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THE FLORA OF THE LIMESTONE HILLS OF THE MALAY PENINSULA

By M. R. HENDERSON, F.L.S.

(Plates III—XII).

A striking feature of the scenery in parts of the Malay Peninsula is the occurrence of abrupt cliffs of limestone. They rise sheer out of the surrounding plain and their precipitous sides, often honeycombed with caves, and their fantastic pinnacles, attract attention immediately.

These outcrops of limestone become more common the further north one goes in the Peninsula and the first to be observed are close to Kuala Lumpur, some 200 miles from Singapore. They are commonest in Perak, Pahang, Kelantan, Perlis and Langkawi. Scrivenor in Burkhill, Dict. Econ. Prod. Mal. Pen. II (1935) p. 1345, gives the following interesting information about them: " If all the limestone hills were collected together they would form a block with an area of over 100 square miles, and a height of about 800 feet, giving a mass of limestone with a volume of about sixteen cubic miles. This rough estimate gives the amount of limestone occurring as hills standing above the country level and does not take into account the far greater amount of limestone forming flat or gently undulating ground which is usually covered by soil and alluvium ". In this article he gives also the chemical composition of the limestone and the chief uses to which it is put. In his " Geology of Malaya ", p. 140, he states that " the limestone of Malaya is so pure that no weathering products are visible except a covering of dark red earth which is largely composed of residual clay coloured by iron oxide ".

The limestone in the Peninsula does not attain any great height above sealevel, few of the hills reaching 2,000 feet.

Botanical collecting has been done on these hills to some extent for many years, but only in the more accessible parts of the north and west. The writer, however, has had opportunities, during the past few years, of visiting most of the important limestone areas and of making collections and observations, and the purpose of this account is to bring together what is now known of the flora and to show how it differs from that on other geological formations. Only the limestone hills are taken into consideration, and not those areas mentioned by Scrivenor where the underlying rock is limestone, covered by soil.

Limestone areas and collections therefrom.

In order to obtain as complete a flora as possible of the limestone, the Herbarium of the Singapore Botanic Gardens was searched for definite records and all publications dealing with the local flora carefully scrutinised. The result was somewhat

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disappointing. In a great many cases the collector did not state definitely that his plant was found on limestone. Merely giving the locality, such as "Batu Caves", is not sufficiently precise, for the specimen may have been gathered somewhere near the base of the cliff, not necessarily on limestone. All such dubious records, therefore, were excluded, unless they were supported by later collections with a definite note that the specimen was found on limestone.

Setul.—Some of the limestone hills here were collected upon by Ridley, Haniff and Kerr.

Perlis.—Many small limestone hills are dotted about the alluvial plain, apart from the boundary range between Siam and Perlis. Ridley collected on the small hills near Kangar, and Corner and Henderson have also collected on those, including Bukit Lagi, Bukit Besih Hangat, Bukit Chupeng, Bukit Ketri, Bukit Wang Tangga, Tebing Tinggi, and on Pulau Rabana, off Kuala Perlis. A native collector (Kiah) from the Botanic Gardens Singapore made collections at Kaki Bukit in 1938.

Langkawi.—This most interesting group of islands has been visited many times, by Curtis, Fox, Haniff, Nur, Ridley, Robinson and Seimund, Kerr, Holttum, Henderson, and Symington. As the islands are not wholly of limestone but also of granite and quartzite, it is sometimes difficult to decide whether some of the older collections were made on limestone or not. Curtis for example often labels his plants as from "near Kuah", but the granite and limestone are close together at this point. Where there is definite indication of a precise locality, it is usually not difficult to determine the formation from which the plant came, but a few localities on labels have not been traced on maps or by enquiries among the local Malays.

The writer in 1934 collected almost exclusively on limestone in Selat Panchor, round the coasts of Pulau Timun and Pulau Dayang Bunting, and at Kisap near Kuah.

Kedah.—Gunong Keriang near Alor Star has been visited by Kunstler, Curtis, Fox, Ridley, Haniff, and the writer. This hill has been the source of several ornamental plants now cultivated at the Anak Bukit Gardens at Alor Star and in the Waterfall Gardens Penang. The large hill at Baling has had very little collecting done upon it. Best obtained a few plants there in 1929, and the writer and Kiah climbed it in 1938, unfortunately at a season (May) when very little was in flower. A large hill to the south of Baling, shown on the 1938 Geological map, has not been visited.

Kelantan.—An extensive range of limestone hills borders the railway line from the state boundary northwards. There are so many that the geological maps do not attempt to mark them all.

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Nur and Foxworthy collected here in 1924 and the writer in 1927. He made large collections on one of the largest hills close to the railway line—Gua Panjang—and visited Gua Ninek and Gua Musang.

The summit of Gunong Stong, c. 5,000 ft., was reported to be capped with limestone, but Symington and Willbourn report that there are only a few boulders of limestone, of no significance from a botanical point of view.

In 1935 the writer visited Kuala Betis on the Nenggiri river and found small limestone hills a short distance up the Sungai Betis, which are not marked on the geological maps. One of these, Gua Teja, was climbed and fairly well explored and collections were made round the base of another, Gua Lambok. What appeared to be large limestone cliffs were seen much further up the Betis, but the 1938 Geological map indicates quartzite and shale in this vicinity. Further up the Nenggiri from Kuala Betis is Gunong Ayam, marked on some maps as limestone and said by the local Malays to be such, but judging from the latest geological map it is more likely to be a quartzite ridge.

Limestone boulders occur on the path between Kuala Betis and Gua Musang, but no hills were seen in this area.

The 1934 map of Kelantan showed a large ridge on the Lebir river, called Batu Papan, marked in the conventional way for limestone. This ridge, however, is composed of shale or ancient volcanic rock (fide E. S. Willbourn), and the only limestone found in the vicinity was a solitary boulder on the river-bank.

Trengganu.—The Geological maps show no limestone hills in this state.

Pahang.—The range along the railway in Kelantan extends south into Pahang almost to Kuala Lipis, the hills gradually getting smaller and further apart as one goes southwards. Near Padang Tungku are one or two small hills. These have not been visited, nor have two large hills shown on the map east of Sungai Yu. Gua Tipus, near Chegar Perah, was collected upon by the writer in 1927.

Bukit Serdam, near Raub, marked on the map as a single hill, is a group of several. The writer has climbed to the highest point and collected upon it, and he has also made collections on Bukit Chintamani, just north of Karak.

Kota Glanggi, on the Benta-Kuantan road, has been visited more than once, first by Ridley, then by Evans, who, however, employed a Dyak collector for plants and labelled them insufficiently. The writer collected on parts of this group in 1929, and in the same year, in company with Carr, climbed Gunong

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Sennyum, near Kuala Krau. Evans also collected at the base of Gunong Sennyum, but again without precise data.

The group of hills northwest of Kuantan has been collected upon only by the writer in 1931. The larger hills of the group, Bukit Sagu and Bukit Cheras, were partially explored.

A group of hills to the south of the Pahang river at Jerantut has not been visited.

Perak.—Collecting on the limestone has been more extensive in Perak than in any other state. Nearly all the limestone areas have been visited.

Kunstler collected chiefly at Gopeng and Kampar, and his collections are almost invariably labelled with precise details of locality. In King's "Materials for a Flora of the Malay Peninsula" there occasionally occurs a locality called "Limbo Hills". This is a misreading of Kunstler's labels. He, or a clerk, almost always spelt "limestone" as "limbstone" and contracted it to "Limbs."

Ridley, Curtis, Burkill and the writer have collected near Ipoh, but in the case of the first mentioned it is not always safe to assume that his plants came from limestone.

Scortechini and Curtis collected a little at Batu Kurau near Taiping, and Kunstler at Gunong Pondok, north of Kuala Kangsar. Some of his labels from here are puzzling. For instance he occasionally labels a plant as from "near Gunong Pondok", giving the altitude as 1,000 feet or more. Burkill and Haniff collected about the base of this hill, and the writer to the summit.

The small hills near Lenggong in Upper Perak were collected upon by Ridley's collector, unfortunately without precise labelling. The writer made fairly comprehensive collections there in 1930.

Selangor.—Batu Caves, near Kuala Lumpur, has been visited many times by nearly all collectors working in the Peninsula, but again in many cases there is difficulty in deciding whether plants are actually from the limestone or not.

Bukit Takun, the very conspicuous hill near Kanching, has been climbed and collected upon by Symington and Nur, and the writer made a hurried ascent in 1937. Ridley collected a little round the base. Although close to Kuala Lumpur and of great interest botanically, this hill has had very little collecting done upon it, perhaps because of the difficulty of the ascent.

One of the earliest references to collecting on the Peninsular limestone that can be traced is one by Tenison-Woods in the Proceedings of the Linnean Society of New South Wales, Jan. 1889,

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p. 34. In the course of a short statement he says that the limestone hills have a distinct flora, but not the same in every place, and that certain species reappear whenever the limestone crops out. He remarks that he never heard of anyone getting to the summit of Gunong Pondok. Actually the ascent of Gunong Pondok is in no way difficult, and very much easier than many smaller hills.

The great majority of limestone hills are climbable without the aid of ropes, for it is usually possible to find a cleft or gully up which one can scramble. The slopes are exceedingly steep, but the presence of abundant vegetation both hides the precipitous nature of the ground and provides the climber with numerous handholds. The rock is often weathered into exceedingly sharp knife-edge ridges and pinnacles which play havoc with clothes and boots.

Interference with the vegetation by man, etc.

The local Malays and aborigines rarely climb these hills, for there is little inducement to do so. Survey beacons are placed on the summits of some hills and this usually entails a certain amount of clearing round the beacon. The caves and overhanging parts of the cliff bases may be used as temporary shelters and in prehistoric times they appear to have been the homes of primitive peoples. Here and there one finds a *kramat* in a cave or rock shelter, such as those at Bukit Chupeng and Gunong Sennyum. Chinese temples, such as those near Ipoh, are occasionally built into limestone hills, utilising hollows and caves in the most ingenious fashion. Large quantities of marble are quarried from easily accessible hills for road metal, ballast for railway tracks, lime burning and smelting of tin ore. Tin ore, bat guano and phosphates are recovered from hollows or caves in many places. Bats are extremely numerous in some of the darker caves and their characteristic smell can often be detected hundreds of feet away. The writer has come across one instance where these bats were used for food by the aborigines. Platforms were erected at the narrow mouth of a dark cave and the bats struck down when emerging at dusk.

Probably the only animal of any size to be found living on the limestone hills of the Peninsula is the serow or *kambing gerun* of the Malays (*Nemorhodeus sumatrensis*), but to judge from tracks seen on many occasions it is certain that elephant, tiger and other large animals frequent the cliff bases. The Malays say that elephant like to rub and scratch themselves on sharp projecting rock edges and have favourite places for doing so. They say also that elephant use the caves when giving birth to young, and certainly tracks and other marks seen tend to corroborate these statements.

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In many localities clearing of the original surrounding vegetation has taken place right to the bases of the hills. The resulting exposure must have altered to some extent the original vegetation on the basal parts of these hills. Thickets of herbaceous climbers and small secondary growth trees may be found in some localities, while in others, where the base of the cliff is undercut or sheer, little change seems to have taken place.

At Gunong Keriang, near Alor Star, Chinese vegetable gardens extended to within a few feet of the base of the hill and no doubt accounted for the large numbers of the Giant Snail (*Achatina fulica*) which were found crawling over the rocks.

A paragraph in the Straits Times of October 17th, 1938, drew the writer's attention to Dr. Charles Hose's statement in his "Fifty Years of Romance and Research" that in Borneo spontaneous fires had been observed on the summits of inaccessible limestone hills. Dr. van Steenis has kindly supplied a translation of a passage in his Maleische Vegetationeschetsen (Tijdschr. Kon. Ned. Aardr. Genootschap, Vol. 52 (1935) p. 48) which may explain the origin of these fires. It reads: "F. H. Endert (Midden Oost Borneo expeditie 1925, 1927, pp. 226-227) mentioned lightning strokes on steep limestone hills in Central East Borneo where after fire firstly *Epithema*, a small fleshy herb, later ferns (among others *Nephrolepis* and *Pteridium aquilinum*, the latter a typical fire plant) and at last shrubs gained ground." Further extracts sent by Dr. van Steenis from Dutch publications dealing with forest fires in the Netherlands Indies seem to point to the conclusion that although lightning strokes are common and evidences of them often seen, no serious fires are caused, due to the heavy rain which normally accompanies lightning storms in this part of the world.

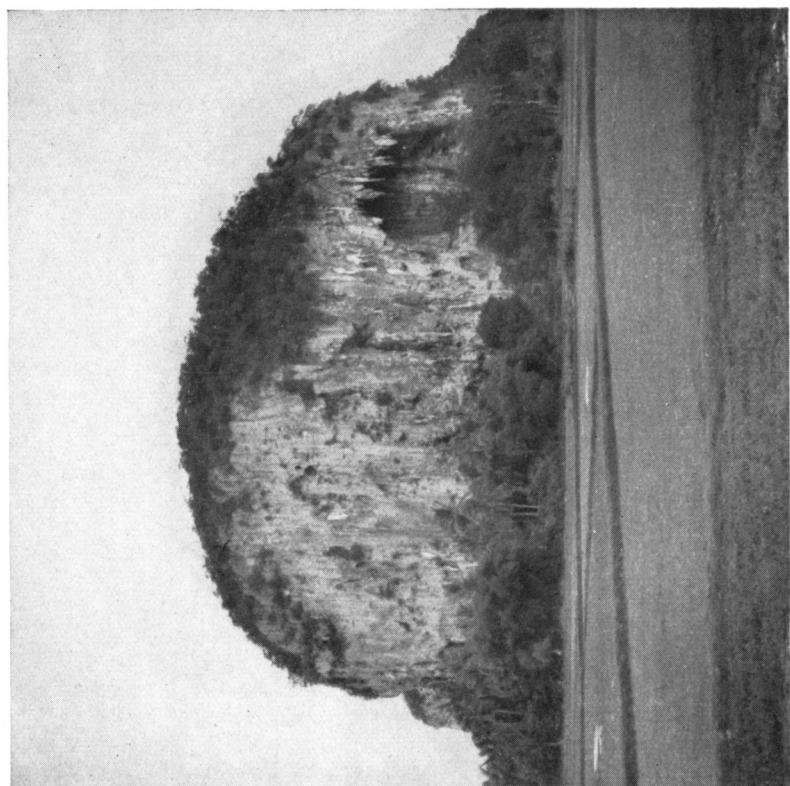
The writer has seen only one instance of damage by fire on limestone hills in the Peninsula and in this case there is very little doubt that the fire was started, accidentally or not, by human agency. *Pteridium aquilinum* is not recorded as occurring on the Peninsular limestone. *Epithema* is of course very common, and *Nephrolepis* often occurs when clearings are made.

In Langkawi, in the neighbourhood of Selat Panchor, there are a few small areas which appear to have been completely cleared. These clearings, if they are artificial, are not of recent date. They are covered with grasses and the original vegetation does not seem to have been able to re-establish itself.

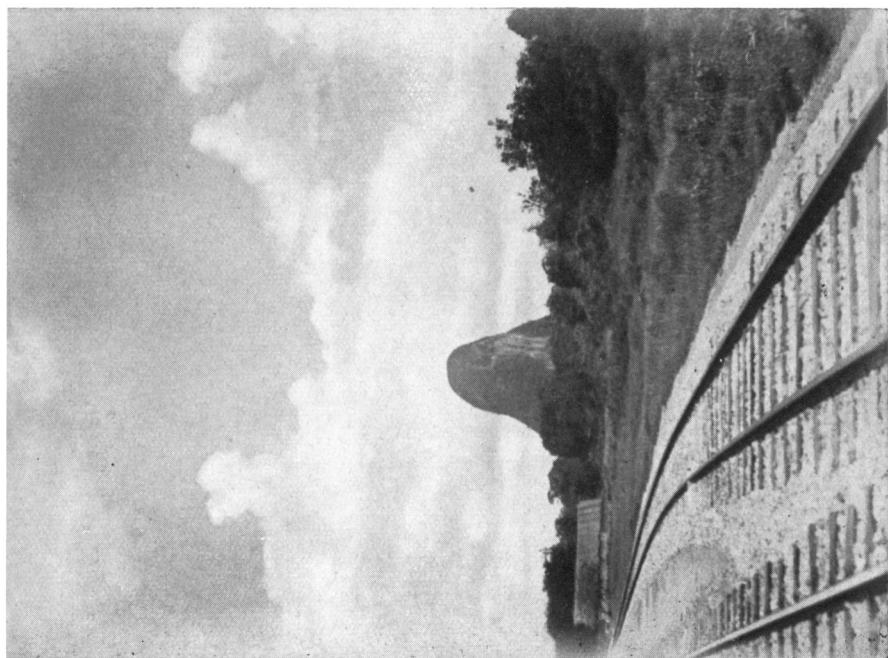
The vegetation of the limestone, therefore, is primary forest, only slightly interfered with by man and other influences. Only where the ground has been disturbed by mining, quarrying and similar activities do secondary growth plants appear.

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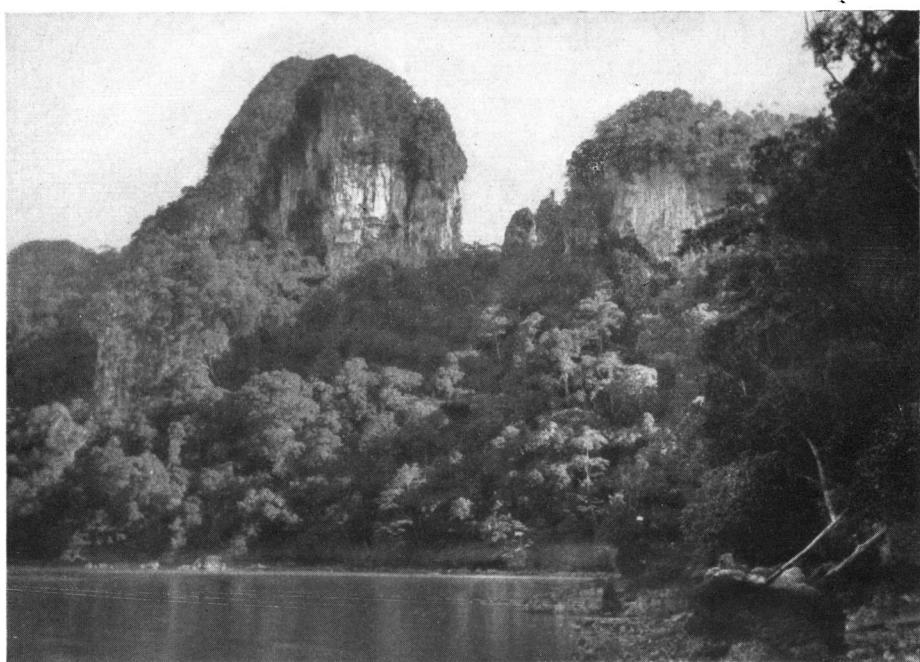


A limestone hill at Kodiang, Kedah.



A limestone hill in Perlis.

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Coastal limestone, Pulau Dayang Bunting, Langkawi.

Types of limestone hills.

The general characteristics of the hills vary from place to place and a very rough classification is possible :

1. Very dry, with little soil and much exposed rock. Trees usually rather stunted. Mosses and herbaceous plants scarce.
2. Wet, often with gullies filled with rich soil and supporting fair sized not stunted trees. Mosses and herbaceous plants present.
3. Hill well covered with soil, usually a stiff red clay. Much less exposure of rock than in 1. or 2. Many tall trees, little or no moss, few herbaceous plants.

There is no hard and fast demarcation between the three types. They grade into one another and combine. Type 2 is possibly the most distinct. The characters of 1 and 3 are often combined. The most striking differences between a typical "dry" hill (Kota Glanggi, Pahang) and a typical "wet" one (Gua Panjang, Kelantan) may be tabulated:

GUA PANJANG (WET).	KOTA GLANGGI (DRY).
Large quantities of mosses, with <i>Corysanthes</i> , <i>Ophiorrhiza</i> etc.	Little or no moss, no <i>Corysanthes</i> or <i>Ophiorrhiza</i> .
<i>Pandanus sp.</i> in great numbers.	No <i>Pandanus</i> .
<i>Taxotrophis ilicifolia</i> absent or very scarce.	<i>Taxotrophis ilicifolia</i> very common.
Few orchids, either epiphytic or on rocks.	Many such orchids.
Succulent <i>Impatiens</i> common.	No <i>Impatiens</i> .
Top mossy with dense growth of thin spindly trees, and deeply covered with mosses, liverworts and humus.	Top dry and bare, rock exposed, no accumulation of humus or mosses. Trees not spindly, but stout, gnarled and twisted or stunted.

The actual structure of the hill may have an effect on the vegetation which covers it. One can imagine the hill to be either a solid block of limestone with drainage only from the surface, or a loose mass of boulders through which water can percolate rapidly. Mr. E. S. Willbourn advances the theory that the numerous amphitheatres or "wang" that occur in limestone hills are caused by cave formation within the hill mass due to underground stream solution, with a subsequent falling in of the cave roof. Something of this sort in progress may be seen at Gunong Sennyum where there are several large caves with their roofs partially collapsed. Kota Glanggi also has many caves and both these hills are of the dry type. A fine example of a "wang" is the hill at Baling in Kedah. In the light of Mr. Willbourn's theory this hill must be in the last stages of dissolu-

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tion, for all that remains is a horseshoe-shaped rim. The outer slopes are very steep but not sheer, except for the basal portions. The inner faces are precipitous with talus slopes at their bases. The floor of the amphitheatre is partially cultivated, as is usual in such wangs. The upper parts at least of this hill can be classified as "dry".

Gua Panjang is a wet hill. It apparently has no caves. Gua Tipus is partly wet and partly dry. It is broken up by deep gullies and has caves, but there is a considerable amount of moss on the top and *Impatiens*, *Corysanthes* and *Pandanus* are present.

The coastal limestone of Langkawi shows little cave formation, but the vegetation is dry and much sparser than on the southern limestone, due no doubt to the proximity of the sea and to the winds. On exposed headlands vegetation is often stunted and reduced, the rocks being covered with grasses, dwarf bamboo and scattered misshapen trees. Where sheltered from the wind the vegetation is more luxuriant, with a closer growth of larger trees. In one or two places, particularly at Tanjong Pinang at the southern corner of Pulau Dayang Bunting, the pruning effect of the north-easterly winds is very marked.

The experienced eye should have little difficulty in picking out a limestone hill even where no bare cliffs are visible, because of the sparser and less luxuriant vegetation compared with that, say, on granite hills. For instance, when sailing close to the coast of Langkawi near Kuah, where limestone and granite are close together, the two formations can be differentiated at a glance. The granite ridges have a much softer outline than the limestone ones, and the vegetation on the granite is very noticeably more luxuriant, with many more tall trees of different species more closely crowded together.

A botanist would not have made the mistake of marking the Batu Papan ridge on the Lebir river in Kelantan as limestone (see p 15).

The hills rise abruptly from the plains and their bases are usually surrounded by masses of fantastically weathered boulders, over which may grow tangles of *Taxotrophis ilicifolia*, tough and difficult to penetrate. *Taxotrophis* is sometimes replaced by other trees, as for instance at Bukit Takun, where the dominant tree at the cliff base is *Oreocnide sylvatica*, or at Bukit Chintamani, where it is *Pisonia excelsa*.

