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# JOURNAL

OF THE

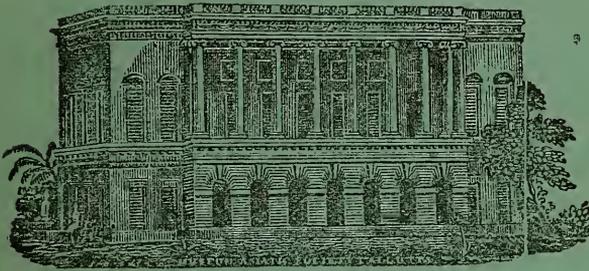
## ASIATIC SOCIETY OF BENGAL.

Vol. LX, Part II, No. II.—1891.

EDITED BY

W. J. SCLATER, ESQ.

HONORARY SECRETARY.



“The bounds of its investigation will be the geographical limits of Asia: and within these limits its inquiries will be extended to whatever is performed by man or produced by nature.”—SIR WILLIAM JONES.

\*\* *Communications should be sent under cover to the Secretaries, Asiat. Soc., to whom all orders for the work are to be addressed in India; or, in London, care of Messrs. Kegan Paul, Trench, Trübner and Co., 57 & 59, Ludgate Hill.*

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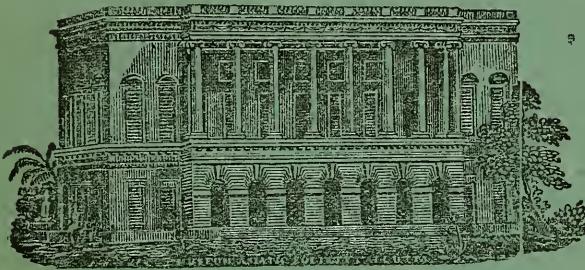
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*Note.*—Plates I and II are not yet ready, they will be issued with a subsequent number of the Journal.

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# JOURNAL

OF THE

## ASIATIC SOCIETY OF BENGAL.



### Part II.—NATURAL SCIENCE.

No. II.—1891.

V.—*The Butterflies of Sumba and Sambawa, with some account of the Island of Sumba.*—By WILLIAM DOHERTY, Cincinnati, U. S. A. Communicated by the NATURAL HISTORY SECRETARY.

[Received April 9th :—Read May 6th, 1891.]

(With Plate II.)

The chain of the Lesser Sunda Islands, extending from Java eastwards to Timor Laut and New Guinea, is of great interest from many points of view, but especially from the ethnologist's. For, whereas a slight tincture of Muhammadan civilization, leading to the entire loss of the native product, has made the people of the Malay Peninsula, Sumatra, and Borneo the most uninteresting of all the sons of men, and only the minutest differences distinguish the natives of Penang from those of Macassar, fifteen hundred miles away, every little island east of Java has an astonishing wealth of peculiarities.

Taking the question of religion and government, Bali, the first, is a densely inhabited island, the home of an ancient civilization. The people are of the Hindu faith, the four original castes still prevail there as they did in India in the time of Mannu, and suttee, extinct everywhere else, still flourishes. In Lombok, a Hindu aristocracy rules a Muhammadan proletariat of a more recent and less pronounced

civilization. In Sambawa\* there are four Muhammadan kingdoms, considerable age, while a few tributary heathen tribes, but little inferior to them in refinement, inhabit the mountains. In part of Flores, the governing race is a tribe of Muhammadan slave-traders, the curse of all that region, and the pagan mountaineers are in a more or less savage state. In Sumba and Timor there are independent heathen tribes. In Solor, Savu (better written Sau or Sawu), and Roti a large part of the population is Christian. The Dutch have no possessions in these islands, except the town of Boleling in Bali, the fort at Bima in Sambawa, and the neighbourhood of Kupang in Timor. But owing to their command of the sea, they have a considerable, and I believe an increasing influence with the trading community, and with many of the native princes. At the present moment they are trying to get possession of Middle Flores, where tin has been discovered, and, if successful, the occupation must have the happiest effect on all the surrounding islands.

From the philologist's standpoint, all the dialects from Bali to Kupang belong to the Javanese branch of the Polynesian family. In Eastern Timor and the islands beyond, some of the languages are of a totally different type, probably that of the original Negrito inhabitants.

As regards race, no part of the world excels these islands in interest. In and east of Timor, the prevalence of wavy or frizzly-haired tribes, generally of low stature, indicates the Negrito as the first occupant. In Sumba the Polynesians are still numerous, and form the ruling race, while traces of them occur in Sambawa,† and even in the mountains of the Celebes. The people of Roti are a strikingly handsome tribe looking somewhat like the better class of Tamils or Telugus, and their origin is certainly a puzzle. Mr. Wallace suggests that they may be of Portuguese blood, introduced by some unrecorded shipwreck. But they themselves say they came from Serang (Ceram). A somewhat similar race occurs at Melolo in Eastern Sumba, and, I hear, in Flores. In Savu, the people have an obvious strain of Negrito blood, but some resemble the Rotinese, while universal tradition ascribes their

\* So pronounced, also sometimes pronounced Sembawa, or, if written in the Hunterian manner, Sambáwá. The Dutch call it Soembawa, which is not only incorrect, but confuses it, with Sumba (Soemba). It is remarkable that the inhabitants of the island have no name for it, Sambawa being simply the name of the western sultanate. Nothing could more surprise a native of Bima, than to be told that Bima and Sambawa are on the same island. The same is true of Flores, for that pretty word is purely European, and there is no native name for the whole island. I see that the island Dutch propose to call it "Soenda" so that these three great neighbouring islands are to stand as Soenda, Soemba, and Soembawa!

† Lengota, the *glarang* or headman of Kala in the mountains of Sambawa, is a fine example of a Polynesian.

origin to Sumba, and their language scarcely differs from Sumbanese. In Sambawa, Lombok, and Bali, the flood of Mongolian immigrants has swept away nearly all traces of the original inhabitants, and the people are indistinguishable from the Malays or Siamese. The same race has entered all the islands, I do not think there is a single island in the Archipelago or the Pacific where the Mongolians have not profoundly modified the original population, whether Polynesian or Negrito. In Sumba the mixture is of great interest, because it presents the same features as in New Zealand and among the eastern and higher tribes of American Indians, namely, a race chiefly or largely Mongolian in blood, but Polynesian in language and manners, and ruled by a princely caste of genuine Polynesian blood. Till I visited Sumba I had no idea of the possibility of this state of affairs so far west. But since then I have been struck with the prevalence of Polynesian features, and even to a certain extent of Polynesian manners\* among the higher tribes between Assam and Burma, namely, some of the Naga tribes—the Angamis, Lhotas and Kachhas,—the Chins and the Lushais. This country may well have been the starting point of this fine race, whence they have extended their conquests eastwards to New York and Yucatan and westwards to Madagascar, and where, judging from what I saw, they may yet survive after their extermination, now so rapidly going on, is complete everywhere else in the world.

Mr. Alfred Russell Wallace has formed all the Lesser Sunda islands, except Bali, separated from Java only by a narrow strait, into his Timorian division of the Austro-Malayan region. So far as the birds are concerned, he seems to have had good reason for this, for out of 160 land-birds known from the group, just half are found nowhere else, a larger proportion than exists even in the peculiar Celebesian fauna. On examination, however, it does not appear that the group is a zoological province in the same sense as is the Celebes. In that island, a great number of peculiar species, and a certain number of peculiar genera, range over the whole island from Menado to Macassar. But the Timor group contains hardly any peculiar genera,† and the peculiar species are generally confined to one or two of its component parts.‡

\* As regards language, the euphonic and structural rules are remarkably alike, but the roots of Naga words are generally as wholly different from those of the Pacific islanders, as theirs are again from those of the American Polynesians.

† Two genera of butterflies, *Ancistroides* and *Jatana*, have been described from Timor only. But I must confess that I cannot find in either any generic character separating it from its allies.

‡ On examining the British Museum Catalogue of Birds as far as completed—*Passeres* and *Picidæ*—I find their distribution as follows. No genera are mentioned as peculiar to the Timor Group, or to any part of it. Only two species are men-

It is simply a long string of islands which has received waifs and strays from various quarters, the eastern ones, Timor, Timor Laut and presumably Wetter, chiefly from the Moluccas, New Guinea, and Australia, the western chiefly from Java. As the stream of Javanese immigrants, crossing narrow seas, is regular and unceasing, the species from that quarter have had fewer opportunities of differentiation, while the visitors from the eastward have for the opposite reason generally become distinct. This renders the fauna of the eastern islands more interesting to the naturalist, and Timor Laut, Wetter,\* Sumba, and the high country of Timor, offer a field of unusual interest.

But Lombok Strait, now known in science as Wallace's Line, after the great naturalist who discovered its faunal importance, is nevertheless an important frontier, cutting off a host of Indo-Malayan forms† from Lombok and the islands eastward, and a few Austro-Malayan forms, such as the cockatoos, from Bali and Java. However, it seems hardly so deep as Mr. Wallace supposed,‡ and it is not impassable even to mammals, seeing that the tiger has of late years crossed it, and is now,

tioned as common to the Indian and Australian regions, passing through these islands, but no doubt a few additional wide-ranging forms could be added.

## Timor.

Peculiar species,	...	...	...	...	29
Extending to Flores only,	...	...	...	...	5
"    "    Lombok only,	...	...	...	...	2
"    "    Bali,    "	...	...	...	...	2
Indo-Malayan,	...	...	...	...	13
Austro-Malayan,	...	...	...	...	3

—  
54

## Lombok, Sambawa and Flores.

Peculiar species,	...	15	(Flores 4, Lombok 4, in com-
Extending to Timor only,...	7		mon 7).
Indo-Malayan,	...	28	
Austro-Malayan,	...	0	

—  
50

So that only seven species (or nine including the two extending to Bali) are confined to the group, as a group, and no Austro-Malayan species extends west of Timor, while the Indo-Malayan species are numerous.

Nothing whatever is known of the birds of Sumba.

\* The island of Wetter seems to be wholly surrounded by deep sea, and merits examination.

† Such as the *Cyprinidæ*.

‡ The depth of Lombok Strait, as now given, seems hardly over fifty fathoms at the deepest part of the shortest line across it. There are several islands in the Strait.

I hear, making fearful ravages among the herds of ponies for which Lombok was once celebrated. As the dividing line between homologous species, Lombok Strait is probably less important than Ombai or even Sumba Straits. I should rather call it the boundary between the Indian Region and the neutral zone beyond, than that between the Indian and the Australian regions.

Sumba is one of the largest of the Lesser Sunda islands, having an area probably exceeding six thousand square miles, for the unexplored southern coast-line, drawn on the maps as concave, is really convex, giving great breadth to the island.\* It is called Sumba or Humba (the S and H being interchangeable here and in Savu, which is generally called Hau by the natives) by all the tribes inhabiting it, but on the maps the more usual names are Chendana (Tjendana), Sandelhout and Sandalwood, names of the same significance, given not because, as has been stated, sandalwood is exported, but because that tree is said to be *tabu* (or *pabili* as the Sumbanese say) to the inhabitants, so that if any one chances to break a twig of it, he is cut into small pieces, and scattered about under the sacred branches. At least, that is what the Malays say, but the Sumbanese, both the mountaineers and the coast-dwellers, entirely deny the existence of the tree on their island.

Deep sea separates Sumba from Flores, the high peaks of which are distinctly visible from Nangamesi Bay, but a bank covered by 50-80 fathoms of water, connects it with Eastern Sambawa, while on the side of Savu and Roti there is apparently deep sea again. No part of the coast has been surveyed even in the most cursory manner, but on account of the development of the horse-trade, the north-east coast from Laura to Réndi has become pretty well known to Arab and Bugis skippers. Except Tarimbang, which has not, I believe, been visited for generations, there is no harbour anywhere in the island. The roadstead of Waingapu or Wayapu, the chief port, is difficult of access, lying between two long coral reefs laid bare at low tide.

The aspect of the north coast of Sumba is most forbidding. Long naked headlands—Sasa, Ngarulubu, Mandolu, famous for their horses—extend far into the sea, marked with the lines of raised beaches. All this side of the island, for as much as forty miles inland and up to a height of two thousand feet, is covered with a sheet of coral overlying sandstone.† The coral must be of considerable age, and is often extraordinarily hard, reminding one of the ancient metamorphic lime-

\* The southern coast of Sambawa is set down quite wrongly on the maps, as I could see from the top of Haruhasa.

† Near Kawangu the sandstone is uncovered, forming hills curiously carved and water-worn.

stones of Greece, in Bœotia and Arcadia. Its surface is infinitely rough and broken, capable of destroying the stoutest boots in a few days. It is owing to this that the Sandalwood ponies develop such hard hoofs that they rarely require to be shod. Fortunately, wherever the ground is level, the coral is hidden by a coating of indurated clay like laterite, and the native paths keep to this as much as possible. A scanty growth of grass, especially the horrible spear-grass, which renders travelling almost unendurable, covers the coral. Wherever the surface consists of irregular piles of jagged fragments, bristling with needle-like points, and full of deep rifts and well-like cavities, a dry, thorny jungle grows, since horses cannot find foothold there, nor fire reach it. The grass is burnt every May or June, and for some months later, the country is as black as a coal, but travelling is easier and is usually done at this season. In some places the soil is exceedingly rich, and the population dense, especially in Melolo and Laura; but the country is everywhere dreary, and is far from green even just after the rains. Nevertheless this region, the north-east coast from Laura to Réndi, is the civilized part of the island, and the seat of all the larger states. The coast itself is generally uninhabited for several miles inland, owing to the depredations of the Endinese pirates. The heat is terrible, but the coast seems singularly healthy, and the climate is more like that of Northern Australia than of the Indian Archipelago.

Till I came to Sumba, no European had ever visited the interior. Learning from the natives that a well-wooded and watered tract existed inland, I pushed across forty miles of a desolate coral wilderness and reached a wholly different country. At Pada Dalung, and thence to Mandas\* (south-west) and Karita (south-east), and, I was told, to Tarimbang on the south coast, the rock is stratified and calcareous, apparently a soft decomposed chalk, and in one deep ravine I saw some huge round boulders which may have been granitic. The interior of the island is a great plateau, somewhat hollowed out in the middle by the river Kambéra, which rises in the forests around Léwa, and in that called Kétikujara or the Horse's Head, west of Mandas, flows eastward, and near Mandas is a considerable river in deep jungle, difficult to ford, haunted by crocodiles, and much larger in volume than at its mouth seventy or eighty miles below. Indeed most rivers of northern Sumba tend to disappear on approaching the coast. The table-land is flat in general outline, but deeply cut by an infinity of exceedingly steep ravines each with a clear swift stream. Flat or steep it is everywhere the richest possible meadow land. The forests lie in great masses, and, except

\* Or Mandasu; spelt Maanalas in Mr. Roos's map of Sumba, which, except over a part of the north coast, seems to have been compiled wholly from hearsay.

at Tabundung and one or two other exceptional places, they are wholly trackless and serve as the boundaries of hostile tribes. West of Mandas, the country appears to descend steeply into the Indian Ocean. This slope was described to me as covered with high forest, with a heavy rainfall\* and a coast so stormy as to be inaccessible during the greater part of the year. The height of the tableland of the Kambéra is usually about 1500-2000 feet; the hill at Pada Dalung must be about 2500 feet above the sea. The climate of this region is delicious. South-east and north-west the country rises, and by its upward trend conceals whatever high mountains may be in that direction. The great isolated *massif* of Tabundung, covered with high forest, lies south of Pada Dalung, and must be about 4000 feet high. East of this is the unknown *tana maringu* (cold country) of Masu, which lies back of Melolo, and is sacred ground. No war may be fought there, and the buffalo and horse have run wild, since those that escaped thither might not be caught and brought back. Masu is the Olympus of the Sumbanese, regarded as the original home of their ancestors, and the place whither their own souls shall go after death.†

West of Pada Dalung the country again rises, and beyond Léwa Paku (*Old Léwa*, the original demesne of the present king of Léwa, who now owns all the middle part of the interior plateau), and the sources of the Kambéra, lies another "cold country," probably of considerable height and extent. This is inhabited by rude mountain tribes, not yet visited either by Europeans or by the Arab and Bugis traders. West of Perwatana and Anakala, on the border of this region, which is called by the general name of Wayéwa, lies a great forest, and then comes Kodi, beyond which the land sinks precipitously into the sea near Gaura or Garu.

A volcano has been said to exist near Tarimbang on the south-western coast. But some people of that state told me this was quite untrue. However, the mountain of Tabundung, which I did not succeed in reaching, may possibly be of volcanic origin. This district, though rather out of the way, seems to be the best accessible collecting-ground on the island.

\* In Java and all the islands to the east of it, with the possible exception of Timor, the rainfall is far greatest on the southern and south-western sides. Thus at Tjilatjap (south coast of Java) the rainfall is 170 inches, at Surabaya 65. At Bima in Sambawa it is 38 inches. At Waingapu in Sumba it can hardly be more than 20, while at Pada Dalung it must be fully 100 inches.

† The Muhammadans of Sambawa, call their Heaven by the Sanskrit name *Sorga* (*Swarga*), and, I believe, say it lies in some distant mountains to the westward, perhaps a idea derived from the Hindus of Java. Hell is called Anaraka.

The upland forests of Sumba are less luxuriant than in Java or Sumatra, and are singularly free from thorns and underbrush, but many of the trees reach the height of a hundred feet, and some of the figs are of enormous girth. The only bamboos on the island occur in the dry valleys near the coast. Palms, except the *lontar* or palmyra, and a few arecas, are exceedingly scarce. The Endinese, who import cocoa-nuts, always destroy the germ of each nut, which perhaps accounts for the absence of this useful tree.

Of the animals of Sumba I can say but little. The natives think there are three kinds of monkeys, but I saw only the *Macacus cynomolgus*, which is very common and tame. A deer like the *Cervus muntjac* is said to be common, as well as another with large branching horns, which they call by the Malay name of *rusa*. Wild pigs abound, and a wild cat. Among birds, cockatoos are so numerous that I have seen the trees white with them; the species is the common lemon-crested one.

Among domestic animals there are pigs (*wei* or *wawi*), goats, fowls (*manu*, a Javanese word), a few buffaloes (*kalambua*, a softened form of the Malay *kribau*), cats (*kamembu*), dogs (*ashu*), and pigeons. Buffaloes are used chiefly for ploughing and for funeral sacrifices. They are the largest animals of which the Sumbanese have any conception, and a huge, ferocious kangaroo-hound, who goes about with the king of Léwa as a very efficient body-guard, has been called by the awe-struck natives the "Roaring Buffalo." Fowls are used chiefly in taking auspices, and pigs and mares are the animals generally employed for food.

Horses are the most valuable product of the island, and "Sandalwood ponies" are perhaps the best in the world, and well known as far as Rangoon and Hong Kong. They are called *jara*, a word which, like the Malay *kuda*, is derived from the Sanskrit *ghora*. The horses live unguarded in troops of twenty or thirty, each having its own range of pasture, the limits of which are carefully respected. Being very curious, they used to follow me for miles over all obstacles, but never dared to cross the ravine which bounded their beat. The colts generally follow the leading stallion (and not their dams) in a long string, which has a most absurd appearance. The mares are rarely ridden, and as in Sambawa are kept for breeding and for food.\* Only stallions are exported. The trade is wholly in the hands of the Arabs and Bugis, who carry the horses to Surabaya in their own vessels at a fixed time every spring. The Sumbanese are the best rough-country riders I have

\* In Sambawa, though the people are Muhammadans, a man is allowed to kill a mare on his birthday and make a feast for his friends. This is also done at the end of Ramazan; and even the Imams do it, though they may have made the Mecca pilgrimage. The Do Donggo sacrifice mares at the time of the rice-harvest.

ever seen, (and I have lived among the Turkman, Bedawin and Iliats), galloping bare back down the steepest slopes. On foot they are a singularly helpless people, and would rather ride twenty miles than walk one. They are fond of their horses and give them the most ornate names, those of mine being interpreted to me as "Beautiful Flower," "Wind in the Grass," and "Lightning." No woman is allowed to mount a horse, and I have seen a princess on foot while her attendant slaves were mounted.

The staple food in Sumba is millet (*usukanu* or *uhukanu*) and maize,\* generally planted alternately, and rice (*usuberesu* or white grain), which is hard to obtain except on the coast. The wet cultivation of paddy is unknown,† though the late king of Taimanu tried to introduce it at Yawahapi-Lukukatoba. Maize is usually eaten parched. Meat is only eaten on great occasions, and there are scarcely any vegetables. Curiously enough, the use of toddy (palm-wine) is unknown, though so common in Flores, Savu, and Roti, and even in the Muhammadan parts of the Celebes. Considering the wealth of the people, and the cheapness of Java rum, the Sumbanese are a sober people, and most of the mountaineers have never tasted spirits. The use of betel is universal. Salt is very scarce and dear.

The people of Sumba do not probably number less than 100,000, and perhaps much more if Laura and Melolo are really as populous as they are said to be. A small colony of curly-haired Savu people are settled at Waingapu and Kabaniru, and a similar race at Memboro. Some of the Melolo people are said to resemble the Rotinese in feature. Otherwise, the bulk of the people may be said to be Mongolians resembling the Javanese, with a Polynesian aristocracy.‡ The former are

\* Maize is probably a recent introduction, but I could hear of no tradition on the subject. A common species of sorghum growing in marshes is called "wild maize." In many of the islands, the word *jawa* or Javanese is applied to maize, showing whence it came. In Sumba the word is *water*, but in Savu *water-jawa*, in Roti *mbèla*, in Timor *pèla*, in the Moluccas *milu*, in Ende (Flores) simply *jawa*, in Roka (Flores) *hai*, in Sambawa *baso*. The word *jawa* is applied to anything foreign. Europeans are called "white Javanese," and I was generally known in Sumba as *umbu maremba jawa* or the King's son from Java.

† The Do Donggo of the mountains of Sambawa have some of the finest wet paddy fields I have ever seen. Yet they are far inferior in capacity to the Sumbanese, and preserve a curious memento of their recent savage state in an annual three days' pilgrimage to the mountain-tops, where they sleep in the open and live wholly on what game they kill, leaving the villages guarded by the dogs tied up in the houses.

‡ Some of the western hill-tribes may belong to a lower race. The Kodi people are said to be of short stature, and to turn the toes inwards in walking, especially the women. To "walk like a Kodi woman" is a staple joke, appealing strongly to the Sumbanese sense of humour.

the same as everywhere. The latter are tall, light-brown men, of somewhat slender, but graceful and manly proportions. The face is rather long, with a Roman nose and a finely-moulded chin; the hair is straight, rather dry and stiff, and a beard is not generally worn. The women are often of a refined and high-bred, though somewhat grave and melancholy beauty, contrasting strangely with their barbarous condition. The quiet dignity of the men is in striking opposition to the innate vulgarity of all Mongolians from Turcomania to Malayana.

The Sumbanese, both men and women, wear a large loose mantle of Manchester cotton dyed black in the mud of the rivers. The women wear also a short black skirt, and on gala occasions a black jacket tastefully embroidered with beads and small cowries. The men wear a waistcloth, a turban, a huge ivory armband, and a heavy belt like that worn by the Greeks and Albanians, containing their krisses and *parang*. They always go about with a square mat-work satchel, generally of very pretty design, containing betel. They exchange betel with everyone they meet outside their village, as a sign of peaceful intentions. I had to carry a supply about also, and never dared to decline it, though it is not at all nice, for the Sumbanese could only explain a refusal as a sign of hostility, just as Bedawin would excite at the refusal of salt. Bows are unknown in Sumba, and so are fire-arms, but a man goes nowhere without two spears, which are never laid aside for an instant. In the remote district of Mandas, I was amused to see that my visitors had covered their spearheads with sheaths tied on with thongs, as if to reassure me, reminding me of the old Norse custom.

“Thereat was the Wrath of Sigurd laid fast in a silver sheath.  
And the peace-strings knit about it, for the blade was fain of death,  
And 'tis ill to show such edges to the broad blue light of day,  
Or to let the hall-glare light them, if ye list not play the play.”

The Kambéra language is understood over the greater part of the island, but Gaura and Laura in the west have languages of their own, and the Memboro dialect is very distinct. All these are closely allied to the Javanese and the languages of Sambawa and Flores. I have taken vocabularies of a number of these, which I hope to publish some day.

Strange to say, Sumba has a currency of its own in the shape of fine copper wire very intricately plaited and cut into lengths of two feet, worth half a rupee each. The ugly, fish-shaped earrings of gold beaten out thin, are always of the same size and value (about a dollar), and are likewise used for money.

The women have spinning-wheels and weaving-frames, and make cloth, especially blankets, generally white with curious figures of fish,

tortoises, prawns, ships, men, deer, etc., but all so conventional in form and so harmoniously arranged that the effect is good. The men also make nets and ropes, both of excellent quality and largely exported, and at Kadungu (Memboro) good pottery is made. The chief exports are horses, slaves and edible birds-nests.

There are three castes of Sumbanese, the *maremba* or lords, the *kabisu* or freeborn citizens, and the *towata* or slaves, the latter being the most numerous.

The ruling classes marry chiefly among themselves, and are inter-related in a most puzzling fashion. Marriages are arranged by the parents, and are of two kinds. If the wife is bought, whether with money or with service, she enters her husband's tribe. In this case she is his property, and he can kill her if he likes. If he pays nothing, he enters her tribe; but this is less usual. Polygamy is not common, but if a man's sisters-in-law remain unmarried, I believe they are after a time considered as his wives. The Sumba women make faithful wives, but before marriage incontinence is universal, and every girl, slave or princess, has her price. Infanticide and abortion are very common, and it is probably largely for this reason that the population is not increasing. Islam always, and Christianity often check this evil, so that the population is large and increasing in Muhammadan Ende and Sambawa, and again in Christian Roti and Solor. The old are treated with great respect. The Sumbanese struck me as a brave, honest and truthful people. But they are too proud to work for others, and will never become a thriving agricultural race like the Javanese.

Exogamy is usual, and the rules of intermarriage are often inconveniently complicated. For instance, I hear that Kanata men can marry only Lakoka women, and Lakoka men only Soru women. Now Lakoka\* and Soru are small independent states in the interior, while Kanata (or Lubu) is fifty miles away on the coast of the Taimanu state.

Apart from the wars of extermination waged now and then by the great chiefs, disputes are continually going on between neighbouring tribes, generally concerning boundaries, horses, or women. They are usually settled without much bloodshed in the following manner. The men meet in a meadow, and form two lines on horseback. Then the chiefs recite war-songs, and make speeches, and the two sides exchange

\* In 1886, shortly before my visit, the king of Léwa sacked Lakoka, in alliance with the Ende slavers. The men were killed, the king took the horses, and the women and children were carried off to Flores as slaves. This is the usual way in which the Endinese do business. It is to be hoped that the Dutch troops now in Flores will put an end to this murderous little state. Its supremacy in this region is owing to its possession of ships and rifles, of which the Sumbanese have none.

abuse and defiances in the Homeric fashion, till the proper degree of excitement is reached, upon which they charge, fighting with spears and shields. As soon as anyone gets speared, his side acknowledges itself beaten and pays a fine, while the others celebrate their victory with much noise and feasting. The horses on these occasions are decorated with collars of white horse-hair, and immense frontal tufts, giving them a most ferocious look, and are said to enjoy the fighting thoroughly. Sham fights, very similar to the real ones, and quite as dangerous, are often held. But horse-fights are the characteristic amusement of Sumba. Two stallions and a mare are placed in a little enclosure, and the former fight till one is dead. On great occasions there is dancing, generally performed by women, and sometimes a poet will sing the praise of his forefathers, exhibiting the skulls of their conquered enemies which have descended to him. The musical instruments in use are drums, gongs, and a guitar with two copper strings.

The dead are buried,\* household articles being broken and thrown into the grave as in the Nicobars. A large oval horizontal slab of stone surrounded by small upright ones, marks the grave. The bodies of chiefs are exposed on the mountains for months after their death. When a propitious time for the funeral comes, a great feast is held, many buffaloes, pigs and mares are killed and eaten, and a number of slaves, both men and women, are strangled and thrown into the grave.† When I was in Sumba, the body of the late king of Taimanu had been lying exposed at Semparingu for more than a year.

I cannot say much about the religion of Sumba. The island presents a remarkable contrast to Sambawa in this respect. In Sumba, though there are a few *ratus* or professional magicians of little influence, the chiefs are the real religious leaders, and it seems to me that the union of church and state in the hands of practical men managing large temporal affairs has kept superstition in bounds. In Sambawa, both in the heathen and in the Muhammadan parts, the *juhīs* or sorcerers are the descendants of the old local chiefs, now replaced by a centralized bureaucracy. Reduced to mere tricksters and jugglers dependent for their food on the popular faith in their magic powers, they have made the people as superstitious as any in the world. The same is the case

\* The Do Donggo in Sumbawa are buried sitting, but I can find no note of the Sumbanese custom.

† On the death of a Sultan of Mbojo (Bima) in Sambawa, 199 buffaloes are sacrificed. A new flagstaff is raised by his successor, and a slave is said to be strangled and buried beneath it. This, if true, illustrates the extreme conservatism of the East, for the people of Bima may be almost called a civilized race, and have been Muhammadans for some centuries.

with the heathen Do Donggo. Here the sorcerers hold a higher rank as *juhi Perafu* or priests of the god Perafu. But all temporal power is in the hands of the *glarangs* or headmen. The result is, that the *mori*, or ancestral spirits, and the *héncha*, or demons, are never out of peoples' minds, everything seen or done has some good or evil significance, there are sacred trees, mountains, springs, stones, and animals, while every spot is the scene of some absurd legend. Each village has its priest's house, priestess's house, and its *uma Perafu* or house of Perafu, closed, empty and of very archaic make. Belief in the evil eye, in the unluckiness of a thousand acts and signs, in the constant presence of evil demons, and in the disastrous effect of anything unusual or uncustomary, make these people the timid, unhappy race they are.\*

The Sumbanese are said to worship one greater god, described as *umbu walu mendoku* or *he who makes all*, who owns all the sandalwood. Also two deities called *umbu awan*, lord of heaven, and *umbu tana*, lord of earth, to whom worship is paid at harvest time, and rice, pigs, horses and buffaloes sacrificed. They also believe in evil spirits, and the huge fig trees in some of the villages are apparently held in veneration. Certain things also are sacred, and hence *tabu* or forbidden (*palili* in Sumba, *léo* or *pomali* in Timor, *perafu* among the heathen of Sambawa). Though the crocodiles receive no regular ceremonial worship as in Roti,† the Sumbanese nevertheless throw them meat, saying, "Don't eat

\* For instance, when I was at Kala in the Donggo country, the *juhies* kept praying and sacrificing all night to prevent evil resulting from my stay there. At Pelunto the people threatened to abandon their homes when they heard I was going to climb Haruhasa, the chief mountain in those parts. And when I returned and nothing happened, they said I had not really done it, just as when the alpinist climbed Ararat, the Armenians would not believe it, because he had not seen the Ark standing intact on the summit, as St. Mesrob had seen it in his dream. At Oo, the *juhi* declared that my visit had caused the terrible rains we had then. Out of revenge I rolled my eyes at him tragically, and repeated the first stanza of "Simple Simon met a Pieman" once or twice when I met him, upon which he fled the country. Such things are quite impossible in Sumba, and their own little devices for keeping off the evil spirits are performed in rather a sceptical mood. As in India they snap their fingers when some one sneezes. If a young man hiccups, they box his ears, if an old man, they ask him respectfully why he did it, to which he calmly replies that he never did, and there is a general smile.

† The following story was told me by Mijnheer Teffer, whose wife, a remarkably beautiful woman, now a Christian, was the daughter of the king of Hai in Roti. There is a caste of priests of the crocodile there. When they want to travel by water they call the crocodile, and he carries them wherever they wish on his back. On a certain day they go down to the bank, and call the crocodile, describing to him their rank and duties. When he comes out, they take him up and carry him, with a band of music and an applauding crowd, to his temple. There they give him rice and sweetmeats, put a robe on him, and begin praying over him. He dislikes the praying

me, but eat such a man, my enemy." But the chief Sumbanese deity is Merapu (the name is obviously equivalent to the Sambawan Perafu), who is the hearth-god, a kind of aggregation, I imagine, of the ancestral spirits. But some say he is a man who lives in Masu, and is a kind of intercessor with the great gods for men, and especially for kings. He is described as black in hue, for when I asked why the Sumbanese dressed wholly in black, they replied that it was Merapu's colour. The largest insect in the island, the black butterfly I have named *Papilio merapu*, is sacred to him. They pray to him in the forest, placing betel, siri, and a bit of gold or silver on a leaf, and setting it on the ground say "Merapu, give me this and that, pasturage for my horses, rain for my maize, and vengeance for my wrongs." Slaves pray to Merapu that the king may live a hundred (*ngasu*) years, for they are afraid of being sacrificed at his death.

The houses are large, with a thatched roof pointed at the top, and a floor raised five or six feet above the ground. Inside, the fireplace is always surrounded by four posts. That on the right hand on entering is called Merapu's post, and the enclosure is sacred to the god. Oaths are taken by laying the hand on this post, and no one is allowed to sing or play the guitar indoors when a fire is on the hearth.

Houses are gathered in a *paraing* (generally called *paré*) or village, or in a *negeri* (Sanskrit, through the Javanese) or town. The political unit, at least in the interior, is a group of open villages, protected by a fortress (*kota*, Sanskrit through the Javanese). Thus Watupéli is the central fortress of Melolo, Kamanu of Mandas, and Lambanapu of Kambéra. On the plains, these fortresses are defended by intricate cactus hedges, but I was told that in Laura (I think) towns are strongly walled with stone, as is the case with some of the hill forts elsewhere. These last are often very striking. Lateng in the Taimanu state, is built on a sharp spur of the mountains, the *col* connecting it with the main mass fortified by wall after wall. On the other side, the hill descends at a very steep angle to the river a thousand feet below, and this almost inaccessible gorge is so industriously cultivated as to be a perfect nest of verdure in this dreary country. In times of peace these forts are often left almost unguarded. Once I lost my way at nightfall in the Kiritana district, but when the moon rose I struck a path, and rode through a country of alternate thorny jungle, and meadows studded with great upright blocks of coral-like tombstones,

and struggles, so that it is necessary to quiet him with more food, and begin the prayers again. When the prayers are said, they carry him back to the river with music and dancing, and when he enters the water all the other crocodiles rise up and pay homage to him as their king.

worn into a thousand fantastic shapes like Gothic gurgoyles. The impressive uncanniness of this place I cannot describe; my horse was in an agony of terror. Finally I came to a citadel on a steep crag, and climbing the wall in constant expectation of attack, I found a mass of huge fortress-like houses of stone, bigger than any built nowadays. After I had gone over most of them and found them full of grain and household utensils, but without inhabitants, I finally stumbled on three very old men, who were speechless with amazement at seeing me. They were in charge of the place and had not had a visitor for months.

The little district with its sheltering citadel was probably till modern times the only kind of state in Sumba. The recent evolution of governments like Léwa and Melolo has as yet had but little influence on the people of the interior.

On the coast, one can now ride from Waingapu to Melolo without receiving anything from the men he meets but polite salutations. In the interior, even in the middle of the Léwa dominions, I never met a native not belonging to the village where I was staying, but we both prepared for battle, and spear and revolver were held in readiness till we had exchanged betel. Twice I was within an ace of being speared, because I came on men suddenly in the forest. When two parties meet, they halt when yet a long way apart, dismount, and drive their spears deep into the earth as a sign of peace, then exchange a "coocy" (the well-known Australian cry, much used in Sumba), and yell out a question or two. Then two men advance, one from each party, and exchange betel, after which the others come forward warily, keeping a good grip on spear and shield. In spite of the tyranny of the kings over their subjects, and their occasional ferocity to conquered enemies, centralized government of any kind is better than this constant distrust of one's neighbours. The northern kings of Sumba have greatly strengthened their power by making it hereditary. The *umbu maremba*, or heir-apparent, is a power even in his father's lifetime. Whereas in Ende, Roti, Savu, and in the less advanced states of Sumba, the king's successor is elected by the nobles from the royal house.

The most powerful of the Sumba kings are those of Léwa (who holds Kambéra by right of conquest), and Melolo (who ruled half the island a generation ago), whose son rules at Petawang. West of Léwa come Taimanu, Kapundu, Palmédo, Kadungu (or Memboro), and finally Laura, which is said to be of great interest, but which has not been visited by any European. The Dutch claim allegiance from the Savu and Timorese immigrants at Waingapu and Kabaniru as well as over a few Arabs, Bugis, and Chinese who trade at Waingapu. But these all pay tribute to the king of Léwa, and the only time they

refused it, he plundered the village, and drove the Dutch agent out of Sumba. When the unhappy Achinese war is over, it is to be hoped that the Dutch will pay some attention to this fine island, hitherto neglected. Owing to the absence of fire-arms, it could be subjugated by an insignificant force; the horse-trade properly developed would prove a mine of wealth; and under settled government the island would be as prosperous as Roti or the Minahasa. However it may have been in the last century, no people in this can rule semibarbarous races better than the Dutch—when they think it worth their while.

Some idea of a Sumbanese king may be gathered from an account of my visit to Tunggu, king of Léwa, which I made with my kind friend Mr. K. H. de Roo van Alderwereld. The king was then at Kawangu near the coast.

We rode from Waingapu across the Matawai, past the Savu settlement of Kabaniru, and reached the Kambéra river, where women were dyeing cloth in the black mud, and a frizzly-haired Timorese was fishing in a canoe. Forging the Kambéra and the Palamenjéli with much difficulty, we reached Kawangu, a village of thirty large houses. A narrow path wound zigzag past three great concentric hedges of cactus guarding the place, and brought us to the king's house. He was an ugly old man, well over six feet high, wearing nothing but a dirty waist-cloth, his skinny limbs uncovered. His long hair was white and knotted over the nape of his neck, his eyebrows were black and stood out from his head, the hairs more than an inch long, shading a pair of singularly bright, unsteady eyes, and giving him an extraordinary appearance. He shook hands with us feebly with his paralyzed left hand, holding his spear in his right all ready for action, for he is forever suspecting some treachery. He had two mares led up, and drove his spear into the throat of each with a wild shout; then he killed a pig for us, saying, politely, "Pork is for kings' sons, but mares' meat is good enough for soldiers." For the mares' meat was for his body-guard, a number of handsome and splendidly-formed young men, with whom he was at that time hoping to conquer the whole island. Later on, we saw him standing among them ladling the boiling meat out of a huge pot, and saying, according to our interpreter, "Eat, my children; he who fights shall eat meat; let slaves stick to millet."

He took us to see his elder brother, who was slowly dying of cancer, and had therefore given up the throne to him many years before. When my trip into the interior was suggested, he coolly made a counter-proposal that we should both go and help him in his campaign against Anakala. For he has no fire-arms, and no doubt thought a rifle or two would have great effect on those sturdy mountaineers. On our

declining this, he invited the leading nobles into the council-house and consulted the auguries about my journey, examining the liver of one fowl after another till one suited him. Every stain or flaw in the liver has its own meaning, and I was surprised at the acuteness of his inferences regarding them. Sometimes he would consult some of the old men, who seemed quite familiar with the science, and evidently considered it as reasonable and reliable as the multiplication table. The king is held the best haruspex in the country, and is also proud of his skill in causing rain or drought. He remarked incidentally that he would give me good weather for my trip. We sat up till late listening to a minstrel singing a song of the king's composition, twangling a guitar the while. The king sat glancing sharply at us alternately, some nervous affection keeping his head and hands in constant motion. Meanwhile his followers sat in a circle round him, looking singularly dignified and austere. They wore black mantles and turbans, their belts were full of handsomely-mounted weapons, their fine Roman faces perfectly quiet, in striking contrast to their master's, whom they so surpassed in dress and bearing. Still I think I understood then somewhat of the power which made this ignorant savage a ruler of men, personally more revered than any sovereign in civilized countries.

The butterflies mentioned in the following list were taken in 1887. The Sambawan specimens are in the hands of Mr. B. Neumoegen. The Sumba ones have remained four years in my possession, during the course of which most of them have suffered greatly, and many of the best have disappeared or been destroyed, including several uniques, of which I have only descriptions made at the time. As, however, no one may visit the interior of Sumba again for many years to come, I shall include these descriptions here. Owing to my small knowledge of Moluccan and Timorese butterflies, and the absence of specimens for comparison, my work is necessarily imperfect. When described, the Sumba butterflies will be sent to M. Charles Oberthür. Of the Sambawa butterflies I cannot give a complete list, and I am obliged to omit most of the *Euploas* and some others. At the time I was there, I counted about 140 species taken in each island. In this list I number only the Sumba species, those from Sambawa being introduced chiefly to illustrate the geographical distribution of the species, and to describe a few novelties.

There is a considerable Austro-Malayan element in the Sumba butterflies, but very few of these forms reappear in Sambawa, *Ornithoptera naias* and *Danais (Nasuma) haruhasa* being the most remarkable of those that do. The list scarcely does justice to this element in

Sumba, since a *Doleschallia* and a *Charaxes* probably of Moluccan type escaped me, and of a *Hypolimnas* apparently near *H. pandarus* I made no description, and the specimens are lost.

A few Papuan or Timorese forms occurring in Sumba do not extend to Sambawa, such as *Radena oberthurii*, and the above-mentioned *Doleschallia* and *Hypolimnas*. In one or two cases a species occurring with little change from Java to Timor has a wholly different representative in Sumba, as in the case of *Papilio maremba*. Ten Sumbanese forms are represented in Sambawa by other allied species, namely, six *Danaïdæ*, three *Pieridæ* and a *Papilio*. Nine species of *Danaïdæ* occur in Sumba and nine in Sambawa, and of these six are the same, and three different. Ten species of *Euplœa* (of nine different groups) were taken in Sambawa, and only six in Sumba (perhaps on account of the continual rain in the interior), of these only one, a large *Salpinx*, was common to the two islands. The dominant *Euplœa* of Sumba was apparently *E. lewa*, that of Sambawa seemed to be the Javanese *E. (Selinda) eleusina*, and both have their mimics. *Trepsichrois*, of which a species is peculiar to each island, appears as a mimic, and rare, whereas further west it is usually a dominant genus.

Information regarding the seasonal forms of the *Satyridæ*, will be found under the head of that family. It will be seen that in these islands the non-ocellate brood appears when the ocellate brood appears in India, as might be expected, the seasons there being similarly reversed. In Sambawa I reared both forms of *Melanitis leda* from the wet-season one, by keeping a wet sponge along with the chrysalids in one box, whence only the ocellate brood was obtained.

My discovery of the dimorphism of these insects, made in 1882-3, and my theory regarding its cause, have now received confirmation from all sides, and may be regarded as proven.

My collecting in Sambawa was in the eastern part of the island in the sultanate of Bima or Mbojo, and was unfortunate, owing to the heavy and unseasonable rains. Owing to the assistance of Mijnheer A. C. de Heer, Controleur of Bima, for whose kindness I offer my best thanks, I was enabled to visit the mountains west of Bima, the Sultan sending his brothers to arrange matters for me. These mountains, which are of some height—two of the peaks, Haruhasa and Ndindi exceeding five thousand feet in elevation—are in the district of Bolo, the capital of which is Sila, and are inhabited by a timid race called the Do Donggo Bolo to distinguish them from the Do Donggo Kai near Prado. The higher parts of the mountains have a very wet climate, and are partly meadow and partly forest. The latter is exceedingly rich and luxuriant, resembling that of Sumatra or Borneo, but is of no great height on account of the violence of the wind.

My impression is, though I can scarcely prove it by lists of species, that the insects of this mountain region, are almost purely Indo-Malayan, or at least more so than those of the coasts. If this is true, it does not at all agree with Mr. Wallace's belief that the Indo-Malayan element is of recent introduction. As these mountains are very easy of access from Bima, where steamers stop every month, and as travelling in the island of Sambawa is safe and pleasant, it seems a pity that some competent ornithologist does not investigate the birds of this district, which ought to afford many novelties.

#### Family DANAIIDÆ.

##### 1. *SALPINK MEIZON*, n. sp.

Male, above, forewing rich brown with blue reflections, a short slender pale lilac spot in the interno-median space, a costal spot and seven large inner-submarginal ones, light blue with purple reflections, generally pointed outwardly and inwardly, the second largest, separated only by a vein from the first, which is prolonged costally, the last with an obscure streak below it. Hindwing with the blue gloss much less conspicuous, the velvety patch pale ochreous externally, darker internally; two or three small subapical lilac spots. *Below* dark brown, both wings with the cell and the spaces just beyond it much paler than the outer part. Forewing with a costal lilac dot, and sometimes one or two subapical, a larger one in the lower median space; below the lower median vein a large ochreous area, pale brown in the middle, extending below the submedian vein, enclosing a short sericeous band. Hindwing with a varying number of minute inner-submarginal lilac spots subapically, and sometimes two or three still smaller outer-submarginal ones subanally.

The basal tuft of the male is very large, light reddish at base, fuscous outwardly; the outer tuft white, very short.

Expanse of male over four inches, the female still larger. Type from Sumba, where it is scarce, also occurring in Sambawa, apparently unchanged. It differs from *S. leucostictos* and *pasithea* in the pale internal areas of the underside, and in the absence of most of the submarginal spots. It somewhat resembles *S. viola*, Butler, from the Celebes, but lacks the blue spots on the hindwing above.

##### *SALPINK (SELINDA) ELEUSINA*, Cramer.

Sambawa, very common. An undescribed *Isamia* occurs in Sambawa.

##### 2. *SALPINK (CALLIPLÆA) SUMBANA*, n. sp.

Above, forewing brown, slightly glossed with blue, the outer margin paler; a costal white spot, and a submarginal row of nine others, the

first six more or less fused into a single mass, the first and sixth sometimes separate, the veins dark, the fourth (above the upper radial vein) much the largest, the seventh and eighth (between the median branches) minute. Hindwing whitish costally, unmarked. *Below* uniform brown, forewing with the spots reduced, those between the median veins generally absent. Hindwing with 4-6 small inner-submarginal spots subapically, the last minute.

Sumba, coast and interior. It seems quite distinct.

SALPINX (CALLIPLŒA) SAMBAVANA, n. sp.

Above, forewing with seven large lilac spots centred with white, the second and last largest, the upper ones sometimes slightly connected, Hindwing with several lilac spots subapically. *Below* both wings with two nearly complete submarginal series of small and delicate white spots, the outer ones minute and not extending to the apex.

Sambawa, one of the numerous local forms of this group. A very distinct species, *C. hyems*, Butler, occurs in Timor.

I have noticed that both *C. sumbana* and *C. sambavana* are occasionally found with the first subcostal vein united to the costal one, showing at the same time the relations this group has with *Hestia*, and the small value of classifications based wholly in venation.

3. STICTOPLŒA MELOLO, n. sp.

Male, above rich dark brown, with blue reflections over all the forewing except the extreme outer margin; four lilac spots, sometimes centred with white, form a narrow subapical mass, the fourth well separated, generally a fifth below it, and occasionally a sixth. In the male the sex marks vary; in the specimen before me, the upper one is shorter than the lower, and only half as broad. Hindwing with two, sometimes three, subapical spots. *Below* rich brown, darker at the end of the cell and on the disc beyond it; a distinct white spot bordered with lilac at the end of the cell, and two near it in the median spaces; generally traces of a few other dots, especially subapically on the hindwing. The semicircle of spots beyond the cell of the hindwing is represented by obscure darker touches. The female is much paler.

Sumba, common; one of the numerous local forms of this genus.

4. STICTOPLŒA LACORDAIREI, Moore.

Sumba, common. The species was described from Java.

EUPLŒA (TREPŒICHROIS) DONGO, n. sp.

Male, above, forewing outwardly shining blue, basally blue-black, with two rows of pale blue submarginal spots, the outer of about eight

or nine dots, not extending above the radial veins, the inner of seven large spots placed irregularly, the first four and the last three in line, the first minute. Hindwing bronzy brown with a slight bluish lustre subapically, the velvety area extending below the upper median vein. *Below* chocolate-brown, forewing with a purple cell-spot, a costal and usually three or four minute discal spots, and one or two submarginal dots near the lower angle. Hindwing with a large paler area subapically around the subcostal branches; usually a few submarginal bluish dots. The wings are short and broad, quite unlike those of *T. midamus*.

Female with no trace of blue. Above, forewing with whitish markings, one geminate in the cell, (besides a basal pale streak there), one costal, two approximate beyond the cell, three discal, two outerdiscal spots, besides a few pale ones subapically and an interno-median pale streak. Hindwing with the white rays larger and more distinct than in *T. midamus*, the submarginal spots obscure. *Below*, all the markings are white and well-defined.

Nearest *T. mindanaensis*, Semper, from the Philippines, but the female and the underside of the male are very different.

Taken sparsely in the mountains of Sambawa, in the Donggo country.

##### 5. *EUPLEA* (*TREPSICHROIS*) *ELWESII*, n. sp. Pl. II, fig. 1.

Female, above brown without any blue reflections, a pale longitudinal streak in the cell, a small round whitish spot at its end, two similar discal spots between the median branches, a long bent pale streak in the upper part of the interno-median space, a subapical area of five large white spots, separated by veins only, from the costa to the upper median vein, the lower spot large and quadrate. Hindwing with four white streaks occupying the greater part of the cell, two good-sized elongate quadrate markings at the base of the spaces between the upper subcostal and the radial vein, small spots beyond the cell below the radial vein, and above the lower median, narrow whitish streaks in the submedian space, and two in the internal space. *Below*, there are obscure subapical dots on both wings, and a few marginal ones nearly obsolete. The white masses of the forewing and the hindwing are unchanged.

This species, the most aberrant of the genus, obviously mimics *Radena oberthurii*, a dominant species in Sumba. No male was seen, and only two females, both now in bad condition, were taken at Koloki and Mandas, Central Sumba, 2—3000 ft.

I name this butterfly after Mr. H. J. Elwes, the well-known lepidopterist and ornithologist.

## 6. • EUPLEA (RASUMA ?) LEWA, n. sp. Pl. II, fig. 2.

Male, above, forewing dark brown, the outer part paler, especially near the lower angle; a broad sericeous streak in the interno-median space, nearly half an inch long; a subapical mass of four blue-bordered white spots, with a minute one above them, the first two small, the third large and quadrate, the fourth smaller, pointed inwardly; a whitish point on the costa, another obsolescent discally in the upper median space. Hindwing unmarked, much paler than the forewing, especially outwardly. *Below*, forewing darkest on the disc and in the cell, the subapical band somewhat reduced in size, one bluish spot in the cell, one near the costa, and three on the disc, the lower one yellowish. Hindwing, with a space above the terminal part of the cell much darker than the rest, a pale band round the disc, one bluish spot in the cell, five or six dots beyond it, and eight rosy ones in an irregular line across the disc, two in each median and in the lower radial space, and one in each of the two next spaces. Expanse over three inches.

Sumba, apparently a dominant species. Like the next species it is separated from all allies by its white subapical band.

I did not find any species resembling this in Sambawa, though a species of *Penoa* occurs there having a somewhat similar sericeous band above. I took only a single male at 2000 feet. A wholly different species, *G. baudiniana*, Godart (*orope*, Boisduval), occurs in Timor, having the hindwing broadly whitish. *E. lewa* is apparently of Papuan affinities.

## 7. EUPLEA (CRASTIA OR VADEBRA) PALMEDO, n. sp. Pl. II, fig. 3.

Closely resembling the preceding species. Male, forewing dark brown above, paler outwardly; a white, rather quadrate, subapical mass diffused at the edges, broken by three slender dark veins. Hindwing nearly white above the upper subcostal vein, the rest brown, the outer discal and subanal area much paler. *Below*, the pale areas are more obvious than in *Euplea lewa*. Forewing with a bluish-white spot in the cell, and two in the disc beyond, besides traces of two streaks in the interno-median space. Hindwing with one spot in the cell, a semicircle of six minute ones beyond it, and a row of seven or eight larger ones in the yellowish discal area, all but one arranged linearly; only one or two submarginal dots visible.

Sumba, coast and interior. It is much less common than *E. lewa*, but as the *climena* group to which it belongs is in most places a dominant one, I am unwilling to believe it a mimic of that species. The species is a very distinct one.

An allied form occurs in Sambawa, with the margins broadly

whitish as in *E. climena*, and without the conspicuous subapical white band of the forewing.

EUPLEA (CRASTIA ?) DEHEERII, n. sp.

Male, above dark brown, with a slight violet gloss, the outer margin broadly paler, not glossed. Forewing with an irregular series of seven small white outer-discal spots, the first three subapical, cordate, separated by veins, the fourth and fifth beyond the line of the others, the fifth minute, the sixth and seventh in the median spaces, distinct, equal, the upper elongate; an obscure dot near the base of the upper median space. Hindwing with three good-sized white subapical inner-submarginal spots, and eight or nine obscure outer-submarginal dots, which do not reach the apex. *Below*, the cell and inner part of the disc of both wings dark brown, the rest paler, with a bronzy gloss. Forewing with a spot in the cell, one costal, four or five discal violet-white spots, seven inner-submarginal white ones arranged as above, and eight or nine outer-submarginal ones minute. Hindwing with a cell-spot, a semicircle of seven inner-discal violet-white spots, and one of nine or ten outer-discal ones, mostly white, some lilac; about twelve small submarginal white spots, larger than those on the forewing.

Like my *Euploea oceanis* from Engano, this species has a large, somewhat velvety, pale brown patch on the underside of the forewing. This lies along the internal vein for more than half its length, about three quarters of it lying above that vein. At the base of this there is an obscure whitish patch, chiefly below the internal vein, while parallel with it is an obscure longitudinal sericeous streak placed below the lower median vein. The hindwing is whitish apically and costally, with a pale brown area surrounding the subcostal veins, entering the cell and the space below the costal vein, extending narrowly along the subcostal veins three-quarters towards the margin.

The species perhaps belongs to Mr. Moore's genus *Gamatoba*. I took it in the mountains of Sambawa, and name it in honour of my friend Heer A. C. de Heer, Controleur of Bima.

Another species from Sambawa, belonged, I think, to the subgenus *Tronga*, making ten *Eupleas* in all from that island, some very rare. Only six were taken in Sumba. At a favourable season, I believe Sumba will yield a far larger number of species than I obtained there.

8. DANAIS (LIMNAS) CHRYSIPPUS, Linn.

Sumba, Sambawa. Somewhat intermediate between typical *chrysippus* and *D. bataviana*; colour bright red as in *chrysippus*, the white

spot at the end of the cell absent, the black border of the hindwing broader than in Indian specimens, and inwardly diffused.

9. DANAIIS (SALATURA) GENUTIA, Cramer.

Sumba, Sambawa. My Sumba specimens are somewhat intermediate between *genutia* and the Javanese *D. intensa*. There is only one submarginal line of spots on the hindwing above, the small subapical spots are nearly obsolete on the forewing above, and below, the red area in the upper median space is present or absent. The general colour is not so dark as in *intensa* and the species larger.

10. DANAIIS (SALATURA) LITORALIS, n. sp. Pl. II, fig. 4, *underside*.

Male, above black, a narrow pale ferruginous band in the cell, a much larger one occupying most of the interno-median space, and another in the lower median space, extending much further outwardly, slightly irrorated with white scales in the middle; a narrow oblique white subapical macular band from the costa, the spot above the upper median vein much beyond the line of those above it; one below it, large; three costal marks, a dot beyond the end of the cell, five marginal and three submarginal spots in the median spaces, one apical and one at the lower angle, all white. Hindwing black, a broad quadrate white band across the disc, and the end of the cell as far as the lower subcostal vein, scarcely reaching the submedian scent-gland, continued outwardly by obscure ferruginous rays, the veins there widely black, an outer row of submarginal white spots, with two inner ones subapically. *Below*, forewing with the ferruginous cell-striga obsolescent, two rows of minute submarginal spots subapically. Hindwing with two complete rows of submarginal white spots, and a few costal ones, including one basally along the lower side of the costal vein, the white area more broken, its discal spots outwardly incised, the cell-spot occupying two-fifths of the cell; most of the disc, including the base of the cell and the costal and subcostal spaces, ferruginous, edged with black; the veins all dark, the submedian and internal veins black bordered with white for most of their length; the outer black border glossed with chocolate-brown.

Nearest *Danaïis abigar (chionippe)* from the Philippines, figured by Mr. Distant from Province Wellesley, Malay Peninsula, though that locality seems to me rather dubious. It differs in the smaller ferruginous area on the forewing and smaller white area on the hindwing. From *D. fulgurata, affinis, aruana*, etc., it differs in the absence of white in the interno-median space of the forewing.

Sumba, scarce. An apparently identical form is common on the dry coast of Sambawa.

In the figure the forewing has been drawn much too short.

DANAIS (NASUMA) HARUHASA, n. sp.

Male, forewing extremely long and falcate, deep fuscous above; a long obscure reddish streak extends along the lower part of the cell, another more distinct, lighter in colour, and enlarged outwardly, in the interno-median space; a third, obscure, between the lower median veins; a small round discal whitish spot in each of the spaces below the upper radial vein, the second a little nearer the base than the others are; two small whitish spots, one on each side of the lower radial vein, are sometimes present (especially in the female) just beyond the cell. Hindwing with discal streak of pale brown, slender and rather obscure, a larger one in the cell: two rows of white submarginal spots, the outer subanal only, minute, the inner obsolescent near the median veins. *Below* dark brown, the apex of the forewing rufous, the pale reddish markings of the forewing somewhat larger, those of the hindwing larger and dull leaden-white in colour, reddish only at their truncate tips, the submarginal series complete and nearly equal. Forewing with the whitish discal spots larger, those just beyond the cell distinct. An additional white spot is present near the apex, and a row of outer-submarginal dots increasing towards the lower angle, an inner-submarginal series confined to the apex. In the female three or four of the outer-submarginal dots are sometimes visible above. In the male the sex-mark is somewhat less prominent than in *D. genutia*.

Sambawa, 1000—2500 feet, scarce. When on the wing it somewhat resembles an undescribed *Euploea* found there.

Nearest *Danais ismare* from the Moluccas, but having the markings of the upperside reddish instead of white, and much reduced in size and number.

11. DANAIS (NASUMA) TAIMANU, n. sp.

Female. It obviously differs from the preceding species in the presence of a broad quadrate white discal band on the forewing, between the first subcostal and the upper median vein, in six pieces separated only by slender dark veins; below this there is one or sometimes two very small white spots. The submarginal spots are all obsolescent except one or two at the apex of the hindwing. The basal marks on the forewing are very indistinct, and merely paler not reddish, that in the cell absent. The discal marks on the hindwing are wholly undefined, resembling a large pale area, broken by dark veins. *Below*, there are generally one or two dots beyond the end of the cell, and also a few minute ones at the apex, one between the lower subcostal veins

more distinct, more or less bifid. The hindwing has the leaden-whitish markings rather broader than in *D. haruhasa*, but those in the median spaces are much shorter, leaving the dark outer border very wide there. The submarginal dots are in one specimen wholly absent, in the other partly present, but very small.

The male is unknown. I took one female at Lateng (1000 feet) in Taimanu, Sumba, and another at Mandas, Sumba. I fear that both are now lost. When flying it somewhat resembles *Euploea lewa*, and no doubt its mimicry of that species accounts for the presence of the broad white band, absent in *D. haruhasa* and *D. ismare*.

The subgenus *Nasuma*, as far as known, inhabits only the Moluccas, Sumba, and Sambawa, but no doubt a species will be found in Timor, while none is known from Java. It is distinguished by its elongate wings, and, at least in the two species described here, the flight is swifter than in *Danais genutia*, etc. It seems likely that these insects have lost some of the protective qualities of their allies, and have acquired a swifter flight and become mimics of other butterflies, the Moluccan form resembling a *Radena*, while the Sumba and Sambawa species look like *Euploeas* when flying.

12. DANAIIS (TIRUMALA) LIMNIACE, Cram.

13. DANAIIS (TIRUMALA) MELISSA, Cram.

Following Herr Semper's instructions, I easily separated these two species, which are extremely alike in general appearance. The *melissa*-form somewhat resembled the figure of *D. australis*, Hombroun and Jacquinet. I also recorded a form of *D. gautama* in Sumba, but no specimens have turned up. *D. limniace* and *melissa* are both common in Sumba and Sambawa.

14. DANAIIS (CHITTIRA) ORIENTIS, n. sp. Pl. II, fig. 5.

Near *D. nilgiriensis*. Cell-mark of forewing with all three rays distinct, though slender, in the females, the upper two obsolescent in the male, the interno-median marks broadly divided, the mark at the base of the lower median space wanting (present in *nilgiriensis*), that in the upper median space small and diffused (large and conspicuous in allied species), the streak above the radial vein much longer than the one above it (as in *D. larissa*), five or six submarginal dots. Hindwing with the cell-spot broad in the middle (narrow in *nilgiriensis*), divided longitudinally by a slender dark line (absent in *D. larissa* and *luzonensis*), a line of six outer-discal spots in the male, nine or ten in the female, the submarginal line of spots incomplete. *Below*, both lines of spots are complete.

Pada Dalung, Central Sumba: a very dull-coloured species. It appears to belong to Mr. Moore's newly-described genus *Badacara*, along with *B. nilgiriensis*.

A single male from Sambawa agrees in the main with those from Sumba. But the whitish markings are better defined and more transparent, the outer submarginal spots of the forewing extend on the underside to the apex, the elongate discal streak between the radial veins is shorter, and all the discal and submarginal marks of the hindwing are somewhat larger and more distinct. The specimen is not now in my possession, and I am unable to compare it with *D. larissa*.

15. *RADENA OBERTHURII*, n. sp. Pl. II. fig. 6.

Male, above dark brown, the markings yellowish, somewhat translucent; a pale streak along the costal vein, the tip clavate and more distinct; the basal cell-streak bifid, its upper ray very slender, short; terminal cell-spot narrow, obliquely transverse; interno-median space with two strong white bands scarcely convergent, a broad dark space between them; a large, elongate spot in the lower median space; a broad obliquely-transverse discal band of four large white spots separated by veins, one on the costa somewhat apart from the others, the fourth largest, ovate, the third incised outwardly; another small spot beyond these on the costa, and six small inner-submarginal spots, the upper three in a line across the apex, the others small, transverse, between the upper median and internal veins; no outer-submarginal spots are present. Hindwing paler brown than the forewing, the cell all white, a large spot in each space beyond it, making, besides the long submedian streaks, four in all, the second (above the upper median vein) incised outwardly, and projecting beyond the others, the first and fourth elongate, the third small, triangular; a line of about nine inner-submarginal dots, placed rather irregularly. *Below*, similar, five or six obscure outer-submarginal dots on the hindwing only. The tufts are long, as in *R. juvena*.

Nearest *Radena purpurata*, Butler, from New Guinea, from which it obviously differs in the two interno-median streaks, and the broad oblique discal band on the forewing.

I name this fine species in honour of the distinguished entomologist, M. Charles Oberthür, of Rennes. It is a dominant species in Sumba, occurring both on the coast and inland, and seems to be the most western representative of the Papuan group to which it belongs.

16. *RADENA KAMBERA*, n. sp. Pl. II. fig. 7.

Allied to *R. juvena*, from Java. The wings are shorter, and

most of the white markings larger. The basal cell-streak is short and dusky, the outer one large, upright, the upper part projecting like the lower, a slender streak above it. The two series of subapical streaks of *juventa* are in *kambera* united into three very long white strigæ, that between the radial veins being nearly half an inch in length; all are incised outwardly; the inner-submarginal spots are large. Hindwing with the dark streak in the cell-spot continued to the end of the cell, slightly forked in the middle. *Below*, the light markings are not yellowish and greenish as in *R. juventa*, but pure white with a slight lilac gloss.

A very distinct species, not very common in Sumba.

In Sambawa there are two species of *Radena*, both I think distinct local forms. One, which appears to be the representative of *R. vulgaris*, is common everywhere; the other is very close to the Javanese *R. juventa*, and is confined to the higher country, though I have taken it as low as 1500 feet. I have now no specimens of either species, and am unable to compare them with their allies.

#### Family SATYRIDÆ.

##### 17. LETHE EUROPA, Fab.

A female, Sumba, 2000 feet; another, Sambawa, 4000 feet, both resembling Java specimens.

##### 18. MYCALESIS (ORSOTRIENA) MEDUS, Fab.

Sumba, Sambawa, common in meadows.

##### 19. MYCALESIS (CALYSISME) PERSEUS, Fab.

The wet-season, ocellate brood prevailed in Sumba till the middle of March, when the non-ocellate form (*blasius*) took their place. In Sambawa, the latter brood had already begun to appear in the middle of April, but a long succession of heavy rains exterminated them, and the ocellate form reappeared and continued in exclusive possession till the latter part of May.

##### 20. MYCALESIS (JATANA) WAYEWA, n. sp.

Female, above dark brown, a small ocellus on the forewing between the lower median branches. Hindwing outwardly whitish, gradually darkening inwardly, with two submarginal dark lines, a small ocellus between the lower median branches. *Below*, dark brown, slightly rufous, not perceptibly striate; a median transverse whitish line, angled at the upper median and above the submedian vein; beyond this the wing is much paler, with a rather small ocellus above the upper radial

vein, a large one above and a small one below the lower median vein; a marginal line and two wavy, dark submarginal ones. Hindwing with the outer half whitish, the dark area very sharply outlined, projecting outwardly above the upper median vein; seven ocelli nearly in line, the first, fourth, and fifth large, subequal, the second and seventh minute; beyond this are two wavy submarginal and marginal dark lines.

The male is darker and more uniform, the ocelli less marked, with a golden-brown sex-mark (as in *M. mineus*) on the submedian vein of the forewing, and a large subcostal ochreous tuft, the subcostal vein and its upper branch, slightly swollen around its bifurcation. The prehensors and sex-marks agree with those of *Calysisme* and so does its venation, except in the point mentioned.

This species occurs both in Sumba and in Sambawa, confined in both to the higher and damper regions. It is apparently the local representative of *Mycalesis mynois*, Hewitson from Timor, but lacks the conspicuous white band of that species. I also suspect it to be the local representative of *M. mineus*, but without a more elaborate study of the prehensors I cannot well prove it. *Mycalesis mynois* is the type of Mr. Moore's genus *Jatana*, the *raison d'être* of which I have not been able to discover.

## 21. YPHTHIMA ASTEROPE, Klug.

Sumba only, found in the driest plains. It is worth remarking that this species has prehensors precisely like those of *Y. pandocus*, the size and habits of which are so different, while the markings are nearly identical.

## 22. YPHTHIMA LEUCE, n. sp.

A local form of *Y. philomela*. The forewing has a large, conspicuous, whitish sex-mark, and an ocellus as in *philomela*; the hindwing has the cilia white, and the outer and abdominal region grey, with two large blue-pupilled ocelli and two minute anal ones. *Below*; the striæ are very irregular; the forewing has a whitish discal band partly inclosing the large ocellus, and extending to the hind-margin; there is a submarginal dark band, the apex and costa are dark. Hindwing chiefly white, the disc being free from striæ over a considerable area, and elsewhere they are very delicate and irregular, forming an obscure transverse fascia, crossing the cell near its end, and a continuous, slender submarginal line. The six ocelli are in pairs, as in *Y. philomela* or *sepyra*, all black, pupilled with blue, and with large ochreous irides.

This species is found in Sumba and Sambawa. It may also be allied to *Y. aphnius* (Timor) of which only the dry-season form is known.

In that case it bears much the same relationship to *aphnius* as *Mycalasis wayewa* does to the Timorese *M. mynois*, the orange band of the hindwing of *T. aphnius* being absent.

Mr. de Nicéville has shown me that the true *Ypthima philomela* of Johanssen has no sex-mark. Since that is the case, the Indian form will stand, I suppose, as *Y. baldus*.

23. MELANITIS CONSTANTIA, Cram.

Sumba, Sambawa, not uncommon on the dry coast. A Sumba female before me has the ochreous band narrow and irregular, almost attaining the costa and the lower angle, its outer border undefined, with three obscure ocelli (the first chiefly white, the last nearly all dark), the outer border with three indentations, and projecting acutely inwardly along the lower median vein. Hindwing with two ocelli, the apical border narrowly ochreous. *Below*, the ocelli are rather small, the aspect that of *M. leda*, the wet-season form.

24. MELANITIS LEDA, Linnæus.

The dry-season brood (*ismene*) appeared in Sumba in the middle of March, in Sambawa in the middle of May; till that date the ocellate brood held the field.

Family ELYMNIADÆ.

ELYMNIA UNDULARIS, Drury.

Sambawa, low country, not differing from Java specimens. No *Elymnias* is known from Sumba or Timor.

Family MORPHIDÆ.

A *Discophora (timora)*, Wallace has been found in Timor, but I saw none of the family either in Sumba or Sambawa.

Family BYBLIADÆ.

25. ERGOLIS ARIADNE, Linn.

Sumba, Sambawa, not differing from the Indian form, hardly so small and dark as the Javanese. I believe *E. merione* also occurs in Sambawa.

Family APATURIDÆ.

26. CYNTHIA DEIONE, Erich.

A single male, Sumba, interior. Common in Sambawa, where the females vary to a remarkable extent, some being as red as the male,

while others are dark green insects like *parthenos*. Intermediate forms are common.

27. *CETHOSIA PENTHESILEA*, Cram.

Sumba and Sambawa, common, even on the coast. A single female taken in the interior of Sumba was very large and richly coloured, resembling the female of the Javanese *C. hypsea*, Doub., but I am not sure that it was distinct from *C. penthesilea*.

*CETHOSIA TAMBORA*, n. sp.

Black, the usual wavy submarginal lines absent on both wings. Forewing with an irregular ochreous subapical band of six marks, the first two slender, minute, the third elongate-quadrangle, the fourth very small, triangular, the fifth long and narrow, the sixth large, triangular, paler; a dull reddish area on the hind margin and basally in the intermedian space, two or three reddish touchés basally in the cell. Hindwing, basal half red, a small dark spot discally between the costal and the subcostal veins, and one between the subcostal branches. *Below*, all blue-black and ochreous-white, except a reddish area on the hind margin of the forewing.

