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Checklist of vascular plants from Batu Caves, Selangor, Malaysia

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Abstract: The vascular plant flora of Batu Caves, a tower karst limestone formation, includes 269 species; 51 species (19%) are Peninsular Malaysian endemics and 80 species (30%) are calciphiles of which 56 (21%) are obligate calciphiles and 26 species are obligate calciphiles endemic to Peninsular Malaysia. Four taxa are endemic to Batu Caves itself. That Batu Caves harbours a sizeable fraction (21.4%) of Peninsular Malaysia's limestone flora underlines the need for detailed checklists of each and every limestone hill to enable adequate planning of conservation programmes to support biodiversity. Because botanical collecting began in the 1890s, Batu Caves is important as the type locality of 24 plant species. Land-use pressures have over time eliminated the surrounding native vegetation, leaving the flora vulnerable to aggressive weedy and alien species. Although designated as a Public Recreation Area, its protection status needs to be enforced and the boundaries clearly marked.

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Introduction

Batu Caves (3°14′ N, 101°41′ E), or Gua Batu (in Malay), is a limestone tower karst formation 11 km northeast of the capital Kuala Lumpur. It rises to 329 m tall and covers about 2.59 km^2. This massif with its vertical cliffs and craggy summit is a dominant landscape feature. Batu Caves is most famous for the Sri Subramaniaswamy Temple that at the Thaipusam festival is visited by hundreds of thousands of devotees who climb the 277 steps up to the Temple Cave. Besides its cultural importance as a religious site, it is also important for its cave ecosystems and associated fauna (Moseley *et al*. 2012) and for its flora (Wycherley 1972).

Batu Caves has been exploited commercially for a very long time. At first by Chinese farmers who since the 1860s collected guano from the caves (Yussof 1997). Quarrying for limestone had already started by 1889 when H.N. Ridley first investigated the caves, flora and fauna. Although Batu Caves was designated as a Public Recreational Area in 1930, quarry licenses continued to be leased in spite of lobbying for the total protection of the massif by the Batu Caves Protection Association and the Malayan Nature Society. Only when quarrying caused rock falls in the Dark Cave adjacent to the Temple Cave did quarrying finally stop in 1981. Batu Caves is now surrounded by residential, light industry and temple buildings with very little if any of the original vegetation that surrounded the foot of the tower karst. Enforcement of its status as a Public Recreational Area is lacking and its boundaries are not clearly marked so that intrusions go unchecked.

The limestone flora in Malaysia is botanically important due to (a) its species richness—14% of Peninsular Malaysia's species occur on the 0.04% of land area that limestone covers (Chin 1977), the result of the many different microhabitats stacked on a single limestone hill (Kiew 1991); (b) it is distinctly different in species composition compared with other forest types both in its common species, for example, species of Dipterocarpaceae, the dominant tree family in Malaysian rain forest, are hardly represented on limestone, and in calciphile species that are restricted to growing on limestone substrate, and (c) in its high level of endemism—21.4% of species (Chin 1977). Saw *et al*. (2009) considered that the limestone flora is one of the most endangered vegetation types in Peninsular Malaysia because of its lack of legal protection and threats from quarrying and disturbance resulting from land use changes.

H.J. Kelsall was the first collector of plants from Batu Caves when in 1891 he discovered three new species (*Adenoncos parviflora*, *Paraboea paniculata* and *P. verticillata*). Ridley has made the most comprehensive collections when he visited in June 1889, December 1896, July and August 1897, August 1908 and December 1920 and described many new species (Wycherley 1972). Then it was apparently easier to access the summit of Batu Caves, but since this time quarrying has left sheer rock faces where previously there were accessible gullies leading to the summit. Now the collector is faced by precipitous rock faces. Ridley collected at a time when Batu Caves was still surrounded by pristine lowland forest, although coffee plantations and later rubber tree plantations were expanding towards Batu Caves. This forest has long since been completely cleared causing the first recorded extinction of a plant species, *Echinodorus ridleyi* Steenis (Alismataceae), in Malaysia. To date, due to its proximity to Kuala Lumpur, more than 35 botanists have sporadically collected specimens from Batu Caves and their research continues to add new records. In fact, Batu Caves is probably the best collected tower karst hills in Peninsular Malaysia. Wycherley (1972) provided a partial list of 199 vascular plant species collected by Ridley.

The aim of this updated checklist is to consolidate what is known of the flora of Batu Caves both from the

many diverse literature sources as well as from herbarium specimens. This is necessary as a basis for drawing up conservation management programmes as well as for tracking the decline or loss of species and the invasion of aggressive alien or weedy species.

Materials and Methods

The checklist is based on a search of the literature (Henderson 1939, Wycherley 1972, and Chin 1977, 1979, 1983a, b are major works, but there are also many specialist articles on specific species) and herbaria that house major collections of specimens collected from Batu Caves, namely The Singapore Herbarium, Singapore Botanic Gardens, Singapore (SING); the Kepong Herbarium, Forest Research Institute Malaysia, Kepong, Selangor (KEP); and the University of Malaya Herbarium, Kuala Lumpur (KLU). The collections at KEP and SING are partially databased using BRAHMS (Botanical Research and Herbarium Management System), which greatly facilitated extraction of data. Extraction of data from KLU was done manually from accession books. In the case of dubious identifications, the herbarium specimen was checked and the name corrected. Only species recorded from the tower karst or limestone-derived soil at the base are included. Thus forest species that Ridley collected are not included in the checklist, nor are weeds that grow on wasteland around Batu Caves, nor exotic aliens that have invaded disturbed areas at the foot of Batu Caves.