The bases of the cliffs in most places are undercut, sometimes very deeply, presumably by freshwater action in inland situations, where streams may often be found disappearing under the cliff, or by the sea where the limestone is coastal, as at Langkawi. An excellent example of what seems to be undercutting by the sea is to be found at the hill at Kisap, a mile or so inland from Kuah, Langkawi.

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Parts of the lower slopes of some hills are covered by scree of loose rock, evidently broken off from the main mass higher up. These sometimes lie near the critical angle of slope and may be decidedly dangerous to negotiate. The lower slopes of other hills often are well covered with soil with little outcropping of rock. Others again are precipitous from the base.

The lower slopes and bases of the hills bear usually a close cover of small trees and shrubs, with herbaceous plants perched in hollows in the rocks where moisture and humus can accumulate. Small herbs such as *Pilea* and *Impatiens* grow in the cracks of the steeper faces, and it is surprising to find succulent plants like *Impatiens* growing in the shallowest cracks with the minimum of dry dusty soil. Small shrubs grow in the cracks of precipitous faces, and aroids climb up these faces with their regularly spaced leaves closely pressed to the surface of the rock. Aerial roots and lianes dangle down from ledges high above.

A species of *Arenga* may often be seen at the bases of dry cliffs, or a little way up them, perched on the tops of boulders in the driest possible situations.

In the damp ground at the mouths of caves, kept moist by the drip from above, such lowgrowing plants as *Pilea* and *Begonia* may be found, all with their leaves turned permanently to the light. In caves with a deep deposit of bat guano, there is no vegetable life. In dimly lit caves, such as those with the roofs partially collapsed, there is usually a sparse vegetation of small trees, such as *Diospyros*, on the cave floor, while small succulents are to be found on the walls.

The steep slopes of such a wet hill as Gua Panjang are well covered with small or medium sized trees, while the slightly less steep gullies, which are often filled with rich soil and humus, support larger trees, often of the *Anonaceae*. There are frequent mossy patches in which *Corysanthes* may be found, and here and there are sheets of *Ophiorrhiza*. A very conspicuous feature of such hills is the number of Pandans. On the steepest slopes they grow out almost horizontally for the first foot or so and then curve up to a vertical position. Other small trees and shrubs show this method of growth but it is most marked in *Pandanus*. Probably the young plants are more sensitive to light than to gravity and grow towards the most intense light, which, on steep slopes well covered by vegetation, would be not from overhead but from a direction more nearly horizontal.

On very dry hills no *Pandanus* may be seen. The cover of vegetation is more open, consisting of somewhat stunted small trees and wiry creepers, and orchids may replace mosses on the rocks. Indeed, the rocks in places may be completely covered with such orchids as *Phreatia*, *Liparis*, *Pholidota*, *Microsaccus*, *Adenoncos*, *Coelogyne*, *Saccolabium*, *Thelasis*, *Trichoglottis*, with

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Arachnis climbing through the trees. On the northern limestone great quantities of *Paphiopedilum niveum* are to be found in places where it has not been cleaned out by "collectors". It prefers spots where there is a little accumulation of humus.

The summit of the hill may be a bare rocky ridge where the white marble rock is heated by the sun to such an extent that it is uncomfortable to the touch. Here there will be scattered stunted trees, no herbaceous plants and little or no undergrowth of shrubs. In such situations *Pistacia malayana* may be found. Normally, however, the summit of a dry hill is more covered than this with small trees of *Vitex siamica*, *Callicarpa angustifolia*, *Memecylon* sp., *Garcinia* sp., *Eriobotrya bengalensis*, etc., with climbers such as *Dioscorea* sp., and a small leaved very thorny *Zizyphus*. The trees are usually misshapen, often leaning at odd angles, and usually with small or tough leaves. Some are surprisingly big considering the nature of the habitat. The deep clefts in the rock and their sharp edges, partially concealed by fallen leaves, make walking difficult and dangerous. There is little or no herbaceous vegetation on such a hill top.

The summit of a wet hill may be very different, with a close cover of small spindly trees, the rocks underfoot covered with a deep spongy mass of mosses, liverworts and humus, a condition approximating to the "mossy forest" of far higher hills.

A number of limestone hills have had survey beacons erected on their summits and where the original vegetation has been cleared for this purpose a strong growth of *Nephrolepis* sp., often appears. On the summit of Gunong Sennyum this fern formed dense thickets six to eight feet tall.

General Characteristics of the Flora.

In compiling the list of flowering plants found on the limestone, all dubious records were set aside and listed separately, and epiphytes and parasites were excluded. The result is a total of about 745 species. This is very roughly about 8% or 9% of the total number of flowering plants in the Peninsula. According to Scrivenor's figures, given on p. 13, the total area of the limestone is roughly 0.2%—0.3% of the total area of the Peninsula. These figures seem to indicate a richer flora per unit of area on the limestone than on other formations. It is very improbable that they indicate a more thorough botanical exploration of the limestone. The first alternative tallies with what is accepted for the temperate limestone floras. Tansley, Practical Plant Ecology (1923) p. 163 writes: "Nevertheless, in any given region, the limestone vegetation is always well marked and characteristic with a number of species immensely more abundant on, if not strictly confined to, the limestone." Ecologists usually attribute this richness of flora on limestone to the chemical and physical

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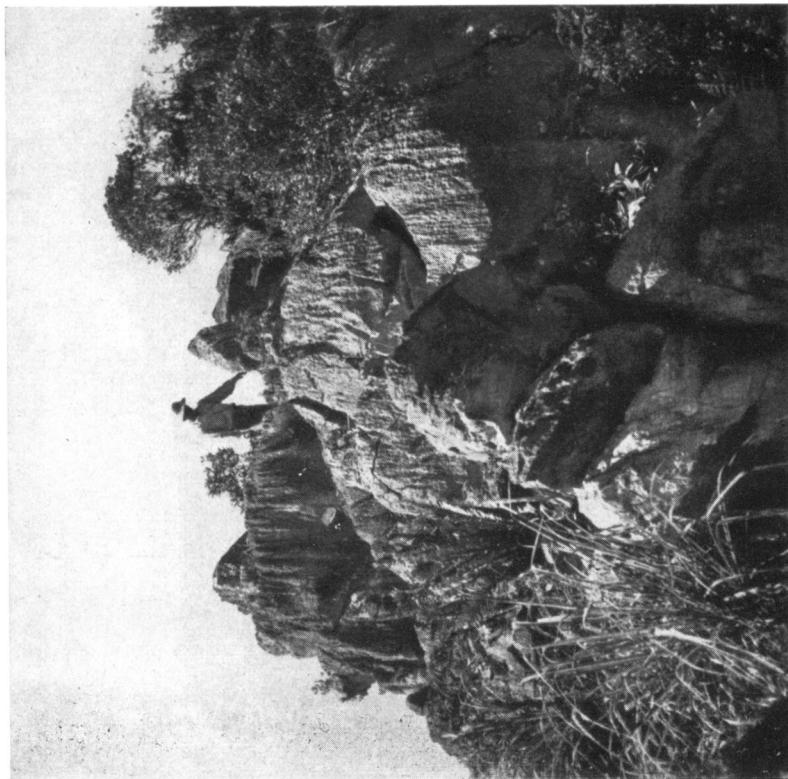
Gunong Baling, Kedah, from the north.



The southern slopes of Gunong Baling, Kedah.



The summit ridge of Gunong Baling, Kedah.



nature of the soil. In this region, at least, the greater age of the limestone compared with other formations, its more extreme conditions of temperature, the great variety of habitat offered by it, and its occurrence in relatively isolated islands may have to be taken into account.

Of the total of 745 species no fewer than about 195 or about 26% are known, in the Peninsula, only from limestone. This includes endemics and non-endemics. Of the latter it has not been possible to trace in most cases whether they are from limestone outside the Peninsula or not, but in many cases they are not. The species endemic and confined to limestone number about 130, about 67% of the total confined to limestone and over 17% of the grand total. Much more collecting remains to be done and doubtless many more species will be added to the limestone flora in the categories both of widely distributed plants and those restricted to limestone, but nevertheless these figures seem to indicate a definite calciphilous element.

Little appears to be known, at least in the tropics, about the adaptability of limestone plants and whether they will grow in acid soils. There is very little experimental evidence one way or the other, but it can be stated that *Impatiens mirabilis* will grow normally and flower amongst granite rocks and chippings, that one or two species of *Kaempferia*, which are almost certainly restricted to limestone in nature, flourish amongst granite rocks, and that seedlings of *Pistachia malayana* have been raised in non-calcareous soil. *Impatiens Foxworthyi* and *I. tipusensis* grew well both in granite chippings and in coral for a year or two and then died. But succulent Balsams of this type are difficult to maintain in cultivation.

A rough estimate shows that of the species enumerated, but excluding those known only from limestone, some eighty to one hundred are species which normally are found in rocky places, usually on or near large boulders or outcrops of rock in lowland forest. Such rocky forest is common in the Peninsula especially in the granite areas. This element of the limestone flora may be termed the "rock-plant" element, the term being used loosely for those plants which grow amongst rocks, and therefore in well-drained situations, as well as for those which normally grow upon the rocks. Most of these plants appear to be indifferent to the nature of the rock upon which they grow, but there is much information on these points still awaiting collection.

Generally speaking, the differences between the flora of the limestone and that of the rest of the Peninsula are those of degree, not of kind. No large groups are peculiar to the limestone. Very few genera are confined to limestone, and even these are small, consisting of one or two species. Nearly all the families well represented in the Peninsula appear on the limestone, in some cases with many species, in others with very few. Those

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groups which consist mainly of large forest trees and whose habitat is moist or swampy lowland forest, are poorly represented, as might be expected. Doubtless those plants which require deep shade and abundant soil moisture for germination and early development do not find these conditions on limestone hills.

The following families have not yet been found on limestone :

Ranunculaceae, Magnoliaceae, Winteraceae, Pittosporaceae, Hypericaceae, Ancistrocladaceae, Gonostylaceae, Linaceae, Malpighiaceae, Oxalidaceae, Simarubaceae, Chailletiaceae, Staphyleaceae, Sabiaceae, Saxifragaceae, Anisophyllaceae, Lythraceae, Onagraceae, Ficoidaceae, Umbelliferae, Caprifoliaceae, Lobeliaceae, Campanulaceae, Ericaceae, Epacridaceae, Symplocaceae, Styracaceae, Bignoniaceae, Polygonaceae, Nepenthaceae, Chloranthaceae, Proteaceae, Opiliaceae, Juglandaceae (Engelhardtia), Myricaceae, Xyridaceae, Eriocaulaceae, Restiaceae (Leptocarpus).

Nepenthaceae is a notable absentee. It prefers acid and poor soils and is very unlikely to be found on limestone. It is probable that representatives of some of the above families, for instance, *Sabiaceae, Symplocaceae, Styracaceae* and *Bignoniaceae* do occur, but one would not expect to find *Onagraceae* or *Polygonaceae*.

The limestone flora is a lowland one. No mountain plants have been found upon it and in this connection it is of interest to draw attention to van Steenis' remarks in Bull. Jard. Bot. Buit., Vol. VIII, 3, p. 296, where he discusses the origin of the Malaysian mountain flora and the possible methods of distribution of alpine plants. He writes : "On limestone mountains which may offer hot conditions during the day and rather cool conditions at night if covered by an open vegetation, plants might be able to descend abnormally low. F. Krasan stated that on the limestone of the Dolomites alpine plants descend to lower altitudes than on the granite and other rocks of the European Alps. I do not know, however, any high limestone peaks in Malaysia, and in any case all are forested, which excludes the true limestone influence, if there were any." To call the upper slopes of such hills as Bukit Chupeng or Gunong Baling forested is perhaps not quite accurate, and on such ridges no doubt extremes of temperature exist. However, it can definitely be said that alpine plants are not found on the Peninsular limestone.

Out of 64 or 65 species recorded as confined to the limestone in the Peninsula but with a distribution outside it, 50 are known only from north of the Peninsula in Siam, Burma, Indo-China and India. Of these about 29 have a restricted range and do not appear to extend beyond Siam. Three species reach the Philippines, eight have a fairly wide distribution north, south and east of the Peninsula, two are known from Sumatra and one, or perhaps two, otherwise only from Borneo. The bulk of the northern plants do not extend far into the Peninsula, most of them being recorded

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from Langkawi, Perlis and Kedah. Evidently they find conditions on the limestone which enable them to penetrate further south than they would do if there were no limestone, but the distance between the limestone of the north and west and that of Perak, Pahang, Selangor and Kelantan is a barrier which they find difficulty in crossing.

Genera restricted to limestone.

Lysimachia peduncularis Wall. is the only representative of *Primulaceae* recorded from the Peninsula. It occurs in Langkawi and it is hardly surprising to find it there, for the genus is not uncommon in Siam. The other genera confined to the local limestone are :—*Pistachia* (*Anacardiaceae*) ; *Stenothyrsus* (*Acanthaceae*) ; *Dichiloboea* (*Gesneraceae*) ; *Lepidanthus* (*Gesneraceae*) ; *Gongylosperma* (*Asclepiadaceae*) ; *Buxus* (*Euphorbiaceae*) ; *Asparagus* (*Liliaceae*) ; and *Hapaline* (*Araceae*). Of these only *Stenothyrsus*, *Gongylosperma*, and *Hapaline* appear to be entirely confined to limestone, even outside the Peninsula, and they are all small genera with one, two, and three species respectively. *Dichiloboea* has one other Burmese and Chinese species which may or may not be from limestone. *Lepidanthus* is a monotypic genus extending into Lower Siam, from whence the records are not all definite.

Frequency of occurrence of the main groups of Phanerogams.

ANONACEAE. This large family is certainly not rare on the limestone, but undoubtedly the available records are incomplete. Seventeen genera are recorded out of a total for the Peninsula of twenty-nine, and about thirty-two species out of a total of about one hundred and eighty. *Miliusa*, *Mitrophora* and *Orophea* are the commonest genera.

POLYGALACEAE. *Polygala hyalina* Wall. is common.

GUTTIFERAE. Three species of *Garcinia*, one of which is restricted to limestone, *Mesua ferrea* L., and *Ochrocarpus siamensis* T. Anders are the only records. *Kayea* and *Calophyllum* appear to be absent.

TERNSTROEMIACEAE. No quite definite records are known. It is probable that *Saurauia cauliflora* Bl. var. *calycina* King is to be found at cliff bases. The only other record is a dubious one of *Schima Noronhae* Reinw. from the northern limestone.

DIPTEROCARPACEAE. This family has been collected only upon the northern limestone and only three species are recorded: *Vatica cinerea* King, *Hopea ferrea* Llanessan, and *Pentace siamensis* (Miq.) Kurz.

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STERCULIACEAE. Six species in four genera are recorded out of the eighteen genera and about fifty-four species known from the Peninsula.

TILIACEAE. No *Elaeocarpus* has yet been recorded.

BALSAMINACEAE. Seven species of *Impatiens* are known from limestone out of the fourteen known from the Peninsula, all confined to the limestone. Some species occur very locally but in large quantities. The most striking is *I. mirabilis* on the northern limestone. Its enormously swollen and brittle stems wedged into cracks in the rocks make it very difficult to collect alive.

RUTACEAE. *Glycosmis pentaphylla* Corr. is common.

BURSERACEAE. There are records of two species only—*Dacryodes floribunda* H. J. Lam from Gunong Pondok, and *Canarium ?purpurascens* Benn. from Kaki Bukit in Perlis.

MELIACEAE. Three or four species of *Aglaia*, *Melia excelsa* Jack, and *Turraea breviflora* Ridl. are the only records. *Xylocarpus obovatus* A. Juss. is on limestone rocks at sealevel in Langkawi but this is a littoral plant and does not occur on limestone except within tidal influence. The large genera *Amoora* and *Dysoxylon* appear to be absent.

OLACINACEAE. *Iodes ovalis* Bl., once found on the limestone at Pulai, near Ipoh, is the only record.

ILICINACEAE. *Ilex Maingayi* Hook. f. has been collected at Gopeng. The majority of the species of *Ilex* in the Peninsula are montane.

AMPELIDACEAE. The only genus common is *Vitis*, with six or seven species.

SAPINDACEAE. Only one species each of *Allophylus*, *Lepisanthes*, *Nephelium* and *Xerospermum* are recorded.

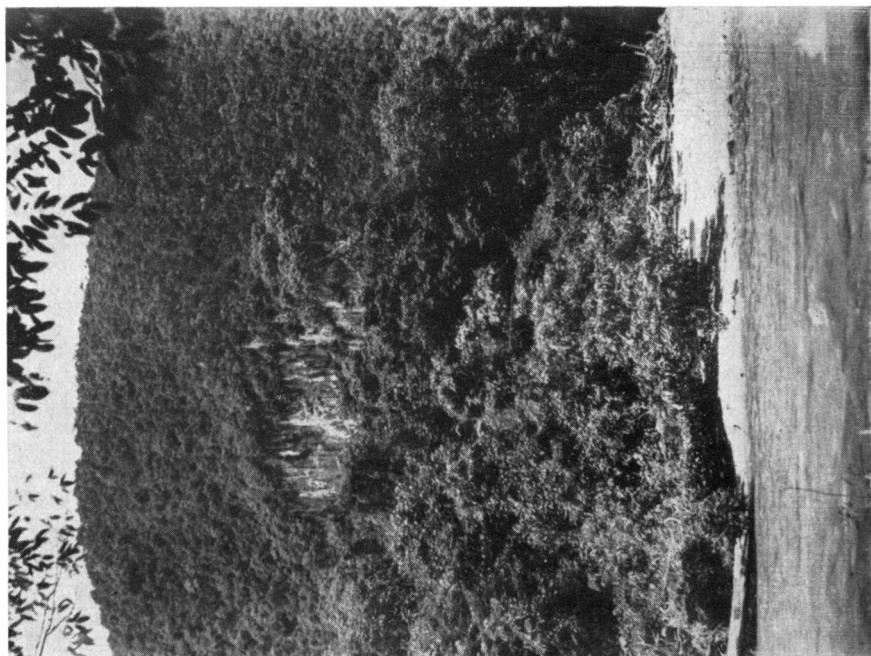
ANACARDIACEAE is rare on the limestone, only eight species out of the total for the Peninsula of about seventy-three having been recorded.

LEGUMINOSAE. Surprisingly few records are known. Of *Papilionaceae* with approximately forty-one genera and one hundred and fifty-five species in the Peninsula, only five genera with eight species are recorded; of *Caesalpinoideae* with fifteen genera and ninety species, six genera and about eleven species. The best represented genus is *Bauhinia*, with six species out of the twenty-six or twenty-seven native to the Peninsula. No *Mimosoideae* are recorded.

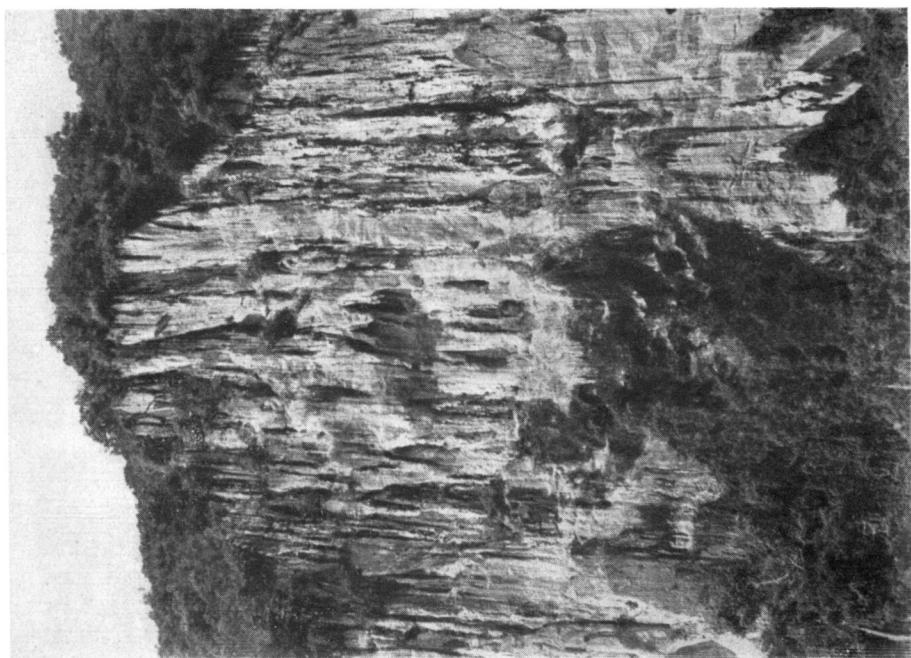
ROSACEAE. As a whole this family is poorly represented, but *Eriobotrya bengalensis* Hook. f. has been collected several times, usually on dry hill tops, and it is probably not uncommon in such situations.

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MALAYAN BRANCH ROYAL ASIATIC SOC., 1939, PLATE VII.

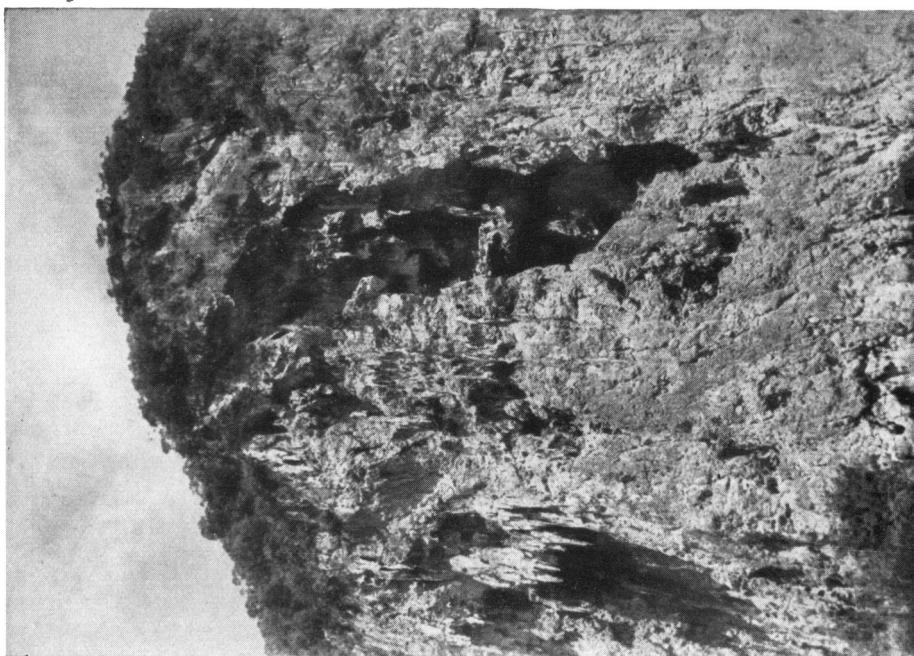


The upper slopes of Gua Panjang, Kelantan.



The precipitous face of Gua Panjang, Kelantan.

MALAYAN BRANCH ROYAL ASIATIC SOC., 1939, PLATE VIII.



Bukit Chupeng, Perlis.



Gua Teja, Kelantan, undercut by Sungai Betis.

COMBRETACEAE. This family has only two species of *Quisqualis* and two of *Terminalia* on the limestone.

