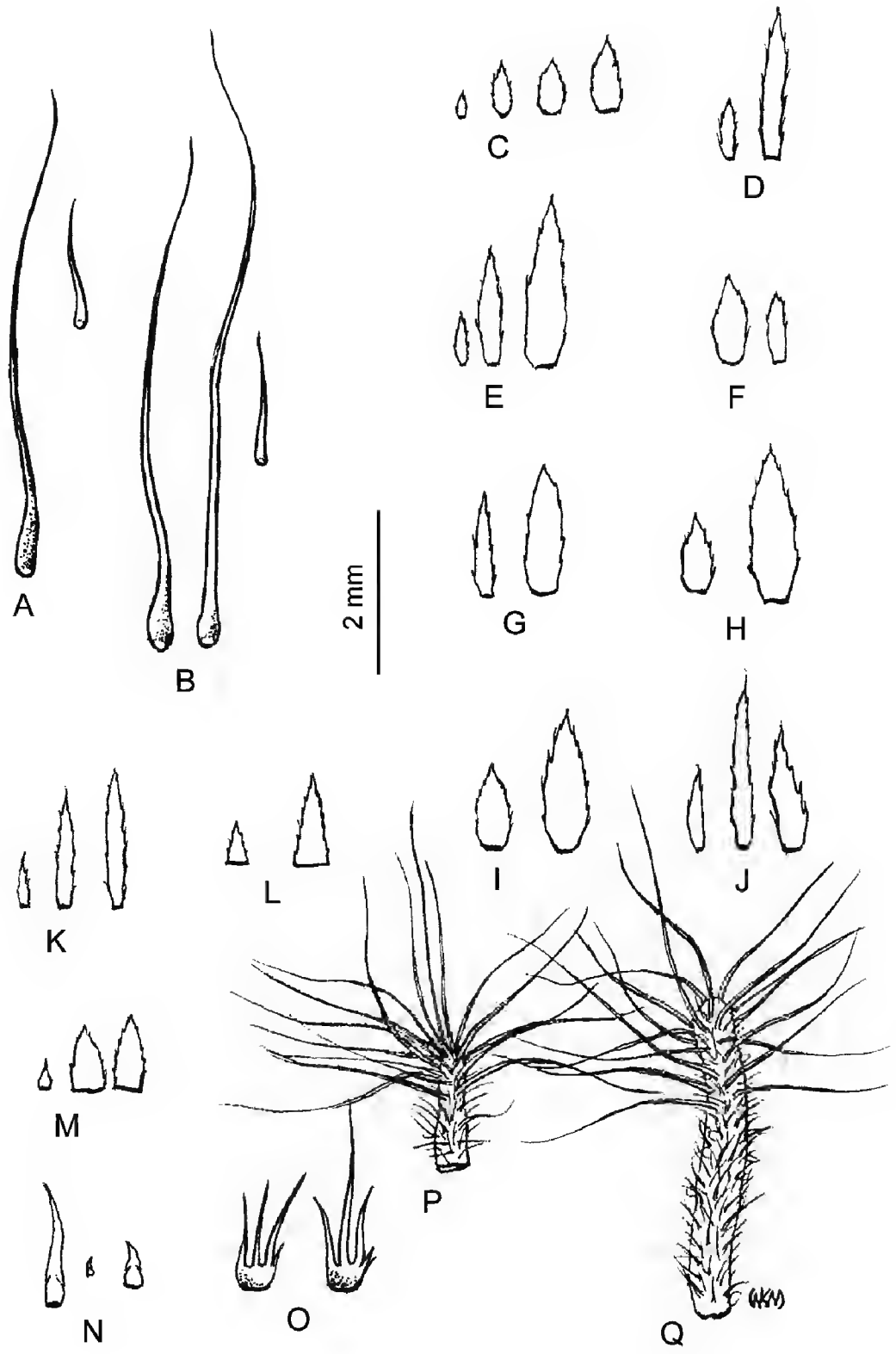

Fig. 1. Hypanthium indumentum types found in *Melastoma* species. Bristles in **A.** *Melastoma molle* Wall. ex Ridl., and **B.** *M. sanguineum* Sims. Scales with serrate margins in **C.** *M. imbricatum* Wall. ex C.B.Clarke, **D.** *M. malabathricum* L. from Ceylon, **E.** Malay Peninsula-Selangor, **F.** Malay Peninsula-Pahang, **G.** Sumatra, **H.** Java, **I.** Borneo-Sarawak, and **J.** Borneo-West Kalimantan, **K.** *M. normale* D.Don, **L.** *M. stenophyllum* Merr. and **M.** *M. kahayanense* K.M.Wong. Subulate-subentire scales in **N.** *M. ariffinii* K.M.Wong. Scales that are deeply divided into linear segments in **O.** *M. ashtonii*. Penicillate emergences in **P.** *M. saigonense* (Kuntze) Merr. and **Q.** *M. beccarianum* Coqn. Drawn by K.M. Wong from (A) *Symington KEP 21361*; (B, left) *Webb et al. WA 64*, (B, middle and right) *Sidek SK 409*; (C, three on left) *Shah & Sidek MS 1123*, (C, right) *Everett FRI 13992*; (D) *Gardner 296*; (E) *Hume 7313*; (F) *Burkill & Haniff SFN 16660*; (G) *Jacobs 8193*; (H) *Zollinger 1938*; (I) *Othman S 21107*; (J) *Church et al. 557*; (K) *Ribu (Dr Prain's collector) s.n. 5 Apr 1902*; (L) *Rahmat Si Boeea 7000*; (M) *Mahyar 890*; (N) *Chai & Ilias S 31110*; (O) *Ashton BRUN 5629*; (P) *Webb et al. WA 81*; (Q) *Wong WKM 189*; all from SING. 2 mm scale shown applies throughout; ineasurements were made with a Micro-Scale with 0.1 mm divisions from Minitool Inc.

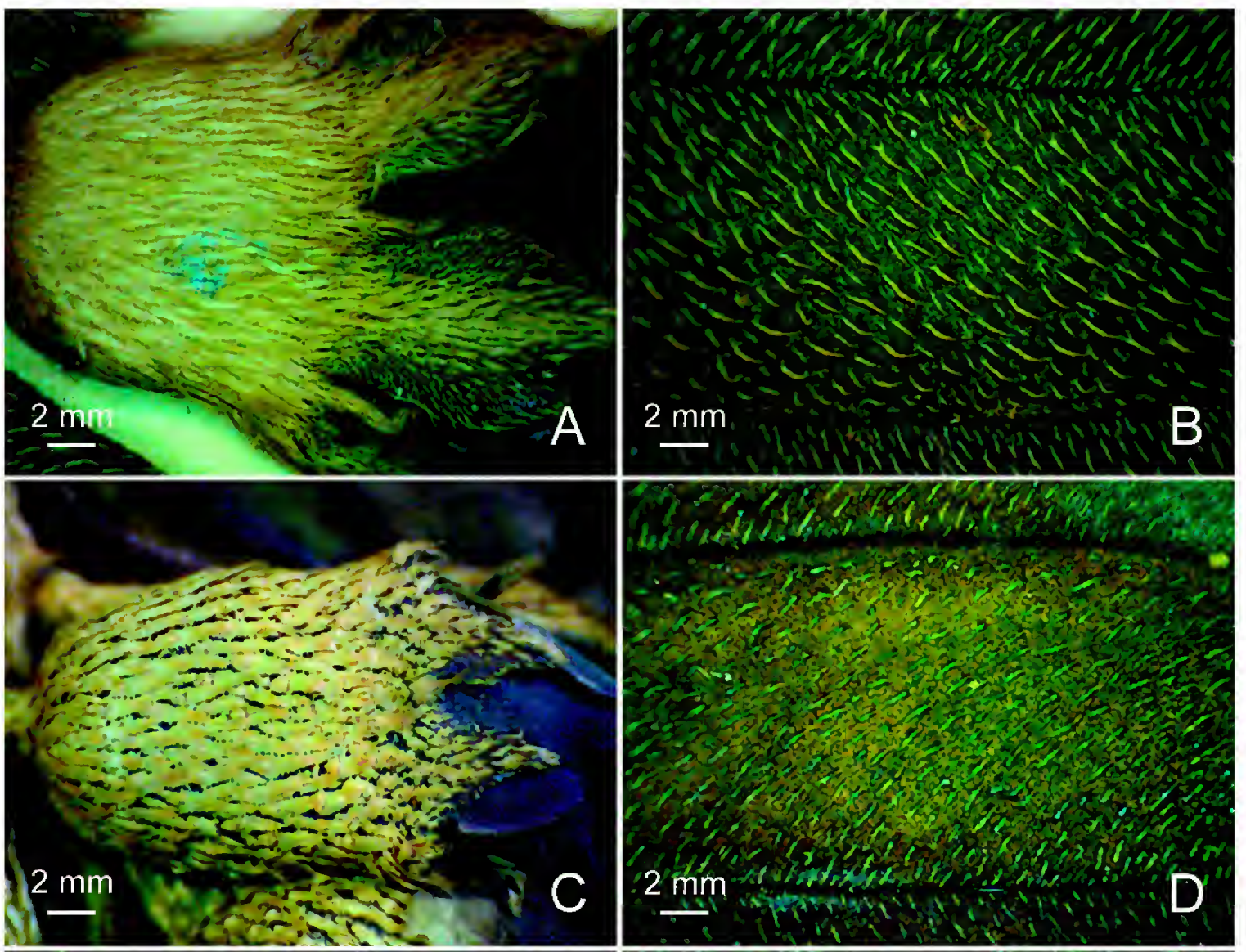

Fig. 2. Hypanthium scales and upper leaf surface scabrid-hairy indumentum. **A–D.** *Melastoma malabathricum* L. **A, B.** Typical in material from Ceylon (*Gardner 296* (= *Hooker 8246*), SING); **C, D.** Malay Peninsula (*Burkill & Shah HMB 935*, SING). **E, F.** *Melastoma normale* D.Don from Sikkim (*Hooker 9577*, SING). (Photomicrographs courtesy of Y.W. Low)

This is, therefore, a highly variable species and, in the present assessment, no consistent varieties or forms seem possible to delimit using clear-cut and discontinuous characters. It is possible that, although apparently extreme environments may be expected to pose selection pressure that skews some morphological expression, this has not happened because the different populations still participate in sufficient

genetic exchange. It is useful to identify some of this variation, bearing in mind the characteristics highlighted in the previous paragraph are consistently present throughout.

