Checklist of vascular plants of Klang Gates Quartz Ridge, Malaysia, a 14-km long quartz dyke

Ruth Kiew¹, Lim Chung-Lu¹

¹ Forest Research Institute Malaysia, 52109 Kepong, Selangor Malaysia

Corresponding author: Ruth Kiew (ruth@frim.gov.my)

Abstract

The Klang Gates Quartz Ridge (KGQR) is proposed for protection as National Heritage and as a UNESCO World Heritage Site because of its spectacular size, exceptional beauty and significant biodiversity. The checklist of vascular plants documents 314 species that comprise a unique combination that grows on lowland quartz and that is distinct from the surrounding lowland equatorial rain forest by the absence of orchids, palms, gingers and tree canopy families. The Rubiaceae, Gramineae, Moraceae, Apocynaceae, Melastomataceae and Polypodiaceae are the most speciose families. The summit vegetation at 200–400 m elevation is dominated by Baeckea frutescens (Myrtaceae) and Rhodoleia championii (Hamamelidaceae) and shows similarities to the plant community on rocky mountain peaks above 1500 m. About 11% of its species are endemic in Peninsular Malaysia and four are endemic to KGQR: Aleisanthia rupestris (Rubiaceae), Codonoboea primulina (Gesneriaceae), Spermacoce pilulifera (Rubiaceae), and Ilex praetermissa (Aquifoliaceae). All four are provisionally assessed as Critically Endangered. Two, Eulalia milsumi (Gramineae) and Sonerila prostrata (Melastomataceae), are endemic to KGQR and a few neighbouring smaller quartz dykes. They are assessed as Endangered. The KGQR is a fragile habitat and conservation management is urgently required to halt the spread of the aggressive alien grass, Pennisetum polystachion and to prevent further habitat degradation from visitors. Based on KGQR being a threatened habitat, its biodiverse flora, and endangered species, it qualifies as an Important Plant Area.

Keywords

Alien species, endangered species, endemic species, flora, Important Plant Area, quartz dyke, Selangor, UNESCO World Heritage Site
Introduction

The Klang Gates Quartz Ridge (KGQR), renamed Gombak Selangor Quartz Ridge (Mohd.-Zainuddin 2015), is a 14 km-long quartz dyke (3.12N, 101.42E to 3.15N, 101.48E) 12 km northeast of Kuala Lumpur in the state of Selangor, Malaysia. Rising to about 400 m, it dominates the skyline north of Kuala Lumpur and is believed to be the longest exposed quartz dyke in the world. Running from east to west, it is flanked to the north by the Hulu Gombak Forest Reserve Extensions and the Klang Gates Dam, a large reservoir covering 207 ha that supplies water to the capital, Kuala Lumpur. To the south, it is increasingly exposed to human disturbance.

Composed of pure quartz, the dyke was exposed as the surrounding granite material weathered away revealing sheer pale grey or white vertical cliffs rising above the surrounding vegetation. Though about 200 m wide at the base, in places the summit ridge is a knife edge only a metre or so wide with precipitous drops on either side. Jagged like a dragon’s spine, it is dissected by vertical faults giving it the appearance of limestone karst, so it has been termed a pseudo-karst formation. It is pierced by three rivers that flow through narrow gullies. The pure quartz weathers to coarse sand that is very nutrient poor, has poor water retention, and has crumbled to form a steep base of colluvium with 30–35° and in places up to 60° slopes.

Adaptation to the extremely poor nutrient status and water retention has resulted in a distinctive flora with a unique assemblage of plants that includes several rare and/or endemic species restricted to the KGQR. It is markedly different from the surrounding tropical lowland rain forest not only in species composition, but also in physiognomy (with sparse stunted trees), complexity (not multi-layered and without the epiphyte flora) and lower species diversity (Saw 2010).

Its striking topography and unique flora have long attracted botanists. The first botanical collections were made by H.N. Ridley, who made three visits in 1908, 1916 and 1921 that mainly concentrated on the summit ridge flora. He wrote the first account of the flora (Ridley 1922a), describing ten new species. Henderson (1928) produced the first comprehensive listing of plants from the KGQR included in his checklist of the flowering plants of Kuala Lumpur. It was based on collections made by Forestry Department staff, in particular by Mohd Hashim in 1908, and by H.L. Hume, employed by the Federated Malay States Museum, in 1921, who discovered the new species, Hydnocarpus humei, that was named in his honour. Subsequently, the herbarium collection of the Federated Malay States Museum was loaned indefinitely to the Singapore Botanic Gardens Herbarium (Henderson 1928). Henderson’s listing of 265 species provided the most complete inventory of the vegetation on the steep slopes that were still forested in those days. Unfortunately, Henderson did not cite specimens. Later significant collections were made by staff of the Forest Research Institute Malaysia, principally by E.J. Strugnell in 1927 and C.F. Symington in 1933, 1935 and 1939. After a long hiatus, Kiew (1978) described a new species, Ilex praetermissa, she had discovered and produced the third account of the flora (Kiew 1982) based on her collections made between 1977–1982 and included for the first time a checklist of ferns collected by B. Molesworth-Al- len and A.G. Piggott, who recorded Syngramma dayi, a fern restricted to quartz habitats.
Effect of Human Activities on the Flora of KGQR

Being so close to the capital Kuala Lumpur, it has suffered disturbance from agricultural activities, urbanisation, visitor pressure, and the invasion of alien weeds. All these activities threaten the continued existence of its flora and species of conservation importance. On the Kuala Lumpur side, encroachment from housing and road building threatens. The north side is protected by the Hulu Gombak Forest Reserve Extensions and the Klang Gates Dam.