The checklist includes family and species names, cites specimens, provides the endemic status, whether endemic in Peninsular Malaysia (E) or endemic in the phytogeographic zone that straddles the border of Peninsular Malaysia and Peninsular Thailand (ET); and status as a calciphile, i.e. whether it is an obligate calciphile *restricted* to growing on limestone (R) or whether it is a characteristic species most *usually* found on limestone (U).

Results

The checklist (Appendix 1) includes 5 lycophyte species, 27 ferns, 2 gymnosperms, 182 dicotyledons and 53 monocotyledons, in total 269 species. This represents 22% of 1,216 species recorded growing on limestone in Peninsular Malaysia (Chin 1977). The percentages of endemic and obligate and characteristic calciphiles (Table 1) are representative of the limestone flora as a whole.

The ten most common families are Orchidaceae (23 species), Apocynaceae (20 species), Rubiaceae (14 species), Araceae (12 species) and Gesneriaceae, Moraceae and Urticaceae (each represented by 9 species). *Ficus* (Moraceae) with 9 species is by far the largest genus.

Of the 56 species of obligate calciphiles (Appendix 1), 26 are endemic in Peninsular Malaysia and are therefore of highest conservation concern. Among these are:

- 4 local endemic species or varieties that are obligate calciphiles and are only known from Batu Caves—*Epithema parvibracteatum*, *Pararuellia sumatrensis* var. *ridleyi*, *Pseuderanthemum lilacinum* and *Rhaphidophora burkillana*
- 3 local endemic species that are obligate calciphiles and are only known from Batu Caves and the nearby Bukit Takun and Bukit Anak Takun that lie about 10 km north of Batu Caves—*Maxburretia rupicola*, *Ophiorrhiza fruticosa* and *Paraboea paniculata*
- very rare species found on one or two other limestone hills, *e.g., Impatiens ridleyi* is known only from Batu Caves and from Gunung Senyum, Pahang.

Other rare species that are not obligate calciphiles but are of conservation importance are

- 4 narrowly endemic species confined to an area within 15 km from Batu Caves—*Begonia phoeniogramma*, *Beaumontia murdochii*, *Piper argyrites* and *Psychotria lanceolaria*
- 6 widespread species that in Peninsular Malaysia are known only from Batu Caves—*Piper mucronata, Pomatocalpa andamanica, Sageretia thea, Sapium insigne, Sauropus macranthus*, and *Trigonostemon villosus*.

Batu Caves is also important because it is the type locality for 24 taxa, even though some have since been reduced to synonymy.

Discussion

Table 1 illustrates the fact that while the limestone flora is species rich (1,216 species), only a fraction are found on a single hill (21.4% of the species on Batu Caves) due in part to local endemism of the obligate calciphiles. This is illustrated by the Gesneriaceae. For the Peninsular limestone flora as a whole, Gesneriaceae is ranked fourth with 39 species but on Batu Caves it is represented by just seven species. Of these, only two grow on non-limestone substrates and are widely distributed; the rest are obligate calciphiles, two are local endemics, while the remaining three are more widespread but none are found on every hill. In fact it is the exception for limestone species to be encountered on every or even most hills. This is especially true among the obligate calciphiles. For instance, eight species of balsam are obligate calciphiles but only *Impatiens ridleyi* grows on Batu Caves and one other hill (Gunung Senyum, Pahang). The implications for conservation are two-fold. Firstly, to be able to make decisions on conservation management a detailed checklist for each hill is necessary and secondly, because each hill harbours only a fraction of the flora, a network of protected hills is required to capture the maximum biodiversity of the limestone flora.

Among the 267 species recorded from Batu Caves, 16 taxa (6%) are of conservation importance, either because they are local endemics that are restricted to just Batu Caves (4 species) or within 15 km of Batu Caves (3

Table 1. Number of taxa on Batu Caves compared with the total Peninsular Malaysia limestone flora.

	Total No. Species	No. and percentage of endemic species	No. and percentage of obligate (R) and characteristic (U) calciphile species
Batu Caves	269	51 (19%)	80 (30%)
Limestone Flora[1]	1,216	261 (21.4%)	335 (27.5%)

[1]Data from Chin 1977.

restricted to limestone and 4 on both limestone and non-limestone substrates) and 6 are widespread elsewhere but in Peninsular Malaysia are known only from Batu Caves.

Because Ridley was collecting when the flora of Peninsular Malaysia was just beginning to be known, many new species were described from Batu Caves (Table 2). From the scientific point of view, Batu Caves is important as a living museum where scientists are able to obtain living material of the authentic specimens from the type locality, for example, for DNA analysis, breeding and other investigations.

