

New records and rediscoveries of plants in Singapore

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ABSTRACT. The city-state of Singapore continues to provide many new records and rediscoveries of plant species in its nature reserves, offshore islands and secondary forests. Eleven new records for Singapore and eight rediscoveries of species previously presumed nationally extinct are reported here along with national conservation assessments. The new records are *Albertisia crassa* Forman, *Arcangelisia flava* (L.) Merr., *Chaetocarpus castanocarpus* (Roxb.) Thwaites, *Dendrokingstonia nervosa* (Hook.f. & Thomson) Rauschert, *Dipterocarpus chartaceus* Symington, *Haplopteris sessilifrons* (Miyam. & H. Ohba) S.Linds., *Hewittia malabarica* (L.) Suresh, *Phyllanthus reticulatus* Poir., *Spermacoce parviceps* (Ridl.) I.M.Turner, *Sphaeropteris trichodesma* (Scort.) R.M.Tryon and *Uvaria micrantha* (A.DC.) Hook.f. & Thomson. The rediscoveries are *Callerya dasyphylla* (Miq.) Schot, *Cocculus orbiculatus* (L.) DC., *Lecananthus erubescens* Jack, *Loeseneriella macrantha* (Korth.) A.C.Sm., *Mapania squamata* (Kurz) C.B.Clarke, *Plagiostachys lateralis* (Ridl.) Ridl., *Scolopia macrophylla* (Wight & Arn.) Clos and *Spatholobus maingayi* Prain ex King.

Keywords. Annonaceae, conservation assessments, Celastraceae, Cyatheaceae, Cyperaceae, Dipterocarpaceae, Fabaceae, Menispermaceae, Peraceae, Phyllanthaceae, Pteridaceae, Rubiaceae, Salicaceae, Sapindaceae, Zingiberaceae

Introduction

Although the plant diversity of Singapore is better known than many other countries in the region (Niissalo et al., 2014), records of species previously unknown in Singapore continue to be found (e.g. Chia et al. 2017; De Kok, 2017; Niissalo & Leong-Škorničková, 2017; Chong et al., 2018) and species thought to be nationally extinct

(Davison et al., 2008; Chong et al., 2009) are rediscovered (Leong et al., 2017; Loo et al., 2017; Chong et al., 2018; Lim et al., 2018). Here we present eleven previously unreported new records for Singapore and eight rediscoveries of species previously presumed nationally extinct. We also apply standard criteria (see Davison, 2008a, 2008b) to derive a national conservation assessment for each species.

New records

Of the eleven new species records, ten are very likely to be native while one (*Hewittia malabarica* (L.) Suresh) is possibly a recent introduction.

1. *Albertisia crassa* Forman (Menispermaceae) (Fig. 1A–C)

This species has previously been reported only from Peninsular Malaysia (Forman, 1986). Collected in Singapore for the first time in 2010, this liana is now known to be widespread in the Central Catchment Nature Reserve (Fig. 1A). No flowering plants have yet been observed but, of the three species of *Albertisia* Becc. known in Malesia (Forman, 1986), only *Albertisia crassa* and *Albertisia papuana* Becc. are found below 1200 m and, of these, only *Albertisia crassa* has bullate leaves when dry. The pronounced bullate leaves, together with its size, shape and venation, quickly differentiate this species from the other Menispermaceae species of Singapore even when sterile (Fig. 1B & C). Several plants have been collected for cultivation at the Native Plant Centre, Pasir Panjang Nursery.

National conservation assessment. Endangered.

Specimens examined. SINGAPORE: **Central Catchment Nature Reserve:** Mandai Track 15 Forest, 9 Mar 2010, *Gwee SING 2010-504* (SING [SING0144687]); MacRitchie, 9 Oct 2014, *Leong et al. MR 2014-055* (SING [SING0212453]).

2. *Arcangelisia flava* (L.) Merr. (Menispermaceae) (Fig. 2)

This species has been reported from Hainan, continental Southeast Asia and throughout Malesia (Forman, 1986) although no material was previously known from Singapore. Recently, a flowering specimen was collected from a single individual on Pulau Tekong, in coastal forest facing the sea, although most of the flowers were still in bud (Fig. 2). In order to lend support to our generic identification based on morphology, two gene regions, trnL-trnF and ITS1-2, were sequenced and compared to sequences submitted to GenBank. The specimen is embedded in the genus *Arcangelisia* Becc. in distance analyses. The new sequences were submitted to GenBank. Based on descriptions in Forman (1986), *Arcangelisia flava* can be distinguished when sterile by a combination



Fig. 1. *Albertisia crassa* Forman. **A.** Individuals in the understorey of Nee Soon Swamp Forest. **B.** Habit. **C.** Dried specimen, showing bullate leaves characteristic of species. B & C from Leong et al. MR 2014-055. (Photos: A, R.C.J. Lim; B & C, P.K.F. Leong)

of the following characters: stems with discoid petiole scars, petiole attachment marginal, petioles swollen on both ends, petioles geniculate at base, having domatia or glandular patches in the basal or secondary vein axils, upper surface of leaf papillose over insertion of petiole, leaves palmately 5-veined at the base and with 1–3 pairs of secondary veins usually arising from above halfway along the midrib, secondary veins prominent especially below, both surfaces usually drying matt with a rather obscure reticulum. *Arcangelisia flava* is now being propagated from stem cuttings at the Native Plant Centre, Pasir Panjang Nursery.

National conservation assessment. Critically Endangered.

Specimens examined. SINGAPORE: **Pulau Tekong:** Tg. Renggam, 3 Aug 2017, Lua & Hassan SING 2017-336 (SING [SING0239566, SING0239567]); *ibid.*, SING 2017-427 (SING [SING0239568]).

3. *Chaetocarpus castanocarpus* (Roxb.) Thwaites (Peraceae, formerly Euphorbiaceae)

Chaetocarpus Thwaites is a pantropical genus consisting of c. 11 species. In Continental Southeast Asia and Malesia only *Chaetocarpus castanocarpus* occurs, a species that can live in a great variety of habitats at low altitude and which can be

locally common. Van Welzen (1994) noted that it was absent from Singapore but, in 2017, he recognised a single specimen at SING that had been collected in Seletar in 1894. *Chaetocarpus castanocarpus* is generally a (tall) tree with groups of light yellow flowers in the leaf axils and yellow, globose fruits that are completely covered by stiff, stinging hairs. Once the fruit wall splits and falls away, three shiny black seeds on a stalk (columella) become visible, each with a small fleshy aril apically. The flowers are either staminate or pistillate. The staminate flowers lack all but one petal and the stamens are united and branch off in two layers from an androphore. The pistillate flowers have a densely hairy ovary and three stigmas that are almost completely split and which have dendritic papillae on top to collect the pollen. The species is probably extinct in Singapore, but may return as the species is not habitat critical. A barrier might be seed dispersal over long distances as the species is probably self-dispersing over short distances through its explosive fruits and then ants may add short distances if the aril acts as an eleiosome.

National conservation assessment. Extinct.

Specimens examined. SINGAPORE: **Seletar**: Apr 1894, *Ridley* 6222 (SING [SING0206955]).

