

As yet we do not know the perfect form of this fungus, but if we take into consideration the general appearance of the plant,—its consistency, the presence of buckles in the filaments,—the supposition that it is derived from a Polypore near to *Coriolus* has nothing improbable in it.

This genus *Echinodia* could be characterised by saying that it is a compound *Stilbum* in which the conidia are produced sympodially.

M. N. PATOUILLARD IN THE BULLETIN DE LA SOCIÉTÉ MYCOLOGIQUE DE FRANCE, XXXIV, 2ND FASCICLE.

LIGHTNING AND HEVEA.

Dr. A. A. L. Rutgers in the *Archief voor de Rubbercultuur in Nederlandsch-Indie*, III., 1919, No. 4, p. 163, ascribes certain cases of bleeding of rubber trees to lightning. His article contains beautiful clear figures illustrating the cases.

Similar damage to a group of trees was observed a few years ago by Mr. F. G. Millar on the Tangga Batu Estate, Malacca, and mycologically examined for me by Professor C. F. Baker, and Mr. R. M. Richards who found no fungal cause. The damage had been done two years before the bleeding began to be noticed; and the bleeding was found to result from the stretching and slight rupturing of the bark by reason of the growth of the wood being excessive over the callus and included rubber of small old wounds. Dr. Rutgers remarks that in certain spots trees may suffer from more than one storm: and if the explanation is correct, as it well may be, one of the damaged trees on the Tangga Batu Estate had been peppered by lightning discharge twice.

I. H. BURKILL.

THE COMPOSITION OF A PIECE OF WELL-DRAINED SINGAPORE SECONDARY JUNGLE THIRTY YEARS OLD.

This little study of secondary jungle is a mite only towards the comprehension of the great complex "rain forest" of Malaya. It is an attempt to make use of the clearing of a small area, with a more or less known history, where nature had been for thirty years at her work of reconstruction. Many hundreds of such studies are needed, and the interest in them will grow as the problems to be solved become more and more apparent upon comparison of results. At present such comparison is impossible: for this study is but a beginning.

The study was undertaken in December last in the following way. The area to be cleared was in all about two acres, but to sort and determine all the plants over it was impossible: this being

so, a surface of about one third of an acre in two parts was reserved for analysis, the limits being marked by stretched wires: over the rest an attempt was made to determine all the species established, but not to ascertain their relative abundance. The larger secondary trees, as they were felled, were all measured that the depth of the vegetation might be determined. The work was done under the supervision of a Foreman-Gardener who preserved twigs of every plant for determination. When his men came to the area reserved for special study, they proceeded first to the removal of the smaller undergrowth, sorting the plants into species, and counting the number of each; then of the larger undergrowth in the same way; and lastly of the trees, which in their turn were measured. The seedlings and small plants upon the ground could not be counted as they suffered a good deal from trampling; their numbers consequently were estimated. As will be seen later the result showed nearly 100,000 plants to the acre.

As far as can be ascertained the history of the jungle had been as follows. Not less than fifty years ago forest covered the ground; it was felled with the exception of one tree of *Shorea macroptera*, Dyer, one tree of *Alstonia angustiloba*, Miq., perhaps a couple of trees of *Campnosperma auriculata*, Hook. f., and possibly other trees. Then there followed a planting of *Albizzia moluccana*, Miq., with various fruit trees, such as the Durian (*Durio zibethinus*, DC.) the Mangosteen (*Garcinia Mangostana*, Linn.), probably the Rukam (*Flacourtia Rukam*, Zoll.), and one if not more exotic trees. This may have been fifty years ago. Next thirty five years ago, beds of Gardenias, Ixoras, Hippeastrums, Eucharis, etc., were made over a part of the ground; and kept up for a few years. But secondary jungle was allowed to come in which therefore was about thirty years old, at the clearing in 1918.

The hill slope faces north west, and is well drained.