MYRTACEAE. This large family is definitely rare on limestone. Two species of *Tristania* are recorded, neither common. *Barringtonia fusiformis* King has been recorded definitely only from Gunong Pondok. *Barringtonia asiatica* Kurz occurs only as a seashore plant on the Langkawi limestone. *Decaspermum fruticosum* Forst., or a closely allied species, has been collected in three or four places. It is a plant one might expect to find oftener on the limestone. The only other definite records in Myrtaceae are those of *Eugenia spicata* Lamk. (*E. zeylanica* Wight), and *E. cerasiformis* DC., both collected in Perak by Kunstler. No one else has collected these common species again on limestone. Undoubtedly *Eugenia* is very rare on the local limestone. Leaves of what may have been *E. palembanicum* (Korth.) Merr. were picked up by the writer on Pulau Dayang Bunting, Langkawi, not far from the sea, but the tree could not be located. Ridley in Journ. Str. Br. Roy. As. Soc., 59, p. 26, mentions *E. claviflora* Roxb. and another, small-leaved, species on Bukit Besih Hangat, Perlis. He collected specimens of the first, but I have not been able to trace what the second may be. In Craib, Enum. Siam. Pl., I, pp. 631-667, there is one record of a *Eugenia* from limestone out of seventy-six species enumerated. Some four species are recorded from limestone in the Philippines, and there is at least one record from Borneo.

MELASTOMACEAE. *Memecylon* appears to be not uncommon, especially on the summits of the hills, for there are records of about eleven species out of a total of thirty-one in the Peninsula. Other genera are poorly represented.

BEGONIACEAE. *Begonia* has about eight species on limestone. Most are small plants of rocky places.

ARALIACEAE. Six species of *Schefflera*, out of a total of about twenty-six, are recorded. Only *Schefflera subulata* Viguier appears to be common and widespread on the limestone. So many species of this genus favour rocky places that one would expect them to occur more frequently on limestone. No other genus is common.

RUBIACEAE. This large family has in the Peninsula about sixty-seven genera and four hundred and seventy species. There are definite records from the limestone of fifty-nine species in twenty-five genera. *Ixora*, *Ophiorrhiza*, *Psychotria* and *Tarenna* are the commonest genera. Most of the species of *Ophiorrhiza*, *Psychotria* and *Tarenna* are local, except for *Psychotria rhinocerotis* Reinw., which is widespread.

COMPOSITAE are poorly represented not only on the limestone, but throughout the Peninsula, most being plants following

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man. Only *Vernonia Curtisii* Craib and Hutch., and *Vernonia rupicola* Ridl., both from Langkawi, can be regarded as belonging to the limestone flora proper, the other records of *Mikania scandens* Willd., *Spilanthes Acmella* Murr., *Vernonia attenuata* DC., and *V. cinerea* Less. being doubtless accidental introductions.

VACCINIACEAE. *Vaccinium Hasseltii* Miq. has been recorded once only.

MYRSINACEAE. *Ardisia* has about fourteen species on the limestone out of a total of about fifty-eight. No other genus is common.

SAPOTACEAE. *Madhuca Ridleyi* H. J. Lam and *Isonandra perakensis* King and Gamble are restricted to limestone and rare upon it. The only other records are *Mimusops Elengi* L., var. *parvifolia* H. J. Lam, common in Langkawi but not known from limestone elsewhere, and *Payena Havilandii* K. & G.

EBENACEAE. *Diospyros* is common, and twelve species are definitely recorded. Some species are rare and local, but a few, such as *D. cauliflora* Bl., appear to be common and widespread.

OLEACEAE. *Jasminum* has six species on limestone, all local and none widespread.

ASCLEPIADACEAE. Although only three species of *Dischidia* are recorded, one, *D. bengalensis* Colebr., is common on bare limestone faces, especially in the north. *Gongylosperma lanuginosum* Ridl. is known only from Langkawi, but it is very common there. Otherwise the family is not well represented, there being eight or nine genera and about fourteen species out of thirty-two genera and one hundred and fifteen species in the Peninsula.

GENTIANACEAE. *Canscora pentanthera* Clarke is very common on dry limestone rocks. It is not confined to limestone although it is not often recorded from elsewhere. *Microrphium pubescens* Clarke is common in Langkawi.

GESNERACEAE. This family has perhaps the most representatives on limestone, although individual species are not often found in profusion in any locality. Of *Boea* there are ten or eleven species from limestone, most of them confined to it. The commonest are *Boea paniculata* Ridl. and *B. verticillata* Ridl. *Chirita caliginosa* Clarke is common on most hills, but not yet recorded from Perlis or Langkawi, and *Ch. viola* Ridl. is another widespread species which apparently tends to replace *Ch. caliginosa* on the northern limestone. *Epithema saxatile* Bl. is common on nearly all the limestone. It is a rock plant, not confined to limestone. *Monophyllaea Horsfieldii* R. Br. is widespread but not very common on limestone and it also is found on acid rocks. *M. patens*

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Ridl. is confined to limestone and seems to occur oftener than *M. Horsfieldii*. Members of the section Eu-*Paraboea* only in *Paraboea* and not of §*Campanulatæ* are recorded from limestone, although the former section is not restricted to limestone. Six or seven species are recorded of which only *P. capitata* is at all widespread. Both *Boea* and *Paraboea* are often found in dry exposed situations, their tough stems and felted or hairy leaves enabling them to withstand a considerable amount of dessication.

There are no definite limestone records of any species of *Didissandra* or *Didymocarpus*.

CONVOLVULACEAE. Four species out of a total for the Peninsula of about fifty-four are recorded, and one of these is a seashore plant.

SCROPHULARIACEAE. Out of fifteen genera and forty-six species known from the Peninsula only *Adenosma capitatum* Benth., *Centranthera hispida* R. Br., and *Curanga amara* Juss. are known from limestone.

ACANTHACEAE. Fourteen genera and about thirty-seven species are known from limestone out of a total of thirty-six genera and one hundred and sixty-eight species in the Peninsula. The genus best represented is *Justicia* with about twelve species, the commonest being *J. uber* Clarke, *J. ptychostoma* Clarke, and *J. subcymosa* Clarke. *Polytrema vulgare* Clarke is quite common and so is *Thunbergia fragrans* Roxb., var. *javanica* K. & G.

VERBENACEAE. *Callicarpa angustifolia* King and Gamble is common and widespread, usually on the summits of the hills. It is recorded only from limestone and so is *Vitex siamica* Williams, which is almost always present on dry hill tops. Otherwise the family is poorly represented.

AMARANTACEAE. *Deeringia polysperma* Miq. is widespread. It is not confined to limestone but is commoner there than elsewhere.

PIPERACEAE. Four species of *Peperomia* are recorded out of about seven in the Peninsula and of those *P. dindigulensis* C. DC. is not uncommon in cracks of rocks and in moss. Only six species of *Piper* out of about seventy-five are recorded and of those *Piper collinum* C. DC. may possibly be confined to limestone. *Zippelia lappacea* Bl. occurs occasionally.

MYRISTICACEAE. There are two definite records only in this family—*Knema laurina* Warb. from Gunong Baling and *Knema missionis* Warb. from Langkawi and Perlis. Undoubtedly this family is rare on the Peninsular limestone. It seems to be more common in the south of the Peninsula than the north and to prefer damp, often swampy, lowland forest.

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LAURACEAE. Also rare on limestone. The only definite records are of two species of *Dehaasia* and three of *Litsea*. No species has so far been recorded from Kelantan, Pahang, Langkawi or Perlis.

EUPHORBIACEAE. Of this large family, having about seventy-two genera and two hundred and fifty species in the Peninsula, thirty-one genera and about fifty-nine species are known from limestone. The genera best represented are *Bridelia*, *Cleistanthus*, *Mallotus*, *Phyllanthus* and *Sauvagesia*. *Actephilopsis malayana* Ridl. is not uncommon. *Andracme australis* Z. & M. is one of the small plants often found in rock cracks. Five species of *Buxus* are recorded, none widespread. The three species of *Buxus* known from the Peninsula—*B. malayana* Ridl. from Pulai and Bukit Takun, *B. rupicola* Ridl. from Langkawi, and *B. Holttumiana* Hatusima from Perlis, are all confined to limestone. Six species of *Cleistanthus* are recorded with certainty out of a total for the Peninsula of thirty. *C. gracilis* Hook. f. seems the commonest. *Croton Cumingii* M.A. is probably more common on limestone, especially in the north, than on other formations. *Mallotus* has five species recorded out of twenty-five, but there are probable records of several others. *Mallotus dispar* M.A. is the commonest and is often to be found at cliff bases. *Phyllanthus* is represented by eight or nine species out of twenty, none widely spread on the limestone. Although four species of *Sauvagesia* are recorded, all are local except perhaps *S. Llanosii* Gage. Rather a large proportion of the total number of species of Euphorbiaceae collected on the limestone has not been found off it—about twenty-seven, including one or two apparently undescribed.

URTICACEAE. Of *Ficus* about fourteen or fifteen species are recorded, not one of them very common. Even *F. diversifolia* Bl. is not so common as might be expected, and only its variety *deltoides* has been collected on limestone. *Oreocnide sylvatica* Miq. occasionally occurs in abundance at cliff bases. *Pilea calcarea* Ridl. is found on most of the limestone except in Perlis and Langkawi and is restricted to it. It is usually to be found low down on the cliffs in spots where there is a little dry dusty soil, but shaded by the surrounding vegetation. *Taxotrophis ilicifolia* Vidal is often exceedingly common on the lower slopes and at the bases of dry hills, rarely extending far up the hill.

CUPULIFERAE. *Pasania spicata* Oerst. var. *gracilipes* DC. from Gunong Pondok is the only record.

ORCHIDACEAE. There are not many true terrestrial orchids common on limestone. *Calanthe Ceciliae* Rchb. f. may be found in abundance in certain localities. *C. veratrifolia* R. Br. is recorded from several localities in Perak and Pahang. Neither of these species is known from the northern limestone. *Corysanthes mucronata* Bl. is common only on the wetter hills

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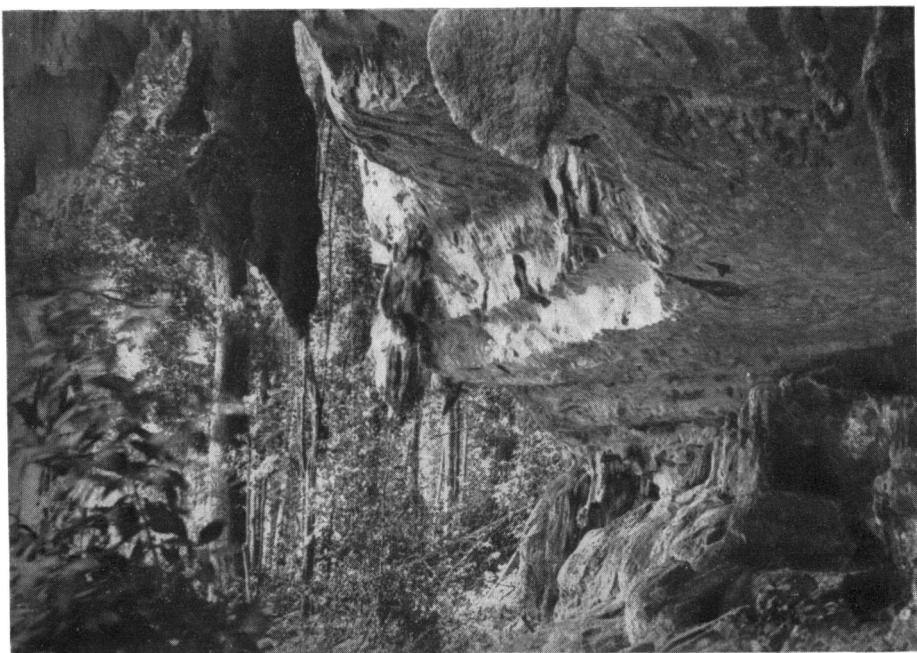


A gully in Gua Tipus, Panang.
Note climbing aroids. The figure in foreground
gives the scale.



Cymbopogon sp. near the summit of Gunong Baling, Kedah.

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Undercut base of Gua Panjang, Kelantan.



Impatiens Foxworthyi HENDERSON at base of limestone cliff in Kelantan.

in moss. Four species of *Habenaria* are recorded, one rather dubiously from limestone. Only *H. Kingii* Hook. f. is recorded from further south than Langkawi. *Paphiopedilum niveum* Pftz. is common only in the north, coming as far south as Gunong Baling. *Eulophia Keithii* Ridl. is common on the northern limestone only. As stated on p. 21 large numbers of orchids may be found on the limestone rocks. They are species which are normally epiphytic in other habitats but which seem to grow indifferently on rocks and trees on the drier limestone hills. The commonest are : *Adenoncos major* Ridl., *A. virens* Bl., *Bulbophyllum lilacinum* Ridl., *Dendrobium euphlebium* Lindl., *D. salaccense* Lindl., *Liparis comosa* Ridl., *L. disticha* Lindl., *Microsaccus brevifolius* Bl., *Pholidota imbricata* Lindl., *Stauropsis gigantea* Benth. (only on northern limestone), *Thelasis carinata* Bl., *Th. decurva* Bl., *Th. elongata* Bl., *Trichoglossis retusa* Bl. Many others have been collected as epiphytes only, but a considerable amount of collecting is still necessary to decide which species are epiphytic only and are never found on rocks. For example, *Phalaenopsis cornu-cervi*, *Ph. Hebe* and *Ph. appendiculata* all occur epiphytically but have not yet been found on limestone rocks. Many of the smaller orchids common on the rocks are also common on mangrove trees.

DIOSCOREACEAE. About seven species of *Dioscorea* are recorded. It is probable that they are commoner and more widely spread than the records show.

LILIACEAE. *Dracaena congesta* Ridl. is the only member of this family common on limestone.

PALMAE. This family is scarce on the limestone and out of a total for the Peninsula of thirty genera and about one hundred and ninety species only eleven or twelve species in nine genera are recorded. Most of the records are from dry hills. The climbing palms are surprisingly rare. A species of *Arenga* is not uncommon near the bases of dry hills and this and *Didymosperma Hookeriana* Becc. are the only species which can be called common and widespread. The curious *Livistona rupicola* Ridl. is common in Langkawi and at Bukit Takun and Batu Caves.

PANDANACEAE. *Pandanus irregularis* Ridl. is the very common species on the wetter Kelantan and Pahang hills. Unfortunately the collections of *Pandanus* are poor, for they are seldom found flowering or fruiting on the limestone, and the only other records are of *P. fascicularis* Lamk. from Langkawi, where it is merely a seashore plant, and two apparently undescribed species, one from Pulai, near Ipoh, and the other from Perlis. Certainly *Pandanus* is abundant only on the wetter hills and possibly only a few species are present.

ARACEAE. Fourteen genera and about twenty-three species are recorded out of a total for the Peninsula of twenty-three genera and about one hundred and twenty-five species. Climbing Aroids, such as *Pothos*, are often common and conspicuous on

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the rock faces, but they are usually sterile. *Alocasia longiloba* Miq., and *A. Lowii* Hook f. are not uncommon. Several species of *Amorphophallus* occur. *A. Prainii* Hook. f. being most often seen. *Arisaema fimbriatum* Mast., and *A. Roxburghii* Kunstl. are widespread. *Hapaline Brownei* Hook. f. is often found in rock cracks. *Pothos macrocephalus* Scort. has not been collected many times but is probably common. No other climbing aroid is recorded as common, but the collections are anything but complete.

CYPERACEAE. Sedges are rare on the limestone and all the records come from open dry places and none from the wet well-covered hills. There are one species of *Carex*, three of *Fimbristylis* and one of *Scleria*.

GRAMINEAE. Grasses are also scarce on the limestone and occur chiefly on the open parts of the northern limestone. Excluding bamboos, eleven or twelve species in ten genera are known and one of these is an introduced grass. One or two are rare species with puzzling distribution. For instance, *Chrysopogon collinus* Ridl. is known only from limestone in Setul and from a small sandstone island off the coast of Pahang. *Eulalia lanipes* Ridl. is abundant on limestone ridges 100-200 ft. above the sea at Langkawi and is otherwise known only from Kedah Peak at 4,000 ft. *Ischaemum Beccarii* Hack., from the top of Batu Caves, was originally described from Borneo and has been found in the Botanic Gardens, Singapore (Ridley, Fl. Mal. Pen., V, p. 204). *Cymbopogon* sp. occurs on the upper slopes of Gunong Baling and is conspicuous by its abundance and refreshing scent. The same species has been collected in Langkawi and the same or an allied species at Bukit Cheras, Kuantan. Mr. C. E. Hubbard of the Kew Herbarium has kindly examined these specimens and reports that they appear to represent one or possibly two undescribed species.

Bamboos are rare on the limestone and only *Schizostachyum elegans* Ridl. is definitely recorded. It was originally described from specimens collected by Haniff in Langkawi, whether or not from limestone is not recorded; but the writer found it to be common on the limestone ridges about Selat Panchar. What was probably this species was seen on Bukit Lagi, Perlis and collected on Gunong Baling, sterile in both localities. Another bamboo, probably a species of *Schizostachyum*, but not *S. elegans*, was seen on the cleared top of Gunong Pondok and a similar bamboo was noted on Bukit Serdam.

It is perhaps surprising that grasses do not grow in the crevices of the precipitous faces of limestone hills, but they are never found in such situations except occasionally after the rock has been disturbed by quarrying. The occurrence of so many of the records from Langkawi may indicate more disturbance there than usual with the original vegetation. History indicates that Langkawi in former days had a much larger population than it has today.

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**A LIST OF THE FLOWERING PLANTS AND GYMNOSPERMS
KNOWN FROM LIMESTONE HILLS IN THE MALAY
PENINSULA.**

A ? BEFORE A LOCALITY INDICATES THAT THE RECORD FROM THAT PARTICULAR PLACE IS NOT QUITE DEFINITE.

DILLENIACEAE.

Tetracera hebecarpa Boerl. GUNONG PONDOK.

Dubious records :

Tetracera Loureirii Pierre. PERLIS.

Dillenia aurea Sm. SETUL.

ANNONACEAE.

Alphonsea sp. GUNONG BALING. Twice collected here, in fruit.

?**Alphonsea** sp. KAKI BUKIT, PERLIS. In fruit.

Anaxagorea javanica Bl. GUNONG PONDOK. KOTA GLANGGI.
Collected several times near limestone. Common in the Peninsula in lowland forest.

Artobotrys grandifolius King. PERAK. Not common in lowland forest.

Canangium odoratum Baill. GOPENG, once collected by Kunstler.
Common in the northern parts of the Peninsula. (See Corner, Gardens Bulletin, Vol. X, part I. p. 13).

Cyathocalyx virgatus King. GUA PANJANG, KELANTAN, at cliff base. Not very common in lowland forest.

Dasymaschalon Blumei Fin. & Gagnep., var. **Wallichii** (Hook. fil.).
Once collected at Gopeng, but probably occurs elsewhere.
Common in lowland forest.

Desmos cochinchinensis Lour. PULAI, in hot dry places. Not uncommon in lowland forest, commoner in the north of the Peninsula than in the south.

Desmos Dunalii Saff. GOPENG. A poor specimen from Langkawi may be this. Not common in forest.

Goniothalamus subevenius King. KUALA DIPANG. The only record of *Goniothalamus* from limestone in the Peninsula.

Miliusa amplexicaulis Ridl. LANGKAWI. BALING. LENGGONG (fide Ridley). Rare in the Peninsula but not confined to limestone as the distribution given in Ridl. F.M.P. Vol. I, p. 97 might suggest.

Miliusa longipes King. KINTA. Not common but widely distributed in lowland forest.

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- Miliusa parviflora** Ridl. LANGKAWI. PERLIS. Known only from a few collections here and confined to limestone.
- Mitrephora crassipetala** Ridl. Base of GUA TIPUS, PAHANG. Apparently rare, known otherwise only from the Tahan river.
- Mitrephora macrophylla** Oliv. ?BALING. GUA PANJANG. Not uncommon in lowland forest.
- Mitrephora Maingayi** Hook. fil & Th. GOPENG. One record only from limestone but otherwise not uncommon on forest edges, especially north of Malacca.
- Mitrephora reticulata** Hook. fil & Th. ?G. PONDOK. KUALA DIPANG. Common in lowland forest as far south as Pulau Tioman.
- Orophea cuneiformis** King. SETUL. PERAK. PAHANG. Apparently known only from these localities and confined to limestone.
- Orophea enterocarpa** Maing. KELANTAN. PERAK. Close to limestone in other localities. Not uncommon in lowland forest as far south as Malacca.
- Orophea gracilis** King. PERLIS. KEDAH. PERAK. Apparently rare, recorded from near limestone at Gopeng by Kunstler, and doubtfully from Gunong Korbu and Lower Siam.
- Orophea hirsuta** King. PERLIS. KEDAH. PERAK. Known from these localities only and only from limestone. Ridley apparently includes a specimen from either Malacca or Negri Sembilan, collected by Alvins, which does not belong here.
- Orophea maculata** Scort. PERAK. ?KOTA GLANGGI. Not very common usually on or near limestone but not confined to it or its vicinity.
- Orophea setosa** King. PERAK. KELANTAN. Not very common in lowland forest from Kelantan to Negri Sembilan.
- Oxymitra biglandulosa** Scheff. GUA PANJANG, KELANTAN, at base. Not uncommon in lowland forest.
- Polyalthia congregata** King. BATU CAVES. Not common in lowland forest. Ridley says usually on limestone, but this does not seem to be the case.
- Polyalthia lateriflora** King. PULAI. Rather rare in lowland forest.
- Polyalthia oblonga** King. GUNONG PONDOK. Not common but widespread in lowland forest.
- Popowia nervifolia** Maing. BATU CAVES, and near limestone in other localities. Not uncommon in lowland forest.
- Popowia velutina** King. GOPENG. Known only from here and confined to limestone.

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Vegetation on summit of a dry hill.



Boea sp. on summit of a dry hill.



Chirita sp. in a cave, Gunong Keriang, Kedah.



Lasia spinosa THW. and
Homalomena sp. at base of Gunong Keriang, Kedah.

Stelechocarpus nitidus King. GUNONG PONDOK. ?GUNONG SENNYUM. A rare plant. Some doubtful specimens are known from Tembeling and Temerloh, not on limestone.

Uvaria dulcis Dun. GOPENG. Only once recorded from limestone, but not uncommon in lowland forest from Penang to Singapore.

Uvaria macrophylla Roxb. LANGKAWI. Known also from limestone in Lower Siam. Common in lowland forest and open places.

Xylopia dicarpa Hook. fil. KINTA. Rare in lowland forest.

Anonacea gen. dub. GUNONG BALING. What appears to be the same has been collected at Lawin, Upper Perak.

Dubious records :

Melodorum lanuginosum *Hook. fil. & Th.* LANGKAWI.

Polyalthia Beccarii *King.* KELANTAN. If not on limestone, certainly found close to it.

Popowia pisocarpa *Endl.* BATU CAVES. KOTA GLANGGI.

MENISPERMACEAE.

Stephania sp. KUALA KILIM, LANGKAWI, *Forest Dept. F.M.S. 46790 (Symington).* The only limestone record of this family.

CAPPARIDACEAE.