Although the Batu Caves tower karst formation has remained largely intact in spite of quarrying activity, the surrounding area has completely changed from pristine forest when Kelsall and Ridley made their collections, to the establishment of plantations that in turn were replaced by residential and industrial buildings and expanding infrastructure associated with the Sri Subramaniaswamy Temple. While the summit and flanks are largely undisturbed, the habitats around the base and associated with the Temple Cave are under severe pressure. This puts at risk populations of sensitive species that require moist shaded conditions, such as *Argostemma inaequilaterum*, which used to grow at the cliff base near the Art Gallery Caves; *Impatiens ridleyi* that only grows around the mouth of the Temple Cave where water constantly drips down; and *Epithema parvibracteatum* and *Monophyllaea hirticalyx* that grow on the rock scree below the skylight at the back of the Temple Cave. The latter species has not been seen for some years. With the removal of tree cover, aggressive invasive species both native, e.g. species of *Macaranga* and *Mallotus* (Euphorbiaceae) and of alien origin, *e.g., Piper aduncum* L. and *Chromolena odoratum* (L.) R.M. King & H. Rob. form thickets that smother the native flora. Of particular concern is *Chromolena* that in dry weather becomes a fire risk. Recently human activity resulted in vegetation fires on one face of the tower karst.

Active conservation management is required to protect these habitats from disturbance that not only drastically changes the microclimate but allows the invasion of these aggressive alien species. To protect the limestone flora there is an urgent need to clearly fence off the Public Recreation Area to prevent further intrusions.

Conclusion

Batu Caves is one of the iconic tower karsts in Peninsular Malaysia not only for its dominance of the landscape, but also for its Temple Cave that attracts hundreds of thousands of devotees. Scientifically it is important for its biodiverse flora, fauna and for its caves. Its flora is important in being species rich, including a high proportion of endemic and obligate and characteristic calciphiles, including taxa that are known only from Batu Caves, besides its historic importance as a type locality.

In view of the pressure on land from its proximity to the capital, Kuala Lumpur, there is an urgent need to enforce its legal protection status, to make clear the boundary of the Public Recreation Area, and to provide a buffer zone, preferably of tree cover, to protect the sensitive habitats at the foot of the cliffs and to provide a barrier to fire.

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Table 2. Species for which Batu Caves, Selangor, Malaysia, is the type locality.

ORIGINAL NAME	CURRENT NAME IF REDUCED TO SYNONOMY
Adenoncos parviflora	
Alyxia selangorica King	*Alyxia pilosa*
Andrachne calcarea Ridl.	*Leptopus australis*
Aporuellia sumatrensis C.B.Clarke var. *ridleyi* C.B.Clarke	*Pararuellia sumatrensis* var. *ridleyi*
Begonia phoeniogramma	
Boea paniculata Ridl.	*Paraboea paniculata*
Boea verticillata Ridl.	*Paraboea verticillata*
Bulbophyllum flammuliferum	
Cnesmone subpeltata	
Epithema parvibracteatum	
Hoya occlusa Ridl.	*Hoya coriacea*
Impatiens ridleyi	
Justicia microcarpa Ridl.	*Rungia laxiflora*
Livistona rupicola Ridl.	*Maxburretia rupicola*
Ophiorrhiza fruticosa	
Pavetta pauciflora	
Phyllanthus erythrocarpus	
Pilea calcarea Ridl.	*Pilea fruticosa*
Polyalthia congregata	*Enicosanthum congregatum*
Polytrema aequala Ridl.	*Ptyssiglottis kunthiana*
Pothos lorispatha Ridl.	*Pothos leptostachyus*
Pseuderanthemum lilacinum	
Psychotria lanceolaria	
Rhaphidophora burkillana	

Literature Cited

Chin, S.C. 1977. The limestone flora of Malaya. 1. *Gardens Bulletin Singapore* 30(1): 165–219 (http://biodiversitylibrary.org/page/43593860).

Chin, S.C. 1979. The limestone flora of Malaya. 2. *Gardens Bulletin Singapore* 32(1): 64–203 (http://biodiversitylibrary.org/page/43631262).

Chin, S.C. 1983a. The limestone flora of Malaya. 3. *Gardens Bulletin Singapore* 35(2): 137–190 (http://biodiversitylibrary.org/page/43578905).

Chin, S.C. 1983b. The limestone flora of Malaya. 4. *Gardens Bulletin Singapore* 36(1): 31–91 (http://biodiversitylibrary.org/page/43650020).

Henderson, M.R. 1939. The flora of the limestone hills of the Malay Peninsula. *Journal of Malay Branch of Asiatic Society* 17(1): 13–87.

Kiew, R. 1991. The limestone flora; pp. 42–50, in: R. Kiew (ed.). *The State of Nature Conservation in Malaysia*. Kuala Lumpur: Malaysian Nature Society.

Moseley, M., T.W. Lim and T.T. Lim. 2012. Fauna reported from Batu Caves, Selangor, Malaysia, annotated checklist and bibliography. *Cave and Karst Science* 39(2): 77–92.