Naturally the jungle bore some impress of the former cultivation. Most noticeable of all were the big trees of *Albizzia moluccana*, towering above all the others, except the *Shorea* and the *Alstonia*. These *Albizzias* were in the habit of fruiting freely and dropping innumerable seeds into the bottom of the jungle; but the seedlings of the seeds which germinated could not grow under the shade, so that the *Albizzia* showed no regeneration. The *Shorea*, too, fruited freely and its seed germinated; but no seedlings were found of any size, showing that the conditions were equally unfavourable to it. It is thought that the *Albizzia* and *Shorea* failed from quite different causes, the *Albizzia* seedlings from want of light, the *Shorea* seedlings from want of deep forest soil and moisture.

An old Mangosteen tree stood dead in the jungle, its foliage space having been closed up. Elsewhere a little circle thirty-six feet across showed where another tree had been until recently. The ground of this circle was occupied by the grass and sedges, *Ischaemum muticum*, Linn., *Scleria sumatrensis*, Retz., and *Scleria hebecarpa*, Nees, into which *Hedyotis congesta*, R. Br., had intruded, and where there were many quite young seedlings of *Anisophyllea disticha*, Hook., and *Macaranga triloba*, Muell. At

a small distance further on stood, newly dead, an exotic Leguminosa (Gardens' No. 1404) which has never been determined. The Gardenias and Ixoras had altogether gone; but *Hippeastrum* had persisted at the foot of some big Albizzia; and *Tacca cristata*, Jack, was in plenty perhaps as a relic from cultivation.

The jungle itself was about forty-five to fifty feet from the upper leaves to the soil, as is shown by the measurements of a number of the larger secondary trees composing it, (vide the annexed table, where they are in the order of their height with their circumference in a second column). The size of the largest tree of each species in the table can be found easily, because the authority for the scientific name is appended only where the species first finds mention. Into the trees climbed a few woody climbers, e.g.

Tetracera assa, DC.
Artabotrys suaveolens, Blume,?
Unona discolor, Vahl,
Caesalpinia Nuga, Ait.
Uncaria pteropoda, Miq.
Smilax barbata, Wall.
Smilax megacarpa, A. DC.
Calamus.

A limited number of epiphytes were present, e.g.

Psychotria ovoidea, Wall.
Acriopsis javanica, Reinw.
Pleopeltis sinuosa, Wall.
Drymoglossum piloselloides, Presl,
Acrostichum scandens, Bory,

most of them growing in the forks of the branches of trees of *Arthrophyllum*, but a few on *Adinandra dumosa* and *Fagraea fragrans*. *Pleopeltis sinuosa* was tenanted by ants.

Herbs under the trees were few. *Tacca cristata*, Jack, was the commonest, and, besides *Hippeastrum* in one spot and the grasses and sedges of another spot as given above, almost the only herbaceous plant.

A LIST OF THE TREES ABOVE 30 FEET IN HEIGHT, EXCLUDING
 THE FEW LARGE TREES WHICH WERE NOT FELLED.

Height of tree.	Girth at breast height.	Name.
97 feet.	106 ins.	<i>Ficus polysyce</i> , Ridl.
79 "	44 "	<i>Durio zibethinus</i> , DC.
77½ "	40 "	do.
68 "	36 "	<i>Adinandra dumosa</i> , Jack.
66 "	34 "	<i>Durio zibethinus</i> .
	32 "	<i>Artocarpus polyphema</i> , Pers. .