The description, which is apparently that of a female, is a poor one, but I believe several specimens of both sexes are in Mr. Neumoen's possession. It is very unlike any known species.

Sambawa, mountains, scarce. I have named it after the great Sambawan volcano, celebrated for its eruption in 1815.

I have dubiously recorded a similar species in Sumba, not taken, the underside more variegated.

Two very beautiful species, *C. lamarckii* and *leschenaultii*, were taken by Mr. Wallace in Timor, but neither seem to extend further westwards.

28. *CUPHA ERYMANTHIS*, Drury.

Sumba, Sambawa, normal. No *Cirrhochroa* was seen in either island, nor has any been recorded from Timor.

29. *ATELLA PHALANTA*, Drury.

Sumba, Sambawa. Sumba specimens are richly marked with purple below.

30. *ATELLA SINHA*, Kollar.

Sumba, Sambawa, normal.

31. *CYRESTIS NAIS*, Wallace.

Two tattered specimens from Pada Dalung in Sumba seem to be

almost precisely intermediate between *C. nivea* and *C. thyodamas*. To indicate their affinities would require a long description. They seem near Mr. Wallace's *C. nais* from Timor, but without better specimens I cannot be sure of their position.

SYMBRENTHIA HIPPOCLUS,\* Cram.

Sambawa, none taken.

32. PYRAMEIS CARDUI, Linn.

Dry meadows, Sumba.

33. JUNONIA ATLITES, Joh.

Sumba, Sambawa.

34. JUNONIA ASTERIE, Linn. var., SUMBÆ.

Above, the subapical ocellus is indistinct, merged in the black band from the costa; the lower ocellus is large and set in a black patch. On the hindwing the lower ocellus is much larger than in Indian specimens of *asterie*, and is marked like the upper one. *Below*, the forewing has only two ocelli, the upper pair on the hindwing are more perfectly merged into one, the black transverse lines are replaced by diffused pale reddish ones; the hindwing has three pale bands across it.

Sumba, Sambawa, common. It is merely an extreme form of the Java variety (*J. javana*, Felder), which connects it with the typical Indian one, differing chiefly on the underside.

The non-ocellate form, *J. almana*, probably conspecific with *asterie*, was not taken.

35. JUNONIA VELLIDA, Fab.

The upperside agrees with Godart's description. The underside is rather brilliantly marked with black or fuscous wavy lines on a pale grey ground, a reddish submarginal band, the hindwing with five ocelli, of which only the second and fifth are distinct, pupilled with bluish.

This pretty little species occurred only on the desert plains of Sumba, and seemed to be rare.

36. JUNONIA AONIS, Linn.

The markings of the forewing are rather fuscous than fulvous except the ocelli, of which only two are distinct, the lower small and attached to the upper. On the hindwing the second of the five ocelli

\* In Eastern Java I found that the female of this butterfly was dimorphic, one form having the yellow spots replaced by white ones, so that it resembled a white *Neptis* instead of a yellow one. No intermediate forms were seen.

is larger than the others. Otherwise the specimens agree with Godart's description. In the female there are distinct reddish-bordered ocelli on the forewing, and the sordid spots are larger. The underside is sometimes reddish, as is often the case with the female of *J. lemonias*. There seem to be two perfectly distinct seasonal forms, that of the dry-season resembling a dead leaf below.

Sumba, Sambawa, those from the latter island not examined. The species is certainly very close to the Javanese *J. erigone*.

37. JUNONIA TIMORENSIS, Wallace.

In the male there is no distinctly rufous area except a submarginal band on both wings, evanescent apically on the forewing. In some females nearly the whole upper surface is more or less rufous, outwardly brighter, a dark area over the apex and disc of the forewing, the subapical spots united, a small distinct ocellus (obscure in the male) between the lower median branches. *Below*, the male is dark with the ocelli distinct, while the above-mentioned females are glossed with silvery-grey scales over both wings, obscuring the subapical band and the ocelli, the median transverse line distinct, angled at the upper median vein. These females evidently belong to the dry-season brood, just appearing at the time I left Sumba, and resembling the other form much as *J. almana* resembles *asterie*. I have not observed any male of this brood.

Sumba. This very distinct species, as Mr. Wallace justly calls it, was previously known only from Timor,

38. JUNONIA ORITHYIA, Linn.

Sumba, Sambawa.

39. PRECIS IDA, Cram.

Sumba, Sambawa.

40. PRECIS IPHITA, Cram.

Sumba, Sambawa.

41. YOMA SABINA, Cram.

Sumba, Sambawa, low country.

I see that Doubleday, followed by M. Oberthür and Dr. Semper, places this species in the very heterogeneous African genus *Salamis*, the type of which somewhat resembles a *Doleschallia*. The only species of *Salamis* at all like *Yoma* are *S. anacardiæ* and *anteva*, forming Wallengren's genus *Protogoniomorpha*, a name which ought to be barred on account of its enormous length. But in these species the cell of the

hindwing terminates opposite the second forking of the median vein, in Yoma at some distance before it. The relations of homologous genera in different zoological regions are as yet very little known, and will no doubt greatly exercise the minds of naturalists in the next century. But for the present I think my genus *Yoma* may be allowed to stand.

42. *HYPOLIMNAS MISIPPUS*, Linn.

Sumba, Sambawa. The female mimics *Danais chrysippus* as usual.

43. *HYPOLIMNAS BOLINA*, Linn.

Sumba, Sambawa. The female sometimes has a red area near the hind margin of the forewing and over the disc of the hindwing.

44. *HYPOLIMNAS SAUNDERSII*, Wallace, (P).

Several broken specimens of what appeared to be a dwarf form of *H. pandarus* were taken in Sumba, but none have survived.

*HYPOLIMNAS ANOMALA*, Wallace.

One male, taken in the mountains of Sambawa. I am unable to say whether it was identical with Javanese specimens or not.

45. *DOLESCHALLIA* sp.

At least one species occurs in the dry coast region of Sumba, but no specimen was taken.

46. *HELICYRA CHIONIPPE*, Felder.

Several specimens seen at Pada Dalung in Sumba, but none taken.

47. *CHARAXES ATHAMAS*, Drury.

Sumba, Sambawa.

48. *CHARAXES* sp.

A very large *Charaxes* apparently of the *eudamippus* group was several times seen in the mountains of Sumba, and again in those of Sambawa. Unlike *C. eudamippus*, which is a ground butterfly, it always alighted high up on trees, so that I could never catch it. Another species, something like *C. pyrrius*, was once seen in Sumba.

Family NYMPHALIDÆ.

49. *PHÆDYMA COLUMELLA*, Cr.

Sumba, Sambawa. The upper band of the hindwing above is much broader than in Indian specimens.

50. NEPTIS HORDONIA, Stoll.

Sumba, Sambawa. The yellow markings above are all much smaller than in Indian specimens.

51. NEPTIS NANDINA, var. SUMBA.

This form greatly resembles the Javanese *N. leucothoë*, a near ally of the Indian *N. varmona*, but the triangular white spot beyond the cell is narrow and elongate, sometimes extending on the underside two-thirds towards the margin. The subapical white band is somewhat less massive, and the four large discal spots are separated by veins, the first elongate, as large as any of the others. The upper band of the hindwing is narrower, the submarginal lines remoter from the margin. The general colour of the underside is dark red, the white bands very slightly outlined with dark. Though the markings resemble those of *N. leucothoë*, the species is probably more allied to *N. nandina*. From this it may easily be distinguished by the brilliant white markings of the upperside. The discal spots are large, that between the upper two median veins large and elongate, the cell-streak is well separated from the triangular spot beyond the cell. The upper band of the hindwing is narrower, especially apically.

Sumba; a somewhat different form occurs in Sambawa, which I am now unable to examine. I did not observe any representative of the *varmona* group in Sumba.

52. ATHYMA PERIUS, Linn.

Sumba, Sambawa. As in India it generally occurs in open meadows, unlike all its allies.

53. ATHYMA KARITA, n. sp.

Male, above deep brown, variegated with darker areas, forewing with an outer-submarginal pale line, and an inner-submarginal series of slender obsolescent greenish streaks. An oblique subapical band of three greenish-yellow spots, the second largest, adjacent to the first, the third as large as the first, round, separate; cell unmarked; a broad discal macular band from the hind-margin to the second median vein, with a small triangular spot above it, that between the two lower median veins rounded-quadrate, as large as the one below it, separated from it only by a vein, and projecting beyond it. Hindwing with two greenish-yellow bands, the upper unbroken, very wide on the costa, extending to the submedian vein, where it tapers to a point; the lower band composed of six transverse spots cut by dark veins, their lower edges incised, the outer ones slender, lunular. *Below* the markings are similar, but whiter and more united, placed on a dull brown ground, a

darker chocolate area discally on the forewing, a row of obscure darker submarginal spots on the forewing, and discally on the hindwing; the abdominal margin of the hindwing is broadly suffused with bluish.

Sumba, a single male taken by the river Waibaku near Pada Dalung, at 1,500 feet. The species seems intermediate between *A. venilia* and *A. amhara*.

#### ATHYMA NEFTE, Cram.

One male taken near Ndindi, Sambawa, at 3000 feet elevation. It is one of the apparently numerous Indo-Malayan species inhabiting the mountainous interior of this island.

#### 54. LIMENITIS\* PROCRIS, Cram.

Sumba, Sambawa.

\* I append the description of a very rare species from Perak, Malay Peninsula, allied to *L. daraxa*.

#### LIMENITIS AGNEYA, n. sp.

Male. Above very deep fuscous, a pea-green band across both wings. Base of forewing somewhat paler, with obliquely transverse darker markings in and below the cell: a submarginal pale line, an outer-discal row of six dark spots set in square paler spaces. The green band extends from the hind margin to the upper median vein in four spots separated by dark veins only, the upper spot a little out of line and smaller. Beyond these a line of three smaller spots runs to meet them obliquely, placed at right angles with the costa, extending from the upper median to the subcostal, the upper smaller than the others and whitish, placed above the inner half of the middle and largest one. More than halfway between these and the apex are two other spots also placed at right angles with the costa, and between the third and fifth subcostal veins, the lower small, greenish, the upper very small, whitish. On the *hindwing* the green band extends from the costa, where it is widest, to the submedian vein, tapering to a point. Its inner margin is convex, its outer straight; it is whitish at both ends and cut by slender black veins. The submarginal pale line and the outer-discal line of spots are much as on the forewing; cilia white, dark at the ends of the veins. *Below* light chestnut-brown, the band as above, but paler green and not cut by dark veins, the basal marks on both wings outlined with lilac, the outer-discal line of spots set in lilac areas, the submarginal line lilac, some darker red discal markings beyond the green band.

Obviously differs from *Limenitis daraxa* in the bifid green band of the forewing; agrees with it in the closed cells of both wings, which make the positions of the species in this genus rather dubious. My single male of *agneya* was taken on Larnt Hill, Perak, at about two thousand feet elevation. *L. daraxa*, not apparently differing in any respect from the Himalayan form, was not uncommon at the summit of the same hill, nearly three thousand feet higher.

Prehensors, seen from the side. In *agneya* the uncus is long, sinuous, hooked at the tip, without branches, the clasp simple, straight, tapering gradually to the

## LIMENITIS HOLLANDII, n. sp.

Male, above, black; cilia alternately black and white, a double undulating submarginal pale line, touched with whitish apically on the forewing; two united white spots placed obliquely subapically above the radial veins, with or without a smaller one below them. A broad common white band, very slenderly cut by dark veins, edged outwardly with purple, across both wings, extending on the forewing nearly to the upper median vein, the upper (fourth) piece small, the inner edge of the band straight, the outer irregular. Hindwing with the white band extending to the submedian vein, where it is tapering, both its edges nearly straight. *Below* chestnut-red of two different shades, the basal two-thirds of the cell mostly white, with a crooked dark mark, an irregular white spot at the end of the cell, its lower side tapering; the white band extends nearly to the lower radial vein; two submarginal pale lines, the inner mostly bluish-white with three white subapical spots; a chestnut longitudinal streak in the internomedian space. Hindwing with the two submarginal lines regular, grey, undulating, base chiefly white with transverse streaks of chestnut, namely, two in the cell, two between the costal and the first subcostal vein, one along the precostal vein; and a long one from the costa tapering to the submedian vein; the white band broad. It is rather a small species.

Several males taken in the Do Donggo country, Sambawa, all above 2000 feet. The species is nearest *L. lysanias* from the Celebes, but is without the rufous bands which that species has on the upperside.

I name the butterfly in honour of the Rev. W. J. Holland, of Pittsburgh, U. S. A., well-known as a lepidopterist.

## 55. SYMPHÆDRA ÆGLE, n. sp.

Male, above black, with some obscure ochreous-greenish spots near the costa, and three in the cell (two at the end), two in the internomedian space, one basal, the other further out, geminate; a row of five white subapical spots in a semicircle above the middle median vein, the second largest, then the first, the third diffused; also a macular submarginal band of dull bluish-whitish spots (the lower two sagittate) extending from the hind margin nearly to the apex, separated by dull

tip. In *L. populi* the tip is abruptly bent downwards. In *daraxa* the tip is blunter than in *agneya*, and there is a long process arising from its upper edge, longitudinal and slightly ascending, set with denticles on both sides. The *necus* is also shorter. The *lower uncus*, absent in most butterflies, is well developed in this genus, strongly hooked at the tip, its point opposed to that of the true or upper uncus, which can be brought into contact with it by muscular action.

bluish-green spaces. Hindwing with a broad bluish-green band from the abdominal margin (where it is whitish) to the costal vein (where it is blue), consisting of spots twice as long as wide, separated by black veins, their inner border diffused, the outer pointed, enclosing a large oval or cordate black spot, slenderly surrounded with blue. *Below*, forewing nearly black, slightly olivaceous apically, the markings white, more or less tinged with greenish or ochreous, arranged in two series, a submarginal one of five or six spots, and a discal one of seven, of which the third is evanescent, the fifth and sixth obliquely elongate, the seventh geminate and purplish; there are also spots on the inner disc, between the median veins and above each radial; cell crossed by two bluish-white bands, one in the middle, one at the end, with several additional spots at the base. Hindwing purplish-brown with a slight bronzy lustre; a submarginal band of dark spots in paler spaces; an irregular discal series of pale spots, three spots in the cell. Eyes dark, proboscis scarlet.

The colour of the underside, the narrow and dull blue band, and the numerous spots on the upperside distinguish it from *S. dirtea*.

A male, Pada Dalung, a female, Mandas, both in Sumba. I have no description of the female.

An *Euthalia*, dark like *E. garuda*, seems also to inhabit Sumba, but none were taken.

#### Family LIBYTHEIDÆ.

##### 56. LIBYTHEA GEOFFROYI, Godart.

Two males, interior of Sumba. The blue of the forewing almost obliterates the subapical spots, which are barely traceable above; the luteous band of the hindwing is very obscure.

##### 57. LIBYTHEA NARINA, Godart.

One female, interior of Sambawa, another seen in Sumba, not taken. The Sambawan specimen agreed well with Moluccan examples; The Philippine form has the white band of the hindwing reduced, while the Assam variety (*L. rohini*, Marshall), has it enlarged.

#### Family NEMEOBIADÆ.

##### ZEMEROS PHEGYAS, Cram.

Sambawa, scarce. No species of this family was observed in Sumba.

Family LYCÆNIDÆ.

Subfamily THECLINÆ.

58. ARHOPALA ARAXES, Feld.

Sumba, coast. A local Celebesian form of *A. amantes*, but apparently distinct.

FLOS APIDANUS, Hew., var.

Sambawa, 3000 feet.

SURENDRA QUERCETORUM, Moore.

Sambawa, coast.

Subfamily APHNÆINÆ.

IRAOTA TIMOLEON, Stoll.

Sambawa. I am almost inclined to think this species a mimic of the white species of *Neptis*; the resemblance is sometimes quite striking, and at any rate the *varmona* group of *Neptis* is partially protected.

59. CURETIS MALAYICA, Feld., var. KIRITANA.

Male black, the red area scarcely extending above the middle median vein, the hind margin dark. Hindwing with the end of the cell and the disc from the subcostal vein to about the lower median, red or reddish, the abdominal and costal margins very widely, the outer margin more narrowly black.

Sumba, Sambawa, scarce. This is, I think, the darkest *Curetis* known, Dr. Felder's *C. obscura*, described as a male, being really a female.

60. HYPOLYCÆNA SIPYLUS, Feld.

Sumba, Sambawa. This is near Dr. Felder's *H. thecloides*, but the lower part of the hindwing above is bluish, not ochreous.

61. LOXURA ATYMNUS, Linn.

Sumba, Sambawa. Two or three more species of the *Aphnæince* were taken in Sumba, but the specimens are now lost.

Subfamily DEUDORIGINÆ.

62. RAPALA IARBAS, Fab.

Sumba, Sambawa, mountains.

RAPALA ORSEIS, Hew.

Sambawa, 1,500 ft., a male and a female.

63. *RAPALA VARUNA*, Horsf.

Sumba, Sambawa, mountains. I also observed a species of *Sinthusa*\* in Sambawa, but no specimens were taken.

Subfamily *LYCÆNINÆ*.

*CYANIRIS AKASA*, Horsf.

Sambawa, 4-5000 feet, rare.

64. *CYANIRIS PUSPA*, Horsf.

Sumba, Sambawa, mountains. The white area is larger than in Indian specimens, extending over three or four spaces and into the cell. The female has the white areas very large and not marked with blue.

65. *ZIZERA PYGMÆA*, Snellen.

Sumba, Sambawa.

66. *ZIZERA LYSIZONE*, Snellen.

Sumba, Sambawa. Another *Zizera* occurred in Sumba.

\* I append the description of a rare Javanese species of this genus.

*SINTHUSA ASPRA*, n. sp.

Male, above, forewing with the costa and the outer margin narrowly black, the base as far as the end of the cell, and more especially the basal half of the internodial space to the hind margin, light violet-blue; a diffused submarginal macular band of the same colour; the disc and the outer half of the hind-margin black, deep blue in some lights, with a few scattered light-blue scales. Hindwing violet-blue, (much richer than on the forewing) from the lower subcostal to the submedian vein; above the lower subcostal vein a line of pale blue scales; the abdominal border widely silvery-whitish. *Below*, white, the spots chiefly very small, black, not annular as in all the allied species; a broad dark fascia across the end of the cell of the forewing; six discal spots, the upper three small, in an oblique line, the lower three larger, in a transverse line nearer the base; a slender marginal dark line, cilia dark. Hindwing with the cell-fascia double; eight discal spots, the fifth evanescent and nearer the base, the eighth elongate and conspicuous; a large black spot in the lower median space; in the next a blue area adjoining the black lobe; beyond this a short black and blue marginal line; tail chiefly black. The prehensors resemble those of *Deudoria*.

The hindwing is angled at the end of the middle median vein; there is a short tail and a very small but distinct lobe. The venation and sex-marks are as in other species of *Sinthusa*. The species has no near allies.

Rare on Arjuno, Eastern Java, taken at 5000 feet in a flock of *Cyaniris akasa* from which it was indistinguishable when settled. The genus is usually mimetic. *S. nasaka*, Moore, strongly resembles *Hypolycaena erylus*, and I have several times mistaken *S. virgo*, Elwes, for a *Cyaniris*.

I have given Mr. de Nicéville the type of this species. The specific name means *white* in modern Greek.

67. POLYOMMATUS BÆTICUS, Linn.  
Sumba, Sambawa, high country.

68. CHILADES TROCHILUS, Freyer (*putli*).  
Sumba, Sambawa.

69. EVERES PARRHASIUS, Fab.  
Sumba, Sambawa.

70. TARUCUS THEOPHRASTUS, Fab.  
Sumba.

71. TARUCUS PLINIUS, Fab.  
Sumba, Sambawa.

72. CASTALIUS ETHION, Doub.  
Sumba, Sambawa.

73. CASTALIUS ROSIMON, Fab.  
Sumba, Sambawa.

74. CASTALIUS ROXUS, Godt.  
Sumba, Sambawa.

75. CATOCHRYSOPS CNEIUS, Fab.  
Sumba.

76. CATOCHRYSOPS PANDAVA, Fab.  
Sumba.

77. CATOCHRYSOPS STRABO, Fab.  
Sumba, Sambawa.

78. NACADUBA GAURA, n. sp. Pl. II, fig. 8, *magnified two diameters.*

Male, above, pale violet, a narrow black border widening apically, the veins brown. Hindwing with a row of six black spots in whitish rings, a marginal dark line, cilia chiefly white. *Below* pale brown, heavily marked with white. Forewing with a serrate, catenulated line of dark spots, surmounted by a row of lunules outwardly whitish, inwardly dark; three transverse quadrate dark bands, paler in the middle, and bordered with white, namely, two in the cell, the basal one continued into the interno-median space, and a broader one across the

wing discally to the submedian vein, slightly dislocated inwardly at the upper median vein, below which it is narrow and broken. Hindwing with a row of serrate ocelli as on the forewing, a very large black ocellus in the lower median space, slenderly edged with dark orange, and then a darker ring; a black anal spot; the three transverse bands much broken, the discal one forming two dark quadrate areas, the upper from the costa to the lower subcostal vein, the lower lying further out, extending thence to the upper median vein; the disc is chiefly white.

This curious species\* is something like Dr. Felder's *Lycena palmyra* from Amboina. The venation places it in *Nacaduba*, but it has little resemblance to the usual forms of the genus, and looks more like a *Catochrysops*.

Sumba, rare.

79. *NACADUBA LAURA*, n. sp., Pl. II, fig. 9, ♀, *magnified two diameters.*

Female, above, forewing about three-fifths dark brown; a large white area, sprinkled, especially at the base, with blue scales, extending from the cell to the hind-margin. Hindwing with the cell and the two spaces beyond it discally white, the rest of the disc paler brown; two submarginal rows of black spots, the outer round, the inner lunular. *Below*, forewing with a large white area occupying the end of the cell and the disc to the hind-margin; a basal transverse dark band across the cell and the interno-median space; the discal transverse bands are obliterated, except costally, one being represented by two brown lines extending from the hind margin into the white area as far as the middle median vein. Hindwing with the white area much smaller and duller-coloured, the transverse bands confused. Both wings have two submarginal rows of conspicuous dark spots, the inner large, black, semicircular on the forewing, lanceolate on the hindwing, the outer paler, transverse. The hindwing has two slender ocelli with slender irides of orange, touched with metallic, the outer one with the black area very large.

\* An allied species, of which *N. gaura* is presumably a local form, occurs in south-eastern Borneo and Java. I also took a male in Engano (unluckily omitted in my list), and I think I found it in the Nicobars. A Bornean specimen before me has the black marginal band above very narrow and equal, the black spots on the hindwing obsolete, except that in the lower median space, which is large. *Below* there are no distinct white areas, but all the markings are conspicuously edged with white. The discal band is bent outwardly and very irregular as far as the middle median vein, below which it is broad, straight and quadrate, the subanal ocellus is broadly bordered with orange.

I propose the name of *N. pseustis* for this species.

I took several females in Sumba, both on the coast and in the interior, and also a single male probably of this species. It was violet blue above, the margin very slenderly dark. Below the white areas were nearly obsolete on the forewing, and on the hindwing reduced a white bar in the band across the end of the cell, and a border one on the disc beyond the cell between the lower subcostal and upper median veins. Expanse over an inch and a quarter.

The species is near *N. perusia*, Felder, from Amboina, and *N. atrata*, Horsfield, from Java, but the extensive white areas of the female easily distinguish it.

80. *NACADUBA HERMUS*, Feld. (*viola*, Moore).  
Sumba, Sambawa.

81. *NACADUBA ARDATES*, Moore.  
Sumba, Sambawa.

82. *NACADUBA MACROPHALMA*, Feld.  
Sumba. The female is marked almost as in that curious little species, *N. kerriana*, Distant, which I have taken at 4000 feet elevation in Karenni east of Burma.

83. *NACADUBA DANA*, de Nicéville.  
Sumba, Sambawa. This is probably Mr. Druce's *N. almora*, but his figure and description are so bad that certainty is impossible.

84. *LAMPIDES BOCHUS*, Cram. (*Jamides bochus*).  
Sumba, Sambawa, rare. The only Sumba specimen I have examined has the blue area above very large, and not at all brilliant. It may be a distinct local form of this species, intermediate between *L. bochus*, Cram. and *L. astraptus*, Feld.

A *Lampides* which occurs in Borneo, Sumatra and the Malay Peninsula but has apparently escaped the notice of naturalists, has the underside like that of *L. bochus*, while the upperside has only a slender marginal dark line and is of a rich blue, darker than that of *L. elpis*. I have given Mr. de Nicéville a Bornean example for description.

85. *LAMPIDES ANOPS*, n. sp. Pl. II, fig. 10.

Male, above, rich azure-blue, violet in some lights, darkening outwardly, translucent, a slender marginal dark line somewhat broader apically on the forewing, the cilia of the hindwing white. Below, ground-colour basally grey, darkening outwardly, but without the slightest

rufous tinge. The markings consist of slightly darker transverse bands, bordered by straight white lines, which are broad and very conspicuous. Forewing with one of these across the cell, with no markings above it costally, one discal from the costa to the middle median, then dislocated inwardly and continued obliquely to the lower median, below which the wing is white with a single dark streak in it. Hindwing with the bands confused and broken. Both wings have the cilia whitish, a marginal dark line, a catenulated line of dark streaks in a white ground, and behind this a line of very conspicuous black lunules, large and lanceolate on the hindwing; behind these are white lunules which extend far into the disc. There is no trace of ocelli, or of metallic scales.

The female is also blue, and has the outer two-thirds of the forewing black above.

Sumba, confined to the mountain-forests above 2000 feet. A beautiful and conspicuous species. I have not examined the prehensors, but the species is so unlike all others that its identification must be easy. In the figure the white markings of the underside have been made too narrow and inconspicuous.

86. *LAMPIDES MASU*, n. sp. Pl. II, fig. 11.

Male, above, bluish-white, whiter than *L. ælianus*, a very slender marginal black line nearly obsolete apically; hindwing with this line more distinct; a broken, catenulated, submarginal dark fascia, double at the anal angle, obsolete apically, with a good-sized dark spot in the lower-median space. *Below* pale brown, the bands scarcely perceptibly darker, bordered by white lines, of which the basal pair on the hindwing are slender; on the forewing one band crosses the cell, one is beyond it from the costa to the middle median vein; these two are continued in common by another nearly to the hind-margin. On the hindwing the bands are irregular, extending further outwardly than in *L. anops* (in which the submarginal lunules greatly encroach on the disc), acutely angled in the interno-median space. Both wings have three conspicuous white submarginal lines enclosing two lines of spots, the outer linear, catenulated, slender, the inner large, black and conspicuous, transverse and wholly surrounded with white on the forewing, lanceolate and irregular on the hindwing. Hindwing with a large subanal ocellus with a narrow orange iris, surmounted by a black and a white lunule; a small similar anal ocellus; both are touched with metallic.

This species is very like the Amboina female figured by Cramer as *aratus*, and is probably a local variety of that species. The female of *L. masu* has the black border of the forewing broad and serrate apically, the inner cordate spots of the hindwing are large and black. The

male differs from *L. subditus*, Moore, in the whitish upperside, and in the pale underside, heavily marked with white, with the orange area smaller; it resembles it in the submarginal band of black spots. *L. subditus* is very close to *L. amphissa*, Felder, from Amboina.

87. LAMPIDES CELENO, Cr.  
Sumba, Sambawa.

88. LAMPIDES ELPIS, Godt.  
Sumba, Sambawa.

89. SPALGIS EPIUS, West.  
Sumba, Sambawa, found on the acacias growing along the dry shore, the specimens normal.

90. MEGISBA MALAYA, Horsf.  
Sumba, Sambawa.

91. NEOPITHECOPS ZALMORA, Butler.  
Sumba, Sambawa.

#### Subfamily GERYDINÆ.

92. GERYDUS TEOS, n. sp.

A local form of *G. symethus*. The white area above is large, extending furthest below the middle median vein; there are no bluish scales; the upper median vein is swollen at its base. Hindwing all dark, not bluish-grey as in *symethus*. Below nearly uniform pale brown, a dark area crossing the end of the cell, surrounding the median vein and its branches discally; beyond this there is a whitish area from the middle median vein to the hind-margin; the transverse discal lunular band only extends down to the middle median vein. Hindwing with the discal lunules nearly joined, very distinctly marked, scarcely darker than the ground-colour, edged with paler. Both wings have a submarginal dark line edged inwardly with whitish, and containing a black dot in each space. The underside is wholly without the sordid irrorations found in *G. symethus*.

The female has a little less white on the forewing above, and a little more white below. The hindwing is acutely angled in the middle and is unmarked above.

Sumba, Sambawa. The Javan form (*G. pandu*, Horsf.) may also be distinct from *G. symethus*.

## 93. GERYDUS BOISDUVALII, Moore, var. ACRAGAS, nov.

Male, above, forewing with the base of the upper median vein swollen beyond the cell and placed in a small longitudinal pale space, no other markings above. Female with a narrow straight white band beyond the cell, extending obliquely to the lower median vein, broken by the dark middle median vein. *Below*, forewing with a white area over the disc to the hind margin, the transverse discal band formed of joined incomplete lunules in both sexes. The female has the hindwing slightly angled.

Sumba, Sambawa. I cannot compare this with the Javanese form, the male of which is still undescribed. But the shape of the band in the female of *G. acragas*, which resembles that of the male of *G. biggsii*, the absence of white or pale markings above in the male, and of sordid irrorations on the underside in both sexes, easily distinguish it from the Indian form of *G. boisduvalii*. It is obviously distinct from a form mentioned by Mr. Distant, who says "in an Amboinese species *G. boisduvalii*, Butler, the distinctive colouring of the anterior wing is reversed, the male having the largest white area to the anterior wings."

The male of *acragas* must certainly be very much like that of *G. irroratus*. Dr. Semper doubtfully identifies with that species a Philippine form having a large round median white patch in the female. I think this very unlikely to prove correct. *G. irroratus* is certainly very close to *G. boisduvalii*, but till the female of Mr. Druce's Siamese form is discovered, the question must be left open.

## Family PIERIDÆ.

## 94. NYCHITONA XIPHIA, Fab.

Sumba, Sambawa, varying greatly in size and markings.

No *Elodina* was seen in either island, though *E. equatia* is known from Timor.

## 95. TERIAS HECABE, Linn.

Sumba, Sambawa, several varieties.

## 96. TERIAS SARI, Horsf.

Sumba, Sambawa.

## TERIAS DRONA, Horsf.

Sambawa, 2-4000 feet. *T. candida*, found by Mr. Wallace in Timor, was not seen.

## 97. TERIAS HARINA, Horsf.

Sumba, Sambawa.

## HUPHINA TEMENA, Hew.

Sambawa. A very beautiful species.

## 98. HUPHINA JULIA, n. sp. Pl. II, fig. 12.

Male, above, creamy-white, a black marginal fascia, scarcely wider on the forewing than on the hindwing, its inner border diffused; the submarginal dark bands of the underside visible through the wings; all the veins of the forewing dark, as well as those of the hindwing outwardly. *Below*, forewing white, a submarginal diffused brown band, connected along the two upper median veins with a dark longitudinal band in the lower part of the cell; apex diffused ochreous-yellow, the yellow area just crossing the submarginal band costally, the outer margin narrowly brown. Hindwing bright yellow; a narrow dark marginal band, a broad, irregular, serrate dark submarginal band enclosing seven large orange-scarlet spots, obsoletely edged with yellow; the subcostal space nearly all scarlet, without any black border inwardly or outwardly. Expanse two and two-third inches.

Female, above, forewing with all the veins heavily outlined with dark, the spaces more or less white, a united subapical white band, and a row of submarginal spots. Hindwing pale yellow, the veins slightly darkened, a broad outer dark band enclosing white spots. *Below*, duller than the male, the radial and upper median veins of the hindwing marked with lines of blackish scales.

Nearest *H. leta*, Hewitson, from Timor, which has the forewing broadly and the hindwing slenderly black above, while below, the disc of the hindwing is uniform black, the submarginal dark band of the hindwing is obsolescent, and the scarlet costal stripe bordered on both sides with black. It is a much smaller butterfly than *H. julia*.

Sumba, interior.

This insect, the most beautiful Oriental species of *Pieris* known, has when flying none of the air of a protected butterfly. If it stood alone, I should certainly suppose it to be a mimic of some form of *Delias hyparete* yet undiscovered in the island. But both *H. leta* and *H. temena* require to be accounted for in the same way, and while it is possible that some Timorese *Delias* may resemble *H. leta*, I feel sure that *H. temena* can have no such original. It must then be assumed that this group is less pressed by its enemies in the Timorian Islands, and has therefore been able to acquire more brilliant colours than its allies.

*Huphina leta*, *julia*, *temena* and *tamar* form the nearest approach to a peculiar group of butterflies which these islands possess. But *H. tamar* is from Bali, beyond Wallace's Line, and no doubt extends into Eastern Java.

## HUPHINA NAOMI, Wallace.

Sambawa.

## 99. HUPHINA EIRENE, n. sp.

Male. It differs from *H. naomi* in the colour of the hindwing below, and that of the subapical spots of the forewing, being lemon, instead of rich orange-ochreous. Above, the median vein and its upper branch are more widely marked with black, and the white of the cell and the hind margin of the forewing is clearer and purer.

In these points it agrees with *H. judith*, Fab. (Java), but differs in the narrow dark markings of the forewing above, the long white discal markings being slenderly continued nearly to the margin. *Below*, the forewing has three subapical lemon spots, a large white spot between the upper median branches, and two white spots beyond the cell, the one above these being obsolete. The black border of the hindwing is narrower than in *H. judith*, enclosing a lemon spot between the subcostals, one (obsolescent) above the radial veins, and one, large and diffused, between the upper median branches; an ochreous spot partly enclosed between the lower median and submedian veins; the anal angle slenderly edged with orange-ochreous.

Sumba, interior, rare. I cannot find the type, and the description is not very good. The species, however, which I compared with good series of *H. judith* and *naomi*, is distinct. It is curious that it should more approach the Javanese species than that of the neighbouring islands.

The species figured by Hombrom and Jacquinet in the "Voyage au Pole Sud," as "*Pieris judith*, var.," and so placed by Kirby, is certainly distinct. I suggest for it the name of *Huphina imogene*. It is nearest my *H. ethel* from Engano.

## HUPHINA VASO, n. sp.

A local form of the Javanese *H. corva*. Male, above, darker than in that species, all the veins heavily outlined with black. Forewing with an almost complete, irregular, outer-discal dark band extending obliquely from the costa to the hind-margin, and continued along the latter to its base; the white submarginal spots beyond this are large. Hindwing with the cell, the upper median, and both the subcostal veins clouded with black, the black border deeply dentate, with a line of diffused black spots submarginally in the middle of the spaces. *Below*, paler than in *corva*, the white markings, especially the submarginal ones, all larger and clearer, the veins all slenderly outlined with ochreous.

Sambawa, coast.

BELENOIS JAVA, Sparr. (*coronea*, Cr.).

Coast of Sambawa, common, not seen in Sumba. Cramer records this species from Borneo, and in the Singapore Museum there is a specimen labelled Jeledu (not far from Malacca). These localities are certainly doubtful, as the butterfly inhabits dry, sterile coasts, and would be quite out of place in forest countries like Malacca or Borneo. On the other hand a coast-butterfly of exceedingly weak flight, but able to float in the air for an indefinite time, would be more apt to be blown out to sea than other insects, and more likely to survive till its arrival in another island. So that stragglers may really have been taken remote from the true habitat of the species.

This butterfly flies like a *Hestia*, and seems to be the most perfectly protected of Eastern *Pierida*. It is hard to believe that it has anything to do with the Indian *Belenois mesentina*, the type of the genus, which is wholly different in appearance and in habits. Like *Delias* and *Prioneris* this genus has the claws bifid.

## DELIAS PASITHOË, Linn., var.

I saw two specimens of this on Mt. Haruhasa in Sambawa at nearly 5000 feet elevation, but as well as I can remember neither were taken. An undescribed *Agarista* mimicking it was caught at the same place. No species of *Delias* was observed in Sumba.

## DELIAS ORAIA, n. sp.

A local form of the Indian *Delias descombesii*, and greatly resembling it. It lacks, however, the black marginal band of *descombesii*, the costa and outer margin of both wings being slenderly grey, especially at the ends of the veins, the cilia lemon. Below the five subapical lunules on the forewing are yellow, not white. The female is generally brighter coloured than that of *descombesii*. The hindwing, however, is much darker over the base and disc, but below the submarginal spots are bright lemon, and the hind-margin rich ochreous.

Sambawa, 2—5000 feet, scarce. The specific name means *beautiful* in modern Greek. I thought it unnecessary to give my detailed description of the species.

The reappearance in Sambawa of a local form of an Indo-Malayan butterfly unknown to Java, is remarkable.\*

\* I take the opportunity to describe a new Javanese species of this genus.

## DELIAS AURANTIA, n. sp.

Near *D. belisama*, Cr. Above orange over the basal half of the wings, including all the cell, the disc as far as the upper radial vein, far beyond the cell, and the hind

100. *APPIAS\** *PAULINA*, Cr.

Two forms of this very puzzling group occurred both in Sumba and in Sambawa. One was all white, with only a slender dark marginal line, resembling *A. albina*. The other had the hindwing and the apex of the forewing bright ochreous-yellow below, resembling *A. lankapura*, but without the dark apex. It generally had a black or gray discal spot on the forewing.

I have dubiously recorded *Appias lycinda* from Sambawa, and from Sumba a female which I supposed to be that of *A. (Saletara) nathalia*.

101. *NEPHERONIA VALERIA*, Cr.

Sumba, Sambawa. The submarginal spots are wholly absent. No yellow female was taken. A different species is, I think, also found in Sumba.

margin to the lower angle; the rest black, its inner border serrate. Hindwing with the black border rather wide and equal. *Below*, forewing black with four (five in *belisama*) orange subapical streaks, the lowest obsolescent; a broad oblique orange streak borders the disco-cellular veins, the cell and median veins are outlined with pale orange, the rest of the cell irrorated with black scales, the hind-margin broadly whitish. Hindwing orange like the upperside, the red area darker than in *belisama* and much larger; the inner lunular band more continuous, a marginal yellow line (nearly obsolete in *belisama*), the inner half of the wing, including most of the cell, and on the disc from the hind-margin to beyond the middle median vein, densely irrorated with black scales. Expanse  $3\frac{1}{2}$  inches. From *D. belisama* this may be distinguished by the much smaller black area of the upperside of the forewing, and the large orange areas of the underside of the same wing. The male of *D. belisama* is also usually white, or white tinged with lemon, or yellow with a slight ochreous tinge. From *D. nakula*, recently described from Java by Mr. H. Grose Smith, *D. aurantia* differs in its larger size and rich orange colour.

This fine butterfly is not uncommon on Mount Arjuno, Eastern Java; I did not take it below 2,500 feet elevation, and it is found at any rate up to 5000 feet. *D. belisama* is also common there, ranging from the low country up to about 3000 feet, so that there is a zone where both are found. When flying together *D. belisama* could always be distinguished by its smaller size, East Java specimens being apparently smaller than West Java ones, and under three inches in expanse. On visiting the great volcano of Sméru further east at a different season, I found *belisama* common, but did not see *aurantia* at all.

At 5000 feet on Arjuno, I took a single faded specimen of a *Delias* only  $1\frac{3}{4}$  inch in expanse. It was white, the outer half dark, the forewing with a subapical bar and a row of five subapical spots. The hindwing had the margin broadly black with five yellow (?) spots in it below only. This species does not resemble anything known to me.

\* This is one of Hübner's silly genera, grounded on nothing whatever. I use it most unwillingly as the equivalent of Mr. Wallace's *Tachyris*. Mr. Distant includes the species of *Huphina* (Mr. Wallace's *Pieris*) under *Appias*, for which I can see no reason. *Catopha* necessarily falls before *Appias*.

102. *HEBOMOIA GLAUCIPPE*, Linn.  
Sumba, Sambawa.

*IXIAS REINWARDTII*, Voll.  
Sambawa, a beautiful species, confined to the dry coast.

103. *IXIAS* near *PIRENE*, Linn. (*pyrene*).  
Sumba, coast, several times seen, but no specimen taken.

*CATOPSILIA PYRANTHE*, Linn. (*evangelina*, Butler).  
Sambawa, coast, not observed in Sumba.

104. *CATOPSILIA CATILLA*, Cr.  
Sumba, Sambawa.

105. *CATOPSILIA CROCALE*, Cr.  
Sumba, Sambawa.

106. *CATOPSILIA SCYLLA*, Boisd.  
Sumba, Sambawa.

#### Family PAPILIONIDÆ.

107. *PAPILIO* (*ORPHEIDES*) *ERICHTHONIUS*, Cram. (*erithonius*).  
Sumba, Sambawa.

108. *PAPILIO* (*ILIADES*) *MERAPU*, n. sp.

Male, above like *P. memnon*, the pale rays gray, and not very distinct on the forewing. Below the basal crimson areas are larger, the longitudinal streaks in the cell of the forewing obsolescent. Hindwing with the outer pale area partly gray, partly orange-ochreous, narrow, the outer line of spots many times larger than in *memnon*, the inner lying outside of the band, only touched outwardly with ochreous; a separate oblique orange stripe on the abdominal border. The species is the largest of the group, much larger than *memnon*, its expanse being six and a half inches.

Koloki, Pada Dalung, Sumba, 2—3000 feet.

This fine butterfly is called by the Sumbanese after their god Merapu, and I was told that it was after a fashion held sacred, though they raised no objection to my catching specimens. As an instance of the sober tastes of this people, I may remark that they consider this butterfly far handsomer than *Ornithoptera naias* or *Papilio maremba*.

A form of *Papilio memnon* occurs in Sambawa, but I have no specimens.

## 109. PAPILIO (MENELAIDES) OREON, n. sp.

A local form of *P. liris*, Godart, from Timor and Australia, differing from de Haan's figure of that species in the following particulars. Female, forewing with the dark border narrower than in *liris*, the pale area not tinged with yellow, extending nearly to the base and apparently more marked with black scales. On the hindwing below, the whitish area is less yellow, extends nearer to the base, (occupying two-thirds of the cell), and somewhat further discally, its outer margin scalloped. The white area between the costal and subcostal veins is nearer the base of that space, and is much narrower, being not so long as broad, deeply concave outwardly. There is a submarginal row of seven crimson spots (five in *liris*), that in the interno-median space joining the white area so as to enclose an oval black spot. On the upperside, the hindwing is obscurely marked with red as in *liris*. Expanse four inches and three quarters.

Of the male I have only one very bad specimen, not perceptibly different from the female.

Sumba, confined to the mountain-forests from which I have named it.

## PAPILIO ARISTOLOCHIÆ, Linn.

Sambawa, normal.

## 110. PAPILIO (CHARUS) HELENUS, Linn.

Sumba, Sambawa, confined to the mountains, scarce.

## 111. PAPILIO (HARIMALA) MAREMBA, n. sp.

Male, above black, the markings metallic golden-green, greenish-blue in some lights. Forewing with the base, all the cell and two-thirds of the hind-margin uniformly powdered with green scales; just beyond the cell and forming a crescent round it, is a rather narrow band of rich green from the upper median vein to well above the subcostal, the veins black; beyond this a broad black band, but slightly irrorated with green; after which there is a broad subapical and submarginal area of diffused green, with separate green spots between the median veins; the outer and costal margins dark; the hind-margin rich green near the lower angle as far as the middle of the interno-median space. A large unbroken dark discal patch covered with a cottony mass of odoriferous hairs, extending from the internal to the upper median vein, reaching inwardly almost to the cell, and outwardly along the veins almost to the outer margin. Hindwing with the base powdered with green, a broad green discal area, scarcely entering the cell, extending from the upper subcostal vein to the hind margin, broadest discally;

beyond it are four green lunules; the outer part, including the tails, black. *Below*, the basal half of the wings deep brown, sparsely sprinkled with whitish scales; forewing with a pale transverse band (much more remote from the base than in *P. pericles*), broad subapically, deeply indented outwardly, below the two lower subcostal branches, abruptly narrowed below the lower radial vein. Hindwing with the disc somewhat whitish subabdominally, a row of seven narrow ocelli, outwardly silvery blue, inwardly dull reddish. The ocelli are much further from the outer margin than in the allied species.

This splendid species has no near allies. Apart from the sex-mark, it is nearest *Papilio brama*, Guérin, from Borneo, Sumatra, and the Malay Peninsula.

Sumba, rare near the coast, commoner in the remote interior.

PAPILIO (HARIMALA) PERANTHUS, var.

Sambawa, mountains, scarce. It seems to be intermediate between the Javanese *P. peranthus* and the Timorese *P. pericles*. I have unluckily neither specimens nor description.

112. PAPILIO (ZETIDES) SARPEDON, Linn.

Sumba, Sambawa. In Sumba the red markings of the underside are sometimes replaced by ochreous-yellow.

113. PAPILIO (ZETIDES) EURYPYLUS, Linn.

Interior of Sumba and Sambawa, scarce.

114. PAPILIO (ZETIDES) AGAMEMNON, Linn.

Sumba, Sambawa.

PAPILIO (PATHYSA) ANTIPHATES, Linn.

Sambawa.

115. PAPILIO (LAERTIAS) POLITES, Linn.

Sumba, Sambawa. In Sambawa one female imitates *P. aristolochiae*, while another is similar, but with the white discal area replaced by orange. I have unluckily not recorded any female from Sumba.

116. ORNITHOPTERA NAIAS, n. sp.

Male, above black, all the veins except at the extreme base and the internal vein, bordered with paler brown, a longitudinal pale streak generally in the middle of the cell. Hindwing with a small translucent golden patch occupying less than half of the cell longitudinally (its lower and basal part black); four discal spaces from the costal to the upper median vein occupied by quadrate golden areas, which are not incised outwardly as in *O. plata*; that between the costal and subcostal

veins is largest and broadest; a slight diffused golden touch between the upper and middle median veins, more distinct below. *Below* forewing with the pale streaks whitish. Collar and patches at the base of the wings red, abdomen mostly black except around the base of the valves.

Female, above dark brown, the pale streaks conspicuous, whitish, occupying two-thirds of the cell, where they are broad with a conspicuous streak in the middle. Hindwing with a golden area, slightly duller than that of the male, occupying two-thirds of the cell transversely, and six discal spaces from the subcostal to the fold above the submedian vein; a minute spot above the subcostal, the next area small, all of them deeply incised outwardly; four pairs of triangular yellow spots are usually on the outer disc, sometimes connected with the inner golden area, by rays of the same colour; there are a few marginal internervular ochreous touches. Collar and base of wings red, abdomen laterally and ventrally yellow with black spots.

The outer margin of the hindwing of the male is remarkably straight; its expanse is nearly five and a half inches.

The golden area of the male differs considerably from that of *O. criton* (Moluccas) and *O. plato* (Timor). In *plato* the red patches are wanting; the female is unknown. In *criton* the female is altogether different. The golden area is probably smaller in *naias* than in any other species of *Ornithoptera*, except the Celebesian *O. haliphron*, in which the cell is all black.

Common in Sumba, both on the coast and in the interior.

In Sumbawa occurs a variety (*O. naias*, var. *sambavana*), which is considerably larger. The female has a large golden spot between the costal and subcostal veins of the hindwing; the outer discal pairs of spots are always connected with the central golden area, more or less enclosing large black spots. In the male a golden spot (generally present, though small in the Sumba form) between the upper and middle median veins, is always absent, while in *O. criton*, and presumably in *O. plato*, it is the largest of all.

## Family HESPERIADÆ.

### *Ismene* Group.

#### 117. PARATA MALAYANA, Feld.

Sumba. Another species occurred both in Sumba and Sumbawa.

#### 118. HASORA BADRA, Moore.

Sumba, Sumbawa. Both this and the Engano form resemble the Javanese, which may and may not be the same as the typical Indian one.

119. *BADAMIA EXCLAMATIONIS*, Fab.  
Sumba, Sambawa.

*Tagiadas* Group.

120. *TAGIADDES BRASIDÆS*, n. sp.

Male, above dark brown, forewing with three subapical hyaline spots, the first two approximate, the third well beyond the others, small; two small discal spots, and two terminally in the cell, hyaline. Hindwing, dark brown, the disc irrorated with gray scales, and bearing three dark spots; the abdominal angle widely white enclosing a line of marginal dark spots, the cilia long, white. *Below*, forewing touched with whitish below the lower median vein. Hindwing two-thirds white, with three subapical dark discal spots (the first united with the apical dark area), the second and third unequal, united, the apical border widely dark brown, tapering to below the lower median vein, twice interrupted by white. Female, like the male the hyaline spots in the cell of the forewing united, the discal ones larger, the brown spots bordering the hindwing smaller above and below.

Sumba, and Sambawa, but those from the latter island may not be quite the same. The species is nearest *T. helferii* from the Nicobars, differing in the white border on the hindwing above, and the dark spots on it below. The hyaline marks are also more conspicuous. This also distinguishes it from *T. alica*, which is also much less white below, and has no distinct marginal spots.

121. *ABARATHA SYRICHTHUS*, Feld.

Above, the discal yellowish bands of the hindwing are much narrower and more obscure than in Indian specimens. Below, the forewing is altogether less white; the white mark beyond the cell, which in the Himalayan form extends far outwardly, is reduced to a slender, transverse crescent; the costal streaks above it are obsolete, the submarginal line of quadrate spots much smaller, and the fifth hyaline spot absent.

Sumba, rare.

*ABARATHA HYPEIDES*, n. sp.

Very near *Pterygospidea helias*, Felder, from the Celebes, but the bands and the discal hyaline spots of the forewing are absent, and the apex of the hindwing is broadly dark. From *A. sura* it differs in the forewing, which is almost uniform dark brown above and below. The hindwing is also less variegated above and below, the white area is larger and more uniform, the inner line of spots is obsolete, the outer

united, and dark apically, nearly obliterated by white scales in the median spaces.

Sambawa. Another species, more like *A. angulatus*, was found in Sumba, but no specimens have survived.

*Gehlota* Group.

122. COLADENIA DAN, Fab.

Sumba, Sambawa. Two species are confused under this name, and occur together in Sumba, Borneo, the Malay Peninsula, and perhaps elsewhere. They differ obviously in flight and in prehensors, but I cannot at present point out any difference in the markings. One has an egg with numerous ribs (over forty) as in *Gehlota*, the other with few (seventeen) as in *Tagiades*.

*Pamphila* Group.

123. TELICOTA MÆSOIDES, Moore.

Sumba, Sambawa. The orange bands are smaller and narrower than in Indian specimens, and the ground-colour dark below.

124. TELICOTA NIGROLIMBATA, Snellen.

Sumba, Sambawa. This is the species figured by Mr. Distant; I am not quite sure of its identity with Heer Snellen's species.

125. TELICOTA GOLA, Moore.

Sumba, Sambawa.

126. AMPITTIA MARO, Fab.

Sumba, Sambawa. I am doubtful of its identity with the Indian form.

*Baoris* Group.

127. CHAPRA MATHIAS, Fab.

Sumba, Sambawa.

128. PARNARA NAROOA, Moore.

Sumba, Sambawa. I am not sure of its identity with the Ceylon form.

*Suastus* Group.

129. SUASTUS CHILON, n. sp.

Above, male all dark brown, no hyaline markings nor patches of lighter-brown scales. *Below*, forewing with a minute white dot distally in the lower median space, the subapical hyaline spots represented by two slight dark streaks, the lower (in one specimen) containing a

lighter dot. Hindwing nearly white (not gray as in *S. gremius*), the borders dark, a conspicuous black cell-spot, and a row of black discal spots, six in one specimen, four in the other.

The absence of hyaline spots distinguishes it from all others.

Two males, Sumba coast.

#### Kerana Group.

#### 130. PLESIONEURA RESTRICTA, Moore.

Sumba, Sumbawa, mountains. My Sumbanese *Hesperiadæ* have suffered more than any other family, and I have been compelled to omit a number of species, a *Halpe*, two *Parnaras*, a *Parata*, etc.

#### EXPLANATION OF PLATE II.

- |   |   |
|---|---|
| Fig. 1. <i>Euplœa elwesii</i> , n. sp. ♀. | 7. <i>Radena kambera</i> , n. sp.         |
| 2. <i>Euplœa lewa</i> , n. sp.            | 8. <i>Nacaduba gaura</i> , n. sp., × 2.   |
| 3. <i>Euplœa pulmedo</i> , n. sp.         | 9. <i>Nacaduba laura</i> , n. sp. ♀, × 2. |
| 4. <i>Danaïs litoralis</i> , n. sp.       | 10. <i>Lampides anops</i> , n. sp.        |
| 5. <i>Danaïs orientis</i> , n. sp.        | 11. <i>Lampides masu</i> , n. sp.         |
| 6. <i>Radena oberthurii</i> , n. sp.      | 12. <i>Huphina julia</i> , n. sp.         |

VI.—*Natural History Notes from H. M. Indian Marine Survey Steamer 'Investigator,'* Commander R. F. HOSKYN, R. N., commanding. No. 24. *List of Deep-sea Holothurians collected during seasons 1887 to 1891, with descriptions of new species.*—By DR. J. H. TULL WALSH. Communicated by the SUPERINTENDENT OF THE INDIAN MUSEUM.

[Received 6th April, 1891;—Read 7th May, 1891.]

Order ELASIPODA, Théel, Chall. Rep. vol. iv, Hol., p. 9.

Family Elpididæ, Théel, l. c., p. 10.

1. PENIAGONE WYVILLII, Théel, Chall. Rep. vol. iv, Hol., p. 42.

One specimen.

Station 118, 15th December, 1890, Bay of Bengal, lat. 12° 20' N., long. 85° 8' E., 1803 fathoms, globigerina ooze, bot. temp. 35° Fahr. (*Alcock*).

Family Deimatidæ.

2. ONEIROPHANTA MUTABILIS, Théel, l. c., p. 62.

One specimen.

April 12th to 13th, 1888, Andaman Sea, N. Sentinel Island bearing N. 15°, W. 18 miles, 250 fathoms (*Wood-Mason*).

3. *DEIMA VALIDUM*, Théel, l. c., p. 68.

"Transparent light orange-red" (*Alcock*).

Two specimens.

April 16th, 1888; Bay of Bengal lat. 11° 15' N., long. 91° 16' E., 1840 fathoms, globigerina ooze (*Wood-Mason*).

A fine specimen; length 130 mm.; length of lateral processes 55 mm.

Station 117, Bay of Bengal, lat. 11° 58' N., long. 88° 52' 17" E., 1748 fathoms, globigerina ooze with pieces of pumice, bot. temp. 35.3° (*Alcock*).

4. *DEIMA FASTOSUM*, Théel, l. c., p. 71.

Two specimens.

Station 118 (*Alcock*).

April 20th, 1888, Bay of Bengal, lat. 6° 18' N., long. 90° 40' E., 1520 fathoms (*Wood-Mason*).

5. *ORPHNURGUS ASPER*, Théel, l. c., p. 82, var. *GLABER*, nov.

Length 150 mm. Body smooth and leathery; skin thin and somewhat transparent; colour (in spirit), body greyish white, feet and processes yellowish-white. Tentacles 20, long, extremities brownish and dendritic. Ventral feet 24 on each side, longer and larger near the centre of the body than at the extremities; longest 20-25 mm. Lateral processes generally longer than the pedicles, longest 30 mm. Two rows of processes on each dorsal ambulacrum; these vary considerably in size and short and long ones seem to alternate. Mouth slightly ventral; anus terminal and patulous. Calcareous bodies, spinous rods or smooth rods with branched extremities. Polian vesicle single, 40 mm., wider in the middle than at the extremities.

Colour in the fresh state "salmon-pink" (*Alcock*).

One specimen.

Station 112, 7th November, 1890, Bay of Bengal, lat. 13° 47' 30" N., long. 92° 36' E., 561 fathoms, grey mud, bot. temp. 44.9° (*Alcock*).

6. *PANNYCHIA WOOD-MASONI*, n. sp.

Length 300 mm. Body long, flat and of equal width throughout; skin calcareous but flexible; colour yellowish-white (in spirit). Tentacles 20, round, with stumpy digits; mouth ventral; anus terminal and without teeth. The middle ambulacrum of the trivium bears a double row of feet; outside these the skin is thrown into longitudinal and transverse folds and ridges; the skin on the dorsum is also ridged.

The lateral ambulacra possess a single row of feet much longer than those on the middle ambulacrum. Just above this row of feet there is a row of long, pointed processes; these average 15 mm. in length. The dorsal ambulacra are furnished with a double row of processes; these are shorter than the lateral ones. One polian vesicle; one stone canal; one bundle of genital tubes which are branched and furnished with irregular dilatations. Calcareous ring small; muscles poorly developed relatively to the size of the animal.

The calcareous bodies consist of large, round, many-holed plates, the centre holes being fairly large, the marginal ones small. Besides these plates, a few branched spicules are present.

This species is very closely allied to *P. moseleyi*, Théel.

Numerous specimens.

January 2nd, 1888, off Port Blair, 271 fathoms, bottom green mud (*Giles*).

April 12th, 1888,  $7\frac{1}{2}$  miles E. of N. Cinque Island, Andaman Sea, 490 fathoms, bottom green mud (*Wood-Mason*).

Station 115, December 9th, 1890, Andaman Sea, lat.  $11^{\circ} 31' 40''$  N., long.  $92^{\circ} 46' 40''$  E., off Dyer Point and N. of Cinque island, 188—220 fathoms, green mud, bot. temp.  $56^{\circ}$  (*Alcock*).

#### AMPHIGYMNAS, nov. gen.

Body ovoid with narrow tail-like extremities; soft and appears to have been surrounded by a jelly-like material when fresh. Feet very numerous over the whole of the trivium and placed more or less irregularly. Lateral margins with two or three rows of long processes. Back covered with processes except near the mouth and anus where the body tapers and where the dorsal surface is naked; mouth terminal, small; tentacles 15, very small and retracted; anus terminal, small. Calcareous bodies moderate sized, irregularly rounded, many-holed plates somewhat like those of *Pannychia*. Calcareous ring of 5 small pieces loosely connected.

##### 7. AMPHIGYMNAS MULTIPES, n. sp.

Length 80 mm., width near middle of body 22 mm.; at oral and anal end about 9 mm.

Colour (in spirit) pale purple; the long lateral processes measure about 15 mm., those on the back are shorter.

One specimen.

Station 115, December 9th, 1890, Andaman Sea, lat.  $11^{\circ} 31' 40''$  N., long.  $92^{\circ} 46' 40''$  E., off Dyer Point and N. of Cinque island, 188—220 fathoms, green mud, bot. temp.  $56^{\circ}$  (*Alcock*).

## 8. LÆTMOGENE SPONGIOSA, Théel, l. c., p. 80.

*Crydora spongiosa*, Théel, Prelim. Rep. Hol., p. 9.

One specimen.

April 17th, 1888, Bay of Bengal, lat. 10° N., long. 91° 7' E., 1924 fathoms (*Wood-Mason*).

## Family Psychropotidæ.

## 9. EUPHRONIDES DEPRESSA, Théel, Chall. Rep. vol. iv, Hol., p. 93.

Two specimens.

Station 118, December 15th, 1890, Bay of Bengal, lat. 12° 20' N., long. 85° 8' E., 1803 fathoms, globigerina ooze with pieces of pumice, bot. temp 35° (*Alcock*).

## 10. BENTHODYTES PAPILLIFERA, Théel, l. c., p. 102.

"Colour purple, tentacles violet black" (*Alcock*).

Two specimens 80 mm. and 68 mm. The fringe is damaged and the dorsal papillæ are not very apparent, but there is, I think, no doubt that these specimens belong to Théel's species.

Station 117 (*Alcock*).

## 11. BENTHODYTES SANGUINOLENTA, Théel, l. c., p. 104.

Four specimens; the row of transverse papillæ below the mouth cannot be made out.

Station 118 (*Alcock*).

## 12. BENTHODYTES OVALIS, n. sp.

Length 65 mm.; breadth 35 mm. including fringe. Body oval, flat, about twice as long as broad and of a deep purple colour throughout. A double row of feet on the middle ambulacrum of the trivium and no transverse line of feet below the mouth; lateral ambulacra with a single row of feet. On the dorsal surface there are three processes on each ambulacrum; the anterior ones are 15 mm. long and not retractile (?); the posterior one in each row is much smaller. Mouth ventral; anus terminal. Tentacles retracted. Calcareous bodies small 3-armed spicules with the end of each arm clubbed and perforated.

One specimen.

April 12th, 1888, 7½ miles E. of N. Cinque island, Andaman Sea, 490 fathoms, bottom green mud (*Wood-Mason*).

## 13. BENTHODYTES GELATINOSA, n. sp.

Before describing the specimens as they appear in spirit it will be better to quote the graphic account of the fresh creature given by Dr. Giles, Ad. Rep. Marine Survey of India, 1877-88, p. 15:—

"I must first notice a very peculiar holothurian, several specimens of which were included in the catch..... When fresh, the animal consists of a tough, muscular sac of a yellowish pink colour, enclosed in a thick coating of perfectly transparent, deep violet-jelly. Though not sticky or glairy, this jelly is of so delicate a consistence that it was almost impossible to clean the mud from the animal without stripping off the coating. After a short exposure to the action of spirit, this jelly, previously fully 15 mm. thick, shrinks to a thickness of less than 5 mm. and becomes comparatively dense. The violet colouring matter dissolves out into the spirit and exhibits a curious affinity for vegetable tissues, deeply staining a paper label which had been placed within the jar. Its attraction for animal tissues though less marked was still very noticeable, the nuclei shewing it best, so that, on microscopical examination, the animal was found to have become stained in a solution of its own pigment. After hardening in spirit it is sufficiently evident that this jelly-like coating cannot be considered as a secretion, but as an integral part of the tissues of the body wall, as it consists of a plexus of stellate and spindle-shaped cells, enclosing within their meshes many nuclei-form bodies and much hyaline connective substance. The body wall contains but few calcareous bodies. Those present consist of a circular plate, having articulated to it a fan-shaped body so shaped that the whole apparatus is not unlike the badge of a grenadier's cap. As far as could be made out, these bodies appertain to the jelly-like layer and not to the dense inner portion of the body wall, which latter appears to be purely muscular. When laid open it is seen that the lungs are very complex and racemose, and that the ambulacral tubes which are very small and straight, give off a number of minute branches to the pedicels. The polian vesicle is of moderate size and simple. It appears to belong to, or be near, the genus *Benthodytes* of the *Elasipod* family *Psychropotidæ*, and is doubtless new as it is identifiable with neither of the species in the Challenger monograph. In all probability, many of its allies must share with this species the peculiarity of a jelly-like coating but no mention of any such appearance is made in the above report."

Length of specimens 100 to 140 mm.—Body soft; extremities and ventral feet are still of a beautiful purple, the body generally is a dark lavender colour (in spirit). The anterior end of the body has a wide lappet-like fringe furnished with papillæ and the border is continued down each side of the flatly cylindrical body and expanded in a less pronounced form as an anal lappet. Along the lateral border there are numerous feet in a single row. Mouth small and ventral; anus large, patulous and somewhat dorsal, situated just above the anal lappet.

Tentacles 15, very small and of a deep purple colour. One, or two, fairly large Polian vesicles; calcareous ring very minute, a double row of sucker feet on the middle ambulacrum of the trivium; these are more numerous and closer together near the anal end while they are entirely absent from the surface just below the mouth. A single row of fairly long, slender retractile papillæ are seen on each dorsal ambulacrum. Two small bundles of genital tubes. The longitudinal muscles are well-developed, broad, orange-yellow and visible through the skin—only a few calcareous spicules and granules were found in the muscular substance of the body.

Many specimens.

January 2nd, 1888, Andaman Sea off Port Blair, 271 fathoms, (*Giles*), two specimens.

April 12th, 1888, Andaman Sea  $7\frac{1}{2}$  miles E. of N. Cinque island, 490 fathoms, (*Wood-Mason*). Two specimens.

Station 115, December 9th, 1890, Andaman Sea, lat.  $11^{\circ} 31' 40''$  N., long.  $92^{\circ} 46' 40''$  E., off Dyer Point and N. of Cinque island, 188—220 fathoms, green mud, bot. temp.  $56^{\circ}$  (*Alcock*). Eleven specimens.

#### Apodogaster, nov. gen.

Body long flat and worm-like; slightly wider anteriorly than posteriorly. Down both sides there is a fringe, like that of *Benthodytes*, in which are seen the long tubes of numerous sucker feet. The odd ambulacrum is naked while the lateral ambulacra have one row of small sucker feet situated just below the lateral fringe. A single row of papillæ on each dorsal ambulacrum. Tentacles 15, mouth ventral. Anus terminal.

Calcareous bodies small granules and small wheel-like plates.

#### 14. Apodogaster Alcocki, n. sp.

Length 80 mm.

"Light pink" (*Alcock*).

One specimen.

Station 112, November 7th, 1890, Bay of Bengal, lat.  $13^{\circ} 47' 30''$  N., long.  $92^{\circ} 36'$  E., 561 fathoms, grey mud, bot. temp.  $44.9^{\circ}$  (*Alcock*).

### Order Apoda.

#### Sub-order Pneumonophora.

#### Family Molpadidæ.

15. *Ankyroderma Danielsseni*, Théel, Chall. Rep. vol. xiv, Hol. p. 39.

One specimen.

April 11th, 1888, 7 miles S. E. by S. of Ross Island, Andaman Sea; 265 fathoms, green mud (*Wood-Mason*).

16. A. MARENZELLERI, Théel, l. c., p. 41.

One specimen.

Station 55, 13th—14th April, 1889, Bay of Bengal, 30 miles W. of Middle Andaman Island (Cape Bluff), 480—500 fathoms, globigerina ooze (*Alcock*).

17. EUPYRGUS SCABER, Lütken, Videnskab. Meddel. Kjöbenhavn 1857, p. 23.

After some indecision as to the correct title of these specimens I have thought it better to name them as above. In general form and appearance they all agree with *Echinosoma hispidum*, Semper, Reis. in Philipp. 1867, p. 44, but differ from *Eupyrgus hispidus*, Barrett, Ann. Mag. Nat. Hist. xx, p. 46, which Semper gives as a synonym of his *Echinosoma*, in having no sucker feet. In the Challenger Report, vol. xiv, Hol. p. 49, *Echinosoma hispidum*, Semp. is given as a synonym of *Eupyrgus scaber*, Lütken, and the *Eupyrgus* of Barrett is not mentioned.

Three specimens.

January 15th, 1888, off Cinque island, Andaman Sea, 650 fathoms (*Giles*.)

Station 107, October 23rd, 1889, Laccadive Sea, lat. 8° 23' N., long. 75° 47' E., 738 fathoms, green mud, bot. temp. 41·9° (*Alcock*).

Station 116, December 9th, 1890, Bay of Bengal lat. 11° 25' 5" N., long. 92° 47' 6" E. off Cinque and Rutland islands, 405 fathoms, green mud, bot. temp. 47° (*Alcock*).

18. TROCHOSTOMA ANDAMANENSE, n. sp.

This species is very closely allied to *T. antarcticum*, Théel, Chall. Rep. vol. xiv, Hol. p. 44.

Length 90 mm.

Body cylindrical and narrowed behind into a tail-like extremity. Skin rough but thin. In spirit the ground colour has become greenish-grey and the spots are more or less blood-red. The tentacles fifteen in number, are yellow and between every two there is, near the base, a blue-black triangular mark. Each tentacle has three very small digits at the free end. Mouth and anus terminal, the latter without teeth, but in one specimen with numerous fine papillæ. One Polian vesicle, one free stone canal; 2 (3?) lungs, not much branched; one bundle of yellow genital tubes. The radii of the calcareous ring are produced backwards as spines. Calcareous bodies not very numerous consisting of a few wide-holed plates and tower like rods which are perforated with 4 to 6

holes. Under the microscope the “chocolate spots” are seen to be composed of rust-red ovoid bodies with a concentric arrangement. They are insoluble in caustic potash.

Colour when fresh “dirty flesh-colour with closely placed deep chocolate spots; the crown (tentacles) being a sort of raw-meat-colour.” (*Giles*).

Three specimens.

December 8th, 1887, S. E. of Cinque island, Andaman Sea, 500 fathoms, green mud (*Giles*).

VII.—*On an undescribed Oriental species of Nepeta.*—By D. PRAIN.

[Received 2nd March 1891;—Read 6th May 1891.]

(With Plate III).

In the Calcutta herbarium there is an example of a very distinct species of *Nepeta* which appears to be as yet undescribed. As it has been collected beyond the frontiers of India, it could not with propriety be dealt with in the paper on *Indian Labiatæ* recently read before the Society. But as it possesses rather more interest than isolated new species usually do, its position in the arrangement of Oriental species elaborated by the late M. Boissier in his work (*Flora Orientalis*, iv, 637-670) dealing with the area in which it occurs, as well as a description and figure of the specimen, are now presented.

NEPETA LINN.

SECT. I. EUNEPETA. SERIES I. Perennes. *Sub-ser.* 2. Nuculæ tuberculatæ.

§ MACROSTEGIÆ *Boiss., Flor. Orient.* iv, 638 (1879) *ampl.*—Verticillata densiflora vel laxiuscula remota. Bracteæ ovatæ vel oblongæ. Calyx fauce pilosus vel glaber.

1. Calyx ore obliquus.

a. Calyx fauce pilosus.

*N. Bellevii.*

b. Calyx fauce glaber.

*N. glomerulosa, N. juncea.*

2. Calyx ore rectus, fauce glaber.

*N. Scordotis, N. Sibthorpii, N. leucostégia.*

34 b. NEPETA BELLEVII *Prain*; robusta, laxe lanata nivea, caulibus elongatis ramosis puberulis obtuse 4-gonis superne subnudis, *foliis* majusculis sursum decrescentibus oblongo-lanceolatis crenato-dentatis

subrugosis apice acutis basi truncatis, utrinque parce lanatis, inferioribus breve petiolatis cæteris subsessilibus ramealibus ovato-lanceolatis; *verticillastris* multifloris laxiusculis remotis, *bracteis* membranaceis ovato-lanceolatis acuminatis cucullatis calyces æquantibus, *calycis* longe hirsuti membranacei striati ore intus piloso obliquo, dentibus e basi angustiore subulatis summo tubum subæquante cæteris eo brevioribus, *corolla* extus puberula tubo calycis fere 2-plo longiore, staminibus exsertis, *nuculis* oblongis apice obtusis ruguloso-tuberculatis areolâ ferri equini calcaribus sursum directis ad instar affixis.

