

on rocks near a village named Pulai (from the *Alstonia* tree, like the mountain) in southern Kelantan close to the Pahang boundary (Mohamed Nur. 11944). It has not been met with outside the Peninsula.

D. PRATT.

I. H. BURKILL.

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## A List of Mosses Collected in the Botanic Gardens, Singapore.

In the previous issue of the Gardens' Bulletin appears a list of all mosses hitherto collected in the Malay Peninsula, prepared by Mr. H. N. Dixon, who has himself determined the majority of the specimens concerned. Our best thanks are due to Mr. Dixon for the very great amount of work which he has put into the preparation of this paper. Before receiving Mr. Dixon's list, I had compiled a list of mosses found in the Singapore Gardens, with such first-hand observations as I had been able to make concerning their habits of growth, as it seemed that few observations of the kind had been recorded. This list is here printed as a supplement to Mr. Dixon's paper. It contains no references to collectors or numbers (these can be found in the complete list) but only names of species and such information as to habit and habitat as I have found on herbarium labels or collected myself. Not having made a critical study of mosses, in many cases I can only speak of the habitats of individual specimens collected by me and identified by Mr. Dixon, but there are a few common species which it is easy to recognise at sight, and of these it is possible to speak with greater certainty.

The Gardens present a fairly wide range of habitat for mosses, from the most exposed positions on the ground or on trees to the shade of the rockeries and the Gardens Jungle; but there is no place so moist and shady as much of the natural jungle of the Peninsula. The conditions are on the whole artificial, and this is reflected in the character of the moss flora; the more typical forest species are infrequent or absent.

A striking feature of the list, referred to by Mr. Dixon in the introduction to his paper, is the large proportion of species of *Syrrhopodon* and *Calymperes*; this is more marked in Singapore than in the north of the Peninsula. In Singapore Island 32 species of the two genera have been found, out of 51 for the whole Peninsula; from the north fewer are recorded, 16 only having been found in Penang (mostly in the Waterfall Gardens or on the hill) which after Singapore is probably the most-collected area. In recent collections I have paid particular attention to these genera, and in searching Penang Gardens it was with difficulty that they could

be found, whereas in Singapore they occur on tree trunks in any slightly shaded spot. It is possible that the more seasonal climate of Penang and the north of the Peninsula is not so favourable for these mosses; in Penang a pronounced dry season early in the year is the rule. They are not usually found in dense shade, but in light shade, on tree trunks, and sometimes on rocks or on the ground (according to the species and the conditions). They do not usually grow in full sunlight, except some of the more resistant species, (e.g. *S. borneense*; this grows in a close cushion which can retain moisture). During rather dry weather they are often much shrivelled up. It is perhaps their habit of growing in somewhat exposed places, together with inability to withstand severe drought, which causes their restriction, on the whole, to places with a fairly heavy and evenly distributed rainfall, or a continuously high atmospheric humidity.

***Microdus miquelianus* (Mont.) Besch.**

On ground in the open.

***Campylopus serratus* Lac.**

Very abundant. It grows on the ground, frequently on the lawns where the grass is poor, in the open, or more usually in moderate shade; sometimes in a close pure growth. It is usually sterile; I have found male plants with antheridia, but not ripe fruits.

***Leucobryum sanctum* (Brid.) Hpe.**

Very abundant locally. It grows on the ground, requiring more shade than *Campylopus serratus*, and often forms large pure patches under trees, or mixed with *Campylopus* and such grasses as will tolerate a little shade. It may also grow on the bases of trees to some extent. No fructifications seen.

***Leucophanes octoblepharoides* Brid.**

***L. albescens* C. M.**

*Leucophanes* spp. usually grow on tree or palm trunks in masses, rather in the same positions as *Syrrhopodon* spp. They may also grow on the ground in moderate shade.

***Fissidens mittenii* Par.**

Found on bare ground under the shade of a *Phoenix sylvestris*.

***F. crassinervis* Lac.**

Mr. Ridley has collected this species in the gardens. I have found it in the Reservoir jungle on the ground by pathsides in shady places rather abundantly, though not forming dense masses like the next species.

**F. zippelianus** D. & M.

Very abundant on brick drains and on rocks in shady places, also on hard ground (stiff clay) in the shade. It forms a dense continuous mat, and has not yet been observed bearing sporogonia. It avoids the mortar between the bricks of the drain (this is sometimes covered with a hypnoid moss) and, appears to avoid the coral in the rockeries.

**Syrrhopodon ciliatus** Schw.

Found on trunks of sago palms in shady places, forming a close mat, sometimes freely fruiting.

**S. fasciculatus** Hk. & Grev.

On the ground beneath an old *Artocarpus rigida*, and on the base of its trunk, shaded also by fronds of *Davallia* growing about the tree.

**S. involutus** Schw.**S. flavus** C. M.

On a dead tree trunk in the Gardens Jungle, abundant.