Saw, L.G, L.S.L. Chua and N. Abdul Rahim. 2009. *Malaysia National Strategy for Plant Conservation*. Malaysia: Ministry of Natural Resources and the Environment & Forest Research Institute Malaysia. 63 pp.

Wycherley, P.R. 1972. Ridley and Batu Caves. *Malayan Nature Journal* 25(1): 22–37.

Yussof, S. 1997. *The Natural and Other Histories of Batu Caves*. Kuala Lumpur: Malaysian Nature Society. 55 pp.

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Appendix 1. Checklist of Vascular Plants from Batu Caves, Selangor, Malaysia. (E endemic in Peninsular Malaysia; ET endemic in Peninsular Malaysia and Peninsular Thailand; R obligate calciphile, U characteristic species, usually found on limestone

FAMILY/ SPECIES	ENDEMISM E/TE	CALCIPHILE STATUS U/R	COLLECTOR, NUMBER
Lycophytes			
Selaginellaceae			
Selaginella alutacia Spring.			Ridley 8150
Selaginella mayeri Hieron			Foxworthy FMS 23243; Ezzawanis FRI 52478; Schuettpelz 711
Selaginella padangensis Hieron			Ridley 8667; Lee s.n.
Selaginella stipulata (Blume) Spring.			Ugul & Bala KLU 21964; Schuellpelz 712
Selaginella willdenowia (Desv. ex Poir.) Baker			Chin 325
Ferns			
Adiantaceae			
Adiantum capillus-veneris L.			Schuettpelz 705
Adiantum malesianum Ghatak.		R	Ridley 8142; Ding DH 712; Sinclair SFN 40058; Ezzawanis FRI 52477
Aspleniaceae			
Asplenium cheilosorum Kunze ex Mett.			Schuettpelz 707
Asplenium macrophyllum Sw.			Sinclair SFN 40056
Asplenium polyodon G.Forst.		U	Stone 7294
Asplenium vittiforme Cav.			Chin 321
Lomariopsidaceae			
Cyclopeltis crenata (Fee) C.Chr.		U	Strugnell FMS 14617, 14622
Nephrolepidaceae			
Nephrolepis falciformis J.Sm.		U	Ding DH 714; Ezzawanis FRI 52481
Polypodiaceae			
Microsorum membranifolium (R.Br.) Ching			Nor-Ezzawanis FRI 52480; Schuettpelz 709
Pyrossia stigmosa (Sw.) Ching		R	Merton 4103
Pteridaceae			
Pteris ensiformis Burm.f.			Allen 2323
Pteris venulosa Blume			Schuettpelz 710
Pteris vittata L.			Abdul-Samat 336; Schuettpelz 713
Schizaeaceae			
Actinostachys inopinata (Selling) Reed		R	Wyatt-Smith KEP 85208
Sinopteridaceae			
Calciphilopteris allenae (Tryon)	E	R	Chin 1270; Kiew RK 1618; Saw FRI 48231
Calciphilopteris ludens (Wall. ex Hook.)		R	Ridley 8135; Ding DH 709
Hemionitis arifolia (Burm.f.) T.Moore		U	Strugnell FMS 17078
Tectariaceae			
Heterogonium pinnatum (Copel.) Holttum		U	Sinclair SFN 40062; Schuettpelz 708
Tectaria sp.			Schuettpelz 704, 706
Tectaria devexa (Kunze) Copel.		R	Molesworth-Allen 2356; Sinclair SFN 40052
Tectaria keckii (Luersson) C.Chr.		R	Molesworth-Allen 2395; Strugnell FMS 14615
Thelypteridaceae			
Amphineuron immersum (Blume) Holttum			Schuettpelz 714
Amphineuron opulentum (Kaulf.) Holttum			Viane & Noe 2325
Pronephrium triphyllum (Sw.) Holttum			Viane & Noe 2328
Vittariaceae			
Antrophyum parvulum Blume		U	Ridley 8644; Kiew, B.H. RK 1343; Sinclair SFN 40070
Woodsiaceae			
Diplazium esculentum (Retz.) Sw.			Molesworth-Allen 1350