Height of tree.	Girth at breast height.	Name.
65½ feet.	29 ins.	<i>Rhodamnia trinervia</i> , Blume.
64 "	27 "	<i>Elaeocarpus petiolatus</i> , Wall.
63½ "	44 "	<i>Eugenia lineata</i> , Duthie.
63 "	41 "	<i>Rhodamnia trinervia</i> .
62 "	34 "	<i>Ixonanthes reticulata</i> , Jack.
	32 "	<i>Rhodamnia trinervia</i> .
61 "	32 "	<i>Hevea brasiliensis</i> , DC.
60 "	31 "	<i>Rhodamnia trinervia</i> .
59 "	19 "	<i>Albizzia moluccana</i> , Miq.
	34 "	<i>Elaeocarpus petiolatus</i> .
58 "	46 "	<i>Artocarpus</i> sp.
57 "	28 "	<i>Arthrophyllum diversifolium</i> , Blume.
	35 "	<i>Rhodamnia trinervia</i> .
	22 "	<i>Pithecolobium lobatum</i> , Benth.
55½ "	40 "	<i>Elaeocarpus stipularis</i> , Blume.
	40 "	do.
55 "	29 "	do.
54½ "	26 "	<i>Arthrophyllum diversifolium</i> .
54 "	42 "	<i>Gordonia singaporeana</i> , Wall.
	33 "	<i>Artocarpus Lakoocha</i> , Roxb.
	16 "	<i>Pithecolobium lobatum</i> .
53 "	31 "	<i>Arthrophyllum diversifolium</i> .
	26 "	do.
	23 "	<i>Adinandra dumosa</i> .
	15 "	<i>Symplocos fasciculata</i> , Zoll.
52½ "	34 "	<i>Arthrophyllum diversifolium</i> .
	28 "	<i>Cupania pallidula</i> , Hiern.
	22 "	<i>Arthrophyllum diversifolium</i> .
52 "	36 "	<i>Artocarpus Lakoocha</i> .
	28 "	<i>Symplocos fasciculata</i> .
51½ "	22 "	<i>Arthrophyllum diversifolium</i> .
51 "	38 "	<i>Symplocos fasciculata</i> .
	32 "	<i>Rhodamnia trinervia</i> .
49½ "	20 "	<i>Hevea brasiliensis</i> .
	17 "	<i>Arthrophyllum diversifolium</i> .
49 "	24 "	<i>Symplocos fasciculata</i> .
	22 "	<i>Durio zibethinus</i> .
	21 "	<i>Arthrophyllum diversifolium</i> .
	18 "	do.
48½ "	27 "	do.
	20 "	<i>Artocarpus Kunstleri</i> , King.
48 "	22 "	<i>Arthrophyllum diversifolium</i> .
	20 "	do.
	15 "	<i>Artocarpus</i> sp.
47½ "	28 "	<i>Arthrophyllum diversifolium</i> .
	26½ "	<i>Rhodamnia trinervia</i> .

Height of tree	Girth at breast height.	Name.
47½ feet.	10 ins.	<i>Arthrophyllum diversifolium</i> .
47 "	32 "	<i>Adinandra dumosa</i> .
	24 "	<i>Arthrophyllum diversifolium</i> .
	23 "	do.
	20 "	<i>Symplocos fasciculata</i> .
46½ "	24 "	do.
	22 "	<i>Adinandra dumosa</i> .
46 "	29 "	<i>Symplocos fasciculata</i> .
	26 "	<i>Artocarpus</i> sp.
	24 "	<i>Arthrophyllum diversifolium</i> .
	17 "	do.
	— "	<i>Litsaea firma</i> , Hook. f.
45 "	28 "	<i>Rhodamnia trinervia</i> .
	21 "	<i>Arthrophyllum diversifolium</i> .
	20 "	<i>Durio zibethinus</i> .
	17 "	<i>Macaranga triloba</i> , Muell.
44½ "	22 "	<i>Symplocos fasciculata</i> .
	18 "	do.
	18 "	<i>Artocarpus polyphema</i> .
	15 "	<i>Arthrophyllum diversifolium</i> .
44 "	24 "	<i>Pithecolobium lobatum</i> .
	24 "	<i>Symplocos fasciculata</i> .
	20 "	<i>Pygeum polystachyum</i> , Hook. f.
	20 "	<i>Symplocos fasciculata</i> .
	20 "	<i>Elaeocarpus stipularis</i> .
	18 "	<i>Gironniera nervosa</i> , Planch.
	18 "	<i>Pithecolobium lobatum</i> .
	14 "	<i>Arthrophyllum diversifolium</i> .
43½ "	28 "	<i>Ficus</i> .
	20 "	<i>Macaranga triloba</i> .
	16 "	<i>Arthrophyllum diversifolium</i> .
43 "	30 "	<i>Rhodamnia trinervia</i> .
	25 "	<i>Palaquium bancanum</i> .
	24 "	<i>Rhodamnia trinervia</i> .
	24 "	do.
42½ "	21 "	<i>Arthrophyllum diversifolium</i> .
	18 "	<i>Artocarpus Kunstleri</i> .
	16 "	<i>Arthrophyllum diversifolium</i> .
	12 "	<i>Timonius wallichianus</i> , Val.
42 "	24 "	<i>Arthrophyllum diversifolium</i> .
	20 "	do.
	17 "	<i>Rhodamnia trinervia</i> .
	16 "	<i>Pithecolobium lobatum</i> .
	15 "	<i>Arthrophyllum diversifolium</i> .
	15 "	<i>Nephelium lappaceum</i> , Linn.
	14 "	<i>Arthrophyllum diversifolium</i> .