Agricultural activities were a particular problem in the 1970s and 1980s (Kiew 1982; Perumal 1992) when there was widespread clearing of sections of the steep base on the south side to plant bananas and pineapple. Clearing the land by burning the vegetation got out of control and the 5 m-tall *Baeckea frutescens* trees were burned to the ground together with thick festoons up to half a metre long of the old man’s beard lichen, *Usnea* sp. Fortunately, *B. frutescens* regenerated from seed and suckers but after 30 years the old man’s beard lichen has not re-established (Kiew pers. obs.). *Rhodoleia championii* (Figure 1) survived the fires with only its leaves being scorched, but in contrast the sappy *Fagraea auriculata* was totally destroyed. Due to the nutrient-poor soil, these agricultural activities failed and the area was quickly invaded by weeds of which the most damaging was the grass *Imperata cylindrica*, a fire hazard because it becomes tinder-dry in dry weather and fuelled fires on the lower slopes.

The impact of urbanisation began with the building of a bungalow in 1883 on the top of the ridge above the gully through which the Klang River flows. Between 1893 and 1895

![Figure 1. *Rhodoleia championii*, one of the dominant tree species on the summit.](image-url)
this gully was dammed to form a reservoir (Barlow 1995). By 1926, the bungalow had become derelict and today any sign of it has almost disappeared, although a few garden plants still persist with the patch of the native *Eriachne pallescens* grass indicating where the bungalow once stood (Kiew 1982). In the 1950s a quarry was established at the western end to utilise the quartz for glass making. It had only a very local impact and was discontinued due to lack of commercial viability. The expanding population of Kuala Lumpur required a greater water supply that resulted in enlargement of the Klang Gates Dam to its present size. This caused some local damage. Housing developments continue to creep ever closer to the KGQR. The major Kuala Lumpur-Karak Highway cuts through the western end. In 2016, a major highway development, the Eastern Klang Valley Expressway, threatened its integrity but due to public protest was re-routed away from the KGQR.

The KGQR’s easy accessibility and proximity to Kuala Lumpur has long encouraged rock climbers and hikers who are rewarded by a panoramic view of the Kuala Lumpur skyline in one direction and the reservoir lake and virgin rain forest in the other (Figure 2). Unfortunately, increasing visitor pressure has its negative effects including cutting down trees for camp fires (Perumal 1992). In the 1980s it was still possible to see quartz crystals 7–10 cm long, but these have long since been taken by visitors. Notable too is the disappearance from easily accessible places of *Eurycoma longifolia*, formerly a striking plant on the summit (Kiew 1982). Local Malays believe it to be a powerful aphrodisiac. The spider orchid, *Renanthera* sp., reported by Adams (1953) is also long gone. Both are the prey of opportunistic collecting by visitors. However, they may persist on inaccessible peaks.

![Figure 2. View of the eastern ridge of Klang Gates Quartz Ridge from summit of western ridge, the summit (foreground) dominated by 2–3 m tall *Baeckea frutescens*.](image-url)
The natural open nature of the KGQR flora makes it vulnerable to invasion by weeds. Formally, it was an island surrounded by rain forest that acted as a buffer against weed dispersal. Now this has gone from the southern side, so the KGQR is open to invasion by any weed that can withstand harsh conditions for plant growth. The agricultural activities mentioned above led to a great increase in the number of weed species recorded from the KGQR (Kiew 1982). After the initial invasion by *Imperata cylindrica*, by the 1990s Wong et al. (2010) reported that the aggressive fern *Dicranopteris linearis* covered large areas, the composite *Chromolaena odorata*, the shrub *Clidemia hirta*, the secondary forest tree *Cyrtophyllum fragrans* and a variety of grasses were already established.

**Legal Protection**

In 1936, 130 ha of the KGQR were gazetted as the Klang Gates Wildlife Reserve to protect all wildlife and in particular the serow, *Capricornis sumatraensis*, a totally protected animal in Malaysia (Perumal 1992). Over the years, KGQR has been proposed to be designated as a National Nature Monument (in 1974 by the Malaysian Nature Society in the Blueprint for Conservation in Peninsular Malaysia) and to be included in the Selangor Heritage Park (Wong et al. 2010). The Hulu Gombak Forest Reserve Extensions were given enhanced protection when upgraded to Permanent Reserved Forest Status and from 2007 the KGQR lies within the Selangor State Park. In June 2015, the Selangor Town and Country Planning Department (JPBD) renamed the KGQR the Gombak Selangor Quartz Ridge and committed to protect it as National Heritage and to get it declared a UNESCO World Heritage Site on the grounds that it is a world-class geological phenomenon being the longest exposed quartz dyke in the world, as well as for its spectacular size, exceptional beauty, and its importance as a significant natural habitat for *in situ* conservation of biodiversity. It is currently on the Tentative List of World Heritage Sites.

In anticipation of the KGQR becoming a UNESCO World Heritage Site, this account aims to make available essential baseline data on the unique assemblage of plants that make up its flora by providing:

- a complete checklist of vascular plant species
- details of the endemic and rare species of conservation importance
- a complete bibliography for the botany of the KGQR.

**Materials and methods**

Accessibility and proximity to Kuala Lumpur means that many botanists have from time to time collected plants there so its flora can be said to be well-collected. This has meant that it has been possible to build the checklist using herbarium specimen data from the herbaria at KEP, KLU and SING that hold the majority of KGQR collections.
Herbarium codes follow Index Herbariorum at http://sweetgum.nybg.org/ih. Herbarium specimens provide a permanent record and, should there be questions about a species’ identity, they can be verified at any time in the future by reference to the specimen. An example of the importance of making herbarium specimens is illustrated by the case of *Hoya mappigera*, a species only described in 2011 but that had been collected from the KGQR in 1962 (*Sinclair 10730*) under the name *Hoya campanulata*.

The database software Botanical Research and Herbarium Management System (BRAHMS) in the National Herbarium of Malaysia (KEP) at the Forest Research Institute Malaysia, Selangor, Malaysia, enabled records to be extracted from its extensive holding. Not included are exotic weeds, invasive species or plants from the surrounding lowland rain forest.