FAMILY/ SPECIES	ENDEMISM E/TE	CALCIPHILE STATUS U/R	COLLECTOR, NUMBER
Diplazium pallidum (Blume) T. Moore			Ridley s.n. 1896
Gymnosperms			
Podocarpaceae			
Podocarpus neriifolius D.Don			Wyatt-Smith KEP 93281; Ng FRI 1633
Podocarpus polystachyus R.Br. ex Endl.		U	Ng FRI 1634
Dicotyledons			
Acanthaceae			
Justicia uber C.B.Clarke	E		Strugnell FMS 14618
Pararuellia sumatrensis (C.B.Clarke) Bremek. var. *ridleyi* (C.B.Clarke) Bremek.	E	R	Ridley 8213, Strugnell FMS 17079; Kiew FRI 48226
Pseuderanthemum crenulatum (Lindl.) Radlk.			Mohd Kasim 500
Pseuderanthemum lilacinum Stapf	E	R	Ridley s.n.
Ptyssiglottis kunthiana (Nees) B.Hansen		U	Ridley s.n. 1914
Rungia laxiflora C.B.Clarke	ET		Ridley 8213
Actinidaceae			
Sauraia leprosa Korth.			Ridley 8269
Sauraia pentapetala (Jack) Hoogland			Ridley s.n. 1921
Anacardiaceae			
Pistacia malayana M.R. Hend.	E	R	Whitmore FRI 758
Annonaceae			
Enicosanthum congregatum (King) Airy Shaw	E		Ridley s.n.
Goniothalamus macrophyllus (Blume) Hook.f. & Thomson			Syahida-Emiza FRI 66738
Polyalthia brunneifolia J.Sinclair	E		Whitmore FRI 757
Polyalthia jenkensii (Hook.f. & Thomson)Hook.f. & Thomson			Bowen 8483
Polyalthia obliqua Hook.f. & Thomson			Whitmore 79243
Sageraea elliptica (A.DC.) Hook.f. & Thomson			Stone 1266
Trivalvaria macrophylla (Blume) Miq.			Wyatt-Smith FMS 30781; Chin SFN 40060
Uvaria grandiflora Roxb. ex Hornem. var. *grandiflora*			Symington FRI 66730
Uvaria javana Dunal			Sinclair FRI 700
Apocynaceae			
Alstonia scholaris (L.) R.Br.			Hamid FMS 6443
Alyxia angustifolia Ridl.	E		Wyatt-Smith KEP 79250
Alyxia pilosa Miq.			Ridley 8558
Beaumontia murtonii Craib			Wyatt-Smith FRI 76343; Saw FRI 48223
Dischidia hirsuta (Blume) Decne.			Rintz RER 110
Gymnema sp.			Rintz RER 10
Heterostemma piperifolium King & Gamble	E	U	Burkill SFN 2261
Hoya coriacea Blume			Ridley s.n. 1890
Hoya finlaysonii Wight			Rintz RER 107
Hoya verticillata (Vahl.) G.Don var. *citrina* (Ridl.) Veldkamp	E	U	Rintz RER 111
Hunteria zeylanica (Retz.) Gardn. ex Thwaites			Ridley 8556
Kopsia griffithii King & Gamble var. *griffithii*			Ezzawanis FRI 52482
Mardenia ridleyi P.I.Forst.	E		Rintz RER 109
Marsdenia tinctoria R.Br.		U	Ridley s.n.; Burkill SFN 6356
Secamone elliptica R.Br.			Chin 351; Rintz RER 12, 59
Tabernaemontana peduncularis Wall.			Ridley 8555
Toxocarpus curtisii King & Gamble			Rintz RER 112
Toxocarpus griffithii Decne.			Ridley 1897
Toxocarpus pauciflora M.R.Hend.	E	R	Chin 353
Tylophora flexuosa R.Br.	E	R	Burkill SFN 6351
Araliaceae			
Schefflera oxyphylla (Miq.) R.Vig.			Symington KEP 32652; Whitmore FRI 15634
Balsaminaceae			
Impatiens ridleyi Hook.f.	E	R	Ridley 8278; Anthonysamy SA 380; Kiew RK 4706
Begoniaceae			
Begonia kingiana Irmsch.	E	R	Burkill 2263; Kiew, B.H. RK 1341
Begonia phoeniogramma Ridl.	E		Ridley 13430; Sinclair SFN 40067; Kiew RK 1257; Symington KEP 32656