4. *Dendrokingstonia nervosa* (Hook.f. & Thomson) Rauschert (Annonaceae)

The genus *Dendrokingstonia* Rauschert was, until recently, monotypic and *D. nervosa* its only species. *Dendrokingstonia* was revised by Chaowasku et al. (2012), who recognised two additional species and reported *D. nervosa* as endemic to Peninsular Malaysia. The genus is primarily characterised by the presence of only a single carpel per flower whereas most Annonaceae have a flower with two or more carpels (Chaowasku et al., 2012). The record of *Dendrokingstonia nervosa* from Singapore represents a southward extension of its distribution from Melaka. The specimen was collected in Bukit Timah Nature Reserve in 2010. It is a small tree with glabrous, elliptic to slightly oblong leaves. The flowers are borne in axillary fascicles on bare twigs where the leaves have fallen off. The specimen shows up to five flowers per inflorescence with an inconspicuous peduncle. All parts of the inflorescence and flower have appressed tomentose hairs. Without flowers or fruits, a leafy twig resembles species from the genus *Monoon* Miq., which could be the reason why this species has previously been overlooked in Singapore.

National conservation assessment. Critically Endangered.

Specimens examined. SINGAPORE: **Bukit Timah**: 8 Oct 2010, *Woon* SING 2010-865 (SING [SING0153601]).

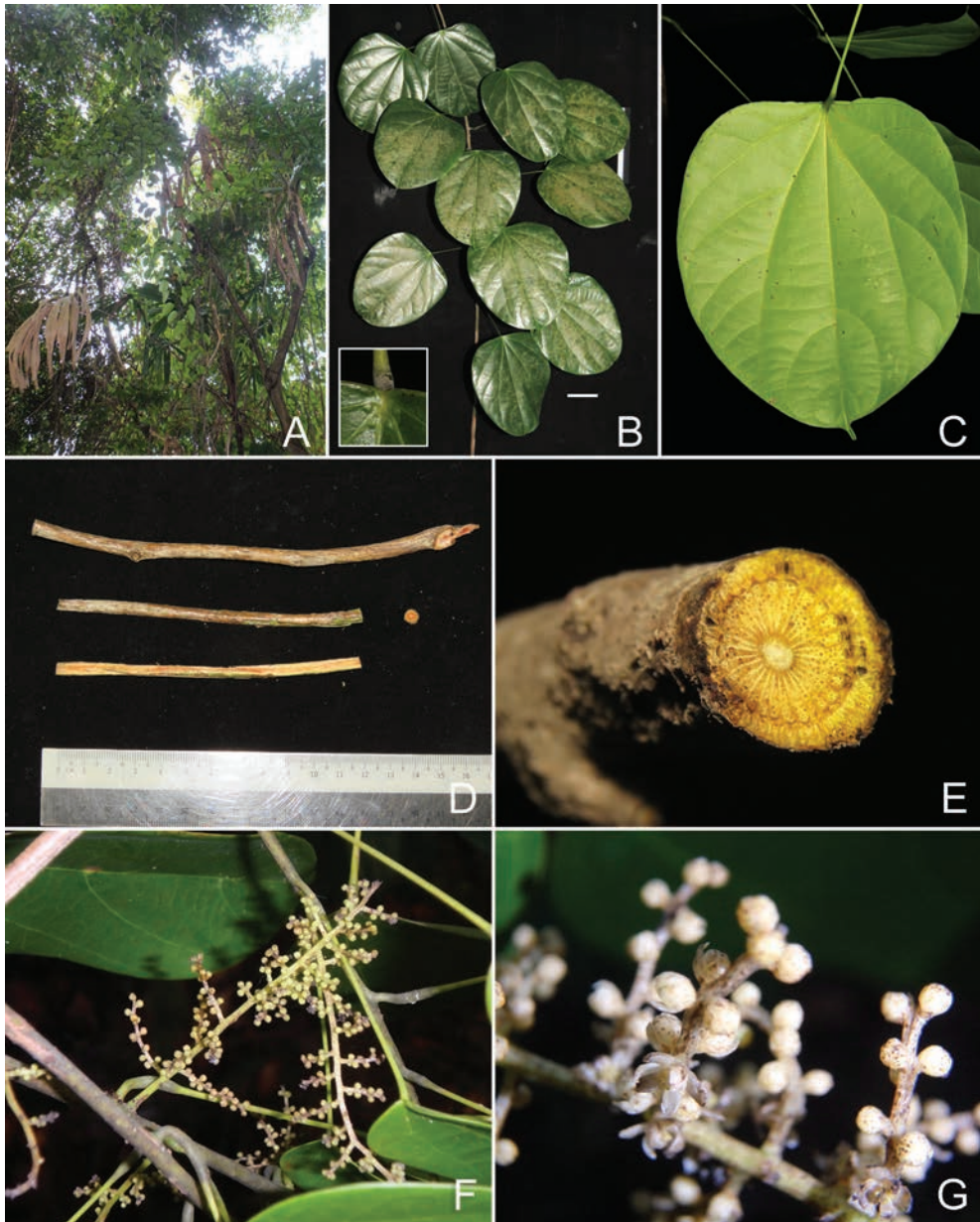


Fig. 2 *Arcangelisia flava* (L.) Merr. **A.** Habit. **B.** Upper side of laminas (inset: domatia or glandular patches in basal nerve axils characteristic of species) (scale bar 6 cm). **C.** Under side of lamina. **D.** Young stem section showing longitudinal and cross section. **E.** Cross section of mature stem. **F.** Inflorescence. **G.** Male flowers. All from *Lua & Hassan SING 2017-336, SING 2017-427*. (Photos A, F & G: H.K. Lua; B–E: R.C.J. Lim)

5. *Dipterocarpus chartaceus* Symington (Dipterocarpaceae)

Species in the genus *Dipterocarpus* C.F.Gaertn. can usually be identified even when sterile (Symington et al., 2004). The combination of scaly-fissured bark and the crisp, papery dried leaves of sterile specimens collected in Singapore allows for unambiguous identification as *Dipterocarpus chartaceus*. The specimens were collected from a coastal habitat that matches the ecological information given for this species by Ashton (1982) and Symington et al. (2004). *Dipterocarpus chartaceus* is known to be distributed from Peninsular Thailand (Pooma et al., 2017) to southern Johor in Peninsular Malaysia (Symington et al., 2004). The discovery in Singapore represents the southern-most distribution of this species. In Singapore only two mature individuals at a single locality are known.

National conservation assessment. Critically Endangered.

Specimens examined. SINGAPORE: Precise locality withheld, 13 Jul 2010, *Lua SING 2010-800* (SING [SING0146706]); *ibid.*, 19 Apr 2012, *Lua & Davison SING 2012-115* (SING [SING0173581]).

6. *Haplopteris sessilifrons* (Miyam. & H.Ohba) S.Linds. (Pteridaceae subfam. Vittarioideae)

This small epiphytic fern has previously been recorded from Peninsular Malaysia “and possibly Borneo” (Lindsay & Middleton, 2015) but not from Singapore. This new record is not based on any new collections but on two old specimens housed at the Royal Botanic Garden Edinburgh that were labelled and filed as “*Vittaria ensiformis* Sw. var. *latifolia*”. This variety was described by Holttum (1955) based on several Malaysian collections but because he failed to give a diagnosis or description in Latin (which was a requirement at that time) the name *Vittaria ensiformis* var. *latifolia* was not validly published. The currently accepted name for *Vittaria ensiformis* var. *latifolia* is *Haplopteris sessilifrons* (Miyam. & H.Ohba) S.Linds. (Lindsay & Middleton, 2015). *Haplopteris sessilifrons* has simple, linear, sessile fronds that are somewhat intermediate between the wide stipitate fronds of *Haplopteris elongata* (Sw.) E.H.Crane and the narrow sessile fronds of *Haplopteris ensiformis* (Sw.) E.H.Crane, both of which are native and extant in Singapore. The two specimens in Edinburgh (which appear to represent two plants) were collected in “Seletar Swamp Forest behind Nee Soon Village” in 1948. This locality is probably long gone, but, with Nee Soon swamp forest nearby, and evidence that *H. sessilifrons* is not restricted to swamp forests in Malaysia, there remains a possibility of rediscovering this species in Singapore.