(i) Leaves are typically elliptic, with 5 longitudinal veins (on the upper surface distinct as 5 longitudinal furrows, the outermost two very near to the leaf margins). In the Malay Peninsula and Borneo there are rheophytic forms with leaves narrowly elliptic to almost linear, with 3 longitudinal veins (on the upper surface distinct as 3 longitudinal furrows), and sometimes 3–5 longitudinal veins on some or many leaves.
(ii) Leaf blades are typically (1.6–)2.5–4.5(–8) cm wide. In the rheophytic forms leaf blades are (0.3–)0.7–1.1(–2.2) cm wide.
(iii) The upper leaf surface typically has short rows of crystalliferous cells immersed in the leaf tissue (visible as pale spicule-like patterns under magnification) proximal to appressed-suberect scabrid hairs typically up to 0.5 mm long (Fig. 2B & D).
(iv) Flowers with open corollas typically span 4–5.5 cm in dried material. In the rheophytes, flowers have open corollas spanning (2.5–)3.5–4 cm in dried material.

Thus a rheophytic variant may be encountered that has leaves as small and narrow as 2 cm long and 1.6 cm wide, with small flowers (spanning only 2.5 cm in dried material). These are, however, connected by intermediate states with other variants, all of which have the hypanthium scales and twig scales described above for the species.

The status of *Melastoma normale* D.Don, which was reduced to synonymy of *M. malabathricum* by Corner (1939) and treated as a subspecies of *M. malabathricum* by Meyer (2001), apparently because of similar hypanthium scale types found in both (Fig. 1D–J, K; 2 A, C, E), requires comment. In spite of the type of *Melastoma normale* D.Don, which should be a Hamilton collection from Nepal (Don, 1825), not being traced (see also Meyer, 2001), there are other Himalayan (including Nepal) collections available that have been identified with it (Naudin, 1850; Clarke in Hooker, 1879), such as *Hooker* s.n. from Sikkim (G-DC, G00319474), *Native Collectors No. 22* from Khasia [Khasi] Hills (G-DC, G00319472), and *Wallich 4039* from Nepal (BM, K, P; also the type of *M. wallichii* DC., placed in synonymy of *M. normale*) that amply display consistent characteristics: a dense twig indumentum of erect-spreading bristles and leaf upper surfaces with 0.6–1 mm long hairs that are erect and then curved over (Fig. 2E), visibly longer than those of typical *M. malabathricum*. Don (1825) himself noted "*ramis undique setoso-pilosis, foliis...supra hispide pilosis...*" Fig. 2 shows the similar hypanthium scale character but different leaf upper surface indumentum in these two species. These morphological differences, together with the high elevation distribution of *Melastoma normale*, and in the absence of any phylogenetic work to indicate otherwise, suggest that Corner (1939) and Meyer (2001) were hasty in synonymising or changing the rank of the taxon. As such, *Melastoma normale* is still considered a distinct species here.

Additionally, a number of other taxa relegated to the synonymy of *Melastoma malabathricum* by Meyer (2001) also seem quite distinct from it, not having the flat

narrowly triangular-lanceolate scales covering the hypanthium, as in *M. malabathricum* (Fig. 2A, C). Included are the following

(i) Hypanthium with dense filiform (bristly) scales: *Melastoma clarkeanum* Cogn. – TYPE: Burma, Tenaserrim, 1000 m, *Helfer 2241* (K, P); *Melastoma homostegium* Naudin – TYPE: Philippines, *Cuming 927* (BM, K, P); *Melastoma robustum* Bakh.f. – TYPE: Indonesia, Riau, Lingga, Gunung Walker, *Bünnemeijer 6585* (L); *Melastoma roemeri* Mansf. – TYPE: Papua New Guinea, Madang, Hellwig-Gebirge, 1000–1500 m, *Von Roemer 1123* (L). The relationship among these taxa require study but nonetheless form recognisable entities with a very different hypanthium scale type.
(ii) Hypanthium with narrow-lanceolate scales with extended bristle-like cauda: *Melastoma pelagicum* Naudin – TYPE: Solomon Islands, Isle Ysabel, *Hombron* s.n. (P).
(iii) Hypanthium with sparse, subulate and subentire scales: *Melastoma scabrum* Ridl. – TYPE: Malay Peninsula, Kedah, Langkawi, Telaga Tujuh, *Ridley 15813* (K).

There are other taxa placed in the synonymy of *Melastoma malabathricum* by Meyer (2001) that, although they have the imbricately arranged serrate hypanthium scales of *M. malabathricum*, differ in other characteristics. An example is *Melastoma stenophyllum*, which differs by its solitary flowers, a broad-triangular hypanthium scale type that is less than three times as long as broad (Fig. 1L), and near-glabrous upper leaf surfaces.

Rheophytic taxa and their morphological distinction

Rheophytes are plant taxa adapted to conditions within the flood zone of swift-flowing streams and rivers, and typically have highly dissected or narrow leaf blades (the latter 'stenophylly'), assumed to be adapted to reduce damage by providing less resistance to swift waters during inundation (Van Steenis, 1981). These plants most often grow on sandy or stony stream banks or islands, and from rock crevices and at rapids, developing strong root holdfasts and easily resprouting or branching. Van Steenis (1981) noted that Northwest Borneo is particularly rich in rheophyte diversity.

A number of *Melastoma* taxa are also rheophytic in adaptation. Despite their superficial morphological similarity, typically being low, much-branched shrubby forms with very narrowly elliptic to linear leaves, and their shared preference for a similar ecology within the flood zone of swift-flowing streams, they can be distinguished by the form of the hypanthium scales, as described in Wong & Low (2015), as well as a number of other characters. Such rheophytic taxa were either overlooked or have not been studied for the last revision of the genus by Meyer (2001).

Here we present a key to the Southeast Asian rheophytic species, compared with *M. malabathricum*, with which they could be confused because the latter also includes rheophytic variants. A new rheophytic species, *Melastoma kahayanense*, is described

that has the *M. malabathricum* hypanthium scale type (flat, triangular to lanceolate, serrate) (Fig. 1M) but with consistently solitary flowers and upper leaf surfaces that are subglabrous or with very minute hairs, in addition to stenophyllous leaves and a rheophytic distribution.

Key to Southeast Asian *Melastoma* rheophytes

1a. Hypanthium scales quite flat, margins irregularly serrate to short-ciliate but not deeply incised towards their base. Calyx without conspicuous intersepalar lobes, often only a low protuberance (1–1.5 mm high) bearing 1-few prolonged scales 1–2(–3) mm long 2

1b. Hypanthium scales basally thickened or inflated, margins subentire to sparsely denticulate or the scale deeply incised almost to base to form several linear segments. Calyx with or without conspicuous, well-formed intersepalar lobes 4

2a. Flowers (1–)3–7(–9) in a cyme. Upper leaf surface hairs appressed-suberect and scabrid, typically up to 0.5 mm long, rarely to 1 mm long, but always conspicuous with ×10 magnification (India to SE Asia and the Pacific, including Malesia) ..... *M. malabathricum*

2b. Flowers solitary. Upper leaf surface subglabrous to minutely scabrid, hairs very tiny and barely emergent from leaf surface, requiring ×50 magnification to see clearly (Borneo, Sumatra) 3

3a. Leaf blades (2.5–)5.5–7(–9) cm long, (0.4–)0.8–1(–1.2) cm wide. Flowers in dried material with open corolla spanning 4.5–5 cm, hypanthium 0.5–0.6 cm diameter, calyx lobes 7–8 mm long; hypanthium scales broadly triangular, their length less than 3 times the width (Sumatra) ..... *M. stenophyllum*

3b. Leaf blades only up to 4 cm long, 0.6 cm wide. Flowers in dried material with open corolla spanning 2.5–3 cm, hypanthium not more than 0.5 cm diameter, calyx lobes 3.5–6 mm long; hypanthium scales narrowly triangular to lanceolate, their length 3 times the width or more (E Kalimantan) ..... *M. kahayanense*

4a. Hypanthium scales subulate, subentire to sparsely denticulate (occasionally with small teeth near the scale apex). Calyx without distinct intersepalar lobes, often just low protuberances bearing 1–few prolonged scales to 2 mm long. Upper leaf surface mostly glabrous or sometimes with minute hairs barely emergent from leaf surface, requiring ×50 magnification to see clearly (NW Borneo: Brunei, Sarawak, W Kalimantan) ..... *M. ariffinii*

4b. Hypanthium scales deeply divided almost to base to form several linear segments. Calyx with conspicuous, well-formed narrowly triangular intersepalar lobes 4–5 mm long. Upper leaf surface totally glabrous (Brunei: Ingei River) ..... *M. ashtonii*

Rheophytic *Melastoma* enumerated

1. *Melastoma ariffinii* K.M.Wong, Gard. Bull. Singapore 67: 71 (2015). – TYPE: Brunei, Tutong, Ramba, Ulu Tutong, down valley to SW of helicopter pad LP 239, 150–200 m asl, 8 May 1992, *Johns, Niga, Shanang & Han 7547* (holotype BRUN; isotype K).