Capparis diffusa Ridl. BUKIT LAGI, PERLIS. Known only from here.

Capparis sp. GUNONG SENNYUM, on floor of cave, *SFN 22319 (Henderson).* Perhaps an undescribed species.

VIOLACEAE.

Rinorea dasycaula Craib. PERLIS. ?LANGKAWI. ?GOPENG. Not common in the Peninsula.

Rinorea Kunstleriana Taub. TAMBUN, and from near cliff bases in Kelantan and Pahang and at Batu Caves. Not uncommon in lowland forest.

Rinorea Wallichiana (Hook. fil.) GUNONG SENNYUM. BUKIT TAKUN. From near limestone in other localities. Not uncommon in lowland forest, often in rocky places.

POLYGALACEAE.

Polygala cardiocarpa Kurz. LANGKAWI. This species apparently does not come further south.

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Polygala hyalina Wall. GOPENG. GUNONG SENNYUM. BUKIT TAKUN. BATU CAVES. This species appears to be confined to limestone in the Peninsula.

Salomonia ciliata DC. LANGKAWI. Otherwise known in the Peninsula only from open country in the north.

Xanthophyllum glaucum Wall. LANGKAWI. ?PERLIS. Usually in the north of the Peninsula in open places.

Dubious record :

Securidaca inappendiculata Hassk. GUNONG SENNYUM. Collected only once in the Peninsula, by Evans, with nothing to show whether it came from the limestone or not.

FLACOURTIACEAE.

Flacourtie jagomas Lour. KAKI BUKIT, PERLIS. The only limestone record so far of this common plant.

Hydnocarpus castanea Hook. fil. & Th. LENGGONG. BATU CAVES. KOTA GLANGGI. All from cliff bases. Not uncommon in lowland forest.

Hydnocarpus ilicifolia King. LANGKAWI. PERLIS. In rocky dry places, usually near the sea.

Dubious record :

Scolopia rhinanthera Clos. LANGKAWI. Usually a littoral plant.

GUTTIFERAE.

Garcinia eugeniaeefolia King. GUNONG BALING, and possibly elsewhere on the northern limestone. Common in forest in the lowlands and up to 3,000 ft.

Garcinia Kunstleri King. PERAK. A rare species known from one other collection not from limestone.

Garcinia minutiflora Ridl. PULAU RABANA. LANGKAWI. PERLIS. Known only from these localities. This plant was described from ♂ specimens collected at Gua Chirita, Langkawi (*Curtis* 2802). From the name this should be a limestone locality. The Pulau Rabana and Perlis specimens are in young fruit, but the foliage is so similar to that of the type that there is little doubt that they belong here. In 1938 Symington collected what appears to be this species on a rocky limestone headland on Pulau Dayang Bunting, Langkawi (*Forest Dept. F.M.S.* 46715). The inflorescence and leaves of this collection agree well with the type, but the ♂ flowers, which are more mature than those of the type, have a large conspicuous pistillode which is not present in Curtis' specimens.

Mesua ferrea Linn. GUNONG PONDOK. Only once recorded from limestone. Not uncommon in dry lowland forest.

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Ochrocarpus siamensis T. Anders. LANGKAWI. Known only from here in the Peninsula, but the records seem to show that it is not confined to limestone.

TERNSTROEMIACEAE.

Dubious records :

Saurauia cauliflora Bl., var. *calycina* King. BATU KURAU. BATU CAVES. Probably from near the cliff bases. Not recorded from elsewhere in the Peninsula.

Schima Noronhae Reinw. SETUL. LANGKAWI. Widely distributed in forest above 2,000 ft., rarely in the lowlands.

DIPTEROCARPACEAE.

Hopea ferrea Llanessan. LANGKAWI, common.

Pentacme siamensis (Miq.) Kurz. LANGKAWI. PERLIS. Not known from further south in the Peninsula.

Vatica cinerea King. LANGKAWI, common. PERLIS. Known in the Peninsula only north of Perak.

MALVACEAE.

Abutilon indicum G. Don. CHUPENG, at cliff base. Probably a weed. Common in waste ground.

Sida javensis Cav. PERLIS.

Dubious record :

Wissadula periplocifolia Presl. CHUPENG. In dry open places in the north of the Peninsula.

STERCULIACEAE.

Helicteres lanceolata D.C. LANGKAWI. In open places in the north.

Leptonychia heteroclita Kurz. PULAI. Often close to limestone in other localities. Common in lowland forest, often in hill forest.

Pterospermum sp. GUNONG KERIANG, KEDAH, SFN 35425 (*Kiah*). Apparently a species not yet recorded from the Peninsula.

Sterculia angustifolia Roxb. GUNONG PONDOK. Known only from here in the Peninsula and from Burma.

Sterculia rubiginosa Vent. LANGKAWI (var. *glabrescens*). LENGGONG. GOPENG. Common in open lowland forest.

Sterculia lancaviensis Ridl. LANGKAWI. Known only from this group of islands but whether confined to limestone or not is not certain.

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Dubious records :

Abroma augusta *Linn. fil.* BATU CAVES. Not uncommon in thickets and near rivers.

Pterospermum Jackianum *Wall.* LANGKAWI.

TILIACEAE.

Columbia Curtissii Ridl. LANGKAWI. Known only from Curtis's collection from small limestone islands.

Columbia integrifolia Ridl. LENGGONG. Known only from here.

Grewia polygama Roxb., var. **Curtissii** Ridl. PERLIS. Known only from here in the Peninsula and confined to limestone.

Dubious records :

Berrya ammonilla Roxb. LANGKAWI. Known only from here in the Peninsula.

Corchorus aestuans *Linn.* PERLIS. Recorded from limestone in Lower Siam.

Pentace floribunda King. GUNONG PONDOK, collected by Kunstler, whose label is confusing.

OXALIDACEAE.

Biophytum adiantoides Wight. PERLIS. Collected also by Curtis at Kuala Dipang but without mention of limestone. Usually on rocky streambanks in forest.

BALSAMINACEAE.

Impatiens cryptoneura Hook. fil. IPOH. Known only from here and confined to limestone.

Impatiens Foxworthyi Henders. GUNONG SENNYUM. BUKIT SAGU. GUA KECHAPI. GUA PANJANG. GUA TEJA. GUA LAMBOK. Common on the Pahang and Kelantan limestone, usually in rock cracks near the cliff bases in shade. Known only from these localities and confined to limestone.

Impatiens mirabilis Hook. fil. LANGKAWI. PERLIS. Known only from these localities and from Lower Siamese limestone.

Impatiens Ridleyi Hook. fil. GUNONG SENNYUM. BATU CAVES. Rare and confined to limestone in the Peninsula. Doubtfully from Lower Siam.

Impatiens Scortechinii Hook. fil. PERLIS. LENGGONG. GUNONG PONDOK. SUNGAI SIPUT. KELANTAN. So far as the records go, confined to limestone.

Impatiens tipusensis Henders. GUA TIPUS, PAHANG. Known only from here.

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Impatiens Vaughanii Hook. fil. JALOR, SETUL, PERLIS. Known only from these localities and probably confined to limestone.

Impatiens sp. A PERLIS plant, *Ridley 15035*, which has been placed under *I. Vaughanii*, Hook. fil., is stated by Craib, Enum. Siam. Pl. Vol. I, p. 214, to be distinct.

RUTACEAE.

Atalantia kwangtungensis Merr. PERAK. SELANGOR. Not uncommon in the Peninsula in open places.

Atalantia spinosa Tanaka. LANGKAWI. PERLIS. KEDAH. Usually in rocky places near the sea.

Glycosmis chlorosperma Spreng. GUNONG BALING. Common in the Peninsula in lowland forest.

Glycosmis Parkinsonii Tanaka, var. *ovatofoliolis* Tanaka. LANGKAWI. SELANGOR. The variety was described from BATU CAVES and is known only from the localities mentioned.

Glycosmis rupestris Ridl. LANGKAWI. PERLIS. KEDAH. PERAK. PAHANG. A widely distributed and variable plant.

Glycosmis sapindoides Lindl. LANGKAWI. Not very common in the Peninsula, often on riverbanks.

Glycosmis sp. KAKI BUKIT, PERLIS, SFN 35229 (*Kiah*). Perhaps a variety of *G. rupestris*, Ridl.

Micromelum pubescens Bl. LANGKAWI. PERLIS. PAHANG. Common in open places throughout the Peninsula.

Murraya Koenigii Spreng. LANGKAWI. Recorded from limestone in Siam.

Dubious record :

Murraya paniculata Jack. Ridley F.M.P. Vol. I, p. 353, states that this is wild on the limestone but no specimens have as yet been collected.

OCHNACEAE.

Dubious record :

Gomphia microphylla Ridl. LANGKAWI, on PULAU DAYANG BUNTING, collected by Robinson and known only from this one collection.

BURSERACEAE.

Canarium ? purpurascens Benn. KAKI BUKIT, PERLIS. Common in forest.

Dacryodes floribunda H. J. Lam. GUNONG PONDOK. Not common in lowland forest.

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MELIACEAE.

Aglaia ?cordata Hiern. BUKIT TAKUN, SELANGOR, a leaf specimen only

Aglaia odoratissima Bl. PERAK. KELANTAN. Common in lowland forest.

Aglaia splendens Koord. & Val. KUALA DIPANG. Rare, otherwise known from Penang and Java.

Aglaia sp. GUNONG BALING, a leaf specimen only.

Melia excelsa Jack. BUKIT TAKUN, SELANGOR. This specimen was identified as *Chukrassia tabularis* Juss., but it now appears that all the Malay Peninsular material referred to this is actually *Melia excelsa* Jack. (Corner, Gard. Bull., X, 2, p. 263).

Turraea breviflora Ridl. BUKIT TAKUN, SELANGOR. Rare, known also only from Ulu Selangor and Singapore.

Xylocarpus obovatus A. Juss. LANGKAWI, but only as a littoral plant and not found on limestone beyond the tidal area.

Dubious record :

Chisocheton glomeratus Hiern. BATU CAVES. Not common in lowland forest.

OLACINACEAE.

Gomphandra sp. KAKI BUKIT, PERLIS, SFN 35256 (*Kiah*).

Iodes ovalis Bl. PULAI. Not very common in lowland forest.

ILICINACEAE.

Ilex Maingayi Hook. fil. GOPENG. Not very common but widespread in lowland forest from Penang to Singapore.

CELASTRACEAE.

Euonymus javanicus Bl. BATU CAVES. Common in forest, often in the hills.

Euonymus Wrayi King. KOTA GLANGGI. Otherwise known only from hill forest above about 4,000 ft.

Glyptopetalum quadrangulare Prain. KEDAH. PAHANG. Not uncommon, often in forest on hills or near the sea.

Gymnosporia Curtissii King. LANGKAWI. PERLIS. Known only from here, but whether confined to limestone or not is not certain.

Hippocratea indica Willd. PERLIS. ?GUNONG SENNYUM (collected by Evans without details). Scattered throughout the Peninsula in open places.

Hippocratea ?nigricaulis Ridl. KAKI BUKIT, PERLIS. GUA TEJA, KELANTAN. Differs a little from the typical form.

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Salacia flavescens Kurz. ?LANGKAWI. SELANGOR. KELANTAN.
Common in lowland forest and open places.

Salacia grandiflora, Kurz. GUNONG PONDOK. Only once from limestone, but otherwise common in open places and lowland forest.

Salacia ?Korthalsiana Miq. GUA TIPUS, PAHANG. The identification of this specimen is somewhat doubtful. Hitherto it has been known only from Singapore and Java.

Dubious record:

Celastrus paniculata Willd. KOTA GLANGGI, collected by Evans without details. Known in the Peninsula only from this collection.

RHAMNACEAE.

Colubrina asiatica Brongn. PULAU RABANA on the seashore.
Common on rocky or sandy beaches.

Zizyphus sp. A small leaved species common on many dry limestone hills, very rarely flowering. This may possibly be *Z. pernettyoides* Ridl., which I have not seen.

Dubious records :

Smythea macrocarpa Hemsl. GUNONG PONDOK, collected by Kunstler without mention of limestone. Not common in the Peninsula in rocky forest.

Ventilago Maingayi, Lawson. LANGKAWI. Common in open places.

Ventilago oblongifolia Bl. BATU CAVES. "near Gunong Pondok", coll. Kunstler.

Zizyphus pernettyoides Ridl. LANGKAWI, collected on Pulau Dayang Bunting by Robinson. Probably from limestone.

AMPELIDACEAE.

Leea rubra Bl. LANGKAWI. PERLIS. KEDAH. Common especially in the north of the Peninsula, usually on tidal river banks.

Leea aequata Linn. LANGKAWI. PERLIS. KELANTAN. PAHANG. ?KUALA DIPANG, SELANGOR. Common in rocky forest, not confined to limestone.

Vitis glaberrima Wall. BUKIT TAKUN, SELANGOR. Lowland forest.

Vitis hastata Miq. PERAK. PAHANG. SELANGOR. A common climber in open places.

Vitis ?japonica Thunb. BUKIT TAKUN, SELANGOR (*Md. Nur*, s.n.).

Vitis lanceolaria Wall. KAKI BUKIT, PERLIS. Common, often in open places.

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Vitis mollissima Wall. ?LANGKAWI. PERLIS. PERAK. Common in open places in forest.

Vitis novemfolia Wall. IPOH. Widespread in lowland forest.

Vitis pyrrhodasys Miq. LANGKAWI. KELANTAN. Common in lowlands.

Vitis repens Wight & Arn. LANGKAWI. BATU CAVES. Common in open places, hedges, etc.

Vitis Scortechnii King, var. **pubescens** King. GUNONG PONDOK. GOPENG. ?BATU CAVES. Not very well known. Possibly confined to limestone.

Vitis sp. PULAI, PERAK, SFN 15071 (Henderson).

Ampelocissus Martinii Planch. GUNONG BALING. ?GUNONG GERIANG. These are the only records of this species from the Peninsula, but *A. arachnoidea* Planch., from Terutau and near Kangar, Perlis, seems hardly separable.

Dubious record :

Vitis discolor Dalz. PERLIS and SETUL, fide Ridley. BATU CAVES.

SAPINDACEAE.

Allophylus Cobbe Bl., var. **glaber** Hiern. GOPENG. Common in lowland forest.

Allophylus Cobbe Bl., var. **villosus** Corner. PERLIS. Common in lowland forest.

Nephelium ?mutable Bl. GUNONG PONDOK (identification of specimen doubtful).

Xerospermum Wallichii King. Base of GUNONG BALING. Not common in forest.

ANACARDIACEAE.

Parishia rosea Ridl. LANGKAWI, common. Known only from here and from islands in Pungah Lower Siam. Probably confined to limestone.

Pentaspadon Curtisi (King) Corner. LANGKAWI. Known only from here and only from limestone.

Pentaspadon Motleyi Ridl. (?not of Hook. fil.). PERLIS. A poor specimen which may not even belong to this genus. C. F. Symington has suggested that it is a species of *Odina*.

Pistachia malayana Henders. LENGGONG. BUKIT TAKUN. Known only from these localities.

Mangifera sp. GUA TEJA, KELANTAN. Trees of a species of this genus were seen on the summit of this hill.

Semecarpus glomerulatus Ridl. LANGKAWI. ?PERLIS. Rare in open places in the north of the Peninsula.

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Semecarpus cochinchinensis Engl. SETUL. ?LANGKAWI. Known only from these localities in the Peninsula.

Spondias pinnata Kurz. Base of GUNONG BALING. Perhaps cultivated.

Dubious records :

Gluta Wrayi King. GUNONG PONDOK, collected by Kunstler without mention of limestone. Rare in lowland forest.

CONNARACEAE.

Dubious records :

Castanola villosa Schellenb. GUNONG SENNYUM, collected by Evans without details. Common in the lowlands in the Peninsula.

Connarus Griffithii Hook. fl. LANGKAWI. SETUL. PERLIS. Collected by Kunstler "near limestone" in Perak. Common in the Peninsula in the lowlands.

LEGUMINOSAE.

Cassia timoriensis DC. var. **typica**. LANGKAWI; common on limestone near the sea. Known only from here and Kedah in the Peninsula. var. **xanthocoma** Miq. KEDAH. KELANTAN. PERAK. Not uncommon, especially near limestone and on riverbanks.

Caesalpinia Nuga Ait. LANGKAWI, as a seashore plant only. Not recorded from limestone elsewhere.

Bauhinia acuminata L. GUNONG PONDOK. Once recorded from limestone. Ridley doubts whether it is wild, except perhaps on G. Pondok.

Bauhinia Curtisiae Prain. LANGKAWI. GUNONG KERIANG. Also recorded from Terutau and known only from these localities.

Bauhinia decumbens Henders. GUNONG SENNYUM, summit. Known only from here.

Bauhinia micrantha Ridl. PERLIS. A rare species, known only from a few localities. Not confined to limestone.

Bauhinia streychnoidea Prain. KELANTAN. ?PAHANG. PERAK. SELANGOR. Commonest on or near limestone, but never very common. Found in a few localities far from limestone.

Bauhinia sp. LANGKAWI, SFN 29146 (Henderson). Possibly undescribed.

Dalbergia Kunstleri Prain. GOPENG. A rare species, otherwise known only from riverbanks at Kinta.

Dalbergia phyllanthoides Bl. BUKIT SERDAM. GUA TEJA. Not common in rocky and dense lowland forest and on riverbanks.

Derris elliptica Benth. PERLIS. Doubtfully wild.

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Desmodium rugosum Prain. LANGKAWI. Known only from here in the Peninsula. Also from Burma and Siam, but apparently not confined to limestone.

Desmodium umbellatum DC. LANGKAWI, as a seashore plant only.

Erythrina indica Lam. GUNONG KERIANG. A seashore plant, often cultivated.

Millettia pterocarpa Dunn. IPOH. Known otherwise only from Kapayang, Kinta, whether or not on limestone unknown.

Peltophorum inerme Llanos. LANGKAWI, as a sea shore plant only.

Dubious records :

Bauhinia mollissima Wall. PERLIS. Common in open country in the north of the Peninsula.

Caesalpinia digyna Rottl. LANGKAWI. PERLIS. Common in the north of the Peninsula.

Crudia Evansii Ridl. GUNONG SENNYUM, collected by Evans without precise data.

Desmodium capitatum DC. PERLIS. Common in open sandy places. Not regarded as likely to occur on limestone.

Desmodium gangeticum DC. PERLIS. GUNONG KERIANG. Not common in lowland forest in the north.

Fordia pauciflora Dunn. UPPER PERAK. Ridley states definitely that this is from limestone, but he did not collect it himself. Rare and known only from a few localities.

Saraca taipengensis Cantley. BATU CAVES. Also from near cliff bases in Kelantan. Common in lowland forest near streams.

ROSACEAE.

Eriobotrya bengalensis Hook. f. LANGKAWI. PERLIS. BUKIT TAKUN. GUA TEJA, and probably elsewhere. Not very common in the Peninsula in rocky forest from sealevel to 5,000 ft.

Rubus angulosus Focke. PULAI, on ground disturbed by mining. BUKIT CHERAS. Widely distributed in the lowlands, usually in open places.

LEGNOTIDACEAE.

Carallia Scortechinii King. ?BATU CAVES. BALING. Widely distributed but rare in the Peninsula in the lowlands.

Dubious record :

Carallia lucida King. PERLIS.

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COMBRETACEAE.

Quisqualis densiflora Wall., var. **parvifolia** Ridl. LANGKAWI.

The variety is known only from here, the species not very common in the Peninsula, usually in rocky and rather open places.

Quisqualis indica L. PERLIS. Commonly cultivated, but probably wild in a few places, scrambling on rocks.

Terminalia pyrifolia Kurz. LANGKAWI, common. Only known from here and Perlis in the Peninsula, not confined to limestone. An open country or scrub plant.

Terminalia triptera Stapf. LANGKAWI, common. GUNONG KERIANG. Known only from these localities in the Peninsula. Not confined to limestone. Recorded several times from limestone in Siam.

MYRTACEAE.

Barringtonia asiatica Kurz. LANGKAWI, but only as a littoral plant.

Barringtonia fusiformis King. GUNONG PONDOK. ?BATU CAVES. Not very common on riverbanks and in bamboo forest.

Decaspermum sp. prox. D. fruticosum Forst. GUNONG SENNYUM. GUA TEJA. BATU CAVES. BUKIT TAKUN.

Eugenia cerasiformis DC. KINTA, collected once by Kunstler. Known also from near the bases of Gunong Sennyum and Kota Glanggi. Not uncommon in lowland forest and up to about 3,000 ft.

Eugenia spicata Lamk. PERAK, once recorded only. Common in open country and near the sea.

Tristania merguensis Wight. PAHANG. LANGKAWI (determination of this specimen doubtful). Common in coastal forest and in the hills.

Tristania subauriculata King. PERAK. Rare, known only from two collections made by Kunstler, one not from limestone.

Dubious records :

Barringtonia spicata Bl. GUNONG KERIANG, KEDAH.

Eugenia sp. PERLIS. Mentioned by Ridley in J.R.A.S.S.B., 59, p. 26, but apparently not collected.

Eugenia claviflora Roxb. PERLIS. Also mentioned by Ridley in the above publication, and collected by him.

MELASTOMACEAE.

Memecylon ?acuminatum Sm. LANGKAWI (identification of specimen doubtful).

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- Memecylon coeruleum** Jack. PERLIS. Only once recorded, otherwise common in open places, often coastal.
- Memecylon dichotomum** Clarke. PAHANG. Only one definite record, but found near limestone in Kelantan. Common in lowland forest, often in rocky places.
- Memecylon Kunstleri** King. PERAK. One record from limestone. Not common, usually in dense lowland forest.
- Memecylon laevigatum** Bl. var. LANGKAWI. GUA TEJA. KELANTAN. BUKIT TAKUN. BATU CAVES. A small leaved variety which is probably commoner on the summits of dry hills than the records indicate.
- Memecylon myrsinoides** Bl. ?LANGKAWI. PERLIS. Widely distributed in lowland forest.
- Memecylon oleaefolium** Bl. GUNONG KERIANG, KEDAH. Widely distributed but not very common in lowland forest.
- Memecylon ovatum** Sm. PERLIS. Not uncommon in the Peninsula on rocky coasts.
- Memecylon sp.** prox. M. laevigatum Bl. LANGKAWI, sterile specimens only.
- Memecylon sp.** LANGKAWI, sterile specimens only.
- Memecylon sp.** BATU CAVES, insufficient for determination.
- Pachycentria tuberculata** Korth. PAHANG, once recorded only. Generally an epiphyte, but also on rocks. Common in forest from sealevel to 4,000 ft.
- Phyllagathis hispida** King. KANCHING, fide Ridley. Usually in hill forest.
- Sonerila elliptica** Stapf. KINTA. ?SUNGAI SIPUT. Known only from these collections, but with some doubt as to whether it is confined to limestone or not.
- Sonerila epilobioides** Stapf. LANGKAWI, common. Known only from here and Terutau, but whether from limestone in Terutau is not recorded.

SAMYDACEAE.

- Homalium dasyanthum**, Warb. LANGKAWI, common. Common in north of Peninsula in rocky places.
- Homalium Kunstleri** King. PERAK. Once or twice collected by Kunstler and known only from these collections.
- Homalium undulatum** King. PERAK. Known only from Kunstler's collections.
- Homalium sp.** LANGKAWI, Forest Dept. F.M.S. 46746 (Symington.) A sterile specimen collected on Pulau Dayang Bunting. Possibly one of the foregoing species.