National conservation assessment. Extinct.

Specimens examined. SINGAPORE: **Seletar:** Swamp forest behind Nee Soon Village, 2 Oct 1948, *Sinclair s.n.* (E [E00126879]), 5175 (E [E00126881]).

7. *Hewittia malabarica* (L.) Suresh (Convolvulaceae) (Fig. 3)

This species has been reported from tropical Africa, India, Sri Lanka, continental Southeast Asia, and throughout Malesia to the Pacific Islands (Staples, 2010) but no material was previously known from Singapore. Recently, a flowering and fruiting individual was discovered climbing on a tree at the edge of secondary forest in Mandai, off Mandai Lake Road. It had cream-coloured flowers with maroon throats and fruits at various stages of development, including some ripe brown ones (Fig. 3). Seeds were collected for propagation at the Native Plant Centre, Pasir Panjang Nursery although there is some uncertainty as to whether *Hewittia malabarica* is native to Singapore or a recent introduction (G. Staples, pers. comm.).

National conservation assessment. Data Deficient.

Specimens examined. SINGAPORE: **Mandai:** Mandai Lake Rd, 29 Nov 2017, *Lua et al.* SING 2017-693 (SING [SING0232226]).

8. *Phyllanthus reticulatus* Poir. (Phyllanthaceae, formerly Euphorbiaceae)

Phyllanthus L. is a common pantropical genus of perhaps 800 species, including herbs and woody plants. *Phyllanthus reticulatus* is one of the most widespread woody species in tropical and subtropical Asia, occurring from India to China and Australia. It is also common in the Malay Peninsula but has not previously been collected in Singapore. The species grows as a shrub or small tree and is quite easy to recognise by the elliptic leaves with obtuse to rounded base and apex, and by the baccate fruits 4–9 mm long with numerous (often 8–10) locules, solitary in the leaf axils. These characters are uncommon in Southeast Asian *Phyllanthus*. This species can be confused with *Breynia* J.R.Forst. & G.Forst. (which has a 3-locular fruit and the sepals are fused, whereas they are free in *Phyllanthus*) and *Flueggea* Willd. (which has obovate leaves and several 3-locular fruits per node). The pubescence of most parts and the leaf size are quite variable in *Phyllanthus reticulatus* (also the fruit size to a certain degree) which has led some authors (e.g. Chantharanonthai, 2007; Luo et al., 2011) to divide it into two or three species. The various authors, however, based their species concepts on different characters. The plant from Singapore belongs to the typical species. It is most likely not threatened even in Singapore but simply overlooked.

National conservation assessment. Data Deficient.

Specimen examined. SINGAPORE: **Bukit Timah:** 10 Feb 2015, *Leong et al.* SING 2015-049 (SING [SING0213643]).

9. *Spermacoce parviceps* (Ridl.) I.M.Turner (Rubiaceae)

The genus *Spermacoce* L. has over 275 species (Govaerts et al., 2018) mainly in the tropics of the Old and New Worlds. Most of them are rather weedy and several of the species found in Singapore are naturalised exotics (Chong et al., 2009). One native species, *Spermacoce parviceps*, has long been overlooked as the material in SING had previously been wrongly assigned to other species. The seed coat is deeply pitted, easily separating it from the shallower seed coat reticulation of the other *Spermacoce* species in Singapore. Also the hairs on the leaves are much longer than those of the other species. As it has not been collected since 1955, even though it is a new national record for Singapore, it must also be considered nationally extinct.

National conservation assessment. Extinct.

Specimens examined. SINGAPORE: **Telok Paku:** 25 Dec 1922, *Burkill SFN 10012* (SING [SING0072751]). **Bedok:** 18 Jun 1955, *Sinclair SFN 40640* (SING [SING0072753]).

10. *Sphaeropteris trichodesma* (Scort.) R.M.Tryon (Cyatheaceae) (Fig. 4)

This tree fern, which can have trunks up to 4.5 m tall and fronds up to 3.5 m long, has been reported from Peninsular and Eastern Malaysia (Sabah and Sarawak) but has not previously been published as occurring in Singapore (it was, however, mentioned in a blog post by Lai (2016) under the synonym *Cyathea trichodesma* (Scort.) Copel. and inadvertently accompanied by a photograph of a similar species). *Sphaeropteris trichodesma* has been collected twice in MacRitchie Reservoir Park, once in 2009 and again in 2018 (Fig. 4). In Holttum (1955) it was included for Borneo and Malaya as “*Cyathea burbidgei*” (non (Bak.) Copel.), a name synonymised under *Cyathea trichodesma* in Holttum (1963). Holttum (1955) suggested that *Cyathea trichodesma* (“*Cyathea burbidgei*”) is very close to *Cyathea squamulata* (Blume) Copel. (now *Sphaeropteris squamulata* (Blume) R.M.Tryon), also native in Singapore, and could possibly be regarded as a variety of that species. He distinguished them mainly by the pubescence of their secondary rachises, costae, costules and veins; those of “*C. burbidgei*” bearing many long pale spreading hairs beneath, while those of *C. squamulata* are not hairy beneath. He also noted that “*C. burbidgei*.... occurs in those areas [of Borneo and Malaya] where *C. squamulata* has not been found” but this is not the case in Singapore as the 2018 collection was found growing together with *Sphaeropteris squamulata*. That said, it should be noted that some tree ferns were salvaged from a natural population in Mandai in 2009 and used for a streambank restoration project in MacRitchie where both collections of *Sphaeropteris trichodesma* were made. It is not, therefore, known whether the two species were quite as inter-mixed as they are now. The discovery of *Sphaeropteris trichodesma* in Singapore brings the number of extant native tree fern species to three. All were traditionally included in the genus *Cyathea* but under the generic concepts proposed by the Pteridophyte