Melastoma polyanthum var. *linearifolium* Bakh.f., Meded. Bot. Mus. Herb. Rijks Univ. Utrecht 91: 69 (1943). – TYPE: Borneo [West Kalimantan], Gunong Narik, Mt Kelam, May 1894, *Molengraaff B3460* (lectotype L, designated in Wong & Low, 2015).

Additional specimens examined. BRUNEI: **Temburong:** First big waterfall on R. Temburong, c. 500 ft, 6 Nov 1959, *Ashton BRUN 759* (BRUN, K, SING). SARAWAK: **5th Division:** Ulu Lawas, Kota Forest Reserve, on bank of Sg. Kota, 21 Oct 1971, *Chai & Ilias S 31110* (A, K, L, SAN, SAR, SING). **Kapit Division:** Balleh, Ulu Mengiong, Sg. Entejum, 27 Oct 1988, *Othman, Rantai & Jugah S 56078*, (K, KEP, L, SAR, SING); Sg. Belaga at upper rapids, 12 Apr 1963, *Ashton S 18242* (K, L, SAR, SING).

This occurs in the Northwest Borneo region, including Brunei, Sarawak and W Kalimantan.

2. *Melastoma ashtonii* K.M.Wong, Gard. Bull. Singapore 67: 74 (2015). – TYPE: Brunei, Belait, Sg. Ingei, rocky river bank, 21 January 1959, *Ashton BRUN 5639* (holotype BRUN; isotypes K, L, SING).

Additional specimens examined. BRUNEI: **Belait:** Falls just upstream from Batu Melintang, 4 Jan 1989, *Wong WKM 680* (BRUN, K, SING).

This species seems to be restricted to the Sungai Ingei area in Brunei.

3. *Melastoma kahayanense* K.M.Wong, **sp. nov.**
This species resembles *M. malabathricum* in its flat, irregularly serrate, imbricate hypanthium scales but differs by its solitary flowers and near-glabrous upper leaf surfaces, in addition to its stenophyllous leaves and rheophytic habit. – TYPE: Borneo, E Kalimantan, headwaters of Sungai Kahayan, 0°28'S 113°44'E, 200 m asl, 30 March 1988, *Mahyar 890* (holotype SING; isotypes A, BO). (Fig. 3A, B)

Rheophytic bush to 2 m high. ***Twigs*** with a dense covering of appressed triangular to ovate-lanceolate flat and finely serrate-edged scales. ***Leaves*** with petioles 0.2–0.4 cm long, c. 0.05–0.1 cm diameter; blades linear, 1.2–4 cm long, 0.2–0.6 cm wide, the 3 longitudinal veins sunken on the upper surface and prominent on the lower surface, covered by a mixture of larger lanceolate appressed scales (c. 0.5 mm long) and smaller appressed lanceolate scales (<0.2 mm long), lamina on the upper surface in dried

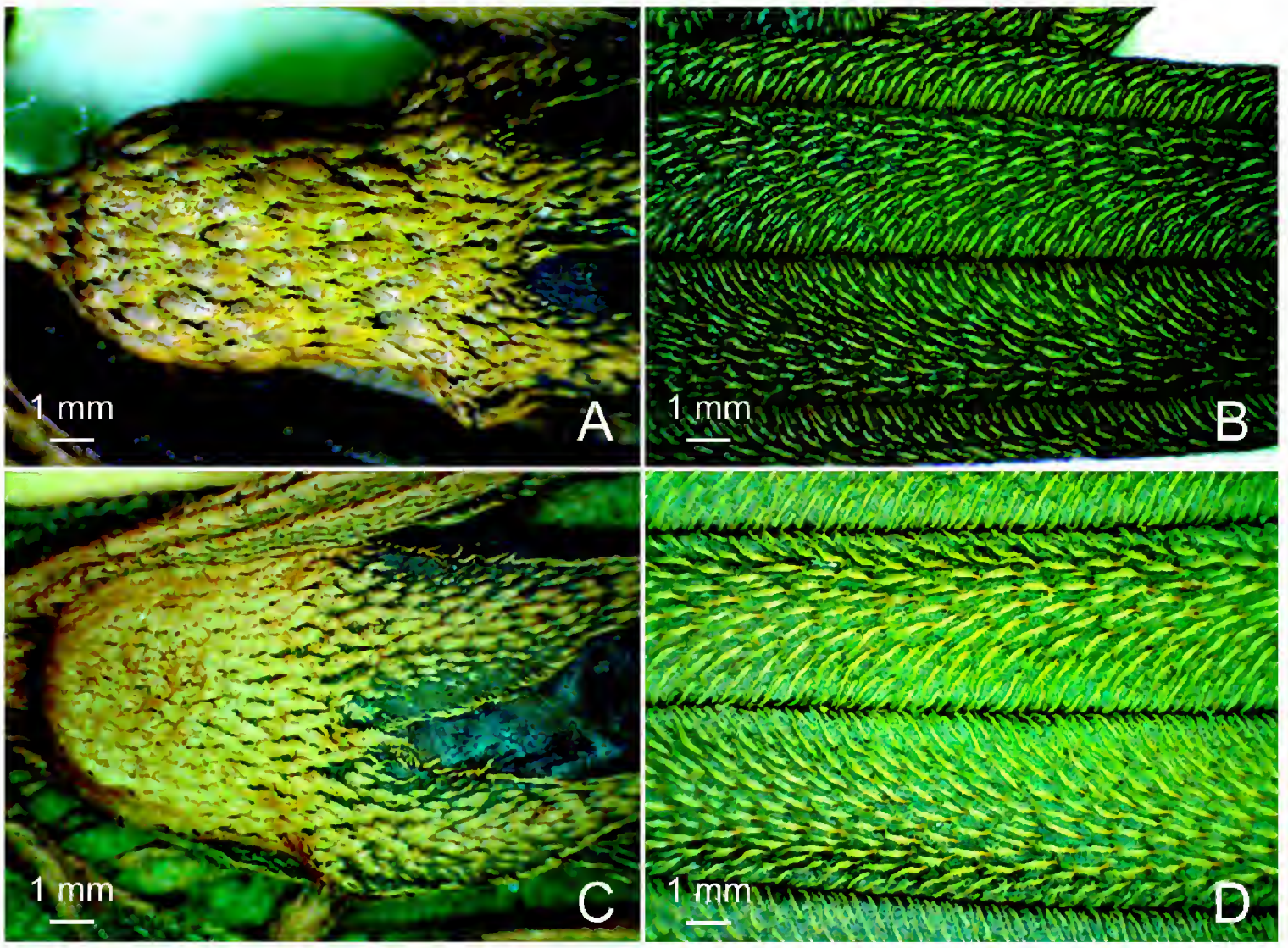

Fig. 3. Hypanthium scale types and upper leaf surface detail. **A, B.** *Melastoma kahayanense* K.M.Wong. **A.** Hypanthium scale narrowly triangular-lanceolate, the length 3 times or more the width. **B.** Upper leaf surface with conspicuous pale elongate spicule-like rows of crystalliferous cells, most of which are barely emergent as minute hairs. **C, D.** *Melastoma stenophyllum* Merr. **C.** Hypanthium scale broad-triangular, the length less than 3 times the width. **D.** Upper leaf surface with conspicuous pale elongate spicule-like rows of crystalliferous cells, most of which are barely emergent as minute hairs. A, B from *Mahyar 890* (SING); C, D from *Rahmat Si Boeea 7000* (SING). (Photomicrographs courtesy of Y.W. Low)

material with abundant conspicuous elongate spicule-like rows of crystalliferous cells which are typically immersed or proximal to minute hairs barely emergent from leaf surface and requiring ×50 magnification to see clearly, on the lower surface with minute appressed scabrid hairs up to 1.5 mm long. ***Flowers*** solitary, pedicel 2.5–4 mm long; hypanthium 4–6 mm long, 3–4 mm diameter, brownish green, densely provided with scales, the scales flat, narrowly triangular to lanceolate, 0.3–0.8(–1) mm long, the length 3–4 times the width, with finely short-serrate margins (the serrations less than 0.1 mm deep), lobes 5, triangular, 3.5–6 mm long, 1.5–2.5 mm wide, without conspicuous intersepalar lobes; petals obovate, 1.3–1.5 cm long, 0.8–1 cm wide, noted as purple; stamens 10, 5 longer and 5 shorter. ***Fruits*** c. 6–8 mm long, 4–5 mm diameter.