Height of tree.	Girth at breast height	Name.
42 feet.	13 ins.	<i>Symplocos fasciculata.</i>
	12 "	<i>Macaranga triloba.</i>
41 "	20 "	<i>Arthrophyllum diversifolium.</i>
	20 "	<i>Symplocos fasciculata.</i>
	18 "	do.
	17 "	<i>Arthrophyllum diversifolium.</i>
	14 "	<i>Symplocos fasciculata.</i>
40½ "	20 "	<i>Arthrophyllum diversifolium.</i>
	12 "	do.
40 "	16 "	do.
	12 "	do.
	9 "	<i>Pithecolobium lobatum.</i>
39½ "	16 "	<i>Symplocos fasciculata.</i>
39 "	25 "	do.
	20 "	<i>Eugenia simulans</i> , King.
	16 "	<i>Mangifera foetida</i> , Lour.
	15 "	<i>Sideroxylon malaccense</i> , C. B. Clarke.
	14 "	<i>Symplocos fasciculata.</i>
	— "	do.
	— "	<i>Artocarpus.</i>
38½ "	20 "	<i>Rhodamnia trinervia.</i>
	14 "	<i>Cinnamomum iners</i> , Reinw.
	10 "	<i>Artocarpus.</i>
38 "	22 "	<i>Ficus alba</i> , Reinw.
	21 "	<i>Cinnamomum iners.</i>
	16 "	<i>Artocarpus Kunstleri.</i>
	16 "	<i>Artocarpus.</i>
	15 "	<i>Symplocos fasciculata.</i>
	15 "	<i>Arthrophyllum diversifolium.</i>
	9 "	do.
	— "	<i>Gordonia singaporeana.</i>
	— "	<i>Pygeum polystachyum.</i>
	— "	<i>Eugenia variolosa</i> , King.
37 "	18 "	<i>Arthrophyllum diversifolium.</i>
	18 "	<i>Artocarpus Kunstleri.</i>
36½ "	18 "	<i>Eugenia grandis.</i>
36 "	16 "	<i>Gordonia singaporeana.</i>
35½ "	32 "	<i>Flacourtia Rukam.</i>
35 "	20 "	<i>Cinnamomum iners</i>
	— "	<i>Timonius wallichianus.</i>
34½ "	21 "	<i>Adinandra dumosa.</i>
	21 "	<i>Cinnamomum iners.</i>
	20 "	do.
	16 "	<i>Ficus.</i>
	14 "	<i>Gordonia singaporeana.</i>
	— "	<i>Adinandra dumosa.</i>

Height of tree.	Girth at breast height	Name.
34 feet.	15 ins.	<i>Cinnamomum iners</i> .
34 "	14 "	<i>Gynotroches axillaris</i> , Miq.
	— "	<i>Symplocos fasciculata</i> .
	— "	<i>Macaranga triloba</i> .
33½ "	18 "	<i>Arthrophyllum diversifolium</i> .
	9 "	<i>Symplocos fasciculata</i> .
33 "	20 "	<i>Timonius wallichianus</i> .
	— "	<i>Clerodendron disparifolium</i> .
	— "	<i>Pithecolobium lobatum</i> ,
	— "	<i>Timonius wallichianus</i> .
	— "	<i>Eugenia grandis</i> .
32½ "	— "	<i>Kurrimia paniculata</i> , Wall.
	— "	<i>Gynotroches axillaris</i> .
32 "	22 "	<i>Ficus</i> .
	14 "	<i>Symplocos fasciculata</i> .
	10 "	<i>Macaranga triloba</i> .
	9 "	<i>Timonius wallichianus</i> .
	— "	<i>Adinandra dumosa</i> .
31½ "	12 "	<i>Gironniera nervosa</i> .
31 "	— "	<i>Cinnamomum iners</i> .
	— "	do.
30½ "	10 "	<i>Pithecolobium clypearia</i> , Benth.