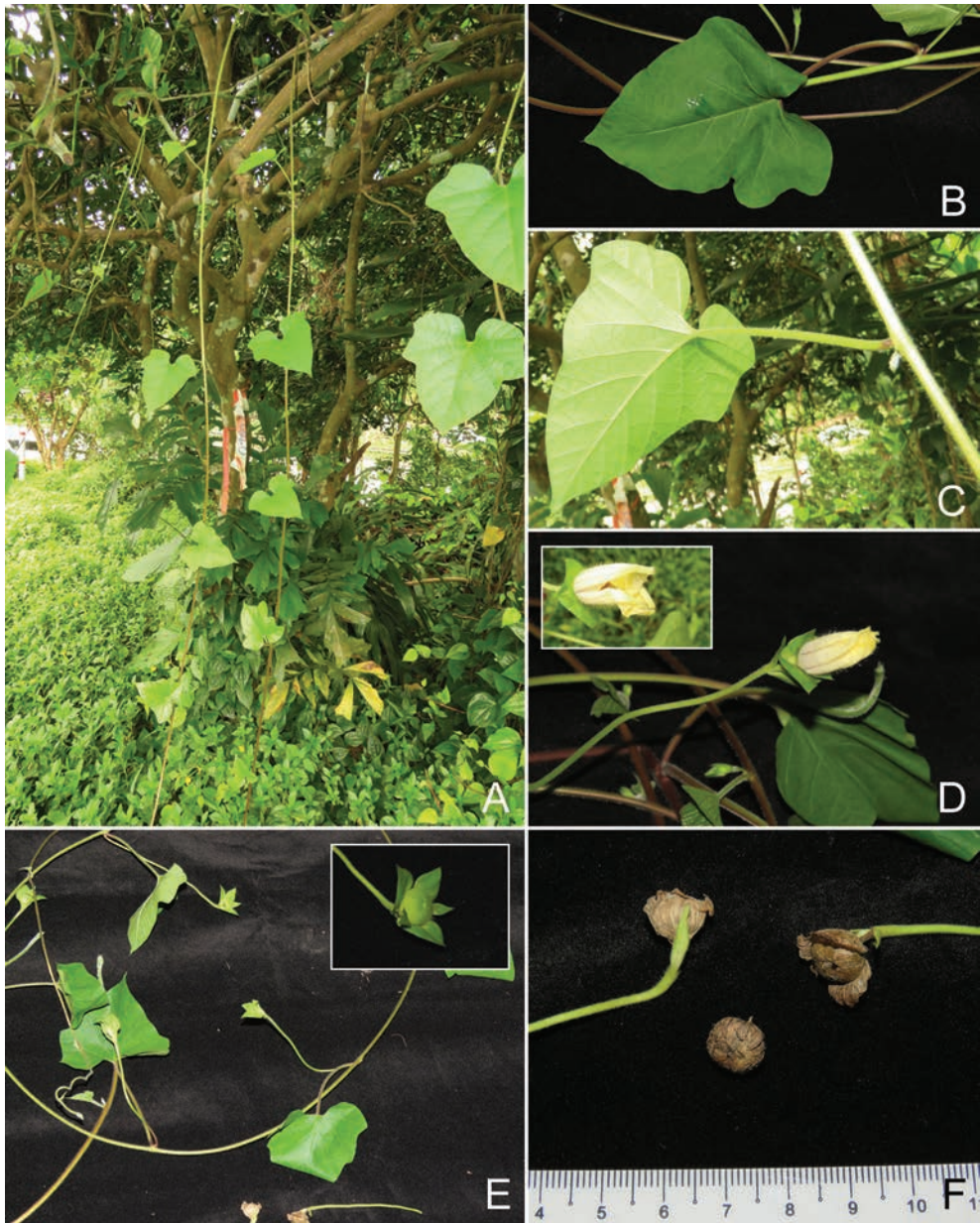


Fig. 3. *Hewittia malabarica* (L.) Suresh. **A.** Habit. **B.** Upper side of lamina. **C.** Under side of lamina. **D.** Closed flowers (inset: close-up of closed flower showing maroon throat). **E.** Immature fruits (inset: hairy fruit). **F.** Mature fruits. All from *Lua et al. SING 2017-693*. (Photos: R.C.J. Lim)

Phylogeny Group (PPG I, 2016), one is now in *Alsophila* R.Br. and the other two are in *Sphaeropteris* Bernh.



Fig. 4. *Sphaeropteris trichodesma* (Scort.) R.M.Tryon. **A.** Undersurface of pinna. **B.** Very scaly stipes. **C.** Undersurface of lamina showing sori with long paraphyses and costule and smaller veins bearing long spreading hairs. *Sphaeropteris squamulata* (Blume) R.M.Tryon. **D.** Undersurface of lamina showing sori with long paraphyses and costule and smaller veins without long spreading hairs. A–C from Lindsay *et al.* SING 2018-041 (SING); D from Lindsay *et al.* SING 2018-042 (SING). (Photos A, B,C. Ho; B, X.Y. Ng; C & D, S. Lindsay from dried herbarium specimens with the hairs more crumpled than when fresh)

National conservation assessment. Critically Endangered.

Specimens examined. SINGAPORE: **Central Catchment Nature Reserve:** MacRitchie Reservoir Park, Petaling Trail, 3 Sep 2009, *Tan TSY2009-49* (SING [SING0147029]); *ibid.*, 19 Jan 2018, *Lindsay et al. SING 2018-043* (SING [SING0239588, SING0239589, SING0239590]).

11. *Uvaria micrantha* (A.DC.) Hook.f. & Thomson (Annonaceae)

This species has a wide distribution ranging from Myanmar and the Andaman Islands (India) and throughout Malesia to North Australia (Utteridge, 2000). *Uvaria micrantha* has not been previously reported from Singapore, but its occurrence in the neighbouring Malaysian state of Johor has been noted by Sinclair (1955). Two specimens, including a flowering branch, were collected on Pulau Ubin, Singapore, in 2003. *Uvaria micrantha* can be readily identified based on a combination of characters: a lianescent growth habit, the presence of compound hairs in tufts which branch directly from the epidermis level (caespitose hairs) intermixed with simple hairs on the young branches, short petioles (2–4 mm long), relatively small leaf laminae (2.5–15 × 2–8 cm; in the Singaporean material only to 2.9 cm wide), globose flower buds, small flowers with red, orange or yellow-green petals (4–6 mm long), usually 2-flowered inflorescences, and small monocarps (10–20 × 10 mm) with short stipes (3–12 mm long) (for species descriptions, see Utteridge, 2000; Attanayake, 2010; Turner, 2012).

National conservation assessment. Critically Endangered.

Specimens examined. SINGAPORE: **Pulau Ubin:** Chek Jawa, 28 Jan 2003, *Gwee et al. GAT196* (SING [SING0043106]); *ibid.*, 7 Oct 2003, *Gwee et al. GAT370* (SING [SING0047715]).

Rediscoveries

Here we report the rediscovery of eight species previously presumed to be extinct in Singapore (Davison et al., 2008; Chong et al., 2009).

1. *Callerya dasyphylla* (Miq.) Schot (Fabaceae) (Fig. 5)

This species, previously known as either *Millettia maingayi* Baker or *Padbruggea maingayi* (Baker) Dunn, was collected in Singapore between 1892 and 1899, all naturally occurring in Singapore Botanic Gardens (Ridley, 1900, 1922). It was next collected in 2003 but the specimen lacks much crucial data, including a locality within Singapore and who made the collection. The latest collection was made during a survey of Pulau Ubin at Bukit Jelutong in 2014, in an area with large boulders (Fig. 5). The individual was a large climber in flower with peeling bark, a diagnostic feature of the