Etymology. The species is named after its type locality, the Kahayan River in East Kalimantan, Indonesian Borneo.

Additional specimens examined. BORNEO: **East Kalimantan:** headwaters of Sungai Kahayan, 5 km NE of Haruwu Village, 0°28'S 113°44'E, 200 m asl, 3 Apr 1988, *Burley et al. 574* (A, BO, SING).

Distribution and habitat. Apparently restricted to the Kahayan river basin in E Kalimantan, on the banks and rocks of swift-flowing streams.

Provisional IUCN conservation assessment. Data Deficient (DD) because it is documented only from one expedition and its current status is unknown.

4. *Melastoma malabathricum* L. rheophytic variants
Melastoma polyanthum var. *angustifolia* Ridl., Fl. Malay Pen. 1: 765 (1922). – TYPE: [Peninsular Malaysia], Pahang, Kuala Tahan, February 1921, *Seimund 952* (lectotype SING, designated here).

Similarly, the names *M. longifolium* Naud. (TYPE: Singapore, July 1939, *Guillou* s.n. (P)) and *M. obvolutum* var. *angustifolium* Cogn. (TYPE: Sarawak, 1965–68, *Beccari 3974* (K)) are also synonyms of *M. malabathricum*; in fact the leaves of their type specimens do not depart significantly from the smallish elliptic leaves typical of *M. malabathricum* and are not immediately reminiscent of the leaves of rheophytic taxa. Van Steenis (1981) accepted *Jacobs 5580* from Brunei (Temburong river, 30 Sep 1958 (L)) as a true rheophyte because that specimen grew in rocky islets along the Temburong river, and identified it as *M. borneense* Bakh.f. That name (TYPE: Borneo, without date, *de Vriese 168* (L: barcode L0008992)) is a synonym of *M. malabathricum*, which is also the identity of the *Jacobs* specimen; these specimens, too, do not have unusually stenophyllous leaves.

The following additional collections also amply illustrate rheophytic variants of *Melastoma malabathricum*. MALAY PENINSULA: **Kelantan:** Gunong Stong, Lata Jari, 13 Oct 1934, *Symington KEP 37820* (KEP, SING). **Pahang:** Kuala Tahan, Feb 1921, *Seimund 555* (SING), *956* (SING); Kuala Teku, Feb 1921, *Seimund 419* (SING), *426* (SING), *427* (SING); Sungai Tahan, 7 Sep 1937, *Corner* s.n. (SING), 2 Mar 1977, *Ng FRI 27026* (KEP, SING), rocky islets in Tahan River, 1891, *Ridley 2664* (SING); Sungai Teku, 20 Feb 1968, *Shah MS 1333* (SING).

Note. Ridley (1922) merely cited "collected on the Tahan River by Seimund" but there are a number of such collections in the SING herbarium. One of these is designated as the lectotype here.

5. *Melastoma stenophyllum* Merr., Mich. Acad. Sci. Arts Letters 24: 83 (1938). – TYPE: Sumatra, near Hoeta Bagasan, 7 September 1934–4 February 1935, *Rahmat Si Boeea 7000* (holotype MICH; isotypes A, L, SING, US).

This species is restricted to Sumatra. Van Steenis (1981) wrongly identified *Ashton S 18242* from Sarawak and *Molengraaff B3460* from West Kalimantan as this species (both specimens are *M. ariffinii*; see above). The hypanthium scales (Fig. 1L) and features of the leaf upper surface are also shown in Fig. 3C & D.

Possibility of interspecific hybridisation and introgression

There is molecular evidence for natural hybridisation among *Melastoma* species, attributed to overlaps in distribution and flowering time, as well as shared pollinators (Liu et al., 2014). There are also species of hybrid origin, such as one in China (probably mistakenly) identified as *Melastoma affine* D.Don (the type of which has not been traced but is of a provenance originally stated as "India Orientalis") that is intermediate in morphological characteristics between *M. candidum* D.Don and *M. sanguineum* Sims (Liu et al., 2014), and *M. intermedium* Dunn that has been shown to have most nuclear gene haplotypes shared with *M. candidum* and *M. dodecandrum* Lour. and chloroplast spacer sequences identical to either putative parental species (Dai et al., 2012). Thus in the sorting of "variable" taxa, the present work adopts the approach that the character-state combinations found to be common to the most number of collections is taken to represent a natural species, whereas odd character-state combinations could be regarded as possible hybrids or introgression products of the species with the same floral hypanthium scale features. It is, of course, possible that a number of distinct, established species occur with the same hypanthium scale type (e.g., *Melastoma malabathricum* and *M. stenophyllum* discussed above; Fig. 1D–J, L), but then these differ in more than one character. In both the Malay Peninsula and Borneo, the odd possibilities of hybrids or introgression products are comparatively few and overlaps are within the range of putative parental species. Notwithstanding, other consistent character-state combinations in Borneo (where there is greater physiographic and edaphic differentiation, and possibly more effective reproductive barriers among populations) are considered to represent distinct species, especially when the ecology or distribution differs from that of similar species. With this approach, at least any variants that are considered significantly different are then identified, and the morphological assessment results in a taxonomy that attempts a hypothesis for further work on the phylogenetic relationships.

Using this approach, a comparatively small number of collections from Malesia (lowlands to mountains up to only around 1800 m) were found to have the hypanthium scale type of *Melastoma malabathricum* but which differ in small vegetative characters, including having twigs with spreading scales (otherwise of the same form) or upper leaf surfaces with longer hairs (0.5–1.2 mm). These are regarded as representing possibly hybrid material or introgression products. Below, we list the specimens known as such.

Recommendation H.2A of the Melbourne Code (McNeill et al., 2012) notes that names or epithets in a hybrid formula should preferably be in alphabetical order or place the female parent first, or indicate female and male parents using symbols, emphasising that if a non-alphabetical sequence is used, its basis should be clearly

indicated. However, in the cases we consider below, the direction of the crosses are not determined, but it is of relevance to note which species is thought to have contributed the hypanthium scale characters and which the stem and branch scale type or upper leaf surface hair type. Thus in our case we do not use hybrid formulas with a multiplication sign (×) as prescribed but indicate the hybridity differently, using a plus sign (+) between the putative donor of the hypanthium scale type (named first) and the donor of the other character(s) considered (named second).

(i) Putative hybrid or introgression products of *Melastoma malabathricum* + *M. muticum* Ridl.
(Twig scales triangular, ovate or lanceolate, serrate, appressed (as in both species); upper leaf surface with long hairs, 0.5–0.8(–1.2) mm long, intermixed with shorter minute hairs, as in *Melastoma muticum*; hypanthium scales as in *M. malabathricum*).
The possibility of *Melastoma muticum* hybridising has been considered before by experienced collectors. There is a note on *Stone 10828* (KLU), collected at 1036 m along the then new Genting Highlands road (with its attendant corridor of disturbance) up the Peninsular Malaysian Main Range, originally identified as *Melastoma muticum* but which we regard here as a putative *Melastoma muticum* + *M. velutinosum* Ridl. (see below), that states: "*M. malabathricum* just reaches this altitude; they are here found growing together. Do they [*M. muticum* and *M. malabathricum*] hybridize?"

MALAY PENINSULA: **Johore:** Gunung Blumut, West Ridge, 2900 ft asl, 14 May 1968, *Whitmore FRI 8716* (KEP, SING). **Pahang:** Cameron Highlands, between Gunung Brinchang and Green Cow Area, 1600–2000 m asl, 19 Oct 1967, *Shimizu et al. M 13479* (KEP, KYO, SING). **Perak:** Gunung Korbu FR, 22 Jul 1933, *Symington KEP 32240* (KEP, SING); Maxwell Hill, summit of Gunung Hijau, 4500 ft asl, 4 Dec 1965, *Shah & Sidek MS 1105* (SING). SUMATRA: **North Sumatra:** Brastagi, Dec 1930, *Symington KEP 23985* (SING).

All these collections are from montane areas where the distribution of *Melastoma malabathricum* and *M. muticum* Ridl. (which has a characteristic mixed indumentum on the upper leaf surface) overlap.

(ii) Putative hybrid or introgression products of *Melastoma malabathricum* + *M. sanguineum*
(Twig scales sparse, small and ovate-appressed and sometimes mixed with larger or longer suberect-erect bristly scales, as in *M. sanguineum*; upper leaf surface and hypanthium scales as in *M. malabathricum*).

MALAY PENINSULA: **Kedah:** Gunong Jerai, 3200 ft, *Burkill HMB 3345* (SING); Langkawi, Pulau Ular, 22 Nov 1941, *Corner* s.n. (SING). **Penang:** Air Itam Dam Reserve, 3 Mar 1965, *Hardial & Samsuri 227* (SING); enroute from Penang Hill to Waterfall Botanic Garden, c. 550 m asl, 14 Oct 1967, *Shimizu et al. M 12990* (KYO, SING); 'top of Hill', Dec 1895, *Ridley* s.n. (SING), 1520 ft, Mar 1881, *King's Coll. 1540* (SING). **Perlis/Thai border:** Setul [=Satun], Mar 1910, *Ridley 15056* (SING). **Selangor:** Ulu Gombak, 18 m.s., 15 Jun 1966, *Carrick JC 1486* (SING).