AFGHANIA AUSTRALI; inter Kandahar et Kelat-i-Ghilzai, *Bellew!*

Rhizoma de-est, caulis p. q. s. plus quam 40 cm. basi fere 1 cm. crassa, foliis inferioribus 7—9 cm. longis his 3—4 cm. latis petiolis 1 cm. longis, ramealibus 2—2.5 cm. longis his 1—1.5 cm. latis sessilibus, *spicâ* 12 cm. longâ hac 2.5 cm. latâ verticillastris (10—12) 12—16-floris imis 2 cm. summis vix 1 cm. remotis, bracteis 12 mm. longis 4—7 mm. latis 3—5-nervis coloratis supra glabris subtus nervis sub lente puberulis margine prope basin parce pilis albis divergentibus ornato prope apicem acuminatum et tandem subulatum sub lente puberulo, *calyce* tandem subinflato pedicello 1—2 mm. longo tubo 6 mm. longo dentibus summo 6 mm., lateralibus 5 mm., imis 4.5 mm. longis extus æquabiliter pilis albis divergentibus parce hirsuto intus tubi ore et dentium basibus pilis simillimis densissime piloso, *corolla* tubo 11 mm. longo extus puberulo colore forsân rosea, *nuculis* 3 mm. longis his 1.5 mm. latis brunneis areolâ albâ calcaribus 1 mm. longis exceptâ manifeste rugulosis.

This very distinct species bears a considerable resemblance to the European *N. tuberosa* but the whorls are much more lax, the calyx mouth is oblique and no secondary reticulation of the membranous bracts is visible. The nutlets of this species also closely resemble those of *N. tuberosa* and *N. Sibthorpii*, but in these European species there is a much smaller areola of the usual type. Among Oriental species it most resembles *N. glomerulosa*, next to which it is now placed, but it differs greatly in having much larger bracts, much longer spikes and many-flowered lax whorls with longer corollas. The nutlets too are different—the horse-shoe shaped areola of the nutlets being perhaps the most remarkable character of this species; its pilose calyx-mouth also is a character which connects it with § PSILONEPETÆ *Benth.* to which group this feature has hitherto been supposed to be confined. Except for this character, however, it is much more obviously related to the other MACROSTEGIÆ than to any PSILONEPETA. Perhaps a preferable view would be to look on this species as the type of a new subsection intermediate between Psilonepetæ and Macrostegiæ though to be

placed in the same subseries as the latter. This subsection would be characterised as follows:—

§ *PSILOSTEGIÆ* (*Sub-sect. nov.*).—*Verticillastra laxiuscula remota*. Bracteæ ovatæ. Calyx fauce pilosus. (Nuculæ tuberculatæ).—*Inter PSILONEPETAS Benth. et MACROSTEGIAS Boiss. quasi mediantes et proximæ MACROSTEGIIS (Boiss., Flor. Orient. iv, 638 et 651) anteponendæ.*

EXPLANATION OF PLATE III.

*NEPETA BELLEVII*, Prain.

- |   |                             |
|---|-----------------------------|
| Fig. 1. Bract.  | Fig. 4. Corolla tube.       |
| 2. Calyx.   | 5. Upper lip of Corolla.    |
| 3. The same, laid open.   | 6. Nutlet, external aspect. |
| 7. The same, showing inner face with characteristic horse-shoe shaped <i>areola</i> . |                             |

VIII.—*Noviciæ Indicæ.* IV. *Two additional species of GLYPTOPETALUM.*—  
By D. PRAIN.

[Received 20th April, 1891;—Read 6th May, 1891.]

In a collection of plants from Great Coco, an island thirty miles north of N. Andaman, are complete examples of a species of *Glyptopetalum* nearly related to *G. zeylanicum*, Thw. This plant was previously collected, but only in fruit, either in Tenasserim or the Andamans by Helfer\* and an example of the gathering (Helfer n. 1973) was described by Kurz in this *Journal* (vol. xli, [1872], pt. 2, p. 299) as *Euonymus calocarpus*, Kurz. The same plant (specimens also incomplete) has been reported from Kondil (Nicobars) by Calcutta garden collectors, and this gathering, along with a plant from Great Nicobar (Novara 188, Jelinek 245; not represented at Calcutta), has been

\* This gentleman, as members are aware, was assassinated in North Andaman; his collections were disposed of in Europe and distributed thence; the circumstances of his decease rendered it impossible to differentiate positively his Tenasserim from his Andamans specimens. Kurz believed this gathering (n. 1973) to be from Tenasserim, and Lawson (*F. B. I.* i, 612) gives the same locality; I am not aware, however, what authority these authors had for this definite decision, the *Herb. Calcutta* specimen on which Kurz based his description yields none.

referred by Kurz in this *Journal* (vol. xlv, [1876], pt. 2, p. 123) to *Euonymus javanicus* Blume.\*

As it is necessary to formally remove the plant from the genus to which it has hitherto been referred† the opportunity has been taken of providing a full description; at the same time a description is given of a second species collected—in fruit—in the Mishmi Mts. by Griffith; a synopsis of all the species now known precedes these descriptions.

In the four species of which the fruit is known, the dorsal raphe does not terminate at the organic base of the seed but there divides into 3-4 lacinate segments of the same appearance and consistence as the raphe itself; from the raphe they only differ in being slightly branched and in not quite reaching the hilum. They form a closely adherent

\* No opinion can be expressed here regarding the Novara expedition specimens; no example of *E. javanicus* has hitherto been obtained in the Nicobars by Calcutta collectors.

† It is true that Kurz did not think *Glyptopetalum* Thw. generically separable from *Euonymus* Linn. for in this *Journal* (vol. xlv, [1875], pt. 2, p. 259) he formally relegates it to *Euonymus* (as a section) and in the *Forest Flora of British Burma* (vol. i, [1877], p. 249) he does not accord *Glyptopetalum* even sectional rank. It must also be pointed out that Bentham and Hooker had already (*Gen. Pl.* i, [1862], p. 361) pointed out how slight are the characters—the principal one being the solitary pendulous ovules—that separate *Glyptopetalum* from *Euonymus*; Baillon also (*Hist. des Plantes*, vi, [1875], p. 1, footnote) takes the same view as Kurz. If therefore the views of Kurz and Baillon ultimately prevail this plant will again be known as *Euonymus calocarpus* Kurz.

But while this is the case it will be seen on referring to the place of its publication that Kurz did not recognise in this species an example of his own section *Glyptopetalum*. In the *Flora of British Burma* too the generic description of *Euonymus* given by Kurz implies that the cells of the ovary are at least 2-ovuled—an implication opposed to his own statement (*J. A. S. B.* xlv, pt. 2, 159) as regards *Glyptopetalum sclerocarpum* and, as regards the species under review, incorrect. Kurz's views regarding the generic position of *Glyptopetalum* may therefore, I think, be ignored, and Baillon's authority can hardly be quoted in Kurz's support since that author takes so comprehensive a view of *Euonymus* that he is prepared to merge in it not merely *Glyptopetalum* Thw. but also *Lophopetalum* Wight, a step which Kurz has nowhere proposed. Moreover the genus *Glyptopetalum*, as founded by Thwaites (*Hook., Jour. Bot.* viii, [1856], p. 267), is sustained by Bentham and Hooker (*Gen. Pl.* i, [1862], p. 361), by Hooker and Thwaites (*Enum. Pl. Zeylan.* [1864], p. 73), by Beddome (*Flor. Sylvat.* i, [1874], t. 102), by Lawson (*Flor. Brit. Ind.* i, [1875], p. 612), by Trimen (*Cat. Ceylon Pl.* [1885], p. 18) and by Durand (*Index Gen. Phaner.* [1888], p. 66); considering too the large number of species of *Euonymus* proper already described and the ease with which species of *Glyptopetalum* are distinguished from these, it appears inadvisable at present to follow Kurz and Baillon in suppressing the latter genus. The present retention of *Glyptopetalum* moreover disturbs the synonymy of only one species instead of changing that of several.

*arillar* structure with meridional segments differing in colour from the testa that it overlies. The presence of this arillus proves that the coloured "aril" (which in turn loosely overlies it) is not a *true arillus* but, as Planchon has pointed out as regards the aril of *Euonymus*, an *arillode*.

#### GLYPTOPETALUM THWAITES.

Characters of *Euonymus* but ovules solitary and pendulous from the apex of the cell.

*Cymes shorter than leaves, flowers under 20 mm. diam. :—*

*Fruit quite smooth :—*

*Peduncles*  $\frac{1}{2}$  *as long as leaves, cymes lax*  
2-3 *times divided*; leaves thinly coriaceous oblong-lanceolate serrate, petals oblong, flowers 12 mm. diam., arillode covering  $\frac{3}{4}$  of seed and lobed at the margin ... 1. *G. zeylanicum.*

*Peduncles very short, cymes dense* 1-2 *times divided :—*

*Cymes longer than petioles, peduncles longer than pedicels*; leaves coriaceous ovate-oblong entire, nerves indistinct, petals oblong, flowers 8 mm. diam., arillode covering  $\frac{2}{3}$  of seed and lobed at the margin ... 2. *G. calocarpum.*

*Cymes not exceeding petioles, peduncles shorter than pedicels, leaves membranous, ovate-oblong serrate, nerves prominent beneath, arillode hardly covering*  $\frac{1}{3}$  *of seed, margin entire...* 3. *G. Griffithii.*

*Fruit rough tubercular*; peduncles  $\frac{1}{2}$  *as long as leaves, cymes lax* 2-3 *times divided, leaves thickly coriaceous, oblong-lanceolate serrate, petals suborbicular, flowers* 8 mm. diam., arillode covering  $\frac{1}{2}$  of seed, margin sinuate... 4. *G. sclerocarpum.*

*Cymes longer than leaves, flowers over 20 mm. diam.*; cymes lax once divided, leaves thinly coriaceous, oblong-elliptic entire, petals obovate, flowers 30 mm. diam.; fruit unknown ... 5. *G. grandiflorum.*

1. GLYPTOPETALUM ZEYLANICUM *Thwaites*. (*F. B. I.* i, 612).

INDIA AUSTRALIS; ZEYLANIA.

2. GLYPTOPETALUM CALOCARPUM.—(*Euonymus calocarpus* *Kurz*, *Jour. As. Soc. Beng.* xli, ii, 299 (1872) et xliv, ii, 159 (1875); *Laws*. in *Hook. f., Flor. Brit. Ind.* i, 609 (1875); *Kurz*, *For. Flor. Brit. Burma* i, 249 (1877).—*E. javanicus* *Kurz*, *Jour. As. Soc. Beng.* xlv, ii, 123 [*Veg. Nicobar.* 19] (1876), *saltem in parte, haudquaquam E. javanicus Blume.*)

TENASSERIM?; *Helper* (n. 1973). N. ANDAMANS; Great Coco, Little Coco, Table island, *Prain*. NICOBARS; *Kondil*, *Calcutta garden collectors*.

Arbuscula glabra ramulis glabris teretibus, *foliis* coriaceis supra viridibus subtus prasinis elliptico-oblongis utrinque cuneatis apice obtusis margine integris nervis 5—6-paribus indistinctis, petiolis brevibus; *cymis* axillaribus vel parum extra-arillaribus paucifloris densioribus pedunculis semel rarius iterumque divisis; pedicellis brevibus; floribus parvis albo-viridescentibus, *calyce* 4-lobo lobis omnibus rotundatis exterioribus interioribus 2-plo minoribus, *corollae* petalis 4 oblongis obtusis planis prope basin 2-foveolatis; *staminibus* 4 filamentis erectis in disci angulis obtusis insertis, loculis antherarum basi divergentibus; ovario pyramidato-tetragono disco affixo stigmatate minuto, 4-loculare; ovulis in loculis singulis pendulis anatropis, raphi extrorsa; *capsula* 1—4-sperma rotundata loculicidim debiscente, *seminibus* oblongis pendulis, arillo laciniato in testa membranacea adhaerente e raphi orto ornatis et arillodio carnosio rubro obtectis; *embryone* intra albumen carnosum orthotrope, cotyledonibus oblongis foliaceis, radícula brevi.

*Arbuscula* 4—12 metr. alta, *foliis* oppositis 9—16 cm. longis his 6—9 cm. latis, petiolis .75 cm., *cymis* 3—9-floris pedunculis 20—30 mm. longis, pedicellis 4 num. longis, *sepalis* exterioribus 1.5 mm. interioribus 3 mm. diam., *petalis* 3 mm. longis latisque, *capsulis* extus viridibus intus pallidis 1 cm. longis his 1—2 cm. latis *seminibus* 8 mm. longis his 7 mm. latis testa aurantiaca, arillo pallido, arillodio rubro 6 mm. alto.

Differs from *G. zeylanicum* by its rounded branches, thicker broader leaves with margins entire, by its much smaller flowers with petals flat and not reflexed at the margin, and by its rather shallower arillode. The true arillus is identical in both and the margin of the arillode is similarly lobed.

## 3. GLYPTOPETALUM GRIFFITHII.

In montibus MISHMI; *Griffith* (n. 1996).

Arbuscula? glabra ramulis glabris sub-4-gonis, *foliis* membranaceis læte-virentibus, elliptico-oblongis apice acuminatis basi cuneatis margine parce et minute dentatis, nervis 6—7-paribus subtus prominentibus,

petiolis distinctis; *cymis* axillaribus paucifloris densis pedunculis semel divisis, pedicellis elongatis; *floribus* .....; *capsula* 1—4-sperma rotundata loculicidim dehiscente; *seminibus* oblongis pendulis basi tantum arillodio carnosio obtectis; *embryone* intra albumen carnosum orthotropo, cotyledonibus oblongis foliaceis, radícula brevi.

Arbuscula? *foliis* oppositis 10—15 cm. longis his 6—9 cm. latis, petiolis 1 cm. longis, *cymis* 3-floris pedunculis 2—4 mm. longis pedicellis 8—9 mm. longis, *sepalis* omnibus 2·5 mm. diam., capsulis extus læte-viridibus intus pallidis 1 cm. longis his 1—2 cm. latis seminibus 8 mm. longis his 7 mm. latis, arillodio 2·5 mm. alto.

This species is well distinguished by its very short cymes with peduncles shorter than the pedicels and by its much shallower arillode. The sepals are all of equal size, the capsules externally are not distinguishable from those of *G. zeylanicum*.

4. GLYPTOPETALUM SCLEROCARPUM *Kurz.* (*F. B. I.* i, 613).  
PEGU.

5. GLYPTOPETALUM GRANDIFLORUM *Beddome.* (*F. B. I.* i, 613).  
INDIA AUSTRALIS.

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K.P. Dass del.

NEPETA BELLAVII Pr. Sm.

A. D. Moll, sc.



# NOTE ON THE PUBLICATIONS

OF THE

## ASIATIC SOCIETY.



The Proceedings of the Asiatic Society are issued ten times a year as soon as possible after the General Meetings which are held on the first Wednesday in every month in the year except September and October; they contain an account of the meeting with some of the shorter and less important papers read at it while only titles or short resumé's of the longer papers which are subsequently published in the Journal are given.

The Journal consists of two entirely distinct and separate volumes; Part I, containing papers relating to Philology, Antiquities, etc.; Part II, containing papers relating to Physical Science.

Each Part is issued in four or five numbers and the whole forms two complete volumes corresponding to the year of Publication.

The Journal of the Asiatic Society was commenced in the year 1832, previous to which the papers read before the Society were published in a quarto periodical entitled Asiatic Researches of which twenty volumes were issued between the years 1788 and 1839.

The Journal was published regularly, one volume corresponding to each year from 1832 to 1864; in that year the division into two parts above-mentioned was made and since that date two volumes have been issued regularly every year.

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The following is a list of the Asiatic Society's publications relating to Physical Science still in print which can be obtained at the Society's House, No. 57 Park Street, Calcutta, or from the Society's Agents in London, Messrs. Kegan Paul, Trench, Trübner and Co., 57 and 59 Ludgate Hill, E. C.

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JOURNAL of the Asiatic Society for 1843 (12), 1844 (12), 1845 (12), 1846 (5), 1847 (12), 1848 (12), 1850 (7), 1851 (7), 1857 (6), 1858 (5), 1861 (4), 1862 (5), 1864 (5), 1865 (8), 1866

(7), 1867 (6), 1868 (6), 1869 (8), 1870 (8), 1871 (7), 1872 (8), 1873 (8), 1874 (8), 1875 (7), 1876 (7), 1877 (8), 1878 (8), 1879 (7), 1880 (8), 1881 (7), 1882 (6), 1883 (5), 1884 (6), 1885 (6), 1886 (8), 1887 (7), 1888 (7 and Suppl.), 1889 (8 and 3 Suppl.), 1890 (9 and 2 Suppl.), @ 1/ per No. to Subscribers and @ 1/8 per No. to Non-Subscribers.

*N. B.* The figures enclosed in brackets give the number of Nos. in each Volume.

Centenary Review of the Researches of the Society from 1784—1883	...	...	...	...	...	Rs. 3	0
Theobald's Catalogue of Reptiles in the Museum of the Asiatic Society (Extra No., J. A. S. B., 1868)	...	...	...	...	...	1	8
Catalogue of Mammals and Birds of Burmah, by E. Blyth (Extra No., J. A. S. B., 1875)	...	...	...	...	...	3	0
Catalogue of Fossil Vertebrata,	...	...	...	...	...	2	0
Catalogue of the Library of the Asiatic Society, Bengal	...	...	...	...	...	3	8
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# JOURNAL

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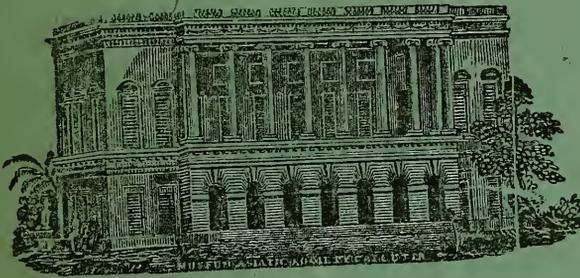
## ASIATIC SOCIETY OF BENGAL.

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EDITED BY

W. J. SCLATER, ESQ.

HONORARY SECRETARY.



The bounds of its investigation will be the geographical limits of Asia: and within these limits its inquiries will be extended to whatever is performed by man or produced by nature."—SIR WILLIAM JONES.

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*Note.*—Plates I and II illustrating Mr. Doherty's papers pu  
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JOURNAL  
OF THE  
ASIATIC SOCIETY OF BENGAL.



Part II.—NATURAL SCIENCE.

No. III.—1891.

IX.—*Additional Uredineae from the Neighbourhood of Simla.*  
By A. BARCLAY, M. B., *Bengal Medical Service.*

[Received 12th June, 1891; Read 1st July, 1891.]

(With Plates IV and V.)

Since the completion of my Descriptive List of the Simla *Uredineae*, published in former volumes of the Journal of this Society I have found, or have been supplied with, 32 other species, which are described in the following pages. Of these 32 species, 4 are *Uromyces* (2 new), 11 *Puccinia* (5 new), 3 *Phragmidia* (all new), 1 *Xenodochus* (new), 2 *Melampsora* (1 new), 5 isolated Aecidial Forms (3 probably new), and 6 isolated *Uredo* Forms (5 probably new). Of the 32 species described, therefore, probably 20 are new.

HEMIUROMYCES.

UROMYCES VIGNAE, n. s.

On *Vigna vexillata*, Benth.

I found this plant (on Tara Devi) towards the end of August immensely attacked by a species of *Uromyces*. The leaves were sometimes almost blackened with pustules. These were irregularly scattered over the leaf blade on both surfaces, but more freely over the lower

surface; and it appeared to me probable that they first emerged from this surface, and later from the upper surface, at a more advanced stage. Each pustule was round and convex, and without any paling of tissue around. On a few of the younger leaves I found some paler brown uredo pustules, on both surfaces of the leaf. Except in colour they were similar to the teleutospore pustules.

The *uredospores* are brownish red, oval to round, thin walled, very spiny, and with a few immature teleutospores among them (Pl. V, fig. 19). They measured when fresh and just wetted  $26-19 \times 19-18\mu$ .

The *teleutospores* are deep brown, oval, very deciduous, with a portion of colourless stalk adherent, with a pale brown shallow mammilla at the free end, a clear nuclear vesicle, a germ pore just under the mammilla, and a smooth surface (Pl. V, fig. 19). The fresh spores just wetted measured  $35-27 \times 22-20\mu$ . The portion of adherent stalk measured up to  $40\mu$  in length. These spores refused to germinate, probably requiring a period of rest. But some uredospores germinated throwing out simple long unbranched tubes.

As this host is nearly related to *Lathyrus sativus*, I at first thought the fungus must be the same as that I have described elsewhere\* on that plant, namely, *Uromyces Pisi*, Pers.; but the uredospores of the fungus on *Vigna* are considerably smaller, whilst the teleutospores are larger. It is therefore probable that the species I have here described is different, and I have named it *Uromyces Vignae*.

#### UROMYCES AGROPYRI, n. s.

On *Agropyrum*, sp.

This grass was collected also by Mr. Lace at Ralli (Bashahr), 7,000 feet, in October.

On some leaves there were light brown pustules on both leaf surfaces, and these contained uredospores. Other pustules were long, linear and black on the under leaf surface, somewhat resembling pustules of *P. graminis*.

The *uredospores* are round to oval, pale brown, densely warted, with several germ pores (4 to 5), and measured when just wetted  $23-20 \times 21-19\mu$ .

The *teleutospores* are lightly adherent to their beds, coming off with a small piece of stalk attached. They are light yellowish brown, much thickened at the apex, smooth on the surface, with a clear nuclear vesicle, measuring when just wetted  $37-28 \times 18-16\mu$ .

Hitherto, so far as I am aware, this genus of grasses was known to

\* Journal of Botany, Sept. 1890.

harbour only two species of *Puccinia* (*P. graminis* and *P. coronata*). This is therefore probably a new species.

UROMYCES PULVINATUS, Kalchb. et Cooke.?

On *Euphorbia hypericifolia*, Linn. var. *indica*.

Mr. Lace collected a *Puccinia* on this species of *Euphorbia* in October in a low valley of Bashahr, about 6,000 feet above the sea level. The under-surfaces of the leaves were profusely covered with dark brown circular pustules, usually distinct from one another, but sometimes coalescing. The spores are readily scraped off. These consist of:—*uredospores* which are yellow, thin-walled, spiny, and  $20 \times 19\mu$ ; and *teleutospores*. These are small, brown, thick-walled, single-celled, with a small piece of stalk adhering (sometimes none), warted on the surface, and generally with a clear nuclear vesicle. When just wetted they measure  $21-17 \times 18-16\mu$ .

Of the several species of *Uromyces* which inhabit species of *Euphorbia* the one I have just described comes nearest *U. pulvinatus*, Kalchb. et Cooke, and *U. Myristica*, B. et B. The former has been described from South Africa, and the latter from North America. In size of spore the Himalayan fungus resembles the former more than the latter; but the spores of *U. pulvinatus* are smooth, whilst those of *U. Myristica* are punctated like mine.

MICRUROMYCES or LEPTUROMYCES.

UROMYCES AMBIENS, Cooke.

On *Bucus sempervirens*, Linn.

Specimens of this fungus were gathered by Mr. Lace in the Bhabar Valley, Bashahr (6,000 feet) in October. The leaves were studded with circular patches 1—4 mm. in diameter. Some of these were orange yellow, and others pale in the centre, but surrounded by a black circle. The centres of all patches contained very prominent papillae (spermatogonia?). All the pustules were hypophyllous. In the case of patches which were not black the central papillae were surrounded by a circular mound covered with epidermis. This mound was a circular covered spore pustule. The spores were orange red, but as they were thick walled and otherwise like immature teleutospores I do not regard them as uredospores. The black circles surrounding the other patches were naked teleutospore beds. The spores from such parts are large, yellowish brown, round to oval, fairly firmly adherent, coming off usually with a short stalk or none, thick walled, showing a distinct pore at the

summit which is not thickened. Their surfaces were smooth, and they measured when just wetted  $44-40 \times 36-34\mu$ .

This is doubtless *Uromyces ambiens*, but I have no access to the measurements of the spores. Cooke's specimens apparently came from the Himalayas.

#### HEMIPUCCINIA.

#### PUCCINIA SORGHI, Schw.

On *Zea Mays*, Linn.

I had long searched in fields of maize for a Uredine, but without success until 1890 when I found it in some fields at Mashobra. Up to this time I was acquainted with the fungus only on *Sorghum vulgare*, on specimens of the plant sent to me for examination from the Poona district. But this is absolutely the first record of its existence on maize in India, so far as I am aware. My specimens were gathered early in October. Pustules were found abundantly on both leaf surfaces, some covered entirely with a scale of epidermis, whilst others were more or less naked. The covered pustules contained uredospores, the naked ones mostly teleutospores, and the perfectly matured open ones, which are inky black, only teleutospores. Some pustules were minute and circular, others long and even linear.

The *uredospores* are pale brownish red, round to oval, beset with shallow warts or short spines, and measure when just wetted  $30-26 \times 26-20\mu$ . By applying sulphuric acid I detected 3 germ pores in each spore, arranged around the short equator.

The *teleutospores* are firmly attached, breaking off with a portion of stalk adhering. They are reddish brown, rounded at both ends, thickened at the free end, constricted at the septum, and apparently smooth on the surface. When just wetted they measured  $42-32 \times 18-16\mu$ . They refused to germinate immediately after ripening. There were no paraphyses.

This fungus is much more like *Pucc. Sorghi* than that which grows on *Sorghum vulgare*, and which I have described elsewhere.\* In the first place the fungus on *Zea* has no paraphyses, and in the second the measurements of both uredo- and teleutospores approximate those given for *Pucc. Sorghi* much more closely. In the publication above alluded to I referred the parasite on *Sorghum* with hesitation to *P. Sorghi*. I am now inclined to think that the latter is a different species. Lastly, even later I found a *Puccinia* on *Pennisetum typhoideum*, Rich. (Bajra)

\* Journal of Botany, Sept. 1890.

at Erode in the Madras Presidency, which is undoubtedly the same as that on *Sorghum*. As neither of these fungi (on *Sorghum* and *Pennisetum*) are Himalayan I shall not describe them in detail here; but in order to enforce my argument that the fungus on *Zea* is *P. Sorghi*, whilst that on *Sorghum* and *Pennisetum* is a different species, which I shall call *Puccinia Penniseti*, I subjoin in tabular form their salient characters.

Host.	Uredospores.	Teleutospores.	Paraphyses.	Apical thickening.	Germ pores in uredospores.
Pennisetum	34 - 30 × 24 - 22	48 - 44 × 29 - 26	present.	none.	2
Sorghum ...	34 - 30 × 22 - 20	50 - 41 × 29 - 22	present.	none.	4-5
Zea ...	30 - 26 × 26 - 20	42 - 32 × 18 - 16	none.	present.	3

#### Puccinia ELLISII, De-Toni ?

On *Angelica glauca*, Edgw.

This plant was found by Dr. G. Watt at Fagoo in August, bearing uredo- and teleutospore pustules, both minute, discrete, and hypophyllous; but whilst the former are pale yellow, the latter are dark brown to black. Both kinds of pustule occurred together on the same leaf.

The *uredospores* are round to oval, very pale yellow, very spiny, and when just wetted 30 - 24 × 25 - 20 $\mu$ . (Pl. IV, fig. 9).

The *teleutospores* are deep brown, rounded at both ends, slightly constricted at the septum, coming off with little or no stalk adhering, not thickened as a rule at the free end, and tuberculated over both cells (Pl. IV, fig. 9). They are sometimes irregular in shape. They measured when just wetted 38 - 22 × 22 $\mu$ .

This is possibly *Pucc. Ellisii*, though both the uredo- and teleutospores of this last mentioned species are larger, the former measuring 35 - 30 × 30 - 24, and the latter 40 - 35 × 25 - 20 $\mu$ . It is certainly not *Pucc. Angelicae*, Schum. which shows a tendency to erupt along the nerves, among other differing characters.

#### Puccinia CASTAGNEI, Thüm ?

On *Apium graveolens*, Linn.

I have hitherto confused a fungus on this host with *Pucc. Pimpinellae*, Strauss; but it is certainly distinct.

The *uredospores* are very pale brown, covered sparsely with spines, and with three germ pores, each covered with a hyaline semilunar

thickening, like that described in *Pucc. Prenanthis*. Through each of these a commencing germ tube protrudes, but one only develops fully. They are in pustules mostly hypophyllous, but some few epiphyllous. These uredospores afford another instance of extremely long retained power to germinate. I put some spores scraped off from leaves gathered on the 31st October into water on the 13th June, and found on the following day that many had germinated most freely, although the accompanying teleutospores remained ungerminated.

The *teleutospores* are brownish yellow, very irregular in shape, the septum often oblique, and even perpendicular, slightly constricted at the septum, generally not thickened at the free end, though sometimes slightly so, mostly rounded at both ends, but sometimes with the lower cell narrowing towards the stalk (Pl. V, fig. 18). After lying 24 hours in water these spores measured  $41 - 26 \times 24 - 18\mu$ .

This is possibly *Pucc. Castagnei*, whose teleutospores are said to be very irregular and to measure  $46 - 36 \times 24 - 18\mu$ .

#### Puccinia Eulaliae, n. s.

On *Pollinia japonica*, Haeck.

The leaves of this grass presented dark reddish brown linear pustules, mostly on their under-surfaces. These pustules contained uredo- and teleutospores with numerous capitate paraphyses.

The *uredospores* are oval or pyriform, pale brown, and spiny, and measure when just wetted  $30 - 28 \times 21 - 20\mu$ .

The *teleutospores* are reddish brown: the upper cell is rounded and not thickened specially anywhere; the lower is broadly wedge-shaped. The surface of the spores is smooth, and they usually have a short piece of stalk adhering. They measure when just wetted  $38 - 34 \times 20 - 18\mu$ . The paraphyses are numerous, reddish brown, capitate, the heads measuring about  $16\mu$ . in diameter.

This is probably a new species.

#### MICROPuccinia.

Puccinia excelsa, n. s.

On *Phlomis lamiifolia*, Royle.

I found this plant early in September on the summit of the Huttoo peak bearing *Puccinia* pustules. I next found it, about the same time at Mahasu, a hill close to Simla. The leaves were densely bespattered on the under surfaces with fairly large, round to oval, dark brown, almost black, circular hemispherical pustules, with a smaller less fre-

quent epiphyllous eruption opposite the beds below. The upper surface of attacked leaves is rendered conspicuous by the yellow zones surrounding the pustules. Pustules were also found on the petiole and smaller stems, though not so frequently.

The spores are fairly easily detached, coming off as a rule with no portion of stalk adhering. They are dark brown, somewhat irregular in size and shape, mostly distinctly constricted at the septum, and mostly narrowing towards the free end, where there is a slight pale mammilla or conical thickening (Pl. V, fig. 12). At the base the spore is sometimes rounded, and sometimes narrowed. It is smooth on the surface. The fresh spores examined at once in water measure  $40 - 28 \times 18 - 14\mu$ .

No uredospores are apparently formed by this species, since I got specimens of teleutospores from the earliest stages of development. The teleutospores would not germinate immediately after ripening.

There is no doubt, I think, that this fungus is distinct from *P. Phlomidis*, Thüm.

#### LEPTOPUCCINIA.

##### PUCCINIA USTALIS, Berk. ?

On *Ranunculus hirtellus*, Royle.

I found seedlings of this plant bearing teleutospore pustules on the Mattiana hill on the 4th September. The pustules were quite young, and there was no trace of uredospore. The teleutospore pustules were small, dark, circular, and hypophyllous, with spots of paling on the upper leaf surface. These pustules were confined to the youngest leaves, and were never found on the upper ones. The pustules had a distinct though not pronounced circinate arrangement. The spores are very firmly adherent; they are long, more or less spindle-shaped, pale yellowish brown, much thickened and conical at the free end, well constricted at the septum, and narrowing towards the stalk. The surface is smooth (Pl. V, fig. 13). In scrapings I noticed many empty spore cases, and I presume therefore that the species is a *Leptopuccinia*. When just wetted the spores measured  $61 - 46 \times 23 - 8\mu$ , the apical thickening being  $10 - 4\mu$  in depth. I placed some spores in water on the 10th September, and on the following day found some had germinated. The sporidia are oval or somewhat semilunar, colourless, and  $13 \times 6\mu$ , in measurement. The sterigmata are four in number, short, conical, and pointed, and together with the whole premycelium colourless.

This is possibly *P. ustalis*, Berk.; but I have no access to the spore measurements.

## MICRO or LEPTOPUCCINIA.

## PUCCINIA DOLORIS, Speg. ?

On *Erigeron alpinus*, var. *multicaulis*, Wall.

This plant, harbouring a species of *Puccinia*, was gathered by Mr. Lace on the 27th August near the banks of the Sutlej in Bashahr, at an elevation of about 7,000 feet. The under surfaces of the leaves bore numerous large black pustules, irregularly scattered as a rule, but sometimes with several smaller pustules in a circle around a larger central one. Most pustules were naked, but some were covered over with a scale of epidermis. Though most pustules are hypophyllous some few are on the upper leaf surface.

The spores are readily detached, coming off with only a very small fragment of stalk adhering. They are yellowish brown, rounded at both ends, well constricted at the septum, thickened and broadly conical at the free end, beset externally over both cells with shallow short ridges and tubercles, and measuring when just wetted  $42-34 \times 18-16\mu$ . The thickening at the free end is usually  $6\mu$  in depth. I placed them in water in October, but they did not germinate.

This fungus resembles *Pucc. doloris* as described by De-Toni\* in many respects, and I have accordingly named it so. But as *P. doloris* is known only, so far as I am aware, from the Argentine Republic, it is quite possible that the Himalayan species is distinct.

## PUCCINIA SAXIFRAGAE-MICRANTHAE, n. s.

On *Saxifraga micrantha*, Edgw.

Mr. Lace collected this plant, bearing a *Puccinia*, in Bashahr at an elevation of 9,500 feet. On the under leaf surfaces were a number of minute, circular, discrete, brown pustules, sometimes very numerous.

The teleutospores are readily detached, and many were found to be empty. The species is probably therefore a *Leptopuccinia*. They are pale brown, not thickened anywhere, with a slight apical mammilla, usually slightly constricted at the septum, but sometimes considerably so, and somewhat irregular in size and shape. When just wetted they measure  $35-26 \times 14-12\mu$ . I placed these spores in water, but none germinated. There were no uredospores in the specimens sent to me.

This species is quite distinct from *Pucc. Saxifragae-ciliatae* mihi. It is also evidently distinct from *P. Saxifragae*, Schlect.

\* Saccardo, Sylloge Fungorum.

## PUCCINIA CAUDATA, n. s.

On *Stellaria paniculata*, Edgw.

Dr. G. Watt collected this plant in Narkanda, bearing a *Puccinia*. The teleutospore beds are dark brown, well raised with a circinate tendency, and hypophyllous, with paled patches on the upper leaf surface. The spores are very adherent, more or less spindle-shaped, pale brown, well constricted at the septum, usually much thickened at the apex, with a long piece of adherent stalk (often twice, or a little more, than the whole length of the spore) and measuring  $37 - 28 \times 16 - 13\mu$ . (Pl. V, fig. 17.).

This is evidently not *P. Arenariae*, Schum. and I have regarded it as a new species.

## PUCCINIA CRASSA, n. s.

On *Pimpinella Griffithiana*, Boiss.

This was gathered by Mr. Lacey in Ziarat in Afghanistan at 8,000 feet. The teleutospore pustules are dark brown and hypophyllous. The spores are brown, almost rounded at both ends, but diminishing somewhat towards the stalk, of which a small fragment remains adherent. They are slightly constricted at the septum, and slightly thickened at the apex (Pl. V, fig. 16). When just moistened the spores measure  $50 - 41 \times 24 - 22\mu$ . The epispore has shallow tubercles over both cells. They would not germinate.

This fungus is quite distinct from *P. Pimpinellae*, Strauss which is one of the most common of the *Uredineae* in Simla. Neither are the spores like any of the other species inhabiting *Pimpinella* described by De-Toni\* (except perhaps *P. Pimpinella*, St var. *Eryngii*, D. C.) It is I think a new species.

## PUCCINIA PULVINATA Rabenh. ?

On *Echinops niveus*, Wall.

A *Puccinia* on this host was gathered for me by Dr. G. Watt in Simla. The leaves had numerous minute well raised black pustules all epiphyllous. The spores are readily detached from their beds. The plant was in full flower inclining to seed. The spores come off sometimes with a long piece of stalk attached, sometimes with a short. The spore surface is studded with shallow tubercles. They are brown, slightly constricted at the septum, mostly rounded at both ends, the free end slightly thickened. Most spores were found empty, so they

\* Saccardo, *loc. cit.*

presumably germinate at once. They measure when just wetted  $52 - 45 \times 24 - 22\mu$ .

This is possibly *Puccinia pulvinata*, though the measurements given by De-Toni are greater than mine ( $68 - 51 \times 38 - 35\mu$ ).

#### PHRAGMIDIUM.

##### PHRAGMIDIUM LACEIANUM, n. s.

On *Potentilla argyrophylla*, Wall.

I first received specimens of this plant harbouring a parasite from Mr. Lace, who gathered them in Bashahr. Subsequently I found specimens myself at Narkanda, and Dr. J. Murray procured specimens at Sarhan in Kulu.

The *uredo pustules* are hypophyllous, brilliantly orange red, discrete, but often so numerous as to give an appearance of coalescence. Each individual pustule is circular and minute. The *spores* are round to oval or pyriform, bright orange red, spiny, and measuring when just wetted  $24 - 20 \times 18 - 16\mu$  (Pl. IV, fig. 3).

The *teleutospore pustules* are also hypophyllous, black, circular, discrete. The *spores* are deep brown, on stalks which narrow gradually away from the spore. They are mostly five-celled; but some are four and some six-celled. The surface is apparently smooth, the free end rounded and slightly thickened, with usually a minute colourless papilla. When just wetted they measure  $132 - 94 \times 50 - 41\mu$ . I could not detect any germ pores; and they would not germinate immediately after ripening.

The specimens sent by Mr. Lace, and those collected by myself were on the red flowered variety, whilst those collected by Dr. Murray were on the yellow flowered variety. This fact may tend to confirm the view taken in Hooker's Flora of British India that these two are varieties of the same species.

This fungus is, I think, distinct from any of the three noted in Saccardo's Sylloge as inhabiting species of *Potentilla*. It is not *Phr. Fragariastris*, D. C., which has warty teleutospores,  $75 - 45\mu$  long and 3-5 celled. It is not *Phr. Potentillae*, Pers. which has smooth teleutospores,  $90 \times 26\mu$ , and 3-7 celled. And it is not *Phr. Tormentillae*, Fuck. which has spores often bent,  $115 \times 28\mu$ , 3-8 celled, and light brown.

##### PHRAGMIDIUM NEPALENSE, n. s.

On *Potentilla nepalensis*, Hook.

I found this host in September attacked with a *Phragmidium* at Mattiana, some miles towards the interior from Simla. The host at

that time was in flower and held both uredo- and teleutospore pustules. Both pustules were mainly hypophyllous, but a few (especially uredo pustules) were epiphyllous.

The *uredo* pustules are very brilliantly orange red and circular, but were often so closely aggregated that they ran together. The spores are round or oval, or more or less irregular in shape, and bright orange red (Pl. IV, fig. 2). They varied much in size,  $28 - 22 \times 22 - 17\mu$ . There were no paraphyses.

The *teleutospore* pustules are much smaller and appear like minute black dots scattered about irregularly. The spores are very dark brown, generally constricted at the septa, apparently with 2-4 pores to each cell, 2-5 celled, but usually 4 celled, with a small and inconspicuous mammilla at the free end, looking more like a slight general thickening of the epispore (Pl. IV, fig. 2). The stalk is long, thin, and inflated at some distance from the attachment to the spore, the inflation containing orange red matter. Normal 4 celled spores measured when just wetted  $68 - 66 \times 26\mu$  and a 3 celled spore  $54 \times 24\mu$ .

Of the three species of *Phragmidium* on species of *Potentilla* described by De-Toni\* only one, namely, *Phr. Fragariastris* has so few cells to each spore, and the one I have just described is, I think, not identical with it. I have therefore named it *Phragmidium nepalense*.

#### PHRAGMIDIUM OCTOLOCLARE, n. s.

On *Rubus rosaefolius*, Smith.

The general appearance of the teleutosporic stage of this fungus (the only one I know it in) is very like that of *Phr. Barclayi*, Dictel,† with somewhat large circular pulverulent hypophyllous pustules.

The teleutospores are dark brown 7-9 celled usually, but mostly 8-celled. The surface is distinctly and coarsely tuberculated, and at the free end there is sometimes a minute colourless papilla, but often none. The stalk is long, swells up somewhat in water, is inflated away from the spore, and this lower part of the stalk swells, more than the upper part adjoining the spore (Pl. IV, fig. 1). The stalk is not unlike that of *Phr. Barclayi*. After lying 24 hours in water the gelatinous sheath shrinks upwards towards the spore, leaving a central axis with orange red swellings at the ends. The spore is constricted at each septum to a slight degree. Each cell of the spore is more flattened from above downwards than in the last mentioned species, the vertical depth of each cell being  $10\mu$  against  $14\mu$  in *Phr. Barclayi*. The spores (taking

\* Saccardo, *loc. cit.*

† I incorrectly regarded it as *Phr. Rubi*, Pers., in my Descriptive List.

those which have 7–9 cells) measure when recently wetted  $130 - 94 \times 23 - 25\mu$  but exceptionally a spore of only two cells may be found, measuring  $44 \times 24\mu$ . I have not observed the germination of these spores; but some spores collected in autumn and put into water did not germinate, and from this I conclude that they must rest. On the other hand some of these spores showed a cell here and there empty; so apparently under special conditions they may also germinate at once.

I am inclined to regard this fungus as distinct from *Phr. Barclayi* and *Phr. quinqueloculare*, mihi. If it be identical with either, it is with *Phr. Barclayi*; but the spores of the latter are usually 6-celled with smooth surface (or with very shallow inconspicuous warts) somewhat less in length and greater in diameter. I am also unable to match it with any of the six species described by De-Toni\* on species of *Rubus*. I propose naming it *Phragmidium octoloculare*.

#### XENODOCHUS.

##### XENODOCHUS CLARKIANUS, n. s.

On *Astilbe rivularis*, Ham.

This fungus was collected by Dr. Clark in the Cheog forest about the beginning of August. On one specimen there were large irregular aecidial patches, especially on the stem, accompanied by hypertrophy, just like that caused by *Phragmidium subcorticium* on *Rosa moschata*. These aecidia were exceedingly brilliantly orange red: they occurred also on leaves. The spores are very bright orange red, in rows, squarish or oblong, densely warted, thickened a little at one end (seen best in empty spores) (Pl. IV, fig. 5). They measure  $31 - 26 \times 26 - 22\mu$ . There were no paraphyses.

But much more numerous were orange waxy looking beds, which to the naked eye resembled *Coleosporium* beds. These in many places simply covered the under leaf surface. I noticed that in some parts these orange waxy beds were gradually changing, and at others had changed into black beds, naked, and under a field lens looking like *Puccinia* beds. The spores from the latter are scraped off with difficulty, and when examined under the microscope presented characters most like those I have read described as *Xenodochus* spores. They have characters, as far as I am able to judge, intermediate between this genus and *Phragmidium*. The spores were in rows, usually 5 to 6 in each row, pale brown, rows being sometimes transversally septate, at others irregularly in various obliquities. The rows of spores were some-

\* Saccardo, *loc. cit.*

times closely amalgamated with rows on either side. Each spore of a regular row measured about  $16 \times 13\mu$  (Pl. IV, fig. 4). I placed these spores in water, but they refused to germinate.

This is apparently a new species of *Xenodochus*. It differs considerably from *X. carbonarius*, Schlecht. in which the aecidiospores are  $28 - 16 \times 20 - 15\mu$  and among which there are paraphyses. Moreover, in the last named species the teleutospore rows have 10 to 20 loculi.

### MELAMPSORA.

#### MELAMPSORA CILIATA, n. s.

On *Populus ciliata*, Wall.

This host is abundant in Simla, and many are occasionally attacked by a species of *Melampsora*. The uredo stage makes its appearance in August or September.

The uredo pustules are minute and discrete, but often very abundant; they are light yellow, and entirely hypophyllous, with scattered yellow dots on the upper leaf surface. The spores are pale orange red, mostly oval, pretty densely covered with spines, thick walled, and measure when fresh  $30 - 21 \times 22 - 20\mu$  (Pl. V, fig. 15). They are borne singly on stalks, and among them are some capitate paraphyses, with heads very distinctly, and often greatly thickened at the free end (Pl. V, fig. 15).

The teleutospore beds are at first orange red, but become brown later. They are entirely hypophyllous. The spores are in compact beds and each spore measures  $34 - 30 \times 9 - 8\mu$ .

This fungus is, I think, different from any of the three described by De-Toni. This will be apparent when the characters are shown tabularly.

	Uredospores.	Teleutospores.	Paraphyses.	Remarks.
<i>M. Tremulae</i> , Tul.	24-15 × 18-13	55-45 × 12-11	Clavate, 9-15.	
<i>M. aecidioides</i> , D. C.	24-17 × 17-15	?	Clavate.	
<i>M. populina</i> , Jacq.	38-28 × 20-15	45-40 × 13	Capitate, 20-17.	epiphyllous.
<i>M. ciliata</i> , mihi ...	30-21 × 22-20	34-30 × 9-8	Capitate.	hypophyllous.

#### MELAMPSORA AECIDIoidES, D. C. ?

On *Populus alba*, Lin.

Mr. Lacey sent me specimens of the leaves of this plant collected at an elevation of 8,500 feet on the 30th August. The under surfaces

were almost wholly covered with brilliant orange red pustules, minute and discrete, though from their enormous numbers they at first sight appeared to be coalescing. The upper leaf surface is profusely flecked with yellow discoloured spots. The spores are orange red, thick walled, spiny, and measure when just wetted  $24 - 21 \times 18 - 16\mu$ . There were no teleutospores.

It is impossible from the uredo spores alone to determine the exact position of this fungus. Possibly it is *M. aecidioides* which occurs also on *Populus alba*. The uredospore measurements coincide very closely with those I have just described, but *M. aecidioides* has paraphyses whilst the Himalayan form has not.

#### ISOLATED AECIDIA.

##### AECIDIUM CUNNINGHAMIANUM, n. s.

On *Cotoneaster bacillaris*, Wall.

I found the leaves of this plant bearing several characteristic *Roestelia* patches first on the Mahasu hill by the road side; then fairly abundantly in Narkanda; and lastly, scarcely in Mashobra. These were found at the end of August. In all these localities, especially Narkanda and Mashobra, I did not see a single *Cupressus* tree, and this inclines me to regard the fungus as distinct from *Gymnosporangium Cunninghamianum*, mihi. The leaf patches were red above, with long filiform peridia on the lower surface, about 3-5 mm. in length. From one to five such patches were found on a single leaf. On superficial examination this fungus looks different from *Gymnosporangium Cunninghamianum*, although the peridium bursts in the same way, namely, by irregular slits on the tube sides. With a field lens numerous spermogonia could be seen on the upper leaf surface.

The aecidiospores are yellowish brown, round or oval, densely beset with minute and very shallow warts, and with apparently numerous germ pores (the addition of sulphuric acid discloses eight pores). These spores measure  $28 - 26 \times 28 - 24\mu$  (Pl. IV, fig. 7). The peridial cells are paler in colour than the aecidiospores, elongated, separating readily from one another laterally, very spiny (not ridgy), and measure from  $60 - 58 \times 26 - 24\mu$  (Pl. IV, fig. 7). The aecidiospores would not germinate in water.

Had it not been for the absence, as far as I could see, of *Cupressus* trees in the neighbourhood of these aecidial patches, I should have been disposed on the whole to regard this fungus as *G. Cunninghamianum*; and, indeed, this identity is still quite possible, since it is by no means easy to be certain that no *Cypress* tree exists in the forests in those

regions. In support of the view of identity are the manner of dehiscence of the peridium, and the closely corresponding sizes of the aecidiospores and the peridial cells (the former in the case of *G. Cunninghamianum* being on an average  $28.6 \times 24.6\mu$ , and the latter  $70 \times 22\mu$ ). I should note also that the peridial tubes of the aecidium on *Cotoneaster* are somewhat longer than those on *Pyrus* (in the latter they are 1 to 2 mm.)

The only *Aecidium* known on *Cotoneaster* is *Aec. Mespili*, D. C.; but the aecidiospores of this species are  $24 - 19\mu$ . in diameter, and I do not think the Simla species can be the same. Until more is known of its life history I propose naming it *Aec. Cunninghamianum*, believing that it will probably prove to be identical with *Gymnosporangium Cunninghamianum*, mihi.

#### ÆCIDIDIUM MORI, n. s.

On *Ficus palmata*, Forsk.

I found this plant first attacked in a valley to the north of Mashobra, and subsequently in Simla itself during October. The leaves are often densely covered with an orange red eruption. In some cases the whole of the lower leaf surface was a mass of these bright pustules. But although the eruption is mainly hypophyllous it is also largely epiphyllous. With a field lens it is difficult to determine the nature of the fungus. Each spore heap is very minute, but shreds of white tissue are seen about them. Under the microscope however, all doubt ceases, for there are very characteristic peridial cells, and the fungus is consequently an *Aecidium*. But it is a very remarkable one in having so small and inconspicuous a peridium. To the naked eye the fungus resembles a *Uredo* form. The spore beds are scattered irregularly all over the leaf surface; but sometimes on somewhat swollen weals on the petiole and midrib. The aecidiospores are very brilliant orange red bodies, round to oval, and apparently smooth on the surface. When just wetted they measure  $17 - 14 \times 16 - 14\mu$ . The peridial cells are colourless and more delicate than usual. They are mostly six-sided and spiny or tuberculated. They measure  $22 \times 18 - 19\mu$ . I placed some of the aecidiospores in water on the 17th of October, and a few were found to have germinated on the following day. The germ tube is long, simple, and unbranched.

Saccardo mentions a *Puccinia sepulta*, B. et C. on the leaves of a species of *Ficus* from Nicaragua and two *Uredo* forms (*U. Fici*, Cast. and *U. ficicola*, Speg.); but even supposing these *Uredo* forms are really *Aecidia*, the spores of the former are much too large, and those of the latter considerably larger than the Simla fungus to permit of their being considered identical. The Simla species is probably therefore new.

This fungus is identical with that I have described as *Caeoma Mori*; and as I have subsequently found that the peridium is distinctly present though incoherent, I feel disposed to relinquish the name *Caeoma Mori* and to substitute *Aecidium Mori*.

*AECIDIUM FLAVESCENS*, n. s.

On *Senecio rufinervis*, D. C.

I found this plant in August bearing an *Aecidium* in the Mashobra woods. The aecidial patches are indicated conspicuously by brown patches with yellow irregular halos around them on the upper leaf surface. On the under surface the peridia are indistinctly seen against the white tomentose natural leaf surface, as they are pale in colour. The peridia are densely aggregated together, and always on the under leaf surface. The tubes are short and open stellately. I counted from one to thirty-two aecidial patches on single leaves. The patches varied from a half to 2 c.m. in diameter. The aecidiospores are oval or round, pale orange red, measuring when well moistened  $22 - 20 \times 16 - 14\mu$ . The peridial cells are almost isodiametric, very rugose on the surface, with short ridges and spines, and measuring  $28 - 22 \times 22 - 20\mu$ . (Pl. IV, fig. 8).

Later in the season leaves in the same locality bore uredospores, and still later teliospores in the form of *Coleosporium*. I have unfortunately had no opportunity of examining these forms.

Two species of *Aecidia* on species of *Senecio* are noted by Saccardo, *Aec. Huallatinum*, Speg., and *Aec. sclerothecium*, Speg.; but the spores of the Simla species are much smaller than those of either of these two species.

*AECIDIUM AQUILEGIAE*, Pers. ?

On *Aquilegia vulgaris*, Linn.

Mr. Lace collected this plant on the 9th August, 1890 at an elevation of 10,000 feet bearing an *Aecidium*. The peridia are hypophyllous, forming a patch of yellow below with a paler area above on which spermogonia may be seen with a field lens. The peridia open by a clean regular margin. The peridial cells are angular, almost isodiametric, five to six-sided, spiny and ridgy, and about  $26 \times 20\mu$ . The aecidiospores are round or faceted when just scraped off, tuberculated, and  $24 - 18 \times 18 - 12\mu$ .

This fungus is very possibly *Aec. Aquilegiae*, Pers. though the spores in the latter are said to be larger ( $30 - 16 \times 20 - 14\mu$ .) and perhaps more spiny.

## AECIDIUM ORBICULARE, n. s.

On *Clematis grata*, Wall.,, *orientalis*, Linn.,, *puberula*, H. f. and T.

This *Aecidium* was sent to me first by Mr. Lace and Dr. Watt, and subsequently I found it myself at Mattiain on *Clematis grata*.

Accidial patches were very numerous on stems, petioles, and leaves, causing considerable hypertrophy of stems and petioles, especially on *Clematis grata*. On leaves the peridia were markedly circinate in arrangement, and all were hypophyllous. The peridial tubes were long and cylindrical, and opened at the summit with an almost clean margin, *i. e.*, very minutely serrated. They measured about 0.75 m.m. in length. The spores are bright orange red, densely beset with shallow warts, round to oval or angular, 25 - 20 × 20 - 14 (*Clematis grata*) 21 - 16 × 16 - 15 (*C. orientalis*) 22 - 19 × 19 - 15 $\mu$ . (*C. puberula*).

The peridial cells were in all cases about 26 - 20 $\mu$ . in diameter, four to six-sided, with bright orange red matter in their centres, and spiny, (Pl. IV, fig. 6).

This may possibly be the New Zealand *Aec. otagense*, Linds.; but the only description available to me is the very brief one by De-Toni, from which it is impossible to decide, since no spore measurements are given. The only other *Aecidium* described by De-Toni on *Clematis* is *Aec. Clematidis*; but the description of the peridium is unlike that I have described. The Himalayan species is therefore, I think, distinct. It is possible that this *Aecidium* is related to *Puccinia Wattiana*, mihi which occurs plentifully on *Clematis Gauriana* and *C. grata*; but in the absence of experimental proof it is impossible to determine.

## ISOLATED UREDO FORMS.

## UREDO COLEBROOKIAE, n. s.

On *Colebrookia oppositifolia*, Smith.

This fungus was collected by Dr. Watt near Suni in October. The under surfaces of the leaves were almost uniformly orange red in colour from innumerable orange red pustules. These pustules are really distinct, but appear to be coalescing from their great numbers, and from the hairy nature of the leaf surface, in which the spores get entangled. Dr. Watt informed me that showers of red dust fell from the leaves as he picked them. The spores are pale orange red, oval, very spiny, measuring when just wetted 28 - 20 × 20 - 17 $\mu$ . These spores were put into water some few days after collection, but they did not germinate freely; one or two did so, however, throwing out long simple sinuous tubes.

## UREDIO ICHNOCARPI, n. s.

On *Ichnocarpus frutescens*, Br.

This fungus was also collected by Dr. Watt in the same neighbourhood, and at the same time. The leaves bore a few scattered isolated, bright orange red pustules on the under leaf surface. The spores were readily scraped off. They are bright orange red, oval, studded with large coarse warts or spines, and measure when just wetted  $24 - 20 \times 16 - 21\mu$ . Even in empty spores I could not detect any germ pores. Among the scraped off uredospores I saw some immature single celled stalked spores which I imagine are teleutospores (*Uromyces*); but they were too immature to allow of decision. They were colourless at this early stage.

An *Aecidium Apocyni*, Schwein. is known to occur in Carolina, Kansas, and Illinois; but it is impossible as yet to say whether it is in any way related to the Himalayan fungus: probably it is not.

## UREDIO IPOMAEAE, n. s.

On *Ipomaea hederacea*, Jacq.

This plant was collected by Dr. Watt near Sairi in September with numerous, white, irregularly shaped covered pustules on the under leaf surface. On examining the pustules they were found to contain an abundance of white powdery spores. The spores are colourless, round or squarish, apparently quite smooth on the surface, and measuring when just wetted  $20 - 17 \times 16 - 14\mu$ . Although I have placed this fungus here among Uredo forms I should note that it looks much like the *Aecidium* of a *Phragmidium*, differing only in not being coloured.

## UREDIO PILEAE, n. s.

On *Pilea trinervia*, Wt.

I found a few of these plants in the woods at Mashobra early in October, attacked by a Uredo. The pustules were minute, pale yellow, and scattered on the under leaf surface. The spores are oval, very pale yellow, studded with prominent spines, and measured when just wetted  $25 - 20 \times 20 - 14\mu$ . I could find no trace of any teleutospore form up to the middle of October.

## UREDIO EHRETIAE, n. s.

On *Ehretia serrata*, Roxb.

This fungus was collected by Mr. J. S. Gamble on the banks of the Tons river near Chakrata. The leaves are attacked by a Uredinous

fungus of somewhat uncertain nature. Some leaves had circular spots varying in diameter from 1 to 8 m.m., whilst others had large hypertrophies of the petiole as it enters the lamina, and these were uniformly covered with bright orange red pulverulent spores. Transverse sections through the fungus and leaf show that the spores are not borne separately on stalks, but from a cup-like depression like the pit of an *acidium* without any peridium. There were also numerous superficial spermogonia. The spores are orange red, oval or pear-shaped, very spiny, decidedly thickened at the free end (remining one of the *acidio-* and uredospores of *Puccinia Prainiana*). When just wetted they measure  $38 - 30 \times 22 - 20\mu$ . They become detached without any portion of the stalk adhering. The spores are given off from both surfaces of the leaves. By applying nitric acid I saw that each spore had two germ pores.

This is the first member of the *Boragineae* which I have seen attacked in India by a Uredine. As *Puccinia Rubigo-vera*, or some variety or allied species, is undoubtedly the most prevalent and destructive rust on wheat, barley, and oats in India, I had long looked for some associated form on a Boragineous host, and this not only by personal search, but also by correspondence. I am afraid, however, that this particular Uredine cannot be the associated form I have been looking for, although it is just possible that it is. For although the spores are given off like uredospores, the cup-shaped depressions in which they are formed, the presence of spermogonia, and the hypertrophy of the host's tissue all render it possible that we have here an anomalous *Acidium*. This question will have to be tested by experiment.

#### UREDO AGRIMONIAE, D. C.

On *Agrimonia Eupatorium*, Linn.

This plant is frequently found attacked with a Uredo in these regions; but I have never seen a teleutosporic stage. The Uredo pustules are hypophyllous, very numerous, and minute. The spores are orange yellow, oval, warty or spiny, and measure  $22 - 17 \times 14 - 13\mu$ , when just wetted.

This is no doubt the widely distributed *Uredo Agrimoniae*.

#### EXPLANATION OF PLATES.

##### Plate IV.

1. Teleutospore of *Phr. octolocularis*,  $\times 220$ .
2. Teleutospore and uredospore of *Phr. nepalense*, former  $\times 220$ , and latter  $\times 350$ .

3. Teleuto- and uredospores of *Phr. Luceianum*,  $\times 220$  and  $\times 350$ .
4. Teleutospore of *Xenodochus Clarkianum*,  $\times 350$ .
5. Aecidiospore of the same  $\times 350$ .
6. Peridial cells of *Aecidium orbiculare*,  $\times 350$ .
7. Peridial cells and aecidiospores of *Aec. Cunninghamianum*, *a*  $\times 350$ ,  
*b*  $\times 220$ .
8. Peridial cells of *Aec. flavescens*,  $\times 350$
9. Teleuto- and uredospores of *Pucc. Ellisii*,  $\times 350$ .
- \*10. Teleutospore of *Pucc. Wattiana*,  $\times 350$ .

Plate V.

11. Teleuto- and aecidiospores and promycelium of *Phr. quinqueloculare*,  
 $\times 350$ .
12. Teleutospores of *Pucc. excelsa*,  $\times 350$ .
13. Telentospores of *Pucc. occulta*,  $\times 350$ .
- \*14. Telentospores of *Pucc. McIntirianus*,  $\times 350$ .
15. Uredospores and paraphyses of *Melampsora ciliata*,  $\times 350$ .
16. Teleutospores of *Pucc. crassa*,  $\times 350$ .
17. Teleutospores of *Pucc. caudata*,  $\times 350$ .
18. Teleutospores of *Pucc. Castagnei*,  $\times 350$ .
19. Teleuto- and uredospores of *Uromyces Vignae*,  $\times 350$ .

X.—Notes on the Collection of Snakes in the Indian Museum with descriptions of several new species.—By W. L. SCLATER, M. A., Deputy Superintendent of the Indian Museum.

[Received 1st August, 1891; read 5th August, 1891.]

(With Plate VI.)

The following notes were drawn up while critically examining and rearranging the collection of Snakes in the Indian Museum; the collection is a fairly large one though there are many Indian species still unrepresented, and I should be very glad if any one would assist me to fill up the gaps especially in the Southern Indian and Ceylonese forms in which the Museum is specially deficient.

The number of Snakes described by Mr. Boulenger in his work on the Reptiles of the Indian Empire and Ceylon amounts in all to 264, of this number the Indian Museum possesses examples of 196, so that no less than 68 are still wanting to complete the Indian Museum Collection; of the 68 deficiencies, however, 22 at least of the species have only been got once and are represented in the British Museum or elsewhere usually by a single specimen.

\* For descriptions of these, see J. A. S. B., Vol. LIX, Pt. II, No. 2, 1890.

To the 264 snakes given in Mr. Boulenger's work I have now eleven to add, of which five are new, and described here for the first time and six are exotic species now recorded from the Indian Empire for the first time, so that the total number of Indian Snakes is now raised to 275.

The Indian Museum possesses a fair number of types, but unfortunately several which I believe should be here are no longer to be found in the collection, such is the case with *Typhlops andamanensis*, Stoliczka, *Calamaria catenata*, Blyth, and several others.

The following is a list of the species, twenty-one in number, of which the types are still in the Museum.

<i>Typhlops theobaldianus</i> , Stol.	<i>Coluber prasinus</i> , Bly.
<i>Trachischium fuscum</i> , (Bly.)	<i>Pseudoxenodon macrops</i> , (Bly.)
„ <i>tenuiceps</i> , (Bly.)	<i>Tropidonotus platyceps</i> , Bly.
<i>Blythia reticulata</i> , (Bly.)	„ <i>nigrocinctus</i> , Bly.
<i>Lycodon gammiei</i> , (Blanf.)	<i>Dipsas multifasciatus</i> , Bly.
<i>Hydrophobus davisoni</i> , (Blanf.)	<i>Hypsirhina blanfordi</i> , Boul.*
<i>Pseudocyclophis bicolor</i> , (Bly.)	<i>Distira tuberculata</i> , (Anders.)
<i>Ablabes scriptus</i> , Theob.	<i>Amblycephalus modestus</i> , (Theob.)
„ <i>nicobarensis</i> , Stol.	„ <i>macularius</i> , (Bly.)
<i>Zamenis ladaccensis</i> , Anders.	<i>Trimeresurus cantoris</i> , Bly.
<i>Zaocys nigromarginatus</i> , (Bly.)	

To these must be added the types of the five new species described below.

<i>Ablabes stoliczkae</i> .	<i>Tropidonotus pealii</i> .
<i>Simotes woodmasoni</i> .	<i>Tropidonotus nicobaricus</i> .
<i>Zaocys tenasserimensis</i> .	

There are also in the Indian Museum the types of the following species found on the borders of the Indian Empire but not yet recorded from within its limits.

<i>Typhlops persicus</i> , Blanf.	<i>Pseudocyclophis persicus</i> , (Anders.)
<i>Calamaria stalknechti</i> , Stol.	<i>Dipsas rhinopoma</i> , Blanf.

The total number of types therefore in the Indian Museum is thirty.

It is only due to Mr. Boulenger to add that it is entirely owing to his useful and excellent manual on Indian Reptiles in the Indian Fauna series that I have been able to work out and rearrange the Snakes in the Indian Museum, so much has been done since Günther's Reptiles of British India appeared and that scattered over so many various separate works and periodicals.

The Snakes in the Museum are now arranged in accordance with

\* Originally described by Blanford as *H. maculosa*, name changed by Boulenger.

Mr. Boulenger's work, and a complete list of them will shortly be published, in the meantime the following notes may be found useful.

TYPHLOPS DIARDI, Schleg., Boulenger, p. 238.

TYPHLOPS BOTHRIORHYNCHUS, Günth., Boulenger, p. 239.

I have found it difficult to separate these two species, in fact the only distinction pointed out by Boulenger is the presence of the pits below the nostrils, these I have found vary considerably in depth and conspicuousness; all the specimens of *T. bothriorhynchus* in the Indian Museum were procured in Assam where *T. diardi* also seems to be most abundant; it would therefore seem possible that this pit might be a sexual or seasonal mark, and that these two species are really one and the same.

TYPHLOPS THEOBALDIANUS, Stol., Boulenger, p. 240.

Of this species, which seems to be unrepresented in the British Museum Collection, the Indian Museum possesses two examples, one the type, the history of which is unknown, and a second procured by Capt. J. Butler at Samagooting in the Naga hills.

TYPHLOPS ACUTUS, (Dum. et Bibr.), Boulenger, p. 241.

This species is not confined to Southern India, it extends to Bengal, and the Indian Museum contains specimens from Sipri in Gwalior, Chybassa in Chota Nagpur, Calcutta and Krishnaghur.

PYTHON MOLURUS, (Linn.), Boulenger, p. 246.

Boulenger does not mention whether the present species extends to China, Günther also expresses a doubt on the subject, the matter may now be settled as the Indian Museum possesses an undoubted specimen of *P. molurus* procured by Surgeon-Major Hungerford at Haiphong (Hiaofung?) near Shanghai.

SILYBURA NIGRA, Beddome, Boulenger, p. 263.

*Silybura wood-masoni*, Theobald (Cat. Rept. Brit. Ind., p. 135) the type of which is in the Indian Museum, seem rather referable to *Silybura nigra* than to *S. pulneyensis*.

SILYBURA BREVIS, Günth., Boulenger, p. 268.

This species extends northwards to the Ganjam hills, whence the Museum possesses a specimen presented by Col. R. H. Beddome.

CALAMARIA CATENATA, Blyth, Boulenger, p. 282.

The type of this species is no longer in the Museum, it had apparently disappeared before the collections of the Asiatic Society were transferred to the Indian Museum, as is mentioned by Theobald in his Catalogue of Reptiles in the Asiatic Society's Museum so that unless the species is rediscovered in Assam, nothing further can be known about it beyond what is contained in Blyth's rather meagre description.

CALAMARIA SUMATRANA, Edeling, *Natuur. Tijdsch. Ned. Indië* xxxi, p. 379, (1870).

A specimen of this apparently rather rare snake from Singapore presented to the Museum by Mr. Davison, was kindly identified for me by Mr. Boulenger; it has hitherto been known from Sumatra only.

TRACHISCHIUM GUENTHERI, Boulenger, p. 285.

There are three snakes in the Indian Museum which seem referable to this species, one from Katmandu in Nepal and two labeled "Allahabad J. Cockburn," the latter probably came from Naini Tal as there are other Himalayan snakes in the collection presented by Mr. Cockburn labelled Allahabad; it is probable therefore that this is the more western representative of *Trachischium fuscum* from which it differs merely in colouration and the number of ventral shields.

TRACHISCHIUM RUBRIVENTER, (Jerdon), Boulenger, p. 286.

The type of this species does not seem to be in the British Museum as the species is "unknown to Mr. Boulenger," neither have I been able to find it among the specimens in the Indian Museum, unless therefore the species is rediscovered, nothing further can be known about it.

LYCODON STRIATUS, (Shaw), Boulenger, p. 292.

LYCODON TRAVANCORICUS, (Bedd.), Boulenger, p. 293.

There are no specimens of *L. striatus* in the Museum from Southern India, the localities from which there are specimens are the hills below Simla, Jemper in Sind, Lahore, Agra, Ajmere, Rajputana, and the Ganjam district; the species is recorded from the Anamalai hills by Günther, but this was before *Lycodon travancoricus* which resembles *Lycodon striatus* very strongly had been discriminated; of this species (*S. travancoricus*), the Museum possesses examples from the Nilgiri hills, the South Arcot district and Tinnevely hills, it therefore appears probable that it entirely replaces *S. striatus* in the southern part of the Indian Peninsula.

LYCODON FASCIATUS, (Anders.), Boulenger, p. 295.

The Indian Museum possesses two specimens of this rather rare species, one from Shillong in the Khasia hills collected by the late Major Cock, and one from Tezpur obtained by Col. Godwin-Austen; the species has been hitherto recorded only from the Kakhyen hills and Western Yunnan.

POLYDONTOPHIS BISTRIGATUS, (Günth.), Boulenger, p. 304.

The geographical area of this species can be extended to the Nicobars whence there is an example procured by Mr. de Roepstorff.

ABLABES STOLICZKAE, sp. nov. Pl. VI, fig. 1.

Rostral shield broader than deep, the part visible from above about two-thirds the length of the internasals; internasals shorter than the prefrontals and somewhat triangular, frontal hardly as long as its distance from the end of the snout, and a good deal shorter than the parietals; nostrils rounded, about the middle of the length of an undivided shield which is quite three times as large as the loreal; this latter is very small and squarish; one preocular not reaching the upper part of the head, two postocular both in contact with the parietals; eye of moderate size, about half the length of the snout; temporals 1 + 2; upper labials eight, fourth and fifth entering the eye; four lower labials in contact with the anterior chin shields which are about as long as the posterior. Scales smooth, in fifteen rows. Ventrals 153-4, subcaudals 116-9. Anal divided. Colour light olive-brown above, lighter olive yellow below, the two colours separated in front by a conspicuous broad longitudinal black streak, extending from just in front of the eye back along the neck for an inch or so.