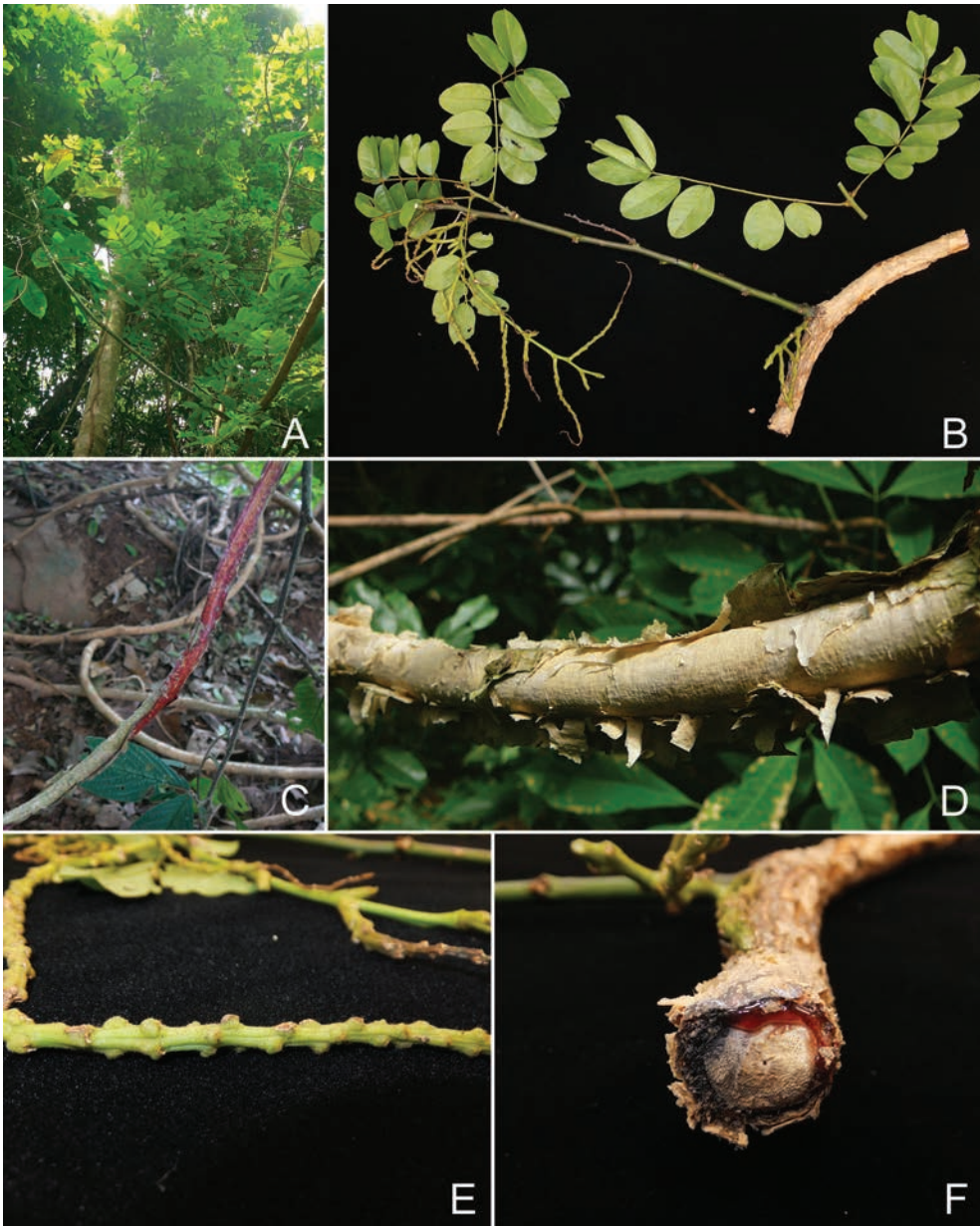


Fig. 5. *Callerya dasyphylla* (Miq.) Schot. **A.** Habit. **B.** Fresh specimen. **C.** Young reddish stems. **D.** Mature woody stems. **E.** Green inflorescence axes. **F.** Red exudate from cut stems. All from Ali Ibrahim *et al.* PU 2014-017. (Photos: A, C & D, S.L. Koh; B, E & F, B.C. Ho)

species (Schot, 1994). The cut stem exuded red sap and the axes of the inflorescence were densely hairy and swollen at the nodes.

National conservation assessment. Critically Endangered.

Specimens examined. SINGAPORE: **Unknown:** Oct 2003, *Anonymous s.n.* (SING [SING0018523]); *ibid.*, *Hullett 145* (SING [SING0047492]). **Pulau Ubin:** Bkt. Jelutong, 24 Nov 2014, *Ali Ibrahim et al. PU 2014-017* (SING [SING0226783, SING0232155, SING0232156]). **Singapore Botanic Gardens:** Potting Yard, 1892, *Ridley s.n.* (SING [SING0018522]); *ibid.*, 1892, *Ridley 3711* (SING [SING0047487]); Rockery, Aug 1899, *Ridley 10435* (SING [SING0047493]).

2. *Cocculus orbiculatus* (L.) DC. (Menispermaceae) (Fig. 6)

This species was previously known from Singapore from collections made between 1889 and 1954 in Changi. During a survey of Coney Island in 2010, prior to its redevelopment, an unknown sterile juvenile individual of a Menispermaceae species was found inside the mangrove habitat. Later, in 2015, another more mature individual, climbing up a tree to 6 m high, was found to be flowering. It was confirmed to be a male individual of *Cocculus orbiculatus* with small flowers with white petals and yellow stamens (Fig. 6). The same individual has been further recollected several times. *Cocculus orbiculatus* was added to the Species Recovery Programme in 2016 (National Parks Board, 2016) and is now being propagated from stem cuttings at the Native Plant Centre, Pasir Panjang Nursery.

National conservation assessment. Critically Endangered.

Specimens examined. SINGAPORE: **Changi:** 1889, *Ridley s.n.* (SING [SING0034253]); Changi Beach, Aug 1892, *Ridley 4714* (SING [SING0034238]); Kampong Changi, 5 Sep 1953, *Sinclair SF 40021* (SING [SING0034237]). **Coney Island:** 25 Oct 2010, *Lua et al. SING 2010-869* (SING [SING0153605]); *ibid.*, 21 May 2015, *Lua et al. SING 2015-153* (SING [SING0222195]); *ibid.*, 8 Nov 2016, *Lim et al. SING 2016-201* (SING [SING0230841]); *ibid.*, 24 Oct 2017, *Niissalo et al. SING 2017-526* (SING [SING0239583]); *ibid.*, 17 Nov 2017, *Lim SING 2017-631* (SING [SING0239570]).

3. *Lecananthus erubescens* Jack (Rubiaceae) (Fig. 7)

This species was previously known from Singapore from collections made between 1890 and 1930 from a number of sites around Singapore, including at Chan Chu Kang (which is now Nee Soon Swamp Forest according to Corlett, 1992). It was rediscovered in Nee Soon Swamp Forest in 2015 (Fig. 7). *Lecananthus erubescens* is a climber with angular stems and elliptic to ovate-lanceolate thinly coriaceous leaves that are very pale green below. The inflorescence is axillary, with the flowers aggregated in a head bearing maroon-purple bracts and white funnel-shaped flowers with five lobes. *Lecananthus erubescens* was added to the Species Recovery Programme in 2016 (National Parks Board, 2016).

National conservation assessment. Critically Endangered.



Fig. 6. *Cocculus orbiculatus* (L.) DC. **A.** Habit. **B.** Twining stem. **C.** Male inflorescences. **D.** Open male flowers. All from *Lim et al. SING 2016-201*. (Photos: R.C.J. Lim)

Specimens examined. SINGAPORE: **Chan Chu Kang:** 1890, *Ridley 3814* (SING [SING0012110]); *ibid.*, May 1889, *Corporal s.n.* (SING [SING0012113]). **Nee Soon Swamp Forest:** 28 Oct 2015, *Leong et al. SING 2015-276* (SING [SING0225274]). **Sungei Jurong:** 1894, *Ridley* (SING [SING0012111]). **Choa Chu Kang:** 1896, *Ridley* (SING [SING0012112]). **Mandai Rd:** Jul 1930, *Corner* (SING [SING0012114]).

4. *Loeseneriella macrantha* (Korth.) A.C.Sm. (Celastraceae) (Fig. 8)

This species was previously known from Singapore from collections made between 1890 and 1922 in areas now in the Central Catchment Nature Reserve and in Tampines. The species was first rediscovered, based on a sterile specimen, in the Western Catchment in 2011. Subsequent fertile collections from various parts of Singapore have since been made. Noteworthy is its occurrence in coastal as well as low-lying inland forest. *Loeseneriella macrantha* is now being propagated from stem cuttings at the Native Plant Centre, Pasir Panjang Nursery (Fig. 8).