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Dubious record :

Osmelia Maingayi King. BATU CAVES. PAHANG. Widely distributed in lowland forest.

PASSIFLORACEAE.

Adenia nicobarica King. LANGKAWI. KEDAH. Not uncommon in the Peninsula, usually in secondary growth.

CUCURBITACEAE.

Alsomitra pubigera Prain var. *glaucia* Craib. LANGKAWI. Not known from elsewhere in the Peninsula.

Gymnopetalum cochinchinense Kurz. PERAK. Recorded once only from limestone. Not very common in the Peninsula in open places and riverbanks.

Melothria marginata Cogn. LANGKAWI. SELANGOR. Not uncommon in waste ground, thickets, riverbanks etc.

Momordica subangulata Bl. IPOH. Not common in the Peninsula, recorded also from riverbanks.

Trichosanthes tricuspidata Lour. PAHANG. Once recorded from limestone. Not uncommon in secondary growth, clearings, riverbanks, etc.

Zanonia Clarkei King. BATU CAVES. KINTA. Known only from these collections.

BEGONIACEAE.

Begonia Curtissii Ridl. (incl. *B. Haniffii* Burkill). LANGKAWI. So far known only from limestone here, and from Lower Siam, also on limestone.

Begonia debilis King. GUNONG PONDOK. The only limestone collection. Rather rare in rocky places.

Begonia Foxworthyi Burkill. PAHANG. KELANTAN. Also found on shale rocks in dense shade at Bukit Batu Papan, Kelantan.

Begonia guttata Wall. LANGKAWI. Rather rare and local in rocky places.

Begonia ignorata Irmsch. KOTA GLANGGI. BUKIT CHERAS. Known only from these localities.

Begonia Kingiana Irmsch. PERAK. KELANTAN. SELANGOR. Known only from these localities and apparently confined to limestone.

Begonia phoeniogramma Ridl. LANGKAWI. SELANGOR. Rare, known also from a few localities in forest on granite rocks.

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Dubious record :

Begonia pseudo-isoptera Irmsch. KELANTAN. The records are not definite, but it is possible that it occurs on limestone. It is a rock and riverbank plant.

DATISCACEAE.

Dubious record :

Tetrameles nudiflora R. Br. GUNONG KERIANG, KEDAH. There is nothing to show whether it was collected on limestone or not. Probably it came from the base of the hill. It is recorded from a similar situation in the Enumeration of Siamese Plants.

ARALIACEAE.

Brassiopsis palmata Kurz. PAHANG, once recorded only, and once from limestone in Lower Siam. Widespread but not common in forest from the lowlands to 5,000 ft.

Schefflera heterophylla Harms. BUKIT CHERAS. Usually a rock plant, not uncommon and widespread in the Peninsula.

Schefflera subracemosa Viguier. KUALA DIPANG. Known only from here.

Schefflera musangensis Henders. BUKIT TAKUN. Otherwise known only from the base of Gua Musang, Kelantan, where it grew epiphytically.

Schefflera subulata Viguier. BUKIT CHERAS. GUNONG SENNYUM. KOTA GLANGGI. ?BATU CAVES. Common in the Peninsula on rocks and trees in forest from sea level to over 2,000 ft. Common on the Pahang limestone.

Schefflera tomentosa Viguier. PERAK. PAHANG. Recorded twice only from limestone. Widespread in lowland forest, often terrestrial, sometimes epiphytic.

Dubious records :

Schefflera minimiflora Ridl. LANGKAWI. It is probable that some of the Langkawi plants were collected on limestone, for it is recorded from limestone in Lower Siam.

Trevesia cheirantha Ridl. PERAK. SELANGOR. It has been collected near the base of Batu Caves. Widespread in lowland forest.

RUBIACEAE.

Amaracarpus saxicola Ridl. BUKIT KAMUNING, PERAK. Known only from here.

Argostemma diversifolium Ridl. LENGGONG. Known only from here in the Peninsula. Recorded also from Lower Siam, but not stated to be on limestone.

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- Argostemma inaequilaterum** Benn. ?GUNONG PONDOK. BATU CAVES. ?LENGGONG. There is only one definite record, but the others are probable. Ridley states that it is usually on limestone. Rare in the Peninsula, probably a rock plant.
- Argostemma pictum** Wall. LANGKAWI. Not uncommon in the Peninsula, usually in hill forest and often on rocks.
- Becheria parviflora** Ridl. BATU CAVES. Rare in the Peninsula in lowland forest.
- Canthium aciculatum** Ridl. KEDAH. PERAK. Not common in lowland forest.
- Coffea malayana** Ridl. PERLIS. PERAK. Not uncommon in lowland forest.
- Geophila herbacea** O. Ktze. LANGKAWI. PERAK. ?SELANGOR. Rare on or near limestone, but common in lowland forest on banks and in rocky places.
- Guettarda speciosa** Linn. LANGKAWI, as a seashore plant only.
- ?**Gynochthodes** sp. IPOH (*Curtis 3339*). A very poor specimen which may not belong to this genus.
- Hedyotis coronaria** Craib. LANGKAWI. PERLIS. KELANTAN. ?IPOH. Not uncommon in the Peninsula from sealevel to over 4,000 ft., usually in forest in shade.
- Hedyotis tenelliflora** Bl. PAHANG, once only from limestone. Not common in the Peninsula in open rather dry places.
- Ixora Brunonis** Wall. GUNONG BALING, summit. Not common in the Peninsula.
- Ixora clerodendron** Ridl. BUKIT CHERAS. GUNONG SENNYUM. KOTA GLANGGI. A little known species, possibly commonest on or near limestone.
- Ixora congesta** Roxb. GUNONG BALING. Common in the Peninsula in forest.
- Ixora nigricans** Wight & Arn. SETUL, ?LANGKAWI. KEDAH. KELANTAN (var. *ovalis*, Pitard). ?GUNONG SENNYUM. UPPER PERAK (var. *ovalis*, Pitard). ?BATU CAVES. Common in the Peninsula.
- Ixora pendula** Jack. LANGKAWI. PERLIS. PAHANG. ?BATU CAVES. Common in the Peninsula.
- Ixora Scortechinii** King & Gamble, var. Base of GUA PANJANG, KELANTAN. Common in lowland forest.
- Ixora umbellata** Koorders & Valetton. PERLIS. KEDAH. KELANTAN. BATU CAVES. Common in forest.
- Knoxia corymbosa** Willd. PERAK, from open places on limestone. Not common in the Peninsula in grassy or open places.

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- Lasianthus stipularis** Bl., var. **hirta** Ridl. KANCHING. The variety is known only from this collection. The species is widely distributed in lowland forest, but not known from limestone.
- ?**Mitragyne sp.** GUNONG PONDOK, SFN 23813 (Henderson).
- Morinda umbellata** Linn., ?var. KEDAH. PERAK. PAHANG. SELANGOR. A plant of doubtful status, which may be a variety of this common species.
- Mycetia malayana** Craib. ?LANGKAWI. KEDAH. KELANTAN. SELANGOR. Widely distributed in lowland forest.
- Nauclea Junghuhnii** Merr. GOPENG ("in rich soil on limestone" coll. Kunstler). The only limestone record. Otherwise it is common in lowland forest.
- Oldenlandia ovatifolia** DC. LANGKAWI. Rare in the Peninsula, not confined to limestone.
- Oldenlandia pterita** Miq. PERLIS. Rare in the Peninsula, known from here and Malacca (not limestone). A plant of roadsides and other open places.
- Oldenlandia rosettifolia** Geddes. LANGKAWI. Known only from here in the Peninsula. Recorded from limestone in Siam, but apparently not confined to it.
- Oldenlandia verticillata** Linn. PULAU RABANA. LANGKAWI. Not very common in the Peninsula in open dry places. Recorded from "evergreen forest" in Siam.
- Ophiorrhiza fruticosa** Ridl. BATU CAVES. Known only from here.
- Ophiorrhiza hispidula** Wall. LANGKAWI. PERLIS. Not uncommon in the Peninsula in forest.
- Ophiorrhiza Kunstleri** King. LANGKAWI. PERLIS. PERAK. KELANTAN. Known only from limestone.
- Ophiorrhiza longerepens** Ridl. KELANTAN. Known so far only from Gua Panjang, where it was common.
- Ophiorrhiza pallidula** Ridl. KELANTAN. SELANGOR. Rare, usually in lowland forest.
- Ophiorrhiza sp.** TANJONG RAMBUTAN, PERAK, SFN 23785 (Henderson).
- Ophiorrhiza sp.** GUNONG BALING, KEDAH. SFN 35276 (Henderson).
- Paederia tomentosa** Bl. ?LANGKAWI. PERLIS. Not very common in the Peninsula in open and rocky places, possibly only on limestone in the north.
- Pavetta indica** Linn. PERLIS. Common in the Peninsula in lowland forest.
- Pavetta pauciflora** Ridl. BATU CAVES. Known only from here.

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Pavetta sp. GUNONG BALING, SFN 35406 (Henderson).

Pavetta sp. GUNONG PONDOK, SFN 23799 (Henderson).

Pavetta sp. LANGKAWI, SFN 21374 (Henderson).

Pavetta sp. KAKI BUKIT, PERLIS, SFN 35226 (Kiah).

Petunga hirta Ridl. PERAK. Known only from one locality on limestone and also rather doubtfully from Sungai Telom, Pahang.

Prismatomeris malayana Ridl. KAKI BUKIT, PERLIS. Common in the Peninsula, usually in open places, often on the coast.

Psychotria angulata Korth. ?PERLIS. PAHANG. SELANGOR. Not uncommon on limestone. Common in the Peninsula in forest, often in rocky places.

Psychotria Cantleyi Ridl. ?PAHANG. BATU CAVES. Widely distributed in lowland forest but only once definitely recorded from limestone.

Psychotria montana Bl. PERAK. Common in the Peninsula, often in rocky forest.

Psychotria rhinocerotis Reinw. LANGKAWI. PERLIS. PERAK. PAHANG. Not uncommon on limestone. Common in the Peninsula in rocky places in forest.

Psychotria rostrata Bl. PAHANG. Only once definitely recorded, but several times collected close to limestone. Common in lowland forest.

Psychotria viridiflora Reinw. PAHANG. ?SELANGOR. Common in open and rocky places both in the lowlands and the hills.

Randia ?oppositifolia Koords. LANGKAWI. PERLIS. KEDAH. PERAK. SELANGOR. A rather doubtful plant. It may be a variety of this species, which is common in the Peninsula.

Randia sp. BUKIT TAKUN, SELANGOR, Forest Dept. F.M.S. 37439 (Symington).

Saprosma sp. KAKI BUKIT, PERLIS, (Kiah, 11/4/38, sine num.).

Tarennia angustifolia Merr. PERAK, top of limestone hills, known only from here in the Peninsula. Two collections are recorded from Siam, one from limestone, the other from rocks, formation not stated.

Tarennia calcarea Ridl. PERAK. Known only from limestone near Ipoh.

Tarennia Curtisi Ridl. LANGKAWI. PERLIS. KELANTAN. Otherwise known only from limestone in Lower Siam. King, in Mat. F.M.P., includes Wray 3612 from Gunong Inas under this species. I have not seen this number, but Wray 4113 from the same locality is not *Tarennia Curtisi*. The variety mentioned by Ridley, F.M.P. II, p. 107 has been found at GUA TIPUS and BATU CAVES and may be a distinct species.

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- Tarennia Ridleyi** Pears. UPPER PERAK. Not very common in the Peninsula, usually in forest in the south.
- Tarennia ?stellulata** Ridl. GUNONG BALING, SFN 35367 (*Kiah*).
- Tarennia sp.** prox. *T. pulchra* Ridl. BUKIT LAGI, PERLIS, (*Henderson sine num.*).
- Tarennia sp.** aff. *T. attenuata* Ind. Kew. BUKIT SAGU, PAHANG, SFN 25091 (*Henderson*).
- Tarennia sp.** BUKIT TAKUN, SELANGOR, Forest Dept. F.M.S. 37415, 39592 (*Symington*) ; SFN 34383 (*Nur*).
- Timonius atropurpureus** Craib. LANGKAWI, apparently common. Perhaps confined to limestone, although only two of the several collections are stated to be from limestone. Recorded from Lower Siam on rocks, formation not specified.

Dubious records :

- Hymenodictyon excelsum** Wall. LANGKAWI. Known only from here in the Peninsula. Recorded from limestone in Siam.
- Ixora javanica** DC. SETUL. KOTA GLANGGI.
- Ixora pumila** Ridl. GUNONG SENNYUM, collected by Evans. Known only from here and Kuala Tahan, Pahang.
- Ophiorrhiza discolor** R. Br. BATU CAVES. Common in the Peninsula in lowland forest, often in rocky places.
- Ophiorrhiza major** Ridl. PERAK. PAHANG. SELANGOR. No definite records, although it is known from near bases of limestone cliffs. Common in lowland forest.
- Ophiorrhiza remotiflora** Ridl. PAHANG. Probably on limestone, as it has been collected close to cliff bases. Rare in the Peninsula, known from granite and shale formations.
- Randia fasciculata** DC. SETUL. PERLIS. Not uncommon in the north of the Peninsula in open places or near the sea.
- Psychotria lanceolaria** Ridl. BATU CAVES. Known only from here.
- Tarennia adangensis** Ridl. LANGKAWI. PERLIS.
- Tarennia Evansii** Ridl. GUNONG SENNYUM, collected by Evans and known only from this collection.

COMPOSITAE.

- Mikania cordata** B. L. Robinson. PERAK, recorded once only and probably present as a weed. Common in the Peninsula in open places, edges of forest, etc. from sealevel to over 4,000 ft.
- Vernonia cinerea** Less. BUKIT CHERAS, PAHANG. The only record from limestone in the Peninsula and no doubt accidentally introduced, as it was found near a frequently visited cave. It is, however, recorded from open deciduous forest on limestone in Siam.

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Vernonia Curtisiae Craib & Hutchins. TERUTAU, LANGKAWI, common. Known also from Siam apparently usually if not always on limestone.

Vernonia rupicola Ridl. LANGKAWI. Recorded also from Adang, on rocks, presumably not limestone. Known only from these localities.

Dubious records :

Spilanthes Acmella Murr. PERAK. BATU CAVES. If on limestone then probably only as a weed.

Wedelia biflora DC. PULAU DAYANG BUNTING, LANGKAWI, fide Craib, Enum. Siam. Pl., II, p. 275.

VACCINIACEAE.

Vaccinium Hasseltii Miq. BUKIT TAKUN, SELANGOR. The only record so far of this family from the Peninsular limestone. No limestone records are given in Craib's Enumeration of Siamese Plants.

PRIMULACEAE.

Lysimachia peduncularis Wall. LANGKAWI. A Burmese and Siamese species not hitherto recorded from our area. In the Peninsula known only from one collection from the limestone.

MYRSINACEAE.

Ardisia biflora King & Gamble. PERAK, fide Ridley,. Known only from collections made by Kunstler and Wray which I have not seen.

Ardisia lanceolata Roxb. BATU CAVES. Not uncommon in the Peninsula in lowland forest.

Ardesia langkawiensis King & Gamble. LANGKAWI. Known only from Ridley's collection on Pulau Dayang Bunting.

Ardisia Meziana King & Gamble. GOPENG, collected once by Kunstler and not seen again.

Ardisia oxyphylla Wall. KELANTAN. Not uncommon in the Peninsula, often in hill forest.

Ardisia platyclada King & Gamble. PERAK. Rare and known only from one other collection not from limestone.

Ardisia Ridleyi King & Gamble. ?LANGKAWI. PERAK. Not uncommon in lowland forest and up to 4,000 ft.

Ardisia pendula, Mez. PERLIS. Not common in the Peninsula in open country.

Ardisia solanacea Roxb. ?LANGKAWI. PERAK. Not very common in forest, often in hill forest.

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Ardisia Vaughnii Ridl. GUNONG BALING. Known also only from Tembeling (Pahang) and Rahman.

Ardisia vestita Wall. PERAK. Once definitely recorded but several times found near limestone. Common in the Peninsula in forest.

Ardisia cf. Hullettii Mez. GUA LAMBOK, KELANTAN, a poor specimen in fruit.

Ardisia sp. aff. A. suffruticosa Ridl. BUKIT CHERAS, PAHANG, in abundance at one spot.

Ardisia sp. prox. A. fulva King & Gamble. LANGKAWI, SFN 21394 (Henderson).

Ardisia sp. GUNONG KERIANG, KEDAH, SFN 35420 (Kiah).

Ardisia sp. LANGKAWI, Forest Dept. F.M.S. 46753 (Symington). Sterile specimens from a rocky headland on P. Dayang Bunting.

Embelia calcarea Fletcher. LANGKAWI. Known only from here in the Peninsula, but what appears to be the same thing was collected by Kloss in Banguey island, off the coast of Borneo.

Maesa pahangiana King & Gamble. KELANTAN. PERAK. Not common, usually on riverbanks.

Myrsine Porteriana Wall. GUNONG BALING, SELANGOR. Not uncommon in the Peninsula, occasionally near the sea, usually in hill forest.

Dubious record :

Ardisia attenuata Wall. BATU BUNGA, SETUL.

SAPOTACEAE.

Isonandra perakensis King & Gamble. KINTA, PERAK, collected once by Kunstler and known only from this collection.

Madhuca Ridleyi H. J. Lam. LENGGONG. BUKIT SERDAM. A curious species known only from these two collections.

Mimusops Elengi Linn. var. **parvifolia** H. J. Lam. LANGKAWI, common. Very rarely wild elsewhere in the Peninsula except perhaps on seashores. The species is often cultivated.

Payena Havilandii King & Gamble. LANGKAWI. Widely distributed in the Peninsula in lowland forest.

EBENACEAE.

Diospyros adenophora Bakh. PAHANG. Known only from one collection from limestone and from Kota Bahru, Kelantan.

Diospyros cauliflora Bl. PERAK. PAHANG. Probably not uncommon on or near limestone. Widespread in lowland forest.

Diospyros daemona Bakh. PAHANG. Known only from one collection.

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- Diospyros ellipsoidea** King & Gamble. PERAK. Not common in dense lowland forest.
- Diospyros ferrea** Bakh. ?LANGKAWI. ?PERLIS. GUNONG BALING. Usually in dry open places especially near the sea.
- Diospyros frutescens** Bl. GUNONG PONDOK. Not common in the Peninsula in lowland forest.
- Diospyros hermaphroditica** Bakh. ?LANGKAWI. PERLIS. Commonest in the north of the Peninsula especially in rocky places near the sea.
- Diospyros Holttumii** Bakh. LANGKAWI. Known only from one collection.
- Diospyros malayana** Bakh., var. *aequabilis* Bakh. KOTA GLANGGI, at base of cliff. Not common in the Peninsula in forest.
- Diospyros pilosanthera** Blanco var. *Helferi* Bakh. LANGKAWI. ?PERLIS, several localities.
- Diospyros retrofracta** Bakh. PERLIS. UPPER PERAK. PAHANG. Known only from these localities in the Peninsula and from Siam, but apparently not confined to limestone there.
- Diospyros toposioides** King & Gamble. KEDAH. UPPER PERAK. ?PERAK. ?SELANGOR. Widespread in forest. Ridley says commonest on limestone, but this is doubtful.
- Diospyros undulata** Wall. LANGKAWI. PERLIS. KEDAH. Known also from Terutau and Lower Siam but whether on limestone or not is not stated.
- Diospyros Wallichii** King & Gamble. ?LANGKAWI. UPPER PERAK. BATU CAVES. Common and widely distributed in forest.
- Diospyros sp.** LANGKAWI, Forest Dept. F.M.S. 34711 (Symington), sterile specimens collected on P. Dayang Bunting.

Dubious records :

- Diospyros pubicarpa Ridl. BATU CAVES.
Diospyros siamensis Hochr. LANGKAWI.

OLEACEAE

- Jasminum adenophyllum** Wall. GUNONG KERIANG, KEDAH. Rare in the Peninsula, recorded from the main range in Selangor and also from Penang. The Penang specimen was collected by Kunstler in 1881, but it may then have been in cultivation in Penang as it is now.
- Jasminum cordatum** Ridl. PULAI, PERAK. Known only from here.
- Jasminum Curtisi** King & Gamble. PERLIS. Once only recorded from limestone, but collected near Ipoh without data. Known only from these collections.

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Jasminum Wrayi King & Gamble var. **hispida** King and Gamble. PERAK. ?BATU CAVES. Not very common in forest.

Jasminum sp. prox. *J. nervosum* Lour. LANGKAWI, Forest Dept. F.M.S. 46737, 46783 (Symington). I have seen no authentic material of Loureiro's species for comparison. It is recorded from limestone in Lower Siam.

Jasminum sp. BATU CAVES. A scrap collected by Ridley and not seen again.

Jasminum sp. BUKIT TAKUN, SELANGOR, Forest Dept. F.M.S. 39587 (Symington).

Ligustrum confusum Dcne. PERLIS. Not previously recorded from the Peninsula. Common in Siam, especially in "padang" formations (fide A. F.G. Kerr).

APOCYNACEAE.

Alstonia angustiloba Miq. BUKIT TAKUN, SELANGOR, but identity of specimen rather doubtful. This is the only record so far of *Alstonia* from limestone in the Peninsula, but *A. Curtissii* K. & G. is recorded from limestone in Lower Siam.

Alyxia selangorica King & Gamble. BATU CAVES. Known only from here in the Peninsula. Also known from Sumatra, in one locality there, at least, not from limestone, and from Siam, ?not on limestone.

Alyxia sp. GUA TIPUS, PAHANG, SFN 19466 (Henderson).

Ervatamia peduncularis King & Gamble. ?LANGKAWI. PERLIS. PAHANG. ?BATU CAVES. Common in forest and sometimes in rather open places up to 2,000 ft.

Holarrhena Curtissii King & Gamble. LANGKAWI. Known only from here in the Peninsula. Extends into Siam and Cambodia.

Hunteria zeylanica (Retz.) Gard. LANGKAWI. UPPER PERAK. ?BATU CAVES. Common in the Peninsula in lowland forest, often in rocky places.

Kopsia alba Ridl. ex Henderson. KELANTAN. Common in this district in the limestone area and in rocky jungle in Pulau Tioman. Recorded from limestone in Lower Siam.

Kopsia Griffithii King & Gamble var. **paucinervia** K. & G. PERAK, fide King and Gamble. The variety known only from this collection, the species also very rare.

Kopsia macrophylla Hook. f. BUKIT SERDAM, in dry clayey soil on limestone. Rare, otherwise known only with certainty from Pulau Jerajak, Penang, and doubtfully from Johore.

Melodinus orientalis Bl. GOPENG. Not common in the Peninsula in forest, often in hill forest.

Melodinus perakensis King & Gamble. GOPENG. Known only from here.

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Parameria polyneura Hook. f. PULAI. The only limestone record, but common in lowland forest.

Rauwolfia perakensis King & Gamble. GUNONG KERIANG. BATU CAVES. Not uncommon in open places, riverbanks, edges of secondary growth, etc., up to 4,500 ft.