There are two specimens of this species in the Museum. One procured at Samagooting in the Naga hills of Assam by Capt. J Butler, the other to which no locality is attached but which was received from Dr. F. Stoliczka of the Geological Survey.

This species differs from all the Indian species of *Ablabes* described by Boulenger, except *Ablabes calamaria*, in having a single nasal shield; in all the other species of the genus the nasal shield is divided or semi-divided.

From *A. calamaria* to which it is most nearly allied, it differs in having a loreal distinct from the nasal shield, in having both postoculars in contact with the parietal and in the much larger number of subcaudals, 116-9 against 64-76 in *A. calamaria*.

ABLABES DORIAE, (Boul.), Boulenger, p. 306.

The Indian Museum is indebted to Mr. R. D. Oldham of the Geological Survey for a specimen of this rather rare snake which he procured in Manipur.

ABLABES COLLARIS, (Ménétries), Blanford, Persia, p. 405.

Two snakes collected by Dr. Anderson in Palestine near Lake Galilee seem referable to this species; they agree very well with the description given by Blanford (*l. c.*) of a Persian specimen in the Genoa Museum except that in the Palestine specimens, the posterior chin shields are slightly smaller than the anterior ones, whereas in the Persian specimens the chin shields are said to be equal in size; the allied species *Ablabes modestus* has been recorded from Palestine, but not so far as I am aware the present one.

SIMOTES CYCLURUS, (Cantor), Boulenger, p. 311.

The type specimens of *Simotes obscurus* and *Simotes crassus* are undoubtedly both faded specimens of this species, as was surmised by Boulenger (*l. c.*); with regard to some of the specimens in the Museum, it is very difficult to say, whether they should be referred to this species or *S. albocinctus*, since the number of anterior temporals and labials entering the eye seem to vary somewhat, so that some of the examples are coloured like one species, but scaled like the other; possibly this may be due to hybridism.

Judging from the specimens of these two snakes in the Indian Museum, it would appear that *S. cyclurus* was an inhabitant of higher lands than *S. albocinctus*.

SIMOTES PURPURASCENS, (Schleg.), Boulenger, P. Z. S. 1890, p. 34.

This species with which according to Boulenger (*l. c.*) *Simotes trinotatus*, Dum. et Bibr., *S. labuanensis*, Günth., *S. catenifer*, Stol. and *S. dennysi*, Blanf., are conspecific, may now be included among the snakes of the Indian Empire, since a specimen was procured by Dr. Anderson from Tavoy in Tenasserim and is now in the Museum.

SIMOTES WOOD-MASONI, sp. nov. (Plate VI, fig. 2.)

Nasal divided; portion of the rostral seen from above a little shorter than its distance from the frontal; suture between the internasals shorter than that between the prefrontals; frontal longer than its distance from the end of the snout, as long as the parietals; loreal small, longer than deep; one preocular, one subocular separating the third labial from the

eye margin, two postoculars; temporals 1 + 2; six upper labials, the fourth alone entering the eye, the fifth the largest; four lower labials in contact with the anterior chin shields; posterior chin shields small, less than half the size of the anterior. Scales in 17 rows. Ventrals strongly angulate, 180-6. Anal undivided. Subcaudals 57.

Colour; adult, above brick reddish with traces of a dorsal and three lateral narrow lighter longitudinal lines; below dusky reddish with a light longitudinal line on either side at the angle of the ventrals; head with a dark median longitudinal mark extending back from the anterior end of the frontal to the nape where it bifurcates into the ground colour of the back, an oblique dark streak across the anterior nasal and the three anterior labials; a second oblique streak from the 4th and 5th labials through the eye above which it bifurcates and meets its fellow from the opposite side, a third oblique streak across the parietals and the sides of the neck. In the young the markings are much more conspicuous, the lighter colour being yellow and contrasting strongly with the darker brown of the markings.

This species is most nearly allied to *Simotes violaceus* and *S. octolineatus*; from the former species it differs in the reduced number of its labials, of which only the fourth enters the eye, and also in colouration.

From *S. octolineatus* it differs in having a subocular which excludes the third labial from the eye and in possessing only a single anterior temporal; in colouration, however, especially of the young, the two species much resemble one another.

There are two examples of this species in the Indian Museum, from which this description was drawn up, one from the Andamans collected and presented by Mr. Wood-Mason, and one from the Nicobars where it was procured by the late Mr. F. A. de Roepstorff.

#### SIMOTES THEOBALDI, Günth., Boulenger, p. 318.

The Indian Museum contains four examples of this rather uncommon species, from Mandalay (Anderson), from Meiktalla (Collett), and from Mergui.

#### SIMOTES PLANICEPS, Boulenger, p. 316.

An example of this snake was procured by Dr. Anderson during one of his two expeditions to Yunnan and Upper Burma, which had apparently never been named or described; unfortunately the specimen is without locality, though it no doubt comes from Upper Burma; the species has hitherto been known from a single specimen only, procured by Fea at Minhla in Burma.

*OLIGODON DORSALIS*, (Gray), Boulenger, p. 318.

The range of this species may be extended from the Khasia hills south to the Naga and Chittagong hills whence the Indian Museum possesses examples procured by Capt. J. Butler and Mr. Bruce respectively.

*OLIGODON SUBLINEATUS*, Dum. & Bibr., Boulenger, p. 320.

Two examples of this species indistinguishable from the typical Ceylon specimens were got by Mr. de Roepstorff in the Nicobars and are now in the Museum.

*OLIGODON SUBGRISEUS*, Dum. & Bibr., Boulenger, p. 321.

This typically Indian species has spread over the natural boundaries of India as far as Killa Abdulla near the Khojak Pass in British Baluchistan whence the Museum possesses a specimen presented by Mr. J. A. Murray.

*OLIGODON MELANOCEPHALUS*, (Günth.), Boulenger, p. 317.

Gunther (P. Z. S. 1864, p. 491) and Jan. (Icon. Ophid. livr. xiii, pl. iii, fig. 4, Oct. 1865), seem to have described and figured the same snake independently under the same specific name, the former making a new genus for its reception, the latter including it in the genus *Homolosoma*.

The examination of a specimen brought by Dr. Anderson from Sebastiyeh (Samaria) in Palestine confirms Boulenger in placing the species in the genus *Oligodon*.

*RHAGERRHIS PRODUCTA*, (Gerv.), Peters Monatsb. Akad. Berlin, 1862, p. 275; Murray, Ann. Mag. N. H. (5) xiv, p. 104.

This rather curious snake was described by Peters (*l. c.*) from Senaar in N. E. Africa, and has since been recorded by Murray from Tanjistan and Bushire in Persia; one of the Tanjistan specimens is now in the Indian Museum and agrees with Peters' description in every respect.

*ZAMENIS KORROS*, (Schleg.), Boulenger, p. 324.

There is an undoubted example of this species in the Indian Museum said to have been procured by Dr. E. F. Keleart in Ceylon; Anderson quoting from Ferguson's "Reptile Fauna of Ceylon" states that this species is not found in Ceylon; it is possible therefore that the specimen in question may be wrongly labelled though there does not seem to be any particular reason for this being the case.

ZAMENIS VENTRIMACULATUS, (Gray), Boulenger, p. 325.

ZAMENIS LADACCENSIS, Anderson, Boulenger, p. 326.

There are no specimens of *Z. ventrimaculatus* in the Indian Museum from Persia or anywhere outside the Indian Empire. The Museum possesses examples from the following localities. Below Simla, Sabathu, Rajanpur in the Punjab, Jeypore Rjpt., and Karachi. Of *Z. ladaccensis* the Indian Museum possesses specimens from Shiraz (including the type of *Gonyosoma dorsalis*, Anders) Bushire, Karman and Regan in Persia; Askan, Zamran, Hung, and Quetta in Baluchistan; Gilgit and Ladak.

If this really represents the true distribution of the two species their geographical areas are quite separate and the two species may be considered quite distinct.

ZAMENIS DIADEMA, (Schleg.), Boulenger, p. 328.

The distributional area of this snake may be extended eastwards as far as Allahabad perhaps as far as Purneah, as there is a specimen probably from the latter place in the Indian Museum.

ZAOCCYS TENASSERIMENSIS, sp. nov. (Plate VI, fig. 3.)

Rostral as broad as deep, just visible from above; suture between the internasals two-thirds of that between the pre-frontals, frontal longer than its distance to the end of the snout, shorter than the parietals; three loreals, one larger anterior, and two smaller posterior; one long and narrow preocular reaching the top of the head but not touching the frontal; one subocular below it wedged in between the fourth and fifth labials; two postoculars; a single pair of long temporals on either side, the posterior temporals not larger than the ordinary scales; upper labials 7 to 8 in number, one very large labial alone entering the eye; in the specimen described this is on one side the fourth, on the other the fifth; five lower labials in contact with the anterior chin shields which are equal to the posterior; scales in sixteen rows all smooth, the two median dorsal rows and the two outer rows adjoining the ventrals on either side are more or less broad and quadrangular, whereas the five intermediate rows on either side are narrow and oblique. Ventrals not angulate, 201; Subcaudals 123; anal divided.

Colour, black above to greenish olive on the head, anteriorly traces of a white vertebral line, in the middle part of the body a series of ill defined white transverse bands bordered with black posteriorly, on the hinder part of the body, the bands are gradually transformed into seven longitudinal series of white spots separated by a black network, of the series of spots the outer series on either side are on the ventrals; below

yellowish the outer edges of the ventrals dusky, tail with a median dusky streak.

This snake is quite different from the only other Indian species of the genus, *Z. nigromarginatus*; in fact it belongs to the other section of the genus characterized by Günther by the possession of three loreals and named by him *Zapyrus*.

It seems to most resemble *Zaocys fuscus* from Borneo, but differs from this snake in colouration and also in the number and position of upper labials.

COLUBER HELENA, Daud., Boulenger, p. 331.

The range of this snake extends somewhat beyond the limits imposed by Boulenger; the Indian Museum possesses examples from the Purneah district and Mutlah in Bengal and from Samagooting in Assam.

COLUBER RETICULARIS, Cantor, Boulenger, p. 332.

The range of this species too may be extended from Sikkim and Assam southwards to Arakan and Pegu whence the Museum possesses specimens.

COLUBER TAENIURUS, (Cope), Boulenger, p. 333.

*Coluber nuthalli*, Theobald (Cat. Rept. As. Soc. Mus., p. 51) the type of which is in the Indian Museum, is obviously a young specimen of *C. taeniurus* and is not identical with *Coluber helena*, as suggested by Boulenger.

COLUBER RADIATUS, Schleg., Boulenger, p. 333.

The Indian Museum possesses examples of this snake from Backergunge in Lower Bengal (E. Taylor) and from Hong Kong, from neither of which localities is this species recorded by Boulenger.

COLUBER PRASINUS, Bly., Boulenger, p. 334.

COLUBER OXYCEPHALUS, Boie, Boulenger, p. 335.

There are in the Museum examples of both these snakes from Darjeeling (Gammie) whence they are not recorded by Boulenger.

TROPIDONOTUS CHEYSARGUS, Schleg., Boulenger, p. 345.

TROPIDONOTUS NIGROCINCTUS, Bly., Boulenger, p. 346.

The distinction given by Boulenger in his key between these two species I find to be by no means a constant one; several of the specimens of *Trop. nigrocinctus* in the Museum possess two anterior temporals; the

colouration, however, of the two species is very distinct, the three oblique black streaks, below the eye, behind the eye and on the neck at once distinguishing *Tropidonotus nigrocinctus* from its ally.

*TROPIDONOTUS HIMALAYANUS*, Günth., Boulenger, p. 347.

This species is much more distinct from *T. subminiatus* than would be gathered from a perusal of Boulenger's description; *T. himalayanus* is much darker and very nearly always retains traces of the dorso-lateral series of white and black spots which are always found in the young, whereas in *T. subminiatus* the ground colour above is much lighter, almost blue, and very seldom retains any traces of the spots; in *T. himalayanus* the labials are all light coloured, edged with black and the oblique dark streak, under the eye so conspicuous a feature in *T. subminiatus* is altogether absent; the ventral surface in *T. himalayanus* is very dark, in some specimens almost black, whereas in *T. subminiatus* it is never dusky.

In none of the large number of specimens of *T. subminiatus* which I have examined, is there any trace of the keels on the outer row of scales, in *T. himalayanus*, however, the outer row of scales is as often keeled as not, and sometimes almost as strongly as in *T. chrysargus* and *T. nigrocinctus*.

The Indian Museum possesses examples of *T. subminiatus* from Sikhim, the Garo, Khasia and Naga hills, Manipur, Yunnan, Burma and from throughout Tenasserim; of *T. himalayanus* from Darjeeling (3000 to 4000 feet), the hills of Assam and Moulmein in Burma.

*TROPIDONOTUS PLUMBICOLOR*, Cantor, Boulenger, p. 351.

As is so often the case with Southern Indian forms, this species extends its range northwards to Mt. Aboo in Rajpootana; the Indian Museum also possesses examples from Nowgong and the Upper Godavery district in the Central Provinces, from the Nilgiri, Anamalai and Tinnevely hills in S. India and from Galle in Ceylon.

*TROPIDONOTUS ANGUSTICEPS*, Blyth, J. A. S. B. xxiii, p. 295; Boulenger, p. 352.

Three bottles containing four snakes were found amongst the collection of the Indian Museum labelled *Tropidonotus angusticeps*, of these snakes one was obviously *T. piscator* and does not seem to have been one of Blyth's original specimens; of the others, two with no history attached are without doubt examples of *Tropidonotus hydrus*, and the fourth, which was said to be the actual type of *T. angusticeps* collected by Capt. Abbott

in Ramri Island on the Arakan coast is a very faded specimen of *Pseudoxenodon macrops*.

The description of *T. angusticeps* seems to refer to both the latter species, *T. hydrus* and to *Pseudoxenodon macrops*.

*TROPIDONOTUS PEALII*, sp. nov. (Plate VI, fig. 4.)

Eye moderate, its diameter hardly equal to its distance from the nostril; rostral just visible from above; internasals broadly truncated anteriorly, suture between them shorter than that between the prefrontals; frontal longer than its distance to the end of the snout, shorter than the parietals; loreal nearly square; 1-2 preoculars; 2-3 postoculars; temporals 2 + 2; upper labials nine, fourth and fifth entering the eye; five pairs of lower labials in contact with the anterior chin shields, which are shorter than the posterior. Scales in 19 rows, strongly keeled, outer row also keeled but not so strongly as the rest; ventrals 142-144, subcaudals 75-77, anal entire.

Colour in spirit dark brown above, with a narrow light longitudinal line on either side, edged rather darker reaching the length of the body, below on either side occupying the lateral scales bordering the ventrals another light and much broader band two scales wide; head dark brown above, the upper and lower labials and rostral yellow, edged and blotched with brown, ventrals very dark brown each tipped laterally with light yellow, the longitudinal band so formed enlarges anteriorly to form a large white mark under the posterior lower labials; an indistinct yellow line along the middle of the ventral shields rather more conspicuous posteriorly.

Total length, 20 in.; tail 5 in.

This species is a very well marked one in every way; it differs from all the other Indian species (except *T. plumbicolor*?) in having an undivided anal shield; apart from this it is perhaps somewhat allied to *Tropidonotus parallelus* with which it agrees in having a small eye and the outer row of scales keeled.

There are in the Indian Museum two examples of this snake, both collected in the Sibsagar district of Assam by Mr. S. E. Peal, who has contributed very largely to our collection of snakes and after whom I have much pleasure in naming this fine new species.

*TROPIDONOTUS NICOBARENSIS*, sp. nov. (Plate VI, fig. 5.)

Eye large, its diameter exceeding its distance from the nostril; nostril just visible from above; internasals truncated, suture between them and between the prefrontals about equal in length; frontal longer than its distance to the end of the snout, very nearly as long as the parietals;

loreal squarish; one large preocular reaching the top of the head, but not touching the vertical; three postoculars; temporals 1 + 2, the posterior pair very much smaller than the anterior and hardly larger than the scales around; upper labials 7 or 8, the third and fourth, or fourth and fifth entering the eye; five pairs of lower labials in contact with the anterior chin shields which are much shorter than the posterior ones. Scales in 19 rows strongly keeled including the outer row; ventrals 162; subcaudals 119; anal divided.

Colour, above bluish olive with a longitudinal dorsal band from the nape to the tail about two scales wide bordered on either side by a narrow black line, another indistinct white line laterally on either side, head uniform, a black streak behind the eye; below lighter than above, uniform; chin, upper labials and snout yellowish without the bluish tinge.

The only example of this new species is one from Camorta in the Nicobars, procured there by Mr. de Roepstorff.

I have referred this snake to *Tropidonotus*, but I am by no means certain that it is properly there located; the only example in the Museum is a small and obviously young one, and I cannot make out that there is very much difference in the size of the maxillary teeth, and the number of subcaudals is very high for this genus; the only species which it seems to resemble at all is *Prymniodon chalceus*, Cope (Günther, Reptiles Brit. Ind. p. 274) which is said to have come from Siam; with the description of this species in Günther, it agrees admirably except in the two important characters of the dentition and the anal shield.

The maxillary teeth of *Prymniodon* are said to be very considerably larger anteriorly than posteriorly, and the anal shield is entire; in the species before me the maxillary teeth appear to be of equal length throughout, and the anal is divided; it is therefore impossible to identify the Nicobar species with *Prymniodon* and I have thought it best, until more specimens are forthcoming to leave it in the genus *Tropidonotus*.

*TROPIDONOTUS RHODOMELAS*, Boie, Blanford, P. Z. S. 1881, p. 221.

*Tropidonotus mortoni*, Theobald, (Cat. Rept. As. Soc. Mus. p. 57) is referable to this species of which we have examples from Singapore and Sinkip Island, Sumatra.

*TROPIDONOTUS TRIANGULIGERUS*, Schleg., Anderson, Journ. Lin. Soc. xxi, p. 345.

This snake was obtained by Dr. Anderson in Mergui and the Museum also contains examples from North Tenasserim, the Malay Peninsula and from Sinkip Island, Sumatra; it is not mentioned by Boulenger, and must be added to the Indian Fauna.

*DIPSAS MULTIFASCIATA*, Blyth, J. A. S. B. xxix, p. 114.

This species, the type of which was described by Blyth, from Subathu near Simla in the North-West Himalayas, was afterwards identified by Stoliczka (J. A. S. B. xxxix, p. 199) with *D. ceylonensis* a species which is otherwise apparently confined to Southern India and Ceylon.

I cannot agree with Stoliczka with regard to this identification, in the first place the preocular shield which extends nearly to the vertical in the case of *D. ceylonensis*, does not or barely reaches the top of the head in *D. multifasciata*; again in none of the specimens of *D. ceylonensis* which I have been able to examine is there the slightest trace of the narrowing of the preocular shield below, so that the lower corner of the loreal enters the eye, this arrangement is found more or less markedly in all the specimens of *D. multifasciata*; finally the colouration of the two species is very different, though perhaps difficult to describe.

The following shows at a glance the difference between the two species, the characters being taken from an examination of the specimens in the Museum:—

*Dipsas multifasciata.*

Loreal entering the eye below the preocular except in two cases where the lower corner of the loreal is prolonged in that direction, but does not quite reach it.

Preocular barely reaching the top of the head in some cases.

Temporals 1+2 or 2+1.

Scales in 21 rows.

Ventrals 231-248. Subcaudals 96-109.

Head with a well marked lateral black band from the prefrontals to the end of the parietals.

A median black streak on the nape.

The labials edged with black.

A well marked streak from the eye to the gape.

Ventrals marked with lateral square blotches throughout.

*Dipsas ceylonensis.*

No approach of the loreal to the eye, preocular of equal width throughout.

Preocular reaching the top of the head and sometimes touching the vertical.

Temporals 2+3.

Scales in 19 rows.

Ventrals 221-3. Subcaudals 90.

All the upper head shields black blotched, no definite longitudinal band.

Three ill-defined longitudinal black bands on the nape generally joined by a transverse band behind and forming a trident.

Labials not edged with black.

Streak from eye to gape ill-defined and interrupted.

Ventrals irregularly and very lightly spotted.

Of *Dipsas ceylonensis*, the Indian Museum possesses examples from the Anamalai hills only; of *D. multifasciata* besides the type from Subathu near Simla examples from Mussooree, Naini Tal and Darjeeling.

DIPSAS CYANEA, (Dum. & Bibr.), Boulenger, p. 361.

This species occurs in Tenasserim; there is an example in the Indian Museum from Tavoy.

DIPSAS CYNODON, Cuv., Günther Reptiles Brit. Ind., p. 368.

This species must be added to the fauna of the Indian Empire; there are in the Indian Museum undoubted examples from the Garo hills (Capt. Williamson), Samagooting (Capt. Butler) and Cachar (Museum Collector) in Assam; and from Thyetmyo (W. T. Blanford) the Burma-Siam hills (Museum Collector), and Mergui (W. Theobald) in Burma; this species is recorded from two of the above localities by Theobald in his Catalogue of the Snakes of the Asiatic Society, and it seems curious that this should have been overlooked by Boulenger.

DRYOPHIS FRONTICINCTUS, Günth., Boulenger, p. 368.

There is a snake in the Indian Museum from Sibsagar in Assam presented by Mr. S. E. Peal which I am unable to identify with any other species; if this is the case it cannot be that this snake is confined to the neighbourhood of brackish water as is suggested by Stoliczka.

DRYOPHIS MYCTERIZANS, (Daud.), Boulenger, p. 370.

This snake like many other Southern Indian species extends north-westwards as far as Mt. Aboo in Rajputana.

DRYOPHIS PULVERULENTUS, (Dum. & Bibr.), Boulenger, p. 371.

This species is apparently generally distributed throughout Peninsular India, there are six undoubted examples in the Indian Museum collected by Mr. V. Ball in Maunbhoom.

CERBERUS RHYNCHOPS, (Schneid.), Boulenger, p. 374.

This species appears to be common on the Andamans and Nicobars.

HYSIRHINA BLANFORDII, Boulenger, p. 377.

This species is founded on a single specimen described by Blanford as probably from the neighbourhood of Bassein; this unique specimen does not seem to be in the British Museum as Mr. Boulenger distinctly says that he has not been able to examine it; there is, however, an ex-

ample of this species in the Museum with no recorded history, which had been identified by Dr. Anderson as *Gerarda bicolor*, and it is possible that this is the missing type which has lost its label.

*HYPsirhina sieboldii*, (Schleg.), Boulenger, p. 377.

This species occurs in Assam; the Indian Museum contains a specimen from Samagooting in the Naga hills.

*FORDONIA leucobalia*, (Schleg.), Boulenger, p. 378.

This species occurs in the Sunderbunds, there is an example thence in the Museum, presented by the Rev. H. J. Harrison.

*CALLOPHIS nigrescens*, Günth., Boulenger, p. 384.

This species varies considerably in colour, of the specimens in the Indian Museum, there is one referable to the spotted variety (var. A. of Boulenger) from the Wynaad; three of the variety with three longitudinal white-edged bands (var. B. of Boulenger) from Malabar, the Anamalai and the Shevaroy hills; and finally two of the variety with five longitudinal bands from Malabar and Ganjam.

*MEGAEROPHIS flaviceps*, Reinh., Günther Rept. Brit. Ind. p. 346.

This species, which is not mentioned by Boulenger, should be included among the Snakes of the Indian Empire; there is an example of it in the Museum from Mergui in Tenasserim, presented by Mr. W. Theobald.

*BURGARUS caeruleus*, (Schneid.), Boulenger, p. 388.

This snake, which is found all over India proper, appears to be very rare on the eastern side of the Bay of Bengal, in fact the Indian Museum possesses what I believe to be the only specimen recorded thence, one procured by Col. Nuthall from Rangoon, and this might have easily reached Burma by ship. Lately, however, the Museum has received a pair of "Kraits" from Meiktalla in Upper Burma where they were found by General H. Collett which differ in some respects from the ordinary Indian form of this snake, although hardly perhaps enough to merit specific distinction.

The following are the points in which this variety differs from the typical Indian form.

The rostral is deeper than broad and extends back to about two-thirds or three-fourths of its distance from the frontal; the ventral shields number 223 and 228 respectively and the subcaudals 49.

The colour above is a dark slaty blue, the dorsal scales are alternately yellow and slate coloured, the yellow extending for about 10 or 12 scales and reappearing again after a somewhat longer interval; the scales on the sides of the yellow dorsal scales also exhibit conspicuous pale edgings so that the whole snake has the appearance of about 12 light coloured bands encircling the body.

*BUNGARUS BUNGAROIDES*, (Cantor), Boulenger, p. 389.

An example of this snake from Darjeeling presented by Mr. J. Gammie has a well marked loreal shield present on either side of the head.

*BUNGARUS LIVIDUS*, Cantor, Boulenger, p. 389.

The range of this species extends as far as Lower Bengal as is shown by an example procured at Saidpur in the Dinajpur district presented by Mr. W. de W. Peal.

The vertical scales of this snake are said by Mr. Boulenger to be "but feebly enlarged and not broader than long," in two, however, out of the three examples of this species in the Museum, the vertebral scales are certainly broader than long in the posterior part of the body.

*NAIA TRIPUDIANS*, Merr., Boulenger, p. 391.

There are in the Indian Museum a very large number of Cobras from different parts of India, and it seemed worth while to try and make out how far the various colour varieties of the Cobra were constant to fixed geographical areas.

The specimens in the Museum are all spirit-preserved ones and not very large, and although a great deal more has still to be done before an accurate knowledge of the geographical distribution of the varieties can be made out, the following seems to roughly indicate the truth.

*a.* Hood with the well known spectacle-marking on it; above and below, stone coloured, with the characteristic dark pectoral band across the chest.

In the Indian Museum examples from Banda, N.-W. P., Ganjam district, Calcutta, and the Krishnagar district.

This is "var. *a*" of Günther's Reptiles and the "Gokurrah" of Fayerer, and is probably found throughout the peninsula of India.

*b.* Hood with a white circular marking, edged with black, behind the hood-marking is a dark, followed by a light ring encircling the body, rest of the body dark, mottled lighter.

In the Indian Museum examples from Calcutta only where it ap-

pears to be the commonest variety, this is the "Keautiah" of Fayer and "var.  $\theta$ " of Günther who also records it from Assam and Sikhim.

c. Hood as above with the circular marking; uniform brown above, below, anteriorly light coloured, posteriorly darker.

In the Indian Museum examples from Assansole, Bengal, Calcutta, Sibsagar and Samagooting, Assam, Chittagong and the Andamans.

This is the variety most commonly met with, I believe, throughout Burma, it appears to correspond to "var.  $\zeta$ " of Günther which he records from Siam.

d. Hood with no marking, light coloured above and below with darker pectoral bands.

The Indian Museum contains examples of this species from the Rungpur district in Bengal, from Assam, the Chittagong hills, Mandalay and Mergui.

e. Hood with no marking, blue black above and below except slight traces of lighter colour on each side of the throat.

The Indian Museum contains examples of this well-marked variety from the Andamans (?) and Singapore, where it appears to be very abundant.

It seems to correspond to part of "var.  $\epsilon$ " of Günther.

f. No marking on the hood; very dark brown, almost black above and below.

The Indian Museum contains examples of this variety from the Punjab and Rajputana, and this is probably the same as part of Günther's "var.  $\epsilon$ " which came from the Deccan.

g. No marking on the head, colour a light sandy with bluish tinge; two dark bands on the neck extending all round, behind these two anterior bands a series of chevron-shaped forwardly directed bands, which become fainter towards the tail.

There are examples of this curiously coloured variety in the Indian Museum from Khojak in British Baluchistan and from the Punjab.

This variety was first described by Eichwald as *Tomyris oxiana* and has been shown by Boulenger and Boettger to be conspecific with the typical *N. tripudians*.

DISTIRA CYANOCINCTA, (Daud.), Boulenger, p. 410.

The types of *Hydrophis trachyceps*, Theobald, (Cat. Rept. As. Soc. Mus. p. 70) and *Hydrophis crassicollis*, (Anderson, J. A. S. B. xl, p. 19) may both be referred to this species, the former was got at Mergui, the latter in the Hooghly below Calcutta.

AMBLYCEPHALUS MONTICOLA, (Cantor), Boulenger, p. 415.

There is a snake in the Indian Museum from Camorta in the Nico-

bars presented by Mr. F. A. de Roepstorff which seems quite identical with undoubted examples of *A. monticola* from Assam.

*AMBLYCEPHALUS MACULARIUS*, (Blyth ?), Boulenger, p. 416.

*AMBLYCEPHALUS CARINATUS*, (Reinw.), Günther, Reptiles Brit. Ind., p. 326.

A good deal of confusion in the synonymy of these snakes has been caused by Mr. Theobald, who when examining and cataloguing the Asiatic Society's collection of Snakes identified as the adult and young of the same species certain snakes which had been referred by Blyth to two different species, *i. e.*, *Aplopeltura boa*, Schleg. (Theobald's adult) and *Pareas macularius*, Blyth (Theobald's young).

I have been quite unable to find any published description by Blyth of the latter species and so I must conclude that *Pareas macularius* is a manuscript name.

These snakes which were five in number Theobald first of all (J. Linn. Soc. x, p. 54), referred to *Pareas macularius*, the manuscript name given by Blyth to the three smaller specimens only; afterward (Cat. Rept. Mus. As. Soc., p. 63) he gave a new name, *Pareas berdmorei*, to these same five snakes, and finally (Cat. Rept. Brit. Ind., p. 203) he identified them with *Pareas margaritophorus*, Jan.

On examining the five snakes in question, it was at once evident that the two larger examples were quite distinct from the three smaller ones in colour and disposition of the head-shields and in fact in every way.

The larger snakes have internasals nearly as large as the prefrontals which latter shields are excluded from the eye, and in every other respect resemble *A. carinatus*; while the smaller snakes in which the prefrontal enters the eye, agree with the description of *A. macularius* as given in Boulenger's Reptiles.

*Pareas berdmorei* is therefore only in part a synonym of *Amblycephalus macularius* as described by Boulenger, and also in part a synonym of *Amblycephalus carinatus*.

There are in the Indian Museum only the three original specimens of *A. macularius*, which were procured by Major Berdmore at Martaban in Burma; of the other species, *A. carinatus*, which is an addition to the Fauna of the Indian Empire, besides the two specimens procured by Major Berdmore in Tenasserim, there are two from Tavoy (Museum Collector), one from the Burma-Siam hills and one from Mergui (Anderson).

*TRIMERESURUS GRAMINEUS*, (Shaw), Boulenger, p. 429.

*TRIMERESURUS PURPUREOMACULATUS*, (Gray), Boulenger, p. 429.

Of these two species there is a very large series in the Museum; and if the insular and Malayan forms be excluded, the two species are fairly

constant in scaling and colour. The points of distinction between the two species are as follows :

In *T. purpureomaculatus* the head scales are juxtaposed and convex or keeled, the temporal scales are strongly keeled, the scales are in 25-27 rows and the colour is in spirit a porphyraceous blue; in *T. gramineus* the head scales are small, smooth, and imbricate, the temporal scales are also smooth, the scales are in 19 to 23 rows and the colour is a uniform green.

It is in most cases perfectly easy to distinguish these two snakes, but there are in the Indian Museum some specimens which are intermediate in character, whether they are hybrids or not it is difficult to say, but as the two snakes inhabit approximately the same geographical area, it is quite possible that this may be the case.

Among the intermediate forms may be mentioned nine snakes from Sibsagar in Assam (register no. 4015-23) which have the juxtaposed convex head shields of *T. purpureomaculatus*, but the smooth temporals and 21 rows of scales of *T. gramineus*; again a snake (register no. 4109) from Moulmein has the convex head shields and keeled temporals but only twenty-one rows of scales.

Of *T. purpureomaculatus* the Museum contains examples from Lower Bengal, and from various localities in Assam and Burma; and of *T. gramineus*, examples from Simla, Sikhim, Assam, Burma and Hongkong.

In the Islands of the Bay of Bengal, Preparis Isle, Cocos Isles, the Andamans and Nicobars there are several different coloured varieties of Pit vipers which, in my opinion with one exception only, are better referred to *Tr. gramineus* than to *Tr. purpureomaculatus*; besides these varieties there is a closely allied form, which is recognised by Boulenger as a separate and distinct species; this is *Tr. cantoris* of Blyth, of which the Museum possesses a fair series, all from the Nicobars with one exception, which is from the Andamans.

The following is a list with brief descriptions of the various varieties above mentioned.

a. Preparis Island variety.

Light brown above with darker dorsal and lateral spots; ventrals light coloured, marbled with brown, scales in 25 rows; this form has the characteristic juxtaposed convex head scales and keeled temporals, and I have considered it to be an insular variety of *T. purpureomaculatus*.

b. Mottled variety.

Brown above blotched with blue, below bluish with brown blotches, scales in 23-25 rows, head scales as in *T. gramineus*. In the Indian Museum there are a good number of snakes of this variety from the Andaman Islands alone.

c. Brown variety.

This resembles the last, but there is little or no trace of the blue mottling on the ventrals which are almost uniform brown. Two examples from the Andamans in the Indian Museum.

d. Uniform or banded variety.

Colour uniform light reddish or dusky or with regular white transverse bands; scales in 21 rows.

This is the variety described by Stoliczka under the name of *T. mutabilis*, and is found on both the Andamans and Nicobars.

e. Green above, lighter below, resembling the typical variety found in Assam and Burma, scales in 21-25 rows.

This variety occurs on the Andamans, Cocos and Nicobars.

All the above varieties with the exception of the first seem to be referable to *T. gramineus* rather than to *T. purpureomaculatus*.

#### EXPLANATION OF PLATE VI.

- Fig. 1. *Ablabes stoliczkae*, sp. nov. × 2.  
 2. *Simotes woodmasoni*, sp. nov.  
 3. *Zaocys tenasserimensis*, sp. nov.  
 4. *Tropidonotus pealii*, sp. nov.  
 5. *Tropidonotus nicobaricus*, sp. nov. × 2.

XI.—*Catalogue of the Diptera of the Oriental region* by MONS. J. M. F. BIGOT. PART I. *Communicated by the SUPERINTENDENT OF THE INDIAN MUSEUM.\**

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### Order DIPTERA.

#### Suborder HOMALOCERATI.

J. Bigot, *adhuc ined.*

#### Division NEMATOCERATÆ.

J. Bigot, *adhuc ined.* : Nematocera, Meigen, *Syst. Besch.*, i, 1818.

#### Family CULICIDÆ.

J. Bigot, *adhuc ined.* : Culiciformes, Meigen *Syst. Besch.* i, 1818 : Culicidæ, Latr. *Fam. Natur.* 1825 : Macquart, *S. à Buff. Dipt.* i, 1834 : Culicinæ, Zetterst., *Ins. Laponica* : Culicinæ Rondani, *Prodr.* i, 1856 : Culicina, Schiner, *Faun. Austr. Fliegen* 1864.

\* This Catalogue was drawn up by M. Bigot at the suggestion of the late Mr. Atkinson and was to have formed part of the series of Catalogues of the Insecta of the Oriental Region, which have been discontinued since Mr. Atkinson's death.

## Genus ANOPHELES.

Meigen, *Syst. Besch.* i, 1818, p. 10 : *Culex*, pt., Linn.

*annularis*, V. der Wulp, *Notes Leyden Mus.*, vi, 1884, p. 249.

Hab. Java.

*barbirostris*, id. *ibid.*, p. 248.

Hab. Java.

*sinensis*, Wiedem., *Auss. Europ. Zweifl. Ins. Hamm.* 1828, i, p. 47.

Hab. China.

## Genus MEGARHINUS.

Rob.-Desvoidy, (*alias Megarhina*) *Essai sur les Tipul.* : *Culex*, pt.

*splendens*, (*Culex*) Wiedem., *Zool. Magaz.* iii, p. 2.

Hab. Java.

## Genus CULEX.

Linn., *Faun. Suec.* 1761 : Meigen, *Illig. Magaz.* ii, p. 260, (auct).

*ianiger*, Wiedem., *Auss. Europ. Zweifl. Ins. Hamm.* 1828, p. 5.

Hab. Java.

*fuscans*, id. *ibid.*, p. 6.

Hab. India.

*fatigans*, id. *ibid.*, p. 10.

Hab. India.

*molestus*, id. *ibid.*, p. 542.

Hab. Sumatra.

*sitiens*, id. *ibid.*, p. 543.

Hab. Sumatra.

*vagans*, id. *ibid.*, p. 545.

Hab. China.

*amboinensis*, (*Melius Megarhina*) Doleschall *Natuur. Tijdschr. Nederl. Indië.* xiv, 1857, p. 381.

Hab. Amboina.

*aureostriatus*, id. *ibid.*, p. 385.

Hab. Amboina.

*cingulatus*, id. *Natuur. Tijdschr. Nederl. Indië, Batavia.* x, 1856, p. 405.

Hab. Java.

*subulifer*, id. *ibid.*, xiv, 1857, p. 382.

Hab. Amboina.

*nero*, id. *ibid.*, xiv, 1857, p. 383.

Hab. Java.

setulosus, id. *ibid.*, xiv, 1857, p. 384.  
Hab. Java.

luridus, id. *ibid.*, xiv, 1857, p. 384.  
Hab. Java.

variegatus, id. *ibid.*, xvii, 1858, p. 77.  
Hab. Amboina.

annulipes, Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 6.  
Hab. Singapore.

imprimens, id. *ibid.*, v, 1861, p. 144.  
Hab. Amboina.

ventralis, id. *ibid.*, v, 1861, p. 144.  
Hab. Amboina.

dives, Schiner *Novara Reise* 1868, p. 31.  
Hab. Batavia.

longipalpis, V. der Wulp, *Tijdschr. Ent.* xxii, blz. lxxvii, p. 9.  
Hab. Sumatra.

crassipes, id. *ibid.*, p. 9.  
Hab. Sumatra.

#### Family CHIRONOMYDI.

J. Bigot, *adhuc in ed.*: Chironomydæ, Schiner *Faun. Austr. Flieg.*, ii, 1864, p. 574: Chironomides Westw., *Introd. Entom.* 1840: Tipul. Culiciform Macquart. *S. à Buff. Dipt.* i, 1834: Chironomides, Macquart, *Dipt. Exot.*, 1838, p. 36.

#### Genus CERATOPOGON.

Meigen, *Illig. Magaz.* ii, 1803, p. 261: Culex pt. Linn.: Chironomus pt. Fabr, Fallen: Culicoides, Latr.; Palpomyda, Prionomyda, Ceratopogon pt., Rossi.

trichopus, Thomson, *Eugenie Resa*, 1868, p. 444.  
Hab. China.

agas, Rondani, *Ann. Mus. Civ. Genova*, vii, 1875, p. 462.  
Hab. Borneo.

#### Genus CHIRONOMUS.

Meigen, *Illig. Magaz.* ii, 1803, p. 260; Thalassomyia, pt. Schiner: Tipula, pt. Linn.

venustus, Wiedem., *Auss. Europ. Zweifl. Ins. Hamm.* 1828, i, p. 547.  
Hab. China.

vicarius, Walker, *Ins. Saunders. Dipt. London*, 1856, p. 423.  
Hab. India.

cubiculorum, Doleschall, *Natuur. Tijdschr. Nederl. Indie, Batavia*, x, 1856, p. 405.  
Hab. Java.

pictus, id. *ibid.*, xiv, 1857, p. 386.  
Hab. Java.

socius, Walker, *List Dipt. Ins. Brit. Museum London*, 1848, *pt. 1*, p. 16.  
Hab. India.

#### Genus TANYPUS.

Meigen, *Illig. Magaz.* ii, 1803, p. 261 : *Tipula pt. Linn.*, Degeer : *Chironomus pt. Fabr.*

pardalis, Doleschall, *Naturk. Tijdschr. Nederl. Indie, Batavia*, v, 1856, p. 405.  
Hab. Java.

melanurus, id. *ibid.*, p. 405.  
Hab. Java.

cyanomaculatus, id. *ibid.*, p. 406.  
Hab. Java.

nigrocinctus, id. *ibid.*, p. 406.  
Hab. Java.

ornatus, id. *ibid.*, xiv, 1857, p. 385.  
Hab. Java.

crux, Wiedem. *Anal. Entom.* 10, id., *Ausser Europ. Zweijl. Ins.* i, Hamm, 1828,  
p. 10.  
Hab. India.

#### Genus MACROPEZA.

Meigen, *Syst., Beschr.*, i, 1818, p. 87 : Wiedem., Macq., Walker, Schiner,  
Rondani, (et auct.).

gibbosa, Wiedem., *Ausser Europ. Zweijl. Ins. pt. i, Hamm.* 1828, p. 20.  
Hab. India.

#### Family CECIDOMYDI.

Bigot, *adhuc ined.* 1891 : *Tipulariæ Gallicoloe*, Gallmücken, Meigen, *Syst. Beschr.* 1818, i, p. xxxiv : *Cecidomyida*, Westw. *Introd. Entom.* 1840 : *Cecidomyidae*, Schiner, *Faun. Austr. Fliegen*, ii, Wien, 1864, p. xviii.

#### Genus CECIDOMYIA.

Meigen, *Illig. Magaz.* ii, 1803, p. 261, Latr., Wiedem., Macq., Schiner, Rondani, V. de Wulp, Walker, (et auct.) : *Tipula pt. Degeer* : *Dasynoura pt Rondani* : *Oligotrophus pt. Latr.*

*deferenda*, Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 105.  
Hab. Sarawak.

*oryzae*, Wood-Mason, *Indian Museum Notes*, i, p. 103, pl. vi, fig. 6.  
Hab. Bengal.

#### Genus LASIOPTERA.

Meigen, *Syst. Besch.* i, p. 88, 1818: *Cecidomyia* pt. Meigen: *Tipula* pt.  
Linn., Degeer.

*bryonicæ*, Schiner, *Novara Reise* 1868, p. 5.  
Hab. Madras.

#### Family DIXADI.

Bigot, *adhuc ined.* 1891.

#### Genus DIXA.

Meigen, *Syst. Besch.* i, 1818, p. 216.

*guttipennis*, Thomson, *Eugenie Resa* 1868 p. 448.  
Hab. China.

#### Family TIPULIDI.

*Tipulidæ*, Leach, in *Sam. Comp.* 1819: *Tipulidæ*, Schiner, *Faun. Austr.*  
*Fliegen* ii, 1864, p. 495: *Tipulariæ*, Latr. *Hist. Nat. Ins.* 1802: *Tipulari-*  
*des*, Leach *Edinb. Encycl.* 1815: *Tipulides*, Westw. *Introd. Mod. Class.*  
*Insects*, 1840.

#### Genus CTENOPHORA.

Meigen, *Illig. Magaz.* ii, 1803, p. 263: Wiedem., Macq., Schiner, Zetterst.,  
Rondani, Ost.-Sacken pt.: *Pselliophora*, pt. Ost.-Sacken. *Berlin Ent.*  
*Zeitschr.* 1886, xxxi. p. 168: *Tanyptera*, Latr.: *Dictenidia* et *Xyphura*,  
pt. Brullé.: *Ceroctena* et *Xyphura* pt. Rondani.

*melanura*, Walker, *List Dipt. Ins. Brit. Museum London*, i, 1848, p. 78.  
Hab. Nepal.

*xanthomelana*, id. *ibid.*, p. 77.  
Hab. India.

*melanura*, id. *ibid.*, p. 78.)  
Hab. Nepal.

#### Genus PSELLIOPHORA.

Ost.-Sacken, *Berlin Entom. Zeitschr* 1886, xxx, p. 168: *Ctenophora* pt. Meigen  
*læta* (*Ctenophora*) Wiedem., *Ausser. Europ. Zweifl. Ins.* i, p. 40: (*Tipula* id. Fabr.)  
Hab. India.

- ardens*, (*Ctenophora*), id. *ibid.*, p. 39.  
Hab. Java.
- compedita*, (*Ctenophora*) id. *ibid.*, p. 39.  
Hab. Java.
- taprobanes*, (*Ctenophora*) Walker *List. Dipt. Ins. Brit. Mus. London*, 1848, i, p. 77.  
Hab. Ceylon.
- fumiplena*, (*Ctenophora*) Walker *Ins. Saunders. Dipt. i, London*, 1856, p. 449.  
Hab. China.
- javanica*, (*Ctenophora*) Doleschall, *Natuurk. Tijdsch. Nederl. Indie, Batavia*, x, 1856, p. 406.  
Hab. Borneo, Java.
- chrysophila*, (*Ctenophora*) Walker *Journ. Proceed. Linn. Soc. Lond.* i, 1857, p. 6.  
Hab. Singapore.
- curvipes*, (*Ctenophora*) V. der Wulp, *Notes Leyden Mus.* vi, 1884, p. 254.  
Hab. Gorontalo, Java?
- annulosa*, (*Ctenophora*) id. *ibid.*, vii, p. 1.  
Hab. Java.
- rubra*, Ost.-Sacken, *Berlin. Entom. Zeitschr.* xxx, 1886, p. 171.  
Hab. Laos.

#### Genus PRIONOTA.

- V. de Wulp, *Notes Leyd. Mus.* vii, 1885 p. 1.
- nigriceps*, V. der Wulp, id. *ibid.*, p. 2.  
Hab. Java.

#### Genus OLIGOMERA.

- Doleschall, *Natuurk. Tijdschr. Nederl. Indie, Batavia* xiv, 1857, p. 387,  
Eriocera, pt. Maquart.
- javensis*, Doleschall, *ibid.*, p. 387: *Eriocera acrostacta*, V. der Wulp.  
Hab. Java.

#### Genus PACHYRHINA.

- Macquart, *S. d. Buff. Dipt.* i, 1834, p. 88: *Tipula* pt.: *Nephrotoma*, pt.  
Olivier, *Encycl. Method.*
- bombayensis*, Macquart *Dipt. Exot. Paris*, 1855, 5th *Suppl.* p. 15.  
Hab. Bombay.
- delecta*, Walker, *Ins. Saunders. Dipt. Lond.* 1856, p. 445, *Tipula* id. Macq.  
Hab. India.

quadrivittata, V. der Wulp, *Notes Leyden Mus.* vi, 1885, p. 9.

Hab. Java.

triplasia, id. *ibid.*, p. 10.

Hab. Java.

fasciata, Macquart, *S. à Buff. Dipt.* i, Paris, 1834, p. 90.

Hab. Java.

doleschalli, (*Nomen Novum*), *Tipula javensis, Doleschall Natuur. Tijdschr. Nederl. Indie, Batavia*, x, 1856, p. 406: Ost.-Sacken, *Ann. Mus. Civ. Genova*, xvi, 1881, p. 399: *P. fasciata*? Macq. (*Vid. Suppl.*).

Hab. Java.

### Genus TIPULA.

Linn., *Faun. Suec.* 1761, p. 430 (et auct).

praepotens, Wiedem., *Auss. Europ. Zweijl. Ins.* i, Hamm, 1828, p. 40.

Hab. Java.

monochroa, id. *ibid.*, p. 41.

Hab. Java.

pedata, Wiedem., *Dipt. Exot.* i, p. 23.

Hab. Java.

umbrina, Wiedem., *Auss. Europ. Zweijl. Ins.* i, Hamm, 1828, p. 49: *T. congrua*, Walker.

Hab. Java.

javana, id. *Dipt. Exot.* i, 1821, p. 27.

Hab. Java.

castanea, Macq. *Dipt. Exot.* i, 1838, p. 54.

Hab. Java.

venusta, Walker, *List Dipt. Ins. British Museum*, i, 1848, p. 64.

Hab. Sylhet.

fulvipennis, id. *ibid.*, p. 67.

Hab. Nepal.

reposita, id. *ibid.*, p. 67.

Hab. Nepal.

melanomera, id. *ibid.*, p. 68.

Hab. Nepal.

nova, id. *ibid.*, p. 71.

Hab. Hong-Kong.

vicaria, id. *Ins. Saunders. Dipt. Lond.* 1856, pt. i, p. 445.

Hab. India.

javensis, Doleschall, *Natuur. Tijdschr. Nederl. Indie, Batavia*, x, 1856, p. 406.

Hab. Java.

- longicornis*, id. *ibid.* xvii, 1858, p. 79.  
 Hab. Amboina.
- vilis*, Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 108.  
 Hab. Borneo.
- fumifinis*, id. *ibid.*, v, 1861, p. 145.  
 Hab. Amboina.
- serrata*, V. der Wulp, *Notes Leyden Mus.* vii, 1885, p. 5.  
 Hab. Serahan?
- pilosula*, id. *ibid.*, p. 5.  
 Hab. Java.
- leucopyga*, id. *ibid.*, p. 6.  
 Hab. Java.
- brobdignagia*, Westwood, *Trans. Ent. Soc. Lond.* 1876, p. 504.  
 Hab. N. China.

Genus CONOSIA.

- V. der Wulp, *Tijdschr. Entom.* 1880, p. 159 : *Limnobia*, pt. Wiedem.
- irrorata*, V. der Wulp, *loc. cit.* p. 161 : *Limnobia* id. Wiedem. *Ausser Europ. Zweifl. Ins.* i, Hamm, 1828, p. 574.  
 Hab. Java.
- crux*, id. *ibid.*, p. 161 : (*Limnophila*) Doleschall, *Natuur. Tijdschr. Nederl. Indie, Batavia*, xiv, 1858, p. 388.  
 Hab. Java.

Genus LIMNOPHILA.

- Macquart, *S. á Buff. Dipt.* i, 1834, 95 : *Limnobia* pt. Meigen (et auctor).  
*Limnomyia*, Rondani *Prodr.* 1861, vi, p. 11.
- basilaris*, Macquart, *Dipt. Exot.* i, Paris, 1838, p. 66 : *Limnobia* id. Wiedem. *Auss. Europ. Zweifl. Ins.* i, Hamm, 1828, p. 27.  
 Hab. Java.
- bicolor*, id. *ibid.*, p. 66 : *Eriocera* id. Ost.-Sacken.  
 Hab. Bengal.

Genus ERIOCERA.

- Macquart, *Dipt. Exot.* pt. v, Paris, 1838, p. 74, *Pterocosmus* pt. Walker :  
*Allarithmia*, Loew, *Bernst. Faun.* 1850, p. 38 : *Physecrania*? pt. Bigot,  
*Ann. Soc. Ent. France*, (3) vii, 1859, p. 123 : *Arrhenica*, pt. Ost.-  
 Sacken, *Proceed. Acad. N. Sci. Philadelphia* 1859, p. 243.
- selene*, Ost.-Sacken *Ann. Mus. Civ. Genova*, xvi, 1881, p. 406.  
 Hab. Sumatra.

*humberti*, Ost.-Sacken, *Berlin. Ent. Zeitschr.*, xxxi, 1887, p. 221.

Hab. Ceylon.

*meleagris*, id. *ibid.*, p. 222.

Hab. Ceylon.

*pachyrrhina*, id. *ibid.*, p. 222.

Hab. Ceylon.

*crystalloptera*, id. *ibid.*, p. 222.

Hab. Ceylon.

*albonotata*, id. *ibid.*, p. 223 : *Limnobia*, id. Loew, *Peter's Reise*, p. 1.

Hab. Ceylon.

*acrostacta*, V. der Wulp, *Notes Leyden Mus.* vi, 1884 p. 11 : *Limnobia*, id. Wiedem. *Dipt. Exot.* p. 1 : *Cylindrotoma*, id. Macquart, *Dipt. Exot.*, i, p. 168, *Suppl.* iii, p. 7 : *Oligoneura javensis*, Doleschall.

Hab. Java.

*albipunctata*, V. der Wulp, *Tijdschr. Entom.* xxiii, p. 158.

Hab. Java.

*ferruginosa*, id. *Notes Leyden Mus.* vii, 1885, p. 13.

Hab. Java.

*lunata*, Westwood, *Trans. Ent. Soc. London*, 1881, pt. iii, p. 367.

Hab. Sarawak.

#### Genus PTEROCOSMUS.

Walker, *List Dipt. Ins. Brit. Mus.* pt. 1, Lond. 1848, p. 78 : *Eriocera*, pt. V der Wulp.

*velutinus*, Walker, *loc. cit.* p. 79.

Hab. Nepal.

*hilpa*, id. *ibid.*, p. 79 : *Eriocera* id., V. der Wulp, *Notes Leyden Mus.* vii, 1885 p. 12.

Hab. Hong-kong.

*lunigerus*, Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 107.

Hab. Borneo.

*infixus*, id. *ibid.*, p. 107.

Hab. Borneo.

*optabilis*, id. *ibid.*, p. 107.

Hab. Borneo.

*combinatus*, id. *ibid.*, p. 107.

Hab. Borneo.

*dilutus*, id. *ibid.*, p. 108.

Hab. Borneo.

Genus LIMNOBIA.

Meigen, *Syst. Besch.* 1818, p. 116: Tipula, pt. Linn., Fabr.: Limonia,  
Meigen, *Illig. Magaz.*, 1803: Dicranomyia, pt. et Limnobia, pt. Ost.-  
Sacken: Limnuomyza, Rondani, *Prodr.* i, 1856: Glochina, pt. Meigen,  
Staeger.

diana, Macq., *S. à Buff. Dipt. Paris*, 1834, p. 107.  
Hab. Bengal.

sorbillans, Wiedem., *Auss. Europ. Zweifl. Ins. Hamm*, 1828, p. 551.  
Hab. Sumatra.

trentepohlii, id. *ibid.*, p. 551.  
Hab. Sumatra.

apicalis, id. *ibid.*, p. 551.  
Hab. Sumatra.

bibula, id. *ibid.*, p. 552.  
Hab. China.

mesopyrrha, id. *ibid.*, p. 26.  
Hab. Java.

costalis, id. *ibid.*, p. 37.  
Hab. India.

sumatrensis, Macquart, *Dipt. Exot. Paris, Suppl.*, iv, 1850, p. 16.  
Hab. Sumatra.

aterrima, Walker, *Ins. Saunders, Dipt. London*, 1856, p. 434.  
Hab. India.

substituta, id., *List Dipt. Ins. Brit. Mus. London*, i, 1848, p. 39.  
Hab. China.

sanguinea, Doleschall, *Natuur. Tijdschr. Nederl. Indie*, xiv, *Batavia*, 1857, p. 391.  
Hab. Java.

impressa, Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 106.  
Hab. Borneo.

rubescens, id. *ibid.*, p. 106.  
Hab. Borneo.

pyrrhochroma, id. *ibid.*, p. 106.  
Hab. Borneo.

argentocincta, id. *ibid.*, p. 107.  
Hab. Borneo.

leucotelus, id. *ibid.*, p. 6.  
Hab. Singapore.

plecioides, id. *ibid.*, p. 6.  
Hab. Singapore.

vittifrons, id. *ibid.*, v, 1861, p. 144.  
Hab. Amboina.

#### Genus CYLINDROTOMA.

Macquart, *S. à Buff. Dipt. Paris*, 1834, p. 107: *Limnobia*, pt. (auctor.)  
albitarsis, Doleschall, *Naturk. Tijdschr. Nederl. Indie* xiv, *Batavia*, 1857, p. 391.  
Hab. Java.

#### Genus PÆCILOSTOLA.

Loew, *Wien. Entom. Monatschr.*, vii, 1863, p. 222.  
pallens, V. der Wulp, *Notes Leyden Mus.* vii, 1885, p. 13.  
Hab. Java.

#### Genus TANYDERUS.

Philippi, *Verh. K. K. Z. B. Gesellsch. Wien*, 1865, p. 780.  
ornatissimus, Ost.-Sacken, *Berlin. Ent. Zeitschr.* xxxi, 1887, p. 228: *Cylindrotoma*  
id., Doleschall, *Natuur. Tijdschr. Nederl. Indie*, xvii, *Batavia*, 1858, p. 80.  
Hab. Amboina.

#### Genus MEGISTOCERA.

Wiedem., *Auss. Europ. Zweifl. Ins.* i, *Hamm*, 1828, p. 55: *Nematocera*, *olim*  
Wiedem., *Dipt. Exot.* i, 1821, p. 29: Macquart, Schiner, Ost.-Sacken,  
etc.  
fuscana, Wiedem. *loc. cit.* p. 55: *Nematocera*, id., Wiedem., *Dipt. Exot.* i, 1821.  
Hab. Java.  
verticalis, id. *ibid.*, p. 56.  
Hab. Java.  
atra, Doleschall, *Naturk. Tijdschr. Nederl. Indie*, xvii, *Batavia*, 1858, p. 80.  
Hab. Amboina.

#### Genus TRICHOCERA.

Meigen, *Illig. Magaz.* ii, 1803, p. 262: *Tipula*, pt. (auctor.): *Limonia*,  
Latr., Macq., Walker, Schiner, Rondani, Ost.-Sacken, etc.  
ocellata, Walker, *Ins. Saunders. Dipt. London*, 1856, p. 433.  
Hab. India.

Genus DICRANOMYIA.

Stephens *Catal. Brit. Ins.* 1829.

saltens, Ost.-Sacken, *Berlin. Ent. Zeitschr.* xxxi, 1887, p. 172: *Limnobia* id.  
Doleschall, *Naturk. Tijdschr. Nederl. Indie*, xiv, *Batavia*, 1857, p. 390.  
Hab. Java.

Genus LIBNOTES.

Westwood, *Trans. Ent. Soc. London*, 1876, p. 505.

thwaitesiana, Westw. *loc. cit.* p. 505.  
Hab. Ceylon.

Genus MONGOMA.

Westwood, *Trans. Ent. Soc. London*, 1881, p. 364.

simplex, Ost.-Sacken, *Ann. Mus. Civ. Genova*, xvi, 1881, p. 402.  
Hab. Ternate.

pœcilopectera, id. *ibid.*, p. 403.  
Hab. Sumatra.

aurantiaca, id. *Berlin. Ent. Zeitschr.* xxxi, 1887, p. 181: *Limnobia* id. Doleschall,  
*Naturk. Tijdschr. Nederl. Indie, Batavia*, xvii, 1859, p. 78.  
Hab. Java.

Genus TEUCHOLABIS.

Osten-Sacken, *Proceed. Acad. Nat. Sci. Philadelphia*, 1859, p. 222.

bicolor, Ost.-Sacken, *Ann. Mus. Civ. Genova*, xvi, 1881, p. 404.  
Hab. Sumatra.

fenestrata, id. *Berlin. Ent. Zeitschr.* xxxi, 1887, p. 188.  
Hab. Ceylon.

determinata, id. *ibid.*, p. 188.  
Hab. Sula.

Family MYCETOPHILIDI.

J. Bigot, *adhuc inedit.* 1891: *Mycetophilidæ*, Schiner, *Faun. Austr. Dipt.* ii,  
*Wien*, 1864, p. 416: *Mycetophilides*, Westwood, *Introd. Modern Class.*  
*Ins.* 1840: *Tipul. Fungicolæ*, Latr.: *Tipul. Fungivoræ*, Meigen.

Genus MYCETOPHILA.

Meigen, *Illig. Magaz.* ii, 1803, p. 263: *Sciara* pt. Fabr.

bimaculata, Walker, *List Dipt. Ins. Brit. Museum*, i, *London*, 1848, p. 100.  
Hab. India.

*pennipes*, Osten-Sacken, *Berlin. Entom. Zeitschr.* xxxi, 1887, p. 204.  
Hab. Borneo.

Genus PLATYURA.

Meigen, *Illig. Magaz.* ii, 1803, p. 264 : *Sciophila*, pt. Meigen : *Sciara*, pt.  
Fabr. : *Ceroplatus*, pt. Fabr., Latr. : *Asindulum*, pt. Latr.

*aenusta*, Walker, *Ins. Saunders. Dipt.* i, London, 1856, p. 421.  
Hab. India.

Genus GLAPHYROPTERA.

Winnertz, *Verhandl. K. K. z. b. Gesellsch. Wien*, xiii, 1863, p. 781 : *Leia* pt.  
*winthemi*, Lehmann, V. der Wulp, *Reisen in Midden Sumatra* iv, *Natuurlijke  
Histoire, Diptera*, p. 7.  
Hab. Sumatra. Borneo ?

Genus SCIOPHILA.

Meigen, *Syst. Besch.* i, 1818, p. 245 : *Platyura*, pt. Fabr., Meig. : *Asindu-  
lum*, pt. Latr.  
*tropica*, Doleschall, *Naturk. Tijdschr. Nederl. Indie*, xiv, *Batavia*, 1857, p. 392.  
Hab. Java.

Genus SCIARA.

Meigen, *Illig. Magaz.* ii, 1803, p. 263 : *Tipula*, pt. Linn., Fabr. : *Hirtea*,  
Fabr. : *Molobrus*, Latr. : *Planetes*, pt. Walker : *Planetella*, pt. Westwood.  
*femoralis*, Doleschall, *Naturk. Tijdschr. Nederl. Indie*, xvii, *Batavia*, 1858, p. 78.  
Hab. Amboina.  
*indica*, Walker, *Ins. Saunders. Dipt.* i, London, 1856, p. 418.  
Hab. India.  
*laticornis*, id. *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 105.  
Hab. Borneo.  
*solita*, id. *ibid.*, p. 105.  
Hab. Borneo.  
*rufithorax*, V. der Wulp, *Reisen in Midden Sumatra*, iv, *Natuurlijke Histoire, Dip-  
tera*, p. 7.  
Hab. Sumatra.  
*thomæ*, id. *ibid.*, p. 7.  
Hab. Sumatra.  
*sulcata*, id. *Tijdschr. Entom.* xxx, 1886-87, p. 177.  
Hab. Java.

Family RHYPHIDI.

J. Bigot, *adhuc ined.* 1891 : Rhyphidæ Schiner, *Faun. Austr. Flieg.* ii, *Wien.*, 1864, p. xxiv.

Genus RHYPHUS.

Latr. *Diction.* iv, 1804 : Tipula pt. Scopoli : Sciara, Rhagio, pt. Fabr. : Anisopus (*olim*) Meigen.

maculipennis, V. der Wulp, *Notes Leyden Mus.* vii, 1885, p. 14.  
Hab. Java.

Family BIBIONIDI.

J. Bigot, *adhuc. ined.* 1891 : Bibionidæ, Schiner, *Faun. Austr. Flieg.*, 1864, p. xvi : Bibionides, Westwood, *Introd. Mod. Class. Ins.* 1840 : Tipulariæ florales, Latr. : Tip. Muscæformes et Latipennes Meig.

Genus SCATHOPSE.

Geoffroy, *Hist. d. Ins.* ii, 1764, p. 545 : Tipula pt. Liun., De Geer, Fabr. : Hirtea pt. Fabr. (Meig. *olim*) : Ceria, Scopoli : Aspistes, Ruth. pt.

pusilla, Doleschall, *Naturk. Tijdschr. Nederl. Indie*, x, *Batavia*, 1859, p. 407.  
Hab. Java.

Genus PLECIA.

Wiedem., *Auss. Europ. Zweifl. Ins.*, i, *Hamm.* 1828, p. 72 : Crapitula, pt. Gimmerth. *Bull. Moscou*, 1845 : Penthetria, pt. Meig. *Illig. Magaz.* ii, 1803, p. 264.

melanaspis, Ost.-Sacken, *Ann. Mus. Civ. Genova*, xvi, 1881, p. 307 : Penthetria, id. Wiedem., *Auss. Europ. Zweifl. Ins.* 1828, i, p. 72 : Penth. japonica, id. *ibid.*, p. 618. : Plecia ignicollis, Walker, *List. Dipt. Ins. Brit. Mus. London*, 1848, p. 116.  
Hab. Nepal.

fulvicollis, V. der Wulp, *Tijdschr. Entom.* xxiii, p. 156 : Hirtea id. Fabr., *Syst. Antl.* p. 53 : Plecia id., Wiedem., *Auss. Europ. Zweifl. Ins.* p. 73 : Penthetria id. Wiedem. *Dipt. Exot.* i, p. 31 : Plecia id. Macquart, *S. à Buff. Dipt.* i, p. 176 : Plecia id. Doleschall *Natuur. Tijdschr. Nederl. Indie*, x, *Batavia*, 1839, p. 407 : Plecia, id. Rondani, *Ann. Mus. Civ. Genova*, vii, p. 462 : Plecia dorsalis, Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 5.

Hab. Sumatra and Malay Peninsula.

tergorata, Rondani, *Ann. Mus. Civ. Genova* vii, 1875, p. 462.  
Hab. Borneo.

forcipata, Ost.-Sacken *Ann. Mus. Civ. Genova*, xvi, 1881, p. 397.  
Hab. Sumatra.

subvarians, Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 105.  
Hab. Sarawak.

tristis, V. der Wulp, *Notes Leyden Mus.* vi, 1884, p. 251.  
Hab. Java.

#### Genus BIBIO.

Geoffroy, *Hist. Ins.* ii, 1764, p. 571: Tipula pt. De Geer, Linn., Schin.  
Hirtea, pt. Fabr., Panzer., Meig., (*olim*), Zetterst., etc.

bicolor, Walker, *List. Dipt. Ins. Brit. Mus.* pt. i, London, 1848, p. 121.  
Hab. India.

rubicundus, V. der Wulp, *Notes Leyden Mus.* vi, 1884, p. 251.  
Hab. Java.

#### Genus SIMULIUM.

Latreille, Buffon. *Hist. Nat. Crust. et Ins.* xiv, 1805, p. 294.

indicum, Becher *Journ. Asiat. Soc. Bengal*, liii, 1884, p. 199, pl. xiv.  
Hab. Assam.

#### Division BRACHYCERATÆ.

J. Bigot, *adhuc ined.* 1891.

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#### Sub-division EMPODIATA.

J. Bigot, *adhuc ined.* 1891.

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#### Family TABANIDI.

J. Bigot, *adhuc ined.* 1891: Tabanii, Latr., 1802, Meigen, Macquart,  
Zetterst., Loew: Tabanidæ, Leach, 1819, Schiner, 1862: Tabanides,  
Latr. 1829: Tabanina, Tabaninæ, Rondani, 1846: Tabanidæ, West-  
wood, Walker: Tabanidii, J. Bigot (*olim*): Anthracina, Rafinesque:  
Sclerostoma, Dumèril: Tabanica, Burmeist.: Tabanites, Newman.

#### Genus CHRYSOPS.

Meigen, *Illig. Magaz.*, ii, 1803, p. 267: Tabanus pt.

ligatus, Walker, *List Dipt. Ins. Brit. Museum, Lond.*, i, 1848, p. 195.  
Hab. Bengal.

terminalis, id. *ibid.*, p. 195.  
Hab. India.

semicirculus, id. *ibid.*, p. 196.  
Hab. India.

stimulans, id., *Ins. Saunders. Dipt. London*, i, 1856, p. 73.  
Hab. India.

pellucidus, *Fabr. Syst. Antl.*, p. 113.  
Hab. Tranquebar.

dispar, *Fabr., Entom. System. Suppl.*, p. 567.  
Hab. India.

fasciatus, *Wiedem., Dipt. Exot.*, i, p. 103.  
Hab. Java.

translucens, *Macquart, Dipt. Exot. pt. i*, 1838, p. 158.  
Hab. Java.

flaviventris, id. *ibid., Suppl. i*, 1846, p. 44.  
Hab. India.

rufitarsis, id. *ibid., Suppl. ii*, 1847, p. 14.  
Hab. Java.

fixissimus, *Walker, Journ. Proceed. Linn. Soc. London*, i, 1857, p. 112.  
Hab. Borneo.

unizonatus, *Rondani, Ann. Mus. Civ. Genova*, vii, 1875, p. 459.  
Hab. Borneo.

albicinctus, *V. der Wulp, Tijdschr. Entom.*, xi, 1868, p. 103.  
Hab. Salawatti.

striatus, id., *Notes Leyden Mus.*, vii, 1885, p. 79.  
Hab. Amoy, China.

clavicrus, *Thomson, Eugenie Resa, Stockholm*, 1858-68, p. 452.  
Hab. Malacca.

#### Genus PANGONIA.

*Latr., Hist. Nat. Crust. et Ins.*, iii, 1794, p. 437 : *Tanyglossa*, *Meigen Klassif.* p. 174 : *Tabanns* pt. *Linn., Rossi, Fabr. : Bombylius*, pt. *Olivier, Encycl. Method.*

amboinensis, *Fabr., Syst. Antl.*, p. 91.  
Hab. Amboina, Himalayas.

longirostris, *Walker, List Dipt. Ins. Brit. Museum, London*, 1854. pt. v, *Suppl.* p. 139.  
Hab. India.

taprobanes, id. *ibid.*, *Addenda*, 1854, p. 324.  
Hab. Ceylon.

rufa, Macquart, *Dipt. Exot. Suppl.* pt. iv, Paris, 1850, p. 18.  
Hab. Bombay.

### Genus SILVIUS.

Meigen, *Syst. Besch.* ii, 1820, p. 27, Wiedem., Macq. : *Tabanus pt.*  
*dimidiatus*, V. der Wulp, *Tijdschr. Entom.*, xi, 1868, p. 102.  
Hab. Salawatti.

### Genus HÆMATOPOTA.

- Meigen, *Illig. Magaz.* ii, 1803, p. 267 : *Tabanus pt.*
- cana, Walker, *List Dipt. Ins. Brit. Mus. London*, pt. i, 1848, p. 207.  
Hab. Bengal.
- atomaria, id. *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 112.  
Hab. Borneo.
- irrorata, Macquart, *Dipt. Exot.* pt. i, 1838, p. 163.  
Hab. Java.
- lunulata, id. *ibid.*, *Suppl.* ii, *Suites*, 1847, p. 15.  
Hab. Java.
- roralis, Fabr. *Syst. Antl.*, p. 107.  
Hab. Tranquebar, Madras Pr.
- javana, Wiedem. *Ausser. Europ. Zweifl. Ins.* i, Hamm, 1828, p. 218.  
Hab. Java.
- cingulata, id. *ibid.*, p. 216.  
Hab. Java.
- borneana, Rondani, *Ann. Mus. Civ. Genova*, vii, 1875, p. 461.  
Hab. Borneo.
- pungens, Doleschall, *Natuur. Tijdschr. Nederl. Indie*, x, Batavia, 1856, p. 407.  
Hab. Java.
- cilipes, J. Bigot, *Nouv. Archives Mus. Paris*, (3) ii, 1890, p. 205.  
Hab. Laos.
- pachycera, id. *ibid.*, p. 206.  
Hab. Laos.
- macrocera, id. *ibid.*, p. 207.  
Hab. Laos.