Among these trees *Rhodamnia*, presumably destined to ultimate suppression, was still aggressive.

The tallest *Arthrophyllum diversifolium* in the jungle was 57 feet high. This is probably about its limit, and the further growth of other trees would have tended to its suppression also. Possibly the age of 35 years for this kind of jungle is its zenith.

The tallest *Macaranga triloba* was 45 feet; and it and others showed signs of decay. The zenith of the species appeared to be past, and it seemed mainly to owe a place to the dying of old fruit trees. However large and old, these Macarangas were tenanted by ants.

Melastoma malabathricum had long lost its hold upon the ground.

The means of analysing this jungle over the whole two acres being wanting; two areas were taken respectively of 5800 and 7880 square feet or together nearly one third of an acre. The areas were defined by means of wires, and then from each in turn (1) the six foot high or lesser woody plants were removed, and determined, (2) the 6-18 feet high woody plants and (3) the trees. The plants not attaining two feet were not counted but their number was estimated. Adding the two areas together, there were on this area of nearly one third of an acre:—

378 trees of 18 feet and more.
 2,728 woody plants of 2 feet to 18 feet.
 about 27,342 smaller plants—mostly small woody seedlings.

30,448 in all.
 or to the acre 96,660 plants.

The woody species of two feet in height or more, found on this area, are enumerated in the list opposite. In point of individuals, the following among them were most abundant:—

<i>Anisophyllea disticha</i>	..	..	..	..	345
<i>Cinnamomum iners</i>	..	..	..	..	321
<i>Rhodamnia trinervia</i>	..	..	..	..	242
<i>Elaeocarpus Mastersii</i>	..	..	..	..	199
<i>Gironniera nervosa</i>	..	..	..	..	190
<i>Arthrophyllum diversifolium</i>	..	..	..	..	164
<i>Palaquium bancanum</i>	..	..	..	..	144
<i>Eugenia grandis</i>	..	..	..	..	139
<i>Timonius wallichianus</i>	..	..	..	..	110
<i>Macaranga triloba</i>	..	..	..	..	107
etc., the rest under 100.					

It is particularly worthy of mention that almost all of these have more or less fleshy fruits which are distributed by birds or monkeys.

The orders most in evidence were:—

MYRTACEAE	..	..	..	..	..	444
RHIZOPHORACEAE	..	..	..	..	..	431
LAURACEAE	..	..	..	..	..	348
URTICACEAE	..	..	..	..	..	334
TILIACEAE	..	..	..	..	..	235
EUPHORBIACEAE	..	..	..	..	..	181
ARALIACEAE	..	..	..	..	..	164
SAPOTACEAE	..	..	..	..	..	163
TERNSTROEMACEAE	..	..	..	..	..	124
RUBIACEAE	..	..	..	..	..	121

It is interesting that the Rubiaceae which in species is so varied in high rain-forests is but the tenth order down the list, that the Anonaceae is still further down and that the Ternstroemiaceae which in the damp *Gleichenia*-grown secondary forest of Singapore is so abundantly represented in *Adinandra*, should be but the ninth order of the list. It is probably correct to say that the relatively good drainage of the bit of the secondary jungle under study accounts for the low place of the Ternstroemiaceae and for the abundance of the orders Urticaceae, Myrtaceae, Tiliaceae, Sapotaceae and Lauraceae, as well as for the absence of *Gleichenia*, *Nepenthes*, etc.

*Enumeration of Woody Plants identified upon the
two areas selected for Analysis.*

(16) DILLENIACEAE.

- | | |
|----------|-------------------------------------|
| 1 plant. | <i>Tetracera Assa</i> , DC. |
| 1 „ | <i>Tetracera sylvestris</i> , Ridl. |
| 9 „ | <i>Wormia suffruticosa</i> , Griff. |
| 5 „ | <i>Wormia Scortechinii</i> , King. |

(5) ANONACEAE.