For cases where species are recorded from KGQR in the literature but specimens were not cited, for instance Henderson (1928), Molesworth-Allen (1963) and Piggott (Kiew 1982), the literature source is cited in the checklist.

**Results**

The checklist compiled in this study contains 314 species of vascular plants in 233 genera and 105 families (Table 1, Appendix I). The most speciose families are Rubiaceae (32 species), Gramineae (15), Moraceae (14), Apocynaceae (11), Melastomataceae (10) and Polypodiaceae (10). Genera with five or more species include: *Ficus* (11 species), *Hedyotis* (5) and *Ixora* (5). About 11% (36 species) are endemic in Peninsular Malaysia. Percentage endemism is lower than the national average of about 25% for tree species (Saw 2010). Four species are endemic to KGQR and a further two endemic to KGQR and several neighbouring smaller quartz dykes.

In the checklist, four species proved to be endemic to KGQR, namely *Aleisanthia rupestris*, *Codonoboea primulina*, *Ilex praetermissa* and *Spermacoce pilulifera* (Figure 3). Following the IUCN criteria and categories (2001), these four species are all provisionally assessed as Critically Endangered under criteria CR B2ab(iii,iv) on the grounds that they are endemic in Peninsular Malaysia, where they are restricted to one locality that although it lies within the Selangor State Park is threatened by habitat degradation from visitor pressure and from invasive species. A further two species, *Eulalia milsumi* and *Sonerila prostrata*, endemic to KGQR and a few nearby smaller quartz dykes in the Gombak Valley, are provisionally assessed as Critically Endangered under criteria CR B2ab(iii,iv).

**Table 1.** Families, genera and species of vascular plants of Klang Gates Quartz Ridge.

| Group          | Families | Genera | Species |
|----------------|----------|--------|---------|
| Lycophytes     | 1        | 1      | 2       |
| Ferns          | 16       | 24     | 36      |
| Gymnosperms    | 1        | 1      | 1       |
| Flowering plants | 87     | 207    | 275     |
| **Total**      | **105**  | **233**| **314** |
EN B2ab (iii, iv) on the grounds that they are endemic species, restricted to two to four quartz dykes that, although they lie within the Selangor State Park, are vulnerable to habitat degradation. Other species of conservation importance include *Syngramma dayi*, endemic in quartz habitats in Perak and Selangor, and a few species that are extremely rare: *Hydnocarpus humei* is known from one other collection from Larut, Perak; *Hoya mappigera* is known from one other collection from Lumut, Perak, and another from Thailand. Further, the specimen of *Galearia fulva* that Ridley described as *G. lancifolia* is strikingly different from the typical form in having extremely narrow leaves and may prove to be a distinct taxon.

**Discussion**

**Habitats**

Without a doubt, it is the summit flora that is of greatest botanical interest for its unique combination of species. *Baeckea frutescens* and *Rhodoleia championii* are the dominant tree species, while shrubs include *Austrobxus nitidus* and *Vaccinium bancanum* and several epiphytic species, for instance *Fagraea auriculata*, *Ficus deltoidea*
var. *angustifolia* and *Rhododendron longiflorum*, that here grow directly on the quartz rocks. The ground layer is sparse with mats of the white moss *Leucobryum aduncum* covering the thin peat layer. The endemic grass *Eulalia milsumi* forms sparse tussocks in soil-filled cracks and crannies. *Aleisanthia rupestris* as its name suggests grows in crevices on the sheer cliff faces in full sun. In contrast, *Ilex praetermissa* grows in forest on steep slopes in partial shade where there is an accumulation of peat. The gorges that pierce the ridge present a completely different cool, humid, shaded environment where lush herbs, for instance *Begonia sinuata*, *Codonoboea primulina* and gingers, can thrive.

**Comparison with other plant communities**

Notable in the checklist is the absence or poor representation of trees typical of the canopy of lowland equatorial rain forest (Saw 2010), such as the Anacardiaceae, Burseraceae, Dipterocarpaceae, Guttiferae, Leguminosae, Myristicaceae, and Myrtaceae, and families like Orchidaceae, Palmae and Zingiberaceae. While it is obvious that the harsh exposed conditions and scanty soil act as a filter that excludes the majority of trees, shrubs and herbs that are typical of equatorial rain forest, it is notable that this lowland quartzite flora at 200–400 m elevation has much in common with the plant community of upper montane forest that grows above 1500 m on mountain peaks with peat that develops on weathered granitic soils (Reid 1951). In fact, Ridley (1922b) first drew attention to this phenomenon noting that KGQR included a “small but quite peculiar flora consisting of several endemic species with several only known from much higher altitudes in our mountains”. Species that illustrate this striking disjunct altitudinal distribution include *Austrobuxus nitidus*, *Baeckea frutescens*, *Dipteris conjugata*, *Oleandra neriiformis*, *Rhodoleia championii* and *Vaccinium bancanum*. Further, Whitmore (1984) drew attention to a few of these species, *Austrobuxus nitidus* and *Baeckea frutescens*, that also grow in lowland heath forest that also has base-poor, often sandy soil topped by a peat layer.