## Genus RHINOMYZA.

Wiedemann, *Nov. Dipt. Gener.*, 1820, p. 8.*fusca*, Wiedem. *ibid.* p. 8.

Hab. Java.

## Genus DITYLOMYIA.

J. Bigot, *Rev. et Mag. Zool. Guérin*, (2) xi, 1859, p. 305.*ornata*, J. Bigot, *ibid.* p. 306.

Hab. Ceylon.

## Genus TABANUS.

Linn, *Favn. Swec.* ii, 1761, p. 462, et auct.: *Theriopectes* pt. Zeller, *Isis Agelanius*, pt. Rondani, 1863: *Atylotus*, pt. Ost.-Sacken, 1876.*auricinctus*, Macquart, *Dipt. Exot.* pt. i, Paris, 1838, p. 130.

Hab. Indian Archipelago.

*pusillus*, *id. ibid.*, p. 127.

Hab. China.

*albilateralis*, *id. ibid.*, p. 129.

Hab. Java.

*cœrulescens*, *id. ibid.*, p. 128.

Hab. Java.

*basalis*, *id. ibid.*, p. 126.

Hab. India.

*brunneus*, *id.*, *S. à Buff. Dipt.* i, Paris, 1834, p. 203.

Hab. Java.

*sumatrensis*, *id. ibid.*, p. 201.

Hab. Sumatra.

*consanguineus*, *id.*, *Dipt. Exot.* pt. i, 1838, p. 127.

Hab. Malabar.

*servillei*, *id. ibid.*, p. 128.

Hab. India.

*rubicundus*, *id. ibid.*, *Supplem.*, 1846, p. 32.

Hab. India.

*dorsolinea*, Wiedem., *Analect. Entomol.* p. 22: *T. striatus* ? Fabr.

Hab. India.

*virgo*, *id. ibid.*, p. 22.

Hab. India.

*orientalis*, *id. ibid.*, p. 21.

Hab. India.

- rubidus*, id., *Dipt. Exot.*, i, p. 69.  
 Hab. Bengal.
- ardens*, id. *ibid.*, p. 78.  
 Hab. Java.
- immanis*, id. *Ausser Europ. Zweifl. Ins.*, i, *Hamm*, 1828, p. 123.  
 Hab. Java.
- hybridus*, id. *ibid.*, p. 557.  
 Hab. Macao, China.
- striatus*, Fabr., *Entom. System.*, iv, p. 371: *T. dorsolinea*? Wiedem.  
 Hab. China; Java.
- rufiventris*, id. *ibid.*, p. 96.  
 Hab. India.
- javanus*, id. *Syst. Antl.*, p. 103.  
 Hab. Java.
- tenebrosus*, Walker, *List Dipt. Ins. Brit. Mus. London*, v, *Suppl.* p. 242.  
 Hab. Malabar.
- pyrausta*, id., *Zoologist*, vii, 1849, *Append.* p. lxxv.  
 Hab. Java.
- vagus*, id. *ibid.*, *Append.* p. lxxviii.  
 Hab. Hong-Kong.
- megalops*, id. *List Dipt. Ins. Brit. Mus. London*, v, *Suppl.* i, 1854, p. 247.  
 Hab. Java.
- aurotestaceus*, id. *ibid.*, p. 247.  
 Hab. Shanghai.
- orientis*, id., *List Dipt. Ins. Brit. Mus.*, pt. i, 1848, p. 152, and v, *Suppl.* i, 1854  
*Addenda*, p. 328.  
 Hab. Sikkim and Nepal.
- explicatus*, id., *ibid.* v, *Suppl.* i. 1854 *Addenda*, p. 328.  
 Hab. Sikkim.
- univentris*, id. *ibid.*, i, 1848, p. 151.  
 Hab. Borneo.
- aurifamma*, id. *ibid.*, p. 155.  
 Hab. Silhet, Assam.
- inseitus*, id. *ibid.*, p. 161.  
 Hab. Silhet, Assam.
- mentitus*, id. *ibid.*, p. 162.  
 Hab. China.
- sinicus*, id. *ibid.*, p. 163.  
 Hab. Hong-Kong.

- amœnus, id. *ibid.*, p. 163.  
Hab. Hong-Kong.
- internus, id. *ibid.*, p. 164.  
Hab. Silhet.
- jucundus, id. *ibid.*, p. 187.  
Hab. Hong-Kong.
- albulus, id. *Ins. Saunders. Dipt. i, London, 1856, p. 46.*  
Hab. India.
- pyrrhus, id. *ibid.*, p. 47.  
Hab. India.
- albimediis, id. *ibid.*, p. 48.  
Hab. India.
- tenens, id. *ibid.*, p. 49.  
Hab. India.
- hilaris, id. *ibid.*, p. 49.  
Hab. India.
- crassus, id. *ibid.*, p. 50.  
Hab. India.
- vagus, id. *ibid.*, p. 50.  
Hab. India, Java.
- rubiginosus, id. *ibid.*, p. 51.  
Hab. India.
- umbrosus, id. *ibid.*, p. 52.  
Hab. India.
- hirtus, id. *ibid.*, p. 52.  
Hab. India.
- puella, id. *ibid.*, p. 53.  
Hab. India.
- sanguineus, id. *ibid.*, p. 54.  
Hab. Java.
- obconicus, id. *ibid.*, p. 54.  
Hab. India.
- consocius, id. *ibid.*, p. 56.  
Hab. India.
- perlinea, id. *ibid.*, p. 56.  
Hab. India.
- nigropictus, Macquart, *Dipt. Exot. Suppl.*, v, Paris, 1855, p. 24.  
Hab. India.
- yao, id. *ibid.*, p. 24.  
Hab. North China.

clausicella, (*Bellardia*, Rondani), id. *ibid.*, p. 25.  
Hab. China.

confucius, id. *ibid.*, p. 26.  
Hab. China.

hoang, id. *ibid.*, p. 27.  
Hab. China.

bubali, Doleschall, *Natuur. Tijdschr. Nederl. Indie, Batavia*, x, 1856, p. 407.  
Hab. Java.

monoculus, id. *ibid.*, xvii, 1858, p. 85.  
Hab. Java.

cinnamomeus, id. *ibid.*, xvii, 1858, p. 84.  
Hab. Amboina.

furunculigenus, id. *ibid.*, xvii, 1858, p. 84.  
Hab. Amboina.

abscondens, Walker, *Trans. Ent. Soc. London*, v, 1860, p. 275.  
Hab. Burmah.

univentris, (*nomen bis lectum*) id. *ibid.*, i, 1857, p. 9.  
Hab. Mt. Ophir; Borneo.

partitus, id. *ibid.*, i, 1857, p. 9.  
Hab. Singapore.

nexus, id. *ibid.*, i, 1857, p. 110.  
Hab. Borneo.

fumifer, id. *ibid.*, i, 1857, p. 110.  
Hab. Borneo.

optatus, id. *ibid.*, i, 1857, p. 111.  
Hab. Borneo.

simplicissimus, id. *ibid.*, i, 1857, p. 111.  
Hab. Borneo.

serus, id. *ibid.*, vi, 1862, p. 20.  
Hab. Ceram.

justorius, Rondani, *Ann. Mus. Civ. Genova*, 1875, p. 455.  
Hab. Sarawak.

alboscutatus, id. *ibid.*, p. 456.  
Hab. Sarawak.

pauper, id. *ibid.*, p. 456.  
Hab. Sarawak.

ignobilis, id. *ibid.*, p. 457.  
Hab. Sarawak.

- dives, id. *ibid.*, p. 457.  
Hab. Sarawak.
- fulvissimus, id. *ibid.*, p. 458.  
Hab. Sarawak.
- variegatus, id. *ibid.*, p. 458.  
Hab. Sarawak.
- apicalis, id. *ibid.*, p. 459.  
Hab. Sarawak.
- geniculatus, V. der Wulp, *Midden Sumatra*, iv, *Natuurlijke Histoire, Diptera*, p. 16.  
Hab. Sumatra.
- incultus, id. *ibid.*, p. 17.  
Hab. Sumatra.
- tristis, id. *ibid.*, p. 17.  
Hab. Sumatra.
- fumipennis, id. *ibid.*, p. 18.  
Hab. Sumatra.
- minimus, id. *ibid.*, p. 18.  
Hab. Sumatra.
- equestris, id., *Notes Leyden Mus.*, vii, 1885, p. 77.  
Hab. Sumatra, Java and Borneo.
- felderi, id. *ibid.*, p. 78.  
Hab. Ning-po, China.
- bucolicus, Schiner, *Novara Reise*, 1868, p. 81.  
Hab. Hong-Kong.
- nicobarensis, id. *ibid.*, p. 81.  
Hab. Nicobar Islands.
- mandarinus, id. *ibid.*, p. 83.  
Hab. Hong-Kong.
- administrans, id. *ibid.*, p. 83.  
Hab. Hong-Kong.
- ceylanicus, id. *ibid.*, p. 93.  
Hab. Ceylon.
- leucosparsus, J. Bigot *N. Archives Mus. Paris*, (3) ii, 1890, p. 203.  
Hab. Laos.
- nigrotectus, (*Bellardia*, Rondani), id. *ibid.*, p. 204.  
Hab. Laos.

*melanognathus*, (*Atylotus*, Ost.-Sacken), id. *ibid.*, p. 204.  
Hab Laos.

*laotianus*, (*Atylotus*, Ost.-Sacken), id. *ibid.*, p. 205.  
Hab. Laos.

#### Family STRATIOMYDI.

J. Bigot, *adhuc ined.*, 1891: Stratiomydæ, Latr. 1802: Xylophagei, Fall. 1810: Notachanta, Latr. 1817: id. Macquart, 1834: Notachanten, Braner 1832: Stratiomydæ, Leach, 1819: id. Rondani, 1856: Stratiomydinæ, Rondani, 1856: Stratiomydes Latr. 1802: Xylophagi, Meigen, 1820: Xylophagidæ Steph., 1829: id. Rondani, 1856: id. Bigot: Xylophagina, Rondani, 1836: Xylophagi, Walker, 1848: Beridæ, Westwood, 1840: Beridina, Rondani, 1836: Cœnomydæ, Westwood, 1840: Cœnomyna, Rondani, 1836: Sicarii, Latr., 1825: id. Macq. 1834: Polychœta, Zetterstedt.

#### Genus XYLOPHAGUS.

Meigen, *Illig. Magaz*, ii, 1803, p. 266.

*brunneus*, Wiedem., *Auss. Europ. Zweifl. Ins.* pt. iv, *Hamm*, 1828, p. 85.  
Hab. India.

#### Genus ANTIDOXION.

Sneller V. Vollenhoven, *Versl. en Med. K. Akad. Wetensch.* xv, 1863.

*flavicorne*, id. *ibid.*  
Hab. Java.

#### Genus ACRASPIDEA.

Schiner *in lit.*, V. Brauer *Zweifl. K. Mus. Wien.*, 1882, p. 75-19.

*felderi*, id. *ibid.*, p. 76-20.  
Hab. Ceylon.

#### Genus SUBULA.

Meigen, *Syst. Besch.* ii, 1820, p. 15: Xylophagus, pt.

*calopodata*, J. Bigot, *Ann. Soc. Ent. France*, (5) ix, 1879, p. 195.  
Hab. Ternate.

*flavipes*, Doleschall, *Natuur. Tijdschr. Nederl. Indie*, xvii, 1858, p. 85.  
Hab. Amboina.

*vittata*, id. *ibid.*, p. 86.  
Hab. Amboina.

*inamœna*, (*Solva*) Walker, *Journ. Proceed. Linn. Soc. London* iv, 1860, p. 98 : Ost.-Sacken, *Ann. Mus. Genova*, xvi, p. 407.

Hab. Java ; Celebes.

#### Genus THYLACOSOMA.

Schiner *in lit.*, V. Brauer, *Zweiflug. K. Mus. Wien.*, 1882, p. 77 : ? Ruba, pt. Walker,

*amboinense*, Schiner *in lit.*, V. Brauer, *loc. cit.*, p. 77.

Hab. Amboina.

#### Genus ENGONIA.

Schiner, *in lit.*, V. Brauer, *Zweifl. Mus. Wien*, 1882, p. 76 : *Negritomyia* ?  
J. Bigot, *Ann. Soc. Ent. France*, (5) ix, 1877, *Bulletin*, p. lxxiv.

*aurata*, Schiner, *in lit.*, v. Brauer, *loc. cit.*, p. 76.

Hab. Amboina.

#### Genus NEGRITOMYIA.

J. Bigot, *Ann. Soc. Ent. France*, 1877, *Bulletin*, p. lxxiv.

*bilineata*, (*Stratiomys*) Fabr. *Syst. Antl.* p. 79 : V. der Wulp, *Notes Leyd. Mus.* vii. p. 59.

Hab. Java.

#### Genus CLITELLARIA.

Meigen, *Illig. Magaz.*, ii, 1803, p. 265 : *Ephippium*, Latr., 1802 : *Rhaphiocera* pt. Macq. : *Stratiomys*, pt. Fabr. *Syst. Antl.*

*heminopla*, Wiedem., *Auss. Europ. Zweifl. Ins.* ii, *Hamm*, 1830, p. 48 : *id.*, *Zool. Mag.* iii, p. 30.

Hab. Tranquebar, Madras Pr.

*varia*, Walker, *List Dipt. Ins. Brit. Mus.*, pt. v, *Suppl. i*, *London*, 1854, p. 63.

Hab. Java.

*angusta*, *id. loc. cit.*, p. 62 : *Ephippium id.*, Macq. *S. à Buff. Dipt.* i, 1834, p. 252.

Hab. Java.

*tenebrica*, *id.*, *loc. cit.*, iii, 1849, p. 522.

Hab. Java.

*notabilis*, Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 108.

Hab. Borneo.

*bivittata*, Wiedem., *Auss. Europ. Zweifl. Ins.*, ii, *Hamm*, 1830, p. 46 : *Stratiomys bilineata*, Fabr. *Syst. Antl.* : *Ephippium spinigerum* ? Dolesch. : *Rhaphiocera spinithorax* Macq. *Dipt. Ex.*

Hab. Java.

- 274 Mons. J. M. F. Bigot—*Catalogue of Oriental Diptera*. [No. 3,  
*spinigerum*, (*Ephippium*) Doleschall, *Natuur. Tijdschr. Nederl. Indie.*, x, 1856,  
 p. 407: Engonia, id. Schin., Brauer.  
 Hab. Java.
- nigerrimum*, (*Ephippium*) Doleschall, *loc. cit.*, xvii, 1858, p. 81.  
 Hab. Java.
- flaviceps*, Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 7.  
 Hab. Singapore.

#### Genus BERIS.

- Latr. *Hist. Nat. Crust. et Ins.* iii, 1802, p. 340: Stratiomys, pt. Fabr., Fall. :  
 Actina, pt. Meig.
- javana*, Macquart, *Dipt. Exot.* i, pt. ii, Paris, 1838, p. 188.  
 Hab. Java.

#### Genus CULCUA.

- Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 109.
- simulans*, Walker, *ibid.*, p. 109.  
 Hab. Borneo, Malacca.

#### Genus CYCLOGASTER.

- Macquart, *S. à Buff. Dipt.* i, Paris, 1834, p. 256.
- radians*, Walker, *Journ. Proceed. Linn., Soc. London*, i, 1857, p. 7.  
 Hab. Singapore.

#### Genus HERMETIA.

- Latr. *Dict. Hist. Nat.* xxiv, p. 192, Fabr., Wied., Macq. : Nemetelus, pt.  
 Degeer. : Bibio, Syrphus, Mydas, pt. auctor. : Xylophagus, pt. Lamarck.
- melanæsia*, Bigot, *Ann. Soc. Ent. France*, (5) ix, 1879, p. 202: H. batjanensis,  
 V. der Wulp, *Tijdschr. Entom.*, xxiii, p. 161: *Massicyta cerioides* Walker. ?  
 Hab. Indian Archipelago.
- rufiventris*, (*Nomen bislectum*) Walker, *Journ. Proceed. Linn. Soc. London*, v, 1861,  
 p. 145.  
 Hab. Amboina.

#### Genus PHYLLOPHORA.

- Macquart, *Dipt. Exot.* i, pt. i, Paris, 1838, p. 178.
- angusta*, Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 7.  
 Hab. Singapore.

## Genus TINDA.

Walker, *Journ. Proceed. Linn. Soc. London*, iv, 1860, p. 101.

*indica*, V. der Wulp, *Notes Leyd. Mus.*, vii, 1885, p. 57: *Biartes* id. Walker, *Ins. Saunders. Dipt.*, i, London, 1856, p. 87: *Tinda modifera*, Walker, *Journ. Proceed. Linn. Soc. London*, iv, 1860, p. 101: *Phyllophora bispinosa*, Thomson, *Eugenie Resa*, p. 454.

Hab. Java, Manilla.

## Genus EVAZA.

Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 109.

*bipars*, Walker, *ibid.*, p. 110.

Hab. Borneo.

*flavipes*, J. Bigot, *Ann. Soc. Ent. France*, (5) ix, 1879, p. 219.

Hab. India.

*argyroceps*, id. *ibid.*, p. 219.

Hab. The Moluccas.

*fulviventris*, id. *ibid.*, p. 220.

Hab. The Moluccas.

## Genus NERNA.

(*nec Nerua*) Walker, *Journ. Proceed. Linn. Soc. London*, iii, 1859, p. 81.

*mollis*, Ost.-Sacken, *Ann. Mus. Civ. Genova*, xvi, 1881, p. 415.

Hab. Sumatra.

## Genus PTILOCERA.

Wiedem., *Auss. Europ. Zweifl. Ins.* ii, *Hamm*, 1830, p. 58: *Stratiomys*, pt.

*quadridentata*, Wiedem., *loc. cit.*, p. 59.

Hab. Java.

*continua*, Walker, *Ins. Saunders. Dipt. London*, 1856, pt. i, p. 84.

Hab. Java.

*smaragdina*, Snellen v. Vollenhoven, *Mem. Entomol. Pays-Bas*, i, 1858, p. 92.

Hab. Celebes.

*amethystina*, id. *ibid.*, p. 92.

Hab. Amboina, Java and Celebes.

*fastuosa*, Gerstaecker, *Linn. Ent.* xi, 1857, p. 333.

Hab. Ceylon.

## Genus WALLACEA.

Doleschall, *Naturk. Tijdschr. Nederl. Indie*, xvii, *Batavia*, 1858, p. 82.

*argentea*, Doleschall, *loc. cit.*, p. 82.

Hab. Amboina.

## Genus ACRASPIDEA.

Braner, *Zweifl. Kais. Mus. Wien*, 1882, p. 19.

*felderi*, Braner, *loc. cit.*, p. 20.

Hab. Ceylon.

## Genus ACANTHINA.

Wiedem., *Auss. Europ. Zweifl. Ins.* ii, *Hamm*, 1830, p. 50.

*azurea*, Gerstaecker, *Linn. Ent.*, xi, 1857, p. 335.

Hab. Ceylon.

## Genus ELASMA.

Jaenicke, *Neu. Exot. Dipter. Frankfurt*, 1867, p. 14.

*acanthinoidea*, Jaenicke, *loc. cit.*, p. 15.

Hab. Java.

## Genus PACHYGASTER.

Meigen, *Illig. Magaz.*, ii, 1803, p. 266: *Nemotelus*, pt. Panzer: *Sargus*, pt. Fall.: *Vappo*, pt. Latr.

*ruftarsis*, Macquart, *Dipt. Exot. Paris, Suppl.* 1846, p. 57.

Hab. Pondicherry.

## Genus TOXOCERA.

Macquart, *Dipt. Exot. Suppl.* iv, *Paris*, 1850, p. 44.

*limbiventris*, Macq., *loc. cit.*, p. 45.

Hab. Java.

## Genus MASSICYTA.

Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 8.

*bicolor*, Walker, *loc. cit.*, p. 8.

Hab. Singapore.

## Genus RHACHICERUS.

Haliday, *List Dipt. Ins.* 1848, p. 154.

*zonotus*, Ost. Sacken, *Ann. Mus. Genova*, xvi 1881, p. 408.

Hab. Sumatra.

## Genus STRATIOMYS.

Geoffr. *Hist. Nat. Ins.* ii, 1764: Hirtea, pt. Scopoli: *Hoplomyia*, Zeller, Loew.

barca, Walker, *List Dipt. Ins. Brit. Museum, London*, 1849, p. 530.  
Hab. China.

garatas, id. *ibid.*, p. 532.  
Hab. China.

apicalis, id. *ibid.*, Part v, 1854, p. 53.  
Hab. North China.

lutatius, id. *ibid.*, 1849, p. 532.  
Hab. Malacca.

solennis, id., *Ins. Saunders. Diptor. London*, i, 1856, p. 79.  
Hab. India.

inanimis, id., *Trans., Ent. Soc. London*, iv, 1857, p. 121.  
Hab. China.

viridana, Wiedem., *Auss. Europ. Zweifl. Ins.*, ii, Hamm, 1830, p. 66.  
Hab. Bengal.

minuta, Fabr., *Entom. System.*, iv, p. 268.  
Hab. Tranquebar, Madras Pr.

pusilla, id. *ibid.*, p. 271  
Hab. Tranquebar, Madras Pr.

rufipennis, Macquart, *Dipt. Exot. Suppl. v. Paris*, 1855, p. 42.  
Hab. South China.

flavoscutellata, V. der Wulp, *Notes Leyd. Mus.* vii, 1885, p. 60.  
Hab. Java.

## Genus ODONTOMYIA.

Meigen, *Klassific.* i, 1804, p. 123: *Stratiomys*, pt. apud V. der Wulp.

viridana, Wiedem., *Analect. Entom.*: Macquart *Dipt. Exot. Suppl.*, iv, 1850, p. 48.  
Hab. Bengal.

consobrina, Macquart, *Dipt. Exot., Suppl.*, ii, Paris, 1847, p. 16.  
Hab. Java.

diffusa (*Stratiomys*) Walker, *List Dipt. Ins. Brit. Mus.*, part v, London, 1854, p. 53.  
Hab. Java.

mutica, V. der Wulp, *Notes Leyd. Mus.* vii, 1885, p. 62.  
Hab. Ternate.

Genus CAMPEPROSOPA.

Macquart, *Dipt. Exot. Suppl.*, iv, 1850, p. 46.

flavipes, Macquart, *loc. cit.*, p. 46.

Hab. Java.

munda, Osten-Sacken, *Ann. Mus. Civ. Genova*, 1881, p. 409.

Hab. Sumatra.

Genus CHRYSOCHLORA.

Latr. *Fam. Natuur.*, 1825, Macquart: Sargus, pt.

baccoides, Rondani, *Ann. Mus. Civ. Genova*, vii, 1875, p. 454.

Hab. Sarawak.

vitripennis, Doleschall, *Natuur. Tijdschr. Nederl. Indie.*, x, 1856, p. 408.

Hab. Java.

Genus MICROCHRYZA.

Loew, *Verhandl. K. K. z. b. Gesellsch. Wien*, 1855, p. 146: Sargus, pt.

gemma, J. Bigot, *Ann. Soc. Ent. France*, (5) ix, 1879, p. 231.

Hab. Ceylon.

Genus TRICHOCHÆTA.

J. Bigot, *Ann. Soc. Ent. France*, (5) ix, *Bullet.* 1878 p. xxii, et errata.

nemoteloides, id. *ibid.*, p. xxii.

Hab. Ternate.

Genus RAPHIOCERA.

Macquart, *S. à Buff. Dipt.*, i, 1834, p. 253.

spinithorax, Macquart, *Dipt. Exot. Suppl.* ii, Paris, 1847, p. 17: Stratiomys bilineata, Fabr.: Clitellaria bivittata Wiedem.: Ehippium spinigerum, Doleschall:

Hab. Java.

Genus PTECTICUS.

Loew, *Verhandl. K. K. z. b. Gesellsch. Wien.*, v, 1855, p. 142.

apicalis, Loew, *loc. cit.*, p. 142.

Hab. Pinang.

cingulatus, id. *ibid.*, p. 143.

Hab. Pinang.

- australis*, Schiner, *Novara Reise*, 1868, p. 65.  
 Hab. Nicobar Islands.
- illustris*, id. *ibid.*, p. 65.  
 Hab. Nicobar Islands.
- apicalis*, (*nom. bislectum*), V. der Wulp, *Notes Leyden Museum*, vii, 1885, p. 62.  
 Hab. Sumatra, Borneo.
- brevipennis*, V. der Wulp, *loc. cit.*, p. 63 : Sargus id. Rondani, *Ann. Mus. Civ. Genova*, vii, 1875, p. 454.  
 Hab. Borneo, Java.
- latifascia*, V. der Wulp, *loc. cit.*, p. 64 : Sargus, id. Walker *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 110.  
 Hab. Borneo, Java.

Genus SARGUS.

- Fabr. *Entom. System. Suppl.*, 1798, p. 566 : Rhagio pt. Schranck : Nemetelus pt. Degeer.
- gemmifer*, Walker, *List Dipt. Ins. Brit. Mus.* iii, *London*, 1849, p. 516.  
 Hab. Sylhet, Assam.
- tenebrifer*, id. *ibid.*, p. 517.  
 Hab. China.
- aurifer*, id. *ibid.*, v. *Suppl.* i, *London*, 1854, p. 96.  
 Hab. India, China.
- luridus*, id. *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 8.  
 Hab. Singapore.
- quadrifasciatus*, id. *ibid.*, v, 1861, p. 146.  
 Hab. Amboina.
- metallinus*, Fabr., *Syst. Antl.*, p. 258 : V. der Wulp, *Notes Leyd. Mus.* vii, 1885, p. 65.  
 Hab. Bengal ; Java.
- longipennis*, Wiedem., *Analect. Entomol.*, p. 31.  
 Hab. Java.
- insignis*, Macquart, *Dipt. Exot. Suppl.*, v, *Paris*, 1855, p. 16.  
 Hab. China.
- viridiceps*, id. *ibid.*, 1856, p. 110 : Ptecticus id. V. der Wulp.  
 Hab. China.
- pallipes*, Bigot, *Ann. Soc. Ent. France*, (5) xi, 1879, p. 222.  
 Hab. Ceylon.
- magnificus*, id. *ibid.*, p. 222.  
 Hab. Assam.

rufus, Doleschall, *Naturk. Tijdschr. Nederl. Indie*, xvii, *Batavia*, 1858, p. 83.  
Hab. Amboina.

ferrugineus, id. *ibid.*, p. 83.  
Hab. Amboina.

formicæformis, id. *ibid.*, xiv, 1857, p. 403 : Sarg. metallinus, V. der Wulp.  
Hab. Amboina.

leoninus, Rondani, *Ann. Mus. Civ. Genova*, vii, 1875, p. 454.  
Hab. Sarawak.

brevipennis, id. *ibid.*, p. 454 : Ptecticus id., V. der Wulp.  
Hab. Sarawak.

lætus, V. der Wulp, *Notes Leyden Mus.* vii, 1885, p. 66.  
Hab. Sumatra.

rubescens, id. *ibid.*, p. 67.  
Hab. Gorontalo.

#### Genus CHRYSOMYIA.

Macquart, *S. à Buff. Dipt. Paris*, 1834, p. 262 : Sargus, pt. et Nemetelus,  
pt. Degeer.

flaviventris, Wiedem., *Analect. Entom.*, p. 31 : Sargus id., Macquart, *Dipt. Exot.* :  
Microchryza id., Ost.-Sacken, 1881.  
Hab. India, Java.

affinis, id. *ibid.*, p. 31 : Sargus id., Macquart, *Dipt. Exot.*  
Hab. India.

#### Genus EUDMETA.

Wiedem., *Auss. Europ. Zweifl. Ins. Hamm*, 1830, p. 43 : Hermetia, pt.

marginata, Wiedem., *loc. cit.*, p. 45 : Hermetia, id. Fabr., *Syst. Antl.* p. 63 : Herme-  
tia cingulata (vel cingulalis,) Guerin, *Icon. Regn. Anim.*, p. 543.  
Hab. Amboina, Java.

#### Family NEMESTRINIDI.

J. Bigot, *ad hoc ined.* : Nemestrinidæ, Macquart, *S. à Buff. Dipt.*, i, *Paris*,  
1834, p. 370 : Anthracii et Bombyliarii, Latr. : Nemestrinidæ, Schiner  
*Faun. Austr., Flieg.*, i, 1862, *Wien.*, p. 44.

#### Genus NEMESTRINA.

Latr. *Hist. Nat. Crust. et Ins.* xiv, 1804, p. 319.

javana, Macquart *Dipt. Exot.* ii, pt. i, *Paris*, 1840, p. 17.  
Hab. Java.

Genus COLAX.

Wiedem., *Analecta Entomol.*, 1824.

*javanus*, Wiedem., *loc. cit.*, 1824, p. 18.

Hab. Java.

*variegatus*, Westwood, *Cabinet of Orient. Entomol.*, London, p. 38.

Hab. China.

Family LEPTIDI.

J. Bigot, *adhuc ined.*: Leptides, Meigen, *Syst. Besch.* ii, 1820: Leptidæ, Westw., *Introd. Entom.*, 1840: Schiner, *Faun. Austr. Flieg.* i, Wien, 1862, p. 170.

Genus LEPTIS.

Fabr., *Syst. Antl.*, 1806, p. 9: Nemetelus, pt. Degeer: Rhagio, pt. Latr., Olivier, Walker.

*decisa*, Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 15.

Hab. Malacca.

*uniguttata*, Ost.-Sacken, *Ann. Mus. Civ. Genova*, xvi, 1881, p. 422.

Hab. Sumatra.

Genus HELIOMYIA.

Doleschall, *Naturk. Tijdschr. Nederl. Indie*, xiv, *Batavia*, 1857, p. 402, *Chrysopyla* ? pt.

*ferruginea*, Doleschall, *loc. cit.*, p. 402.

Hab. Amboina.

Genus ATHERIX.

Meigen, *Illig. Magaz.*, 1803, p. 271: Rhagio pt. Fabr.: Bibio, pt. Fabr.: Leptis, pt. Fabr., Fall.: Ibisia, pt. Rondani.

*nigritarsis*, Doleschall, *Naturk. Tijdschr. Nederl. Indie*, xvii, *Batavia*, 1858, p. 92.

Hab. Amboina.

*labiatus*, Bigot, *Bull. Soc. Zool. France*, xii, *Paris*, 1887, p. 21.

Hab. Ceylon.

Genus CHRYSOPILA.

Macquart, *Dipt. Nord. France*, i, 1827: Leptis, pt. Meigen: Rhagio, pt. Latr., Walker: Atherix, pt. Fabr.

*maculipennis*, Walker, *Journ. Proceed. Linn. Soc. London*, i, 1857, p. 118.

Hab. Borneo.

*lupina*, Ost.-Sacken, *Ann. Mus. Civ. Genova*, 1881, p. 420.

Hab. Sumatra.

*uniguttata*, id. *ibid.*, p. 422.

Hab. Sumatra.

*ferruginosa*, id. *ibid.*, p. 419; *Leptis* id., *Wiedem. Zool. Magaz.*, iii, p. 4.

Hab. Java. and N. Ceram.

*insularis*, Schiner, *Novara Reise*, 1868, p. 119.

Hab. Nicobar Islands.

#### Genus SURAGINA.

Walker, *Journ. Proceed. Linn. Soc. London*, iv, 1860, p. 110.

*signipennis*, id. *ibid.*, vi, 1862, p. 8.

Hab. Ternate.

#### Family CYRTIDI.

J. Bigot, *adhuc ined.*: *Vesiculosidæ*, Bigot (*olim*): *Acrocera*, Meigen, 1803:  
*Acroceridæ*, Leach, 1819: *Acrocerinæ*, Zetterst., 1842: *Inflatæ*, Latr.,  
1809: *Cyrtidæ*, *Oncodinæ*, Rondani, 1846.

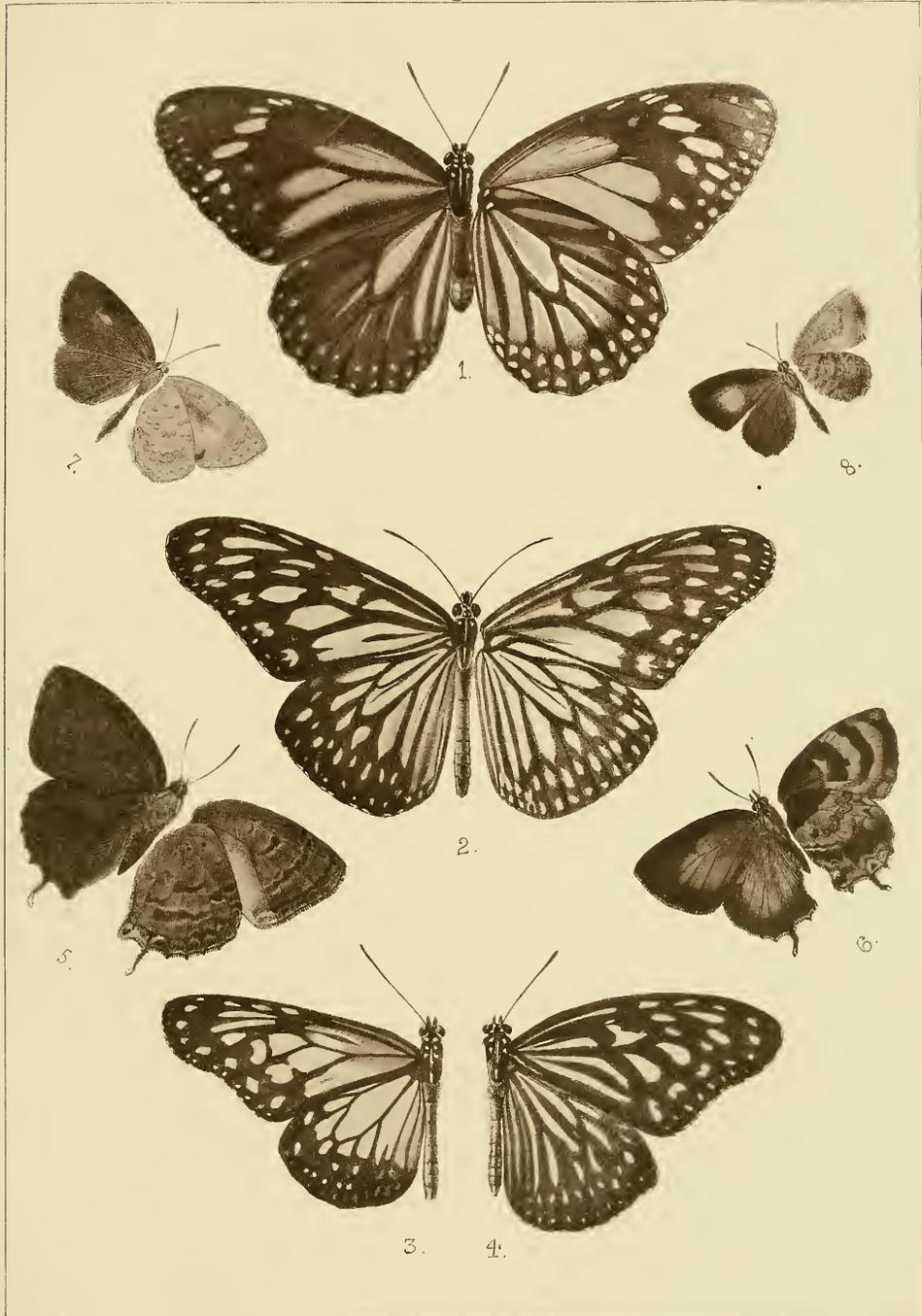
#### Genus ONCODES.

Latr. *Precis*, 1796, p. 154: *Henops*, Illiger, 1798, (*alias Oggeodes*.)

*costalis*, (*Henops*), Walker, *Ins. Saunders. Dipt. London*, i, 1856, p. 203.

Hab. India.

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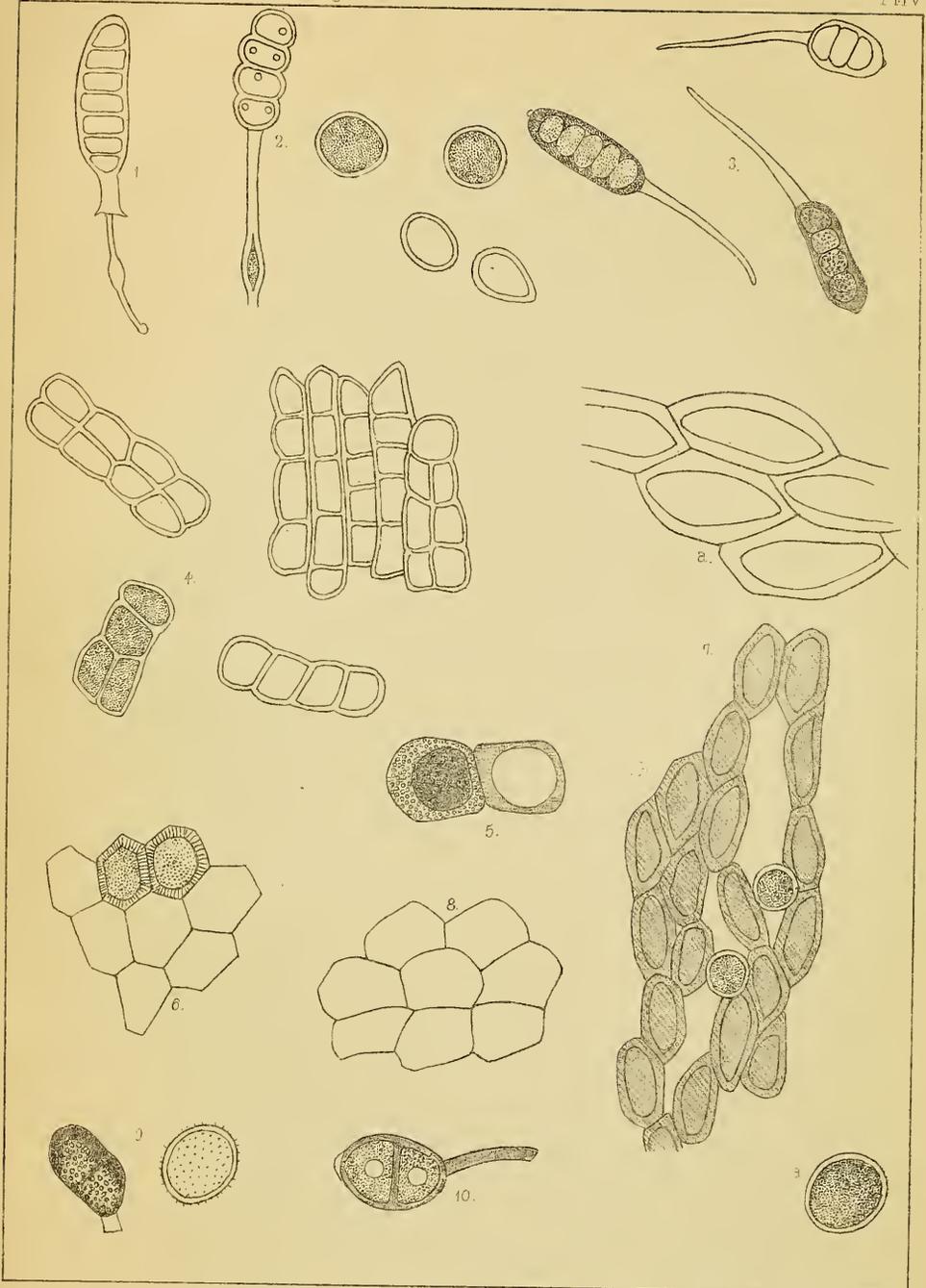
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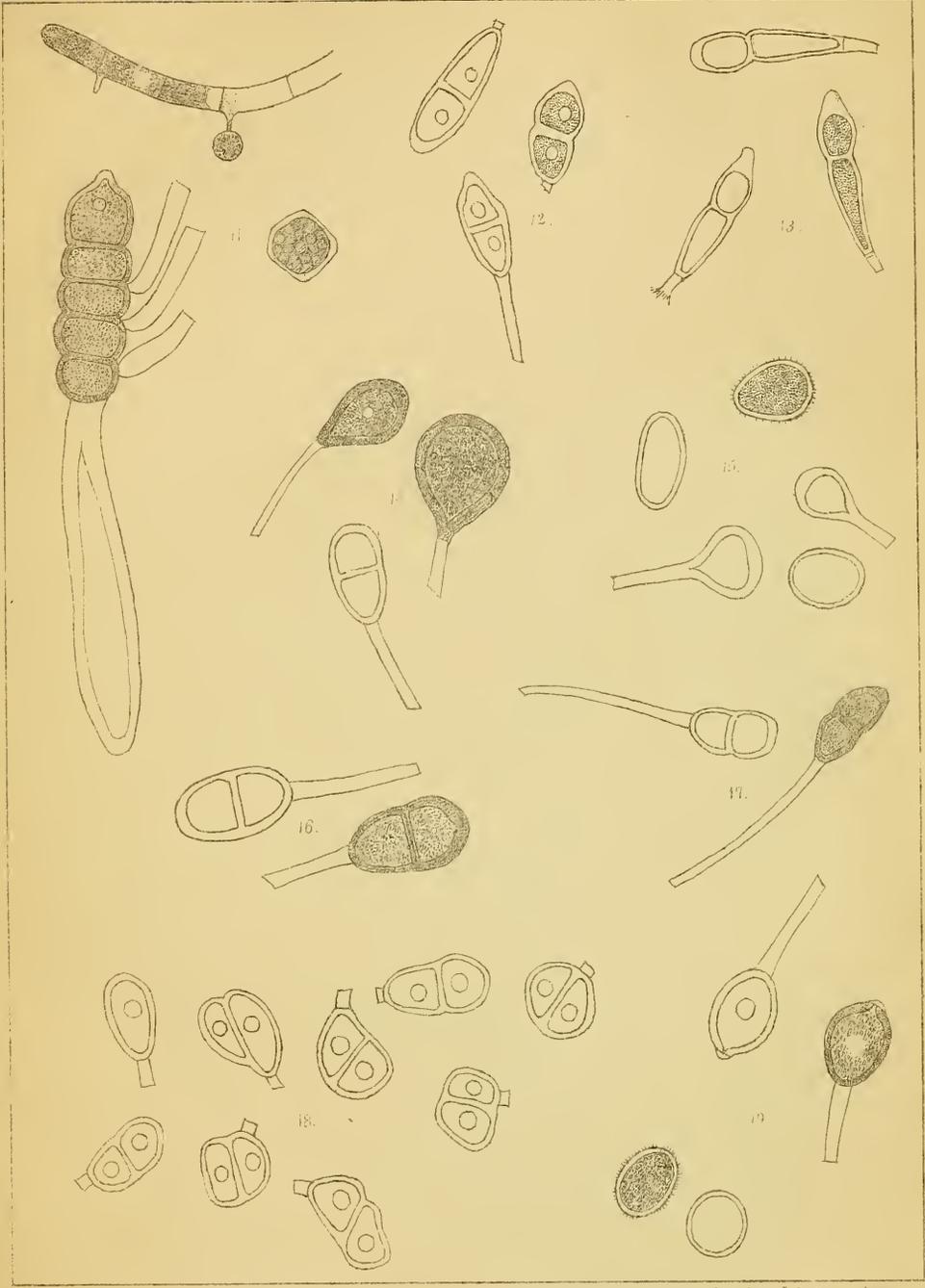




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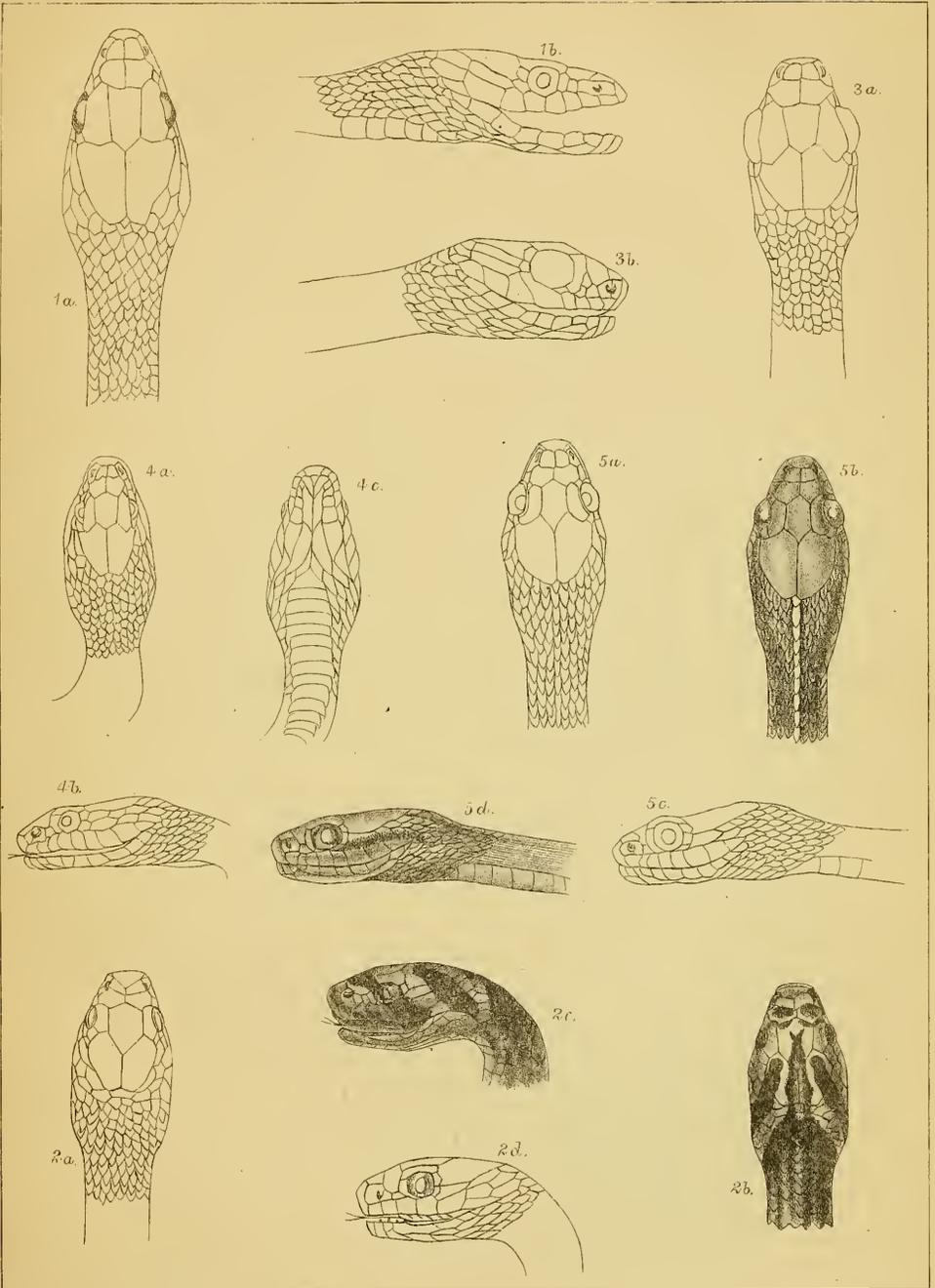




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## ASIATIC SOCIETY OF BENGAL.

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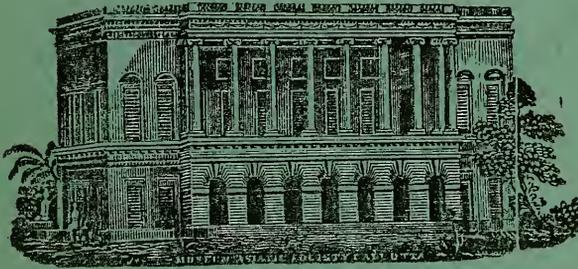
EDITED BY

W. J. SCLATER, ESQ.

AND

SURGEON CAPTAIN J. H. TULL WALSH,

HONORARY SECRETARIES.



“The bounds of its investigation will be the geographical limits of Asia: and within these limits its inquiries will be extended to whatever is performed by man or produced by nature.”—SIR WILLIAM JONES.

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ERRATUM.

Page 299 for *Fimbistylis* read *Fimbristylis*.



# JOURNAL

OF THE

## ASIATIC SOCIETY OF BENGAL.



### Part II.—NATURAL SCIENCE.

No. IV.—1891.

XII.—*Natural History Notes from H. M.'s I. M. Survey Steamer "Investigator," Commander R. F. HOSKYN, R. N., Commanding—No. 25. The Vegetation of the Cocos Group.—By D. PRAIN.*

[Received—Oct. 23rd; read—4th Nov. 1891.]

#### § INTRODUCTORY.

The Cocos are a small group of three islands, Table Island, Great Cocos, and Little Cocos, lying about 30—45 miles north of Landfall Island, the most northerly of the Andaman group proper, in Lon.  $93^{\circ} 21'$  E., Lat.  $13^{\circ} 56'$  to  $14^{\circ} 10'$  N., and form one of the links in the island-chain that stretches southwards from Cape Negrais in Arracan to the Nias Islands off the western coast of Sumatra.

The first link in this chain is Diamond Island, Lon.  $94^{\circ} 18'$  E., Lat.  $15^{\circ} 51'$  N.,  $\frac{1}{2}$  miles south of Cape Negrais and 130 miles north-north-east of the Cocos; the next is the island of Preparis, (not yet botanically investigated), larger than Diamond Island but smaller than the Great Cocos, 80 miles south-south-west from Diamond Island and 50 miles to the north of the Cocos. The strait between Diamond island and Preparis is somewhat under 100 fathoms, that between Preparis and the Cocos somewhat over that depth. The channel between the Great and the Little Cocos is under 50 fathoms, a depth not greatly if at all exceeded in the passage between the Cocos and Landfall. The next link in the chain is the Andaman Group proper, extending from about Lat.  $10^{\circ} 40'$  to

13° 45' N., consisting of several large islands that are separated by straits and channels which, with the exception of a passage 30 miles wide and about 100 fathoms deep between Rutland Island and Little Andaman, are all very narrow and usually quite shallow. Further south we find in the same chain the Nicobar Islands; these, separated by wider intervals than the members of the Andaman Group are, extend from 6° 45' to 7° 15' N. Besides being wider, the passages between the individual islands here are much deeper and the main channels between the Andamans and Nicobars on the one hand, and between the Nicobars and Sumatra or the Nias Islands on the other, in place of being under 150 fathoms deep, give soundings of 500, 750, and even 900 fathoms. There is, however, along the line from Little Andaman to the island of Simalu or to Acheen Head an undoubted ridge, for the floor of the Sea of Bengal to the westward is 2,000 fathoms deep, and that of the Andaman Sea to the eastward is in some places at as great a depth. Whether any portion of the now submarine sections of the southern, or Nicobars half of this ridge has ever been subaërial it is difficult to say but it seems likely from its present physiographical configuration that the most recent land connection must have been between the northern or Andaman half of the ridge and the adjacent Indo-Chinese district of Arracan.

Table Island, the most northerly member of the Coco group, and lying 45 miles north of Landfall, is about a mile across and is rather longer than broad, with a considerable outlying islet, Slipper Island, at its north-west corner; southward, across a strait about two miles wide, lies the Great Coco some 9 miles long from north to south and about  $2\frac{1}{2}$  across at the widest part with several small islets off both its east and west coasts and with a very considerable outlying islet, Jerry Island, at its southern extremity; finally, some 6 miles south-west of Great Coco, and 30 miles north of Landfall, is the Little Coco about  $2\frac{1}{4}$  miles long from north to south and  $\frac{1}{4}$  to  $\frac{1}{2}$  a mile wide.

Through the kindness of Capt. Hoskyn, R.N., the writer, in company with Dr. Alcock of H. M. I. M. "Investigator," has been able to visit the group on two occasions. On Nov. 30th and Dec. 1st, 1889, Table Island was examined. On Dec. 2nd, 1889, a naturalist's party, which the writer was privileged to join, landed on Great Coco and remained encamped on a small cleared hill in its north-eastern peninsula until Dec. 8th. From Nov. 14th till Nov. 23rd, 1890, a similar party, of which the writer again was a member, was encamped on a sandy spit covered with coco-nut trees at the south end of the island; while between Nov. 25th and Nov. 30th, 1890, the Little Coco was examined.

On Table Island is situated the well known lighthouse of this name and the western slopes of the main island as well as most of Slip-

per Island, which at low-tide is not separated from the main island, are cleared on account of some cattle of which the lighthouse-keeper has charge. Throughout the rest of the island, however, except for a few pathways that have been cut on account of the cattle, the jungle is very dense and uniform. Around a bay at the south side of this island as well as on the north coast is a fringe of coco-nut trees. The height of Slipper Island is 110 feet; the highest point of Table Island proper is 150 feet. On the occasion of the visit referred to, the eastern half of the island, where the jungle is as yet intact, was traversed from south to north; the northern and western coasts were examined; the island was traversed from west to east along one of the cattle paths; the clearing was also examined for introduced weeds and escapes from cultivation.

On Great Coco Island there is a small clearing on a peninsula that forms the north-eastern extremity of the island, the site of an abandoned settlement which, some years ago, it was attempted to effect and where the writer was encamped during his first visit. Except at this point and on two or three of the more exposed cliffs and slopes on the western sea-face of the island, which are only grass-clad, there is a uniform jungle from end to end of the island and from base to summit of the numerous more or less parallel steep ridges that compose it. The shore is fringed with coco-nut trees in quite a thin belt where the ridges that compose the island come close to the shore, and this fringe is broken here and there where these ridges end in abrupt headlands; the belt widens however at the heads of the various bays and in two places in particular,—on the eastern side of the island along the bay that extends southward from the north-eastern peninsula already mentioned, as well as across the isthmus joining this peninsula to the main island and thence along the northern end of the island to the mouth of the principal creek—again, on the western side of the island for half a mile or more northwards from the southern end—this belt of coco-nut trees is 100 yards or more in width. Where the beach meets the coco-nut belt there is an invariable sea-fence of *Pandanus* with other ordinary Indian Ocean littoral plants; this fence is generally less dense where the beach is composed of sand than when it consists of coral shingle. Except on the very crests of the ridges, and sometimes even there, and on the more exposed western headlands, the forest is composed of very tall trees with below these a dense undergrowth; this undergrowth is particularly dense, owing to the number of creepers, on the crest of ridges destitute of tall trees, and on the slopes of the western sea-face that are not grassy. It is also very dense immediately behind the coco-nut belt especially if, as frequently happens, this belt passes insensibly into the mudflats that characterise the outskirts of a mangrove swamp. On the sides of ridges however, as

opposed to their crests, the under-jungle is not so dense, largely owing to the mass of creepers being carried up to the tall trees above, while on the neck of land that connects the main island with the peninsula at the north-east corner, and on the narrow, more level tongue that forms the south end of the main island and stretches towards Jerry Island, the jungle is rather opener and more penetrable than elsewhere. The height of the outlying north-eastern peninsula which probably at one time has been a separate islet, at least at high-tide, is 80 feet; the highest ridge of the main island has an elevation of 300 feet; the other ridges mostly reach from 150—200 feet. Jerry Island, the chief outlying islet off Great Coco, consists at the southern end of a low ridge 60 feet high with a vegetation quite like that of the ridges on the main island; the northern half, however, consists of a level spit stretching towards the main island; this spit is composed of coral-shingle, and though covered with coco-nut and other trees there is only a sparse undergrowth within its *Pandanus* belt. Between Jerry and the main island extend wide sandstone reefs on which the waves and currents have thrown up a small eyot of sand, coral-shingle, dead shells, and drift timber on which stranded fruits and seeds are germinating. The other outlying islets call for no remark; all of them look like detached continuations of particular ridges and most of them have the vegetation characteristic of these. During the first visit daily excursions were made into the island towards the northern and eastern parts; the jungle was found to be so dense on the ridges and the level ground so difficult owing to the ramifications of a considerable creek, which, with its concomitant mangrove swamps, finds an outlet into the northern bay, that it was only on one occasion that the western coast was reached. It was impossible to do anything like justice to the interior; still, the northern and north-eastern peninsulas, the northern half of the east coast, the north coast and about two miles of the west coast at the north end were fairly thoroughly examined. During the second visit, profiting by the experience of the former season, fewer attempts were made to force a passage in a straight line through all obstacles, and the edges of ridges—*juga ipsissima*—were in particular carefully avoided. The compass was discarded, no particular objective in the shape of a hill visible from the sea-shore was permitted to occupy the attention exclusively; the easiest rather than the shortest road was chosen as the route to be followed. In this way the island was crossed in four or five different places, all, however, towards the southern end; the west coast was explored for about four miles and the east coast examined northwards as far as the point reached when working in the opposite direction in the previous year. The outlying islet, Jerry, was also examined fairly thoroughly and its coasts skirted.

Little Coco consists of several ridges the highest having an elevation of 200 feet. The ridge jungle is much as in the other islands, but the level land is more largely composed of a basis of coral-shingle than is the case in the other two islands and the undergrowth is not quite so dense as in the level land on Great Coco. The coco-nut fringe is quite as uniform as in the Great Coco, but there is only one point,—at the head of a shallow bay in the middle of the west coast,—where the belt is as much as thirty yards wide. During his visit to this island the writer was able to cut his way from west to east across the highest ridge; to cross in another part along more level and frequently swampy ground; to work through a lagoon that occupies the south-western part of the island, and to skirt the whole coast on two different occasions.

The islands have all the physical features of the Andaman islands of the main chain as opposed to those of the Archipelago lying to the north-east of Port Blair; the rocks indeed recall at once those of Ross Island and of the shores of Port Blair in South Andaman. They are also equally like those forming Diamond Island, off the Arracan coast at the mouth of the Bassein river and, as in these localities, are best seen at points where the inland ridges end in abrupt headlands or are continued as long reefs exposed wholly, or in part, at low-tide.\* Such reefs not infrequently rise into outlying islets. These islets are some distance from the main island, and are bare and rocky, or jungle-clad, according to size and exposure, those off the west coast being all very bare. The bays between the headlands are mostly wide and shallow, and are filled up, except opposite the mouths of creeks, with an accumulation of coral debris that becomes at times banked up, causeway-like, between the shore and an outlying island; these causeways are in some instances becoming stocked with the mangrove-vegetation of the neighbouring creeks.

The floor of these shallow bays is remarkably flat and uniform and is, at the sea-edge of the bay where the reef ends, generally rather shallower than it is within, so that at low-tide each bay consists of a long shallow pool, one to two feet deep, separated from the sea itself by a long low bank of exposed coral. The bottom of such a pool is usually covered by a close meadow of *Cymodocea ciliata*, but though this species is so common there seems to be no other marine phanerogam present. *Algae*, too, are remarkably inconspicuous, being of small size and very

\* For further notices of the physiography of the islands the reader is referred to *Alcock; Nat. Hist. Reports in Hoskyn, Administration Reports of the Marine Survey of Indi:* 1889-90, pp. 14, 15; 1890-91, pp. 11, 12; where also notices of the fauna, particularly marine, will be found. In *Hume; The Islands of the Bay of Bengal in Stray Feathers*, vol. ii, pp. 111—119, an account of these islands will also be found; there the ornithology of the group is exhaustively discussed.

scarce; the only exceptions are *Turbinaria ornata*, which is fairly frequent both on the coral reefs and on the sandstone ledges; *Padina pavonia*, more common on the exposed sandstone reefs but less frequent on the coral than *Turbinaria*; and *Sargassum ilicifolium*, which is the only really common seaweed and which occurs in great meadows at the outer margins of the fringing reefs and sandstone ledges that are exposed at low-tide, as well as in the deeper water beyond.

Reefs such as those described are extremely common in all the islands of the Andaman and Nicobars groups that the writer has visited, and the marine vegetation is remarkably uniform in appearance as well as in specific constituents. On Car Nicobar, for example, as well as on Rutland Island, at the extreme south end of the Andaman main group, localities which the writer has visited on different occasions, it is hardly possible to detect a species not represented on the reefs of the Cocos. On similar reefs in South Andaman, however, a second species of *Cymodocea*, quite as profuse where it exists, but more local in its occurrence, has been gathered, and on a similar reef in Little Andaman large meadows of *Halophila ovalis* were found associated with those of *Cymodocea*. The beach between such a reef and the *Pandanus* sea-fence consists, so far as the writer's observations extend, almost exclusively of coral sand mixed with small shells or fine fragments of large shells. The heavy surf in such a bay as this breaks at the outer margin of the reef, and even at high-tide in rough weather the swell is so weakened there that the waves which break on the beach are not so heavy as to have any great erosive power. Indeed their effect appears to be on the whole accretive, for the sand that accumulates at the head of the bay becomes bound by *Ipomœa biloba*, *Sesuvium*, *Euphorbia Atoto*, etc., the *Pandanus* fence encroaches on the beds of *Ipomœa*; the coco-nut zone widens seawards, and behind it the first line of beach-forest, containing *Terminalia*, *Hernandia*, *Erythrina*, *Pongamia*, *Stephegyne*, *Thespesia*, and the second line of the same forest, characterised by *Mimusops*, *Gyrocarpus*, *Pisonia*, *Ardisia*, *Cycas* assert themselves in an area previously covered by the tides. In certain situations, too, the true mangroves stalk forward into the tolerably quiet waters of these bays, while in a different but equally effective manner, by sending up suckers from among its curious pith-like roots, *Avicennia* establishes itself upon the reef. The guyed and stilted habit of the former makes their position very secure; the latter, from the enormous area covered by its roots, must also be difficult to overthrow. The process of land-making behind a fringing reef, either as a sandy flat covered with coco-nut trees, or as a mangrove swamp spreading seawards, is well exemplified in the two bays lying respectively to the south and to the north of the position of the first season's

camp; the effects are so like what must result if land were slowly rising that it is only after careful examination of all the conditions that one's mind becomes disabused of this specious impression. There is no direct evidence that the land is rising and, as will be evident on considering what has been said above, there is no necessity for supposing that it is. But though this is a very common type of bay, it is not the only type. On Great Coco, in some cases, and on Little Coco very generally a different stage may be observed. The shallow pools described as existing between the surf-built embankment at the margin of the fringing-reef and the beach, have in them many living corals that raise great rings which rise to almost the surface of the water in the pool at low-tide and, like huge lichens, grow peripherally till they meet and coalesce. The surf, too, breaks off pieces of greater or smaller size which are lodged in the pool behind, and by-and-bye become more or less cemented together. In this way the whole of a pool becomes in time completely filled up with growing coral and cemented blocks, and there are many reefs, especially on Little Coco, that are completely uncovered at low-tide, while small patches of similar reef are here and there seen that ordinarily the high-tides do not cover. The uniformity that the surfaces of some of these exposed reefs display is very striking. They are almost as even as a paved floor and are as bare and destitute of marine vegetation as they are of living coral. The edge of such a reef, in place of being a fairly continuous embankment higher than the floor of the bay behind, is now broken into hundreds of jagged gulleys through which the wave-wash from the almost level platform tears its way back to the deep water beyond the fringing-reef. The main interest of this stage of the reef is less, however, from the present point of view, its actual physical condition than its effect on the vegetation of the shore.

Behind a coral bay like one of those first described, and which characterises a less advanced stage of the history of the fringing-reef, has gone on a long and steady growth of land, with some shingle in it doubtless, especially as one approaches the nearest ridge, but chiefly composed of coral sand with a thin coating of humus derived from the vegetation it has supported. The main force of the surf has for long been spent on the outer embankment, and the force of the waves that at high-water passed over its top has been so much diminished ere these reached the beach that there they did not act destructively. Now all this is altered. At low-tide the force of the surf is still all expended on the edge of the reef, but as soon as the water has risen so high that the edge of the reef is covered, this force instead of being dissipated in the deeper water of a pool is accentuated as the breakers roll landward across a reef on which the water shallows slightly as the shore is approached; by the

time the surf ceases to break on the edge of the reef practically its whole force rolls in over this even and slightly shallowing reef till it falls on the shore in huge erosive breakers that eat away the soil, so that *Pandanus* fence, coco-nut zone, and beach-forest all in turn disappear, and the waves at high tide grind on the prostrate stems of huge *Mimusops*, *Ficus Rumphii*, and *Dipterocarpus* trees, and undermine the roots of their old companions that are still standing but that the next storm will lay beside those on the beach. But this active denudation no more indicates a sinking of the land than do the heightened reefs that cause the action indicate that the land has risen, and as direct indications either of rising or of sinking are altogether absent we must conclude that the islands are at present practically stationary. But it is interesting to find, as one does here, in adjacent bays, such diverse indications of the same condition.

There are bays of a third type in the group, few in number, however, and of small size, in which the water is deep quite up to the beach; the sweep of the waves in these is extremely large, even when the sea outside is quiet, owing to the strong currents that prevail round the islands. They have all, as might be expected, rocky sides; the beaches on which the waves break are of sand, not shingle, and owing apparently to this excessive sweep of the waves the *Pandanus* fence and coco-nut zone at the head of such a bay is a good number of yards away from the beach, a considerable sand-bank covered with *Ipomœa biloba*, *Vigna lutea* and other sand-binding species, intervening between the limits of ordinary tides and the woody vegetation.

The nature of the beaches behind the numerous long, comparatively flat sandstone ledges, exposed at low-water and therefore not coral-covered, has yet to be noted. Such beaches are always of coral-shingle mixed with large shells, the pieces of coral being rounded or oblong and sometimes of considerable size. The most remarkable example of such a beach in this group is that at the south end and south-east corner of Little Coco where the sandstone reef is particularly extensive and where the south-west monsoon must break with singular force. This beach consists of an abrupt shingle wall, in many places 6 or 7 feet high, and yet not much wider at the base than twice its own height. Though very steep towards the sea-face it slopes more gradually at the back; behind it at this point there stretches a low flat tract of muddy land not much higher than the reef itself, covered by a dense jungle of *Hibiscus tiliaceus*, *Vitex Negundo*, *Leea*, and similar shrubs, but with few trees, the whole loaded with tangled masses of *Cassytha*. The *Pandanus* fence is here particularly dense, and along with it are coco-nut trees growing on the shingle; from the appearance and size of these it seems clear that, slight

as the defence seems, this shingle beach completely prevents erosion though at the same time accretion is probably very slow. In the case of the highest and most advanced coral reefs usually the same shingle beach occurs; from which fact we might conclude that as the initial stage of any fringing-reef must have been that of a simple submerged sandstone ledge of greater or less extent, we see here the original shingle beach, thrown up where this ledge originally became subaërial, to which the waves have eaten back over the present raised reef until all the sandy soil formed during the earlier "embankment and pool" stage has, with the vegetation it supported, been swept into the sea. This shingle having been reached the erosive action has been checked, and the surer, if slower process of shingle accumulation has been initiated or, at all events, renewed. From this account of these bays it will be seen that the fringing-reef exhibits in some parts a phase more advanced than it exhibits in others. But it does not therefore follow that these more advanced "platform" portions are older than the earlier "embankment and pool" portions. They cannot, in one sense, be so old, for we must suppose that all these reefs commenced contemporaneously, and the "embankment and pool" reefs are still growing, whereas the "platform" reefs have now no living coral. The different stages therefore merely indicate that the sandstone reefs running out from the headlands in which the various ridges end are in different parts of the islands situated at different depths, and the condition of the reefs indicates that the sandstone ledges are shallower, and that deep water is further from the shore towards the south than towards the north end of the islands. At quite the southern extremity of Little Coco bare sandstone reefs, too shallow for the growth of a coral fringing-reef, stretch away south-eastward in much the same way as the well-known Algnada reefs extend southward off Cape Negrais. On the east coast of Little Coco are high coral reefs exposed at low-tide, fringed by a coral-shingle beach, while towards the north end of the island are similar high reefs fringed by a shore of sandy soil which, with the beach-forest growing on it, is being washed away by the sea. On the west coast, where the reefs are high, and, though still in the "pool" stage appear from their jagged edges to be approaching the "platform" stage, a line of low sand-dunes, perhaps the highest development of the epoch of sand-accretion, have been thrown up; these at present protect the shore and have actually closed up, at the south-west corner, the mouth of a mangrove-creek.

Similarly, in Great Coco, near the southern extremity and between the main island and Jerry there is a large bare sandstone reef which exhibits very well the arrangement and dip of the strata; further up the east coast denudation is going on, still further north the site of a beach-

forest is being composed by accretion, while at the north end a mangrove forest is invading the sea. The west coast of Great Coco is more or less rocky and abrupt, for nearly the whole extent of the island.

No denudation is taking place in Table Island, the shores of which rise rather abruptly from the beach in most of its circumference, though there is a bay at the north side looking towards Slipper Island that is fringed with *Pemphis acidula* and has a small flat space immediately within its *Pandanus* fence.