- | | |
|-----|--|
| 1 „ | <i>Artabotrys suaveolens</i> , Blume.? |
| 4 „ | <i>Unona discolor</i> , Vahl. |

(2) MAGNOLIACEAE.

- | | |
|-----|----------------------------------|
| 2 „ | <i>Kadsura scandens</i> , Blume. |
|-----|----------------------------------|

(57) BIXACEAE.

- | | |
|------|---|
| 57 „ | <i>Flacourtia Rukam</i> , Zoll. and Moritz. |
|------|---|

(92) GUTTIFERAE.

- | | |
|------|---------------------------------------|
| 7 „ | <i>Garcinia eugeniaefolia</i> , Wall. |
| 2 „ | <i>Garcinia Mangostana</i> , Linn. |
| 83 „ | <i>Calophyllum</i> sp. |

(124) TERNSTROEMACEAE.

- | | |
|------|--------------------------------------|
| 96 „ | <i>Adinandra dumosa</i> , Jack. |
| 28 „ | <i>Gordonia singaporeana</i> , Wall. |

(4) MALVACEAE.

- | | |
|-----|--------------------------------|
| 4 „ | <i>Durio ziberthinus</i> , DC. |
|-----|--------------------------------|

(19) STERCULIACEAE.

- | | |
|------|-------------------------------------|
| 16 „ | <i>Sterculia rubiginosa</i> , Vent. |
| 3 „ | <i>Sterculia laevis</i> , Wall. |

(235) TILIACEAE.

- | | |
|-------|---------------------------------------|
| 36 „ | <i>Elaeocarpus petiolatus</i> , Wall. |
| 199 „ | <i>Elaeocarpus Mastersii</i> , King. |

(23) LINACEAE.

(1) SIMARUBACEAE.

- | | |
|-----|------------------------------------|
| 1 „ | <i>Eurycoma longifolia</i> , Jack. |
|-----|------------------------------------|

(6) BURSERACEAE.

- | | |
|-----|------------------------------------|
| 6 „ | <i>Canarium Planchonii</i> , King. |
|-----|------------------------------------|

(2) MELIACEAE.

- | | |
|-----|----------------------------------|
| 2 „ | <i>Sandoricum indicum</i> , Cav. |
|-----|----------------------------------|

(4) OLACACEAE.

- | | |
|-----|---------------------------------------|
| 3 „ | <i>Lepionurus sylvestris</i> , Blume. |
| 1 „ | <i>Gomphandra penangiana</i> , Wall. |

(4) CELASTRACEAE.

- 4 „ *Kurrimia paniculata*, Wall.

(1) ILICACEAE.

- 1 „ *Ilex macrophylla*, Wall.

(2) AMPELIDACEAE.

- 2 „ *Leea sambucina*, Willd.

(37) SAPINDACEAE.

- 29 „ *Cupania pallidula*, Hiern.

- 8 „ *Nephelium lappaceum*, Linn.

(3) ANACARDIACEAE.

- 3 „ *Melanochyla auriculata*, Hook. f.

(32) LEGUMINOSAE.

- 1 „ *Pterocarpus indicus*, Willd.

- 1 „ *Caesalpinia Nuga*, Ait.

- 4 „ *Adenanthera pavonina*, Linn.

- 25 „ *Pithecolobium lobatum*, Benth.

- 1 „ *Pithecolobium angulatum*, Benth.

(2) ROSACEAE.

- 2 „ *Pygeum polystachyum*, Hook. f.

(431) RHIZOPHORACEAE.

- 86 „ *Gynotroches axillaris*, Miq.

- 345 „ *Anisophyllea disticha*, Hook.

(444) MYRTACEAE.

- 242 „ *Rhodamnia trinervia*, Blume.

- 139 „ *Eugenia grandis*, Wight.

- 51 „ *Eugenia simulans*, King.

- 12 „ *Eugenia variolosa*, King.

(11) MELASTOMACEAE.

- 4 „ *Pternandra echinata*, Jack.

- 7 „ *Melastoma malabathricum*, Linn.