FAMILY/ SPECIES	ENDEMISM E/TE	CALCIPHILE STATUS U/R	COLLECTOR, NUMBER
Bignoniaceae			
Radermachera glandulosa (Blume) Miq.			Ridley 8537
Boragineaceae			
Ehretia timorensis Decne.			Chin 1248
Capparaceae			
Capparis pubiflora DC.			Burkill SFN 6369
Celastraceae			
Euonymus javanicus Blume			Symington KEP 30800
Glyptopetalum quadrangulare Prain ex King			Chin 334
Loeseneriella cumingii Laws.			Wyatt-Smith 76342; Sinclair SFN 40054
Maytenus curtisii (King) Ding Hou	ET	R	Chin 1261
Salacia macrophylla Blume			Wyatt-Smith KEP 79149
Chloranthaceae			
Chloranthus erectus (Buch.-Ham.) Verdc.			Chin 1666
Convolvulaceae			
Argyreia kunstleri (Prain) Prain ex Ooststr.	E		Ridley 8220
Erycibe rheedii Blume			Burkill SFN 6365
Lepistemon binectiferum (Wall.) Kuntze			Ridley s.n.; Stone 8976
Cucurbitaceae			
Bayabusua clarkei (King) W.J. de Wilde	E		Ridley 8275
Coccinia grandis (L.) Voight			Syahida-Emiza FRI 66740
Melothria pendula L.		R	Chew FRI 51926
Momordica cochinchinensis (Lour.) Spreng.			Ridley 8277
Neoalsomitra clavigera (Wall.) Hutch.			Syahida-Emiza FRI 66732
Scopellaria marginata (Blume) W.J. de Wilde & Duyfjes			Ridley 8280
Dilleniaceae			
Dillenia excelsa (Jack) Gilg			Ng FRI 27201
Dipterocarpaceae			
Anisoptera costata Korth.			Strugnell 17073
Hopea dryobalanoides Miq.			Wyatt-Smith KEP 98274
Ebenaceae			
Diospyros kurzii Hiern.			Sinclair SFN 40055; Wyatt-Smith KEP 76341
Elaeocarpaceae			
Elaeocarpus pedunculatus Wall. Ex Mast.			Chin 1262
Erythroxylaceae			
Erythroxylum cuneatum (Miq.) Kurz			Ng FRI 1636
Euphorbiaceae			
Bridelia tomentosa Blume			Stone 8978
Cnesmone subpeltata Ridl.	E	R	Whitmore FRI 751
Homalanthus populneus (Grisel.) Pax			Sinclair SFN 40074
Macaranga tanarius (L.) M.A.			Whitmore FRI 754
Mallotus dispar (Blume) M.A.		U	Strugnell FMS 14619; Symington FMS 32653; Wyatt-Smith KEP 94598
Mallotus repandus (Willd.) M.A.			Symington FMS 30793, 32654
Sapium insigne (Royle) Benth.		R	Ng FRI 1626
Trigonostemon villosus Hook.f.			Whitmore FRI 1752
Gentianaceae			
Duplipetala pentanthera (C.B.Clarke) Thiv.		U	Ridley 8218; Kiew RK 1617
Fagraea carnosa Jack		U	Wyatt-Smith KEP 85211
Fagraea ceilanica Thunb.			Ng FRI 1627
Gesneriaceae			
Cyrtandra pendula Blume			Kiew, B.H. RK 1344
Epithema parvibracteatum Hilliard & B.L.Burtt	E	R	Ridley 8217; Siti-Munirah FRI 70502
Microchirita caliginosa (C.B.Clarke) Y.Z.Wang		R	Anthonysamy SA 379; Sinclair SFN 40066; Symington FMS 30796
Monophyllaea hirticalyx Franch.	E	R	Chin 2107
Monophyllaea horsfieldii R.Br.			Anthonysamy SA 378; Sinclair SFN 40061
Paraboea paniculata (Ridl.) B.L.Burtt	E	R	Ridley 8226; Kelsall 1970; Wyatt-Smith KEP 79245; Yusof 02
Paraboea verticillata (Ridl.) B.L.Burtt	E	R	Ridley 8551; Kelsall s.n.; Ng FRI 1628; Kiew FRI 48225
Guttiferae			
Garcinia murdochii Ridl.			Chin 1253

FAMILY/ SPECIES	ENDEMISM E/TE	CALCIPHILE STATUS U/R	COLLECTOR, NUMBER
Labiatae			
Callicarpa angustifolia King & Gamble		R	Wyatt-Smith KEP 79249; Ng FRI 1637; Saw FRI 48230
Clerodendrum deflexum Wall.			Ridley s.n.; Wyatt-Smith KEP 79247
Lauraceae			
Cryptocarya griffithiana Wight			Chin 1246
Dehaasia pauciflora Blume			Chin 328
Litsea angulata Blume			Ridley 8505
Lecythidaceae			
Barringtonia fusiformis King			Ridley 8284
Leguminosae			
Derris trifoliata Lour.			Stone 8980
Pterolobium densiflorum Prain			Whitmore FRI 15635
Melastomataceae			
Pogonanthera pulverulenta (Jack) Blume			Wyatt-Smith KEP 85210
Meliaceae			
Aglaia teysmanniana (Miq.) Miq.			Chin 1245; Putz FRI 23689
Chisocheton patens Blume			Ridley 8609
Chukrasia tabularis A.Juss.			Wyatt-Smith FRI 76344
Memecylonaceae			
Memecylon lilacinum Zoll. & Moritzi			Ridley 8279
Memecylon ovatum Sm.			Chin 313
Memecylon scutellatum var. *brevifolium*			Ridley s.n.
Menispermaceae			
Cyclea laxiflora Miers			Whitmore FRI 759
Moraceae			
Ficus calcicola Corner		R	Whitmore FRI 15633
Ficus callophylla Blume			Ng FRI 1635
Ficus hispida L.f.			Symington FMS 30790
Ficus lepicarpa Blume			Ridley 8185
Ficus punctata Thunb.			Ridley 8501
Ficus sagittata Vahl.			Ridley 8524, 13374
Ficus schwarzii Koord.			Ridley 8188
Ficus subulata Blume			Symington FMS 30773
Ficus sundaica Blume			Ridley s.n.; Chin 1272
Myrsinaceae			
Ardisia sp. Z TFM 4:273	E		Symington KEP 30799
Myrtaceae			
Rhodamnia cinerea Jack			Chin 1255
Syzygium scortechinii (King) P. Chantaranothai var. *cuneatum* (M.R.Hend.) I.M.Turner	E		Symington FMS 30791
Syzygium stapfianum (King) I.M.Turner	E		Wyatt-Smith KEP 80267
Olacaceae			
Strombosia ceylanica Gardn.			Ridley 8150
Strombosia javanica Blume			Ridley 8267
Oleaceae			
Jasminum cordatum Ridl.	ET	R	Chin 359; Syahida-Emiza FRI 66737
Ligustrum confusum Decne.		R	Ding Hou 704; Kiew RK 1615
Pandaceae			
Microdesmis casearifolia Hook.f. ex Planch.			Symington FMS 30783
Phyllanthaceae			
Actephila excelsa (Dalz.) M.A. var. *acuminata* Airy Shaw		R	Chin s.n.
Glochidion obscurum (Roxb.) ex Willd.)			Chin 472
Glochidion rubrum Blume			Chin s.n.
Leptopus australis (Zoll. & Mor.) Pojarkova		R	Ridley 8203
Phyllanthus oxyphyllus Miq.			Ridley 8174
Phyllanthus reticulatus Poir.			Ridley s.n.
Sauropus androgynus (L.) Merr.			Syahida-Emiza FRI 66734
Sauropus macranthus Hassk.		R	Ridley 8183, 8257
Piperaceae			
Peperomia portulacoides (Lam.) A. Dietr.		R	Kelsall s.n. 1891; Ridley 19446
Piper argyrites Ridl.	E		Ridley s.n.