When the beach between the reef and the *Pandanus* sea-fence consists of coral sand it is usual to find outside the jungle proper a belt of *Ipomœa biloba*, at times covered with parasitic *Cassytha*; where it is composed of shingle *Ipomœa biloba* may also occur, though it is more usual to find its place taken by *Ipomœa denticulata*. Along with these *Ipomœas* occur *Euphorbia Atoto* and, less frequently, *Sesuvium Portulacastrum*. Usually just within these occurs the common sea-face jungle-fence of *Pandanus*, *Sophora tomentosa*, *Cesalpinia Bonducella*, *Tournefortia argentea*, *Desmodium umbellatum*, *Premna integrifolia*, *Olerodendron inerme*, *Colubrina asiatica*, *Canavalia obtusifolia*, *Vigna lutea*, *Guettarda speciosa*, *Allophylus Cobbe*, etc., and then, particularly if the beach is a shingle one, as trees in the same zone, *Ixora brunnescens*, *Terminalia Catappa*, very common, *Stephegyne diversifolia*, *Thespesia populnea*, *Hernandia peltata*, *Erythrina indica*, *Pongamia glabra*, *Ficus Rumphii*, *Barringtonia speciosa*, *Gyrocarpus Jacquinii*, etc., with a thin line of *Cocos nucifera* growing up slantingly beneath these and stretching their crowns seawards as if in search of light. Where the beach is sandy the sea-face jungle makes a less dense hedge, and within it lies a flat space of sandy soil with a grove of *Cocos nucifera*, stretching back from 10 to 100 yards to where, usually on lower and muddy ground tunnelled by *Cardisoma* and other land-crabs, commences a dense jungle that shades off almost insensibly into the vegetation of a true mangrove-swamp. The sand beneath the coco-nut trees in these groves is covered in Great Coco by a close sward of *Thuarea sarmentosa*, with here and there patches of *Ipomœa biloba*, clumps of *Tacca pinnatifida*, or large examples of *Crinum asiaticum* and *Cycas Rumphii*, and with patches of *Eranthemum* here and there beneath these. The more rocky portions of the coast have in the sea-face jungle-fence described above some other species that do not seem to care for sand or shingle, such as *Hibiscus tiliaceus*, *Tabernamontana crispa*, *Desmodium polycarpon* and *Desmodium triquetrum*, *Briedelia*, *Derris uliginosa*, *Pluchea indica*, etc. Within the coco-nut zone on the flat land we meet with more *Gyrocarpus Jacquinii*, with the Andamanese Bullet-wood (*Mimusops littoralis*), various species of *Dipterocarpus*, *Miliusa* sp., common, and some species of *Meliaceæ*; the climbing undergrowth in this tract

is very characteristic, more so than the trees, consisting of *Caesalpinia Nuga*, *Capparis sepiaria*, and, very largely, of *Pisonia aculeata*. In the more muddy soil which occurs on the outskirts of the mangrove-swamps other shrubs and creepers occur; such as *Leea sambucina* with stilted roots like the mangroves, *Cynometra ramiflora*, *Hibiscus tiliaceus*, *Flagellaria indica*, *Mucuna gigantea*, remarkably common, *Sarcostigma edule*, *Plecosperrnum andamanicum*, *Antitaxis calocarpa*, *Salacia prinoidea*, which extends also into the swamp proper, *Acrostichum scandens*, etc. Not infrequent in such situations, when there is no high forest overhead is *Vitex Negundo* which is particularly common on Little Coco. In this muddy tract the tall trees remain much the same as in the drier area just behind the beach. Further inward the vegetation is that characteristic of a true mangrove swamp, *Bruguiera*, *Ceriops*, *Rhizophora*, *Aegiceras*, *Avicennia*. The *Avicennia*, strangely, does not appear to be common in many of the creeks, though there is one creek, on the east side and near the south end of Great Coco, in which it is the prevailing tree; except indeed for a few *Bruguiera gymnorhiza* trees along the open channel of the creek, the whole swamp consists of *Avicennia officinalis* with thousands of its curious roots protruding through the mud and water as described already in a former paper (*J. A. S. B.* vol. lix, p. 272); considering the situation and loose structure of these roots, which are of the consistence of *solah*-pith, there seems every possibility that they are concerned in the process of transpiration; the large area covered by the roots of each tree must also afford great stability to a species which affects, as this one does, the situation of the mangroves without having their stilted roots. In this particular swamp each tree was loaded with the climbing form of *Salacia prinoidea* and, as the latter happened to be in flower at the time of the visit, the foetid nature of the atmosphere experienced may be imagined.

Between the headlands, in most cases, a choked-up creek is to be found; generally this extends but a short way into the jungle, though sometimes it winds about on the level ground for a considerable distance as a mangrove-swamp. In two places the creeks on Great Coco are apparently open at all times to the tide; the chief creek is that which debouches at the north end of the island. There are no open creeks in the other two islands, though at the south-west corner of Little Coco what has been a creek of considerable extent is now converted into a large lagoon by a broad bank of sand having been blown and beaten up by the south-west monsoon into a firm embankment across its former outlet.

On the ridges the trees are much the same, as to species, as on the lower ground, except that the *Milium* which is common below is scarce

there, and the *Gyrocarpus* is rather uncommon. The *Mimusops* too, is not so abundant on the drier ground. The *Pandanus*, however, especially on the western side of the islands, ascends to the tops of the ridges and along with the *Capparis sepiaria* occurs *Capparis oxyphylla* (*C. tenera*, var.), the other common creepers being *Lygodium flexuosum*, *Abrus precatorius*, *Mezoneuron enneaphyllum*, *Mucuna pruriens*, *Thunbergia laurifolia*, *Dioscorea* (two species), *Calamus* (two species) exceedingly abundant and making an almost impassable cane-brake especially on the crests of the ridges; *Pæderia foetida* is another common creeper, as also is *Modecca cordifolia*. The jungle with which these are associated contains, besides the shrubs met with on the lower ground, thickets of *Cyclostemon assamicus* and other Euphorbiaceous shrubs, *Alsodeia bengalensis*, *Glyptopetalum calocarpum*, *Grewia* (two species), *Diplospora singularis*, *Ficus* (several species), etc. On one hill, in Great Coco, there is a limited patch of bamboo-jungle, the species being a *Dendrocalamus*, probably a variety of *D. Strictus*. This species also occurs on Table Island, where flowering specimens were obtained, and at first there seemed to be room for doubt as to whether it might not have been introduced on the lighthouse-island, though certainly it only occurs there in the untouched jungle and no examples exist in the clearing. The presence of the same species, however, in quantity, in the interior of Great Coco, on a hill which it is hardly extravagant to suppose had not been before ascended by any one, may be held to dispose finally of the doubt. Among the features of the jungle on exposed sea-slopes that are not grass-clad must be noted the presence in quantity, besides the other creepers found on the ridges, of *Ipomœa palmata*, *Ipomœa grandiflora* and *Convolvulus parviflorus*, the latter a particularly characteristic species on the west coast. The herbaceous undergrowth consists of *Oplismenus compositus*, *Cyperus elegans*, and a few other sedges and grasses in local patches or as stray examples; in places also occur patches of *Alocasia fornicata*, *Calanthe* sp. (apparently *C. veratrifolia*), *Dracœna spicata*, *Desmodium laxiflorum*; in one place nearly in the centre of the island, some plants of *Urena lobata* (this species does not occur in the clearings of either island and cannot here be looked upon a weed introduced by human agency); in the drier parts considerable quantities of *Acrostichum appendiculatum*; along the sides of dry torrents a good deal of *Adiantum lunulatum*; and in one or two damp, flat spots *Ceratopteris thalictroides*.

On Table Island the west side has been artificially cleared and it is impossible to say that it ever has been jungle-covered, but several of the headlands on the west side of the Great Coco, as has already been mentioned, have naturally bare grassy slopes. There are none of these,

however, on the Little Coco. The principal grass on these slopes, and throughout the two clearings as well, is the very uninviting *Andropogon contortus*, mixed with a small amount of *Ischœmum ciliare*; besides these there is some *Cyperus polystachyus*, and in the clearings of both islands *Eleusine indica* in tufts, with here and there a little *Panicum colonum*. In Table Island, though not in Great Coco, *Eleusine ægyptiaca* and *Panicum Helopus* have also become established. In this connection it should be mentioned that *Thuarea sarmentosa*, which is the common sward-grass under the coco-nut trees of Great Coco, is very rare in Little Coco; the only spot where the coco-nut zone is there of any width has *Ischœmum muticum* growing throughout it in abundance; in Great Coco *Ischœmum muticum* is rare.

On the low ground the epiphytes in the taller trees are two species of *Hoya*, *Scindapsus officinalis*, *Dendrobium secundum* (the only common light-loving orchid, which is particularly common on trees of *Heritiera littoralis*, etc., about the mouths of creeks), *Davallia solida*, *Polypodium (Niphobolus) adnascens*, and *Polypodium quercifolium*. There is a great absence of epiphytes from the trees growing in the interior, the ferns mentioned are in particular confined to the trees nearest the sea. In the muddy ground behind mangrove-swamps there are on the stems of *Cynometra* and other trees, great numbers of an orchid that proves, on having been flowered in the Calcutta garden, to be a *Dorites* with violet flowers; apparently, however, it is only a variety of *D. Wightii*.

Perhaps a better idea of the vegetation of the islands may be obtained if extracts from the writer's notes, enumerating the species met with in particular localities, be given. Of these only a few are selected, illustrative, as far as possible, of different kinds of soil and of diverse situations. From these it will be seen that any attempt to divide the forest into distinct zones and regions is attended with difficulty, since the various forests—*Mangrove*, *Beach*, *Mud-flat*, and *Dry-ridge* jungles—merge into each other on every hand.

In crossing the island on the drier level ground near the south end of the island one finds after the belt of coco-nuts, which is there about 100 yards wide on the western side, a jungle at first not very dense of *Canarium commune*; *Aglaia andamanica*; *Millettia* sp.; *Gyrocarpus Jacquini*, very common; *Mimusops littoralis*, the most common tree, with often great masses of *Hoya*, and near the sea with *Polypodium quercifolium* as epiphytes—all the *Mimusops* here is uniformly dying back in the topmost branches; *Bombax* sp., looking much more like *B. malabaricum* as to leaves than like the Andaman species identified by Kurz with *B. insigne*; *Dracontomelum sylvestris*; *Spondias mangifera*; *Semecarpus heterophylla*; *Albizia procera*; *Dipterocarpus* sp.; *Sterculia alata*; *Erio-*

*dendron anfractuosum*, etc. Under the *Cocos nucifera* on the sandy soil a sward of *Thuarea sarmentosa* with patches of *Ipomœa biloba* and with a quantity of *Eranthemum succifolium*; further inland there is a dense undergrowth of *Glycosmis pentaphylla*; *Ardisia humilis*; *Ficus brevicuspis* and *Ficus Dæmonum*; *Alsodeia bengalensis*; *Glyptopetalum calocarpum*; *Cyclostemon assamicus*; etc.—covered with a mass of *Pisonia aculeata*; *Cæsalpinia Nuga*; *Capparis sepiaria*; *Mucuna gigantea*, less common here than on muddy soil; *Calamus* sp., not very common; *Sarcostigma edule*; *Antitaxis calocarpa*; *Derris scandens*; *Thunbergia laurifolia*; *Dioscorea*, two sp.; *Vitis pedata*, very common; *Acacia rubricaulis*, often. Of sub-herbaceous plants may be mentioned *Dracœna spicata*, it is, however, less common on level ground than on the ridges. Further on were met with *Cynometra ramiflora*, with occasionally *Dorites Wightii* epiphytal, but less commonly so than where the soil is moist and muddy; considerable quantities of *Leea sambucina*; *Sterculia villosa*, as a small tree; *Stephegyne diversifolia*, though rarely; *Artocarpus Gomeziana*; *Terminalia bialata*; some *Siphonodon celastrineus*; *Oroxylum indicum*; and, as the opposite side of the island is approached, *Croton sublyratus*; *Hernandia peltata*; *Sterculia rubiginosa*; *Terminalia Catappa*; *Erythrina indica*; and the *Pandanus* sea-fence. Just before reaching this coast-zone a single example of a stemless palm (*Livistona* sp.?) was met with; another example of this was obtained on the hill where the 1889 encampment was made at the north-east corner of the island. In cutting a path across the island at another point a level sandy tract was reached on which for several hundred yards grew nothing except young *Gyrocarpus Jacquini*.

Crossing at a point where a ridge had to be passed it was found that much of the flat land behind the coco-nut zone was taken up with a jungle of *Gyrocarpus Jacquini*, *Macaranga Tanarius* and *Mallotus andamanicus* to the exclusion of other species; but even as far as the base of the ridge many fruits of *Cocos nucifera* that had been floated inland during the rainy season, when the whole of this level tract is evidently water-covered, are germinating freely and some coco-nut trees that have reached the light have begun to bear. On the ridge itself a dense jungle prevails, much matted, especially along the crest, with creepers; the chief of these is *Thunbergia laurifolia*, the others being *Dioscorea* sp.; *Capparis sepiaria* and *Capparis tenera*; *Derris uliginosa*; *Anodendron paniculatum*; *Abrus precatorius* and *A. pulchellus*; *Calamus*; *Pædiria fatida*; *Modecca*; *Trichosanthes palmata*; *Porana spectabilis*; a little further along this ridge the west side and the flat land at its base was found to be a dense thicket of *Caryota sobolifera*; the herbaceous undergrowth was remarkably sparse and consisted of a few plants of *Zingiber* sp.; some patches of *Alocasia*, and a few patches of *Oplis-*

*menus*. The eastern side of this ridge had no flat land between it and the sea and was rather more open, the tall trees and creepers were much as on the west side, with the addition of *Argyrea tiliæfolia* and *A. Hookeri*; large masses of *Erycibe paniculata*, which is here always a heavy climber and not shrubby; and among the undergrowth with the addition of *Claoxylon* sp.; *Corypha* sp.; and near the shore *Blachia andamanica*; *Pluchea indica*; *Onesmone javanica*. On bare isolated rocks lying well out on the reefs, and never covered completely by the tide, the species found are always *Fimbristylis* sp.; *Cyperus pennatus*; and *Berhaavia repens*. The same species also occur on bare rocky patches of the coast all round the island but especially on the west coast. Other species associated with these in such situations are *Desmodium polycarpon*; *D. triquetrum*; *Blumea virens*; *Vernonia divergens*; *V. cinerea*; *Pluchea indica*, etc.

The isthmus uniting the outlying peninsula at the north-east corner with the main island has, mixed with the coco-nut trees occurring there, a sparse forest of *Mimusops* and *Dipterocarpus*, with an undergrowth towards the north coast almost exclusively of *Macaranga Tanarius*, towards the south almost entirely of *Dodonæa viscosa*, though here and there on hummocks of soil as opposed to sand, are other trees, like *Oroxylum indicum*; *Heterophragma adenophyllum*, etc. Among the herbaceous species here the most noteworthy is *Anisomeles ovata*, the only *Labiata* on the islands, which is, however, at this particular spot, very plentiful. On the coast of the north-east peninsula *Physalis minima* is a common species, it occurs, however, in similar situations here and there on both the Great and the Little Coco; on the slope above *Strobilanthes phyllostachyus* is gregarious and plentiful, as it likewise is at the north end of Little Coco in a similar situation.

As an example of the vegetation of level ground, where the soil is shingle instead of sand, the north end of Jerry island may be described. Here on the beach is a dense thicket of *Pemphis acidula*; behind this, a few examples of *Pandanus odoratissimus*; many *Scaevola Kœnigii*; some *Tournefortia argentea* and *Sophora tomentosa* bushes; many coco-nut trees; much *Cesalpinia Bonducella*. Behind this sea-fence the shingle is covered with a mass of *Ipomœa biloba*, a striking contrast to what occurs at the north-east corner of the island where the shingle has *I. denticulata* only. The trees on this shingle are *Terminalia Catappa*, *Cocos nucifera*, *Ardisia humilis*, *Ixora brunnescens*, *Guettarda speciosa*, *Macaranga Tanarius*, *Mimusops littoralis*, *Gyrocarpus Jacquini*, *Hernandia peltata*. Besides the *Ipomœa* the only herbaceous vegetation consisted of a few fruiting *Amorphophalli*; the tubers of these brought to Calcutta have since sent up bulbiferous leaves that shew the species to be nearly

related to, but probably quite distinguishable from, *A. bulbifer* and *A. tuberculiger*, the two species hitherto known which exhibit this character. The east side of this island has *outside* the *Pandanus* fence, which is there about three times as broad and thick as on the west, a belt of *Thespesia populnea* and *Guettarda speciosa*, with patches of *Pemphis acidula* and *Clerodendron inerme*, and some trees of *Cordia subcordata* and *Champereia Griffithiana* as well as a few thickets of *Vitex Negundo* and *Desmodium umbellatum*.

The sandy isolated spit on the reef between Great Coco and Jerry Island is not covered even by spring-tides—it is about 70 feet long from north to south by some 30 feet across, and at the time of the writer's visit there could be counted on it (mostly near the east side, and towards the south end) about a dozen germinating coco-nuts; three seedling *Hibiscus tiliaceus*, a seedling *Thespesia*, some seedlings of *Gyrocarpus*, four seedling *Mucuna*, two seedling *Erythrina*, six seedling *Carapa moluccensis*, one seedling *Barringtonia speciosa*, one seedling *Entada scandens*, some young *Ipomœa biloba*, and one young *Cynometra*, with two or three other species not recognised.

In general features Little Coco so greatly resembles the other islands that it is unnecessary to deal with it in detail. The chief feature is perhaps the great abundance of *Corypha elata* and *Siphonodon celastrineus*; still both species were met with, though sparingly, on the Great Coco.

Before concluding, however, this general account of the vegetation of the islands the two fresh water accumulations deserve to be more particularly noted. That on the Great Coco consists of a small lake in the narrow neck of land that joins the outlying north-eastern peninsula to the rest of the island. This lakelet is about 300 yards long and hardly 100 yards wide, with its longer diameter *across* the isthmus. Its depth is a little over 3 feet; it is uniformly deep from side to side and from end to end, with a hard, even bottom. At either end it is only separated from the sea by some 80 to 100 yards of shingle bank, and it seems difficult to understand why the water it contains does not ooze out, and how it is that it is unaffected by the adjacent salt water, since the bottom of the lake is lower than the point reached by the waves that beat up on the single beach, if not actually lower than the level of the highest tides. The bottom seems to be no more than the floor of what has formerly been a shallow bay on the fringing-reef, and the shingle banks which separate it at either end from the sea seem to be nothing more than the ultimate embankments that would result when the causeways connecting outlying islets with the main island are so enlarged by accretion as to cease to be covered by the tides. This postulates that the present out-

lying north-eastern peninsula had originally been detached from the main island and, being an islet of considerable width, that a causeway, ultimately becoming an embankment, has been thrown up by wave-action from each of the two adjacent bays. Soil washed down from the adjacent slopes during the rainy season has in the form of fine silt closed up the porous shingle banks at either end till these can now retain the fresh water within them and prevent the percolation of sea-water from without. To the east side of this lake there is a small flat meadow covered with *Kyllinga* and *Fimbistylis* along with some *Cyperus polystachyus* but very little grass. Whether this meadow was originally a naturally bare patch or is only part of the clearing made in connection with the abandoned settlement on the adjacent hill it is difficult to say. If, however, it was artificially cleared, it is unlike the rest of the clearing in this, that no woody jungle is reappearing in it now. At the time of our visit a number of snipe frequented the meadow. Close to the edge of the lake is a continuous belt of *Hygrophila quadrivalvis*; within this, and extending into the water, is a belt of *Polygonum* all round the margin of the lake; inside the *Polygonum* float large matted patches of *Panicum Myurus*. Here and there are patches *Limnanthemum indicum*; there is also a considerable quantity of *Nymphæa rubra*. The ordinary white *Nymphæa Lotus*, so common in similar spots in the Andamans, is not present, a circumstance which inclines one to think that this red water-lily may have possibly been introduced during the attempt to settle in the island. The water is quite potable and apparently wholesome; neither *Chara* nor *Zanichellia* is present, perhaps the water is rather deep for these.

Very different in many respects is the lagoon on Little Coco which is simply a mangrove creek that has been banked off from the sea by a small sand-dune having been thrown up across its mouth. It is not more than  $1\frac{1}{2}$ –2 feet deep anywhere, with also a level but at the same time a softer bottom than the Great Coco lake, and this bottom is covered uniformly throughout by a meadow of *Chara* mixed with *Zanichellia*. Here the water, though perhaps potable on an emergency, and though used by native craft that call in for it, is slightly brackish, and the lake is fringed throughout by *Bruguiera*, *Lumnitzera*, *Ceriops*, *Avicennia*, etc., while clumps of similar mangrove trees occur throughout it. Its area is considerably greater than that of the Great Coco lake, for it is about a quarter of a mile long and a furlong across at the widest part; it was haunted at the time of our visit by teal. Here, curiously enough, *Panicum Myurus* does not occur, its place being taken by *Paspalum scrobiculatum* which floats in great patches at its south-western corner. There is no *Limnanthemum* and the *Nymphæa*

present is, as in the Andamans in such situations, the common *N. Lotus* and not, as in the Great Coco, the red-flowered variety. On the banks and extending into the water are considerable beds of *Scirpus subulatus* which does not occur in the other lake. Here on the other hand there is neither *Polygonum* nor *Hygrophila* present.

Beyond the coco-nuts the vegetable products of the island can hardly be very highly assessed. *Mimusops littoralis* (Andamanese Bullet-wood) is common and so is *Lagerstrœmia hypoleuca* (Andamanese Pyen-ma); *Pterocarpus indicus* (Padouk) is rare however; and even of second- or third-rate timber trees such as *Diospyros Kurzii* (Zebra-wood); *Dipterocarpus* sp. (Wood-oil trees); *Heritiera* (Sundri); there is no great quantity; the only bamboo found (*Dendrocalamus strictus* VAR ?) is not very valuable and is not abundant; while the only abundant natural grass (*Andropogon contortus*) is so uninviting that the cattle on the island prefer eating *Pandanus* leaves to grazing it.

In the subjoined list of the species obtained during the two visits (which must not, however, be considered complete, though it may safely be assumed to be representative of the vegetation of the islands), it will be seen that a number of species are undetermined. As a matter of fact they are probably mostly species hitherto undescribed, but owing to the shortness of time at the writer's disposal, and owing to both the visits being at the same season of the year, it was impossible to obtain complete material of these, and it has therefore been impossible to prepare for them specific descriptions. In some cases roots or seeds of these have been brought to Calcutta and are now in cultivation there, so that their identification will, it is hoped, only be a matter of time.

In presenting this list the writer wishes to acknowledge much kind assistance received by him in its preparation; as regards *Phanerogams*, from his friends Mr. W. B. Hemsley, F. R. S., who has kindly compared a number of the more critical specimens at Kew; Mr. J. F. Duthie, F. L. S., who kindly assisted him in naming the grasses, and Mr. J. S. Gamble, F. L. S., who examined the solitary bamboo; and as regards *Cryptogams*, from Dr. G. King, F. R. S., who kindly assisted him in determining the *Ferns*; Mr. G. Masee, F. L. S., who, through the good offices of Mr. Hemsley, kindly named the *Fungi* and supplied the description of a new species of *Xylaria*; and Mr. G. R. Milne Murray, F. L. S., who, through the intervention of Dr. King, most kindly examined the *Alge*.

The list is followed by an analysis indicating its systematic, its physical, and its phytogeographic nature.

§ § LIST OF PLANTS COLLECTED IN THE GREAT COCO, LITTLE COCO AND  
TABLE ISLAND.

**PHANEROGAMÆ.**

THALAMIFLORE.

ANONACEÆ.

1. *MILIOUSA* sp.

Great Coco; Little Coco; very common in both islands.

The specimens obtained are in fruit only; the leaves are glabrous but otherwise are much like those of *M. Roxburghiana*; the fruits are very like those of *M. macrocarpa*.

MENISPERMACEÆ.

2. *CYCLEA PELTATA* H. f. and T.

Great Coco; common.

Burma, Nicobars. Not previously recorded from the Andaman group.

3. *ANTITAXIS CALOCARPA* Kurz.

Great Coco; common.

Andamans, Nicobars.

NYMPHÆACEÆ.

4. *NYMPHÆA LOTUS* Linn.

Great Coco; plentiful in the small lake at the north-east corner of the island—only the red flowered form (*N. rubra* Roxb.). Little Coco; sparingly in the lake at the south-west corner of the island—only the white form (*N. Lotus* Linn.).

This species is not included in any Andamans list and Kurz (*Report on the Vegetation of the Andamans*, p. 15) comments on the absence of NYMPHÆACEÆ. As a matter of fact this species does occur in the Andamans; as does *Barclaya longifolia*. *Nymphæa Lotus* is very plentiful everywhere about the settlement at Port Blair, and in one arm of a creek that had been shut off from the tide by a bank of earth only three months before, the writer in December 1890 found hundreds of seedling plants already springing up. The lake in which it occurs on Little Coco is only a mangrove creek naturally closed from the sea by a sand-bank and the water is still slightly brackish; the vegetation around consists of *Bruguiera*, *Lumnitzera*, *Ceriops*, *Avicennia*, and other mangrove swamp species.

## CAPPARIDÆ.

5. *CAPPARIS SEPIARIA* Linn. *var. GRANDIFOLIA* Kurz Mss. ex Prain, Jour. As. Soc., Beng., lix, Pt. 2, p. 275.  
Table Island; Great Coco; Little Coco. Very common everywhere in the group, both on ridges and flat land.  
Diamond Island (Arracan); Andamans; Java; Bali; Madura.
6. *CAPPARIS TENERA* Dalz. *var. LATIFOLIA* H. f. and T. (*C. oxyphylla* Wall.)  
Table Island; Great Coco; Little Coco. Very common everywhere in the group, but only on ridges.  
Tenasserim; Andamans (Middle Island and South Island).

## VIOLACEÆ.

7. *ALSODEIA BENGALENSIS* Wall.  
Table Island; Great Coco; Little Coco. One of the commonest undershrubs in the group.  
Silhet, rare; Martaban, frequent; Andamans, very common everywhere; Nicobars, very rare.

## GUTTIFERÆ.

8. *GARCINIA*? sp.  
Great Coco.  
An altogether doubtful plant represented by one leaf specimen among the plants collected by Mr. Kurz in 1866; nothing resembling it was met with in 1889 or 1890. Mr. Kurz did not himself collect in Great Coco. A deputation that visited the island while he was at Port Blair brought him a few specimens; there may even be some confusion as to the locality—the deputation visited Narcondam and elsewhere as well as the Cocos.
9. *CALOPHYLLUM INOPHYLLUM* Linn.  
Little Coco. In beach-forests on shingle behind the sea-face vegetation, not common.  
Shores of India, Andamans, Nicobars, Burma, Malaya, Polynesia, Australia, and E. African islands.

## DIPTEROCARPEÆ.

10. *DIPTEROCARPUS PILOSUS* Roxb.?  
Great Coco; eastern coast, inland from Ford Bay, common. Only leaf specimens obtained and it is not impossible that they may belong to *D. Griffithii*, Miq.

## 11. DIPTEROCARPUS ALATUS Roxb.

Great Coco ; common. Little Coco ; infrequent.  
Chittagong, Burma, Tenasserim, Andamans.

## MALVACEÆ.

## 12. SIDA ACUTA Burm.

Table Island ; cleared hillsides near lighthouse.  
A cosmopolitan tropical weed.

## 13. URENA LOBATA Linn.

Great Coco ; in one spot only, in interior of island.

A cosmopolitan tropical weed, introduction in this case may be attributed to bird agency. It hardly seemed to be indigenous as there were where it was gathered only a few plants. Yet human agency appears impossible : the species is not present at the north-east of Great Coco where once a small clearing was made, nor on Table Island where there is now a large clearing. It does not seem to be present in the Little Coco.

Cosmopolitan in the tropics.

## 14. HIBISCUS SABDARIFFA Linn.

Great Coco only ; as if spontaneous in the small clearing ; one of the few remains of a garden that existed during the short time an attempt was made to settle in the island ; the few plants seemed unhealthy.

Cultivated in the tropics.

## 15. HIBISCUS ABELMOSCHUS Linn.

Table Island only ; common throughout the clearing, escaped from cultivation.

Cosmopolitan in the tropics.

## 16. HIBISCUS TILIACEUS Linn.

Table Island ; Great Coco ; Little Coco ; common, especially on the western coast, also plentiful at times in muddy flats behind mangrove swamps. A stunted almost glabrous form occurs on coral-shingle on Jerry Island.

Littoral species, cosmopolitan in the tropics.

## 17. THESPESIA POPULNEA Corr.

Very common on all the islands.

Littoral species on all tropical coasts in eastern hemisphere, introduced into West Indies.

## 18. BOMBAX INSIGNE Wall.? vars.—??

There are two forms of *Bombax* present in the islands :—

1. A tree with armed trunk and branches ; leaflets about 6, entire, narrowly lanceolate 5–8 inches long, 1–1½ inches wide, gradually tapering to both ends almost sessile, stamens numerous. This is com-

mon in all the islands, and if the writer is correct in considering the character of armed or unarmed trunk a trivial one, is the common *Bombax* in S. Andaman. The leaves suit exactly, and though in S. Andaman the trunk of old tall trees is smooth, young saplings are armed, as are the ultimate branchlets even of old trees. The leaves are unlike any of the Indian or Burmese gatherings either of *Bombax malabaricum* or of *Bombax insigne*.

2. A tree with unarmed trunk and branches, leaflets about 6, entire, obovate, acuminate 9–11 inches long,  $2\frac{1}{2}$ –3 inches wide, gradually tapering into petiolules  $\frac{1}{2}$ – $\frac{3}{4}$  inches long, stamens numerous. This was obtained only in Little Coco, it occurs in South Andaman also, for there are specimens at Calcutta, obtained by Mr. Kurz at Port Monat on the west coast. It does not at all resemble as to leaves of the other form nor does it resemble the leaves of Wallich's type specimen of *B. insigne*. But its leaves precisely resemble those of Wall. Cat. 1840/4 (from Taong Doung, Burma), which was issued as *B. malabaricum* var. *albiflorum*, Wall. The number of stamens makes it impossible to refer the Andaman plant at least to *B. malabaricum*.

In South Andaman both forms have the leaves glaucous beneath; in the Cocos neither form has; so that this character perhaps cannot be held as valid. Mr. Kurz did not consider the two Andamans forms separable from each other, and in one place he referred them to *B. malabaricum*, but afterwards, on account of the staminal character, united them to *B. insigne*. He has, however, left a manuscript name "*B. heterophyllum*," which proves both that he had noted the existence of the two kinds of foliage and that he could not separate the plants exhibiting them from each other.

It should be noted that the convicts and others at Port Blair distinguish two kinds of "Semul" or "Cotton-tree." The distinction does not, however, apply to the two forms referred to above, but to these two taken together and to the following species.

Both islands.

South Andaman. Burma?

19. *ERIODENDRON ANFRACTUOSUM* DC.

Both islands, common.

India, Burma, Malaya, Africa, and America.

STERCULIACEÆ.

20. *STERCULIA VILLOSA* Roxb.

Great Coco; Little Coco.

India.

21. *STERCULIA RUBIGINOSA* Vent. *var.* *GLABRESCENS* King.  
Great Coco.  
A variety restricted to the Andamans and Nicobars.
22. *STERCULIA PARVIFLORA* Roxb.  
Little Coco ; only leaf specimens which, however, agree with some from Penang.
23. *STERCULIA ALATA* Roxb.  
Both islands, frequent.  
India, Burma, Malaya.
24. *STERCULIA COLORATA* Roxb.  
Great Coco.  
India, Burma, Malay Archipelago.
25. *STERCULIA CAMPANULATA* Wall.  
Little Coco.  
Burma, Andamans, Java.
26. *HERITIERA LITORALIS* Dryand.  
Great Coco ; Little Coco ; common in the creeks.  
Littoral species on tropical coasts of eastern hemisphere.
27. *BUETTNERIA ANDAMANENSIS* Kurz.  
Little Coco ; common.  
Andamans, Tenasserim.

## TILIACEÆ.

28. *BERRYA AMMONILLA* Roxb.  
Little Coco, frequent.  
India, Ceylon, Burma, Andamans.
29. *GREWIA LÆVIGATA* Vahl.  
In all the islands, common.  
India, Burma, Malaya, Australia, Africa.
30. *GREWIA CALOPHYLLA* Kurz.  
Little Coco, common.  
Andamans.
31. *GREWIA MICROCOS* Linn.  
Great Coco, infrequent.  
India, Burma, China, Malaya.

## DISCIFLORÆ.

## RUTACEÆ.

32. *GLYCOSMIS PENTAPHYLLA* Corr.  
In all the Islands ; both the arboreous and the shrubby form extremely common.  
Throughout India, Indo-China, and Malaya.

## BURSERACEÆ.

33. *GARUGA PINNATA* Roxb.  
Great Coco ; common.  
India, Burma, Malaya.
34. *CANARIUM EUPHYLLUM* Kurz.  
Great Coco ; very common.  
Andamans.

## MELIACEÆ.

35. *AGLAIA ANDAMANICA* Hiern.  
Great Coco, Little Coco ; common. Flowers sweet-smelling.  
Andamans.
36. *AMOORA ROHITUKA* W. & A.  
Great Coco ; common.  
India, Burma, Malaya.
37. *CARAPA MOLUCCENSIS* Lamk.  
Great Coco ; rather uncommon. The form with obtuse leaves (*C. obovata* Bl.) only occasional in the creeks, but very frequent germinating along the beaches of all the islands. The form with ovate cordate acuminate leaves in two or three places on rocky parts of the eastern coast. Little Coco ; in one place only (form = *C. obovata* Bl.)
38. *CHICKBASSIA TABULARIS* A. Juss. ?  
Great Coco ; common. In leaf only, but evidently identical with the tree identified with this species by Mr. Kurz in *Reg. Veg. Andam.*, p. 33.

## OLACINEÆ.

39. *CANSJERA RHEEDII* Gmel.  
Great Coco ; a common climber.  
India, Burma, Malaya, N. Australia, S. China.
40. *PHLEBOCALYMNA LOBBIANA* Mast.  
Little Coco.  
Tenasserim and Martaban.
41. *SARCOSTIGMA WALLICHII* Baill. (*S. edule* Kurz.)  
Great Coco ; rather common.  
Andamans. Mr. Kurz has in the Calcutta herbarium suggested the reduction of his own species to *S. Wallichii Baill.*, a plant from the Salween valley, nor is there any character by which the two can be distinguished.

## CELASTRINEÆ.

42. *GLYPTOPETALUM CALOCARPUM* Prain, Jour. As. Soc. Beng., lx, 2, 209  
—*Euonymus calocarpus* Kurz.

Common in all the islands, also reported from Narcondam (leaf specimens only, and the locality perhaps a mistake—the writer could not find the shrub in Narcondam). Very nearly related to *G. zeylanicum* Thwaites, from Ceylon and S. India, but easily distinguished by its shorter racemes, smaller flowers and hardly foveolate petals. The fruits and seeds are exactly as in *G. zeylanicum*. In this the leaves are always entire.

43. *SALACIA PRINOIDES* DC.

Great Coco; in creeks, an extensive climbing shrub, associated with *Avicennia officinalis*.

India, Burma, Malaya, Philippines.

44. *SIPHONODON CELASTRINEUS* Griff.

Great Coco, occasional; Little Coco, very common. A considerable tree.

Pegu, Penang., Java.

RHAMNEÆ.

45. *VENTILAGO CALYCVLATA* Tulasne.

Great Coco.

India, Burma, Malaya.

46. *ZIZYPHUS CENOPLIA* Mill.

Great Coco, not at all common.

India, Burma, Malaya, N. Australia.

47. *COLUBRINA ASIATICA* Brogn.

Little Coco; coast at north end of island.

India, Ceylon; Burma, Malaya; N. Australia; S. W. Africa.

AMPELIDÆ.

48. *VITIS PENTAGONA* Roxb.

Table Island and Great Coco; common.

Chittagong, Arracan, Andamans.

49. *VITIS CARNOSA* Wall.

Common on all the islands.

India, Burma, Malaya.

50. *VITIS PEDATA* Wall.

Great Coco, and Little Coco; very common.

India, Burma, Malaya.

51. *LEEIA SAMBUCINA* Willd.

Interior of all the islands, common.

India, Burma, Malaya.

52. *LEEIA HIRTA* Roxb.

Great Coco.

India, Burma, Malaya.

## SAPINDACEÆ.

53. *ERIOGLOSSUM EDULE* Blume.  
Both islands, on ridges, common.  
India, Burma, Malaya, North Australia.
54. *ALLOPHYLUS COBBE* Blume.  
Great and Little Coco; not uncommon along the western sea-face.  
India, Burma, Malaya.
55. *SAPINDUS DANURA* Voigt.  
Great Coco.  
Assam, Burma.
56. *POMETIA TOMENTOSA* Kurz.  
Great Coco, common.  
Indo-China, Andamans, Nicobars, Malaya, Ceylon.
57. *DODONÆA VISCOSA* Linn.  
Great Coco; a small tree very common at the north-east corner of the island.  
Cosmopolitan in the tropics.

## ANACARDIACEÆ.

58. *ODINA WODIER* Roxb.  
Great Coco.  
India, Ceylon; Burma, Tenasserim.
59. *PARISHIA INSIGNIS* Hook. f.  
Great Coco; in leaf only.  
Tenasserim, Andamans.
60. *SEMECARPUS SUBPANDURIFORMIS* Wall.  
Great Coco only, but there rather frequent near the eastern coast.  
Chittagong; *Gamble*. Arracan, in the Kolodyne valley, *Kurz*; on Boronga Island, *Kurz*. Originally this was known only from specimens grown in the Calcutta garden (introduced from Chittagong) distributed by Dr. Wallich (*Cat.* n. 987).
61. *SEMECARPUS HETEROPHYLLUS* Blume.  
Great Coco, interior, rather frequent; Little Coco, interior, extremely common.  
Pegu, Tenasserim; Andamans, Nicobars; Sumatra, Java.
62. *SPONDIAS MANGIFERA* Willd.  
Great Coco and Little Coco, very common in the interior of both islands; the fruits are yellow and extremely sour, but much eaten by the wild pigs (*Sus andamanensis*) which abound.  
Tropical Asia; Mr. Kurz found this in S. Andaman also.
63. *DRACONTOMELUM MANGIFERUM* Blume.  
Great and Little Coco, frequent: in leaf only.

Andamans, Nicobars; Malay Peninsula and Archipelago; Philippines and Fiji Islands.

#### MORINGEÆ.

64. *MORINGA PTERYGOSPERMA* Gaertn.

Great Coco; a few trees have been planted at the north-east corner of the island by the people of the attempted settlement; a large number of seedlings have already appeared though the introduction has been so recent.

India; indig. in North-West Himalaya, elsewhere cultivated in tropical countries.

#### CALYCIFLOREÆ.

#### CONNARACEÆ.

65. *CONNARUS GIBBOSUS* Wall.

Great Coco.

Tenasserim, Malaya; Andamans.

#### LEGUMINOSÆ.

66. *CROTALARIA SERICEA* Retz.

Table Island; very common throughout the clearing; apparently introduced, as it was not found in Great Coco or Little Coco. This species does not seem to occur in the Andaman group proper; at Port Blair in S. Andaman *Crotalaria retusa* is the species that has been introduced and occupies similar localities.

India, Burma, Malaya.

67. *DESMODIUM UMBELLATUM* DC.

In all the islands, very common on the coast.

India, Burma, Andamans, Malaya, Philippines, Polynesia, Mascarene islands.

68. *DESMODIUM TRIQUETRUM* DC.

Table Island and Great Coco; very common on bare rocky slopes on west coast, occasional on higher ground in the interior; Little Coco, occasional in the interior.

India, Burma, Malaya, Andamans; Philippines; S. China.

69. *DESMODIUM LAXIFLORUM* DC.

In all the islands, rather frequent on the higher ground in the interior.

India, Burma; Andamans, Nicobars; Malaya.

70. *DESMODIUM POLYCARPUM* DC.

Table Island and Great Coco; very abundant on all the rocky slopes

on the western coasts. This species has been referred to (*Jour. As. Soc., Beng.*, lix, pt. 2, p. 251) as perhaps introduced into the Andamans, because Mr. Kurz did not meet with it in 1866 when he explored a part of the group. But from what the writer has been able to note since, he is convinced that the species is indigenous in the Andaman group.

East Africa; Tropical Asia; Malaya, Philippines; China, Japan; Polynesia.

71. *DESMODIUM TRIFLORUM* DC.

Table Island, in the lighthouse clearing on grassy slopes. There is a white- and a red-flowered variety and both are equally common.

Cosmopolitan in the tropics.

72. *ALYSICARPUS VAGINALIS* DC.

Great Coco, in the small clearing at the north-east corner of the island, probably introduced.

Tropical weed indigenous in eastern hemisphere; introduced in America.

73. *PHASEOLUS* sp.

Great Coco. Appearing as seedlings in the droppings of the half-wild cattle on a bare grassy hill-side in the south-west of the island, much frequented by these, were seen during the second visit to the island numerous examples of what appears to be a species of this genus. Each leaflet has in the centre a reniform white mark which ought to be distinctive, yet the writer cannot recall a variety which exhibits this. The origin of the seeds could not be traced, no *Phaseolus* was observed in the abandoned clearing in 1889, and unfortunately it was impossible to re-examine that locality in 1890.

74. *ABRUS PRECATORIUS* Linn.

Great Coco, common; Little Coco, very common.

Cosmopolitan in the tropics.

75. *ABRUS PULCHELLUS* Wall.

In all the islands, very common.

Africa, India, Burma, Malaya, Andamans.

76. *ERYTHRINA INDICA* Lamk.

In all the islands, in coast zone; not nearly so common as it is on Diamond Island at the mouth of the Bassein river.

India, Burma, Malaya; Andamans, Nicobars.

77. *MUCUNA GIGANTEA* DC.

Great and Little Coco; one of the commonest climbers on flat land in the interior behind the mangrove swamps.

India, Andamans; Malaya; Philippines; Polynesia.

78. *MUCUNA PRURIENS* DC.

Table Island, very common, interior jungle on ridges.

Cosmopolitan in the tropics.

79. *PUERARIA CANDOLLEI* Graham.  
Little Coco, common.  
Pegu, Tenasserim.
80. *PUERARIA PHASEOLOIDES* Benth.  
Great Coco, common on the western coast.  
India, Burma, S. China, Malaya.
81. *CANAVALIA OBTUSIFOLIA* DC. (*Dolichos lineatus* Thunbg.)  
In all the islands, one of the commonest climbers along the sea-face here as on the Burmese, the Andamans, Nicobars and Malay coasts.  
Cosmopolitan on tropical shores.
82. *VIGNA LUTEA* A. Gray.  
Little Coco, very common on coasts both east and west; Great Coco, rather rare.  
Martaban, Malaya; Andamans, Nicobars.  
Cosmopolitan in tropics, but absent from India.
83. *PTEROCARPUS INDICUS* Willd.  
Great Coco, infrequent.  
India, Burma, Andamans, Malaya; Philippines; S. China.
84. *DERRIS SCANDENS* Benth.  
Great and Little Coco; very common.  
India, Burma, Andamans, Malaya; S. China, N. Australia.
85. *DERRIS SINUATA* Benth.  
Great Coco, extremely common on the eastern coast.  
Pegu, Tenasserim, Malay Peninsula; Andamans, Malay islands; Ceylon.
86. *DERRIS ULIGINOSA* Benth.  
Both islands, common, on rocky parts of the coast.  
India, Burma, Malaya, Africa, Australia, Polynesia.
87. *PONGAMIA GLABRA* Vent.  
In all the islands, a common tree in the coast zone and especially along the sides of mangrove creeks; never seen climbing.  
India, Burma, Andamans, Malaya; Polynesia; N. Australia; Seychelles.
88. *SOPHORA TOMENTOSA* Linn.  
Great and Little Coco, west coast, but infrequent.  
Cosmopolitan on tropical sea-shores.
89. *MEZONEURON ENNEAPHYLLUM* W. & A.  
Great Coco, common on summits of interior ridges.  
Cachar, Chittagong; Pegu, Tenasserim, Ceylon, Malay Archipelago.
90. *CÆSALPINIA BONDUCELLA* Flem.  
In all the islands, very common in the sea-face jungle along the beaches.  
Cosmopolitan in the tropics.

91. *CÆSALPINIA NUGA* Ait.

In all the islands; very common in the jungle on flat land behind beaches and mangrove-swamps.

India, Ceylon; Burma; Malaya; Philippines; N. Australia; S. China; Polynesia.

92. *TAMARINDUS INDICA* Linn.

Great Coco; a single large tree on west side of mouth of creek opening into Pollok Bay. This tree grows in a place where it could hardly have been planted; if planted where it grows it can hardly be imagined for what object the position was selected and the tree is obviously much older than the last attempt at settlement in the island. This bay is at certain seasons an anchorage for Burmese junks calling to obtain coco-nuts and the introduction of the tree is probably due to a tamarind fruit having been cast overboard from one of these junks and thrown up by the tide where the tree now grows.

Throughout the tropics, cultivated; perhaps indigenous in Africa.

93. *CYNOMETRA RAMIFLORA* Linn.

In all the islands; very common in flat, muddy lands behind mangrove swamps.

India, Ceylon; Burma, Andamans, Nicobars, Malaya; Philippines; N. Australia.

94. *ENTADA SCANDENS* Benth.

In all the islands, frequent; its seeds occur in all the shore-drifts and it was one of the species found germinating on a sandy spit (an incipient island) between Jerry Island and the south end of Great Coco.

Cosmopolitan in the tropics.

95. *ADENANTHERA PAVONINA* Benth.

Table Island and Great Coco, common.

India, Ceylon; Burma, Andamans, Malaya; Philippines; S. China.

96. *ACACIA CONCINNA* DC.

Great Coco, rather common.

India, Ceylon; Burma, Malaya; S. China.

97. *ACACIA PENNATA* Willd.

In all the islands, very common.

Africa; India, Ceylon; Burma, Andamans, Malaya.

98. *ALBIZZIA LEBBEK* Benth.

Great Coco.

Africa; India, Ceylon; Burma, Tenasserim, Malaya: Andamans; China; N. Australia.

99. *ALBIZZIA PROCERA* Benth.

In all the islands exceedingly common on the interior ridges; stunted and weatherbeaten where it approaches the west coast.

India, Burma, Malaya, Philippines, (not yet recorded from south Andaman).

#### RHIZOPHOREÆ.

100. *RHIZOPHORA MUCRONATA* Lamk.  
Great and Little Coco, frequent in mangrove swamps.  
Tropical shores of Africa, Asia, and N. Australia.
101. *RHIZOPHORA CONJUGATA* Linn.  
Great Coco, common.  
Tropical shores of Asia, and Africa.
102. *CERIOPS CANDOLLEANA* Arn.  
Great Coco, common.  
Tropical shores of Eastern Hemisphere.
103. *CERIOPS ROXBURGHIANA* Arn.  
Great Coco, not common.  
Tropical shores of Eastern Hemisphere.
104. *BRUGUIERA GYMNORHIZA* Lamk.

In all the islands, common. This is the chief constituent of the mangrove jungle in the group; it germinates very freely also along the sandy beaches though there it doubtless does not persist; it also germinates along the ridges of coral that are formed between the mainland and small outlying islets like Lascelles Island, Rat Island, Button, and others, and as the roots spread they help to collect the "drift" of the tides and shew how it is possible for the island to increase in size without postulating a general upheaval for the group. On bare rocky promontories on the west coast where long rocky ledges and reefs of loose boulders run many yards out to sea, numbers of seedlings also appear and though these spots are exposed to the full force of the south-west monsoon many of these resist the waves for at least several seasons; the only other constituent of the mangrove jungle that does this is *Avicennia*, many specimens of which though dwarf and weatherbeaten are evidently of considerable age. *Pemphis*, which also greatly affects such positions is not partial to mangrove swamps proper at all and was never seen along the creeks. In the small lake on Little Coco the water of which was potable though not good almost all the constituents of a mangrove swamp were growing freely.

Tropical shores of Eastern Hemisphere and Polynesia.

#### COMBRETACEÆ.

105. *TERMINALIA CATAPPA* Linn.  
In all the islands; one of the commonest trees on the shore and

not infrequent in the interior on flat lands, but not met with ascending the ridges. There is apparently no such species as *T. procera*.

Andamans, Malaya; planted elsewhere in the tropics.

106. *TERMINALIA BIALATA* Kurz.

Great Coco, frequent.

Burma, Tenasserim, Andamans.

107. *LUMNITZERA RACEMOSA* Willd.

Little Coco, very common among mangroves in the lagoon.

Tropical shores of Eastern Hemisphere and Polynesia.

108. *ILLIGERA CONYZADENIA* Meissn.

Great Coco, a rather common climber.

Tenasserim, Andamans.

109. *GYROCARPUS JACQUINI* Roxb.

In all the islands, probably the commonest species in the group.

Tropical sea-shores of the old world and Polynesia.

#### MYRTACEÆ.

110. *BARRINGTONIA SPECIOSA* Forst.

In all the islands, very common.

Ceylon; Andamans, Nicobars; Malaya; Australia; Polynesia: on sea-shores.

111. *BARRINGTONIA RACEMOSA* Blume.

In all the islands, very common.

India, Ceylon; Burma, Malaya; Andamans, Nicobars; Polynesia: on sea-shores.

#### MELASTOMACEÆ.

112. *MEMECYLON EDULE* Roxb.

Great Coco; east coast, on rocky promontory at south end of Ford Bay—only one tree seen.

Andamans, Malaya, Philippines. Mr. Kurz has a specimen from Great Coco also, only in leaf, and has it from S. Andaman in flower.

#### LYTHRACEÆ.

113. *PEMPHIS ACIDULA* Forst.

In all the islands; very common, especially on the west coast on rocky or shingly promontories.

Tropical shores of Eastern Hemisphere.

114. *LAGERSTRÆMIA HYPOLEUCA* Kurz.

Great Coco, common in the interior.

Andamans.

115. *LAGERSTRÆMIA* sp.

Little Coco ; one tree only seen.

A tall straight tree, about 100 feet, leaves sessile, oblong-lanceolate 8 in. long,  $2\frac{1}{4}$ – $2\frac{3}{4}$  in. wide, thinly coriaceous, fruit  $\frac{1}{2}$  in., calyx woody, lobes spreading.

The leaves of this are unlike those of any Indian species ; the fruit is very like that of *L. calyculata* Kurz, from Martaban, but the leaves are very different, being larger, much thinner, and perfectly glabrous. This, when flowers are found, will almost certainly prove a distinct species.

## PASSIFLOREÆ.

116. *MODECCA CORDIFOLIA* Blume (fide Masters).

Great Coco, common.

Andamans ; the specimens are exactly like the common Andaman coast *Modecca* and the flowers appear not to differ from those of *M. cardiophylla* Mast.

117. *CARICA PAPAYA* Linn.

Great Coco, introduced but perfectly naturalised and already extending in an unbroken line among the coco-nuts on the east coast, from the north-east corner to within 3 miles of the south end of the island ; one or two isolated specimens occur at the south-east corner evidently originating from fruits washed up by the sea. Half a mile from the south end on the west coast is another spot, well into the interior, where some trees occur—the result apparently of independent introduction as they occur near the remains of some huts used by coco-nut gatherers who visit the island at intervals.

Cultivated in warm countries ; originally American.

## CUCURBITACEÆ.

118. *TRICHOSANTHES PALMATA* Roxb.

Little Coco ; near north end of island.

India, Ceylon ; Burma, Andamans ; Malaya ; N. Australia ; China, Japan.

## FICOIDEÆ.

119. *SESUVIUM PORTULACASTRUM* Linn.

In all the islands ; common on sandy beaches on the east coast.

All tropical and sub-tropical sea-shores.

## COROLLIFLORÆ.

## RUBIACEÆ.

120. *STEPHEGYNE DIVERSIFOLIA* Hook. f.  
In all the islands, extremely common.  
Chittagong, Burma, Tenasserim ; Philippines.
121. *MUSSËNDA CALYCINA* Wall. (*M. macrophyllæ* forma distinctior).  
In all the islands very common. The calyx-teeth in these examples are  $\frac{3}{4}$  in. long and  $\frac{1}{4}$  in. broad.  
Pegu, Tenasserim, Andamans.
122. *WEBERA KURZII* Hook. f.  
Little Coco ; common in interior.  
Andamans.
123. *RANDIA LONGIFLORA* Lamk.  
Little Coco, common.  
Assam, Chittagong, Burma, Tenasserim, Malaya ; Andamans, Nicobars.
124. *DIPLOSPORA SINGULARIS* Korth.  
In all the islands, extremely common.  
Assam, Burma, Tenasserim ; Malaya. Not yet reported from other parts of the Andaman group.
125. *GUETARDA SPECIOSA* Linn.  
Great Coco, east coast ; frequent.  
Cosmopolitan on tropical sea-shores.
126. *IXORA GRANDIFOLIA* Zoll. & Mor., var. *KURZEANA* Teys. & Binnend.  
In all the islands, common in the interior jungle ; a small straggling shrub.  
Nicobars. This is exactly like the type of Teysmann and Binnendyk's *I. Kurzeana*.
127. *IXORA BRUNNESCENS* KURZ.  
In all the islands ; very common along the beaches. A fine tree, often 60–80 feet ; extremely unlike the preceding.  
Andamans, Nicobars.
128. *IXORA CUNEIFOLIA* Roxb.  
Little Coco ; infrequent.  
Assam, Burma, Tenasserim.
129. *PAVETTA INDICA* Linn.  
In all the islands, very common.  
India ; Burma, Andamans ; Malaya ; S. China ; N. Australia.
130. *MORINDA CITRIFOLIA* Linn., var. *BRACTEATA* Roxb.  
In all the islands, exceedingly common along the coast.  
Laccadives ; Andamans ; Nicobars ; Sunderbuns ; Arracan.

131. *PSYCHOTRIA ADENOPHYLLA* Wight.  
Very common in all the islands.  
Assam, Pegu, Tenasserim ; Andamans.
132. *PÆDERIA FETIDA* Linn.  
Very common in all the islands.  
India, Burma, Malaya.

## COMPOSITÆ.

133. *VERNONIA CINEREA* Less.  
Table Island, common in the clearing near the lighthouse ; Great Coco, frequent in the small clearing at the north-east corner but also plentiful on bare rocks on the western sea-face of the island. Though probably an introduced plant in the two first situations, its appearance on the west coast, where it is extremely plentiful, indicates that it has also reached the island independently of human agency.  
Tropical Asia, Africa and America.
134. *VERNONIA DIVERGENS* Benth.  
Great Coco ; plentiful on rocky promontory at north end of island.  
India, Burma, Tenasserim.
135. *ADENOSTEMMA VISCOSUM* Forst.  
Great Coco, on the western coast and at the north end of the island.  
Cosmopolitan in the tropics.
136. *AGERATUM CONYZOIDES* Linn.  
Table Island, common in the clearing near the lighthouse.  
Cosmopolitan in the tropics ; originally American.
137. *BLUMEA VIRENS* DC.  
Great Coco, profuse on rocks on western sea-face ; in one sheltered cove the stems were over 8 feet high.  
India, Burma, Tenasserim (Mergui, *Griffith*).
138. *PLUCHEA INDICA* Less.  
Great Coco, common on the coast.  
India, Burma, Malaya, China ; sea-shores.
139. *WEDELIA SCANDENS* C. B. Clarke.  
In all the islands, common in the sea-fence jungle, a rather brittle woody climber with stems 30—50 feet long.  
Tropical sea-shores of India, Burma, Malaya, Andamans and Nicobars.

## GOODENOVIÆ.

140. *SCÆVOLA KENIGII* Vahl.  
In all the islands, very common in the coast zone.  
India, Burma, Malaya, Australia, Polynesia ; on sea-coasts.

## MYRSINÆ.

141. *ARDISIA HUMILIS* Vahl.

In all the islands, common in the beach forest.

India, China, Malaya.

142. *ÆGICERAS MAJUS* Gaertn.

Great Coco; fruits seen in the sea-drifts on the coast; doubtless the species occurs frequently in the mangrove swamps, though no individual tree was met with.

. Cosmopolitan on tropical sea-coasts.

## SAPOTACEÆ.

143. *MIMUSOPS LITTORALIS* Kurz.

In all the islands; next to *Gyrocarpus Jacquini*, this (the Andaman Bullet-wood) is the commonest tree in the group.

In Jerry Island, off the south end of Great Coco, and for about two miles along the coast at the south end of Great Coco, nearly every tree that has attained a height of 80 feet presents from the sea the appearance of being dead. Closer inspection, however, shews that in many (perhaps most) cases only the whole of the main branches are dead, while about their bases or along the main trunk numerous close bunches of small branches have appeared, the leaves of which keep the trees still alive. The same thing is apparent at the south-west corner of Little Coco but is less striking because less extensive.

Andamans, Nicobars.

## EBENACEÆ.

144. *DIOSPYROS KURZII* Hiern.

Little Coco; Great Coco, rare.

Andamans, Nicobars.

## APOCYNEÆ.

145. *RAUWOLFIA SERPENTINA* Benth.

Great Coco, common.

India, Burma, Tenasserim, Java; not previously reported from the Andamans.

146. *CERBERA ODOLLAM*, Gaertn.

Great Coco, rare; in mangrove swamps.

India, Malaya, Andamans; China; Australia, Polynesia.

147. *OCHROSIA BORBONICA* Gmel.

Little Coco, common; in beach forests.

Andamans, Malaya, Seychelles, Mascarene Islands.

148. *TABERNÆMONTANA CRISPA* Roxb.  
In all the islands, very common along the west coast.  
Andamans Nicobars, Diamond Island (off Arracan coast).
149. *STROPHANTHUS WALLICHII* A. DC.  
Great Coco; a large climber, in leaf only.  
India, Assam, Chittagong.
150. *ANODENDRON PANICULATUM* A. DC.  
In all the islands.  
India, Burma, Malaya, Philippines.
151. *CHONEMORPHA MACROPHYLLA* G. Don.  
Little Coco, common.  
India, Andamans, Malaya.

## ASCLEPIADEÆ.

152. *SARCOLOBUS GLOBOSUS* Wall.  
Great Coco and Little Coco; common in mangrove swamps.  
Sunderbuns, Tenasserim, Malay Peninsula; Nicobars.
153. *HOYA PARASITICA* Wall.  
Great Coco.  
Assam, Khasia, Chittagong, Tenasserim, Malaya; Andamans.
154. *HOYA DIVERSIFOLIA* Blume.  
In all the islands; extremely common.  
Burma, Malaya.
155. *DISCHIDIA NUMMULARIA* R. Br.  
Little Coco; not common.  
Cachar, Chittagong, Tenasserim, Malaya, Andamans; Australia.

## GENTIANACEÆ.

156. *LIMNANTHEMUM INDICUM* Thwaites.  
Great Coco; abundant in the small lake at the north-east corner of the island; not in the lake on Little Coco and not previously reported from the Andamans. The lake is adjacent to the small clearing and the species may possibly be an introduced one in this locality.  
Afghanistan; India, Burma, Malaya; Australia, Fiji; Mascarene islands.

## BORAGINEÆ.

157. *CORDIA SUBCORDATA* Lamk.  
Great Coco, a rather common tree in the beach-forests on the east coast.  
Andamans, Malaya; Australia; Sandwich Islands.

158. *TOURNEFORTIA ARGENTEA* Linn. f.

Great Coco, very rare; Little Coco, extremely common on the western coast and in the beach-forests, where it often reaches a height of 35—40 feet with a trunk of sometimes a foot diameter.

Ceylon; Malaya, Andamans, Nicobars; Australia; Mauritius.

## CONVOLVULACEÆ.

159. *ERYCIBE PANICULATA* Roxb.

Great Coco, very common in interior.

India, Burma, Tenasserim; Malaya; Andamans, Nicobars; Australia.

160. *ARGYREIA TILIÆFOLIA* Wight.

Great Coco; common on the coasts.

India; Andamans, Malaya; Philippines; near the sea.

161. *ARGYREIA HOOKERI* Clarke.

In all the islands, common.

Sikkim, Bhutan, Assam, Martaban.

162. *ARGYREIA LANCEOLATA* Choisy.

Great Coco: exactly=*Wall. Cat.* 1395.

Tenasserim, Andamans.

163. *LETTSOMIA PEGUENSIS* Clarke.

Little Coco.

Pegu, Tenasserim, Andamans.

164. *IPOMÆA GRANDIFLORA* Lamk.

In all the islands, very abundant on the coasts.

East Africa; India, Burma, Malaya, Andamans; Australia, Polynesia; introduced in America.

165. *IPOMÆA COCCINEA* Linn.

Table Island, rampant in the jungle near the lighthouse clearing; escape from the light-keeper's garden.

Native of America; cult., and a frequent escape, in tropical Asia.

166. *IPOMÆA BATATAS* Lamk.

Table Island, cultivated in the lighthouse garden.

Native of America; cult., in the tropics generally.

167. *IPOMÆA DIGITATA* Linn.

Great Coco, on the west coast, occasional.

Cosmopolitan in the tropics.

168. *IPOMÆA DENTICULATA* Choisy.

Great Coco, very plentiful at north end of island, but almost altogether restricted to the coral-shingle; at south end of island and on Little Coco, exceedingly uncommon.

Seychelles ; Ceylon ; Malaya, Andamans and Nicobars ; Australia, Polynesia.

169. *IPOMÆA TURPETHUM* R. Br.

Both islands, not uncommon.

India, Burma ; Malaya ; Australia, Polynesia ; Mauritius, Seychelles.

170. *IPOMÆA BILOBA* Forsk.

In all the islands, very common ; affects principally the sandy beaches ; in Jerry Island, however, grows on the shingle and occurs under rather dense jungle, from side to side of that island, at its north end.

Cosmopolitan on tropical sea-shores.

171. *CONVOLVULUS PARVIFLORUS* Vahl.

In all the islands ; very common in the jungle along the western sea-face.

Africa ; India, Burma, Malaya, Andamans ; Australia.

172. *PORANA SPECTABILIS* Kurz.

Great Coco.

Tenasserim, Andamans.

### SOLANACEÆ.

173. *SOLANUM MELONGENA* Linn.

Table Island, cultivated in the light-house garden ; Great Coco, plentiful and quite naturalised all over the clearing at the north-east corner of the island ; remains of the garden.

Cult. in all warm countries.

174. *PHYSALIS MINIMA* Linn.

Great Coco ; abundant on rocky parts of the coast just above limits reached by spray during storms, on east, north and west coasts ; Little Coco, on rocks in similar situations at north end of island.

Cosmopolitan in the tropics.

175. *CAPSICUM MINIMUM* Roxb.

Table Island, in clearing, occasional, escape from the light-keeper's garden ; Great Coco, throughout the clearing very abundant ; unlike *Solanum Melongena* this is not confined to the clearing but is extending into the jungle much as *Carica Papaya* is.

India and Malaya ; cultivated and frequent as an escape.

### SCROPHULARINEÆ.

176. *SCOPARIA DULCIS* Linn.

Table Island and Great Coco ; abundant in the clearings on both islands ; introduced.

An American weed, now cosmopolitan in the tropics.

## BIGNONIACEÆ.

177. *OROXYLUM INDICUM* Vent.

Little Coco, very plentiful at north-east corner of the island ; Great Coco, rare.

India, Ceylon ; Indo-China, Andamans ; Malaya.

178. *HETEROPHRAGMA ADENOPHYLLUM* Seem.

In all the islands, very common.

Assam and Eastern Bengal, Burma, Tenasserim ; Andamans.

## ACANTHACEÆ.

179. *THUNBERGIA LAURIFOLIA* Lindl.

In all the islands, very common.

Arracan, Tenasserim, Malaya ; Andamans.

180. *HYGROPHILA QUADRIALVIS* T. And.

Great Coco, abundant in the wet ground at the margin of the small lake and forming a continuous ring outside the belt of *Polygonum* growing at the water's edge.

India ; Andamans, Burma, Malaya.

181. *STROBILANTHES PHYLLOSTACHYUS* Kurz.

Great and Little Coco, a gregarious species common on most of the rocky promontories on the east coast of both islands.

Pegu, Tenasserim.

182. *ERANTHEMUM ALBUM* Nees.

Great Coco ; common in the beach-forests.

Chittagong, Burma ; Malaya ; Andamans, Nicobars.

183. *ERANTHEMUM CINNABARINUM* Wall., *var. SUCCISIFOLIA* Clarke (*E. SUCCIFOLIUM* Kurz.).

Great and Little Coco ; common in the beach-forest.

Nicobars.

These two species are recorded because in the large suite of specimens collected, some examples agree exactly with Andamans specimens named *E. album* by Dr. T. Anderson, and others agree exactly with the original specimens of Mr. Kurz's *E. succifolium*. But I do not think that there are really two species present. The plants are referred by Anderson to *E. album*, but are considered by Clarke a white-flowered fern of *E. cinnabarinum*, and are held by Kurz to be two distinct species. The original specimens of Kurz's *Eranthemum album*, T. And. ? (314 of Nicobars list) I cannot, however, distinguish from those of *E. succifolium* (313 of that list).

184. *RUNGIA PARVIFLORA* Nees, *var. PECTINATA* Clarke.

Table Island ; in the light-house clearing.

India, Burma, Andamans ; a weed, introduced.

## 185. PERISTROPHE ACUMINATA Nees.

Great Coco, very common on the east coast.  
Tenasserim, Malaya ; Andamans.

## VERBENACEÆ.

## 186. LIPPIA NODIFLORA Rich.

Little Coco, in swampy ground at west side of island, plentiful.  
Cosmopolitan in the tropics.

## 187. PREMNA INTEGRIFOLIA Linn.

In all the islands, very common on the coast.  
India, Ceylon ; Burma, Malaya ; Andamans, Nicobars ; on sea coasts.

## 188. PREMNA sp.

Great Coco ; a climber common on the western sea-face, also obtained on Rutland Island.

In fruit only ; almost certainly *P. obtusifolia*.

South Andaman, Malayan Archipelago, Australia.

## 189. VITEX NEGUNDO Linn.

Great Coco ; east coast, very rare ; Little Coco ; in salt marshes, extremely common.

Afghanistan, Tropical Asia, Philippines.

## 190. VITEX PUBESCENS Vahl.

Table Island ; common on north coast.

India, Burma, Malaya.

## 191. VITEX WIMBERLEYI Kurz.

Little Coco, not common.

Andamans.

## 192. CLERODENDRON INERME Gaertn.

In all the islands, extremely common on the coasts.

India, Burma, Tenasserim, Andamans and Nicobars.

## 193. AVICENNIA OFFICINALIS Linn.

Common in one mangrove swamp near south end of Great Coco ; elsewhere rare.

Indian, Malayan, and Polynesian sea-coasts.

## LABIATÆ.

## 194. ANISOMELES OVATA R. Br.

Great Coco ; abundant in beach-forest at north end of island. This does not occur in the small clearing, but is very abundant in the jungle near it. It may have been introduced by man but is more probably indigenous ; it occupies much the same situations and is even more plentiful in Diamond Island. Not previously reported from the Andamans.

India, Burma, Malaya, China, Philippines.

## INCOMPLETEÆ.

## NYCTAGINEÆ.

195. *BOERHAAVIA REPENS* Linn.

In all the islands, common on every rocky promontory and on all the isolated rocks on the reefs not covered by the tides.

Cosmopolitan in the tropics.

196. *PISONIA ACULEATA* Linn.

In all the islands, one of the commonest climbers in the beach-forests.

Cosmopolitan in the tropics.

197. *PISONIA EXCELSA* Blume.

In all the islands, common in the beach-forests.

Andamans, Malaya.

## AMARANTACEÆ.

198. *CELOSIA CRISTATA* Linn.

Table Island, an escape in the light-house clearing.

Cosmopolitan in the tropics.

199. *ACHYRANTHES ASPERA* Linn. *var. TYPICA.*

Table Island and Great Coco, common in the clearings, introduced.

Cosmopolitan in the tropics.

*var. PORPHYRISTACHYA* Hook. f.

Little Coco, very abundant in the beach-forests; stems 10–15 feet long, climbing over the sea-face jungle. A plant in habit remarkably unlike the preceding.

South-Eastern Asia.

200. *GOMPHRENA GLOBOSA*, Linn.

Table Island, an escape, but very plentiful and extending into the jungle.

Cosmopolitan in the tropics; probably originally American.

## POLYGONACEÆ.

201. *POLYGONUM BARBATUM* Linn.

Great Coco; this plant fringes the small lake at the north-east corner of the island, growing partly in and partly out of the water, just within it is a floating belt of *Panicum Myurus*, while outside is a ring of *Hygrophila quadrivalvis*. None occurs in the lake on Little Coco.

Africa; India, Ceylon; Burma, Malaya.

## ARISTOLOCHIACEÆ.

202. *BRAGANTIA TOMENTOSA* Blume.

Little Coco; abundant on the interior ridges.

Tenasserim, Andamans; Java.

203. *ARISTOLOCHIA TAGALA* Cham. & Schlecht.  
Both islands, frequent.  
India, Burma, Malaya ; Nicobars.

## PIPERACEÆ.

204. *PIPER CANINUM* Blume.  
Great Coco.  
Tenasserim, South Andaman, Malaya.

## MYRISTICÆÆ.

205. *MYRISTICA IRYA* Gaertn.  
Great Coco ; frequent in interior towards eastern side.  
Ceylon, Andamans, Tenasserim, Malaya.
206. *MYRISTICA GLAUCA* Blume.  
Great Coco.  
Burma, Andamans, Malaya.

## LAURINEÆ.

207. *DEHAASIA KURZII* King.  
Little Coco.  
Tenasserim, Andamans.
208. *HERNANDIA PELTATA* Meissn.  
In all the islands, on the eastern coasts.  
East Africa, Madagascar ; Laccadives, Ceylon ; Andamans, Nicobars ; Mergui, Malaya, Archipelago ; North Australia ; Polynesia.
209. *CASSYTHA FILIFORMIS* Linn.  
Great Coco, occasional ; Little Coco, extremely plentiful on all the coasts.  
Cosmopolitan in the tropics.

## LORANTHACEÆ.

210. *LORANTHUS LONGIFLORUS* Desrouss.  
Great and Little Coco.  
India, Ceylon ; Burma, Malaya ; Andamans.

## SANTALACEÆ.

211. *CHAMPEREIA GRIFFITHIANA* Planch.  
Both islands ; common on the coasts.  
Tenasserim, Malaya ; Andamans, Nicobars.