National conservation assessment. Critically Endangered.



Fig. 7. *Lecananthus erubescens* Jack. **A.** Habit. **B.** Inflorescence with open flower. All from *Leong et al. SING 2015-276*. (Photos: P.K.F. Leong)

Specimens examined. SINGAPORE: **Central Catchment Nature Reserve:** Bukit Mandai, 14 Jan 1890, *Goodenough 1894* (SING [SING0004331]); Seletar, 1894, *Ridley 6141* (SING [SING0004329]); Nee Soon Firing Range, 10 Oct 2014, *Lua SING 2014-407* (SING [SING0226786]), *SING 2014-409* (SING [SING0231948]); Chestnut Peninsula, 1 July 2015, *Leong et al. SING 2015-201* (SING [SING0226599]). **Tampines:** 1 Feb 1922, *Burkill 7617* (SING [SING0004330]). **Western Catchment:** 1 Feb 2011, *Lua et al. SING 2011-026* (SING [SING0153721]). **Pulau Pawai:** 10 Apr 2012, *Lua & Davison SING 2012-112* (SING [SING0173580]). **Pulau Ubin:** 22 Jan 2014, *Lai SING 2014-25* (SING [SING0203175]).

5. *Mapania squamata* (Kurz) C.B. Clarke (Cyperaceae) (Fig. 9)

This species was previously known from Singapore only from four collections by Ridley made between 1894 and 1903. In 2017 flowering and fruiting material was collected in a primary forest patch along the stream in Upper Peirce (Fig. 9). Chong et al. (2009) reported nine species of *Mapania* Aubl. for Singapore of which four were listed as Nationally Extinct. For species description see Simpson (1992).

National conservation assessment. Critically Endangered.



Fig. 8. *Loeseneriella macrantha* (Korth.) A.C.Sm. **A.** Inflorescence. **B.** Open flowers. (Photos: R.C.J. Lim)



Fig. 9. *Mapania squamata* (Kurz) C.B.Clarke. **A.** Habit. **B.** Detail of leaf (lower side) and apex (upper side). **C.** Inflorescence and infructescences. **D.** Inflorescence arising from the base of the plant. **E.** Old infructescence. **F.** Young infructescence. All of SING2017-468. (Photos: J. Leong-Škorničková)

Specimens examined. SINGAPORE: **Upper Peirce:** 14 Sep 2017, *Leong-Škorničková et al. SING 2017-468* (SING [SING0239582]). **Bukit Timah:** 1894, *Ridley s.n.* (SING [SING005164]); *ibid.*, Feb 1900, *Ridley s.n.* (SING [SING0005161]), *ibid.*, *Ridley s.n.* (SING [SING005163]). **Bukit Panjang:** 1903, *Ridley s.n.* (SING [SING0005162]).

6. *Plagiostachys lateralis* (Ridl.) Ridl. (Zingiberaceae) (Fig. 10)

This species was previously known from Singapore from only two collections made by Ridley in 1892 (note that three Ridley specimens from Bukit Timah and MacRitchie that were cited as *Plagiostachys lateralis* by Niissalo et al. (2017) have been redetermined as *P. mucida* Holttum). In August 2017, a fruiting individual with a few seedlings in the immediate vicinity were found in a patch of primary forest by Upper Peirce Reservoir. The presence of an infructescence enabled an unambiguous identification, as the lectotype (designated by Holttum, 1950) is also a fruiting specimen. In spite of an extensive search in the surrounding areas no more adult individuals were found. As a specimen could not be prepared without compromising the survival of the sole adult plant, only a photographic record is presented here (Fig. 10). The plant has been accessioned as SNG-410 under a long-term conservation project focusing on Singapore's native gingers (more details in Leong-Škorničková et al., 2014). Regular monitoring for flowering and fruit set is in progress to attempt propagation of more individuals.

National conservation assessment. Critically Endangered.

Specimens examined. SINGAPORE: **Bukit Mandai:** 1892, *Ridley 4620* (SING [SING0034150]). **Chan Chu Kang:** 1892, *Ridley s.n.* (SING [SING0034149]).

7. *Scolopia macrophylla* (Wight & Arn.) Clos (Salicaceae) (Fig. 11)

This species was previously known from Singapore from collections made between 1890 and 1953. During a survey of Coney Island in 2014, prior to its redevelopment, a fruiting individual was found at the drier part towards the back mangrove behind an abandoned building. It had thorny twigs, leaves that flushed orange and red, and black berries (Fig. 11). *Scolopia macrophylla* was added to the Species Recovery Programme in 2017 (National Parks Board, 2017) and is now being propagated from stem cuttings at the Native Plant Centre, Pasir Panjang Nursery.

National conservation assessment. Critically Endangered.

Specimens examined. SINGAPORE: **Changi:** 1890, *Ridley 1818* (SING [SING0017555]); *ibid.*, 1892, *Ridley 3606a* (SING [SING0017554]); *ibid.*, 5 Sep 1953, *Sinclair SF 40022* (SING



Fig. 10. *Plagiostachys lateralis* (Ridl.) Ridl. **A.** Habit. **B.** Detail of ligule on young shoot. **C.** Detail of ligule on mature fruiting shoot. **D.** Inflorescence in side view. **E.** Inflorescence in semi-front view. **F.** & **G.** Seedlings. All of SNG-410. (Photos: J. Leong-Škorničková)

[SING0017549], [SING0017550]. **Tampines Rd:** 1893, *Ridley s.n.* (SING [SING0017551]). **Serangoon:** 1897, *Ridley 8903* (SING [SING0017553]). **Punggol:** 1898, *Ridley s.n.* (SING [SING0017552]). **Coney Island:** 24 Oct 2014, *Neo et al.* SING 2014-352 (SING [SING0212431], [SING0212432], [SING0212433]). **Pasir Panjang Nursery:** 20 Dec 2017, *Ng 2017-831* (SING [SING0239572]).