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Piper kurzii Ridl.			Ridley 8180
Piper mucronatum C.DC.	E		Poore 807
Piper umbellatum L.			Symington FMS 30794
Rhamnaceae			
Sageretia thea (Osbeck) M.C.Johnst.		R	Whitmore FRI 15627; Ng FRI 1638
Ventilago oblongifolia Blume			Chin 344
Zizyphus pernettyoides Ridl.	E	R	Chin 343
Rhizophoraceae			
Carallia brachiata (Loir.) Merr.			Ridley 8265
Rubiaceae			
Aidia densiflora (Wall.) Masam.			Whitmore FRI 755, 15632
Argostemma diversifolium Ridl.	E	R	Teruya 500
Argostemma inaequilaterum Benn.		U	Ridley 8233; Symington KEP 30789
Chassalia sp.			Chin 474
Mycetia malayana (Wall. Ex Ridl.) Craib		U	Hamid KEP 7011
Ophiorrhiza discolor R.Br.			Ridley s.n.
Ophiorrhiza fruticosa Ridl	E	R	Ridley 8237, 8274; Ng FRI 1639
Ophiorrhiza pallidula Ridl.	E		Ridley s.n.
Pavetta pauciflora Ridl.	E	R	Ridley s.n. 1920
Psychotria lanceolaria Ridl.	E		Ridley s.n.
Psychotria penangiana Hook.f.	E		Strugnell KEP 17081
Tarenna adangensis (Ridl.) Ridl.		R	Ding DH 708
Tarenna angustifolia (King) Merr.		R	Wyatt-Smith KEP 79248; Whitmore FRI 15628; Syahida-Emiza FRI 66731
Tarenna sp. 16	E	R	Chin 1249
Rutaceae			
Clausena excavata Burm.f.			Chin 345
Glycosmis chlorosperma Spr.			Symington FMS 30792
Glycosmis trichanthera Guillaumin var. *trichanthera*		R	Wyatt-Smith KEP 85207; Stone 8977
Paramignya scandens (Griff.) Craib	E		Stone 8981
Salicaceae			
Osmelia maingayi King			Ridley 8593
Scolopia spinosa (Roxb.) Warb.			Chin 354
Sapindaceae			
Allophylus cobbe (L.) Raeusch.			Ridley s.n.
Dimocarpus longan Lour. subsp. *malesianus* Leenh.		R	Curtis 3773
Sapotaceae			
Pouteria obovata (R.Br.) Baehni			Ng FRI 1623
Solanaceae			
Lycianthes biflora (Lour.) Bitter		U	Wyatt-Smith KEP 79150
Solanum erianthum D.Don			Merton 4105
Sterculiaceae			
Pterospermum acerifolium (L.) Willd.			Wyatt-Smith KEP 79246; Symington FMS 30782
Sterculia sp.			Chin 1263
Ulmaceae			
Celtis philippinensis Blanco		R	Chin 2100
Urticaceae			
Debregeasia squamata King ex Hook.f.		U	Ridley s.n. 1897
Dendrocnide stimulans (L.f.) Chew			Ridley 8527
Elatostema curtisii (Ridl.) H.Schrot.	E		Ridley 4717, 8196
Elatostema latifolium (Blume) H.Schrot.			Ridley 8200
Elatostema repens (Lour.) Hallier f.			Ridley 8186
Nothocnide mollissima (Blume) Chew			Ridley s.n. 1920
Oreocnide rubescens (Blume) Miq.			Ridley 8242; Sinclair SFN 40069; Omar FMS 7995
Pilea fruticosa Hook.f.	E	R	Ridley 8526; Ding DH 720
Poikilospermum cordifolium (Barg.-Petr.) Merr.			Mohd Nur 8962
Violaceae			
Rinorea horneri (Korth.) Kuntze			Chin 338
Vitaceae			
Cayratia wrayi (King) Gagnep.			?Ridley
Cissus hastata Miq.			Whitmore FRI 15629