## EUPHORBIACEÆ.

212. *EUPHORBIA ATOTO* Forst.  
In all the islands, very common on the sandy beaches.  
India, Ceylon; Andamans, Nicobars; Malaya; Australia; China; Polynesia.
213. *EUPHORBIA PILULIFERA* Linn.  
Table Island; in light-house clearing, still rare.  
Cosmopolitan tropical and subtropical weed.
214. *BRIDELIA KURZII* Hook. f.  
In all the islands, common on the western sea-face.  
Nicobars.
215. *BRIDELIA TOMENTOSA* Blume.  
Great Coco, common.  
India; Burma; Andamans, Malaya; China; Philippines; North Australia.
216. *PHYLLANTHUS COLUMNARIS*, Muell.-Arg.  
Table Island, common.  
Pegu, Tenasserim.
217. *FLUEGGIA MICROCARPA* Blume.  
Great Coco.  
Africa; India, Ceylon; Assam, Burma, Malaya; Australia; China.
218. *CYCLOSTEMON ASSAMICUS* Hook. f.  
In all the islands, a very common tree, gregarious where it occurs.  
Sikkim, Assam.
219. *APOROSA VILLOSULA* Kurz.  
Great Coco.  
Pegu, Tenasserim, Andamans.
220. *CROTON SUBLYRATUS* Kurz.  
In all the islands, common in the beach-forests.  
Andamans and (perhaps) Tenasserim.
221. *BLACHIA ANDAMANICA* Hook. f.  
Great Coco, coasts, very common; Little Coco, frequent in beach-forests.  
Andamans.
222. *CLAOXYLON LONGIFOLIUM* Muell.-Arg.  
Great Coco.  
Malaya.
223. *MALLOTUS ACUMINATUS* Muell.-Arg. (= *M. Helferianus* Kurz.).  
Great Coco, common.  
Tenasserim; Andamans; Malaya.
224. *MALLOTUS ANDAMANICUS* Hook. f.  
Great and Little Coco; common, and, where it occurs, gregarious.  
Andamans.

225. *MACARANGA TANARIUS* Muell.-Arg.  
Great Coco and Little Coco; common in the beach-forests.  
Arracan (Diamond Island); Andamans; Malaya.
226. *CNESMONE JAVANICA* Blume.  
Great Coco; plentiful on rocky promontories at north end of island.  
Bengal, Assam, Burma, Malaya.

## URTICACEÆ.

227. *PHYLLOCHLAMYS SPINOSA* Bureau.  
Little Coco, common.  
India, Ceylon; Burma, Malaya; Andamans.
228. *PLECOSPERMUM ANDAMANICUM* King.  
Little Coco.  
Tenasserim, Andamans.
229. *FIGUS BENJAMINA* Linn.  
Great Coco; not in fruit, therefore the particular variety cannot be determined.  
India, Assam, Burma, Andamans, Malaya.
230. *FIGUS RUMPHII* Vahl.  
Little Coco, on the east coast; this species is here very rare. In Diamond Island, Arracan, this is one of the commonest trees on the coast.  
India, Burma, Malaya, Andamans.
231. *FIGUS RETUSA* Linn. *var. NITIDA* Thunbg. (sp). *F. comosa* Curtis, Bot. Mag., t. 3305 [1834].  
In all the islands, very common. The fruits of this species, as Mr. Kendall, I. M., pointed out to me, is one of the favourite foods of a large pigeon, *Carpophaga bicolor*, which visits the group in enormous numbers during the cold weather.  
India; Burma; Andamans, Malaya; China; Australia; New Caledonia.
232. *FIGUS BREVICUSPIS* Miq.  
In all the islands, common. The fruits are borne both on young branches in leaf axils, and on old wood in bunches.  
Andamans, Malaya.
233. *FIGUS CALLOSA* Willd.  
Great Coco.  
India, Burma, Malaya.
234. *FIGUS HISPIDA* Linn. f.  
Great Coco, common.  
India, Ceylon; Burma, Malaya.  
*var. DEMONUM* Kœnig (sp.).

Little Coco.

Distribution of type.

235. *FIGUS GRISEA* Wall. Cat. 4544.

Great Coco. Fruits of this a favourite food of the Green Parrots.  
Burma. (Salween valley).

236. *ANTLIARIS TOXICARIA* Leschen.

Great Coco.

India, Ceylon ; Burma, Tenasserim, Malaya.

237. *ARTOCARPUS GOMEZIANA* Wall.

Great Coco and Little Coco, very common.

Tenasserim, Malaya, Andamans.

#### Gymnospermæ.

#### CYCADACEÆ.

238. *CYCAS RUMPHII* Miq.

In all the islands, very common in beach-forests, sometimes attains a height of 50 feet, and a girth of over 5 feet.

Tenasserim, Andamans, Nicobars ; Malaya ; North Australia, New Guinea.

#### Monocotyledones.

#### ORCHIDACEÆ.

239. *DENDROBIUM SECUNDUM* Wall.

In all the islands, common. The only *very* common orchid on forest trees ; specimen brought and flowered at Calcutta.

Martaban, Tenasserim ; Penang, Sumatra, Java, Cochin China.

240. *CALANTHE VERATRIFOLIA* R. Br.

Great Coco, not uncommon on the interior ridges. The same species was also found, a few days later, on Rutland Island at the opposite end of the Andaman group.

India, Andamans, Malaya.

241. *DORTES WIGHTII* Benth. *var.*—?

Great Coco, frequent on trees in the low, flat swampy land near the coast ; specimens were brought and flowered at Calcutta. The foliage as well as the shape and markings of the flowers quite agree with those of the typical plant, but in the Coco Island specimens the flowers are distinctly larger and the ground colour is violet instead of yellow.

242. *AERIDES MULTIFLORUM* Roxb.

Great Coco, occasional near the sea.

India, Burma, Andamans, Malaya.

## 243. PHOLIDOTA IMBRICATA Lindl.

Great Coco, occasional.

India, Burma, Malaya.

## SCITAMINEÆ.

## 244. COSTUS SPECIOSUS Linn.

Great Coco, frequent.

India, Himalaya, Indo-China, China, Malaya.

## 245. ZINGIBER sp.

Great Coco, common. Near *Z. corollinum* Hance; probably a new species (*Baker in sched.*). In fruit only on the occasion of these visits; the rhizomes brought to Calcutta have not yet flowered.

## 246. MUSA SAPIENTUM Linn.

The *Plantain* is cultivated in the light-house garden; it has already disappeared, probably owing to the presence of cattle, from the site of the garden on Great Coco.

## AMARYLLIDACEÆ.

## 247. CRINUM ASIATICUM Linn.

In all the islands, very common in the coast zone.

Andamans, Nicobars, Malaya.

## TACCACEÆ.

## 248. TACCA PINNATIFIDA Forst.

In all the islands, common in the coast zone. Some of these were huge specimens and the tubers brought to Calcutta produced leaves and flowers in no way inferior to those in their native habitat. The following measurements are from an average specimen—the tallest grown had a peduncle 116 inches high.

Leaf-stalk 40 inches, lamina 3-fid, each lobe 36 in. long, the lateral lobes 2-fid from the 8th inch; the central lobe and each segment of the lateral lobes 36 in. across; peduncle 80 inches; leafy bracts 3 in. long, 2 in. across; filiform bracts 16 in. long, their basal sixth green, the remainder pale purple; perianth segments  $\frac{2}{3}$  in. long,  $\frac{1}{3}$  in. across, pale green with purplish edges.

India, Burma, Malaya, Andamans,

## DIOSCOREACEÆ.

## 249. DIOSCOREA GLABRA Roxb.

In all the islands, common.

India, Burma, Malaya, Andamans.

250. *DIOSCOREA PENTAPHYLLA* Linn.

In all the islands, common.

India, Ceylon, Burma.

## LILIACEÆ.

251. *SMILAX MACROPHYLLA* Roxb.

In all the islands, common.

Eastern Himalaya, Assam, Arracan, Pegu.

252. *ASPARAGUS RACEMOSUS* Roxb.

Great Coco ; in low-lying lands behind the mangrove-swamps at north end of island.

India, Burma, Andamans, Java.

253. *DRACÆNA ANGUSTIFOLIA* Roxb.

Both islands ; small tree in coast zone.

India, Burma, Andamans, Malaya ; N. Australia.

254. *DRACÆNA SPICATA* Roxb.

In all the islands, frequent on interior ridges.

India, Burma, Malaya, Andamans, Nicobars.

255. *GLORIOSA SUPERBA* Linn.

Great Coco ; east coast, frequent.

Tropical Asia and Africa.

## COMMELYNEÆ.

256. *POLLIA ZORZOGONENSIS* Endl.

Great Coco, rather common.

India, Burma, Andamans, Narcondam, Malaya.

257. *COMMELINA OBLIQUA* Hassk.

Great Coco. Seeds smooth, but only two in number in both specimens collected.

India, Burma, Malaya ; not before reported from the Andamans.

258. *ANEILEMA OVATUM* Wall.

Great Coco, Little Coco ; common.

Pegu, Tenasserim, Andamans.

## FLAGELLARIEÆ.

259. *FLAGELLARIA INDICA* Linn.

In all the islands, very common in beach-forests.

India, Indo-China, Andamans, Nicobars, Malaya ; Australia ; Mauritius.

## PALMÆ.

260. *CARYOTA SOBOLIFERA* Wall.

In all the islands, very common in beach-forests.

Indo-China, Andamans, Malaya.

261. *CORYPHA ELATA* Roxb., Flor. Ind. 2, 176; Griff., Ind. Palm. 112, t. 220 D.—*C. Gebanga* Kurz, Jour. As. Soc. Beng. 43, pt. 2, 206, nec Blume.—*C. macropoda* Kurz, l. c. 205, t. 15.

Great Coco, rare; Little Coco, very common.

This palm, which is very common in Little Coco and particularly so near the lake at the south-west corner of the island has leaf stalks up to 25 feet long and leaves up to 20 feet across and is clearly identical with Kurz's *C. macropoda*. But Kurz's plant does not appear to be specifically distinct from *C. elata*. Kurz has himself in his subsequent writings noted that his first impression that this is a stemless palm was erroneous, admitting that it has a stem at least 8—12 feet high. Moreover in Little Coco at least one example had reached a height of 60 feet and was not yet in flower in 1890, while in 1889 and 1890 Dr. King and myself obtained both flowering and fruiting specimens of Kurz's Andamanese *Corypha* near Port Blair; these prove the species to be *Corypha elata*. Kurz is, I believe, in error in identifying Roxburgh's *C. elata* with Blume's *C. Gebanga*, the two trees—as grown in Hort. Calcutta—are very different in appearance; the leaves of *C. Gebanga* are much paler in colour and Blume's figure of the inflorescence of *C. Gebanga* (Rumphia 2, tt. 97, 98 and 105) shows an open panicle that will not at all suit *C. elata*, which has a very dense inflorescence like a gigantic head of parsley. In any case Roxburgh's name (1832) has four years' priority and Kurz's reduction is, therefore, on that ground alone, untenable. The writer is of opinion, and Dr. King agrees, that the examples of *C. elata* in Hort. Calcutta may have been originally introduced from the Andamans and that the species is only there indigenous. At all events it has not hitherto been found wild in any part of India or Burma.

262. *LIVISTONA* sp.

Great Coco; occasional on inland ridges. This palm, the 3 or 4 examples of which met with were stemless or had stems under two feet high, seems to be nearly related to *L. Jenkinsiana* Griff., Palm. Brit. Ind. 128, t. 226 A. B. and to *L. speciosa* Kurz, Jour. As. Soc. Beng., 43, 2, 204, t. 13, 14, the differences between which species Mr. Kurz himself admits are not great. The Coco species may not of course be a dwarf one, but if it is not it seems remarkable that no tall examples were met with. The leaves are remarkably like those of *L. speciosa* and Mr.

Kurz's description would suit them very well except that the transverse veins are, in the Great Coco plant, even more prominent than in *L. speciosa*; the *ligula* however is very different.

Mr. Kurz does not describe the *ligula* in *L. speciosa*; it is, however, shewn (perfectly accurately) in t. 13, f. 5. as cordate and entire—just as it is in *L. Jenkinsiana*. In the species under review the *ligula* is larger, ovate orbicular, and armed at the margin with small but hard, flat black blunt spines, a character exhibited by no flabellate-leaved palm of which specimens are preserved in Calcutta Herbarium.

263. CALAMUS ANDAMANICUS Kurz.

In all the islands, common.

Andamans.

264. CALAMUS TIGRINUS Kurz.

In all the islands, common.

Andamans, Tenasserim.

265. COCOS NUCIFERA Linn.

In all the islands, extremely abundant. Probably not truly indigenous, though perhaps not intentionally introduced. It has long been known that this palm occurred on these islands; the name "Cocos Islands," applied to the group, is of older date than 1652, and it has often been the subject of remark that while this is so and while every island in the Nicobars, even uninhabited ones like Batti Malv, has Coco-nut trees, the species is altogether absent from the intervening Andaman islands. Kurz, in *Forest Flora Brit. Burma*, says the Coco-nut occurs on north-east Andaman also, but the writer is unable to ascertain on what authority, and the statement is contradicted by the officers of the settlement at Port Blair who alone know the coasts of the group intimately. There are here and there individual trees on the Andaman coasts now; Dr. Alcock tells me there is one on South Sentinel; the writer saw one on Rutland Island; Captain Simpson, Assistant Port Officer, Madras, tells me he recollects being in a small bay in one of the islands of the Eastern Andaman Archipelago where there are some trees. But all these are quite recent introductions and are mainly due to the humanitarian efforts of the officers of the Andamans who plant them when they visit various places along the coasts; the instance quoted by Captain Simpson is, however, attributed to a wreck. No explanation based on the set of currents in these seas is sufficient to explain the peculiar distribution of the Palm, and the writer is inclined to believe that the presence of the species in the Coco Islands is due to the wreck of some Coco-laden craft on their coasts.

Once established the species spreads with great rapidity. On Barren Island one tree was known in 1881; in 1891 thirteen were counted, of

which seven were bearing. In Narcondam there were in 1891 Coco-nut trees, many of them bearing, in 3 separate bays on the N. W., N., and N. E. aspects of the island respectively. These *may* have been brought from the Coco group by a strong North-East to South-West current that sets down on this island from the neighbourhood of that group, but I am inclined to think they owe their presence to an act of unrecorded piety on the part of some humane individual who has visited the island, for in the North Bay where the trees are most numerous, there is, just behind the coco-nut zone, a large patch of Plantains which clearly must have been introduced intentionally.

It should not be forgotten that at some remote period a colony may have been started in the Coco group and then abandoned. It is known that in recent times two such attempts have been made and that both have failed owing to the unhealthiness of the place. It may be that the Coco-nut was intentionally introduced on some similar occasion of which no record has been left. In any case, to speak of the coco-nut as "wild" here, as Mr. Kurz does (*Jour. As. Soc. Beng.*, xliii, Pt. 2, p. 200) is apt to convey the erroneous impression that the species is here truly indigenous.

The coco-nut cannot be said to be known in a truly wild state, though it occurs on many uninhabited islands, and its original home is by no means certain.

The quality of these coco-nuts is little inferior to that of those cultivated at Port Blair and though distinctly inferior to those cultivated in the Nicobars they are much the same as those on Batti Malv where there are no inhabitants.

America, Polynesia, Malaya, India.

#### PANDANEÆ.

##### 266. PANDANUS ODORATISSIMUS Linn. f.

In all the islands, common on the coasts.

India, Indo-China, Malaya, Andamans, Nicobars.

#### AROIDEÆ.

##### 267. AMORPHOPHALLUS sp. (aff. *A. bulbifer*).

Great Coco, common; Little Coco, occasional. Only leaves and very advanced fruit obtained; tubers brought to Calcutta have as yet only produced leaves, but these leaves are bulbiferous and indicate this as a species nearly related to, but apparently distinct from, both *A. bulbifer* and *A. tuberculiger*.

##### 268. ALOCASIA FORNICATA Schott.

Great Coco, common.

India, Indo-China, Malaya, Andamans.

269. *SCINDAPSUS OFFICINALIS* Schott.  
In all the islands, common.  
India, Indo-China, Malaya, Andamans.
270. *POTHOS SCANDENS* Linn.  
In all the Islands, common.  
India, Indo-China, Malaya, Andamans.

## NATADACEÆ.

271. *CYMODOCEA CILIATA* Ehrb. ?  
On the reefs of all the islands ; extremely common and forming vast submarine meadows. This species is exceedingly common in the Andamans and has been met with in equal abundance at Rangachang near Port Blair (there associated with another species of apparently the same genus), at Rutland Island, at Little Andaman (there in company with *Halophila ovalis*), and at Car Nicobar. No flowering or fruiting specimens have yet been reported at Calcutta. This is the plant supposed by Kurz (*Jour. As. Soc. Beng.*, xlv, Pt. 2, p. 154) to be a small form of *Enhalus aceroides*.
272. *ZANICHELLIA PALUSTRIS* Linn.  
Little Coco, in the small lake along with *Chara fetida*.  
Cosmopolitan in salt-marshes.

## CYPERACEÆ.

273. *CYPERUS POLYSTACHYUS* Rottb.  
Great Coco ; west coast, rather common on the bare grassy slopes.  
Cosmopolitan.
274. *CYPERUS ELEGANS* Linn.  
Great Coco ; frequent in wet patches in the dense interior jungle.  
India, Indo-China, Malaya, Andamans ; America.
275. *CYPERUS DILUTUS* Vahl.  
Great Coco ; occasional.  
India, Indo-China, Malaya, Andamans.
276. *CYPERUS PENNATUS* Lamk.  
In all the islands, very common on the coast in rocky places.  
Sea-shores of the Indian Ocean.
277. *KYLLINGA BREVIFOLIA* Roxb.  
Great Coco, clearing at north-east corner ; Table Island, clearing near light-house ; common.  
India, Indo-China, Malaya, Andamans.
278. *FIMBRISTYLIS DIPHYLIA* Vahl.  
Table Island and Great Coco, in the clearings ; also on the rocky coasts.  
India, Burma, Malaya, Andamans ; Australia, Africa, America.

279. *FIMBRISTYLIS FERRUGINEA* Vahl.  
Great Coco and Little Coco, on coral-shingle.  
India, Burma, Malaya.
280. *FIMBRISTYLIS QUINQUEANGULARIS* Kunth.  
Great Coco and Table Island, in marshy ground.  
India, Indo-China, Malaya.
281. *FIMBRISTYLIS MILIACEA* Vahl.  
Great Coco, flat marshy ground near the small lake.  
India, Indo-China, Malaya.
282. *SCIRPUS SUBULATUS* Vahl.  
Little Coco, in the lake at the south-west corner of the island,  
abundant.  
Bengal (Salt lakes); Beluchistan, Panjab; Africa, (Egypt).

## GRAMINEÆ.

283. *PASPALUM SCROBICULATUM* Retz.  
Little Coco, abundant in the lake.  
India, Indo-China, Malaya.
284. *PANICUM CILIARE* Retz.  
Great Coco, near south end of island.  
India, Indo-China.
285. *PANICUM COLONUM* Linn.  
Table Island, light-house clearing; Great Coco in the clearing, also  
at south end of island in Coco-nut zone.  
Cosmopolitan in the tropics.
286. *PANICUM HELOPUS* Trin.  
Table Island, in the clearing.  
India, Indo-China.
287. *PANICUM JAVANICUM* Poir.  
Great Coco, common.  
India, Indo-China, Malaya.
288. *PANICUM MYURUS* Lamk.  
Great Coco; in matted menses floating in the small lake at north-  
east corner of island.  
India, Indo-China, Malaya.
289. *PANICUM MONTANUM* Roxb.  
Great Coco, with the next species, in deep jungle.  
India, Indo-China, Malaya, Andamans.
290. *OPLISMENUS COMPOSITUS* Roem. & Schult.  
Great Coco, in dense jungle, occasional.  
Cosmopolitan or nearly so.

291. *THUAREA SARMENTOSA* Pers.  
Great Coco, common as a turf under Coco-nut trees.  
Shores of Indian Ocean.
292. *ISCHÆMUM CILIARE* RETZ.  
Great Coco, common on grassy slopes and under Coco-nut trees.  
India, Indo-China, Malaya.
293. *ISCHÆMUM MUTICUM* Linn.  
Great Coco, occasional only ; Little Coco, extremely abundant.  
India, Indo-China, Malaya.
294. *ANDROPOGON CONTORTUS* Linn.  
Table Island and Great Coco ; the common grass both in the clearings and on the naturally bare headlands of the western coast.  
Cosmopolitan in the tropics.
295. *ELEUSINE INDICA* Gaertn.  
Table Island, frequent ; Great Coco, rare.  
Cosmopolitan in the tropics.
296. *ELEUSINE ÆGYPTIACA* Roxb.  
Table Island ; in the light-house clearing, scarce.  
Cosmopolitan, or nearly so, in the tropics.
297. *DENDROCALAMUS STRICTUS* Nees, *var.*— ?  
Great Coco, on one hill, abundant ; Table Island, plentiful. Flowering examples were obtained on Table Island which have been kindly examined by Mr. J. S. Gamble. There seems no doubt as to the species, the specimens do not however quite agree with typical examples. There is little doubt that this Bamboo is here indigenous and, from an account received from Mr. Godwin-Austen (formerly of Port Blair), appears to occur on Saddle Peak in North Andaman also. It does not occur in South Andaman.  
India, Burmah.

## CRYPTOGAMÆ.

### VASCULARES.

### FILICES.

298. *DAVALLIA SOLIDA* Sw.  
Great Coco, east coast, very common on *Mimusops littoralis* and other tall trees.  
Andamans, Malaya, Polynesia, Australia.
299. *ADIANTUM LUNULATUM* Burm.  
Great Coco, on interior ridges frequent ; Table Island, common.  
Cosmopolitan in the tropics.

300. CERATOPTERIS THALICTROIDES Brogn.  
Great Coco, in wet places in the interior with *Cyperus elegans*.  
Cosmopolitan in the tropics.  
When discussing the weeds of the Andaman Flora (*Jour. As. Soc. Beng.*) the writer imagined this fern to have been introduced into these islands by human agency, at least indirectly. But the Coco locality proves sufficiently to his mind that its presence is altogether independent of mau's presence, and he has since then collected it in similar situations in South Andaman. It is probably not at all common however, and hence it had escaped the notice of Mr. Kurz when he collected in the Andamans.
301. POLYPODIUM IRIOIDES Lamk.  
In all the islands, frequent.  
India, Indo-China, Andamans, Malaya; Australia, Polynesia; Africa
302. POLYPODIUM ADNASCENS Sw.  
Great Coco, on trees in mangrove swamps; Little Coco, on trees in lagoon at south-west end of island.  
India, Indo-China; Andamans, Nicobars; Malaya; Polynesia; Africa.
303. POLYPODIUM QUERCIFOLIUM Linn.  
In all the islands, very plentiful in the same situations as *Davallia solida*.  
India, Indo-China; Andamans, Nicobars; Malaya; North Australia.
304. VITTARIA ELONGATA Sw.  
Great Coco, not very common.  
India, Indo-China; Andamans, Malaya; Australia, Polynesia; Africa.
305. ACROSTICHUM SCANDENS J. Sm.  
Great Coco, very common in the low-lying lands behind the coast zone.  
India, Indo-China; Andamans, Malaya; Australia, Polynesia.
306. ACROSTICHUM APPENDICULATUM Willd., var. SETOSA.  
Great Coco, the only common ground fern on the interior ridges.  
India, Indo-China; Andamans, Malaya.
307. LYGODIUM FLEXUOSUM Sw.; Bedd.  
In all the islands, common in the dense dwarfed jungle on the ridges.  
India, Burma; Andamans, Malaya; Australia; Africa.

## CHARACEÆ.

308. CHARA FETIDA A. Braun.  
Little Coco; abundant in the lagoon.  
India, Indo-China.

## MUSCI.

## 309. CALYMPERES DOZYANUM Mitt.

Great Coco, on damp rocks in a sheltered bay on west coast, also on *Mimusops* trunks in coast zone; Little Coco, on trunks of *Mimusops littoralis*.

Samoa; Java, Philippines; Ceylon; Admiralty Islands.

## 310. BRYUM CORONATUM Schwaegr.

Great Coco, on charred stumps of *Mimusops littoralis* at south end of island.

Tropics of both hemispheres.

## HEPATICÆ.

## 311. LEJEUNIA sp.

In all the islands, on trees, common.

## 312. HEPATICA sp. (genus indeterminable).

Great Coco, on trees in mangrove swamps.

## CELLULARES.

## LICHENES.

## 313. COLLEMA NIGRESCENS Achar.

Little Coco, soft pulpy masses on stems of *Cycas Rumphii*  
Cosmopolitan.

314. PHYSCIA sp. (near *Ph. obscura* Fr.)

Little Coco, on stems of *Cycas Rumphii*.

## 315. PHYSCIA sp.

Great Coco, on rocks, west coast.

## 316. LEPRARIA sp. (specimens imperfect).

Great Coco.

## FUNGI.

## 317. LENTINUS LEUCOCHROUS Fries.

Great Coco, on dead wood, common.

\* Asia.

## 318. LENZITES DEPLANATA Fries.

Great Coco, on dead wood, common.

\* Asia.

## 319. LENZITES SUBFERRUGINEA Berk.

Great Coco

\* Asia.

320. POLYPORUS FULVUS Fries.  
Great Coco.  
\* Asia.
321. POLYPORUS XANTHOPUS Fries.  
Great Coco, on dead stems.  
Cosmopolitan in the tropics.
322. POLYPORUS SANGUINEUS Fries.  
Great Coco; on dead stems of *Cocos nucifera*.  
Cosmopolitan in the tropics.
323. POLYPORUS GRAMMATOCEPHALUS Berk.  
Great Coco, on dead wood.  
India, Indo-China, Malaya, Australia, America.
324. POLYPORUS AUSTRALIS Fries.  
Great Coco.  
Cosmopolitan in the tropics.
325. HEXAGONA PERGAMENEA Berk. & Broome.  
Great Coco,  
Ceylon (*Berkeley and Broome, Jour. Linn. Soc.* xiv, 57).
326. HEXAGONA SERICEO-HIRSUTUS Kl.  
Great Coco; on dead wood.  
North America (*Klotzsch, Linnæa* viii, 483).
327. HEXAGONA TENUIS Hook.  
Great Coco, on dead wood.  
Nicobars (*Fenzl, Novara Bot.* ii, 138); Mauritius (*Klotzsch, Linnæa* viii, 482).
328. DEDELEA FLABELLUM Berk.  
Great Coco, on dead wood.  
\* Asia.
329. DEDELEA SANGUINEA Kl.  
Great Coco, on dead wood.  
India (*Klotzsch, Linnæa* viii, 481).
330. DEDELEA QUERCINA Fries.  
Great Coco, on dead wood.  
Cosmopolitan.
331. DEDELEA CONCENTRICA Fries.  
Great Coco, on dead wood.  
Cosmopolitan in the tropics.
332. THELEPHORA INCRUSTANS Pers.  
Great Coco, on *Pongamia glabra*; Little Coco, on *Cycas Rumphii*.  
Cosmopolitan.
333. BOVISTA LILACINA Berk.  
Great Coco, on grassy slopes.  
Cosmopolitan in the tropics.

334. *HIRNEOLA POLYTRICHA* Mont.

Great Coco, on dead wood.

Tropics of both hemispheres and Polynesia.

335. *XYLARIA CLAVARIOIDES* G. Massée, sp. nov.

*Xylaria* (*Xylocoryne*) stromatibus sæpius solitariis rarius in cæspitibus 2—5 connatis cylindræis, 2—4 cm. altis,  $\frac{1}{3}$ — $\frac{1}{2}$  diam.; extus atris papilloso-scabris, intus candidis stipite elongato, coriaceo-suberoso nigro-velutino demum nudo; peritheciis clavulæ omnino immersis; ascis cylindricis, pedicellatis, octosporis; sporidiis oblique monostichis, ellipticis, nigricantibus 10—11  $\times$   $\mu$ . (Prain n. 45). In lignis putridis.

Great Coco, common on dead stems of *Minusops littoralis*.336. *DALDINIA VERNICOSA* Cos. & de Not.

Great Coco, on dead wood.

India, America.

337. *RHYTISMA* sp.In all the islands, on leaves of *Ficus brevicuspis*.

Andamans, (the same species apparently is equally common at Port Blair).

## 338. ———.

Besides the above there occurs on both islands a *Fungus* which appears to be very widely dispersed throughout the Andamans and Nicobars, but has so far been only found as a white mycelium that appears as a narrow band on the bark of slender branches, runs upwards along these and divides into still narrower bands on the branchlets; these branch and anastomose and send still narrower bands (threads) upwards along the petioles of the leaves and finally spread as a thin network on the *under* surface of the lamina. The writer has found the same blight (known to the officers at Port Blair as "thread-blight") on the following species: *Alsodeia bengalensis*, *Ochna squarrosa*, *Bombax insigne*, *Camellia theifera*, *Hibiscus rosa-sinensis*, *Gardenia* sp., *Pongamia glabra*, *Diplospora singularis*, *Blachia andamanica*, *Ficus nitida*; it is also reported to occur on a species of *Phalenopsis*. Its effect is in every case the same, the leaves affected become yellow and sickly, and as regards *Ochna* among indigenous species and the Tea-plant among cultivated species, when affected they become brown and die. The blight spreads with great rapidity and for a time threatened the existence of the Tea-industry at Port Blair. Drs. Cunningham and Barclay have both examined specimens but as there is no sign of any advance beyond the mycelial stage the position of the *Fungus* is at present indeterminate.

339. ———.

A second fungus of some interest is an *Uredine* that was found in considerable quantity on *Clerodendron inerme*. This the writer has met with, always producing the same characteristic effects on this *Clerodendron*, in South Andaman, Little Andaman, and Car Nicobar, as well as on Great Coco. The specimens were examined by the late Dr. Barclay, but were found insufficient for determination.

340. ———.

A third fungus of note causes a "dry-rot" in the fallen trunks of *Mimusops littoralis* on the beach. The effect produced simulates in a wonderful manner charring by fire; it appears to be confined, so far as the drift timber and wreckage on these islands is concerned, to *Mimusops* and *Quercus*—the planks of a wooden vessel, apparently of oak, that had been wrecked on Little Coco, being attacked like the Bullet-wood trees; Teak, Sundri and other logs were not affected.

#### ALGÆ.

341. *SARGASSUM ILICIFOLIUM* J. Agardh.

In all the islands; in great beds at the outer margins of the fringing reefs and in the deeper water beyond; the only really common sea-weed.

Almost Cosmopolitan in the tropics; not from Australia (*Hemsl., Report on Bot. of Admiralty Islands*, p. 271).

342. *TURBINARIA ORNATA* J. Agardh.

In all the islands; rather common both on coral and on sandstone reefs.

\* Indian Ocean.

343. *PADINA PAVONIA* Gaill.

In all the islands; on both coral and sandstone.

Cosmopolitan in tropical seas.

344. *DICTYOTA DICHOTOMA* Lamour.

Great Coco; on coral reefs.

Common in both north and south temperate seas, rarer in the tropics.

345. *LITHOTHAMNION POLYMORPHUM* Aresch.

Great Coco; on coral reefs.

Atlantic, Mediterranean, South Africa; Chonos Archipelago.

346. *ACANTHOPHORA THIERII* Lamour.

Little Coco; pools on coral reefs.

Cosmopolitan in tropical seas.

347. *JANIA TENELLA* Kuetz.

Great Coco; on reefs, on *Lithothamnion polymorphum*.

\* Indian Ocean.

## 348. GRACILARIA CRASSA Harv.

In both islands ; in pools on coral sand.

\* Indian Ocean.

## 349. GELIDIUM CORNEUM J. Agardh.

Great Coco ; on coral reefs ; also growing on *Halimeda Opuntia*.

Almost Cosmopolitan.

[A specimen of a *Gelidium* washed up by the tide on Little Coco, was too much withered and bleached to be identified ; another was collected there on the reefs, but in too early a stage of development to be named.]

## 350. CAULERPA CLAVIFERA J. Agardh.

Both islands ; on reefs.

Cosmopolitan in tropical seas.

## 351. CAULERPA PLUMARIS J. Agardh.

Little Coco ; in pools on coral reefs.

\* Indian Ocean.

## 352. VALONIA FASTIGIATA Harv.

Great Coco ; on coral reefs.

Indian Ocean and Pacific.

## 353. VALONIA CONFERVOIDES Harv.

Great Coco ; in pools on coral sand.

\* Indian Ocean.

[A species of *Valonia* was collected on Little Coco also, but in too early a stage of development to be named].

## 354. HALIMEDA OPUNTIA Lamour.

In both islands ; both on sandstone and on coral reefs, rather common.

Cosmopolitan in tropical seas.

## 355. SIPHONOCLOUDUS ? FILIFORMIS De Toni.

Washed ashore on the coast of Little Coco after stormy weather that prevailed for three days during our visit.

## 356. VAUCHERIA sp.

Little Coco ; on sandstone reefs. None of the specimens obtained were in fruit.

Andamans and Nicobars, the same species apparently was found by the writer to be plentiful in South Andaman and in Car Nicobar.

## 357. CALOTHRIX PULVINATA J. Agardh.

Little Coco ; in pools above high water mark.

Cosmopolitan.

## 358. ———.

A *Nostocaceous Alga* in habit, very like the preceding, was obtained

in the shallower *tidal* pools on Great Coco, but the specimens were too much withered to be determinable.

[Where an asterisk precedes the distribution of any *Fungus* or *Alga* it has been impossible to ascertain whether the species in question extends beyond the area indicated].

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§ § § NATURE, DISTRIBUTION, AND PROBABLE ORIGIN OF THE FLORA.

In this list 358 distinct species are recorded, distributed among 268 genera and 95 natural orders; 297 species are *Phanerogams* and 61 are *Cryptogams*, giving a proportion of nearly five flowering plants to one flowerless species, the exact proportions and percentages being:—

Phanerogams : Cryptogams :: 4·85 : 1.

Phanerogams = 83 %; Cryptogams = 17 %.

In the two groups *Filices* and *Algæ* the list represents the *Cryptogamic* flora with probably the same degree of adequacy that it does the *Phanerogamic*. In the other *Cryptogamic* groups it is to be feared the representation is not so complete. Still the scarcity of *Mosses* and *Lichens* is a very striking feature of the flora, so is the paucity of *Ferns*; with all three groups it is not merely a case of few species being present, there are, except perhaps in the case of *Acrostichum scandens*, which is common, remarkably few individuals of these species.

Among the 297 *Phanerogams*, 238 are *Dicots*; only one of these (*Cycas Rumphii*) is a *Gymnosperm*, the other 59 being *Monocots*. The *Dicots* are distributed amongst 59 natural orders and 178 genera, the *Monocots* amongst 14 natural orders and 45 genera. The proportions and percentages here are:—

Dicots : Monocots :: 4 : 1.

Dicotyledons = 80 %; Monocotyledons = 20 %.

Altogether 66 per cent. of the flora consists of *Dicotyledons*, whilst among these the *Polypetalæ* exceed in number the rest of the groups combined, a somewhat unusual circumstance, since, as regards species at least, the Indian *Gamopetalæ* usually exceed the *Polypetalæ*; *Polypetalæ* here constitute, as it happens, one-third, or 33 % of the whole flora.

There are only 15 *Vascular Cryptogams* in the list as against 46 *Cellular Cryptogams*; these are together distributed amongst 45 genera and 22 natural orders; The proportions and percentages are:—

Vascular : Cellular :: 1 : 3.

Vascular Cryptogams = 25 %; Cellular Cryptogams = 75 %.

The subjoined table gives a synoptic view of the systematic disposition of the Coco Island Flora.

TABLE I. *Systematic synopsis of Coco Island orders, genera and species.*

PHANEROGAMÆ .....	73	223	297
<i>Dicotyledones</i> .....	59	178	238
Angiospermæ .....	58	177	237
Polypetalæ .....	30	86	119
Thalamifloræ .....	10	19	31
Discifloræ .....	10	29	33
Calycifloræ .....	10	38	55
Gamopetalæ .....	17	59	75
Incompletæ .....	11	32	43
Gymnospermæ .....	1	1	1
<i>Monocotyledones</i> .....	14	45	59
CRYPTOGAMÆ .....	22	45	61
<i>Vasculares</i> .....	8	12	15
Filices .....	4	7	10
Characeæ .....	1	1	1
Musci .....	1	2	2
Hepaticæ .....	2	2	2
<i>Cellulares</i> .....	14	33	46
Lichenes .....	2	3	4
Fungi .....	7	14	24
Algæ .....	5	16	18
TOTAL .....	NAT. ORDERS 95	Genera..... 268	Species..... 358

Of the 73 natural orders of *Phanerogams* 24 are represented by single species and 14 more by two species each. The most extensively represented natural order is *Leguminosæ*, with 34 species; followed after a long interval by *Euphorbiaceæ* and *Gramineæ*, each 15 sp.; *Convolvulaceæ*, 14 sp.; *Rubiaceæ*, 13 sp.; *Urticaceæ*, 11 sp.; *Cyperaceæ*, 10 sp. *Filices*, amongst *Cryptogams*, are also represented by 10 species. None of the other orders have more than 8 species.

As to genera: 29 of these natural orders of *Phanerogams* are represented by one genus; 13 by 2 genera; 11 by 3 genera; 6 by 4 genera; 5 by 5 genera; 4 by 6 genera; one natural order each where there are 7 genera (*Apocynæ*); 8 genera (*Gramineæ*); 11 genera (*Rubiaceæ*); 12 genera (*Euphorbiaceæ*); and 22 genera (*Leguminosæ*): *Leguminosæ* thus leads both as regards genera and species. The subjoined table exhibits the relationship of the orders according to the wealth of their representation.

TABLE II. *Natural orders of Coco Island Phanerogams arranged according to their richness in species.*

Number of species.	Number of orders.	NAMES OF ORDERS.
34	1	<i>Leguminosæ.</i>
15	2	<i>Euphorbiaceæ, Gramineæ.</i>

Number of species.	Number of orders.	NAMES OF ORDERS.
14	1	<i>Convolvulaceæ.</i>
13	1	<i>Rubiaceæ.</i>
11	1	<i>Urticaceæ.</i>
10	1	<i>Cyperaceæ.</i> [ <i>Filices</i> are also represented by 10 species.]
8	3	<i>Malvaceæ, Sterculiaceæ, Verbenaceæ.</i>
7	3	<i>Compositæ, Apocynæ, Acanthaceæ.</i>
6	2	<i>Anacardiaceæ, Palmææ.</i>
5	6	<i>Ampelidæ, Sapindaceæ, Rhizophoreæ, Combretaceæ, Orchidaceæ, Liliaceæ.</i>
4	4	<i>Tiliaceæ, Meliaceæ, Asclepiadaceæ, Aroidæ.</i>
3	10	<i>Olacineæ, Celastrineæ, Rhamneæ, Lythraceæ, Solanaceæ, Nyctagineæ, Amarantaceæ, Laurineæ, Scitamineæ, Commelynaceæ.</i>
2	14	<i>Menispermaceæ, Capparidæ, Guttiferæ, Dipterocarpeæ, Burseraceæ, Myrtaceæ, Passifloraceæ, Myrsinæ, Boraginæ, Bignoniaceæ, Aristolochiaceæ, Myristicæ, Dioscoreaceæ, Naiadæ.</i>
1	24	<i>Anonaceæ, Nymphæaceæ, Violaceæ, Rutaceæ, Moringæ, Connaraceæ, Melastomaceæ, Cucurbitaceæ, Ficoidæ, Goodenovieæ, Sapotaceæ, Ebenaceæ, Gentianaceæ, Scrophularineæ, Labiate, Polygonaceæ, Piperaceæ, Loranthaceæ, Santalaceæ, Cycadaceæ, Amarylhidaceæ, Taccaceæ, Flagellariceæ, Pandanaceæ.</i>

If the species are classified according to their habit we find that 78 are climbers, 74 are trees that may exceed 30 feet in height, 20 are small trees that do not exceed 30 feet, 48 are shrubs and 138 are herbaceous, (treating as herbaceous species like *Carica*, *Scævola*, *Musa*, *Crinum*, etc., and all *Cryptogams* except the two climbing ferns, *Lygodium* and *Acrostichum scandens*, which are here included among the other climbers). But though as regards number of species herbaceous forms are so largely represented they are as a matter of fact extremely inconspicuous, two-fifths of them being cryptogams and one-third of these being marine. Nor, if we except the herbaceous climbers, which are here dealt with along with the woody ones, and the species that occur on the few bare grassy slopes, are herbaceous phanerogams more numerous than herbaceous cryptogams. The most numerous represented herbs are *Andropogon contortus*, *Desmodium polycarpon*, *Desmodium triquetum*, *Vernonia cinerea*, *Blumea virens*, the various species of *Fimbristylis*, *Cyperus pennatus* and *polystachyus*, *Boerhaavia repens*, *Ischaemum muticum*, *Thuarea sarmentosa*. Herbaceous species that frequent deep

jungle only, such as *Desmodium laxiflorum*, *Urena lobata*, *Cyperus elegans*, *Oplismenus compositus*, *Panicum montanum*, *Alocasia fornicata*, *Costus speciosus*, *Zingiber* sp., *Amorphophallus* sp., *Acrostichum appendiculatum*, *Ceratopteris thalictroides*, etc., are not only very rarely met with, but are represented by extremely few individuals where they do occur.

Woody shrubs and small trees taken together do not, as regards species, quite equal in number the large trees. In point of number of individuals, however, this is not the case, for it is not unusual to find these, woody shrubs and the smaller trees truly gregarious, particularly on the ridges; the chief examples are *Glycosmis pentaphylla*, *Alsodeia bengalensis*, *Glyptopetalum calocarpum*, *Cyclostemon assamicus*, *Macaranga Tanarius*, *Miliusa* sp., *Cynometra ramiflora*, *Leea sambucina*, *Dendrocalamus strictus*; a far larger area is covered by small trees and woody undershrubs heavily loaded with creepers than is covered by tall forest. In the mangrove-swamps most species may be spoken of as gregarious, but even here there is no great number of trees over 40 feet high; and the only gregarious tall trees are *Minusops littoralis* and *Gyrocarpus Jacquinii*, both denizens of the beach-forest behind the Coco-nut zone, and *Cocos nucifera* itself. Among the arboreous species in these islands have to be included *Cycas Rumphii*, which is very commonly 30—35 feet high and of which one specimen measured in Great Coco had a clear stem from ground to crown of 42 feet; also *Tournefortia argentea* which in Little Coco (and elsewhere in the Andaman group) is a tree 25—40 feet high with very black bark and a trunk often 3—3½ feet in girth; *Pongamia glabra* too, recorded by Mr. Baker in the *F. B. I.* as sometimes a climber, is here, as it also is in Bengal, always a tree from 20—60 feet in height. *Salacia prinoides* on the other hand is here always a heavy extensive climber.

Erect woody species therefore, including both trees and shrubs in this category, form almost exactly two-sevenths of the flora as regards number of species. As regards individuals, however, it will be no over-estimation to say that these constitute six-sevenths of the vegetation, not merely in bulk but in actual number of individuals.

Climbing species, as compared with those having an erect or prostrate habit, show a much higher proportion of woody to herbaceous species. This is owing to the fact that of the 78 climbers only two are cryptogams, while in the other group 59 cryptogams are included. To give therefore an accurate conception of the conditions that prevail, the Cellular cryptogams ought to be excluded. Of the 312 Phanerogams and Vascular cryptogams 234 are of erect habit and 78 are climbing, giving a proportion of:—

Erect sp. : climbing sp. : : 4 : 1.

Among these erect vascular plants the proportion of woody to herbaceous is therefore :—

Woody sp. : Herbaceous sp. : : 3 : 2.

Of the climbers 35 are woody and 43 are herbaceous so that here the proportion is :—

Woody sp. : Herbaceous sp. : : 2 :  $2\frac{1}{2}$ .

Instead therefore of being lower amongst climbers than erect species, the proportion of herbaceous species to woody ones, when attention is confined to vascular plants only, is actually higher. And in number of individuals too there is a much more even balance among climbing species, since herbaceous climbing species, as well as woody ones, can easily raise themselves to the light and air for want of which no great quantity of herbaceous undergrowth can exist; indeed the herbaceous climbing species possess many advantages over their woody rivals, for they are not as a rule so heavy and as, moreover, they sometimes (*e. g.*, *Modecca*, *Trichosanthes*, *Dioscorea*, *Gloriosa*) die down annually, they do not destroy the species on which they are supported so soon as do heavy perennial creepers like *Calamus*, *Thunbergia*, *Anodendron*, *Chonemorpha*, *Derris*, etc., which in a few seasons drag down the trees on which they climb.

Some of the woody climbers, such as *Anodendron* and *Thunbergia*, climb to great heights, and are not surpassed in this respect even by the *Modecca*. The majority of the woody climbers, however, like *Sarcostigma*, *Salacia*, *Pisonia aculeata*, *Plecosperrnum*, the species of *Acacia* and of *Capparis*, are not to be found on tall trees at all, but load heavily the woody undergrowth of small trees and shrubs that forms the bulk of the forest. Nor is it unusual to find the forest, where composed of tall trees, exhibiting both classes of creepers; the characteristic lofty creepers on the tall trees overhead, the heavy woody creepers on the shrubby undergrowth below.

Of the climbing species 20, or 25%, are armed. As a rule the armed species may be said to belong to the class of undergrowth climbers; with the exception of the two species of *Calamus*, the lofty climbers are unarmed.

The habit of the Coco Island species is shewn in the subjoined table.

TABLE III. *Habit of Coco Island species.*

Vascular species (Phanerogams and Vascular Cryptogams).....	312
Species with erect habit .....	234
Woody species .....	142
Trees .....	94
Exceeding 30 feet.....	74
Under 30 feet .....	20
Shrubs.....	48
Herbaceous species (Herbs and Herbaceous shrubs).....	92
Climbing species .....	78
Woody climbers .....	35
Armed.....	13
Unarmed.....	22
Herbaceous climbers .....	43
Armed .....	7
Unarmed .....	36
Non-vascular species (Lower Cryptogams) .....	46
Total Coco Island species .....	358

As regards habitat it will be gathered from what has been said above that a very large proportion of the flora is of arborescent forest-type. Next in point of numbers to the inland forest species, though only half as numerous, are the littoral species; following these at about an equal interval are parasitic or saprophytic species—a class here almost entirely composed of *Fungi*; after these in succession epiphytes; marine species, (mainly *Algæ*); weeds of cultivation; cultivated species; marsh or water plants; and species of open grassy slopes.

The subjoined table gives the numbers of each class of species; the meadow species, here separated from the forest species, are, owing to the smallness of their numbers, in all subsequent tables included with the forest species.

TABLE IV. *Habitat of Coco Island species.*

Civilized species .....	33
Cultivated plants .....	15
Weeds of cultivation .....	18
Wild species.....	325
Parasites and Saprophytes (Phanerog. 1) .....	31
Epiphytes.....	19
Marine plants (Phanerog. 1) .....	19
Littoral species .....	80
Inland species .....	176
Forest species .....	162
Jungle .....	150
Grassy species .....	12
Marsh and water species .....	14
Total Coco Island species .....	358

The subjoined table exhibits the relationship that subsists between the systematic disposition of the species and their habit and habitat.

TABLE V. *Relationship between systematic arrangement, habit and habitat.*

HABIT.				SYSTEMATIC ARRANGEMENT.	HABITAT.								
Total.	Climbers.	Trees.	Shrubs.		Herbs.	Cultivated sp.	Weeds.	Forest sp.	Marsh.	Littoral.	Marine.	Epiphytic.	Parasiticete.
1	...	1	...	...	Anonaceæ	...	...	1	...	...	...	...	1
2	2	...	...	...	Menispermaceæ	...	...	2	...	...	...	...	2
1	...	...	1	...	Nymphæaceæ	...	...	1	...	...	...	...	1
2	2	...	...	...	Capparideæ	...	...	2	...	...	...	...	2
1	1	...	...	...	Violaceæ	...	...	1	...	...	...	...	1
2	2	...	...	...	Guttiferæ	...	...	1	1	...	...	...	2
2	2	...	...	...	Dipterocarpeæ	...	...	2	...	...	...	...	2
8	3	2	3	...	Malvaceæ	...	2	2	2	2	...	...	8
8	1	7	...	...	Sterculiaceæ	...	...	6	2	...	...	...	8
4	1	3	...	...	Tiliaceæ	...	...	4	...	...	...	...	4
1	...	1	...	...	Rutaceæ	...	...	1	...	...	...	...	1
2	2	...	...	...	Burseraceæ	...	...	2	...	...	...	...	2
4	4	...	...	...	Meliaceæ	...	...	3	1	...	...	...	4
3	2	1	...	...	Oleaceæ	...	...	3	...	...	...	...	3
3	1	1	1	...	Celastrineæ	...	...	2	1	...	...	...	3
3	3	...	...	...	Rhamnææ	...	...	2	1	...	...	...	3
5	3	2	...	...	Ampelideæ	...	...	4	1	...	...	...	5
5	4	1	...	...	Sapindaceæ	...	...	5	...	...	...	...	5
6	6	...	...	...	Anacardiaceæ	...	...	5	1	...	...	...	6
1	1	...	...	...	Moringeæ	...	1	...	...	...	...	...	1
1	1	...	...	...	Connaraceæ	...	...	1	...	...	...	...	1
34	18	6	7	3	Leguminosæ	...	3	2	19	10	...	...	34
5	5	...	...	...	Rhizophoreæ	...	...	5	...	...	...	...	5
5	1	3	1	...	Combretaceæ	...	...	2	3	...	...	...	5
2	2	...	...	...	Myrtaceæ	...	...	2	...	...	...	...	2
1	1	...	1	...	Melastomaceæ	...	...	1	...	...	...	...	1
3	2	1	...	...	Lythraceæ	...	...	2	1	...	...	...	3
2	1	...	1	...	Passifloreæ	...	1	1	...	...	...	...	2
1	1	...	...	...	Cucurbitaceæ	...	...	1	...	...	...	...	1
1	...	...	1	...	Ficoideæ	...	...	1	...	...	...	...	1
13	2	6	5	...	Rubiaceæ	...	...	9	4	...	...	...	13
7	1	1	5	...	Compositæ	...	3	2	2	...	...	...	7
1	...	...	1	...	Goodenovieæ	...	...	1	...	...	...	...	1
2	2	...	...	...	Myrsinææ	...	...	1	...	...	...	...	1
1	1	...	...	...	Sapotaceæ	...	...	1	...	...	...	...	1
1	1	...	...	...	Ebenaceæ	...	...	1	...	...	...	...	1
7	2	2	2	1	Apocynææ	...	...	4	3	...	...	...	7
4	4	...	...	...	Asclepiadaceæ	...	...	1	1	3	...	...	4
1	...	...	1	...	Gentianaceæ	...	...	1	...	...	...	...	1
2	2	...	...	...	Boraginææ	...	...	2	...	...	...	...	2
14	14	...	...	...	Convulvulaceæ	...	2	3	9	...	...	...	14
3	...	1	2	...	Solanaceæ	...	2	...	1	...	...	...	3
1	...	...	1	...	Scrophularinææ	...	...	1	...	...	...	...	1
2	2	...	...	...	Bignoniaceæ	...	...	2	...	...	...	...	2
7	1	...	6	...	Acanthaceæ	...	1	3	1	2	...	...	7

HABIT.				SYSTEMATIC ARRANGEMENT.	HABITAT.										
Total.	Climbers.	Trees.	Herbs.		Cultivated sp.	Weeds.	Forest sp.	Marsh.	Littoral.	Marine.	Epiphytic.	Parasiticafe.	Total.		
8	2	3	2	1	Verbenaceæ ...	...	...	2	1	5	...	...	8		
1	...	...	...	1	Labiatae ...	...	...	1	...	...	...	...	1		
3	1	1	...	1	Nyctagineæ ...	...	...	...	3	...	...	...	3		
3	...	...	...	3	Amarantaceæ ...	...	...	2	1	...	...	...	3		
1	...	...	...	1	Polygonaceæ ...	...	...	...	1	...	...	...	1		
2	1	...	...	1	Aristolochiaceæ ...	...	...	2	...	...	...	...	2		
1	1	...	...	1	Piperaceæ ...	...	...	1	...	...	...	...	1		
2	...	2	...	...	Myristicææ ...	...	...	2	...	...	...	...	2		
3	1	2	...	...	Laurineæ ...	...	...	1	1	...	...	1	3		
1	...	...	...	1	Loranthaceæ ...	...	...	...	...	...	...	1	1		
1	...	1	...	...	Santalaceæ ...	...	...	...	1	...	...	...	1		
15	...	13	...	2	Euphorbiaceæ ...	...	...	1	13	1	...	...	15		
11	1	10	...	...	Urticaceæ ...	...	...	11	...	...	...	...	11		
1	...	1	...	...	Cycadaceæ ...	...	...	...	1	...	...	...	1		
5	...	...	...	5	Orchidaceæ ...	...	...	...	1	...	4	...	5		
3	...	...	...	3	Scitamineæ ...	...	...	1	2	...	...	...	3		
1	...	...	...	1	Amaryllidaceæ ...	...	...	...	1	...	...	...	1		
1	...	...	...	1	Taccaceæ ...	...	...	...	1	...	...	...	1		
2	2	...	...	...	Dioscoreaceæ ...	...	...	...	2	...	...	...	2		
5	3	...	1	1	Liliaceæ ...	...	...	4	1	...	...	...	5		
3	...	...	...	3	Commelynaceæ ...	...	...	...	3	...	...	...	3		
1	1	...	...	...	Flagellaricææ ...	...	...	...	1	...	...	...	1		
6	2	3	1	...	Palmeæ ...	...	...	1	4	1	...	...	6		
1	...	...	1	...	Pandanaceæ ...	...	...	...	1	...	...	...	1		
4	2	...	...	2	Aroidææ ...	...	...	...	2	...	2	...	4		
2	...	...	...	2	Naiadaceæ ...	...	...	...	1	1	...	...	2		
10	...	...	10	...	Cyperaceæ ...	...	...	2	3	4	1	...	10		
15	...	1	14	...	Gramineæ ...	...	...	5	6	2	2	...	15		
10	2	...	...	8	Filices ...	...	...	1	1	...	8	...	10		
1	...	...	...	1	Characeæ ...	...	...	...	1	...	...	...	1		
2	...	...	...	2	Musci ...	...	...	...	...	...	2	...	2		
2	...	...	...	2	Hepaticææ ...	...	...	...	...	...	2	...	2		
4	...	...	...	4	Lichenes ...	...	...	...	...	...	4	...	4		
24	...	...	24	...	Fungi ...	...	...	1	...	...	23	...	24		
18	...	...	18	...	Algæ ...	...	...	...	...	18	...	...	18		
358	78	94	48	138	TOTALS	...	15	18	162	14	80	19	21	29	358

In considering the distribution of the species in this list it has to be borne in mind that the islands in which they have been collected form an integral portion of the phytogeographic province of South-Eastern Asia—an area comprising the Indian Peninsula and Ceylon, the lower slopes of the Himalaya—particularly its eastern and central portion, South China, Indo-China and Malaya. To this area too apparently ought to be added, at least as regards many littoral species and many

species with succulent fruits, Northern Australia. While, therefore, in the table of distribution the occurrence of the species in the large divisions of the globe are given on the left hand side, on the right hand the distribution within South-Eastern Asia itself is given. Further, since the geographical position of these islands indicates that they are an integral portion of the Andaman chain, and as the Andamans altogether form as it were part of the debatable land between Indo-China and Malaya, the occurrence of the species there is also noted. In all cases where the occurrence of a species in the Andamans is, at least so far as we yet know, only due to its presence in the Coco Islands, the species in question is indicated by [ ] brackets. The other debatable territory, so far as Malaya and Indo-China are concerned, is Tenasserim, and in all cases where the occurrence of a Coco Island species in Indo-China depends entirely on its occurrence in Tenasserim it is marked by the same [ ] brackets in the Indo-Chinese column. Similarly when, as is frequently the case, a species is only African in the sense of occurring in the Mascarene Islands, the same [ ] brackets are used in the African column.

TABLE VI. *Distribution of the species observed in the Coco Group.*

DISTRIBUTION IN S. E. ASIA.							NAMES OF SPECIES.	GENERAL DISTRIBUTION.				
Westn. Section.			Eastn. Section.					Africa.	S. E. Asia.	Australia.	Polynesia.	America.
Ceylon.	India.	Himalaya.	S. China.	Indo-China.	Andamans.	Malaya.						
					x		Milusa sp. ...		x			
x	x			x	x	x	Cyclea peltata ...		x			
					x		Antitaxis calocarpa ...		x			
x	x	x		x	x	x	Nymphaea Lotus ...	x	x			
				x	x	x	Capparis sepiaria var. grandifolia ...					
				x	x		Capparis tenera var. latifolia ...		x			
				x	x		Alsodeia bengalensis ...		x			
					[x]		Garcinia sp. ...		x			
x	x		x	x	x	x	Calophyllum inophyllum ...	[x]	x	x	x	
				x	x	x	Dipterocarpus pilosus ...		x			
				x	x	x	Dipterocarpus alatus ...		x			
x	x	x	x	x	x	x	Sida acuta ...		x	x	x	x
x	x	x	x	x	x	x	Urena lobata ...		x	x	x	x
x	x	x	x	x	x	x	Hibiscus Sabdariffa ...		x	x	x	x
x	x	x	x	x	x	x	Hibiscus Abelmoschus ...		x	x	x	x
x	x		x	x	x	x	Hibiscus tilliaceus ...		x	x	x	x
x	x			x	x	x	Thespesia populnea ...		x	x		x
	x			x	x		Bombax insigne ...		x			

DISTRIBUTION IN S. E. ASIA.							NAMES OF SPECIES.	GENERAL DISTRIBUTION.				
Westn. Section.			Eastn. Section.					Africa.	S. E. Asia.	Australia.	Polynesia.	America.
Ceylon.	India.	Himalaya.	S. China.	Indo-China.	Andamans.	Malaya.						
x	x	x	x	x	x	x	<i>Eriodendron anfractuosum</i> ...	x	x	-	-	x
-	x	-	-	-	[x]	-	<i>Sterculia villosa</i> ...	-	x	-	-	-
-	-	-	-	-	x	-	<i>Sterculia rubiginosa</i> var.	-	-	-	-	-
-	-	-	-	-	x	-	<i>glabrescens</i> ...	-	-	-	-	-
-	-	-	-	x	x	x	<i>Sterculia parviflora</i> ...	-	x	-	-	-
-	x	x	-	x	[x]	-	<i>Sterculia alata</i> ...	-	x	-	-	-
-	-	-	-	-	x	-	<i>Sterculia colorata</i> ...	-	x	-	-	-
-	x	x	-	x	x	x	<i>Sterculia campanulata</i> ...	-	x	-	-	-
-	-	-	-	-	x	x	<i>Heritiera littoralis</i> ...	x	x	x	x	-
-	-	-	-	[x]	x	-	<i>Buettneria andamanensis</i> ...	-	x	-	-	-
-	x	x	-	-	x	x	<i>Berrya Ammonilla</i> ...	-	x	-	-	-
-	x	x	x	-	x	x	<i>Grewia lævigata</i> ...	-	x	x	-	-
-	-	-	-	-	x	-	<i>Grewia calophylla</i> ...	-	x	-	-	-
-	x	x	x	x	x	x	<i>Grewia Microcos</i> .	-	x	-	-	-
-	x	x	x	x	x	x	<i>Glycosmis pentaphylla</i> ...	-	x	x	-	-
-	-	-	-	-	x	x	<i>Garuga pinnata</i> ...	-	x	-	-	-
-	-	-	-	-	x	-	<i>Canarium euphyllum</i> ...	-	x	-	-	-
-	-	-	-	-	x	-	<i>Aglaiæ andamanica</i> ...	-	x	-	-	-
-	x	x	x	x	x	x	<i>Amoora Rohituka</i> ...	-	x	-	-	-
-	x	x	-	-	x	x	<i>Carapa moluccensis</i> ...	x	x	x	x	-
-	x	x	-	-	x	x	<i>Chickrassia tabularis</i> ...	-	x	-	-	-
-	x	x	-	x	x	x	<i>Cansjera Rheedii</i> ...	-	x	x	-	-
-	-	-	-	-	x	-	<i>Phlebocalymna Lobbiana</i> ...	-	x	-	-	-
-	-	-	-	-	x	-	<i>Sarcostigma Wallichii</i> ...	-	x	-	-	-
-	-	-	-	[x]	[x]	-	<i>Glyptopetalum calcarpum</i> ...	-	x	-	-	-
-	x	x	-	-	x	x	<i>Salacia prinooides</i> ...	-	x	-	-	-
-	-	-	-	[x]	[x]	x	<i>Siphonodon celastrineus</i> ...	-	x	-	-	-
-	-	x	x	-	x	x	<i>Ventilago calyculata</i> ...	-	x	-	-	-
-	x	x	x	-	x	x	<i>Zizyphus Enopia</i> ...	-	x	x	-	-
-	x	x	-	x	x	x	<i>Colubrina asiatica</i> ...	-	x	x	x	-
-	-	-	-	-	x	-	<i>Vitis pentagona</i> ...	-	x	-	-	-
-	x	x	x	-	x	x	<i>Vitis carnosa</i> ...	-	x	x	-	-
-	x	x	-	-	x	x	<i>Vitis pedata</i> ...	-	x	-	-	-
-	x	x	x	-	x	x	<i>Leea sambucina</i> ...	-	x	x	x	-
-	-	-	-	-	x	x	<i>Leea hirta</i> ...	-	x	-	-	-
-	-	x	x	-	x	x	<i>Erioglossum edule</i> ...	-	x	x	-	-
-	x	x	-	x	x	x	<i>Allophylus Cobbe</i> ...	-	x	x	-	-
-	-	x	-	-	[x]	-	<i>Sapindus Danura</i> ...	-	x	-	-	-
-	x	x	x	-	x	x	<i>Pometia tomentosa</i> ...	-	x	-	-	-
-	x	x	x	-	x	x	<i>Dodonæa viscosa</i> ...	-	x	x	x	x
-	x	x	-	-	x	-	<i>Odina Wodier</i> ...	-	x	-	-	-
-	-	-	-	[x]	[x]	-	<i>Parishia insignis</i> ...	-	x	-	-	-
-	-	-	-	x	[x]	-	<i>Semecarpus subpanduriformis</i>	-	x	-	-	-
-	-	-	-	x	x	x	<i>Semecarpus heterophyllus</i> ...	-	x	-	-	-
-	x	x	x	-	x	x	<i>Spondias mangifera</i> ...	-	x	-	-	-
-	-	-	x	x	x	x	<i>Gracontomelum mangiferum</i>	-	x	-	x	-

DISTRIBUTION IN S. E. ASIA.							NAMES OF SPECIES.	GENERAL DISTRIBUTION.					
Westn. Section.			Eastn. Section.					Africa.	S. E. Asia.	Australia.	Polynesia.	America.	
Ceylon.	India.	Himalaya.	S. China.	Indo-China.	Andamaus.	Malaya.							
x	x	x	x	x	x	x	Moringa pterygosperma	...	x	x	[x]	[x]	[x]
							Connarus gibbosus	...					
							Crotalaria sericea	...					
x	x	x	x	x	x	x	Desmodium umbellatum	...	x	x	x	x	x
x	x	x	x	x	x	x	Desmodium triquetrum	...	x	x			
							Desmodium laxiflorum	...					
x	x	x	x	x	x	x	Desmodium polycarpum	...	x	x	x	x	x
x	x	x	x	x	x	x	Desmodium triflorum	...	x	x	x	x	x
x	x	x	x	x	x	x	Alysicarpus vaginalis	...	x	x	x	x	x
p	p	p	p	p	p	p	Phaseolus sp. ...	...		x			
x	x	x	x	x	x	x	Abrus precatorius	...		x			
x	x	x		x	x	x	Abrus pulchellus	...		x			
x	x	x	x		x	x	Erythrina indica	...	[x]	x	x	x	
							Mucuna gigantea	...	[x]	x	x	x	
x	x	x	x	x	x	x	Mucuna pruriens	...		x	x	x	x
				[x]	[x]		Pueraria Candollei	...					
							Pueraria phaseoloides	...					
x	x						Canavalia obtusifolia	...		x			
							Vigna lutea ...	...		x			
							Pterocarpus indicus	...					
x	x	x	x	x	x	x	Derris scandens ...	...					
x							Derris sinuata ...	...					
x	x						Derris uliginosa ...	...					
x	x						Pongamia glabra	...	[x]				
x	x						Sophora tomentosa	...					
x	x			[x]			Mezonenron enneaphyllum	...					
x	x	x	x				Cæsalpinia Bonducella	...					
x	x						Cæsalpinia Nuga	...					
x	x	x	x				Tamarindus indica	...					
x	x			[x]			Cynometra ramiflora	...					
x	x	x	x				Entada scandens	...					
x	x	x	x				Adenanthera pavonina	...					
x	x	x	x				Acacia concinna	...					
x	x	x					Acacia pennata ...	...					
x	x	x	x				Albizzia Lebbek ...	...					
	x	x					Albizzia procera ...	...					
x	x						Rhizophora mucronata	...					
x	x						Rhizophora conjugata	...					
x	x						Cerriops Candolleana	...					
							Cerriops Roxburghiana	...					
x							Bruguiera gymnorrhiza	...	[x]				
							Terminalia Catappa	...					
				[x]			Terminalia bialata	...					
x	x						Lumnitzera racemosa	...					
				[x]			Illegera Conyzadenia	...					
	x						Gyrocarpus Jacquini	...					
x	[x]						Barringtonia speciosa	...	[x]				

DISTRIBUTION IN S. E. ASIA.							NAMES OF SPECIES.	GENERAL DISTRIBUTION.						
Westn. Section.			Eastn. Section.					Africa.	S. E. Asia.	Australia.	Polynesia.	America.		
Ceylon.	India.	Himalaya.	S. China.	Indo-China.	Andamans.	Malaya.								
							<i>Barringtonia racemosa</i>	...	x	x				
	x						<i>Memecylon edule</i>	...		x	x			
	x	x					<i>Pemphis acidula</i> ...	...	x	x	x			
							<i>Lagerstroemia hypoleuca</i>	...		x	x			
						[x]	<i>Lagerstroemia</i> sp.	...		x				
							<i>Modecca cordifolia</i>	...		x	x			
	x	x	x	x	x	x	<i>Carica Papaya</i> ...	...	x	x	x			
	x	x	x	x	x	x	<i>Trichosanthes palmata</i>	...		x	x	x		
	x	x		x	x	x	<i>Sesuvium Portulacastrum</i>	...	x	x	x	x		
							<i>Stephegyne diversifolia</i>	...		x	x			
		x					<i>Mussaenda calycina</i>	...		x				
							<i>Webera Kurzii</i> ...	...		x				
							<i>Randia longiflora</i>	...		x				
							<i>Diplospora singularis</i>	...		x				
	x	x					<i>Guettarda speciosa</i>	...	x					
							<i>Ixora grandiflora</i> var.	...						
							<i>Kurziana</i> ...	...		x				
							<i>Ixora brunnescens</i>	...		x				
							<i>Ixora cuneifolia</i> ...	...		x				
	x	x					<i>Pavetta indica</i> ...	...		x	x			
	x	x					<i>Morinda citrifolia</i> var.	...						
							<i>bracteata</i> ...	...		x				
						[x]	<i>Psychotria adenophylla</i>	...		x				
							<i>Paderia foetida</i> ...	...		x				
	x	x	x	x	x	x	<i>Vernonia cinerea</i>	...	x	x	x	x	x	x
	x	x	x	x	x	[x]	<i>Vernonia divergens</i>	...		x				
	x	x	x	x	x	x	<i>Adenostemma viscosum</i>	...	x	x	x	x	x	x
	x	x	x	x	x	x	<i>Ageratum conyzoides</i>	...	x	x	x	x	x	x
						[x]	<i>Blumea virens</i> ...	...		x				
							<i>Pluchea indica</i> ...	...		x				
	x	x					<i>Wedelia scandens</i>	...	x	x	x	x		
	x	x					<i>Scævola Koenigii</i>	...		x	x	x		
	x	x	x	x	x	x	<i>Ardisia humilis</i> ...	...		x				
	x	x					<i>Ægiceras majus</i> ...	...		x	x	x		
							<i>Mimusops littoralis</i>	...		x				
							<i>Diospyros Kurzii</i>	...		x				
	x	x	x	x	x	x	<i>Rauwolfia serpentina</i>	...						
	x	x					<i>Cerbera Odollam</i>	...	[x]	x				
	x	x					<i>Ochrosia borbonica</i>	...						
							<i>Tabernaemontana crispa</i>	...		x				
		x				[x]	<i>Strophanthus Wallichii</i>	...		x				
	x	x					<i>Anodendron paniculatum</i>	...		x				
	x	x	x				<i>Chonemorpha macrophylla</i>	...		x				
		[x]					<i>Sarcolobus globosus</i>	...		x				
							<i>Hoya parasitica</i> ...	...		x				
							<i>Hoya diversifolia</i>	...		x				
							<i>Dischidia nummularia</i>	...			x			

DISTRIBUTION IN S. E. ASIA.							NAMES OF SPECIES.	GENERAL DISTRIBUTION.					
Westn. Sectn.			Eastn. Sectn.					Africa.	S. E. Asia.	Australia.	Polynesia.	America.	
Ceylon.	India.	Himalaya.	S. China.	Indo-China.	Andamans.	Malaya.							
x	x	x		x	x	x	Limnanthemum indicum	...	x	x	x	x	
x	x			x	x	x	Cordia subcordata	...	x	x	x	x	
x	x		x	x	x	x	Tournefortia argentea	...	x	x	x	x	
x	x	x		x	x	x	Erycibe paniculata	...		x	x		
x	x			x	x	x	Argyrea tiliæfolia	...		x	x		
				x	x		Argyrea Hookeri	...		x			
				[x]	[x]		Argyrea lanceolata	...		x			
				x	x		Lettsomia penguensis	...		x			
x	x			x	x	x	Ipomæa grandiflora	...	x	x	x	x	
x	x	x		x	x	x	Ipomæa coccinea ...	...	x	x	x	x	x
x	x	x		x	x	x	Ipomæa Batatas ...	...	x	x	x	x	x
x	x			x	x	x	Ipomæa digitata ...	...	x	x	x	x	x
x				x	x	x	Ipomæa denticulata	...	[x]	x	x	x	
x	x	x		x	x	x	Ipomæa Turpethum	...	x	x	x	x	
x	x			x	x	x	Ipomæa biloba ..	...	x	x	x	x	x
x	x			x	x	x	Convolvulus parviflorus	...		x	x		
				[x]	x		Porana spectabilis	...		x	x		
x	x	x		x	x	x	Solanum Melongena	...	x	x		x	x
x	x	x		x	x	x	Physalis minima ...	...	x	x	x	x	x
x	x	x		x	x	x	Capsicum minimum	...		x	x		
x	x	x		x	x	x	Scoparia dulcis ..	...	x	x		x	x
x	x	x		x	x	x	Oroxylum indicum	...		x	x		
				x	x		Heterophragma adenophyl- lum ...	...		x			
				x	x	x	Thunbergia laurifolia	...		x			
x	x			x	x	x	Hygrophila quadrivalvis	...		x			
x				[x]	[x]		Strobilanthes phyllostachyus	...		x			
x				[x]	x		Eranthemum album	...		x			
					?		Eranthemum succifolium	...		x			
x	x	x		x	x	x	Rungia parviflora var. pec- tinata ...	...		x			
					x	x	Peristrophe acuminata	...		x	x		
x	x	x		x	x	x	Lippia nodiflora ...	...	x	x	x		x
x	x			x	x	x	Premna integrifolia	...		x			
							Premna sp. (? P. obtusifolia)...	...		x	?		
x	x	x		x	x	x	Vitex Negundo ...	...	x	x			
x	x			x	x	x	Vitex pubescens ...	...		x			
					x	?	Vitex Wimberleyi (? V. Suma- trana) ...	...		x			
x	x			x	x	x	Clerodendron inerme	...		x	x	x	
x	x			x	x	x	Avicennia officinalis	...	x	x	x		x
x	x	x		x	[x]	x	Anisomeles ovata	...		x			
x	x	x		x	x	x	Boerhaavia repens	...	x	x	x	x	
x	x			x	x	x	Pisonia aculeata ...	...	x	x	x		x
					x	x	Pisonia excelsa ...	...		x			
x	x	x		x	x	x	Celosia cristata ...	...	x	x			x
x	x	x		x	x	x	Achyranthes aspera	...	x	x	x	x	x