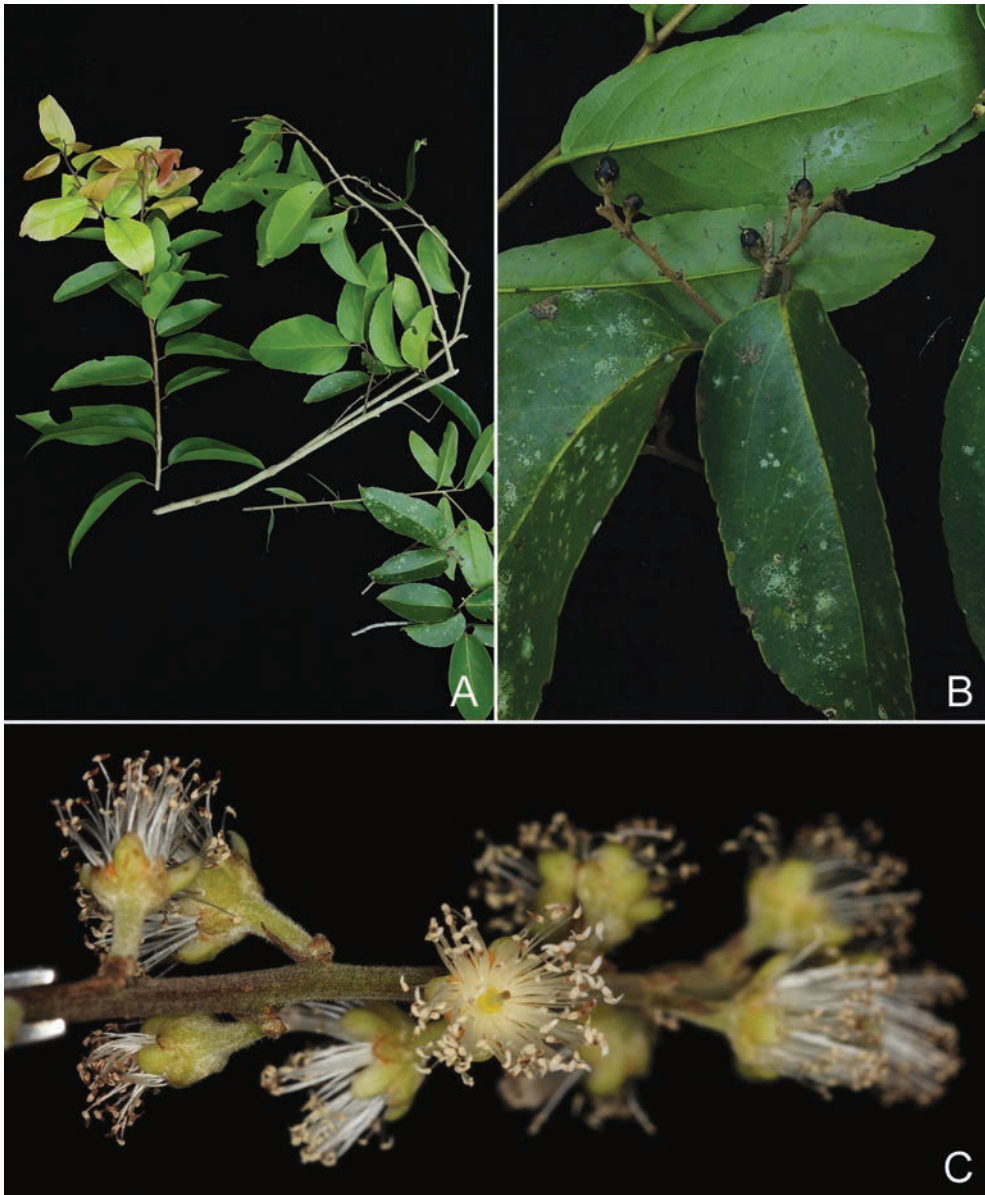


Fig. 11. *Scolopia macrophylla* (Wight & Arn.) Clos. **A.** Fresh specimen. **B.** Fruits. **C.** Inflorescence. A & B from Neo *et al.* SING 2014-352, C from Ng 2017-831. (Photos: A & B, P.K.F. Leong; C, X.Y. Ng)

8. *Spatholobus maingayi* Prain ex King (Fabaceae) (Fig. 12)

This species was previously known from Singapore from collections made between 1894 and 1927. In 2014, fallen fruits were seen on the forest floor of Mandai Track 15 forest, in a primary forest patch within the larger mature secondary forest, and



Fig. 12. *Spatholobus maingayi* Prain ex King. Fresh specimen. From Lua *et al.* SING 2014-240. (Photo: P.K.F. Leong)

immediately recognised as belonging to the genus *Spatholobus* Hassk. because of the distinctive flattened fruits with the single winged appendage and apical seeds. Only one *Spatholobus* liana was found in the vicinity and no inflorescence was observed. A lower vegetative shoot of the plant was collected on the assumption that the fallen fruits were from the same plant on higher branches (Fig. 12). Only three species of *Spatholobus* are reported for the flora of Singapore: *S. ferrugineus* (Zoll. & Moritzi) Benth., *S. maingayi* and *S. ridleyi* Prain ex King (Chong *et al.*, 2009). Unfortunately, the identification key given by Ridder-Numan & Wiriadinata (1985) focuses on the

floral characters and fruits are not mentioned. *Spatholobus ferrugineus* can be easily excluded because of the distinctive dense rusty-brown velutinous hair all over its leaves, young stems and fruits. On comparison to type specimens of *Spatholobus maingayi* and *S. ridleyi*, and illustrations in Ridder-Numan & Wiriadinata (1985), our collection of the samaroid fruits match better with those of *S. maingayi*. Fruits of *Spatholobus maingayi* have the thickened dorsal margin bent into an S- or C-shape and narrow abruptly into a blunt or obtuse tip at the seed apex, whereas those of *S. ridleyi* have the dorsal margin essentially straight and gradually tapered into a sharp acute tip at the seed apex.

National conservation assessment. Data Deficient.

Specimens examined. SINGAPORE: **Near Bukit Timah:** Ridley 6397 (SING [SING0018544]). **Singapore Botanic Gardens:** Garden Jungle, 1894, Ridley 6799 (SING [SING0000672]); *ibid.*, 8 Dec 1927, Furtado s.n. (SING [SING0034657]); *ibid.*, 29 Dec 1927, Furtado 1253 (SING [SING0036458]). **Central Catchment Nature Reserve:** Mandai Track 15 Forest, 15 July 2014, Lua *et al.* SING 2014-240 (SING [SING0205848]).

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References

- Ashton, P.S. (1982). Dipterocarpaceae. In: Van Steenis, C.G.G.J. (ed.) *Flora Malesiana*, ser. 1, vol. 9, part 2, pp. 237–552. The Hague, Boston, London: Martinus Nijhoff Publishers.
- Attanayake, A.M.A.S. (2010). Systematics of *Uvaria* (Annonaceae) in Borneo and the reproductive biology of Sri Lankan endemic, *Uvaria semecarpifolia*. Ph.D. thesis. Hong Kong: University of Hong Kong.
- Chantaranothai, P. (2007). *Phyllanthus*. In: Van Welzen, P.C. & Chayamarit, K. (eds) *Flora of Thailand*, vol.8, part 2, pp. 473–507. Bangkok: The Forest Herbarium, National Park, Wildlife and Plant Conservation Department.
- Chaowasku, T., Keßler, P.J.A. & Van Der Ham, R.W.J.M. (2012). A taxonomic revision and pollen morphology of the genus *Dendrokingstonia* (Annonaceae). *Bot. J. Linn. Soc.* 168: 76–90.
- Chia, E.J.J., Ooi, Z.Y., Lua, H.K., Loo, A.H.B., Ang, W.F., Ong, K.H. & Wong, K.M. (2017). *Glochidion obscurum* Bl. (Phyllanthaceae), a new record for Singapore. *Nat. Singapore*, 10: 49–53.
- Chong, K.Y., Tan, H.T., & Corlett, R.T. (2009). *A Checklist of the Total Vascular Plant Flora of Singapore: Native, Naturalised and Cultivated Species*. Singapore: Raffles Museum of Biodiversity Research, National University of Singapore.