It might be expected that the quartzite flora would share similarities with the limestone flora that also grows on a rocky, free-draining substrate with poor soil development. However, comparison with the flora of Batu Caves with 269 species (Kiew 2014), a karst hill just 7 km from the KGQR, shows that in fact they share very little in common with just five species that grow in both localities, namely, *Alstonia scholaris* (a secondary forest species), *Pogonanthera pulverulenta* (an epiphyte that grows on trees, not on the rock substrate), *Microsorum membranifolium* (a lithophyte), and the figs, *Ficus hispida* and *F. punctata*. Even at the family level, the differences are very pronounced. At Batu Caves, Orchidaceae is the most speciose family with 23 species contrasting with just two orchid species on KGQR; while speciose families on KGQR, Rubiaceae (32 species), Gramineae (15 species), Melastomaceae (10 species), Polypodiaceae (10 species) and are represented by 13, 0, 1 and 2 species, respectively, on Batu Caves.
Changes in the flora

The repeated burning of a large section of the southern face has resulted in long-term detrimental consequences. The steep slope is still covered by secondary vegetation among which the aggressive fern *Dicranopteris linearis* smothers competing vegetation. Many of the trees recorded by Henderson (1928) have not been recollected for more than 50 years, though they might still persist on the undisturbed northern side. *Sonerila prostrata* and *Spermacoce pilulifera* have not been re-collected for more than 35 years.

Among the site endemic species, *Ilex praetermissa* populations are now found only on the northern side suggesting that they are unable to disperse and become established in secondary vegetation on the southern side. This species is critically endangered having an extremely small population size and, in addition, it is a dioecious species (Kiew 1983). Wong et al. (2010) counted only 20 *Ilex* plants on a 250 m transect.

The endemic grass, *Eulalia milsumi*, is also seriously threatened by disturbance. Although reasonably common in less disturbed habitats, Wong et al. (2010) discovered that its population is highly sensitive to disturbance by aggressive smothering by weeds like *Dicranopteris linearis* and that it was significantly less frequent in disturbed areas. In addition, recently it is particularly threatened by the large, tussock forming alien grass, *Pennisetum polystachion*, first reported from KGQR by Yao (2007), but is now widespread (Kiew 2009; Lim and Yao 2010).

Fortunately, *Aleisanthia rupestris* appears to be less influenced by disturbance (Wong et al. 2010) probably because it grows in such exacting conditions in full sun on vertical rock faces rooted in tiny cracks and crevices where even weeds are unable to gain a toe-hold.

The very small population of *Codonoboea primulina* of less than 150 individuals that grows in an extremely small area measuring about 50 m² (Kiew 1983), is most at risk from botanical collectors, even though there is no need for repeated collecting because it is already represented in most major herbaria in the world.

Conclusion

The proposal by the Selangor Town and Country Planning Department to protect the KGQR under the National Heritage Act 2005 (Act 645) status is long overdue. Globally, it is indeed unique for a combination of its great size, the tall exposed quartz dyke with its pseudo-karst morphology, and its unique assemblage of plant species that includes endemic and rare plants. It meets all three criteria for being designated an Important Plant Area (Anderson 2002). The quartz dyke is a fragile, threatened habitat vulnerable to visitor pressure and invasive plant species, it harbours a unique biodiverse flora quite unlike that of either lowland forest or the limestone hill flora and of its 314 species 11% are endemic to Peninsular Malaysia, among which four are provisionally assessed as Critically Endangered and two as Endangered. Management of the dyke not only needs
to control visitor access (Mohd.-Zainuddin 2015) but also to manage the invasion of aggressive weed species, most notably the *Dicranopteris linearis* thickets and to weed out *Pennisetum polystachion* by hand before it irreversibly impacts on the native flora.

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Appendix I

Checklist of vascular plant species collected from the Klang Gates Quartz Ridge, Selangor, Malaysia.

(Endemism: E – endemic in Peninsular Malaysia, EE – endemic in KGQR, E? – possibly endemic in Peninsular Malaysia).

Family classification follows the Flora of Peninsular Malaysia for ferns (Parris 2010) and flowering plants (Kiew et al. 2010).

Where details of herbarium specimens are not available, the literature source is provided, namely Henderson (1928), Molesworth-Allen (1963) and Piggott in Kiew (1982).

LYCOPHYTES
SELAGINELLACEAE
Selaginella strigosa Bedd.
Sinclair SFN 40140

Selaginella stipulata (Blume) Spring
Molesworth-Allen

FERNS
ADIANTACEAE
Haplopteris ensiformis (Sw.) E.H.Crane Piggott

Haplopteris scolopendrina (Bory) C.Presl Piggott

ASPLENIACEAE
Asplenium affine Sw.
Syahida FRI 55109

Asplenium nitidum Sw.
Kiew RK 1090, Parris 10968, Sinclair SFN 40142

Asplenium pellucidum Lam.
Molesworth-Allen, Piggott

BLECHNACEAE
Blechnopsis orientalis (L.) C.Presl Piggott
CIBOTIACEAE
Cibotium barometz (L.) J.Sm.
Anthonysamy SA 374, Molesworth-Allen, Piggott

DAVALLIACEAE
Davallia denticulata (Burm.f.) Mett. ex Kuhn
Molesworth-Allen
Davallia heterophylla J.Sm.
Ng FRI 22112, Molesworth-Allen, Piggott
Davallia repens (L.f.) Kuhn
Piggott
Davallia solida (G.Forst.) Sw.
Molesworth-Allen, Piggott

DENNSTAEDTIACEAE
Microlepia speluncae (L.) T.Moore var. hancei (Ptantl) C.Chr. & Tardieu
Piggott
Pteridium esculentum (Forst.) Cockayne
Molesworth-Allen, Piggott

DIPTERIDACEAE
Dipteris conjugata Reinw.
Piggott

GLEICHENIACEAE
Dicranopteris linearis (Burm.f.) Underw.
Piggott

HYMENOPHYLLACEAE
Hymenophyllum blandum Racib.
Molesworth-Allen, Piggott

NEPHROLEPIDACEAE
Nephrolepis biserrata (Sw.) Schott
Anthonysamy SA 373
Nephrolepis falciformis J.Sm.
Piggott