Rauwolfia sumatrana Jack. PERAK. Rare in the Peninsula and perhaps only on limestone.

Wrightia laevis Hook. f. PERLIS. KELANTAN. Not very common but widely distributed in lowland forest in the Peninsula. Recorded from limestone in Lower Siam.

ASCLEPIADACEAE.

Dischidia bengalensis Colebr. PULAU RABANA. LANGKAWI. GUNONG SENNYUM. Common on the northern limestone, often on bare rock faces. Common on trees, often in the open, from sealevel to 5,000 ft.

Dischidia hirsuta Dcne. BATU CAVES. BUKIT CHERAS. Not common on limestone, but otherwise common as an epiphyte on trees in more or less open places.

Dischidia tomentella Ridl. PERLIS. Known only from here.

Gongylosperma lanuginosum Ridl. LANGKAWI, on bare limestone cliffs. Known only from here. One other species is known from limestone in Siam.

Gymnanthera insularum King & Gamble. LANGKAWI. Known only from here and Lower Siam, but whether always on limestone or not is not certain.

Heterostemma piperifolium King & Gamble. IPOH. BATU CAVES. Not common, usually in forest.

Hoya citrina Ridl. ?BATU KURAU. BATU CAVES. Known only from these localities and from Ulu Bubong (not limestone).

Hoya coronaria Bl. IPOH. Collected once only on limestone, but common in mangrove, secondary growth, on riverbanks and near the sea.

Hoya occlusa Ridl. BATU CAVES. Known only from here and collected once only.

Hoya parviflora Wight, ?var. PERLIS. KELANTAN. Not uncommon as an epiphyte.

Marsdenia tinctoria Br. PERLIS. IPOH. BATU CAVES. Perhaps remains of cultivation.

Secamone micrantha Dcne. ?LANGKAWI (probable). ?PERLIS. IPOH. Not very common but widespread in the Peninsula, in open places or on rocks by the sea.

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Toxocarpus Curtisii King & Gamble. ?LANGKAWI. ?PERLIS. BUKIT TAKUN. Not common, known otherwise only from forest at about 3,000 ft.

Toxocarpus pauciflorus Henders. BUKIT CHINTAMANI. Known only from here.

Tylophora calcicola Henders. GUA NINEK, KELANTAN. BUKIT CHERAS, PAHANG. Known only from these localities.

Tylophora perakensis King & Gamble. GUNONG KERIANG. ?PERAK. Not common in the Peninsula in forest.

Tylophora tenuis Bl. PERLIS. BATU CAVES. Not common on limestone, but common in the Peninsula, often on tidal rivers and in open places.

Dubious record :

Toxocarpus langkawiensis King & Gamble. LANGKAWI. Known only from here.

LOGANIACEAE.

Fagraea calcarea Henders. BUKIT CHINTAMANI. Known only from here.

Fagraea carnosa Jack. BUKIT SERDAM at 1,500 ft. alt. Collected once only on limestone. Rather rare in the Peninsula, near the sea or in rocky places in forest.

Fagraea Curtisii King & Gamble. LANGKAWI, several times recorded, but whether or not always on limestone is unknown. Known only from here and from Channing, Kelantan (not limestone).

Fagraea obovata Wall. BUKIT TAKUN. Common in lowland forest or near the sea, usually in rocky places.

Mitreola oldenlandioides Wall. LANGKAWI. Known only from here in the Peninsula, but not confined to limestone.

Strychnos chloropetala A. W. Hill. LANGKAWI. Described from Siam, where it occurs frequently on limestone. Not hitherto recorded for the Peninsula.

GENTIANACEAE.

Canscora pentanthera Clarke. LANGKAWI. PERLIS. KEDAH. KELANTAN. PAHANG. PERAK. SELANGOR. Commonest on dry limestone rocks but not confined to them.

Microrhynchium pubescens Clarke. LANGKAWI. Apparently common here but the records do not show whether it is confined to limestone or not. Known only from here.

Microrhynchium sp. BUKIT SAGU, PAHANG, SFN 25158 (Henders). Possibly only a glabrous variety of the preceding species.

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BORAGINACEAE.

Cordia Griffithii Clarke. LANGKAWI. ?PERLIS. Not common in open places.

Cordia sp. GUNONG KERIANG, KEDAH, SFN 35418 (*Kiah*). Said to be a climber.

Ehretia timorensis DC. LANGKAWI. Only once definitely recorded from limestone. Not very common in the Peninsula, often in rocky forest.

CONVOLVULACEAE.

Argyreia obtusifolia Lour. LANGKAWI. Not common in the Peninsula, not south of Perak, usually in more or less open places.

Ipomoea illustris Prain. PULAU RABANA. LANGKAWI. A sea-shore plant, not common in the Peninsula, not south of Penang.

Jacquemontia paniculata Hall. LANGKAWI. ?PERLIS. Rare in the Peninsula, in open and rocky places, not confined to limestone.

Lettsomia Maingayi Clarke. GUNONG SENNYUM. BUKIT CHERAS. ?KOTA GLANGGI. Not uncommon, usually in lowland forest.

Dubious record :

Lepistemon flavesens Bl. BATU CAVES. Not very common in the Peninsula, usually on forest edges.

CARDIOPTERIDACEAE.

Cardiopteris lobata Wall. PERLIS. Apparently scarce in the Peninsula, in open places and secondary growth.

SOLANACEAE.

Solanum biflorum Lour. KELANTAN. PAHANG. SELANGOR. Rare in the Peninsula, known only from limestone or from localities very close to it.

Solanum decemdentatum Roxb. GUNONG SENNYUM. Rare in the Peninsula, usually in rocky rather open places.

Solanum nigrum L., and *S. verbascifolium* L., have been collected near the bases of limestone hills, and *Capsicum frutescens* has been seen as an escape from cultivation on hill bases in Perlis.

SCROPHULARIACEAE.

Adenosma capitatum Benth. LANGKAWI. Common in the Peninsula along roads, in open sandy places, on seashores, etc.

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Centranthera hispida R. Br. LANGKAWI, in grass in open places.
Not previously recorded from the Peninsula.

Dubious record :

Curanga amara juss. SELANGOR. Not uncommon in the north of the Peninsula along borders of forest and on riverbanks.

LENTIBULARIACEAE.

Utricularia minutissima Vahl. LANGKAWI. Scarce in the Peninsula in damp and sandy spots. Known also from the Anamba Islands.

GESNERACEAE.

Boea acutifolia Ridl. LANGKAWI. PERLIS. So far as is known confined to limestone in these localities.

Boea brachycarpa Ridl. GUA NINEK, KELANTAN. Known only from here.

Boea coerulescens Ridl. IPOH. SUNGAI SIPUT. BUKIT SERDAM. Known only from these localities, and presumably confined to limestone.

Boea lanata Ridl. LANGKAWI, common on exposed rock faces. Known only from here and probably confined to limestone.

Boea minutiflora Ridl. GUNONG SENNYUM. Known only from here.

Boea paniculata Ridl. PERAK. SELANGOR. Apparently confined to limestone and known only from these localities.

Boea parviflora Ridl. PERAK, several localities. Known only from these localities and presumably confined to limestone.

Boea suffruticosa Ridl. LANGKAWI. Known only from Curtis's collections from here.

Boea verticillata Ridl. KEDAH. PERAK. PAHANG. SELANGOR. Except for one doubtful specimen collected by Kunstler at Sungai Ryah, known only from these localities and confined to limestone.

Chirita calignosa Clarke. PERAK. PAHANG. SELANGOR. In most localities, but not recorded from Langkawi, Perlis or Kedah. There are two collections by Kunstler, one from Sungai Ryah and one from Larut, with no mention of limestone. These are not quoted by Ridley in his Flora. Otherwise it is known only from limestone.

Chirita parvula Ridl. KOTA GLANGGI. Although collected by Evans without mention of limestone, it is highly probable that it is a limestone plant. It is known only from here and from Jalor, also very probably from limestone.

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- Chirita rupestris** Ridl. PERLIS. Known also only from Bukit Penarak, Langkawi, which, so far as can be traced, is not limestone.
- Chirita sericea** Ridl. PERAK. Known only from here, and perhaps confined to limestone, but the records are not definite.
- Chirita viola** Ridl. LANGKAWI. KEDAH. PAHANG. KELANTAN. Usually, but not always on limestone.
- Dichiloboea speciosa** Stapf. LANGKAWI. Known only from here and confined to limestone.
- Epithema saxatile** Bl. LANGKAWI. PERLIS. PAHANG. PERAK. SELANGOR. Common on nearly all the limestone, but not confined to it. A rock plant.
- Lepadanthus flexuosus** Ridl. GUNONG KERIANG, KEDAH. Known only from here in the Peninsula. Also from Lower Siam, but the records do not show whether it is confined to limestone there or not.
- Monophyllaea glabra** Ridl. LANGKAWI. Known only from here in the Peninsula and only from limestone. Also from Lower Siam, possibly always on limestone, though this is not definitely recorded.
- Monophyllaea Horsfieldii** R. Br. PAHANG. KELANTAN. PERAK. SELANGOR. Not very common on limestone. A rock plant, often on acid rocks.
- Monophyllaea patens** Ridl. KELANTAN. PAHANG. PERAK. SELANGOR. Not very common on limestone and confined to it.
- Paraboea Bakeri** Henders. BUKIT CHERAS, PAHANG. Known only from here.
- Paraboea Bettiana** Henders. BUKIT CHERAS. Known only from here.
- Paraboea capitata** Ridl. PERAK, several localities. PAHANG. Usually on limestone but not confined to it.
- Paraboea ferruginea** Ridl. LANGKAWI. Known only from here and probably always on limestone.
- Paraboea laxa** Ridl. LANGKAWI. Known only from here and only from limestone.
- Paraboea vulpina** Ridl. LANGKAWI. Known only from here and from two localities in Perak, apparently not on limestone.
- Rhyncoglossum obliquum** Bl. GUA TIPUS, PAHANG. One record only from limestone in the Peninsula, but known from limestone in Lower Siam. Not common in the Peninsula, usually in hill forest.
- Stauranthera grandiflora** Benth. PAHANG. KELANTAN. Not common in the Peninsula, usually in rocky places in forest.

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Stauranthera umbrosa Clarke. PERAK. One definite record only, but known from near Batu Caves. Not common in the Peninsula in rocky places.

Dubious records :

Boea divaricata Ridl. LANGKAWI at Ayer Hangat and on "small islands". Known only from here. The locality "small islands" very probably indicates limestone. Ayer Hangat is not in the limestone area, as far as can be ascertained.

Boea lancifolia Ridl. TERUTAU, without data. Known only from here.

Cyrtandra pendula Bl. IPOH. Common in lowland forest. *C. cupulata* Ridl. has been found close to limestone in several localities, but the genus as a whole is usually found in wet places in forest.

Didymocarpus crinita Jack. PERAK, without precise locality, collected by Kunstler. Common in forest up to 4,000 ft.

Didymocarpus pectinata Clarke. PERAK, without precise locality, collected by Kunstler. Rare, known only from this collection and two in Selangor.

Apparently both Kunstler's collections were made at the same place. He states that they were on limestone "in dense jungle", but as they have not been collected again on limestone and no other *Didymocarpus* has been found on limestone, there is a possibility that he mistook the rocks.

Paraboea regularis Ridl. LANGKAWI, without definite details. Known only from here and doubtfully from Lower Siam.

ACANTHACEAE.

Andrographis tenuiflora T. Anders. TERUTAU. LANGKAWI. Known only from these localities in the Peninsula and apparently only on limestone.

Aporuellia sumatrensis Clarke, var. **Ridleyi** Clarke. BATU CAVES. The variety is known only from here, the species from Sumatra.

Barleria siamensis Craib var. **glabrescens** Ridl. LANGKAWI. The variety is known only from here, the species submontane in Siam.

Barleria prionitis L. PERLIS, collected by Ridley and thought by him to be wild. Otherwise cultivated or an escape from cultivation.

Dicliptera rosea Ridl. ?SETUL. PERLIS. KEDAH. Known only from these localities. If the Setul specimen came from limestone then the plant is confined to limestone.

Gymnostachyum decurrens Stapf. BUKIT SERDAM. GUA TIPUS. Not common in lowland forest.

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- Gymnostachyum diversifolium** Clarke. LANGKAWI. Not common in the north of the Peninsula, usually in lowland forest.
- Gymnostachyum Robinsonii** Ridl. LANGKAWI. Known only from here.
- Gymnostachyum** sp. GUA TEJA, KELANTAN, SFN 29687 (Henderson).
- Hemigraphis Ridleyi** Clarke. LANGKAWI. ?PERLIS. ?KEDAH. Not very common in open places, grassy places, riverbanks, etc.
- Justicia henicophylla** Clarke. PAHANG. ?PERAK. Not common in forest, usually submontane.
- Justicia hirticarpa** J. B. Imlay. KISAP, LANGKAWI, SFN 29176 (Henderson). The only other collection of this species is Curtis 2117 labelled "Kuah". Curtis may have collected it on the limestone at KISAP, which is not far from the village of Kuah.
- Justicia microcarpa** Ridl. BATU CAVES, at base. Known only from here.
- Justicia pectinella** Ridl. GUNONG BALING. BUKIT CHINTAMANI. Also from near Kota Glanggi. Not common in forest.
- Justicia ptychostoma** Nees. LANGKAWI. PERAK. SELANGOR. Common in rather open places and riverbanks.
- Justicia Robinsonii** Ridl. LANGKAWI. Known only from here and from Burau, the latter collection without details.
- Justicia rupestris** Ridl. PERLIS, at cliff bases. Known only from here.
- Justicia subalternans** Clarke. KINTA. Apparently known only from this collection.
- Justicia subcymosa** Clarke. PERLIS. KEDAH. PERAK. SELANGOR. Common in lowland forest.
- Justicia über** Clarke. PERLIS. KELANTAN. PAHANG. ?SELANGOR, and probably from other localities. Common in lowland forest.
- Justicia vasculosa** Wall. IPOH. Recorded once only from limestone. Not uncommon in lowland forest.
- Justicia valida** Ridl. GUNONG KERIANG, KEDAH. Known only from here and Lower Siam.
- Polytrema cupreum** Ridl. PERAK. Known only from two collections from near Ipoh, one of which is without details.
- Polytrema vulgare** Clarke. PERAK. PAHANG. ?BATU CAVES. Common in lowland forest, sometimes in rocky places. Recorded from limestone in Lower Siam.

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- Pseuderanthemum crenulatum** Radlk. PULAU RABANA. LANGKAWI. ?PERLIS. ?KEDAH. PERAK. ?BATU CAVES. Not uncommon on or near limestone and in lowland forest.
- Pseuderanthemum graciliflorum** Ridl. LANGKAWI. ?PERLIS. ?KEDAH. Common in lowland forest.
- Rostellaria procumbens** Nees. LANGKAWI, in open very dry places. Not common in the Peninsula in open, usually sandy places.
- Rungia minutiflora** Clarke. LANGKAWI. Known only from here, and probably confined to limestone.
- Stenothrysus Ridleyi** Clarke. IPOH. A monotypic genus collected a few times in this locality, apparently always on limestone.
- Strobilanthes leucopogon** Ridl. LANGKAWI. Known only from here, but one collection is from granite.
- Strobilanthes pachyphyllus** Clarke. KINTA. Known only from here.
- Strobilanthes sp.** LANGKAWI, SFN 29096 (Henderson). Collected also on Pulau Pong Pinang off the coast of Lower Siam, SFN 4024 (Haniff & Nur). This island is said to be limestone.
- Thunbergia fragrans** Roxb., forma **javanica** Clarke. LANGKAWI. PERLIS. BATU CAVES, and possibly elsewhere. The variety seems to be wild and not uncommon on the limestone and on riverbanks or in hedges. The species is probably not wild.

Dubious records :

- Lepidagathis incurva Don. LANGKAWI. PERLIS. KEDAH. Common in open and waste ground in the north of the Peninsula.
- Nelsonia campestris R. Br. LANGKAWI. PERLIS.
- Polytrema aequale Ridl. GUNONG SENNYUM. BATU CAVES. Not common in lowland forest.
- Ruellia repens Linn. GUNONG KERIANG, KEDAH. Common in open places in the Peninsula, especially in grass. Recorded from limestone in Lower Siam.
- Staurogyne comosa Kuntze. PERAK. SELANGOR. Usually in hill forest.
- Staurogyne malaccensis Clarke. GUNONG KERIANG. Not uncommon in lowland forest.
- Staurogyne merguensis Kuntze. PULAU DAYANG BUNTING, LANGKAWI. Collected by Robinson without data. Not common in lowland forest in the north of the Peninsula, often in rocky places.

VERBENACEAE.

- Callicarpa angustifolia** King & Gamble. LANGKAWI. KELANTAN. PAHANG. PERAK. SELANGOR. Very often on the tops of dry hills and confined to limestone.

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Callicarpa arborea Roxb. PULAI. Not uncommon in the Peninsula in lowland forest. Recorded from limestone in Lower Siam.

Clerodendron paniculatum Wall. Summit of GUNONG BALING, KEDAH. Perhaps not wild. See note in Ridley, F.M.P. Vol. II, p. 628.

Clerodendron penduliflorum Wall. ?KEDAH. PAHANG. PERAK. SELANGOR. Not uncommon in lowland forest in the north of the Peninsula.

Clerodendron serratum Spreng., var. **Wallichii** Clarke. BUKIT SERDAM. One record only from limestone but it occurs near limestone in other localities. Common in the lowlands in open places and near rivers.

Glossocarya mollis Wall. PULAU RABANA. ?PERLIS. Known only from these localities in the Peninsula.

Lantana aculeata L. PULAI, PERAK. A weed on ground disturbed by mining.

Premna pyramidata Wall. IPOH. Once only from limestone. Not uncommon in lowland forest and on riverbanks.

Stachytarpheta indica Vahl. PULAI, PERAK. As a weed in ground disturbed by mining.

Vitex pubescens Vahl. LANGKAWI, not uncommon here. Common in the peninsula in open places and secondary growth.

Vitex siamica Williams. LANGKAWI. PULAU RABANA. PERLIS. KEDAH. KELANTAN. PAHANG. SELANGOR. Common on summits of dry hills and found only on limestone.

Dubious records :

Clerodendron langkawiense King & Gamble. LANGKAWI. TERUTAU. One at least of Curtis's collections is not from limestone.

Sphenodesme pentandra Jack. SETUL. Common in the Peninsula on margins of forest.

LABIATAE.

Acrymia ajugiflora Prain. KANCHING. The only other collection of this plant also comes from limestone and was made by Kunstler and labelled "N.K.L." This may mean "near Kuala Lumpur." Prain in the "Materials" and Ridley in his Flora both quote Kunstler's collection as from Perak, but Kunstler used printed tickets and often did not delete the word "Perak" even though the plant was not collected in that State.

Coleus atropurpureus Benth. LANGKAWI. Also from limestone in Lower Siam. Not uncommon in the Peninsula in open ground and waste places.

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Cymaria dichotoma Benth. PERLIS. ?KEDAH. IPOH. ?LENGGONG.

The Kedah and Lenggong records are very probably from limestone. Not common in the north of the Peninsula, usually but not always on limestone.

Gomphostemma crinitum Wall. PERAK. PAHANG. At cliff bases. Not uncommon in forest, sometimes in the hills.

Gomphostemma oblongum Wall. GUNONG SENNYUM. ?KOTA GLANGGI. Not very common in the Peninsula, often in the hills.

Leucas ?mollissima Wall. GUNONG BALING, summit, SFN 35381 (*Kiah*). Probably this species, which has not hitherto been recorded from the Peninsula.

NYCTAGINACEAE.

Boerhaavia repanda Willd. PERLIS. Known only from here in the Peninsula.

Pisonia aculeata L. LANGKAWI. PERLIS. These and one collection from Pulau Tioman (not limestone) are the only records from the Peninsula.

Pisonia excelsa Bl. PERAK. PAHANG. Not common in the Peninsula, known also from rocky islands (not limestone) off the East Coast.

AMARANTACEAE

Deeringia amaranthoides Merr. PERAK, on limestone, fide Ridley. Not common in the Peninsula, not confined to limestone.

Deeringia polysperma Miq. ?PERLIS. KEDAH. PERAK. PAHANG. KELANTAN. Commonest on limestone but also found on granite rocks.

ARISTOLOCHIACEAE.

Dubious record :

Apama tomentosa Soler. IPOH. Occurs near limestone in Pahang. Common in the Peninsula in lowland forest.

PIPERACEAE.

Peperomia dindigulensis Miq. KOTA GLANGGI. GUA TIPUS. BUKIT CHERAS. BATU CAVES. In cracks of rocks and in moss. Known only from these localities in the Peninsula.

Peperomia kotana C. DC. KOTA GLANGGI. Known only from here and from Pulau Tioman (not limestone).

Peperomia portulacoides A. Dietr. BATU CAVES, fide Ridley. The only record of this species from the Peninsula.

Peperomia sp. GUNONG BALING, KEDAH.

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Piper boehmeriaefolium Wall. PULAI, PERAK, on bare rock. Not common in the Peninsula in forests, sometimes submontane.

Piper collinum C. DC. GOPENG, fide C. de Candolle in the "Materials". The only other collection of this species is an unlocalised one collected in Perak by Scortechini, and quoted by de Candolle.

Piper caninum A. Dietr. GUNONG BALING. Common in the Peninsula.

Piper nigrum L. BATU CAVES, fide C. de Candolle. Possibly an escape from cultivation.

Piper retrofractum Vahl. PERLIS. Not common in the Peninsula, usually near the sea.

Piper Scortechinii C. DC. GOPENG, fide C. de Candolle. Known only from here and from the Taiping Hills.

Piper umbellatum L., var. **subpeltatum** Willd. ?PERAK. SELANGOR. Common in the Peninsula in lowland forest, often in rocky places.

Zippelia lappacea Benn. GUA PANJANG, at base. ?KUALA DIPANG. Rare in the Peninsula in forest.

Dubious records :

Piper argyrites Ridl. BATU CAVES. Rare, otherwise known only from Ginting Bidai (not limestone).

Piper flavispicum C. DC. PERAK, near a small limestone hill, fide C. de Candolle. Known only from here.

MYRISTICACEAE.

Knema laurina Warb. GUNONG BALING, GUNONG PONDOK (identification of this specimen doubtful). Common in the Peninsula in lowland forest.

Knema missionis Warb. LANGKAWI. ?PERLIS. One of the few members of this family common in the north of the Peninsula.

MONIMIACEAE.

Kibara chartacea Bl. BUKIT CHERAS. Recorded once only from limestone, otherwise not uncommon in lowland forest.

LAURACEAE.

Dehaasia Curtisiae Gamble. SELANGOR. Otherwise known only from Penang Hill.

Dehaasia microcarpa Bl. GOPENG. Recorded once only from limestone. Not uncommon in lowland forest.

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Litsea chinensis Lam. GUNONG BALING. This widespread species has not yet been recorded from the Peninsula, unless it has been redescribed under another name.

Litsea Noronhae Bl. GUNONG PONDOK. One record only actually from limestone, but often from near limestone. Not common in lowland forest.

Litsea polyantha Juss. GUNONG PONDOK. Not uncommon in the Peninsula in lowland forest and on riverbanks.