(iii) Possible hybrid or introgression products with parent species unidentified: *Melastoma malabathricum* + unknown taxa
(Twig scales suberect-spreading, not appressed as in *Melastoma malabathricum*; other characteristics including hypanthium scale characters as in *M. malabathricum*).

BORNEO: **Sabah:** Sipitang, 5 miles from Kampung Mendulong, road to Meligan, 4 Sep 1983, *Lee SAN 96893* (A, SAN, SING). **Sarawak:** Mulu National Park, along Sg. Melinau, south of Long Birar, 4°00N, 114°50'E, 100 m asl, 12 Apr 1978, *Stone 13681* (KLU, SAR).
MALAY PENINSULA. **Kedah:** Koh Mai Forest Reserve, 4 Apr 1938, *Kiah SFN 37397* (SING); Kuala Pegang to Kg. Ibul, 6 Feb 1968, *Whitmore FRI 4631* (KEP, SING); Langkawi, Guard Regiment Camp, 10 Dec 1960, *Alphonso & Samsuri A 131* (SAN, SAR, SING); Kuah, 4 Aug 1961, *Samat 26* (KLU, SING); Langkawi, south coast 4 miles west of Kuah, 10 Dec 1969, *Whitmore FRI 12976* (KEP, SING). **Kelantan:** Gua Musang, 18 Aug 1971, *Boey 302* (KLU); Kota Bahru, 23 Apr 1937, *Corner* s.n. (SING). **Kuala Lumpur:** University of Malaya, around Jabatan Botani, 11 Sep 1986, *Rosmawati 3* (KLU); University of Malaya, wasteland in campus, 6 Sep 1974, *Jayamohan* s.n. (KLU). **Pahang:** Tasek Bera, north end, Kuim, 30 m asl, 8 Mar 1969, *Flenley 58* (KLU); Ulu Sg. Krau, NE Gunung Benom, 800 ft asl, 1 Mar 1967, *Whitmore FRI 3138* (KEP, SING). **Perak:** Batu Gajah, 26 Jun 1924, *Burkill & Haniff SFN 13362* (SING); Kuala Kangsar, 14 Jun 1925, *Haniff SFN 14919* (SING); Kuala Kangsar, Lubok Merbok, 21 Oct 1924, *Haniff SFN 16007* (SING). **Selangor:** Kepong, Bukit Beruang, 18 Nov 1927, *Pawanche KEP 13422* (SING); Klang Gates quartz ridge, 19 Mar 1960, *Carrick 650* (KLU); ibidem, 18 Nov 2006, *Lee & Wong* s.n. (KLU); Pudu, 16 Aug 1922, *Seimund FMS Museums 10327* (SING); Ulu Gombak 18 mile stone, 6 Mar 1968, *Teo T&P 51* (K, L, SING); Ulu Kuang, May 1972, *Provencher Nr.T.51* (KLU). **Trengganu:** Kuala Berang, 29 Apr 1937, *Corner SFN 33490* (SING). **Singapore:** Changi Reserve, 11 Mar 1889, *Goodenough* s.n. (SING); Seletar Reservoir, 10 Mar 1971, *Anthony 259* (SING).

A number of such collections have odd characters noted: having witches broom (*Goodenough* s.n.) or galls (*Anthony 259*), chlorotic (*Burkill & Haniff SFN 13362*), or with white flowers (*Seimund FMS 10327*). It is not possible to determine without appropriately designed studies if these could be related to recessive conditions such as produced in a hybrid swarm.

Possible hybrid or introgression products of *Melastoma muticum* + *M. malabathricum* also exist. This material has hypanthium scales resembling those of *Melastoma muticum* (very narrow, near-filiform scales with length 5–8 times the width, and sparse inconspicuous short cilia on the margin); twig scales triangular-ovate and appressed as in *M. malabathricum*; upper leaf surface with long and very minute hairs intermixed as in *M. muticum*.)

MALAY PENINSULA: **Pahang:** Cameron Highlands, Gunong Brinchang, 5 Nov 1960, *Poore 453* (KLU); ibidem, summit, 6500 ft, 11 May 1965, *Stone 5612* (KLU).

Also, there are specimens that are possibly the hybrid or introgression products of *Melastoma muticum* + *M. velutinosum* (which have the hypanthium scale type of *M. muticum* but suberect bristles covering the twigs as in *M. velutinosum*); both species are found in the Main Range mountains of the Malay Peninsula.

MALAY PENINSULA: **Pahang:** Genting Highlands, 3400 ft [1036 m] asl, 8 Jul 1972, *Stone 10828* (KLU); Ulu Kali, 1 Dec 2012, *Sugumaran SM 345* (KLU).

It may seem, from this listing, that a good number of collections are considered of hybrid or introgression origin. In fact, such variation has not been detected for all species, and for some species less widespread than *Melastoma malabathricum*, the number of such odd taxa is very small, represented by 1–few collections. It would stand to reason that in a very widespread species, such as *Melastoma malabathricum*, distributed from Sri Lanka through Malesia and mainland Southeast Asia to north Australia and the Pacific region, and from near sea level to around 1800 m on mountains, there would be more collections of putative hybrids or introgression products to be expected.

ACKNOWLEDGEMENTS. I am grateful to the curators of the following herbaria for hosting these studies: BRUN, KLU, SAN, SAR, SING. Low Yee Wen, Bazilah Ibrahim and Alsa Moo of SING were especially helpful with specimen imaging and annotations. David Middleton's suggestions have helped improve the manuscript for publication.

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Gardens' Bulletin Singapore 67(2): 403–406. 2015
doi: 10.3850/S2382581215000320

Clarifying the nomenclature of *Crateva trifoliata* (Capparaceae)

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ABSTRACT. *Capparis trifoliata* Roxb., the supposed basionym of '*Crateva adansonii* subsp. *trifoliata* (Roxb.) Jacobs' and '*Crateva trifoliata* (Roxb.) B.S.Sun', is shown to represent an illegitimate renaming of *Crateva religiosa* G.Forst. However, Jacobs effectively excluded the nomenclatural type of *Capparis trifoliata*, thus avoiding creating a superfluous name, and instead described *Crateva adansonii* subsp. *trifoliata* Jacobs validated by the citation of the Latin description of *Crateva erythrocarpa* Gagnep. Sun also excluded the type of *Crateva religiosa*, but his effective transfer of *C. adansonii* subsp. *trifoliata* to specific rank does not have priority over *Crateva erythrocarpa* Gagnep., which is therefore the correct name for this taxon when it is considered a distinct species. The name *Crateva nurvula* Buch.-Ham. is formally lectotypified.

Keywords. *Capparis*, China, *Crateva*, India, nomenclature, Roxburgh, typification

Introduction

William Roxburgh named an Indian species *Capparis trifoliata*. The name was included in Roxburgh's *Hortus Bengalensis* (Roxburgh, 1814: 41) but as no description was included the name remained invalid. A brief description was eventually published in the second edition of *Flora Indica* (Roxburgh, 1832: vol. 2, p. 571), 17 years after Roxburgh had died. Jacobs (1964), in a revision of the genus *Crateva*, included *Capparis trifoliata* within the wide-ranging (seasonally dry tropical Africa and Asia) and variable *Crateva adansonii* DC. In order to categorise the variation within the species, Jacobs recognised a series of five subspecies separable on leaf characters. These consisted of *Crateva adansonii* subsp. *adansonii* in Africa, *C. adansonii* subsp. *odora* (Buch.-Ham.) Jacobs in India, *C. adansonii* subsp. *trifoliata* (Roxb.) Jacobs in Indochina, *C. adansonii* subsp. *formosensis* Jacobs in China and Taiwan and *C. adansonii* subsp. *axillaris* (C.Presl) Jacobs in the Philippines and Java. While some recent works have favoured splitting up *Crateva adansonii*, others have maintained Jacobs's system (Chayamarit, 1991; Liu & Liao, 1996; Philcox, 1996). However, there is a nomenclatural problem with *Capparis trifoliata* Roxb., upon which Jacobs evidently based *C. adansonii* subsp. *trifoliata*. In the original validation in *Flora Indica*, Roxburgh cited '*Crateva religiosa* Willd. 2. 853' in synonymy. This is a reference to Willdenow's *Species Plantarum*. In turn, Willdenow referred to Vahl (1794: 62) and Forster (1786: 203). The latter element (also referred to by Vahl) relates to the original

publication of *Crateva religiosa* G.Forst. Roxburgh, Willdenow and Vahl, in their somewhat confused view, also all referred to the *Hortus Malabaricus* element 'niirvala' (Van Rheede tot Draakestein, 1682: 49–50, t. 42) – now considered to represent a separate species. Roxburgh stated that his species was native to India and certainly included what Jacobs later referred to as *Crateva adansonii* subsp. *odora* as shown by a Roxburgh specimen from William Hooker's herbarium now at Kew and Roxburgh's Icones no. 157 also at Kew. Jacobs (1964: 199) referred to a Roxburgh specimen in the Herbarium of the East India Company as the holotype of *Capparis trifoliata*. This does seem to be a specimen of *Crateva adansonii* subsp. *trifoliata*. It is mounted with another Roxburgh specimen but Jacobs made it clear that he was referring to the specimen annotated '1' on the sheet. The origins of the specimen are unknown. Nomenclaturally, *Capparis trifoliata* Roxb. represents a superfluous renaming of *Crateva religosa* and, as no type was indicated by Roxburgh, it is typified by the type of *C. religiosa* (McNeill et al., 2012: Art. 7.5). Therefore Jacob's subspecies' name also appears to be based on *Crateva religiosa*. Similarly so does '*Crateva trifoliata* (Roxb.) B.S.Sun' which has been used in recent Chinese floras (Sun, 1999; Zhang & Tucker, 2008).