OLEANDRACEAE
Oleandra neriiformis Cav.
Kiew RK 1080, Piggott

POLYPODIACEAE
Drynaria rigidula (Sw.) Bedd.
Piggott
Goniophrabium perussum (Cav.) W.H.Wagner & Grether
Piggott
Lepisorus longifolius (Blume) Holttum
Strugnell FMS 14623
Leptochilus macrophyllus (Blume) Noot.
Piggott
Microsorum membranifolium (R.Br.) Ching
Ingram FMS 14605
Pyrois angustata (Sw.) Ching
Symington 39403, Piggott
Pyrois lanceolata (L.) Farw.
Anthonysamy SA 372, Piggott
Selliguea heterocarpa (Blume) Blume
Piggott
Selliguea lateritia (Baker) Hovenkamp
Kiew RK 1088
Selliguea stenophylla (Blume) Parris
Piggott

PTERIDACEAE
Pteris biourita L.
Strugnell FMS 14603
Pteris longipinnula Wall. ex J.Agardh
Molesworth-Allen, Piggott
Syngramma dayi (Bedd.) Bedd.
Parris 10967, Sinclair SFN 40139

SINOPTERIDACEAE
Cheilanthes tenuifolia (Burm.f.) Sw.
Piggott

TECTARIACEAE
Tectaria fissa (Kunze) Holttum
Kiew RK 1089, 1091, Parris 10969, Hume 7065
Tectaria singaporiana (Wall. ex. Hook. & Grev.) Copel.
Molesworth-Allen

**WOODSIACEAE**
*Diplazium polypodioides* Blume
Ingram FMS 14602

**GYMNOSPERMS**

**GNETACEAE**
*Gnetum gnemon* L. var. *brunonianum* (Griff.) Markgr.
Henderson
*Gnetum* sp.
Kiew RK 991

**FLOWERING PLANTS**

**ACANTHACEAE**
*Peristrophe acuminata* Nees var. *acuminata*
Henderson
*Pseuderanthemum graciliflorum* Ridl.
Henderson
*Pseuderanthemum selangorense* (C.B.Clarke) Ridl.
Henderson
*Staurogyne kingiana* C.B.Clarke
Henderson

**ACHARIACEAE**
*Hydnocarpus humei* Ridl.
Hume 7256
*Ryparosa fasciculata* King
Henderson

**ANACARDIACEAE**
*Buchanania sessilifolia* Blume
Henderson
*Semecarpus velutina* King
Mohd. Hashim FMS 102
*Swintonia schwenckii* Teijsm. & Binn. ex Hook.f.
Henderson

**ANISOPHYLLEACEAE**
*Anisophyllea corneri* Ding Hou
Watson 538, Kiew RK 992

**ANNONACEAE**
*Alphonsea elliptica* Hook.f. & Thomson
Syahida FRI 55106
*Mitrella kentii* (Blume) Miq.
Symington KEP 39393
*Trivalvaria pumila* (King) J.Sinclair
Sinclair SFN 40143, Kiew RK 1170

**APOCYNACEAE**
*Alstonia scholaris* (L.) R.Br.
Henderson
*Chilocarpus costatus* Miq.
Henderson
*Dischidia bengalensis* Colebr.
Kiew RK 211
*Epigynum ridleyi* King & Gamble
Henderson
*Hoya campanulata* Blume
Strugnell FMS 13033
*Hoya mappigera* Rodda & Simonsson
Sinclair SFN 10730
*Hoya revoluta* Wight
Kiew RK 1155, Strugnell FMS 55109
*Kibatalia maingayi* (Hook.f.) Woodson
Watson 533
*Pottsia laxiflora* (Blume) Kuntze
Henderson
*Willughbeia edulis* Roxb.
Mohd. Hashim FMS 402, Kiew FRI 65534, Symington KEP 39395

**AQUIFOLIACEAE**
*Ilex praetermissa* Kiew
Kiew RK 215, RK 125, Strugnell FMS 33213, Symington KEP 39398

**ARACEAE**
*Aglaonema nebulosum* N.E.Br.
Henderson
*Amydrium medium* (Zoll. & Moritizi)
Nicolson
Henderson
*Anadendrum microstachyum* (de Vriese & Miq.) Backer & Alderw.
ARALIACEAE
Arthrophyllum diversifolium Blume
Henderson
Schefflera oxyphylla (Miq.) R.Vig.
Henderson

ARISTOLOCHIACEAE
Thottea piperiformis (Griff.) Mabb.
Kiew RK 1139, Stone 15648

BEGONIACEAE
Begonia bottttumii Irmsch.
Henderson 7291
Begonia wrayi Hemsl.
Ridley 13430
Begonia sinuata Wall. ex Meisn.
Kiew RK 1084, Sinclair SFN 40132, Saw FRI 34264

CAMPANULACEAE
Lobelia zeylanica L.
Henderson

CAPPARACEAE
Capparis versicolor Griff.
Ridley s.n., Henderson

COMMELINACEAE
Amischotolype gracilis (Ridl.) I.M.Turner
Ridley s.n. (1908), Kiew RK 1180

COMPOSITAE
Blumea balsamifera (L.) DC.

CONARACEAE
\textit{Rourea rugosa} Planch.
Henderson

CONVOLVULACEAE
Argyrea capitiformis (Poir.) Ooststr.
Henderson
Neuropeltis maingayi Peter ex Ooststr. var. maingayi
Henderson

COSTACEAE
Cheilocostus \textit{speciosus} (J.Koenig)
C.D.Specht.
Henderson

CYPERACEAE
Cyperus \textit{compressus} L.
Henderson
Cyperus \textit{cyperoides} (L.) Kuntze
Kiew RK 1142
Cyperus \textit{laxus} Lam.
Kiew RK 1147A
Fimbristylis \textit{thouarsii} (Kunth) Merr.
Symington KEP 33210, KEP 39410
Mapania \textit{palustris} (Hassk. ex Steud.) Fern-Vill.
Kiew RK 1144