**S. manni** C. M., f. **minor** Fl.

On tree trunks in Gardens Jungle, creeping. Apparently a common species in Singapore, but always the f. *minor*.

**S. repens** Harv. Apparently a common species in Singapore.**S. revolutus** D. & M.

On a Sabal trunk, underneath epiphytic ferns (*Asplenium nidus*) in thick rounded cushions. The fern roots with their accumulated debris are like huge sponges, and water flows down from them for some time after rain has ceased. The tufts of *Syrrhopodon* are also sponge-like and can hold much water. Apparently the same species occurs on the trunk of a big *Dyera costulata*, where also it is shaded and has ferns above it.

**S. rufescens** Hk.

Collected several times in Singapore by Mr. Ridley. Probably grows on tree trunks, but the only definite habitat note is its occurrence on the mass of roots of an old *Platynerium*. This is similar to the habitat described for the last species.

**Calymperes dozyanum** Mitt.

On a raised root of *Albizia* sp., in a rather shady spot.

**C. hampei** D. & M.

On roots and ground in shade.

**C. nicobarense** Hpe.

Collected by Mr. Ridley in the Economic Garden. Apparently a common species in Singapore; otherwise only known from Langkawi and the Nicobar Islands.

**C. salakense** Besch.

Collected in the Gardens once, by Mr. Ridley.

**C. serratum** A. Br.

Obtained by Mr. Ridley either in the Gardens or on Bukit Timah; exact locality uncertain.

**Barbula indica** Brid.

Grows in thick cushions, in rather exposed places. It is the commonest moss on open brick drains, and does not avoid the mortar. It will grow also in moderate shade, in which case it may be found side by side with *Fissidens zippelianus*.

**Macromitrium goniorrhynchum** D. & M.**Bryum coronatum** Schwaegr.

On rocks in rather exposed places (sun rockery) and on the ground; found also on rocks in moderate shade. It grows both on coral and other rocks. In dry weather it is quite shrivelled up, but during wet periods soon forms thick green cushions, which later bear abundant fruits.

**Myurium rufescens** (Hornsch. and Rw.) Fleisch.**Callicostella prabaktiana** (C. M.) Jaeg.**Pelekium velatum** Mitt.

On coral in shady rockeries, abundant. This is the only record from Singapore; in other parts of the Peninsula it is usually found on limestone.

**Ectropothecium buitenzorgii** (Bel.) Jaeg.**E. monumentorum** (Dub.) Jaeg.**E. moritzii** (C. M.) Jaeg.

Very abundant (though possibly mixed with other species). It often forms a close carpet on the ground in shady places, and on the bases of tree trunks; also to some extent among grass.

**E. singaporense** Dixon.

Collected once only, "on grass in open" (Binstead).

**E. zollingeri** (Bry. jav.) Jaeg.

In tank in plant house, fruiting only when left dry (Burkill).

**Trismegistia lancifolia** (Harv.) Broth.**Isopterygium albescens** (Schw.) Jaeg.

On the ground in a shady place. Found also by Binstead on a palm.

**I. minutirameum** (C. M.) Jaeg.

**Plagiothecium miquelii** (Bry. jav.) Broth.

This is a very common moss in the Peninsula, usually on old logs in shady places, but also occurring on the ground.

**Taxithelium isocladum** (Bry. jav.) Ren. & Card.

**T. instratum** (Brid.) Broth.

**T. nepalense** (Harv.) Jaeg.

**Vesicularia dubyana** (C. M.) Broth.

**V. montagnei** (Bel.) Broth.

**V. reticulata** (C. M.) Broth.

**Meiothecium microcarpum** (Harv.) Mitt.

Occurs on palm trunks and elsewhere in more exposed positions than most hypnoid mosses, often with algae of the genus *Trentepohlia*.

**Rhaphidostegium caespitosum** (Sw.) Jaeg.

**Trichostelium Boschii** (D. & M.) Jaeg.

**T. brachypelma** (C. M.) Broth.

**T. singaporense** Fleisch.

The hypnoid mosses are so alike in habit and are so abundant that I cannot distinguish any of them in the field with certainty, and cannot make any definite statement about the habitat of most of them. They are usually found on tree trunks, on logs or on the ground, in rather shady places.

**Hypnodendron arborescens** (Mitt.) Lindb.

Small specimens, collected in the Gardens Jungle by Mr. Ridley.

· R. E. HOLTUM.

## Additions to the List of Fraser Hill Plants.

This list is intended to supplement the enumeration of Fraser Hill plants published by Burkill and Holttum in this Bulletin, Vol. III, pp. 33—110.

The material from which it is compiled was obtained by a native collector working under the writer's supervision in August 1923, and by Mr. R. E. Holttum in the following month.

A few plants from the collections of Messrs. Burkill and Holttum have been added, where these have been determined since the publication of the original list.

All the plants, except where otherwise noted, were collected between the 3800 and 4200 feet contours.