Dubious record :

Litsea glabrifolia Ridl. GUNONG SENNYUM, collected by Evans without data. Also from near limestone at Kuala Dipang. Known only from these two localities.

HERNANDIACEAE.

Illigera lucida Teysm. & Binn. LANGKAWI. PERLIS. ?PERAK, several localities, none very definite. Not common in the Peninsula but widespread.

THYMELEACEAE

Wikstroemia viridiflora Meissn. LANGKAWI. BATU CAVES. Not common in the north of the Peninsula in open rocky places and on seashores.

?**Wikstroemia sp.** BUKIT SAGU, PAHANG., SFN 25093 (Henderson).

SANTALACEAE

Scleropyrum sp. GUNONG BALING, SFN 35374 (Kiah). GUNONG SENNYUM, SFN 22278 (Henderson). Both collections are in fruit. They may belong to an undescribed species.

EUPHORBIACEAE.

Actephila excelsa M.A. ?LANGKAWI. KELANTAN. ?PERAK. BATU CAVES. Not common in the Peninsula in lowland forest, often in rocky places.

Actephila ovalis Gage. LANGKAWI. PERLIS. KEDAH. Possibly confined to limestone, but some records from Langkawi are indefinite. Known only from these localities and from Lower Siam.

Actephilopsis malayana Ridl. LANGKAWI. PERLIS. PERAK. Not uncommon in lowland forest or in rocky or open places.

Aleurites moluccana Willd. GUNONG PONDOK. Usually on sea-shores.

Andrachne australis Zoll & Mor. LANGKAWI. PERLIS. KEDAH. KELANTAN. PERAK. SELANGOR. Common on limestone and rarely if ever found on other formations in the Peninsula.

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Ridley in Kew Bull. 1923, p. 361, makes two species—*Andrachne hirta* and *A. calcarea*—for what appear to be merely forms of this widespread plant.

Antidesma montanum Bl. ?SETUL. ?LANGKAWI. ?PERLIS. PAHANG. Common in the Peninsula in lowland forest, often near the sea.

Antidesma tomentosum Bl. GOPENG. Once only definitely recorded from limestone. Not uncommon in the Peninsula in forest, sometimes in the hills.

Antidesma sp. aff. *A. rostratum* Tul. BUKIT SAGU. PAHANG. SFN 25092 (*Henderson*).

Antidesma sp. PERLIS, SFN 23011 (*Henderson*), SFN 35233 (*Kiah*).

Aporosa stellifera Hook. f. GOPENG. The only record from limestone. Common in lowland forest.

Baccaurea lanceolata M.A. KEDAH. PERAK. ?BATU CAVES. Not very common in the Peninsula in lowland forest, but widespread.

Blumeodendron Kurzii J. J. S. GOPENG, once collected by Kunster. Rare in the Peninsula. What appears to be this species has been found in the swamp forests of Johore.

Bridelia ovata Dcne. LANGKAWI. PERLIS. Not very common in open or rocky places in Penang and the north of the Peninsula.

Bridelia tomentosa Bl. GUNONG BALING, on summit. Common in the Peninsula in open places.

Bridelia sp. BUKIT CHERAS, PAHANG, SFN 25206 (*Henderson*).

Buxus Holttumiana Hatushima. KAKI BUKIT, PERLIS. Known only from one collection.

Buxus malayana Ridl. PULAI, PERAK. BUKIT TAKUN, SELANGOR. Known only from these localities. Confined to limestone.

Buxus rupicola Ridl. DAYANG BUNTING, LANGKAWI. Known only from here and very probably confined to limestone.

?**Cephalomappa** sp. BUKIT TAKUN SELANGOR, Forest Dept. F.M.S. 37403, 39582 (*Symington*).

Cladogynos orientalis Zipp. LANGKAWI. ?PERLIS. KELANTAN. Rare in the Peninsula on or near limestone in the north only.

Claoxylon longifolium M.A., var. **brachystachys** Hook. f. LANGKAWI. The species common in the Peninsula in lowland forest, the variety usually near the sea.

Cleistanthus decurrens Hook. f. GOPENG. Not common, collected only a few times in Perak and Penang.

Cleistanthus glaucus Jack. GOPENG, fide Ridley. Known only from here and from Lumut (not limestone).

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- Cleistanthus gracilis** Hook. f. LANGKAWI. PERLIS, fide Ridley. KEDAH, fide Ridley. PERAK. PAHANG. A small leaved variety is common on the limestone and may be confined to it. The typical form is not known definitely from limestone.
- Cleistanthus hirsutulus** Hook. f. PERAK. ?BATU CAVES. Not very common in lowland forest and by rivers, but widespread.
- Cleistanthus Kingii** Jabl. GUNONG PONDOK. IPOH. Known only from these localities and from granite at Sungai Siput.
- Cleistanthus parvifolius** Hook. f. GOPENG, top of limestone hills. Known only from here.
- Cnesmone subpeltata** Ridl. GUNONG PONDOK. BATU CAVES. Known only from these localities.
- Coelodiscus subcuneatus** Gage. LANGKAWI. KELANTAN. Not common, but widespread in lowland forest, usually in rocky places.
- Croton argyratus** Bl. GUNONG PONDOK. ?KOTA GLANGGI. Common in the Peninsula in lowland forest.
- Croton calcicolum** Ridl. KANCHING, fide Ridley. Known only from here in the Peninsula, and from Borneo.
- Croton Cumingii** M.A. LANGKAWI. PERLIS. PERAK. ?KOTA GLANGGI. Not very common in the Peninsula in rocky places, commonest on limestone in Langkawi and Perlis.
- Drypetes nervosa** Pax. GOPENG. Known only from here and from a specimen collected by Scortechini in Perak without precise locality.
- ?**Endospermum** sp. GUNONG PONDOK (*Henderson s. n.*, sterile specimens only).
- ?**Erismanthus** sp. GUA PANJANG, KELANTAN, SFN 19543 (*Henderson*).
- Euphorbia antiquorum** L. LANGKAWI. PERLIS. Wild only on the northern limestone.
- Euphorbia hirta** L. BUKIT SERDAM, on cleared summit A common weed in waste ground
- Excoecaria** sp. aff. *E. quadrangularis* M.A. GUNONG PONDOK. GUA TEJA. SFN 23809, 29693 (*Henderson*).
- Excoecaria oppositifolia** Griff. LANGKAWI. GUA TEJA. GUNONG PONDOK. Known only from these localities in the Peninsula and from a specimen collected by Scortechini in Perak without precise locality. Possibly confined to limestone.
- ?**Gelonium** sp. BUKIT TAKUN, SELANGOR, Forest Dept. F.M.S. 37411 (*Symington*).
- Glochidion obscurum** Bl. GOPENG. Once only from limestone; otherwise common in lowland forest and riverbanks.
- Glochidion** sp. LANGKAWI, SFN 29056 (*Henderson*).

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- Glochidion sp.** BUKIT TAKUN, SELANGOR, *Forest Dept. F.M.S. 37413, 37453 (Symington), SFN 34377 (Nur).*
- Macaranga tanarius** M.A. ?PERLIS. BATU CAVES. Common in the Peninsula in open places, riverbanks, occasionally in rocky forest.
- Mallotus cuneatus** Ridl. PERLIS (Kakit Bukit, Tebing Tinggi, Bukit Lagi). Known only from here and only from limestone.
- Mallotus dispar** M.A. BUKIT CHERAS, PAHANG. Only once collected actually on limestone, but it is common near limestone in most localities. Also from near granite rocks.
- Mallotus Griffithianus** Hook. f. GOPENG. Not uncommon in lowland forest.
- Mallotus leucocalyx** M.A. ?LANGKAWI. PERLIS. ?GUNONG KERIANG. GUNONG BALING. Known in the Peninsula only from north of Penang and if not always on limestone, apparently usually close to it.
- Mallotus philippinensis** M.A. GUNONG KERIANG. Not uncommon in the Peninsula in open places.
- Mallotus Wrayi** King. GUNONG PONDOK. Not common, usually in rocky lowland forest.
- Microdesmis casearifolia** Planch. ?LANGKAWI. PERLIS. Common in the Peninsula in forest.
- Phyllanthodendron coriaceum** Gage. GOPENG. IPOH. KOTA GLANGGI (fide Ridley). Rare in the Peninsula and known only from these localities.
- Phyllanthus columnaris** M.A. LANGKAWI. PERLIS, Rare in the north of the Peninsula and perhaps confined to limestone, but the records are not all definite.
- Phyllanthus sp.** aff. erythocarpus Ridl. BUKIT CHERAS, SFN 25221 (Henderson). BATU CAVES, SFN 6354 (Burkhill). Recorded also from Ulu Gombak (not limestone).
- Phyllanthus ficifolius** Gage. LANGKAWI. Known only from here, but the records indicate that it is not confined to limestone.
- Phyllanthus frondosus** Wall. GUNONG SENNYUM, summit. BATU CAVES, summit. Common in the Peninsula in forest, rocky places, occasionally in swamps and thickets, from sealevel to 4,000 ft.
- Phyllanthus Hamiltonianus** M.A. PERLIS. Rare in open places in the north of the Peninsula.
- Phyllanthus pulcher** Wall. GUA TEJA, KELANTAN. Common in the Peninsula often on streambanks. From limestone in Lower Siam.
- Richeriella malayana** Henders. GUNONG PONDOK. IPOH. Rare in lowland forest, usually in rocky places.

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- Sauropus calcareus** Henders. GUNONG SENNYUM. Known only from here.
- Sauropus Llanosii** Gage. LANGKAWI. PERLIS. PAHANG. Not common in open places in the north of the Peninsula.
- Sauropus parvifolius** Ridl. ?LANGKAWI. PERLIS. Rare in hedges and open places in the north.
- Sauropus spectabilis** Miq. BATU CAVES. Known only from here in the Peninsula.
- Tragia laevis** Ridl. LANGKAWI. Known also only from Perlis and Kelantan, not on limestone.
- Trigonostemon salicifolius** Ridl. KANCHING, fide Ridley. Known only from here and from Ulu Gombak (not limestone).

Dubious records :

- Breynia Keithii Ridl. SETUL. Rare in open places in the north.
- Bridelia retusa Spreng. LANGKAWI, collected by Robinson at Pulau Dayang Bunting, without data. Probably from the limestone. Known only from here in the Peninsula.
- Cleidion javanicum Bl. SETUL. BATU CAVES. Probably from limestone. Known only from these localities in the Peninsula.
- Glochidion perakense Hook. f. PERLIS. Not very common in forest.
- Homalanthus populifolius Grah. Not uncommon near cliff bases, but not yet recorded actually from the limestone. Common in the Peninsula, often in secondary growth.
- Mallotus brevipetiolatus Gage. PERLIS. Collected also in Perak by Kunstler, and known only from these collections.
- Mallotus floribundus M.A. SETUL. Common in the Peninsula.
- Mallotus repandus M.A. PERLIS. BATU CAVES. Not very common in the Peninsula in open forest.
- Mallotus subpeltatus M.A. PERLIS. PERAK. Rare in the Peninsula.
- Phyllanthus dalbergioides Wall. LANGKAWI. PERAK. Rare in the Peninsula in forest.
- Phyllanthus erythrocarpus Ridl. BATU CAVES. Probably on the limestone. Known only from here.

URTICACEAE.

- Boehmeria nivea** H. & A. GUNONG KERIANG. Perhaps an escape from cultivation.
- Celtis Collinseae** Craib. LANGKAWI (sterile specimens only). PULAU RABANA. ?PERLIS. GUNONG KERIANG. In the Peninsula known only from these localities.

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- Conocephalus amoenus** Hook. f. KOTA GLANGGI. ?BATU CAVES. Common in the Peninsula in lowland forest, usually epiphytic.
- Debregeasia squamata** Hook. f. ?KUALA DIPANG. BATU CAVES. Not common in the Peninsula, often in rocky forest.
- Elatostema Curtisii** Schroter. ?PERAK. BATU CAVES. Not common on rocks in forest.
- Elatostema latifolium** Bl. ?SETUL. KELANTAN. PERAK. ?BATU CAVES. ?KOTA GLANGGI. GUNONG SENNYUM. Often abundant in the Peninsula in forest in rocky or sandy places.
- Ficus annulata** Bl. LANGKAWI, by sea. Widely distributed in the Peninsula in the lowlands.
- Ficus diversifolia** Bl. var. *deltoidea* King. KEDAH. KELANTAN. PAHANG. Only this variety of this common and variable fig. has been collected on the limestone, and it is by no means common there.
- Ficus elastica** Roxb. IPOH, but doubtfully wild.
- Ficus gibbosa** Bl. KAKI BUKIT, PERLIS. Widely spread in the Peninsula, often near the sea.
- Ficus glabella** Bl. ?LANGKAWI. PULAI. Not uncommon in lowland forest in the Peninsula.
- Ficus hispida** Bl. PERLIS, at base of Bukit Lagi. Common in the Peninsula especially near the sea and in secondary growth.
- Ficus quercifolia** Roxb. KOTA GLANGGI. Not very common in the Peninsula on rocks by streams.
- Ficus Miquelii** King. KELANTAN. PERAK. SELANGOR. Common in the Peninsula in lowland forest, often in swampy places.
- Ficus obtusa** Hassk. BUKIT TAKUN, SELANGOR. Not common in the Peninsula.
- Ficus obtusifolia** Roxb. PULAU RABANA. LANGKAWI. ?GOPENG. Rare in the Peninsula, apparently known only from these localities.
- Ficus parietalis** Bl. BUKIT CHERAS. ?GUNONG PONDOK. Widespread in the Peninsula in lowland forest.
- Ficus pomifera** Wall. GUNONG BALING. Not uncommon in the Peninsula usually in lowland forest in damp places and by streams.
- Ficus ramentacea** Roxb. PULAI, PERAK, at cliff base in ground disturbed by mining. Common in the Peninsula in lowland forest.
- Ficus retusa** L. LANGKAWI. ?PERLIS. PAHANG. Not uncommon in the Peninsula, usually near the sea in dry and rocky places, sometimes on riverbanks.
- Ficus Scortechnii** King. ?LANGKAWI. GUNONG BALING. Common all over the Peninsula.

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- Ficus villosa** Bl. PERAK. ?BATU CAVES. Common in the Peninsula on trees and rocks in lowland forest and open places.
- Ficus sp.** BUKIT TAKUN, SELANGOR, *Forest Dept. F.M.S. 37426, 37451, 39590 (Symington)*. SFN 6283 (Burkhill), from the limestone at Ipoh, seems to be the same.
- Fleurya interrupta** Gaud. GUNONG KERIANG, KEDAH. Common in the Peninsula as a weed in waste ground.
- Oreocnide sylvatica** Miq. BUKIT TAKUN, common at cliff base. BATU CAVES. Not very common in the Peninsula in forest, usually above 2,000 ft.
- Phyllochlamys spinosa** Bureau. LANGKAWI, common. Not common in the Peninsula, not confined to limestone.
- Pilea calcarea** Ridl. KELANTAN. PAHANG. PERAK. SELANGOR. On nearly all the limestone except in Perlis and Langkawi. Known only from limestone.
- Pilea fruticosa** Hook. f. IPOH. GOPENG. Known only from these localities and confined to limestone.
- Pilea sp.** BUKIT LAGI, PERLIS, (*Henderson s.n.*).
- Streblus asper** Lour. ?LANGKAWI. GUNONG KERIANG, at base. In the north of the Peninsula in open dry places.
- Taxotrophis ilicifolia** Vidal. Common at the bases of most dry hills and rarely extending far up the hill. Not uncommon in the Peninsula in dry and rocky forest.

Dubious records :

- Cudrania javensis *Trecul.* PERLIS. Not common in lowland forest.
- Elatostema repens *Hall. f.* SETUL. KELANTAN. BATU CAVES.
- Ficus punctata *Thunb.* BATU CAVES.
- Laportea stimulans *Miq.* GUNONG KERIANG. BUKIT TAKUN. BATU CAVES. Probably occurs on the limestone. Not uncommon in the peninsula in open places or rocky forest.

CUPULIFERAE.

- Pasania spicata** Oerst., var. **gracilipes** DC. GUNONG PONDOK. Common in the Peninsula in lowland forest.

BURMANNIACEAE.

- Burmannia gracilis** Ridl. LANGKAWI, but not confined to limestone, as it is recorded from Gunong Raya, which is granite. Also from limestone in Lower Siam, and known only from these localities.

ORCHIDACEAE.

(Only those species which are definitely recorded as growing terrestrially or on rocks are listed. Many of those are to be

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found growing epiphytically in the same localities. Species which so far have been found only on trees on the limestone are excluded.)

Abdominea minimiflora J. J. Sm. ?KOTA GLANGGI. BATU CAVES. Rare in the Peninsula, usually epiphytic.

Adenoncos major Ridl. GUNONG SENNYUM. ?KOTA GLANGGI. ?GUA TIPUS. Not very common but widespread, usually epiphytic.

Adenoncos virens Bl. KOTA GLANGGI. GUA TIPUS. BATU CAVES. Common in the Peninsula on mangrove and forest trees. Usually abundant on the limestone where it occurs, like *A. major*. On trees or rocks, not confined to rocks.

Appendicula purpurascens De Vr. KOTA GLANGGI. Not very common in the Peninsula, epiphytic in forest, often in the hills.

Arachnis flos-aeris Bl. KOTA GLANGGI. BUKIT SERDAM. Probably also on other dry hills, but seldom flowering. Not very common in the Peninsula, often in rocky forest.

Bulbophyllum flammuliferum Ridl. BATU CAVES. Not common, except locally in mangrove.

Bulbophyllum lilacinum Ridl. LANGKAWI. PERLIS. Epiphytic or on the rocks. Also from Kedah (not limestone) and Lower Siam.

Bulophyllum rupicolum Ridl. SETUL, fide Ridley. Known only from here.

Calanthe Ceciliae Rchb. f. GUNONG SENNYUM. KOTA GLANGGI. BUKIT CHINTAMANI. ?BATU CAVES. Often abundant amongst boulders at cliff bases. Not very common but widespread in lowland forest.

Calanthe veratrifolia R. Br. GOPENG. PULAI. GUNONG SENNYUM. GUA TIPUS. Common in the Peninsula in forest up to about 4,000 ft.

Coelogyne Kingii Hook. f. GUNONG SENNYUM. Not common in forest.

Coelogyne pandurata Lindl. KINTA. Not uncommon in the Peninsula, usually epiphytic in forests by streams.

Coelogyne Rochussenii De. Vr. GUNONG SENNYUM. Common in the Peninsula, epiphytic in forest.

Corymbis brevistylis Hook f. KUALA DIPANG. ?GUNONG SENNYUM. Rare, known only from these localities.

Corymbis longiflora Hook. f. BATU CAVES, and probably elsewhere at cliff bases. Common in lowland forest.

Corysanthes mucronata Bl. GUA PANJANG. GUA TIPUS. BUKIT TAKUN. Not common in the Peninsula on mossy rocks.

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- Cymbidium Dayanum** Rchb. fil. ?SETUL. PERLIS (KAKI BUKIT). Also from limestone in Lower Siam. Usually epiphytic and not common in the Peninsula.
- Dendrobium callibotrys** Ridl. BUKIT TAKUN, on rocks and trees. Not common, usually on mangrove trees in the south of the Peninsula.
- Dendrobium euphlebium** Lind. GUNONG SENNYUM. BUKIT SAGU. BUKIT CHERAS. Not uncommon in the Peninsula on mangrove and forest trees.
- Dendrobium eulophotum** Lindl. LANGKAWI. No records from southern limestone, although common as an epiphyte in the lowlands.
- Dendrobium leonis** Rchb. f. GUNONG SENNYUM. Probably occurs on other limestone. Common in the lowlands.
- Dendrobium secundum** Lindl. LANGKAWI, but oftener as an epiphyte than on the rocks. Common in the Peninsula in the lowlands.
- Dendrobium salaccense** Lindl. LANGKAWI. PERLIS. BUKIT SAGU. BUKIT CHERAS. Probably elsewhere on limestone. Not uncommon in the Peninsula in the lowlands.
- Desmotrichum fimbriatum** Bl. GUNONG BALING. PAHANG. Very probably from limestone in Lower Siam. Common in the lowlands as an epiphyte.
- Desmotrichum** sp. LANGKAWI, sterile specimens only.
- Dipodium pictum** Rchb. GUNONG SENNYUM. Common in the Peninsula in lowland forest.
- Eria pannea** Lindl. GUNONG SENNYUM. Not uncommon in the Peninsula in lowland forest.
- Eria pendula** Ridl. GUNONG SENNYUM. ?BATU CAVES. Not common in the Peninsula in forest and by streams.
- Eria rigida** Bl. ?LANGKAWI. GUA TIPUS. Known only from these localities in the Peninsula.
- Eulophia Keithii** Ridl. LANGKAWI. PERLIS. KEDAH. Known only from these localities and Siam, but the records are not clear as to whether it is confined to limestone or not.
- Geodorum citrinum** Jack. LANGKAWI. Not very common in the north of the Peninsula in forest.
- Habenaria carneae** N.E. Br. LANGKAWI. Known only from here and Lower Siam, and apparently confined to limestone.
- Habenaria glaucescens** Ridl. LANGKAWI. Also from Lower Siam, not certainly but possibly from limestone.
- Habenaria Kingii** Hook. f. GUNONG BALING. IPOH. ?GUNONG PONDOK. Not common in the Peninsula, usually on limestone, but not confined to it.

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- Haemaria discolor** Lind. SETUL. Only once recorded from limestone. More usually on granite rocks, not common in the Peninsula but widespread and abundant where it occurs.
- Liparis comosa** Ridl. KOTA GLANGGI. GUNONG SENNYUM. GUA TIPUS. BUKIT SAGU. Not uncommon in forest, often in the hills.
- Liparis disticha** Lind. KOTA GLANGGI. GUNONG SENNYUM. BUKIT SERDAM. GUA TIPUS. Common in the Peninsula in forest up to 5,000 ft., often in mangrove.
- Liparis sp.** GUA LAMBOK, KELANTAN (*Henderson s.n.*).
- Microsaccus brevifolius** Bl. GUNONG SENNYUM. KOTA GLANGGI. BATU CAVES. Probably common on limestone on dry hills in the south. Common in the south of the Peninsula on mangrove trees.
- Microsaccus javensis** Bl. BUKIT TAKUN. ?BATU CAVES. On forest and mangrove trees.
- Microstylis congesta** Rchb. f. LANGKAWI. Common in the Peninsula, usually in lowland forest.
- Microstylis Hendersonii** J. J. Sm. GUA PANJANG, KELANTAN, in moss at c. 1,200 ft. Known only from here.
- Microstylis ?micrantha** Hook. f. GUNONG BALING. GUNONG SENNYUM. Not uncommon in the Peninsula in lowland forest, in wet places or on rocks.
- Microstylis reniloba** Carr. PERLIS. Known only from one collection.
- Oberonia transversiloba** J.J. Sm. GUA TIPUS, PAHANG. Known only from here.
- Paphiopedilum niveum** Pftz. PULAU RABANA. LANGKAWI. GUNONG BALING. Probably confined to limestone, here and in Lower Siam.
- Pholidota imbricata** Lindl. LANGKAWI. GUNONG BALING. GUA PANJANG. BUKIT CHERAS. BUKIT TAKUN. BATU CAVES, and probably elsewhere. Commonest in the Peninsula on limestone, but not confined to it.
- Phreatia minutiflora** Lind. PERAK. PAHANG. SELANGOR. Usually on mangrove trees.
- Podochilus lucescens** Bl. LANGKAWI. Not very common in the Peninsula but widespread, usually in the lowlands.
- Podochilus tenuis** Lindl. GUA TIPUS, PAHANG. Not uncommon in the Peninsula on wet rocks and tree trunks.
- Polystachya siamensis** Ridl. LANGKAWI. ?BUKIT CHERAS. Not common in the Peninsula, usually in the north.
- Preptanthe rubens** Ridl. LANGKAWI. PERLIS. Known only from these localities.