DICHAPETALACEAE
Dichapetalum \textit{griﬃthii} (Hook.f.) Engl.
Henderson

DILLENIACEAE
Tetracera \textit{asiatica} (Lour.) Hoogl.
Julius FRI 54873

DIOSCOREACEAE
Dioscorea \textit{pyrifolia} Kunth
Anthonysamy SA 195
DIPTEROCARPACEAE
Shorea bracteolata Dyer
Watson 741
Shorea parvifolia Dyer subsp. parvifolia
Watson 739

DRACAENACEAE
Dracaena elliptica Thunb.
Kiew RK 224
Dracaena maingayi Hook.f.
Kiew RK 1124, RK 1140
Dracaena umbratica Ridl.
Kiew RK 1194

EBENACEAE
Diospyros sumatrana Miq.
Henderson

ELAEOCARPACEAE
Elaeocarpus mastersii King
Kiew RK 77, Symington 33207, Burkill SN 10028
Elaeocarpus nitidus Jack var. nitidus
Phoon 108, 110
Elaeocarpus stipularis Blume var. stipularis
Phoon 107

ERICACEAE
Rhododendron longiflorum Lindl.
Ridley s.n., Symington KEP 33215
Vaccinium bancanum Miq. var. tenuinervium J.J.Sm.
Symington KEP 33206, 39404

GENTIANACEAE
Fagraea auriculata Jack
Henderson

GESNERIACEAE
Aeschynanthus pulcher (Blume) G.Don
Kiew RK 1081, Syahida FRI 55108
Codonoboea primulina (Ridl.) Kiew
Ridley s.n., Kiew RK 1182, Soh FRI 471218, Syahida FRI 55105
Codonoboea quinquevulnera (Ridl.) C.L.Lim
Kiew RK 1077, Symington KEP 39407, Syahida FRI 55107

GUMMULACEAE
Acroceras tonkinense (Balansa) C.E.Hubb.
Chew FRI 51872
Axonopus compressus (Sw.) P.Beauv.
Chew FRI 51866

MACARANGACEAE
Macaranga hullettii King ex Hook.
Henderson
Macaranga hypoleuca (Rchb.f. & Zoll.) Müll.Arg.
Henderson
Mallotus macrostachyus (Miq.) Müll.Arg.
Henderson
Pimelodendron griffithianum (Müll.Arg.) Benth.
Henderson

FAGACEAE
Castanopsis inermis (Lindl. ex Wall.) Benth.
& Hook.f.
Mohd Hashim FMS 305
Castanopsis megacarpa Gamble
Henderson
Lithocarpus ewychkii (Korth.) Rehder
Henderson
Lithocarpus sudaicus (Blume) Rehder
Mohd Hashim FMS 29

GRAMINEAE
Acroceras tonkinense (Balansa) C.E.Hubb.
Chew FRI 51872
Axonopus compressus (Sw.) P.Beauv.
Chew FRI 51866
Centotheca lappacea (L.) Desv.
Chew FRI 51873
Chrysopogon aciculatus (Retz.) Trin.
Chew FRI 51868

Cyrtococcum patens (L.) A.Camus
Chew FRI 51875

Digitaria fuscascens (J.Presl) Henrard
Chew FRI 51864

Eragrostis brownii (Kunth) Nees
Chew FRI 51863

Eriachne pallescens R.Br.
Chew FRI 51862, Kiew RK 1126, Symington KEP 47125

Eulalia milsumi (Ridl.) Symington KEP 39405, Chew FRI 51879

Lophatherum gracile Brongn.
Chew FRI 51871

Melinis repens (Willd.) Zizka
Chew FRI 51867

Ottochloa nodosa (Kunth) Dandy
Chew FRI 51874

Panicum brevifolium L.
Chew FRI 51876

Paspalum conjugatum P.J.Bergius
Chew FRI 51880

Pennisetum polystachion (L.) Schult.
Chew FRI51865

GUTTIFERAE

Calophyllum ferrugineum Ridl. var. oblongifolium (T.Anderson) P.F.Stevens
Wyatt-Smith 66609

Mesua elegans (King) Kosterm.
Ridley 13527

Mesua kunstleri (King) Kosterm. var. kunstleri
Symington KEP 47132

HAMAMELIDACEAE

Rhodoleia championii Hook.f.
Foxworthy KEP 10031, Strugnell KEP 10991, Kiew RK 210

HUGONIACEAE

Indorouchera griffithiana Planch. Hallier f.
Henderson

ICACINACEAE

Gomphandra quadrifida (Blume) Sleumer
Henderson

IXONANTHACEAE

Ixonanthes icosandra Jack
Henderson

Ixonanthes reticulata Jack
Symington KEP 33220, 37450

LABIATAE

Callicarpa longifolia Lam.
Henderson

Callicarpa pentandra Roxb.
Henderson

Clerodendrum deflexum Wall.
Henderson

Rotheca serrata (L.) Steane & Mabb.
Kiew RK 209, Anthonsamy SA 163

Vitex longisepala King & Gamble
Henderson

LAURACEAE

Alseodaphne nigrescens (Gamble) Kostem.
Henderson

Litsea umbellata (Lour.) Merr.
Mohd Hashim FMS 198

Litsea costalis (Nees) Kosterm.
Mohd Hashim FMS 277

LECYTHIDACEAE

Barringtonia macrostachya (Jack) Kurz
Kiew RK 1107

Barringtonia scortechinii King
Kiew RK 1179

LEGUMINOSAE

Archidendron contortum (Mart.) I.C.Nielsen
Henderson

Archidendron jiringa (Jack) I.C. Nielsen
Henderson

Derris elegans Grah. ex Benth.
Strugnell FMS13389
Bauhinia bidentata Jack
Mead FMS 30765