However, apparently unwittingly, Jacobs (1964) effectively excluded the type of *Crateva religiosa* from *C. adansonii* subsp. *trifoliata* by recognising *Crateva religiosa* as a taxon distinct from *C. adansonii* subsp. *trifoliata* in the same paper. Such exclusion by implication is permitted under the code (McNeill et al., 2012: Art. 52.2; cf. Ex. 7). While Jacobs provided a description in English of *Crateva adansonii* subsp. *trifoliata* this is not sufficient to validate a new taxon at this date. However Jacobs also cited *Crateva erythrocarpa* Gagnep. in synonymy. This was published by Gagnepain with a Latin description. Therefore *Crateva adansonii* subsp. *trifoliata* is validated by the Latin description of *C. erythrocarpa*.

Sun (1999) also seemed to base *Crateva trifoliata* on *Capparis trifoliata* Roxb. However, Sun excluded *Crateva religiosa* G.Forst. from the flora of China, noting that the application of the name to the species used to make fish lures in Taiwan and the Ryukyus was erroneous. Therefore, like Jacobs, Sun excluded Roxburgh's nomenclatural type and effectively created a new combination at species rank based on Jacobs's subspecies. But this combination only has priority at species rank from the date of Sun's publication. Therefore the correct name at species rank is *Crateva erythrocarpa* Gagnep.

Crateva adansonii subsp. ***trifoliata*** Jacobs, Blumea 12: 199 (1964). – *Crateva trifoliata* (Jacobs) B.S.Sun, Fl. Reipubl. Popularis Sin. 32: 489 (1999). – TYPE: *W. Roxburgh* s.n. (EIC 6972C, specimen annot. 1) (holotype K-W [barcode no. K001126439]).

Crateva erythrocarpa Gagnep., Bull. Soc. Bot. France 55: 322 (1908). – TYPE: Vietnam, montagne de Chaudoc, July 1876, *F.-J. Harmand 608* (lectotype P [barcode no. P05427398], designated by Jacobs (1964: 199)).

Crateva religiosa G.Forst., Diss. Pl. Esc. 45–46 (1786). – *Capparis trifoliata* Roxb., Fl. Ind. 2: 571 (1832), *nom. illeg.*, *superfl.* – TYPE: ?India, *G. Forster* s.n. (lectotype K [barcode no. K000651081], designated by Jacobs (1964: 191)).

Roxburgh, Willdenow and Vahl all cited the Van Rheede element 'niirvala' in synonymy. This has also been considered to be a separate species, *Crateva nurvala* Buch.-Ham. Jacobs (1964: 194) effectively lectotypified the name with a Buchanan-Hamilton specimen in the Wallich Herbarium (K-W). However, as Nicolson et al. (1988) have noted, Buchanan-Hamilton did not consider his own specimens to be the true *Crateva nurvala* but a variety of it. Therefore Jacobs's typification is incorrect. Nicolson et al. (1988) stated 'However it appears that Van Rheede's illustration should be taken as the type.' It is questionable whether this is a valid typification – the opening of the sentence casts doubt making it unclear that the authors are accepting their typification. I therefore formally typify the name here. Note that after the type of a Loureiro name was refound *Crateva nurvala* was included in synonymy of *Crateva magna* (Lour.) DC. (Jacobs, 1976).

Crateva magna (Lour.) DC., Prodr. 1: 243 (1824). – *Capparis magna* Lour., Fl. Cochinch. 1: 331 (1790). – TYPE: Cochinchina, *J. Loureiro* s.n. (lectotype BM [barcode no. BM000629693], designated by Jacobs (1976: 822)).
Crateva nurvala Buch.-Ham., Trans. Linn. Soc. London 15: 121 (1827), as 'nürvala'. – TYPE: Van Rheede, Hort. Malab. 3: t. 42 (1682) (lectotype, designated here).

ACKNOWLEDGEMENTS. I am very grateful to Prof. J. McNeill (E) for guidance on nomenclatural matters and Wong Wei San (SUTD) for Chinese translation. Comments from two anonymous reviewers helped improve the paper.

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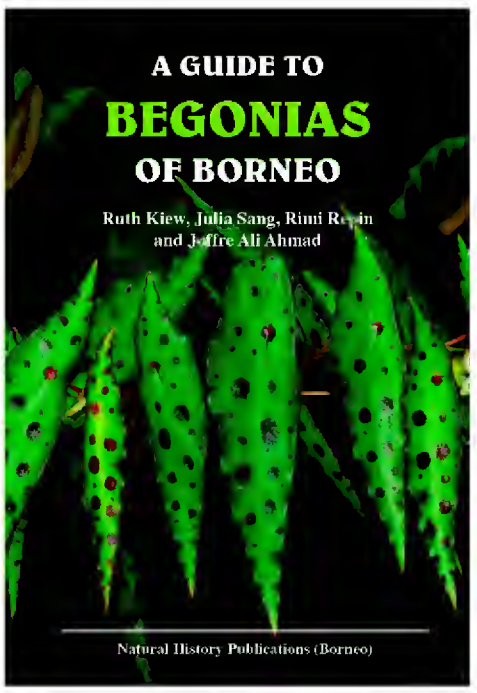
Gardens' Bulletin Singapore 67(2): 407–408. 2015
doi: 10.3850/S2382581215000332

BOOK REVIEW: **A Guide to Begonias of Borneo.** ***Ruth Kiew, Julia Sang, Rimi Repin and Joffre Ali Ahmad.*** 2015.
Kota Kinabalu: Natural History Publications (Borneo). 21.5 × 15 cm, soft or hard cover, 304 pp. ISBN 978-983-812-160-6 (softcover), ISBN 978-983-812-161-3 (hardcover). Price RM 80 (softcover), RM 140 (hardcover).



Begonias are well-known ornamentals which are cultivated for their spectacular blooms and range of leaf shapes and colouration. The diversity of the common hybrids pales, however, in comparison to the diversity of wild begonias. *Begonia* is estimated to have more than 1800 species, placing it amongst the ten largest genera of flowering plants. Some 200 species have been described from the biodiversity hot-spot of Borneo alone, but no monograph on Bornean begonias is available. Therefore, up till now detailed information on Bornean species could only be accessed by consulting an array of specialist literature. Photos capturing the stunning variation in leaf shape, colour and texture, as well as their flowers, have not been available for most Bornean species.

The authors of *A Guide to Begonias of Borneo*, together combining decades of experience of *Begonia* systematics and conservation, managed to unlock this information for anybody interested in *Begonia* and appreciative of botanical diversity and the rich natural heritage of Borneo. The guide provides a richly illustrated 25-page introduction giving concise information on previous research, diversity, typical habitats, dispersal biology, identification and conservation of Bornean *Begonia*. The main body of the guide consists of species pages, with usually two or sometimes more pages dedicated to each of the 134 featured species (c. 70% of the documented species diversity in Borneo). These species pages include (i) brief descriptions of growth habit, leaves, flowers and fruits, sometimes elaborating on unique features of the species; (ii) a full page photograph of the growth habit, usually a large photograph showing an inflorescence or a fruiting or flowering leafy branch, as well as some smaller inset detail shots of flowers and fruits; (iii) information on species distributions on Borneo, but no distribution maps, and usually also some information on habitats where the species can be found; (iv) notes on the etymology of the species epithet and, sometimes, additional information on plant usage and ethnobotany.

The descriptions are concise and use only few technical terms, making information on the species easily accessible, and the figures are of high quality. The guide does not provide an identification key to the species nor specimen-level information but, given the current rate of new species discovery, this kind of information in a static book format would soon be outdated and would be better placed in a more dynamic online database format (e.g., see the *Begonia Resource Centre* available at http://padme.rbge.org.uk/begonia/). The descriptions and figures are detailed enough, however, to aid with species identification.

The guide can serve as a beautiful coffee table book, but it is also scientifically relevant. In the introduction, the authors emphasise that every field trip in Borneo brings to light further new species of *Begonia*, and that the approximately 200 species described from the island probably represent only a fraction, possibly about one third, of the estimated total Bornean *Begonia* species diversity. Given the narrow distributions of the vast majority of Asian *Begonia* species and the rates of land conversion and deforestation in Borneo, this means that many species will likely go extinct before they have been described. In this race against time, the recent precursor papers in the Journal *Sandakania*, in which 60 new Bornean species were described, and *A Guide to Begonias of Borneo*, are key publications. These will stimulate interest in this fascinating group of plants and greatly facilitate further species descriptions and assessments of the conservation status of Bornean *Begonia*.