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Cissus javana DC.		R	Chin 1755
Cissus nodosa Blume			Ng FRI 1631; Ding DH 711
Leea indica (Burm.f.) Merr.			Chin 476
Leea saxatilis Ridl.	E	U	Ridley 305, Merton 4098
Tetrastigma leucostaphylum (Dennst.) Alston ex Mabb.			Ridley
Tetrastigma pedunculare (Wall. ex Lawson) Planch.			Chin 789
Tetrastigma scortechinii (King) Gagnep.	E		?Curtis
Araceae			
Alocasia inornata Hallier f.			Ridley 8168; Herscovitch 940101; Hay 9057
Alocasia longiloba 'lowii'		R	Ridley s.n.; Sinclair 40071
Apoballis mutata (Hook.f) S.Y.Wong & P.C.Boyce			Ridley s.n.
Homalomena griffithii (Schott.) Hook.f.			Nicolson 1155
Homalomena humilis (Jack) Hook.f.			Ridley s.n. 1889
Pothos leptostachyus Schott.		R	Ridley s.n.
Rhaphidophora burkilliana Ridl.	E	R	Mohd. Nur 8965
Rhaphidophora montana (Blume) Schott.		R	Ridley s.n. 1889
Schismatoglottis calyptrata (Roxb.) Zoll. & Moritzi			Ridley s.n. 1889
Scindapsus hederaceus Miq.			Ridley s.n.
Scindapsus perakensis Hook.f.			Ridley s.n.
Typhonium fultum Ridl.	ET	R	Ridley 8165
Convallariaceae			
Peliosanthes teta Andrews			Sinclair SFN 40059
subsp. *humilis* (Andrews) Jessop			
Dracaenaceae			
Dracaena sp.			Saw FRI 48224
Gramineae			
Dichanthium mucronulatum R.K.Jansen	E	R	Ridley 8129; Chin 1271
Echinochloa colona (L.) Link			Duistermaat FRI 51920
Eleusine indica (L.) Gaertn.			Duistermaat FRI 51922
Eragrostis pilosa (L.) P.Beauv.			Duistermaat FRI 51925
Eragrostis amabilis (L.) Wight & Arn. ex Hook. & Arn.			Duistermaat FRI 51924
Oplismenus compositus (L.) P.Beauv.			Duistermaat FRI 51916
Sporobolus indicus (L.) R.Br. var. *flaccidus* (Roem. & Schult.) Veldkamp			Duistermaat FRI 51921
Orchidaceae			
Adenoncos parviflora Ridl.			Kelsall s.n. 1891
Adenoncos sumatrana J.J.Sm.			Ridley 8171
Appendicula anceps Blume			Saw FRI 48228
Bulbophyllum flammuliferum Ridl.	E	R	Ridley s.n.
Calanthe ceciliae Reichb.f.			Ridley 8486
Calanthe vestita Lindl.		R	Ridley s.n. Dec 1896; Strugnell FMS 17077
Corybas calcicolus J. Dransf. & G.Smith	E	R	Chin 355; Dransfield s.n. 1970
Corymborkis veratifolia Blume			Ridley 8128
Dendrobium subulatum (Blume) Lindl.			Ridley s.n. 1894
Goodyera pusilla Blume		R	Symington FMS 30776
Grosourdya appendicula (Blume) Reichenb.f.		U	Ridley s.n. 1897
Oberonia sinuosa Ridl.			Ridley s.n.
Pennilabium angraecum (Ridl.) J.J.Sm.	E		Ridley 8131
Pholidota imbricata Hook.		U	Ridley s.n. 1897
Phreatia plantaginifolia (K.D.Koenig) Ormerod			Ong FRI 67738
Polystachya concreta (Jacq.) Garay & H.R.Sweet			Saw FRI 48229; Ong FRI 71387
Pomatocalpa andamanica (Hook.f.) J.J.Sm.		R	Chin 1244
Renantherella histriconica (Reichb.f.) Ridl.			Chin 1264
Schoenorchis micrantha Blume			Ridley s.n 1896
Taeniophyllum filiforme J.J.Sm.			Ridley s.n. 1896
Thelasis pygmaea Blume			Ridley s.n. 1896, 8465
Trichoglottos retusa Blume		U	Kelsall s.n.
Ventricularia tenuicaulis (Hook.f.) Garay		U	Ridley 8133

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Palmae			
Calamus manan Miq.			Loh FRI 21521
Calamus scipionum Lour.			Tahir FRI 18537
Iguanura wallichiana (Wall. ex Martelli) Hook.f.			Kiew, B.H. RK 1345
Maxburretia rupicola (Ridl.) Furtado	E	R	Ridley 8285; Whitmore FRI 15636; Saw FRI 48227
Oncospermum horridum (Griff.) Scheff.			Chin, S.C. obs.
Pandanceae			
Pandanus penangensis Ridl.	E	U	Whitmore FRI 15625
Zingiberaceae			
Alpinia javanica Blume			Ridley s.n. 1889
Amomum testaceum Ridl.		U	Ridley 13122
Etlingera littoralis (J.Koenig) Giseke			Ridley s.n. 1890