Flemingia strobilifera (L.) W.T.Aiton
Strugnell FMS 13387

†Fordia albiflora (Prain) Dasuki & Schot
Henderson

LOGANIACEAE
Norrisia malaccensis Gardner
Symington KEP 37448

LORANTHACEAE
Macrosolen cochinchinensis (Lour.) Tiegh.
Symington KEP 37446, Stone 15641
Scurrula ferruginea (Jack) Danser
Kiew RK 1125

LOWIACEAE
†Orchidantha longiflora (Scort.) Ridl.
Henderson

MALVACEAE
Durio griffithii (Mast.) Bakh.
Symington KEP 47126
Grewia laevigata Vahl
Henderson
Microcos tomentosa Sm.
Henderson
Pterospermum javanicum Jungh.
Watson 531

MARANTACEAE
Donax canniformis (G.Forst.) K.Schum.
Henderson

MELASTOMATAE
†Anerincleistus pauciflorus Ridl.
Sinclair SFN 40137
Diplectria divaricata Kuntze
Henderson
Medinilla crassifolia (Reinw. ex Blume)
Blume
Poore 1086
Melastoma malabathricum L.

Omar FMS 9936

Oxyspora bullata (Griff.) J.F.Maxwell
Kiew RK 1178
Oxyspora exigua (Jack) J.F.Maxwell
Henderson
Pogonanthera pulverulenta (Jack) Blume
Kiew RK 993, Putz FRI 21901, Wyatt-Smith KEP 66610
Pterandra echinata Jack
Henderson
Sonerila obliqua Korth.
Kiew RK 1086, Sinclair SFN 40133
†Sonerila prostrata Ridl.
Ridley s.n., Foxworthy KEP 10039, Symington KEP 47134

MELIACEAE
Chisocheton pentandrus (Blanco) Merr.
subsp. paucijugus (Miq.) Mabb.
Henderson
Dysoxylum arborescens (Blume) Miq.
Mohd Hashim FMS 1310

MELIOSMACEAE
Meliosma sumatrana (Jack) Walp.
Henderson

MEMECYLACEAE
Memecylon dichotomum (C.B.Clarke) King
var. dichotomum
Henderson

MENISPERMACEAE
Pericampylus glaucus (Lam.) Merr.
Henderson

MORACEAE
Artocarpus gomezianus Wall. ex Trécul
Henderson
Ficus chartacea (Wall. ex Kurz) King
Henderson
Ficus deltoidea Jack var. angustifolia (Miq.)
Corner
Mohd Hashim FMS 1103, Kiew RK 214, Strugnell FMS 13029
*Ficus deltoidea* Jack var. *kunstleri* (King) Corner
Kiew RK 93, Mead FMS 30761, Symington KEP 39390
*Ficus fulva* Reinw. ex Blume Henderson
*Ficus hispida* L.f. Anthonysamy SA 167
*Ficus obscura* Blume var. *borneensis* (Miq.) Corner Henderson
*Ficus pellucidopunctata* Griff. Henderson
*Ficus punctata* Thunb. Davies 2837
*Ficus sagittata* Vahl Henderson
*Ficus sumatrana* Miq. Symington KEP 39394
*Ficus trichocarpa* Blume Henderson
*Ficus villosa* Blume var. *villosa* Henderson
*Knema malayana* Warb. Henderson
*Knema plumulosa* J.Sinclair
Mohd Hashim FMS 279
*Myristica cinnamomea* King Kiew RK 222

**MYRSINACEAE**

*Antistrophe caudata* King & Gamble
Kiew RK 1181, Sinclair SFN 40132
*Ardisia colorata* Roxb. Henderson
*Ardisia lanceolata* Roxb. Henderson
*Ardisia villosa* Roxb. Henderson
*Grenacheria amentacea* Mez Henderson
*Grenacheria lampani* Mez Henderson
*Labisia pumila* (Blume) Fern.-Vill. Kiew RK 1148

**MYRTACEAE**

*Baeckea frutescens* L.
Symington KEP 37441
*Syzygium attenuatum* (Miq.) Merr. & L.M.Perry Strugnell FMS 13036, Symington KEP 33202
*Syzygium chloranthum* (Duthie) Merr. & L.M.Perry Mead FMS 30764
*Syzygium gratum* (Wight) S.N.Mitra Kiew RK 850
*Syzygium subdecussatum* (Wall. *ex* Duthie) I.M.Turner var. *subdecussatum*
Kiew RK 213, Symington KEP 47123

**OCHNACEAE**

*Campylospermum serratum* (Gaertn.) Bittrich & M.C.E.Amaral Henderson

**MYRISTICACEAE**

*Gymnacranthera forbesii* (King) Warb. Henderson
*Horsfieldia majuscula* (King) Warb. Henderson
*Horsfieldia polyspherula* (Hook.f. *ex* King) J.Sinclair var. *sumatrana* (Miq.) W.J.de Wilde Watson FMS 537
*Knema furfuracea* (Hook.f. & Thomson) Warb. Henderson
*Knema hookeriana* (Wall. *ex* Hook.f. & Thomson) Warb. Henderson
*Knema plumulosa* J.Sinclair
Mohd Hashim FMS 279
*Myristica cinnamomea* King Kiew RK 222

**MYRTACEAE**

*Baeckea frutescens* L.
Symington KEP 37441
*Syzygium attenuatum* (Miq.) Merr. & L.M.Perry Strugnell FMS 13036, Symington KEP 33202
*Syzygium chloranthum* (Duthie) Merr. & L.M.Perry Mead FMS 30764
*Syzygium gratum* (Wight) S.N.Mitra Kiew RK 850
*Syzygium subdecussatum* (Wall. *ex* Duthie) I.M.Turner var. *subdecussatum*
Kiew RK 213, Symington KEP 47123

**OCHNACEAE**

*Campylospermum serratum* (Gaertn.) Bittrich & M.C.E.Amaral Henderson
OLEACEAE
Jasminum elongatum (P.J.Bergius) Willd.
Kiew RK 1154