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- Preptanthe vestita** Rchb. f. BUKIT TAKUN. SELANGOR. The only definite record from limestone rocks. Otherwise known only in the Peninsula from Batu Caves (?epiphytic) and doubtfully from Pulau Adang (epiphytic).
- Saccolabium miserum** Ridl. LANGKAWI. ?GUNONG BALING. Not very common as far south as the Dindings.
- Saccolabium sacculatum** Ridl. LANGKAWI. Known only from here, but whether always on limestone is not certain.
- Saccolabium secundum** Ridl. LANGKAWI. Common in the Peninsula on lowland trees, often near the sea or rivers.
- Saccolabium saxicolum** Ridl. KOTA GLANGGI. GUNONG KERIANG. IPOH. On trees and rocks, fide Ridley. Rare, usually on limestone but not confined to it.
- Saccolabium setulense** Ridl. SETUL, fide Ridley. Also from Lower Siam.
- Saccolabium tenuicaule** Hook. f. LANGKAWI. GUNONG SENNYUM. ?BATU CAVES. Not very common but widespread.
- Sarcochilus tanyphyllus** Ridl. KOTA GLANGGI, fide Ridley as to being on rocks. Known only from here, not uncommon as an epiphyte.
- Spathoglottis Handingiana** Par. & Rchb. f. LANGKAWI. Known only from here in the Peninsula. Also from limestone in Lower Siam.
- Stauropsis gigantea** Benth. LANGKAWI, common on rocks near the sea. ?PERLIS. Known only from the north of the Peninsula, Siam, and Burma. *Stauropsis breviscapa* is recorded from limestone in Borneo.
- Tainia plicata** Ridl. GUA TIPUS, PAHANG. Known only from here in the Peninsula.
- Thecostele maculosa** Ridl. GUNONG SENNYUM. Not very common in the Peninsula in lowland forest, but widespread.
- Thelasis carinata** Bl. GUNONG SENNYUM. ?KOTA GLANGGI. ?BATU CAVES. Common in the Peninsula on mangrove and lowland forest trees.
- Thelasis decurva** Bl. BUKIT CHERAS. KOTA GLANGGI. Common in the Peninsula on mangrove and lowland forest trees.
- Thelasis elongata** Bl. ?LANGKAWI. GUNONG SENNYUM. KOTA GLANGGI. BUKIT CHERAS. Common in the Peninsula, usually on mangrove trees.
- Thunia alba** Rchb. f. SETUL. Known only from here in the Peninsula.
- Trichoglossis retusa** Bl. GUNONG SENNYUM. KOTA GLANGGI. GUA TIPUS. BATU CAVES. In the Peninsula apparently confined to limestone, either on rocks or as an epiphyte.

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Tropidia curculigoides Lindl. GUNONG BALING, near base.
Common in the Peninsula in forest, sometimes in the hills.

Vrydagzynea sp. BUKIT TAKUN, SELANGOR, *Forest Dept. F.M.S.*
37410 (Symington).

Dubious records :

Adenoncos parviflora Ridl. BATU CAVES. Known only from here.

Agrostophyllum bicuspidatum J. J. Sm. GUA PANJANG. KOTA GLANGGI. Common in the Peninsula in lowland forest.

Apostellis flabelliformis Ridl. PERLIS. GUNONG PONDOK, close under the cliff base, not actually on the limestone. *A. plicata* is recorded from limestone in LOWER SIAM.

Ascochilus hirtulus Ridl. LANGKAWI. KOTA GLANGGI. BATU CAVES. So far recorded only as an epiphyte, but it probably occurs on the rocks.

Cymbidium Munronianum King. SETUL. Rare in the Peninsula and only in the North.

Cymbidium Finlaysonianum Lindl. GUNONG SENNYUM, but not recorded whether on rocks or epiphytic. Common in the Peninsula in the lowlands.

Habenaria Susannae Br. SETUL. LANGKAWI. Known only from here and from Perlis in the Peninsula and certainly often found off limestone.

Saccolabium latifolium Ridl. SETUL. BATU CAVES. Not uncommon in lowland forest.

Saccolabium parvum Ridl. KOTA GLANGGI. Known only from here.

Staurochilus fasciatus Ridl. LANGKAWI, on rocks and trees, fide Ridley, but type of rocks not stated.

Thelasis capitata Bl. BATU CAVES. Not common in the Peninsula in lowland, forest not in mangrove.

Trichoglottis tetraceras Ridl. LANGKAWI. PERLIS. Known only from these localities.

ZINGIBERACEAE.

Alpinia latilabris Ridl. PERLIS, fide Ridley. Rare, but not confined to limestone.

Amomum testaceum Ridl. SETUL. PERLIS. KEDAH. BATU CAVES. Usually on or near limestone but not confined to it. Not common, but widespread, usually in rocky forest.

Costus speciosus Sm. LANGKAWI. KELANTAN. Common in the Peninsula on forest edges, open places in lowland forest, etc.

Gastrochilus acuta Ridl. SETUL. PERLIS. BUKIT SAGU. PAHANG. Known only from these localities and apparently confined to limestone.

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- Gastrochilus Curtisii** Baker. LANGKAWI, apparently always on limestone. Known only from here, except for a doubtful specimen from Pahang, not from limestone.
- Gastrochilus (Boesenberglia) sp.** PERLIS, (Henderson A. 480).
- Globba aurantiaca** Miq. ?GUNONG BALING. BUKIT CHINTAMANI. ?BATU CAVES. Common in the Peninsula in lowland forest.
- Hornstedtia macrochilus** Ridl. IPOH. Not common in lowland forest, often in damp places.
- Hornstedtia megalochilus** Ridl. SETUL. Common in the Peninsula in lowland forest, often in wet places.
- Hornstedtia metriochilus** Ridl. IPOH. ?BATU CAVES. Common in lowland forest, often in wet places.
- Hornstedtia triorgyale** Ridl. GUNONG PONDOK, at cliff base. Rare, usually in hill forest.
- Kaempferia elegans** Wall. LANGKAWI. PERLIS. KEDAH. Rare in the Peninsula, apparently usually, if not always on limestone, but there is a doubtful specimen from Trengganu, not from limestone.
- Kaempferia pulchra** Ridl. LANGKAWI. PERLIS. KEDAH. Usually, if not always on limestone, but there are a number of doubtful specimens collected as medicinal plants in Perak, not from limestone. These are possibly from cultivated plants.
- Zingiber spectabile** Griff. LENGGONG, in deep rich soil on limestone. Common in the Peninsula in lowland forest, often in damp places.

Dubious records:

- Hitcheniopsis Kunstleri** Ridl. LENGGONG, at cliff base. KINTA, base of cliffs (var. *rubra* Ridl.).
- Hornstedtia pauciflora** Ridl. BATU CAVES, base of cliff. A rare plant known only from here and the base of Gunong Inas, Perak.

MARANTACEAE.

- Stachyphrynum cylindricum** Schum. GUNONG BALING. IPOH. Not common, known only from these localities and from Kelantan, not on limestone.

LOWIACEAE.

- Orchidantha calcarea** Henders. LENGGONG. Known only from here.

MUSACEAE.

- Musa malaccensis** Ridl., var. *minor* Ridl. PERLIS. This variety of the common species is known only from here and is the only *Musa* recorded from the Peninsular limestone.

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LILIACEAE.

Asparagus racemosus Willd. LANGKAWI. Rare in the Peninsula, known only from this collection.

Chlorophytum malayense Ridl. PERLIS. GUNONG PONDOK. KUALA DIPANG. Rare, usually on limestone but not confined to it.

Dracaena congesta Ridl. PERLIS. PAHANG. SELANGOR. Not uncommon in the Peninsula in lowland forest, most abundant on the limestone.

Dracaena Curtisii Ridl. ?SETUL. LANGKAWI. Known only from these localities and perhaps confined to limestone.

Dracaena yuccaeifolia Ridl. SETUL. LANGKAWI. Also from limestone in Lower Siam, and known only from these localities.

Peliosanthes lurida Ridl. LANGKAWI. KEDAH. PAHANG. Not uncommon in forest, often in rocky places.

Tupistra grandis Ridl. KISAP, LANGKAWI. Rare in forest up to 4,000 ft.

AMARYLLIDACEAE.

Crinum defixum Ker. LANGKAWI. Not uncommon in the north of the Peninsula in fields and open damp places.

Curculigo latifolia Dryand. PULAI, PERAK. Common in the Peninsula in forest from sealevel up to 6,000 ft.

Euryclodes sylvestris Salisb. PERLIS, fide Ridley. Not uncommon in the Peninsula, usually in sandy and rocky places near the sea. Often cultivated.

TACCACEAE.

Tacca pinnatifida Forst. LANGKAWI. Not common in the Peninsula as a seashore plant in sandy places.

DIOSCOREACEAE.

Dioscorea calcicola Prain & Burkhill. GUNONG BALING. Known also from Kedah Peak, doubtfully from Penang Hill, and from limestone in Lower Siam.

Dioscorea esculenta Lour. PERLIS. KEDAH. Not common in the Peninsula.

Dioscorea gibbiflora Hook. fil. ?LANGKAWI. GUNONG SENNYUM. BATU CAVES. Not uncommon in the Peninsula in forest.

Dioscorea glabra Roxb. LANGKAWI. PERLIS. Common in the Peninsula in forest and open places.

Dioscorea ?membranacea Pierre. PERLIS, SFN 22884 (*Henderson*), 1939] Royal Asiatic Society.

Dioscorea myriantha Kunth. PERLIS. Known also from Langkawi, but probably not from limestone there. Known only from these localities and the Philippines.

Dioscorea pyrifolia Kunth. LANGKAWI. BATU CAVES. Very common in the Peninsula in hedges, secondary growth, open places, etc.

Dioscorea triphylla Lamk. LANGKAWI. Common in the Peninsula in hedges and other open places.

Dioscorea sp. GUA TEJA, KELANTAN, on summit (Henderson s.n.). Possibly one of the foregoing species.

ROXBURGHIACEAE.

Stemona tuberosa Lour. PERLIS, fide Ridley. ?LANGKAWI. ?KOTA GLANGGI. Not uncommon in the north of the Peninsula in dry places.

COMMELINACEAE.

Aneilema subovatum Ridl. LANGKAWI. PERLIS, SFN 22822 (Henderson), determination doubtful. Known only from these localities in the Peninsula.

Pollia subumbellata Clarke. PERLIS. KEDAH. Confined to limestone in the Peninsula except for a doubtful specimen from Tembeling, Pahang.

Pollia thrysiflora Endl. BATU CAVES, at base. Common in the Peninsula in forest, often in hill forest.

Dubious record :

Aneilema lineolatum Kunth. GUNONG KERIANG, KEDAH. Not uncommon in forest, especially in the north of the Peninsula.

TRIURIDACEAE.

Sciaphila asterias Ridl. LANGKAWI. GUA NINEK, KELANTAN. GUA TIPUS, PAHANG. Rare, known only from these localities and from the Teku river, Pahang (not limestone).

PANDANACEAE.

Pandanus fascicularis Lamk. LANGKAWI, as a seashore plant only, never found on inland limestone.

Pandanus irregularis Ridl. KELANTAN. PAHANG. Common on the limestone here and confined to it. Not known from elsewhere.

Pandanus sp. PULAI, PERAK, SFN 23759 (Henderson).

Pandanus sp. KAKI BUKIT, PERLIS, SFN 35285 (Kiah). *Pandanus* is exceedingly rare on the north-west limestone.

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Pandanus sp. have been seen, but always without flowers or fruit, on GUNONG PONDOK, BUKIT SERDAM, BUKIT CHERAS and BUKIT SAGU.

ARACEAE.

Aglaonema costatum N. E. Br. LANGKAWI. Known only from here in the Peninsula, but whether confined to limestone or not is not known.

Aglaonema oblongifolium Schott. LANGKAWI. PERLIS. ?GUNONG KERIANG. GUNONG SENNYUM. IPOH. BATU CAVES. Common in the Peninsula in lowland forest, often in wet places.

Alocasia longiloba Miq. GUNONG KERIANG. LENGGONG. ?KOTA GLANGGI. Common in the Peninsula in the lowlands, usually in rather open places.

Alocasia Lowii Hook. fil. PERLIS. KUALA DIPANG. BATU CAVES. Not uncommon in rocky forest. By no means confined to limestone, as might be inferred from the distribution given by Ridley, F.M.P., V, p. 98.

Amorphophallus carneus Ridl. LANGKAWI, fide Ridley. PERLIS. SETUL, fide Ridley as to being on limestone. Apparently confined to limestone and known only from these localities except for doubtful specimens from Lower Siam.

Amorphophallus haematospadix Hook. fil. LANGKAWI. PERLIS. Known only from these localities and from Jalor, and probably confined to limestone, although the collectors' labels do not make this clear.

Amorphophallus Prainii Hook. fil. KELANTAN. PAHANG. ?BATU CAVES. Common near cliff bases and amongst boulders. Common in the Peninsula in lowland forest and in open and rocky places.

Amorphophallus variabilis Bl. LANGKAWI, fide Ridley as to being on limestone. Rare in the Peninsula in forest.

Amydrium humile Schott. BUKIT TAKUN, SELANGOR. Common in the Peninsula in rocky places.

Anadendrum marginatum Schott. KELANTAN. PAHANG. Not very common in the Peninsula and rather local in forest, epiphytic or on rocks.

Anadendrum montanum Schott. BATU CAVES. Ridley's var. *cordatum* (F.M.P., V, p. 110) appears merely to be a juvenile form of this common lowland species.

Arisaema fimbriatum Mast. PULAU RABANA. LANGKAWI. BUKIT SAGU. ?KOTA GLANGGI. BUKIT TAKUN. Also from limestone in Lower Siam. Usually on limestone, if not confined to it.

Arisaema Roxburghii Kunth. ?LANGKAWI. ?KOTA GLANGGI. BUKIT CHERAS. BUKIT TAKUN. ?BATU CAVES. Not uncommon in forest, often in the hills.

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- Colocasia gigantea** Hook. fil. PERLIS. GUNONG SENNYUM. IPOH. BATU CAVES. Not uncommon in the Peninsula in open places.
- Epipremnum giganteum** Schott. PERLIS. Also from limestone in Lower Siam. No doubt common in the Peninsula on rocks and trees but not often collected.
- Epipremnopsis media** Engl. PERLIS. Common in the Peninsula in lowland forest on rocks and trees.
- Hapaline Brownei** Hook. fil. ?LANGKAWI. GUNONG KERIANG. KELANTAN. Probably confined to limestone. Recorded from Lower Siam without data as to habitat.
- Homalomena humilis** Hook. fil., var. **pumila** Furtado. IPOH. Common in the Peninsula in forest.
- Homalomena** sp. GUNONG KERIANG, KEDAH, in damp places at base of cliff.
- Lasia spinosa** Thw. PERLIS. KEDAH. PAHANG. In damp spots at cliff bases. Common in the Peninsula in wet places.
- Pothos lorispatha** Ridl. BATU CAVES, fide Ridley. Known only from here.
- Pothos macrocephalus** Scort. PERLIS. UPPER PERAK. KELANTAN. Not common in forest, but widespread. Locally common on the limestone and probably in other localities than those mentioned.
- Pothos scandens** Linn. KEDAH. UPPER PERAK. BATU CAVES. Common in the Peninsula on trees. Hardly differs from the preceding species.
- Raphidophora Maingayi** Hook. fil. BATU CAVES. Apparently common in forest on rocks and trees but seldom flowering.
- Schismatoglottis mutata** Hook. fil. KOTA GLANGGI. ?GOPENG. ?BATU CAVES. Not uncommon, often in hill forest.
- Scindapsus perakensis** Hook. fil. GUNONG PONDOK. ?BATU CAVES. Not very common in the Peninsula on rocks in forest.
- Typhonium filiforme** Ridl. BUKIT LAGI, PERLIS. KUALA DIPANG. The identification of the Perlis specimen is somewhat doubtful. The plant is known only from these two collections.
- Typhonium fultum** Ridl. LANGKAWI. BUKIT CHINTAMANI. BATU CAVES (fide Ridley as to being on limestone). Known only from these localities.

Dubious records :

- Aglaonema Schottianum** Miq. LANGKAWI. PERLIS. Common in lowland forest.
- Schismatoglottis calyprata** Zoll. & Mor. KOTA GLANGGI. GUNONG SENNYUM. Common in the Peninsula, usually in rocky forest.

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Typhonium flagelliforme Bl., var. *angustissimum* Ridl. PERLIS.
Typhonium trilobatum Schott. PERLIS. Not uncommon in the north and east of the Peninsula, usually in open places.

PALMAE.

Areca triandra Roxb. SETUL. LANGKAWI. Not common in the north of the Peninsula in forest.

Arenga ?pinnata Merr. GUNONG BALING. GUNONG PONDOK. BUKIT SERDAM. BUKIT SAGU. PULAI. GUA LAMBOK. Only poor collections of this plant are available and its status is still obscure.

Calmus sp. GUNONG BALING, near base of cliff.

Calamus sp. LANGKAWI.

Calamus sp. PULAI, PERAK.

Caryota mitis Lour. LANGKAWI. ?PERLIS. ?KOTA GLANGGI. Common in the Peninsula in forest, often in rocky places.

Didymosperma Hookeriana Becc. SETUL. PERLIS. KOTA GLANGGI. GUA TEJA. Common in lowland forest.

Iguanura ?corniculata Becc. BUKIT SERDAM, SFN 25059 (Henderson).

Iguanura polymorpha Becc. GUNONG PONDOK. IPOH. GUA PANJANG. At cliff bases. In forest in the north of the Peninsula, usually in the hills.

Licuala modesta Becc. GUNONG PONDOK. Common on the Taiping Hills and scarce elsewhere.

Livistona cochinchinensis Mart. GUNONG PONDOK. Not rare in the Peninsula by ricefields and in the hills.

Livistona rupicola Ridl. LANGKAWI. BUKIT TAKUN. BATU CAVES. Known only from limestone in these localities. In Langkawi this plant grows on very exposed rocks close to the sea and is there stunted. It may also be found in more sheltered positions where it attains a height of 10 ft. or more.

Plectocomiopsis ferox Ridl. TELOK APAU, LANGKAWI. Known only from here.

Dubious records :

Calamus concinnus Mart. SETUL. Rare in the Peninsula in open places.

Calamus siamensis Becc. PERLIS. Not uncommon in open places in the north of the Peninsula.

CYPERACEAE.

Carex malaccensis Clarke. LANGKAWI, but not always on limestone. Known only from here in the Peninsula and from Siam.

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Fimbristylis fuscoidea Clarke. LANGKAWI. Rare in the Peninsula, known otherwise only from open "heath" country in Setul and Perlis.

Fimbristylis trichophylla Ridl. LANGKAWI. Known only from here and confined to limestone.

Fimbristylis sp. prox. F. fusca Benih. GUNONG SENNYUM, summit, SFN 22259 (Henderson). BUKIT TAKUN, Forest Dept. F.M.S. 39575, 39576 (Symington), SFN 34378 (Nur).

Scleria lithosperma Sw. LANGKAWI, open places on ridges above sea. BUKIT SERDAM, on cleared summit. KOTA GLANGGI, on open dry summit. Common in the Peninsula, usually in dry places in forest.

GRAMINEAE.

Alpuda varia Hook., var. **intermedia** Ridl. LANGKAWI. The only record from limestone, otherwise rare in the Peninsula on riverbanks.

Centotheca latifolia Trin. LANGKAWI. Common in the Peninsula in forest, especially by paths, sometimes near the sea.

Chrysopogon collinus Ridl. SETUL. Known only from here and from a small sandstone island off the coast of Pahang, growing in thick bird guano.

Chrysopogon orientalis A. Camus. LANGKAWI, abundant in open places. Usually in sandy places near the sea.

Cymbopogon sp. BUKIT CHERAS, PAHANG, SFN 25224 (Henderson).

Cymbopogon sp. LANGKAWI, SFN 29106 (Henderson). GUNONG BALING, Kiah s.n., SFN 36256 (nat. coll.). What appears to be the same was collected by Curtis in Langkawi at the "Hot Springs", which are not in the limestone area.

Dicanthium caricosum Stapf. GUNONG SENNYUM, on cleared summit. BUKIT SERDAM, on cleared summit. BUKIT TAKUN, in open place. Rare in the Peninsula, known only from the above localities and Kedah and Raub, Pahang.

Eulalia lanipes Ridl. LANGKAWI. Known otherwise only from Kedah Peak. The Langkawi plant is somewhat more hairy than the type.

Isachne ?Kunthiana Wight. LANGKAWI, SFN 17423 (Holttum), SFN 28945 (Henderson).

Ischaemum aristatum Linn. LANGKAWI. ?PERLIS. Common in the Peninsula by roadsides and other open places.

Ischaemum Beccarii Hack. BATU CAVES. A Bornean species known only from here in the Peninsula except for its occurrence as a weed in the Botanic Gardens, Singapore in 1897.

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Oplismenus compositus Beauv. LANGKAWI. PERLIS. KEDAH.
Common in the Peninsula in dry rocky and sandy places.

Schizostachyum elegans Ridl. LANGKAWI. PERLIS (sterile plants seen only). GUNONG BALING (sterile specimens only). Known only from these localities. Originally described from plants brought to the Penang Gardens by Haniff and cultivated there. There is now no record of where Haniff obtained his plants, so that it is not certain whether the species is confined to limestone or not.

?**Schizostachyum sp.** GUNONG PONDOK. BUKIT SERDAM. Only sterile specimens seen.

Stenotaphrum Helferi Munro. GUNONG BALING. GUNONG PONDOK. At cliff bases. Not common in the Peninsula, west of the main range.

Tricholaena rosea Nees. BATU CAVES, on quarry face. An African grass introduced into Selangor in 1901 and now widely distributed in the Peninsula in open and waste places.

GNETACEAE.

Gnetum cuspidatum Bl. GUA PANJANG, KELANTAN. Not uncommon in the Peninsula in lowland forest. It seems probable that this and probably other species of *Gnetum* are not uncommon on the limestone, but they grow on the most inaccessible and precipitous faces and are very difficult to collect.

CONIFERAE.

Podocarpus polystachyus R. Br. GUA PANJANG, KELANTAN. BUKIT CHERAS, PAHANG. BUKIT TAKUN, SELANGOR. Common in the Peninsula near the sea. Perhaps commoner on the limestone than the records indicate.

CYCADACEAE.

Cycas siamensis Miq. SETUL. LANGKAWI. PERLIS. UPPER PERAK. PAHANG. Apparently confined to limestone in the Peninsula but often cultivated. Commonest on the north-western limestone, scarce in Pahang and very scarce or absent in Kelantan.