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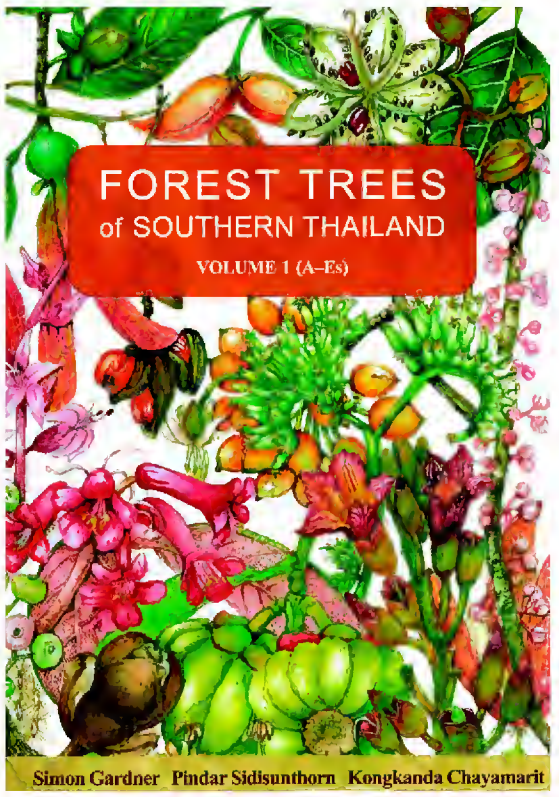
Gardens' Bulletin Singapore 67(2): 409–410. 2015
doi: 10.3850/S2382581215000344

BOOK REVIEW: **Forest Trees of Southern Thailand, Volume 1 (A–Es).** ***Simon Gardner, Pindar Sidisunthorn and Kongkanda Chayamarit.*** 2015.
Bangkok: Kobfai Publishing Project. 24 × 17 cm, hard cover, 768 pp. ISBN 978-616-7150-39-0 (English edition), ISBN 978-616-7150-43-7 (Thai edition). Price 2200 Baht.



In 2000, the remarkable book *A Field Guide to the Forest Trees of Northern Thailand* was published in both English and Thai. That book contained easy-to-use keys, simple descriptions and numerous paintings and photographs, thereby making identification of the trees of the region, and access to information about them, much simpler. It became a best seller. The same three authors have now turned their hands to a sister project, the trees of southern Thailand, again with English and Thai language editions. The biggest difference is in the sheer scale of the task: southern Thailand has a much greater number of tree species than northern Thailand and no longer will the information fit into a single volume. Indeed three volumes are planned of which the first has just been published, the second is planned for early 2016, and the third for late 2016. The commitment to excellence displayed in the northern Thailand book is again very evident in the first volume of this new work. It is both an excellent source of knowledge and simply a beautiful book to peruse.

The inside front and back covers provide an illustrated glossary of technical botanical terms (e.g. leaf type, leaf arrangement, leaf shape, inflorescence type, fruit type etc.). The opening chapter gives information on how to use the guide, how to go about identifying trees, the classification of trees into orders and families (using APG III), and how to collect parts from trees in order to identify them later. The Introduction is divided into three sections: Geography, Flora and Vegetation. The Geography section includes information on geology, topography and climate; the Flora section tells us there are at least 2250 tree species in southern Thailand, comprising about 75% of Thailand's total, as well as how geographical and historical factors have led to such species richness in the region; and the Vegetation section guides us through the major forest types and their major floristic compositions. Black and white photos and drawings abound to illustrate the text.

The bulk of the book, however, is given over to the systematic presentation of the trees of southern Thailand. The arrangement is alphabetical by family, then alphabetical by genus within each family, and then alphabetical by species within each genus. Keys are provided to the genera within a family and to the species within a genus for the larger genera. For the larger families spot characters are given for the genera to aid identification. Families, genera and species are described, with diagnostic characters highlighted in bold type. But this is no ordinary Flora, as more than half of almost every page of the volume is devoted to colour photographs, line drawings

and paintings of trees. The authors recommend various ways of using the information contained within the volume to identify trees, including just flicking through and looking at the pictures. As a professional botanist myself, used to using weighty academic Floras, I have lost count of the number of times that I have fruitlessly been attempting to identify something and wished I could just look at pictures. This guide to southern Thai trees gives us both licence and opportunity to indulge in such activities!

The first volume includes all plant families from Acanthaceae to Escalloniaceae so includes major families such as Annonaceae, Apocynaceae, Burseraceae, Combretaceae and Ebenaceae. And, of course, it has the Dipterocarpaceae, the characteristic family of Asian tropical forests. Eight genera and over 70 species are covered in the book from this family alone, with photographs and drawings of whole trees, bark, leaves, flowers and fruits for most of them.

Inevitably in a project of such scale not all identifications are correct. For example, Johnson & Murray's paper on *Xylopia* in this issue of *Gardens' Bulletin Singapore* notes that there are two misidentifications in this genus. At the same time, however, the *Xylopia* paper draws our attention to an extremely positive aspect of the wider project that resulted in this book. A vast amount of field work was necessary to collect and photograph the species in this volume and those collections are, and will continue to be, available for taxonomic study. Johnson & Murray's study of the collection accompanying the photos of the incorrectly identified *Xylopia vielana* led to the description of a new species, *Xylopia platycarpa*. Perhaps more such examples will arise, particularly in those families not yet completed for the *Flora of Thailand*. Nevertheless, it is abundantly clear that the authors have striven hard to produce a work of botanical accuracy as well as aesthetic appeal and a small number of misidentifications is an inevitable consequence of such an ambitious project. The authors are to be commended for having that ambition and seeing it to fruition.

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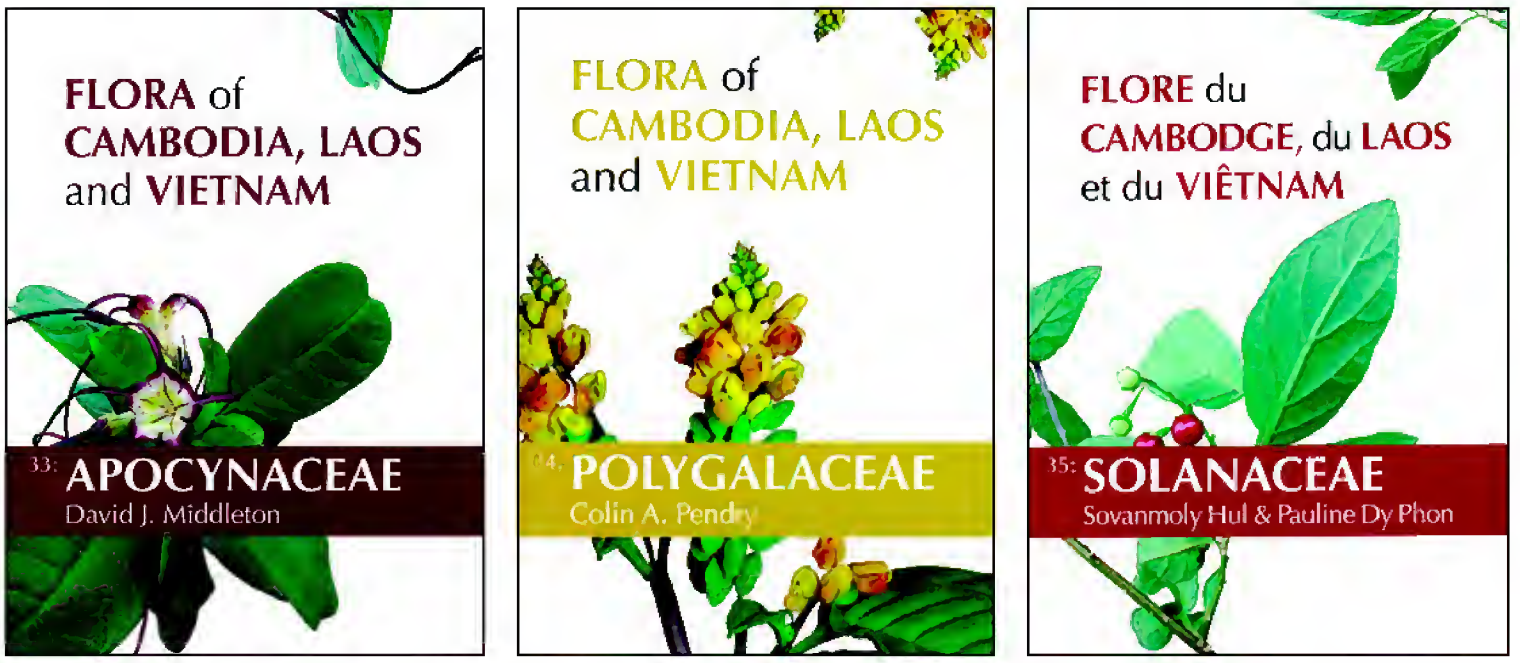
Gardens' Bulletin Singapore 67(2): 411–414. 2015
doi: 10.3850/S2382581215000356

BOOK REVIEW: **Flora of Cambodia, Laos and Vietnam**
Fascicle 33 Apocynaceae *by* ***David J. Middleton.*** 2014.
(288 pages, 48 colour photographs, 48 line drawings; paperback; text in English; 160 × 240 mm. ISBN 978-2-85653-751-0. £35 incl. packing & postage)
Fascicle 34 Polygalaceae *by* ***Colin A. Pendry.*** 2014.
(72 pages, 14 colour photographs, 5 line drawings; paperback; text in English; 160 × 240 mm. ISBN 978-2-85653-752-7. £15 incl. packing & postage)
Fascicle 35 Solanaceae *by* ***Sovanmoly Hul & Pauline Dy Phon.*** 2014.
(104 pages, 29 colour photographs, 25 line drawings; paperback; text in French; 160 × 240 mm. ISBN 978-2-85653-750-3. £20 incl. packing & postage)
Paris: Publications scientifiques du Muséum national d'Histoire naturelle & Edinburgh: Royal Botanic Garden Edinburgh.