(164) ARALIACEAE.

- 164 „ *Arthrophyllum diversifolium*, Blume.

(121) RUBIACEAE.

- 2 „ *Uncaria pteropoda*, Miq.

- 7 „ *Randia anisophylla*, Jack.

- 110 „ *Timonius wallichianus*, Val.

- 1 „ *Canthium molle*, King and Gamble.

- 1 „ *Psychotria ovoidea*, Wall.

(163) SAPOTACEAE.

- 19 „ *Sideroxylon malaccense*, C. B. Clarke.

- 144 „ *Palaquium bancanum*, Burck.

(76) STYRACACEAE.

- 76 „ *Symplocos fasciculata*, Zoll.

(4) APOCYNACEAE.

- 4 „ *Alstonia angustiloba*, Miq.

(4) LOGANIACEAE.

- 4 „ *Fagraea fragrans*, Roxb.

(1) ACANTHACEAE.

- 1 „ *Eranthemum malaccense*, C. B. Clarke.

(11) VERBENACEAE.

- 3 „ *Vitex pubescens*, Vahl.

- 8 „ *Clerodendron disparifolium*, Blume.

(348) LAURACEAE.

- 321 „ *Cinnamomum iners*, Reinw.

- 9 „ *Alseodaphne* ?

- 6 „ *Nothaphoebe umbelliflora*, Blume.

- 11 „ *Litsaea firma*, Hook. f.

- 1 „ *Litsaea myristicaefolia*, Wall.

(2) THYMELAEACEAE.

- 2 „ *Gonystylus Maingayi*, Hook. f.

(181) EUPHORBIACEAE.

- 1 „ *Bridelia tomentosa*, Blume.

- 1 „ *Cleistanthus heterophyllus*, Hook. f.

- 2 „ *Glochidion superbum*, Baill.

- 5 „ *Glochidion brunneum*, Hook. f.

- 1 „ *Aporosa fruticosa*, Muell.

- 49 „ *Microdesmis caseariaefolia*, Planch.

- 2 „ *Baccaurea motleyana*, Muell.-Arg.

- 13 „ *Baccaurea* sp.

- 107 „ *Macaranga triloba*, Muell.-Arg.

(334) URTICACEAE.

- 190 „ *Gironniera nervosa*, Planch.

- 3 „ *Ficus alba*, Reinw.

- 10 „ *Ficus Miquelii*, King.

- 1 „ *Ficus chrysocarpa*, Reinw.

- 42 „ *Artocarpus Scortechinii*, King.

- 1 „ *Artocarpus Lakoocha*, Roxb.

- 2 „ *Artocarpus polyphema*, Pen.

- 85 „ *Artocarpus superba*, Becc.

(1) CUPULIFERAE.

- 1 „ *Quercus Lamponga*, Miq.?

(5) LILIACEAE.

- 1 „ *Smilax barbata*, Wall.
 2 „ *Smilax megacarpa*, Roxb.
 2 „ *Dracaena* sp.
-

- 34 „ Undetermined.

Some attention was given to the size of the leaves in the jungle. On the whole none were larger than those of *Macaranga triloba*, which have an average size of 500 square cm. Those of *Ficus* varied from 150 to 350 square cm. Others were measured thus:—

<i>Tacca cristata</i>	on the average about 180 square cm.
<i>Baccaurea</i>	170 to 190 square cm.
<i>Hevea brasiliensis</i>	120 to 300 „
<i>Timonius wallichianus</i>	90 to 100 „
<i>Cinnamomum iners</i>	60 to 100 „
<i>Arthrophyllum diversifolium</i>	90 to 140 „
<i>Alstonia angustiloba</i>	90 to 110 „
<i>Rhodamnia trinervia</i>	40 to 50 „
<i>Elaeocarpus petiolatus</i>	about 60 „
<i>Eugenia simulans</i>	60 to 70 „
<i>Pithecolobium lobatum</i>	20 to 70 „
<i>Durio zibethinus</i>	
<i>Adinandra dumosa</i>	30 to 40 „
<i>Vitex pubescens</i> , leaflets	20 to 70 „
<i>Flacourtia Rukam</i>	25 to 30 „
<i>Symplocos fasciculata</i>	15 to 18 „
<i>Psychotria ovoidea</i>	about 8 „
<i>Anisophyllea disticha</i>	1 to 2 „

These are only a few measurements and a vast array must be collected sooner or later by botanists in order to establish the relationship of size of leaf to types of forest.