- Chong, K.Y., Lim, R.C.J., Loh, J.W., Neo, L., Seah, W.W., Tan, S.Y. & Tan, H.T.W. (2018). Rediscoveries, new records, and the floristic value of the Nee Soon freshwater swamp forest, Singapore. *Gard. Bull. Singapore* 70 (Suppl. 1): 49–69.
- Corlett, R.T. (1992). The ecological transformation of Singapore, 1819–1900. *J. Biogeogr.* 19: 411–420.
- Davison, G.W.H. (2008a). The red list categories. In: Davison, G.W.H., Ng, P.K.L. & Ho, H.C. (eds) *The Singapore Red Data Book: Threatened Plants and Animals of Singapore*, 2nd ed., pp. 1–4. Singapore: The Nature Society (Singapore).
- Davison, G.W.H. (2008b). Criteria for determining category of threat. In: Davison, G.W.H., Ng, P.K.L. & Ho, H.C. (eds), *The Singapore Red Data Book: Threatened Plants and Animals of Singapore*, 2nd ed., p. 268. Singapore: The Nature Society (Singapore).
- Davison, G.W.H., Ng, P.K.L. & Ho, H.C. (eds) (2008). *The Singapore Red Data Book: Threatened Plants and Animals of Singapore*, 2nd ed. Singapore: The Nature Society (Singapore).
- De Kok, R.P.J. (2017). Two new records of *Litsea* (Lauraceae) from Singapore and the lectotypification of twenty-two names from several Lauraceae genera. *Gard. Bull. Singapore* 69: 167–177.
- Forman, L.L. (1986). Menispermaceae. In: Van Steenis, C.G.G.J. & de Wilde, W.J.J.O. (eds) *Flora Malesiana*, ser. 1, vol. 10, part 2, pp. 157–253. Dordrecht, Boston, London: Martinus Nijhoff Publishers.
- Govaerts, R., Ruhsam, M., Andersson, L., Robbrecht, E., Bridson, D., Davis, A. & Schanzer, I. (2018). *World Checklist of Rubiaceae*. Royal Botanic Gardens, Kew. <http://wcp.science.kew.org>. Accessed 19 Jan. 2018.
- Holttum, R.E. (1950). The Zingiberaceae of the Malay Peninsula. *Gard. Bull. Singapore* 13: 1–249.
- Holttum, R.E. (1955) [‘1954’]. *Ferns of Malaya. A Revised Flora of Malaya*, vol. II. Singapore: Government Printing Office.
- Holttum, R.E. (1963). Cyatheaceae. In: Van Steenis, C.G.G.J. & Holttum, R.E. (eds) *Flora Malesiana*, ser. 2., vol. 1, part 2, pp. 65–176. The Hague, Boston, London: Martinus Nijhoff / Dr W. Junk Publishers.
- Lai, J. (2016). *Cyathea trichodesma*: a new record found in MacRitchie wetland. *Flying Fish Friends*. <http://flyingfishfriends.blogspot.sg/search/label/Cyathea%20trichodesma>. Accessed 10 Mar. 2018.
- Leong, P.K.F., Lee, C., Tay, F.E.L., Ang, P. & Yam, T.W. (2017). *Pinalia floribunda* (Lindl.) Kuntze (Orchidaceae): Rediscovery and conservation of a species thought extinct in Singapore. *Nat. Singapore* 10: 67–71.
- Leong-Škorničková, J., Thame, A. & Chew, P.T. (2014). Notes on Singapore native Zingiberales I: A new species of *Zingiber* and notes on the identities of two further *Zingiber* taxa. *Gard. Bull. Singapore* 66: 153–167.
- Lim, R.C.J., Ng, X.Y., Yeo, C.K. & Ang, W.F. (2018). Rediscovery in Singapore of *Fagraea splendens* Blume (Gentianaceae), with notes on propagation. *Nat. Singapore* 11: 7–14.
- Lindsay, S. & Middleton, D.J. (2015). The clarification and synonymisation of two taxa of *Vittaria* from Peninsular Malaysia and a new combination in *Haplopteris* (Pteridaceae subfam. Vittarioideae). *Gard. Bull. Singapore* 67: 39–43.
- Loo, A.H.B., Lua, H.K. & Ang, W.F. (2017). Rediscovery in Singapore of *Calamus densiflorus* Becc. (Arecaceae). *Nat. Singapore* 10: 1–5.
- Luo, S.X., Esser, H.-J., Zhang, D.X. & Renner, S.S. (2011). Nuclear DNA sequences help disentangle *Phyllanthus reticulatus* (Phyllanthaceae), an Asian species not occurring in Africa, but introduced to Jamaica. *Syst. Bot.* 16: 99–104.

- National Parks Board (2016). NParks further identifies 46 threatened native plants and animals for species recovery programmes. National Parks Board, Singapore Government. <https://www.nparks.gov.sg/news/2016/9/nparks-further-identifies-46-threatened-native-plants-and-animals-for-species-recovery-programmes>. Accessed 5 Feb. 2018.
- National Parks Board. (2017). NParks announces that over 500 species have been discovered or rediscovered locally over the past five years. National Parks Board, Singapore Government. <https://www.nparks.gov.sg/news/2017/5/festival-of-biodiversity>. Accessed 5 Feb. 2018.
- Niissalo, M.A. & Leong-Škorničková, J. (2017). *Hanguana podzolicola* (Hanguanaceae), a new record for Singapore. *Gard. Bull. Singapore* 69: 157–165.
- Niissalo, M., Wijedasa, L., Boyce, P.C. & Leong-Škorničková, J. (2014). *Hanguana neglecta* (Hanguanaceae): a new plant species from a heavily collected and visited reserve in Singapore. *Phytotaxa* 188(1): 14–20.
- Niissalo, M.A., Leong-Škorničková, J., Khew, G.S. & Webb, E.L. (2017). Very small relict populations suggest high extinction debt of gingers in primary forest fragments of a tropical city. *Amer. J. Bot.* 104: 182–189.
- Pooma, R., Poopath, M. & Newman, M.F. (2017). Dipterocarpaceae. In: Santisuk, T. & Balsev, H. (eds) *Flora of Thailand*, vol. 13, part 4, pp. 557–685. Bangkok: The Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation.
- PPG I (Pteridophyte Phylogeny Group) (2016). A community-derived classification for extant lycophytes and ferns. *J. Syst. Evol.* 54(6): 563–603.
- Ridder-Numan, J.W.A. & Wiriadinata, H. (1985). A revision of the genus *Spatholobus* (Leguminosae, Papilionoideae). *Reinwardtia* 10(2): 139–205.
- Ridley, H.N. (1900). The flora of Singapore. *J. Straits Branch Roy. Asiat. Soc.* 33: 27–196.
- Ridley, H.N. (1922). *Flora of the Malay Peninsula*, vol. I. London: L. Reeve & Co. Ltd.
- Schot, A.M. (1994). A revision of *Callerya* Endl. (including *Padbruggea* and *Whitfordiodendron*) (Papilionaceae: Millettieae). *Blumea* 39: 1–40.
- Simpson, D.A. (1992). A revision of the genus *Mapania*. Royal Botanic Gardens, Kew.
- Sinclair, J. (1955). A revision of the Malayan Annonaceae. *Gard. Bull. Singapore* 14: 149–516.
- Staples, G. (2010). Convolvulaceae. In: Santisuk, T. & Larsen, K. (eds) *Flora of Thailand*, vol. 10, part 3, pp. 330–468. Bangkok: The Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation.
- Symington, C.F., Ashton, P.S. & Appanah, S. (2004). In: Barlow, H.S. (ed.) *Foresters' Manual of Dipterocarps. Malayan Forest Records*, no. 16, 2nd ed. Kuala Lumpur: Forest Research Institute Malaysia.
- Turner, I.M. (2012). Annonaceae of Borneo: a review of the climbing species. *Gard. Bull. Singapore* 64: 371–479.
- Utteridge, T.M.A. (2000). Revision of the genus *Cyathostemma* (Annonaceae). *Blumea* 45: 377–396.
- Van Welzen, P.C. (1994). A taxonomic revision of S.E. Asian *Chaetocarpus* Thwaites (Euphorbiaceae). *Rheedea* 4: 93–101.