It has been ten years, a whole decade, after the publication of the last issue of the *Flore du Cambodge, du Laos et du Viêtnam* (Flora of Cambodia, Laos and Vietnam, or FCLV), a project begun by André Aubréville in 1960 to succeed *La Flore générale de l'Indochine* (The General Flora of Indochina) coordinated by H. Lecomte & H. Humbert during 1907–1934, and H. Humbert until 1951. That last issue was Fascicle 32, Myrsinaceae, by Chi Ming Hu & Jules Vidal, issued in December 2004.

The new issues are Fascicle 33 (Apocynaceae, by David J. Middleton, in English), Fascicle 34 (Polygalaceae, by Colin A. Pendry, in English), and Fascicle 35 (Solanaceae, by Sovanmoly Hul & Pauline Dy Phon, in French), all issued in December 2014.

These finely produced issues not only welcome back a key regional project after a hiatus but also see a redoubled organisation and collaboration to engage more specialists in what is the longest-running international science endeavour in the Cambodia, Laos and Vietnam (CLV) region. The added use of English as an alternative language will certainly make the revisions more amenable to potential contributors as well as more accessible to users of floras.

It is easy to see why botanists have been attracted to this region and perhaps also fairly easy to understand why efforts at the documentation of the plant life have

not been on a dauntless path since the Portuguese Jesuit missionary João de Loureiro published the *Flora Cochinchinensis* in 1790. Loureiro's work was an extension of his interest in local medicinal plants after spending 35 years, mostly as chief mathematician and naturalist, in the service of the King of Cochinchina, a region in the southern third of modern Vietnam that included Saigon and Hue, and at some later point a French colony (Merrill, 1935). Loureiro's specimen collections, which would have been important reference material, were partly destroyed, and his plant descriptions were very brief and, understandably, often ambiguous or unclear. The CLV region has been, and is still to a large degree, a landscape difficult to traverse: initially because of thick vegetation cover, disease and mountainous terrain in many parts, and latterly still with the risk posed by landmines from the 20th century war years that riddle parts of the landscape. The relative isolation of mainland SE Asia caused by the Miocene uplift of the Himalayas, connectivity with the Chinese Henduan Mountains to the northwest and the main South Chinese karst region to the north, general climatic distinction from the wetter tropical region of Malesia to the south, as well as emergence through episodes of climatic oscillations, geological changes and vegetation range expansions and contractions, have been important biogeographic features that have shaped a very rich and special biota. Loureiro's work was important but can be difficult to relate to other pioneering botanical work with floristic overlaps in the region, especially when specimen material is lacking or poorly referenced. The trauma of the Second World War and subsequent political realignments and regional conflicts would stretch the pause in scientific research into the 1990s. And, meanwhile, floristic and other progress has raced on around the CLV region. It is not surprising that the CLV flora remains one of the poorest explored and documented, complex to tackle even for the specialist, and for which much painstaking research is now required.

Economic reforms and the opening up of the CLV region have brought its countries into wider collaboration with outside botanical institutions. The early French effort, fostered much through the collecting activities of such as Balansa, Chevalier, Eberhardt, Harmand, Pételot, Pierre, Schmid, Thorel, Vidal, and Poilane, brought in some 75,000 specimen collections (Regalado et al., 2005); probably now over 30,000 collections have been added through collaborative programmes since the 1990s. Encumbered by so many historical factors, it is still most meaningful to approach the flora of this block of mainland SE Asia with a single definitive regional flora—even if each country uses a different language and, as faster progress on the Vietnamese front demonstrates, there is a local need to produce national floras, such as the *Flora of Vietnam* series (in Vietnamese) initiated through the Hanoi-based Institute of Ecology & Biological Resources (which can emphasize conservation efforts more directly), and checklists, as in the 3-volume *Checklist of Plant Species of Vietnam* (in Vietnamese) produced through the Vietnam National University in Hanoi. In the end, all checklists and floras will be subject to revision—some more intensively than others—as further exploration, collecting and revision will show. In this regard, even a number of earlier FCLV accounts are ripe for revision, although tackling these should subsequently be more systematic and easier given its regional scope. Even with a shift towards online floras that are more easily updated as parts are made available,

continuing the printed version of the FCLV is not without merit. It is one thing being able to access websites with a good satellite cellphone from just about anywhere, and another to afford sufficient and up-to-date computer equipment and software to carry out sustained flora work that could make reference to the results of the published revisions. Moving the taxonomic inventory into many locations on mainland SE Asia, and encouraging sustained local efforts at continuing documentation (the Flora is *not* an end-point), is not devoid of challenges.

The present treatment of **Apocynaceae** for Fasc. 33 (38 genera, 119 native spp.) revises only two subfamilies, Rauvolfioideae and Apocynoideae, and does not cover the other three subfamilies which have been traditionally included in the Asclepiadaceae. No genus is overly represented, with the largest mostly 6–10 spp., but more than half of the species are native climbing species, including some big lianas. Seventeen species are endemic to the region, most of them in Vietnam. Another 12 commonly cultivated species are also identified. In all, this Apocynaceae treatment includes 109 species for Vietnam, 64 species for Laos, and 49 species for Cambodia.

In Fasc. 34, **Polygalaceae** (5 genera, 43 spp.) includes the cosmopolitan *Polygala* (over 500 spp., 22 spp. in CLV), the largest genus in this family of c. 1000 species. Nine species are endemic to the region, again mostly in Vietnam and especially in *Xanthophyllum*. There are 34 species known in Vietnam, 28 species in Laos, and 16 species in Cambodia. The life form coverage is interesting; besides herbs, shrubs, trees and lianas, there is also the diminutive myco-heterotrophic *Epirixanthes elongata*, which is an easily overlooked inhabitant of the forest floor but otherwise a widespread taxon ranging from E India to S China and Moluccas.

Fasc. 35 presents the **Solanaceae** (8 genera, 48 spp. including *Solanum camranhense* Dy Phon & Hul newly published in the revision) and includes *Solanum*, the largest genus in the family (c. 1500 spp., 34 spp. in CLV). In CLV all *Capsicum, Cestrum, Datura, Lycium, Nicotiana* and *Physalis* species, along with numerous *Solanum* species, are introduced from the New World: they include weeds as well as major and minor crops. Only five species are apparently endemic to the region. There are 41 species known in Vietnam, 29 species in Laos, and 23 species in Cambodia.

Standard inclusions for all three revisions are a concise introduction with notes on taxonomy, diversity, morphology, palynology, karyology and pertinent biological aspects as known, uses, keys (to genera, and also to species) and detailed descriptions of all taxa, with notes on ecology and distribution. Citations of specimens studied are provided. The descriptions in Polygalaceae and Solanaceae are of about maximum length compared to past revisions in the FCLV, but the Apocynaceae treatment includes some lengthy descriptions in a number of cases. For Solanaceae, good notes are given on the local use of numerous species and at the end of the volume there is an index of vernacular names in different native languages. There are a good number of rather exquisite line illustrations in the Apocynaceae (48 by Alain Jouy) and Solanaceae (25 by Dominique Storez and Alain Jouy) issues, but far fewer for Polygalaceae (only five by Holly Somerville); the inclusion of colour images of species as plates in the final section of each issue is helpful (8 plates for 38 spp. in Apocynaceae, 4 for 8 spp. in Polygalaceae, 7 for 16 spp. in Solanaceae). The presentation of genera is alphabetical

for Apocynaceae but not so for the other two revisions. Printing quality is excellent but the text font style tends to deliver a somewhat faint print.

Overall, these have been excellently produced. The FCLV is well off on its second leg.

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The Gardens' Bulletin
Singapore

VOL. 67 2015 **ISSN 0374-7859**

VOLUME 67

No. 1 pages 1–252 (printed version published 4 June 2015)
No. 2 pages 253–414 (printed version published 23 December 2015)

THE GARDENS' BULLETIN, SINGAPORE

The ***Gardens' Bulletin, Singapore*** is a peer-reviewed journal publishing *original papers* and *reviews* on a wide range of subjects: plant taxonomy (including revisions), phytogeography, floristics, morphology, anatomy, as well as horticulture and related fields, such as ecology and conservation, with emphasis on the plant life of the Southeast Asian-Pacific region.

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Printed by **Oxford Graphic Printers Pte Ltd**

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