OPILIACEAE
Champereia manillana (Blume) Merr.
Henderson
Lepionurus sylvestris Blume
Henderson

ORCHIDACEAE
Renanthera sp. (Spider orchid)
Adam obs.
Dendrobium acerosum Lindl.
Strugnell FMS 13398

PALMAE
Calamus javensis Blume
Henderson
Eugeissona tristis Griff.
Adams obs, Kiew obs.
Licuala triphylla Griff.
Kiew RK 1079, RK 1172
Pinanga disticha (Roxb.) Blume ex
H.Wendl.
Kiew RK 1173

PANDACEAE
Galearia fulva (Tul.) Miq.
Hume 7146

PANDANACEAE
Benstonea ornata (Solms.) Callm. & Buerki
Kiew RK 1145, Rk 1810

PENTAPHRAGMATACEAE
Pentaphragma horsfieldii (Miq.) Airy Shaw
Henderson

PENTAPHYLACACEAE
Eurya acuminata DC.
Henderson

PHRYMACEAE
Cyrtandromoea grandis Ridl.
Kiew RK 1146

PHYLLANTHACEAE
Antidesma salicinum Ridl.
Henderson
Aporosa benthamiana Hook.f.
Henderson
Baccara brevipes Hook.f.
Henderson
Breynia discigera Müll.Arg.
Henderson
Bridelia tomentosa Blume
Burkill SFN 10033, Julius FRI 54866
Glochidion superbum Baill.
Henderson
Phyllanthus pulcher Wall.
Henderson
Sauropus androgynus (L.) Merr.
Henderson

PICRODENDRACEAE
Austrobxus nitidus Miq.
Kiew RK 848, Symington KEP 37444,
Wyatt-Smith KEP 6612

PIPERACEAE
Piper porphyrophyllum N.E.Br.
Henderson
Piper stylosum Miq.
Kiew RK 1176

POLYGALACEAE
Salomonia cantoniensis Lour.
Kiew RK 208
Xanthophyllum griffithii Hook.f. ex
A.W.Benn.
Watson 529
Xanthophyllum wrayi King
Henderson
PRIMULACEAE
Maesa ramentacea (Roxb.) A.DC.
Henderson

PROTEACEAE
Helicia attenuata (Jack) Blume
Hume FMS 7251

RHIZOPHORACEAE
Carallia eugenoidea King
Ridley s.n. (1921), Strugnell FMS 33208, Symington KEP 39396
Carallia suffruticosa Ridl.
Sinclair SFN 40136

ROSACEAE
Prunus grisea (Blume) Kalkman var. tomentosa
Henderson

RUBIACEAE
EE Aleisanthia rupestris (Ridl.) Ridl.
Ridley s.n., Symington KEP 33201, Kiew RK 216
Argostemma pictum Wall.
Kiew RK 1185
Chassalia curviflora (Wall.) Thwaites
Henderson
Greenea corymbosa (Jack) K.Schum.
Kiew RK 1153
Hedyotis auricularia L.
Henderson
Hedyotis capitellata Wall. ex G.Don
Henderson
Hedyotis corymbosa (L.) Lam.
Henderson
Hedyotis dichotoma J.Koenig ex Roth
Kiew RK 207
Hedyotis vestita R.Br. ex G.Don
Henderson
Ixora concinna R.Br. ex Hook.f.
Kiew RK 1143
Ixora congesta Roxb.
Kiew RK 1152
Ixora javanica (Blume) DC. var. javanica
Henderson
Ixora lobbii Loudon
Henderson
Ixora pendula Jack var. pendula
Kiew RK 1151
Lasianthus densifolius Miq.
Henderson
Lasianthus maingayi Hook.f.
Henderson
EE Lasianthus oblongus King & Gamble
Henderson
Mitragyna speciosa (Korth.) Havil.
Henderson
Mussaenda villosa Wall. ex G.Don
Henderson
Nauclea subdita (Korth.) Steud.
Henderson
Neonauclea pallida (Reinwa. ex Havil.) Bakh.f.
Henderson
Ophiorrhiza communis Ridl.
Henderson
Ophiorrhiza discolor R.Br.
Henderson
Pavetta gracilisflora Wall. ex Ridl.
Henderson
Porterandia anisophylla (Jack ex Roxb.) Ridl.
Henderson
EE Psychotria maingayi Hook.f.
Henderson
Psydrax sp.
Kiew RK 213
Rothmannia macrophylla (R.Br.) Bremek.
Kiew RK 1149
EE Spermacoce pilulifera (Ridl.) I.M.Turner
Henderson
Timonius wallichianus (Korth.) Valeton
Kiew RK 989
Uncaria lanosa Wall. var. glabra (Blume)
Ridsdale
Henderson
Urophyllum hirstum (Wight) Hook.f.
Henderson

**RUTACEAE**
*Glycosmis chlorosperma* Spreng. var. *chlorosperma*
Henderson

**SALICACEAE**
*Homalium caryophyllaceum* Benth.
Henderson

**SAPINDACEAE**
*Guioa diplopetala* (Hassk.) Radlk.
Symington KEP 37447

*Lepisanthes tetraphylla* Radlk.
Kiew RK 1141, Symington Keo 37449

*Pometia pinnata* J.Forst. & G.Forst.
Henderson

**SAPOTACEAE**
*Payena lucida* DC.
Henderson, Mohd Hashim FMS 37449

**SIMAROUBACEAE**
*Eurycoma longifolia* Jack
Kiew RK 990, RK 1073

**SMILACACEAE**
*Smilax myosotiflora* A.DC.
Kiew RK 1147B

**STYRACACEAE**
*Styrax benzoin* Dryand.
Henderson

**THYMELAEACEAE**
*Gonystylus maingayi* Hook.f.
Henderson

**TORRICELLIACEAE**
*Aralidium pinnatifidum* (Jungh. & de Vr.-ise) Miq.