It has been said above that fruit trees had been planted over the ground before the secondary jungle was allowed to spring up. The presence of these trees complicates the history somewhat, but the changes of the vegetation may have been as follows:—

1st stage. Fruit trees standing in Lallang grass (*Imperata arundinacea*).

2nd stage. *Melastoma malabathricum*, bird dispersed, sprang up through the lallang, followed by the equally bird distributed *Rhodamnia trinervis* and *Fagraea fragrans*, while through monkeys visiting the fruit trees all manner of just edible fruits that the monkeys feed on were dropped about them.

3rd stage. In a ring round the fruit trees with their roots partly in the damper soil under the fruit-trees' shade, and their leaves just beyond the shade, sprang up *Eugenias*, *Symplocos fasciculata*, *Timonius*, *Cinnamomum iners*, *Arthrophyllum diversifolium*. Of these by its quicker growth *Arthrophyllum* prospered.

Macaranga triloba with explosive fruits also appeared, but perhaps its seeds may be able to lie dormant for a long time.

4th stage. *Macaranga* prospered but reaching the limit of its growth, other trees began to shade it, and to cause it to lose place.

5th stage. *Arthrophyllum diversifolium* gained a conspicuous place, like the *Macaranga* to lose it as the associated species of greater height got above it.

This is the point at which the jungle in question, thirty years old, appeared to be. And at it *Gynotroches axillaris* had become the conspicuous small tree of the undergrowth. With years as the ground conditions became more and more those of the permanent forest *Gynotroches* would have lost place to *Anonaceae*, *Myristicaceae* and shade loving *Rubiaceae*, while forest lianes of the *Leguminosae*, *Ampelidaceae*, and *Apocynaceae* would have been able to grow and to add to the density of the canopy. Then ultimately the condition would come in when the giant forest trees of the *Dipterocarpaceae*, *Meliaceae*, *Leguminosae*, *Malvaceae*, etc., are at home. Tentatively I put this at upwards of one hundred years from the upspringing of the first growth of the secondary jungle.

It is interesting to note some of the absentees from the secondary jungle under study. In the first place there were no *Loranthaceae*. It is hard to say why. *Maesa* was absent and the whole of the *Connaraceae*. *Salacia* was expected, but was absent too. The following larger trees were not found, *Xanthophyllum*, *Pyrenaria*, *Glycosmis*, *Ochanostachys*, *Scorodocarpus*, and *Gonocaryum*. The want of regeneration of *Shorea* has already been commented on.

When the ground had been cleared, the rubbish was burned in small bonfires. Immediately a dense growth of seedlings of *Albizia* sprung up, started into growth by the scorching of their imperious seed-coats. These seedlings had bacterial nodules upon the rootlets, and it is evident that the species could be used as a green manure. A little later weeds came in. *Eleusine indica* was the commonest grass at first, but *Paspalum conjugatum* took possession of the soil with greater rapidity and was accompanied by *Paspalum sanguinale* in patches. Two sedges appeared *Cyperus umbellatus* and *C. Irya* and a supply of the following weeds, *Physalis minima*, *Capparis Hullettii*, *Alternanthera sessilis*, *Pouzolzia indica*, *Melochia corchorifolia*, *Synadrella nodiflora*. *Vandellia crustacea* and *Spermacoce ocymoides*, all having small dry seeds except the first. Then spreading like the *Paspalum* appeared *Trichosanthes wallichiana*, *Commelyna nodiflora*, *Merremia hastata* and *Passiflora foetida*. There appeared a few plants of *Clitorea cajanifolia* and of *Blumea balsamifera* and a good sprinkling of the seedlings of the following trees, *Commersonia platyphlla* and *Trema*, with *Melastoma malabathricum* and *Solanum verbascifolium*. There was also plenty of *Clerodendron scandens*.