DISTRIBUTION IN S. E. ASIA.							NAMES OF SPECIES.	GENERAL DISTRIBUTION.				
Westn. Sectn.			Eastn. Sectn.					Africa.	S. E. Asia.	Australia.	Polynesia.	America.
Ceylon.	India.	Himalaya.	S. China.	Indo-China.	Andamans.	Malaya.						
x	x	-	-	x	x	x	<i>Achyranthes aspera</i> var. por- phyristachya ...	-	x	-	-	-
x	x	x	x	x	x	x	<i>Gomphrena globosa</i> ...	x	x	x	-	x
x	x	x	x	x	x	x	<i>Polygonum barbatum</i> ...	x	x	x	x	-
x	x	x	x	x	x	x	<i>Bragantia tomentosa</i> ...	x	x	x	-	-
x	x	x	x	x	x	x	<i>Aristolochia tagala</i> ...	-	x	-	-	-
x	-	-	-	[x]	x	x	<i>Piper caninum</i> ...	-	x	-	-	-
x	-	-	-	[x]	x	x	<i>Myristica Irya</i> ...	-	x	-	-	-
-	-	-	-	-	x	x	<i>Myristica glauca</i> ...	-	x	-	-	-
-	-	-	-	-	x	x	<i>Dehaasia Kurzii</i> ...	-	x	-	-	-
x	x	-	x	x	x	x	<i>Hernandia peltata</i> ...	[x]	x	x	x	-
x	x	x	x	x	x	x	<i>Cassytha filiformis</i> ...	x	x	x	x	x
x	x	x	-	x	x	x	<i>Loranthus longiflorus</i> ...	-	x	-	-	-
-	-	-	-	[x]	x	x	<i>Champereia Griffithiana</i> ...	-	x	-	-	-
x	x	-	x	x	x	x	<i>Euphorbia Atoto</i> ...	-	x	x	x	-
x	x	x	x	x	x	x	<i>Euphorbia pilulifera</i> ...	x	x	x	x	-
-	-	-	-	-	x	x	<i>Bridelia Kurzii</i> ...	-	x	-	-	-
x	x	x	x	x	x	x	<i>Bridelia tomentosa</i> ...	-	x	x	-	-
x	x	x	x	[x]	[x]	x	<i>Phyllanthus columnaris</i> ...	-	x	-	-	-
-	-	-	-	-	x	x	<i>Flueggia microcarpa</i> ...	x	x	x	x	-
-	-	-	-	-	[x]	-	<i>Cyclostemon assamicus</i> ...	-	x	-	-	-
-	-	-	-	-	x	-	<i>Aporosa villosula</i> ...	-	x	-	-	-
-	-	-	-	[x]	x	-	<i>Croton sublyratus</i> ...	-	x	-	-	-
-	-	-	-	-	x	-	<i>Blachia andamanica</i> ...	-	x	-	-	-
-	-	-	-	-	x	-	<i>Claoxylon longifolium</i> ...	-	x	-	-	-
-	-	-	-	[x]	x	x	<i>Mallotus acuminatus</i> ...	-	x	-	-	-
-	-	-	-	-	x	-	<i>Mallotus andamanicus</i> ...	-	x	-	-	-
-	-	-	-	-	x	x	<i>Macaranga Tanarius</i> ...	-	x	-	-	-
-	-	-	-	-	x	x	<i>Cnesmone javanica</i> ...	-	x	-	-	-
x	x	-	-	-	x	x	<i>Phyllochlamys spinosa</i> ...	-	x	-	-	-
-	-	-	-	[x]	x	x	<i>Plecosperrum andamanicum</i> ...	-	x	-	-	-
-	x	x	-	-	x	x	<i>Ficus Benjamina</i> ...	-	x	x	-	-
-	x	x	-	-	x	x	<i>Ficus Rumphii</i> ...	-	x	-	-	-
x	x	x	x	x	x	x	<i>Ficus retusa</i> var. nitida ...	-	x	x	-	-
-	-	-	-	-	x	x	<i>Ficus brevicuspis</i> ...	-	x	-	-	-
x	x	-	-	-	x	x	<i>Ficus callosa</i> ...	-	x	-	-	-
x	x	x	x	x	x	x	<i>Ficus hispida</i> ...	-	x	x	-	-
-	-	-	-	[x]	[x]	-	<i>Ficus grisea</i> ...	-	x	-	-	-
x	x	-	-	-	x	x	<i>Antiaris toxicaria</i> ...	-	x	-	-	-
-	-	-	-	-	x	x	<i>Artocarpus Gomeziana</i> ...	-	x	-	-	-
-	-	-	-	[x]	x	x	<i>Cycas Rumphii</i> ...	-	x	x	-	-
-	-	-	-	-	x	x	<i>Dendrobium secundum</i> ...	-	x	-	-	-
x	x	-	-	-	x	x	<i>Calanthe veratrifolia</i> ...	-	x	x	-	-
x	x	x	-	-	[x]	-	<i>Dorites Wightii</i> ...	-	x	-	-	-
-	x	x	-	[x]	[x]	-	<i>Ærides multiflorum</i> ...	-	x	-	-	-
x	x	x	-	-	x	x	<i>Pholidota imbricata</i> ...	-	x	-	-	-
x	x	x	x	x	x	x	<i>Costus speciosus</i> ...	-	x	-	-	-

DISTRIBUTION IN S. E. ASIA.						NAMES OF SPECIES.	GENERAL DISTRIBUTION.				
Westn. Sectn.			Eastn. Sectn.				Africa.	S. E. Asia.	Australia.	Polynesia.	America.
Ceylon.	India.	Himalaya.	S. China.	Tudo-China.	Andamans.						
					[x]	Zingiber sp. ...					
x	x	x	x	x	x	Musa sapientum ...		x	x	x	x
x	x	x	x	x	x	Crinum asiaticum ...		x	x	x	x
x	x	x	x	x	x	Tacca pinnatifida ...		x	x	x	x
x	x	x	x	x	x	Dioscorea glabra ...		x	x	x	x
x	x	x	x	x	x	Dioscorea pentaphylla ...		x	x	x	x
x	x	x	x	x	x	Smilax macrophylla ...		x	x	x	x
x	x	x	x	x	x	Asparagus racemosus ...		x	x	x	x
x	x	x	x	x	x	Dracæna angustifolia ...		x	x	x	x
x	x	x	x	x	x	Dracæna spicata ...		x	x	x	x
x	x	x	x	x	x	Gloriosa superba ...		x	x	x	x
x	x	x	x	x	x	Polia zorzogonensis ...		x	x	x	x
x	x	x	x	x	x	Commelina obliqua ...		x	x	x	x
x	x	x	x	x	x	Aneilema ovatum ...		x	x	x	x
x	x	x	x	x	x	Flagellaria indica ...		x	x	x	x
x	x	x	x	x	x	Caryota sobolifera ...		x	x	x	x
x	x	x	x	x	x	Corypha elata ...		x	x	x	x
x	x	x	x	x	[x]	Livistona sp. ...		x	x	x	x
x	x	x	x	x	x	Calamus tigrinus ...		x	x	x	x
x	x	x	x	x	x	Calamus andamanicus ...		x	x	x	x
x	x	x	x	x	x	Cocos nucifera ...		x	x	x	x
x	x	x	x	x	x	Pandanus odoratissimus ...	[x]	x	x	x	x
x	x	x	x	x	[x]	Amorphophallus sp. ...		x	x	x	x
x	x	x	x	x	x	Alocasia fornicata ...		x	x	x	x
x	x	x	x	x	x	Scindapsus officinalis ...		x	x	x	x
x	x	x	x	x	x	Pothos scandens ...		x	x	x	x
x	x	x	x	x	x	Cymodocea ciliata ...		x	x	x	x
x	x	x	x	x	x	Zanichellia palustris ...		x	x	x	x
x	x	x	x	x	x	Cyperus polystachyus ...		x	x	x	x
x	x	x	x	x	x	Cyperus elegans ...		x	x	x	x
x	x	x	x	x	x	Cyperus dilutus ...		x	x	x	x
x	x	x	x	x	x	Cyperus pennatus ...	[x]	x	x	x	x
x	x	x	x	x	x	Kyllinga brevifolia ...		x	x	x	x
x	x	x	x	x	x	Fimbristylis diphylla ...		x	x	x	x
x	x	x	x	x	x	Fimbristylis ferruginea ...		x	x	x	x
x	x	x	x	x	x	Fimbristylis quinqueangularis ...		x	x	x	x
x	x	x	x	x	x	Fimbristylis miliacea ...		x	x	x	x
x	x	x	x	x	[x]	Scirpus subulatus ...		x	x	x	x
x	x	x	x	x	x	Paspalum scrobiculatum ...		x	x	x	x
x	x	x	x	x	x	Panicum ciliare ...		x	x	x	x
x	x	x	x	x	x	Panicum colonum ...		x	x	x	x
x	x	x	x	x	x	Panicum Helopus ...		x	x	x	x
x	x	x	x	x	x	Panicum javanicum ...		x	x	x	x
x	x	x	x	x	x	Panicum Myurus ...		x	x	x	x
x	x	x	x	x	x	Panicum montanum ...		x	x	x	x
x	x	x	x	x	x	Oplismenus compositus ...		x	x	x	x
x	x	x	x	x	x	Thuarea sarmentosa ...	[x]	x	x	x	x

DISTRIBUTION IN S. E. ASIA.							NAMES OF SPECIES.	GENERAL DISTRIBUTION.					
Westn. Sectn.			Eastn. Sectn.					Africa.	S. E. Asia.	Australia.	Polynesia.	America.	
Ceylon.	India.	Himalaya.	S. China.	Indo-China.	Andamans.	Malava.							
x		x		x	x	x	Ischæmum ciliare	...		x	x		
x		x		x	x	x	Ischæmum muticum	...		x	x	x	
x	x	x	x	x	x	x	Andropogon contortus	...	x	x	x	x	x
x	x	x	x	x	x	x	Eleusine indica ...	...	x	x	x	x	x
x	x	x	x	x	x	x	Eleusine ægyptiaca	...	x	x	x	x	x
			x		[x]		Dendrocalamus strictus	...					
x	x	x			x	x	Davallia solida ...	...		x	x	x	
x	x	x	x	x	x	x	Adiantum lunulatum	...	x	x	x	x	x
x	x	x	x	x	x	x	Ceratopteris thalictroides	...	x	x	x	x	x
x	x	x	x	x	x	x	Polypodium irioides	...	x	x	x	x	x
x	x	x	x	x	x	x	Polypodium adnascens	...	x	x	x	x	
x	x	x	x	x	x	x	Polypodium quercifolium	...		x	x	x	x
x	x	x	x	x	x	x	Vittaria elongata ...	...	x	x	x	x	
x	x	x	x	x	x	x	Acrostichum scandens	...		x	x	x	
x	x	x	x	x	x	x	Acrostichum appendiculatum	...		x	x		
x	x	x	x	x	x	x	Lygodium flexuosum	...	x	x	x		
x	x	x	x	x	x	x	Chara fœtida ...	...		x			
x							Calymperes Dozyanum	...		x		x	
x	x	x	x	x	x	x	Bryum coronatum	...	x	x	x	x	x
							Lejennia sp. ...	...		x			
x	x	x	x	x	x	x	Collema nigrescens	...	x	x	x	x	x
x	x	x	x	x	x	x	Physcia obscura ?	...	x	x	x	x	x
							Physcia sp. ...	...		x			
							Lepraria sp. ...	...		x			
							Lentinus leucochrous	...		x			
x	x	x		x	x	x	Lenzites deplanata	...		x			
x	x			x	x	x	Lenzites subferruginea	...		x			
							Polyporus fulvus ...	...		x			
x	x	x	x	x	x	x	Polyporus xanthopus	...	x	x	x	x	x
x	x	x	x	x	x	x	Polyporus sanguineus	...	x	x	x	x	x
x	x	x	x	x	x	x	Polyporus grammatocephalus	...		x	x	x	x
x	x	x	x	x	x	x	Polyporus australis	...	x	x	x	x	x
x							Hexagona pergamenea	...		x			
					[x]		Hexagona sericeo-hirsuta	...		x			x
							Hexagona tennis ...	...	x	x			
	x						Dedælea flabellum	...		x			
	x						Dedælea sanguinea	...		x			
x	x	x		x	x	x	Dedælea quercina	...	x	x	x	x	x
x	x	x	x	x	x	x	Dedælea concentrica	...	x	x	x	x	x
x	x	x	x	x	x	x	Thelephora incrustans	...	x	x	x	x	x
x	x	x	x	x	x	x	Bovista lilacina ...	...	x	x	x	x	x
x	x						Hirneola polytricha	...	x	x			x
					[x]		Xylaria clavarioides	...					
					[x]		Daldinia vernicosa	...		x			x
							Rhytisma sp. ...	...		x			
x	x			x	x	x	Sargassum ilicifolium	...	x	x		x	x
					x	x	Turbinaria ornata	...		x			

DISTRIBUTION IN S. E. ASIA.								NAMES OF SPECIES.	GENERAL DISTRIBUTION.				
Westn. Sectn.				Eastn. Sectn.					Africa.	S. E. Asia.	Australia.	Polynesia.	America.
Ceylon.	India.	Himalaya.	S. China.	Indo-China.	Andamans.	Malaya.							
x	x	-	-	x	x	x	Padina pavonia ...	...	x	x	x	x	x
-	-	-	-	-	x	x	Dictyota dichotoma	...	x	x	x	x	x
x	x	-	x	x	x	x	Lithothamnion polymorphum	...	x	x	x	-	-
x	x	-	x	x	x	x	Acanthophora Thierii	...	x	x	x	x	x
-	-	-	-	-	x	x	Jania tenella ...	...	-	x	-	-	-
-	-	-	-	-	x	x	Gracilaria crassa ...	...	-	x	-	-	-
x	-	-	-	-	x	x	Gelidium corneum	...	x	x	x	x	x
x	x	-	-	x	x	x	Caulerpa clavifera	...	x	x	x	x	x
-	-	-	-	-	x	x	Caulerpa plumaris	...	-	x	-	-	-
x	x	-	-	x	x	x	Valonia fastigiata	...	x	x	x	x	x
x	x	-	-	x	x	x	Valonia confervoides	...	x	x	x	-	-
x	x	-	-	x	x	x	Halimeda Opuntia	...	x	x	x	x	x
-	-	-	-	-	x	x	Siphonocladus ? filiformis	...	x	x	x	-	-
-	-	-	-	-	[x]	-	Vaucheria sp.	...	-	x	-	-	-
x	x	-	-	-	x	x	Calothrix pulvinata	...	x	x	x	x	x

Reviewing the general distribution of the flora as given in TABLE VI, we find that of the 358 species, 70 are cosmopolitan in the tropics, 10 more are nearly so, 49 are more or less widely spread throughout the tropics of the old world, 41 extend from South-eastern Asia to Australasia, while 188 species are confined to South-eastern Asia. The sub-joined synoptic table indicates these distributional features more exactly and gives at the same time the relationship of this distribution both to the habit and to the habitat of the species.

TABLE VII. *Relationship of General Distribution to Habit and Habitat.*

HABIT.				DISTRIBUTIONAL FEATURES.	HABITAT.									
TOTAL.	Climbers.	Trees.	Herbs.		Cultivated sp.	Weeds.	Forest sp.	Marsh.	Littoral.	Marine.	Epiphytic.	Parasitic or Saprophytic.	TOTAL.	
70	14	5	2	49	<i>Cosmopolitan in the tropics.</i> America, Africa, Asia, Australia, Polynesia ... ..	12	16	6	6	12	8	2	8	70
					<i>In tropics of both Hemispheres, but hardly cosmopolitan.</i>									
3	1	1	...	1	America, Africa, Asia, Australia ... ..	...	...	...	...	2	...	...	1	3
2	...	...	...	2	America, Africa, Asia, Polynesia ... ..	...	...	...	...	...	1	...	1	2
3	1	1	...	1	America, Africa, Asia ... ..	...	...	2	...	...	...	...	1	3
2	...	...	...	2	America, Asia ... ..	...	...	...	...	...	...	...	2	2
					<i>Widely distributed in Eastern Hemispheres; not in America.</i>									
29	7	13	4	5	Africa, Asia, Australia, Polynesia ... ..	...	...	2	...	26	...	1	...	29
12	1	3	3	5	Africa, Asia, Australia ... ..	...	...	3	3	5	1	...	...	12
2	...	1	...	1	Africa, Asia, Polynesia ... ..	...	...	...	...	1	...	1	...	2
6	1	1	2	2	Africa, Asia ... ..	...	...	2	1	2	1	...	...	6
					<i>Confined to Asia and Australasia.</i>									
15	2	2	3	8	Asia, Australia, Polynesia ... ..	...	...	...	...	10	1	3	1	15
23	8	7	6	2	Asia, Australia ... ..	...	...	16	...	6	...	1	...	23
3	...	1	...	2	Asia, Polynesia ... ..	...	...	2	...	...	...	1	...	3
188	43	59	23	58	South-Eastern Asia only ... ..	...	3	2	129	4	16	7	12	15
358	78	94	48	138	TOTALS	15	18	162	14	80	19	21	29	358

In discussing the phytogeographic distribution of these species within the province of South-Eastern Asia it is necessary to distinguish between the districts forming the Western section, *viz.*:—the lower Himalayan slopes with the plains at their foot, Peninsular India, and Ceylon—from the Eastern section, which comprises Southern China, Indo-China, Malaya, including the Philippines, New Guinea, and the coasts of Northern or Tropical Australia. Of the 358 species in the Coco Islands, which therefore necessarily all occur in the Eastern section, 252 species, or 70 per cent., are found in the Western section as well. Of the whole number 153 species, or 43 per cent., extend to Australia, whereas only 140, or 39 per cent., are known to occur in South China.

The following tables indicate the distribution of the species so far as these three portions of S. E. Asia are concerned.

TABLE VIII. *Distribution in S. E. Asia of the species extending from the Coco-group to Cis-gangetic India.*

In all three Cis-gangetic districts ( <i>Himalaya, India, Ceylon</i> ):—	134
In China, Indo-China, Malaya, Australia	72
In Indo-China, Malaya, Australia	9
In China, Indo-China, Malaya	26
In Indo-China, Malaya	24
In China, Indo-China, <i>Andamans</i>	1
In Indo-China, <i>Andamans</i>	2
<hr/>	
In <i>Himalaya</i> and <i>India</i> :	14
In Indo-China, Malaya, Australia	1
In China, Indo-China, Malaya	1
In Indo-China, Malaya	7
In China, Indo-China, <i>Andamans</i>	1
In Indo-China, <i>Andamans</i>	3
In <i>Andamans</i>	1
<hr/>	
In <i>India</i> and <i>Ceylon</i> :—	76
In China, Indo-China, Malaya, Australia	33
In Indo-China, Malaya, Australia	21
In Indo-China, Malaya	15
In Indo-China, <i>Andamans</i>	1
In <i>Andamans</i> , Malaya, Australia	3
In <i>Andamans</i> , Malaya	3
<hr/>	
In <i>Himalaya</i> :—	5
In China, Indo-China, Malaya	1
In Indo-China, Malaya	2
In Indo-China, <i>Andamans</i>	2
<hr/>	
In <i>India</i> :—	13
In Indo-China, Malaya, Australia	1
In China, Indo-China, Malaya	1
In Indo-China, Malaya	3
In Indo-China, <i>Andamans</i>	3
In <i>Andamans</i> , Malaya, Australia	2
In <i>Andamans</i>	3
<hr/>	
In <i>Ceylon</i> :—	10
In Indo-China, Malaya, Australia	1
In Indo, China, Malaya	6
In <i>Andamans</i> , Malaya	2
In <i>Andamans</i>	1
<hr/>	
Total number of species extending from the Coco Group to Cis-gangetic India	252

TABLE IX. *Distribution in S. E. Asia of the species extending from the Coco Group to China.*

Extending as far as <i>Australia</i> :—	106
In Indo-China, Malaya, Australia; <i>Himalaya, India, Ceylon</i>	72
In Indo-China, Malaya, Australia; <i>India, Ceylon</i>	33
In Indo-China, Malaya, Australia	1
<hr/>	
Extending as far as <i>Malaya</i> :—	31
In Indo-China, Malaya; <i>Himalaya, India, Ceylon</i>	26
In Indo-China, Malaya; <i>Himalaya, India</i>	1
In Indo-China, Malaya; <i>Himalaya</i>	1
In Indo-China, Malaya	3

Extending as far as the <i>Andamans</i> only:—	8
In Indo-China, Andamans; <i>Himalaya, India, Ceylon</i> .....	1
In Indo-China, Andamans; <i>Himalaya, India</i> .....	1
In Indo-China, Andamans; <i>India</i> .....	1
<hr/>	
Total number of species extending from the Coco Group to China ...	140

TABLE X. *Distribution in S. E. Asia of the species extending from the Coco Group to Australia.*

Extending as far as <i>China</i> :—	106
To Malaya, Indo-China, China; <i>Himalaya, India, Ceylon</i> .....	72
To Malaya, Indo-China, China; <i>India, Ceylon</i> .....	33
To Malaya, Indo-China, China .....	1
<hr/>	
Extending as far as <i>Indo-China</i> :—	38
To Malaya, Indo-China; <i>Himalaya, India, Ceylon</i> .....	9
To Malaya, Indo-China; <i>Himalaya, India</i> .....	1
To Malaya, Indo-China; <i>India, Ceylon</i> .....	21
To Malaya, Indo-China; <i>India</i> .....	1
To Malaya, Indo-China; <i>Ceylon</i> .....	2
To Malaya, Indo-China .....	4
<hr/>	
Extending as far as the <i>Coco Group (Andamans)</i> only:—	9
To Malaya, Andamans; <i>Ceylon, India</i> .....	3
To Malaya, Andamans; <i>Ceylon</i> .....	1
To Malaya, Andamans; <i>India</i> .....	2
To Malaya, Andamans .....	3
<hr/>	
Total number of species extending from the Coco Group to Australia ...	153

The analysis of these species thus shows that the figures do not indicate any special connection either with China, with India, or with Australia; many of the species in these tables are cosmopolitan or nearly so, and thus possess no special phytogeographical interest. The number of species that extend from India, Ceylon or the Himalaya to the Andamans and no further, is only 23, or  $6\frac{1}{2}$  per cent. of the whole flora; this figure, therefore, more nearly represents what may be considered the peculiarly Indian element in the Flora of the Andamans. There are only three species that extend from South China to the Andamans and no further southwards, and as all three are found in India and may as readily be extensions from India to China as from China to India we may assert that there is no distinctive Chinese feature in the flora at all. Only 9 species extend upwards from Australia as far as the Andamans, but not as far as Indo-China; but all these are characteristic Malayan species and may just as well be considered extensions from Malaya to Australia as from Australia through Malaya to the Coco Islands. The occurrence of as many as 10 of the species in Ceylon and not in India would seem at first to indicate that there is some foundation for a remark by Mr. Kurz, already alluded to in connection with the vegetation of Diamond Island (*J. A. S. B.* lix, pt. 2, p. 290), concerning the presence of a Ceylon

element in the Andamans flora. But a consideration of that section of TABLE VIII in which they are detailed shows that they afford little corroboration of this hypothesis for there is only one species (*Dedoëlea flabel-lum*) restricted to the Andamans and Ceylon, and as this is a *Cryptogam*, too great a reliance ought not to be placed on the fact; Indian *Cryptogams*, other than ferns, have not as yet been assiduously collected and the occurrence here of this Ceylon species perhaps indicates rather a wide dispersion for it than any peculiar affinity of the flora of the group with that of Ceylon.

The general conclusion to which we are led by the evidence these tables afford is, that the flora of the Coco Group is almost purely Trans-gangetic, and that while this is the case there is no appreciable Chinese or Australian element present. We have still to ascertain whether it is an Indo-Chinese or a Malayan element that prevails in the flora, and to what extent any independent element exists.

From their geographical position we have to look upon the Coco Islands as part of the Andaman Group: in one sense therefore all the Coco Island species are Andamanese. But there are as many as 30 of the species in the list,\* or about 8 per cent. of the flora, whose presence in the Andamans is due only to their having been found in the Coco Group. At the same time, however, it must be remembered that 19 species, or over 5 per cent. of the flora, are peculiar to the Andamans as a whole, not occurring either in Indo-China or in Malaya, while 24 more are only known as Indo-Chinese from their presence in Tenasserim.† Of these 24 Andamans-Tenasserim species, 22, or 6 per cent. of the flora, are confined to these two districts, only two of them extending even as far as the Malay Peninsula. The bearing of this peculiar distribution in the Andamans and in Tenasserim, but neither northward to Indo-China nor southward to Malaya, the writer has already had occasion to note;‡ it will be referred to again below in connection with the probable origin of the Coco Island flora. Another circumstance that must be borne in mind is that as yet very little is known of the flora of North Andaman, and it is not improbable that some of the 30 *Non-Andaman* Coco species will yet be found to occur in that island.§

\* Indicated in the list of distribution by [] brackets in the Andamans column.

† Indicated by [] brackets in the Indo-Chinese column.

‡ *Ann. Roy. Bot. Garden*, vol. iii, p. 238.

§ As an example of this possibility may be instanced *Dendrocalamus Strictus* which does not occur in South Andaman. Mr. Godwin-Austen, formerly of Port Blair, one of the very few officers who have ascended Saddle Peak, the highest point of North Andaman, has informed the writer that at one point in the ascent a Bamboo is met with quite different from the Bamboos near Port Blair; not very

Of the 358 species, 232, making 65 per cent. of the whole, occur at once in Indo-China, Malaya and the Andamans; 40 occur in Malaya and the Andamans, 8 of these extending to Tenasserim but not occurring in Burma or Siam (Indo-China proper); 22 occur in Indo-China but not in Malaya, 12 of them being present in the Andamans also; 40 occur in the Andamans without appearing either in Indo-China or in Malaya, though 8 of these appear in Tenasserim, which connects Indo-China with the Malay Peninsula, just as the Andamans connect Indo-China with the Malay Archipelago; 8 occur only in the Coco Islands and Tenasserim, and 13 are apparently confined to the Coco group. This last number is probably too high; some of these species, as well as some of those others for which the Coco locality is as yet the only record from the Andamans, may occur in North Andaman.

The following table gives the distribution of the species in these three districts as well as in the sub-district of Tenasserim:—

TABLE XII. *Distribution of Coco Island species in the Indo-Chinese and Malayan districts.*

A.			
Species extending from Coco Group to:—			
Indo-China, Tenasserim, Andamans, Malaya, ...	...	...	232
Indo-China, Tenasserim, —————, Malaya, ...	...	...	2
—————, Tenasserim, Andamans, Malaya, ...	...	...	8
—————, Tenasserim, —————, Malaya, ...	...	...	1
—————, —————, Andamans, Malaya, ...	...	...	32
Indo-China, —————, Andamans, —————, ...	...	...	12
—————, Tenasserim, Andamans, —————, ...	...	...	8
Indo-China, —————, —————, —————, ...	...	...	10
—————, Tenasserim, —————, —————, ...	...	...	8
—————, —————, Andamans, —————, ...	...	...	32
Total species extending from Coco Group			345
Species confined to Coco Group	...	...	13
Total Coco Island species			358

B.				No. of species.	percentage of flora.
Species occurring in:—					
Indo-China	...	...	256	71	
Tenasserim	...	...	259	72	
Andamans	...	...	324	90	
Malaya	...	...	275	76	
Species confined to Coco Group	...	...	13	3½	

This table therefore leads to the conclusion that phytogeographically

tall, but extremely hard and tough, and forming dense thickets very difficult to pass through—a general description agreeing very well with that of *Dendrocalamus strictus* as it occurs in Great Coco.

as well as physiographically the Cocos Group forms an integral part of the Andamans. Further, it shows that of the possibly predominating elements in their flora, the Indo-Chinese element, as a whole, is slightly weaker even in that part of the Andamans nearest to Burma than is an element indicating a Tenasserim influence and an element indicating a Malayan influence. This seems strange when we recollect that not only do the Cocos form that part of the Andamans nearest to Burma but that there is a shallow ridge, at times raised into islands, along the line between the Cocos and the nearest point on the Burmese mainland, whereas Tenasserim is at the opposite side of a deep sea, while Malaya is separated from the opposite extremity of the Andaman group by a much greater distance and by much deeper straits than Burma is from the area under discussion.

In order, if possible, to account for this peculiarity of distribution, it becomes necessary to discuss the probable origin of the flora of the group.

The first step in such an inquiry is to ascertain the species in a flora that *may* possibly have been introduced and that do not therefore *necessarily* postulate for an isolated locality such as the Cocos any former connection with neighbouring land. It is, of course, evident that if a previous land connection be shewn to be necessary to explain the presence of *any* species in the islands this same land connection would sufficiently explain the presence of most of the species that occur there without requiring the suggestion of any extraneous means of introduction. But until all the possibilities of introduction by means of physical agencies now at work under existing physiographical conditions are completely exhausted, we are not at liberty to assume the existence of dissimilar physiographical conditions or a different application of the present physical agencies.

There is, however, always great difficulty in deciding absolutely what species are indigenous and what species are introduced in any locality, and here no species will be considered "indigenous" for which it is possible to suggest in the remotest fashion any means of introduction. At the risk therefore of including among introduced species many that are probably quite entitled to be termed indigenous, the possibilities are discussed under the headings of the various active introducing agencies. As this involves a use of the terms "indigenous" and "introduced" somewhat different from the sense in which they are generally accepted, it seems better that the possibly introduced species be spoken of as "migrant"; and the certainly indigenous residuary species termed "remanent," many of the "migrant" species being doubtless perfectly "indigenous" in the generally received sense.

Even within the group of "migrant" species difficulties often arise owing to certain species being assisted in one way from island to island

over intervening seas and in another way along continuous land. As an example may be mentioned *Gyrocarpus Jacquini*, whose progress from island to island is clearly a sea-assisted process, yet whose dispersal inland when it is once established is greatly aided by wind because of its curious dipteroid fruit. It might even be suggested that the wings of this fruit may be sufficient to account for its transmission across intervening seas; but no one who has carefully observed the fall of its fruits is likely to consider this possible. Another very pertinent instance is *Terminalia Catappa*, a species distributed by ocean currents over all the coasts of the Andaman Sea, but which nevertheless occurs far inland as well as on the beaches. The explanation of its inland dispersal is extremely simple, for rats and frugivorous bats are extremely fond of the fleshy part of its fruits while they leave uninjured the stone and kernel. Both these animals are apt when disturbed while eating to carry off in their mouths the fruit they may be devouring, ultimately dropping it some distance from the place where the parent tree grew. But though bats occur in far off lonely islands like Batti Malv and Barren Island, and though their presence there indicates the possibility that animals of the kind may, like fruit-eating birds, carry undigested seeds from one island to another, it is clear, since they do not swallow the stones of *Terminalia Catappa* that they are not to be held responsible for the passage of that species across intervening seas. The farther spread of these species within new localities by agencies quite distinct from that necessary to account for their initial appearance is, it will be admitted, amply demonstrated.\* Other examples are *Pisonia aculeata* and *excelsa* which are perhaps introduced by the sea along these coasts. If they are, however, it is quite certain that their presence inland may be amply accounted for owing to their sticky fruits having become attached to birds or animals that have come in contact with them.†

\* Residents in India are familiar with the treatment of "country-almonds" by the large "flying-foxes;" fruits carried off by them, and with a portion bitten out of the fleshy side, may be constantly found dropped at considerable distances from the trees on which the almonds grew. In Barren Island there is no doubt that the frugivorous bats which exist there are partly responsible for the same thing, and the writer had an opportunity of witnessing the rats, which abound on that island, engaged in the same act, these creatures having come down to the shore for the fruits that are common there and when disturbed scampering off up gullies with fruits in their mouths.

† A striking instance of the possibility of their becoming attached to the bodies of passing animals was witnessed by the writer on a path between Rangachang and Ali Mnsjid in South Andaman in April 1891. Though some miles from the sea a considerable number of *Pisonia excelsa* trees occurred at the place, and the path was strewn with their fruits. A tree-snake was seen which had become entangled in a fallen panicle of these so that all escape was impossible, its every movement in-

And in addition to these instances it may be remarked that the whole group of species which may possibly have been introduced in the crops of grain-eating birds can be only considered as indirectly bird-introduced, since some accident must have happened to account for the death of the introducing bird in order to explain the germination of the seed and final introduction of the plant.

The "migrant" species, meaning thereby all that have certainly been introduced and all for which introduction is conceivable, may be divided into "civilized" species introduced by man, and "sylvestrian" or wild species. The wild species may be divided into "coast" species, further subdivided into "marine" and "littoral" species, the whole of the coast species being sea-introduced; and into "inland" species. These latter, which may of course also occur on the shore, but for the introduction of which the sea has not been responsible, may best be classed as "wind-introduced" and as "bird-introduced" species. Species introduced by birds may have been introduced either attached to the bodies of these or carried in their crops. These different groups will be discussed in detail; last of all the "remanent" species will be considered.

The "civilized" species comprise cultivated plants and weeds of cultivation or of waste places; the former corresponding practically to domestic animals like the cow or horse, and to domestic insects like the bee or silk-worm, the latter to the vermin that associate themselves with, or accompany man and his domestic creatures. This group therefore contains the species that may, directly as economic or æsthetic plants, or indirectly as weeds, have been introduced by man. The list subjoined includes the whole of the species present in the islands that are known to be sometimes thus introduced; those that are likely to be here indigenous, or to have been introduced by other than human agency, are enclosed within brackets and will be found again in one or, at times, more than one of the subsequent lists.

*List of Civilized species found in the Coco Group.*

\* *Nymphæa rubra.*

This variety has perhaps been introduced intentionally into Great Coco, where it occurs in the small lake. It has to be recollected that it is a favourite flower with the Burmese and is sold for votive purposes in the Pagodas

volving it more hopelessly in the tangled sticky mass. After the snake died its body was carefully examined and it was found that it had suffered no previous physical injury which could account for its inability to escape.

- about Rangoon; also that the settlement was attempted by a Rangoon gentleman whose servants were, at least partly, Burmese. But typical white *Nymphæa Lotus* occurs in Little Coco, clearly independently of human agency.
- Sida carpinifolia.* Table Island (the older clearing) only.  
 [ *Urena lobata.* As a rule this species would, without hesitation, be dealt with as a weed; in Great Coco, however, it does not occur in the clearing and it was not found on Table Island at all. If introduced here, we may safely say that human agency is not responsible for its appearance; more probably it has been introduced by the agency of birds].
- \* *Hibiscus Sabdariffa.* Great Coco; in the old garden and evidently struggling against extinction.
5. \* *Hibiscus Abelmoschus.* Table Island only; but common in many parts of the clearing.
- \* *Moringa pterygosperma.* Great Coco; a few trees evidently planted; these are very healthy, and seedlings are already springing up under the adjacent Coco-nut trees.
- \* *Crotalaria sericea.* Table Island only; but very abundant; the species may have been unintentionally introduced, but more probably has been brought by the servants at the light-house, who are Burmans and with whom the flower is a favourite.
- \* *Desmodium triflorum.* Table Island only; common however on all the grassy slopes.
- \* *Alysicarpus vaginalis.* Great Coco; not seen on Table Island, though it probably occurs there.
10. \* *Phaseolus sp.* Seedlings in cow-dung on one grassy slope at south-west corner of island. These were seen in 1890; no species was seen in 1889 likely to have given origin to these and there is no indigenous species to which it seems likely they could belong. Unfortunately

- neither clearing could be revisited in 1890 to enable the writer to make further investigation.
- \* *Tamarindus indica.* Great Coco; only one tree and that, though almost certainly introduced by man probably unintentionally so.
- \* *Carica Papaya.* Great Coco; perfectly naturalised and very profuse in the Coco-nut zone, especially in the north end of the island.
- [*Vernonia cinerea.* Both islands; extremely abundant in the clearings, but also plentiful on grassy slopes and bare rocky headlands of the western coast of Great Coco; it also occurs on Rutland Island, at the opposite extremity of the Andaman group, where introduction by man is hardly conceivable: here probably it owes its presence to the agency of wind.]
- [*Adenostemma viscosum.* Great Coco; common on bare rocky promontories on west side and at north end of island. If introduced here it has been introduced independently of human agency; it is probably a sea-introduced species, but perhaps its fruits *may* have come attached to the feathers of birds.]
15. \* *Ageratum conyzoides.* Table Island; common in the clearing; not present in Great Coco.
- \* *Ipomæa coccinea.* Table Island; a garden escape, but very plentiful on the edges of jungle-paths far from the lighthouse garden.
- \* *Ipomæa Batatas.* Table Island; cultivated only: has not survived on Great Coco, probably owing to the presence of wild pigs. These the writer did not see on Great Coco but their traces were abundant on Table Island and the pigs themselves were obtained on Little Coco. Moreover, Mr. Hume (*Stray Feathers*, ii, p. 111) actually met with them on Great Coco. During our visits 5 or 6 abandoned pariah dogs were seen

- on the island ; but, though these must necessarily have rendered the pigs shy, it can hardly be supposed that they have exterminated them.
- \* *Solanum Melongena.* Table Island ; cultivated. Great Coco ; in the old garden and also plentiful all over the clearing ; apparently quite naturalised.
- \* *Capsicum minimum.* Table Island ; cultivated, and as an escape. Great Coco ; very plentiful and spreading far into the jungle.
20. \* *Scoparia dulcis.* Both islands ; common in the clearings.
- \* *Rungia pectinata.* Table Island ; only in the clearing ; not plentiful and as it is not met with in Great Coco is probably here, as it often is, an introduced weed. But it need not always be so since the species is abundant on bare rocky promontories at the south end of Rutland Island where introduction by human agency is not to be thought of.
- [*Anisomeles ovata.* Great Coco ; this species is not present on Table Island apparently, and on Great Coco it was only found on the isthmus connecting the north-eastern peninsula—where the clearing is—with the main island. But the species does not occur *in* the clearing, and it is remarkably abundant where it occurs. Moreover it is exceedingly abundant in Diamond Island, off the Arracan Coast, which is another section of the same island chain ; the writer is therefore inclined to believe that the species does not owe its introduction to human agency but that it may be classed among the remanent species.]
- [*Boerhaavia repens.* In all three islands, common on rocky promontories and bare isolated rocks though a frequent weed of cultivation this owes its presence here, not to human influence, but to the agency of

the sea or to that of littoral birds, such as the Bitterns and Terns that frequent the reefs and rocks, its sticky fruits probably attaching themselves to the feet of these.]

- \* *Celosia cristata*. Table Island, a common escape.
25. \* *Achyranthes aspera*. Both islands, common in the clearings and undoubtedly introduced by man. But on Little Coco, the very distinct var. *porphyristachya* is abundant as a climber in the *Pandanus* sea-fence and is probably, like the same variety in the Nicobars, Laccadives, etc., a plant introduced by the sea.
- \* *Gomphrena globosa*. Table Island, an abundant escape.
- \* *Euphorbia pilulifera*. Table Island, a weed in the clearing, still rare.
- \* *Musa sapientum*. There is a Plantain-garden attached to the lighthouse on Table Island. No Plantains are left on Great Coco, doubtless owing to the cattle. These animals eat not only coco-nut leaves but also the leaves of *Pandanus odoratissimus*, so that one is surprised to find that they have left anything in the garden at all. Except for the cattle (and perhaps the pigs, which might grout up the stocks) there is no reason why the Plantain should not thrive if left to itself. In Narcondam there is a grove of Plantains, introduced (by Col. Tytler?), in excellent health.
- \* *Cocos nucifera*. Common in all three islands but deserving neither to be deemed indigenous nor to be considered a species introduced by the sea. The question whether its presence is due to some old attempt at settlement or to the shipwreck of some coco-nut laden craft is discussed more fully below.
30. \* *Kyllinga brevifolia*. Both islands, only in the clearings.
- \* *Fimbristylis diphylla*. Both islands, only in the clearings.

- |                               |  |
|-------------------------------|--|
| * <i>Panicum ciliare.</i>     | Great Coco ; near south end of island beside some shelter huts used by coco-nut collectors.  |
| <i>Panicum colonum.</i>       | Both islands, in the clearings and also at south end of Great Coco near the shelter huts.  |
| * <i>Panicum Helopus.</i>     | Table Island, in the clearing.   |
| 35. * <i>Eleusine indica.</i> | Table Island, clearing, common ; Great Coco, rare in the clearing, also a few tufts among droppings of cattle on a bare hill at south-west corner of the island. |
| * <i>Eleusine ægyptiaca.</i>  | Table Island ; lighthouse clearing, still rare. [All the <i>Cyperaceæ</i> and <i>Gramineæ</i> may have been introduced by birds.]                                |

Of the above, nineteen are species which are, or may be, cultivated for economic or æsthetic reasons—the economic plants being *Hibiscus Sabdariffa* (the Rozelle), *Hibiscus Abelmoschus* (the Musk-mallow), *Moringa pterygosperma* (the Horse-Radish tree), *Phaseolus* sp., *Tamarindus indica* (the Tamarind), *Carica Papaya* (the Papaw), *Ipomœa Batatas* (the Sweet-Potato), *Solanum Melongena* (the Bringal), *Capsicum minimum* (the Bird's-Eye Chillee), *Musa sapientum* (the Plantain), *Cocos nucifera* (the Coco-nut), *Panicum ciliare*, *colonum* and *Helopus* (three wild fodder-millets). Ten of these have undoubtedly been intentionally introduced—one (the Tamarind) certainly has not, and the three fodder grasses may have come as weeds, or equally probably, may have been introduced by grain-eating birds. The æsthetic plants are *Nymphœa rubra*, *Crotalaria sericea*, *Ipomœa coccinea*, *Celosia cristata*, and *Gomphrena globosa*. *Crotalaria sericea* may have been involuntarily introduced, the others almost certainly have been brought intentionally. The other seventeen are, or may be, weeds, but there is every probability that five of them, *Urena lobata*, *Vernonia cinerea*, *Adenostemma viscosum*, *Anisomeles ovata*, and *Boerhaavia repens* do not owe their presence here to human agency.

Of the introduced economic species three are evidently unfitted to survive under the conditions to which, when abandoned, they are exposed. The Rozelle succumbs to climatic influences, the Sweet-Potato and the Plantain are destroyed by animals. On the other hand the propagation of two of these species—the Papaya and the Bird's-Eye Chillee—is remarkable both for its extent and rapidity, and for the fact that the flavour and pungency of the fruit of these species remains undiminished.

The Coco-nut tree deserves to be specially noticed. It is not known where *Cocos nucifera* is "indigenous" and the suggestion that it is "really wild" on the Coco Islands and along the north-western coast of North Andaman, made by the late Mr. Kurz, (*Forest Flora of British Burma* ii, 540), though true enough so far as the Coco Islands are concerned, is denied, as regards North Andaman, by those officers at Port Blair who have had opportunities of investigating the shores of the group. Mr. Kurz did not himself visit either the Coco group or North Andaman, and unfortunately he does not give any authority for the latter part of his statement. But, granting its correctness, the fact remains that about Port Blair the tree only occurs as a recent introduction and it is not met with elsewhere either in South or Middle Andaman, except as a few young trees that have, on Rutland Island, the Sentinels, etc., been deliberately planted. More recently the writer has been told of a bay in one of the islands of the "Archipelago," near Port Blair, which is lined with Coco-nut trees, the result of the wreck of a particular craft that was lost on her way from the Nicobars to a Burmese port; this statement the writer has not yet been able personally to verify. In Narcondam there are Coco-nut trees in no fewer than three places, and as there is absolutely nothing to disturb them there, they are spreading rapidly. In Barren Island also there is one bay where a considerable number of Coco-nut trees grow and where also the species is rapidly spreading. But in both these islands the introduction has been deliberate and quite recent; this in Narcondam is particularly evident from the fact that the oldest trees occur along with a grove of Plantains, though it is equally apparent that the spread of the species to one, and probably to both, of the two other bays where it occurs, has been unassisted by man and is due to fallen nuts having been drifted round from the first planted trees. It is, however, very remarkable that *Cocos nucifera* should be so abundant in the Coco group and be absent from, or very rare in, the Andamans proper, including Little Andaman, and that the species should again occur in such abundance in the Nicobars. The direction of the ocean currents has been suggested as possibly explaining the fact, but with very unsatisfactory results, because, whatever be the theoretical direction assumed for these currents in order to explain the distribution of *Cocos nucifera*, it must fail to coincide with the direction postulated to explain the distribution of *Casuarina equisetifolia*, a tree which is extremely common in the Nicobars and is so plentiful in Little Andaman, where there are no Coco-nuts, that the English equivalent for the Andamanese name of the island is "Casuarina-sand," the name taking its origin from the great prevalence of this species on all its beaches. But though there are no Coco-nut trees in the Andaman group

proper, there is one place where *Casuarina equisetifolia* occurs. This is a small bay, Casuarina Bay, on the west coast of North Andaman, on the beach of which the species is plentiful. In the Coco group, where there are Coco-nut trees, there is no *Casuarina equisetifolia* though it occurs again in Arracan and Chittagong where there are no Coco-nuts. As a matter of fact there is a steady current northward along the west coast of the Andamans for a considerable period of the year and it is difficult to understand why both *Cocos* and *Casuarina* do not occur plentifully along the whole west coast of the Andaman chain. The writer's examination of the ocean-drifts of the Coco group during his two visits did not throw much light on the subject. Wreckage in considerable quantity is to be found along the whole of the coasts, in most cases, however, belonging to wrecks that have occurred on the spot; the disposition of the fragments therefore only throws light on the "set" of local currents. Among the exceptions to this were a dressed teak-log on the east side of Great Coco, a padouk-log on the east side of Jerry Island, a quantity of Burmese sea-fishing-gear on the cyot between Great Coco and Jerry, fragments of two different Andamanese canoes on the east coast of Great Coco, a clump with roots of a very large Bamboo (not improbably *Bambusa gigantea*) on the west side of Great Coco, part of a third Andamanese canoe on the east side of the Little Coco, and a fruit, with part of stalk, of *Nipa fruticans* at the south end of Little Coco. Except the Andamanese canoes the whole of these objects indicated a "set" of ocean-current from Burma, for though *Nipa fruticans* which, strangely, appears to be absent from the Cocos, is both a Burmese and an Andamans species, this particular fruit had its stalk cut cleanly off by some sharp implement, and if it came from the Andamans it must therefore have floated from the neighbourhood of the settlement at Port Blair, a sufficiently improbable circumstance, as the examination of a map of the Andaman sea will show. Now if the set of the currents is such as to bring "drift" from Burma, and if these currents have brought the Coco-nut tree originally to the islands, we must explain how it happens that the islands of the "Archipelago" near port Blair, on the shores of which an undoubtedly Burmese "drift", in the shape of teak-logs, etc., is very plentiful, do not have Coco-nut trees on all their coasts. It has been suggested that the ocean-currents *have* thrown up Coco-nuts on the shores of the Andamans as well as on those of the Cocos, but that owing to the presence of the aboriginal inhabitants, always on the outlook for what they may pick up on the shore, the establishment of the species in the larger group has been impossible because any nut thrown up is found by them and immediately eaten or destroyed. This suggestion the writer owes to Mr. M. V. Portman of

Port Blair; it remains nevertheless difficult to understand why not a single Coco-nut should have escaped the notice of the Andamanese—who after all are not a numerous race—while, as it happens, we have Mr. Kurz's positive statement that in certain parts of North Andaman the species does occur.

It seems to the writer that for this particular group of islands, although the spread of the Coco-nuts *within* the group is undoubtedly due to the agency of the sea, the ocean-current theory does not explain the presence of the species, and that the original introduction has more probably been due to human interference. The question remains whether this was voluntary or involuntary. It may have been the result of an attempt at settlement in the island. The most recent attempt, which dates from 1878, is not the only one on record. An earlier attempt, as unsuccessful as the last, was made in 1849. But it does not follow, though these are the only attempts known, that they are the only ones which have been made. Both were made entirely on account of the Coco-nut being present in the islands, as perhaps other attempts before them may have been, for it appears that the name Coco Islands, implying the establishment there of *Coco nucifera* and the knowledge of that fact by navigators, dates from some of the very earliest European visits to Eastern seas. But it is not impossible that a yet earlier attempt to settle here may have been made and that the introduction of the Coco-nut may have been one of its results. It is easy to understand that these islands should have been chosen in preference to the more inviting-looking Andaman group owing to the character for ferocity which, for some curious reason, was attributed to the inhabitants of the Andamans by early navigators, and it is as easy to understand that the adverse natural conditions which prevail, and which have caused the failure of all recent attempts at settlement, must soon have led to the abandonment of the earliest attempt. The writer feels inclined to think that this may be the true explanation of the presence of *Coco nucifera* in the Cocos Islands. But it may quite as readily have been due to involuntary introduction by ship-wreck; for while disinclined to accept the suggestion that there are no Coco-nut trees in the Andamans because the Andamanese have eaten all the stranded Coco-nuts, when it is applied to nuts thrown up by ocean-currents, the writer thinks this explanation may well enough account for the presence of Coco-nut trees in the Cocos while they are absent from the main islands, if introduction by reason of ship-wreck is postulated. In the Cocos there are no inhabitants, while in the main islands there are; and though it is scarcely reasonable to suppose that the Andamanese would detect every nut that is cast up on the beach, there is little doubt that they would soon become aware of the

wreck of a Coco-nut craft and, becoming aware of it, there is as little doubt that they would soon consume every Coco-nut the vessel contained.

Now that the Coco-nut tree is established in the islands, it germinates profusely. Even towards the centre of the island on flat or muddy tracts one meets with groves, containing from a score to several hundreds of trees, that have originated from nuts which have been floated inland by unusually high tides and left stranded far from the coast. The stems of these inland examples are abnormally tall, shooting up till the leafy head rises above the surrounding jungle; as far as can be seen, they do not flower till this happens. Once they have flowered and fruited the fallen nuts multiply the species fifty-fold. The nut appears to have but few enemies, and though a good many may be seen with a hole drilled through the husk and with the kernel scooped out, (apparently both crabs and rats are able to effect this,) the number thus destroyed forms quite an inappreciable proportion of the whole. The tree does not, however, invade the ridges, the soil is doubtless, as it is in South Andaman, too poor to suit it; while in trees growing along the bays on the west side of Great Coco the contents of the nut are distinctly less and their quality is appreciably poorer than in trees at the head of the bays on the opposite side; these in turn produce nuts that do not bear comparison with the magnificent examples grown in the Nicobars.

In the subjoined table the distribution of the "civilized" species is given; in those cases where the species is believed to be truly indigenous in a particular area the distribution mark indicating the area in question is enclosed within ( ) brackets. From this table we learn that 28 of these species, or 80 per cent. of the whole, are cosmopolitan in the tropics, and that, with the exception of one weed and two cultivated species, which do not occur in the Orient, they are sub-tropical as well as tropical species. The original home of about one-half of the species is known with some degree of certainty and it is interesting to note that 7, or 20 per cent. of the class, are originally natives of the New World, introduced in consequence of human intercourse into, and now established in, the Eastern Hemisphere as well. Ten of them are known to be natives of South-Eastern Asia; only six of these have spread beyond that area.

TABLE XII. *Distribution of "Civilized" species present in the Coco Group.*

Cultivated species.	Weeds.	SPECIES.	Africa.	Orient.	S. E. Asia.	Australia.	Polynesia.	America.
1	—	<i>Nymphaea rubra</i> ...	x	x	x	—	—	—
—	1	<i>Sida carpinifolia</i> ...	x	x	x	x	x	x
—	1	[ <i>Urena lobata</i> ] ...	x	—	x	x	x	x
1	—	<i>Hibiscus Sabdariffa</i> ...	x	x	(x)	x	x	x
1	—	<i>Hibiscus Abelmoschus</i> ...	x	x	(x)	x	x	x
1	—	<i>Moringa pterygosperma</i> ...	x	x	(x)	x	x	x
1	—	<i>Crotalaria sericea</i> ...	—	—	(x)	—	—	—
—	1	<i>Desmodium triflorum</i> ...	x	x	x	x	x	x
—	1	<i>Alysicarpus vaginalis</i> ...	x	x	(x)	x	x	x
1	—	<i>Phaseolus</i> sp. ...	—	p	—	p	p	p
1	—	<i>Tamarindus indica</i> ...	(x)	x	x	x	x	x
1	—	<i>Carica Papaya</i> ...	x	x	x	x	x	(x)
—	1	<i>Vernonia cinerea</i> ...	x	x	x	x	x	x
—	1	<i>Adenostemma viscosum</i> ...	x	x	x	x	x	x
—	1	<i>Ageratum conyzoides</i> ...	x	x	x	x	x	(x)
1	—	<i>Ipomoea coccinea</i> ...	x	x	x	x	x	(x)
1	—	<i>Ipomoea Batatas</i> ...	x	x	x	x	x	(x)
1	—	<i>Solanum Melongena</i> ...	x	x	(x)	x	x	x
1	—	<i>Capsicum minimum</i> ...	—	—	(x)	—	—	—
—	1	<i>Scoparia dulcis</i> ...	x	x	x	x	x	(x)
—	1	<i>Rungia pectinata</i> ...	—	—	(x)	—	—	—
—	1	[ <i>Anisomeles ovata</i> ] ...	—	—	(x)	—	—	—
—	1	[ <i>Boerhaavia repens</i> ] ...	x	x	x	x	x	—
1	—	<i>Celosia cristata</i> ...	x	x	x	—	—	x
—	1	<i>Achyranthes aspera</i> ...	x	x	x	x	x	x
1	—	<i>Gomphrena globosa</i> ...	x	x	x	x	x	(x)
—	1	<i>Euphorbia pilulifera</i> ...	x	x	x	x	x	x
1	—	<i>Musa sapientum</i> ...	x	—	(x)	x	x	(x)
1	—	<i>Cocos nucifera</i> ...	x	—	x	x	x	(x)
—	1	<i>Kyllinga brevifolia</i> ...	x	x	x	x	x	x
—	1	<i>Fimbristylis diphylla</i> ...	x	x	x	x	x	x
1	—	[ <i>Panicum colonum</i> ] ...	x	x	x	x	x	x
—	1	<i>Panicum ciliare</i> ...	x	x	x	x	x	x
1	—	[ <i>Panicum Helopus</i> ] ...	x	x	x	x	—	—
—	1	<i>Eleusine indica</i> ...	x	x	x	x	x	x
—	1	<i>Eleusine ægyptiaca</i> ...	x	x	x	x	x	x

The only *Cryptogam* that belongs to this class is the incompletely known *Fungus* the mycelium of which has proved so destructive to the tea-crop at Port Blair. From what has been said in the account of this species it will be seen that the species, whatever it may be, is certainly indigenous in, or at any rate has not been introduced by human agency into, the Andaman group.

We have now to consider the "sylvestrian", or truly wild, "migrant" species. These may be conveniently subdivided into "coast" and "inland" species—the former a group the members of which may, and here in most instances probably do, owe their presence

to introduction by means of ocean-currents. But just as we have seen that some of the weeds may be claimed as indigenous, or at all events as introduced by other than human agency, so here we find that these classes pass insensibly into each other and that species which may be introduced by the sea, such as *Entada scandens*, *Gloriosa superba*, *Boerhaavia repens*, *Cocos nucifera*, etc., may quite as reasonably owe their presence to a previous land-connection, to wind, to birds, or to involuntary or voluntary human agency. The more doubtful instances, however, will be found discussed in detail below. This group of species, however, as a whole, is characterised by a general distribution which is directly affected by the geographical features of, and the currents that prevail in, the surrounding seas, and is only indirectly, if at all, influenced by the configuration of the adjacent land.

The "coast" species have to be further subdivided in "marine" and "littoral" species, and the former group, as comprising the plants for which the influence of ocean-currents is most evident, will be considered first. Only one *Phanerogam* belongs to this class; this species, *Cymodocea ciliata*, is however almost the most plentiful, the only other common species being *Sargassum ilicifolium*; all the others are very inconspicuous, being few in number, small in size, and scantily represented.

The following table gives at once a list of, and indicates the marine distribution for, these species; for six of them, as the general list shews, this is, as regards the *Algae*, only approximate.

TABLE XIII. *Distribution of the "Marine" species present in the Coco Group.*

SPECIES.				SPECIES.			
	Atlantic.	Indian Ocean.	Pacific.		Atlantic.	Indian Ocean.	Pacific.
<i>Cymodocea ciliata</i> ...	—	x	—	<i>Gelidium corneum</i> ...	x	x	x
<i>Sargassum ilicifolium</i> ...	x	x	x	<i>Caulerpa clavifera</i> ...	x	x	x
<i>Turbinaria ornata</i> ...	—	x	—	<i>Caulerpa plumaris</i> ...	—	x	—
<i>Padina pavonia</i> ...	x	x	x	<i>Valonia fastigiata</i> ...	—	x	x
<i>Dictyota dichotoma</i> ...	x	x	x	<i>Valonia confervoides</i> ...	x	x	x
<i>Lithothamnion polymorphum</i> ...	x	x	—	<i>Halimeda Opuntia</i> ...	x	x	—
<i>Acanthophora Thierii</i> ...	x	x	x	<i>Siphonocladus? filiformis</i> ...	—	x	—
<i>Jania tenella</i> ...	—	x	—	<i>Vaucheria</i> sp. ...	—	x	—
<i>Gracilaria crassa</i> ...	—	x	—	<i>Calothrix pulvinata</i> ...	x	x	x

Nearly one-half of the species are cosmopolitan in tropical seas; probably some of the six of which the distribution is not accurately ascertained are also cosmopolitan. One species appears to extend

only to the Pacific from the Indian Ocean, another only to the Atlantic from the Indian Ocean. The *Cymodocea*, though present in Africa, appears not to be recorded from the Mascarene Islands, and *Sargassum ilicifolium* though occurring in Malayan waters, has not yet been found on the coasts of Northern Australia. One species, *Dictyota dichotoma*, is rather more frequent in sub-tropical than in tropical seas and is cosmopolitan in both the northern and the southern hemispheres.

The next group of species to be considered—the “littoral”—includes many plants for which the evidence of introduction by the sea is almost as palpable as in the case of the “marine” species themselves. They germinate on the beaches, and grow only near the sea, preferably in muddy creeks or on the sand or shingle; their fruits and seeds are found in every “drift” and the species themselves occur on every Indian or Malayan coast. Such are the true mangroves and the species like *Avicennia*, *Algiceras*, *Carapa*, that are constantly associated with the mangrove-vegetation; the sand-binding species like *Ipomœa biloba*, *Euphorbia Atoto*, *Sesuvium Portulacastrum*, *Vigna lutea*, *Thuarea sarmentosa*; the tropical sea-fence of *Pandanus odoratissimus*, *Desmodium umbellatum*, *Sophora tomentosa*, *Tournefortia argentea*, *Clerodendron inerme*, *Vitex Negundo*, with its concomitant climbing vegetation, *Canavalia obtusifolia*, *Ipomœa digitata*, *Argyrea tiliifolia*; the outer beach-forest of *Terminalia Catappa*, *Hernandia peltata*, *Erythrina indica*, *Stephegyne diversifolia*; the inner beach forest of *Cycas*, *Mimusops* and *Pisonia*; and even the species of the mud-flats within, like *Leea sambucina*, *Hibiscus tiliaceus*, *Cynometra ramiflora*, *Flagellaria indica* and many more. The seeds of all these have been observed by the writer in the “drifts” of these islands and many of them have been noted, either in the Andamans and Nicobars, or in Narcondam, germinating on the beach. There are others, however, that are more doubtful, and, though the whole of the species for which this mode of introduction is conceivable are given below, the species for which any doubt is possible are enclosed in brackets and the more equivocal of these are discussed at the end of the list.\*

\* Since this paper was written and while these pages have been passing through the press two papers have appeared that deal with this section of the flora of the Malayan countries much more fully than the scope of the present paper permits. To these papers, viz:—*Schimper: Die Indo-Malayische Strandflora* (Jena: Gustav Fischer, 1891) and *Karsten: Ueber die Mangrove-Vegetation in Malayischen Archipel; Bibliotheca Botanica*, Heft 22 (Cassel: Theodor Fischer, 1891) neither of which had appeared when the writer's remarks were written and which he greatly regrets having been unable to refer to in the text, the writer would refer those who are interested in the subject of mangrove and coast plants and the influence of ocean-currents and their distribution.

TABLE XIV. *Distribution of "littoral" species present in the Coco Group.*

SPECIES.	Atlantic.		Indian Ocean.				Malay seas.	Pacific.		
	Eastern America.	Western Africa.	Eastern Africa.	Mascarene Islands.	Indian coasts.	Burma, Malacca, Andaman, Java.	Malay Islands.	Northern Australia.	Polynesia.	Western America.
<i>Calophyllum inophyllum</i> ..	...	—	—	—	×	×	×	×	×	—
<i>Hibiscus tiliaceus</i> ...	...	×	×	×	×	×	×	×	×	×
<i>Thespesia populnea</i> ...	...	—	×	×	×	×	×	×	×	—
[ <i>Sterculia rubiginosa</i> , var.]	...	—	—	—	—	—	—	—	—	—
5. <i>Heritiera littoralis</i> ...	...	—	—	×	×	×	×	×	×	—
<i>Carapa moluccensis</i> ...	...	—	—	×	×	×	×	×	×	—
<i>Colubrina asiatica</i> ..	...	—	×	×	×	×	×	×	×	—
<i>Leea sambucina</i> ...	...	—	×	×	×	×	×	×	×	—
[ <i>Leea hirta</i> ] ...	...	—	—	—	—	—	—	—	—	—
10. [ <i>Dodonaea viscosa</i> ...	...	×	×	×	×	×	×	×	×	×
[ <i>Dracontomelum mangiferum</i> ]	...	—	—	—	—	×	×	—	×	—
<i>Desmodium umbellatum</i> ...	...	—	—	×	×	×	×	×	×	—
[ <i>Desmodium triquetrum</i> ]	...	—	—	—	—	×	×	—	—	—
[ <i>Desmodium polycarpum</i> ]	...	—	—	×	×	×	×	×	×	—
15. <i>Erythrina indica</i> ...	...	—	—	—	×	×	×	×	×	—
<i>Mucuna gigantea</i> ...	...	—	—	—	×	×	×	×	×	—
<i>Canavalia obtusifolia</i> ...	...	×	×	×	×	×	×	×	×	×
<i>Vigna lutea</i> ...	...	×	×	×	×	×	×	×	×	×
<i>Derris sinuata</i> ...	...	—	—	—	×	×	×	—	—	—
20. <i>Derris uliginosa</i> ...	...	—	—	—	×	×	×	×	×	—
<i>Pongamia glabra</i> ...	...	—	—	—	×	×	×	×	×	—
<i>Cæsalpinia Bonducella</i> ...	...	×	×	×	×	×	×	×	×	×
<i>Cæsalpinia Nuga</i> ...	...	—	—	—	×	×	×	×	×	—
<i>Sophora tomentosa</i> ...	...	×	×	×	×	×	×	×	×	—
25. <i>Cynometra ramiflora</i> ...	...	—	—	—	—	×	×	×	—	—
<i>Entada scandens</i> ...	...	×	×	×	×	×	×	×	—	—
<i>Rhizophora mucronata</i> ...	...	—	—	×	×	×	×	×	×	—
<i>Rhizophora conjugata</i> ...	...	—	—	—	—	×	×	—	—	—
<i>Ceriops Candolleana</i> ...	...	—	—	—	—	×	×	—	—	—
30. <i>Ceriops Roxburghiana</i> ...	...	—	—	—	—	×	×	—	—	—
<i>Bruguiera gymnorhiza</i> ...	...	—	—	—	×	×	×	×	×	—
<i>Terminalia Catappa</i> ...	...	—	—	—	—	×	×	—	—	—
<i>Lumnitzera racemosa</i> ...	...	—	—	—	—	×	×	—	—	—
<i>Gyrocarpus Jacquini</i> ...	...	×	×	×	×	×	×	×	×	×
35. <i>Barringtonia speciosa</i> ...	...	—	—	—	×	×	×	×	×	—
<i>Barringtonia racemosa</i> ...	...	—	—	—	×	×	×	×	×	—
<i>Pemphis acidula</i> ...	...	—	—	—	×	×	×	×	×	—
<i>Sesuvium Portulacastrum</i> ...	...	×	×	×	×	×	×	×	×	×
<i>Stephegyne diversifolia</i> ...	...	—	—	—	—	×	×	—	—	—
40. <i>Guettarda speciosa</i> ...	...	—	—	—	×	×	×	×	×	—
<i>Ixora brunnescens</i> ...	...	—	—	—	—	×	×	—	—	—
<i>Morinda bracteata</i> ...	...	—	—	—	—	×	×	—	—	—
<i>Adenostemma viscosum</i> ...	...	×	×	×	×	×	×	×	×	×
<i>Pluchea indica</i> ...	...	—	—	—	—	×	×	—	—	—
45. <i>Wedelia scandens</i> ...	...	—	—	—	—	×	×	—	—	—
<i>Scævola Kœnigii</i> ...	...	—	—	—	—	×	×	—	—	—

SPECIES.	Atlantic.		Indian Ocean.				Malay seas.		Pacific.	
	Eastern America.	Western Africa.	Eastern Africa.	Mascarene Islands.	Indian coasts.	Burma, Malaccæ, Andaman, Java.	Malay Islands.	Northern Australia.	Polynesia.	Western America.
[ <i>Ardisia humilis</i> ] ...	—	—	—	—	x	x	x	—	—	—
<i>Aegiceras majus</i> ...	—	—	—	—	x	x	x	x	x	—
<i>Mimusops littoralis</i> ...	—	—	—	—	—	—	—	—	—	—
50. <i>Cerbera Odollam</i> ...	—	—	—	—	x	x	x	x	x	—
<i>Ochrosia borbonica</i> ...	—	—	—	x	x	x	x	—	—	—
<i>Tabernæmontana crispa</i> ...	—	—	—	—	—	x	—	—	—	—
<i>Sarcolobus globosus</i> ...	—	—	—	—	x	x	x	—	—	—
<i>Cordia subcordata</i> ...	—	—	—	x	[x]	x	x	x	x	—
55. <i>Tournefortia argentea</i> ...	—	—	—	x	x	x	x	—	x	—
<i>Argyrea tiliaefolia</i> ...	—	—	—	—	x	x	x	—	—	—
<i>Ipomæa grandiflora</i> ...	—	—	—	x	x	x	x	x	x	—
<i>Ipomæa digitata</i> ...	x	x	x	x	x	x	x	x	x	x
<i>Ipomæa denticulata</i> ...	—	—	—	x	x	x	x	x	x	—
60. <i>Ipomæa biloba</i> ...	x	x	x	[x]	x	x	x	x	x	x
<i>Convolvulus parviflorus</i> ...	—	—	—	—	x	x	x	x	x	—
<i>Physalis minima</i> ...	x	x	x	x	x	x	x	x	x	x
[ <i>Oroxylum indicum</i> ] ...	—	—	—	—	x	x	x	—	—	—
<i>Eranthemum succifolium</i> ...	—	—	—	—	—	x	p	—	—	—
65. [ <i>Peristrophe acuminata</i> ] ...	—	—	—	—	—	x	x	—	—	—
[ <i>Lippia nodiflora</i> ] ...	x	x	x	x	x	x	x	x	x	x
<i>Premna integrifolia</i> ...	—	—	—	—	x	x	p	p	—	—
<i>Premna</i> sp. ...	—	—	—	—	—	x	p	p	—	—
<i>Vitex Negundo</i> ...	—	—	—	x	x	x	x	—	—	—
70. [ <i>Vitex pubescens</i> ] ...	—	—	—	—	x	x	x	—	—	—
[ <i>Vitex Wimberleyi</i> ] ...	—	—	—	—	—	x	—	—	—	—
<i>Clerodendron inerme</i> ...	—	—	—	—	x	x	x	x	x	—
<i>Avicennia officialis</i> ...	x	x	x	x	x	x	x	x	x	x
<i>Boerhaavia repens</i> ...	—	x	x	x	x	x	x	x	x	—
75. <i>Pisonia aculeata</i> ...	x	x	x	x	x	x	x	x	—	—
[ <i>Pisonia excelsa</i> ] ...	—	—	—	—	—	x	x	—	—	—
<i>Achyranthes porphyristachya</i> ...	—	—	—	—	—	x	x	—	—	—
<i>Hernandia peltata</i> ...	—	—	—	x	x	x	x	x	x	—
<i>Cassytha filiformis</i> ...	x	x	x	x	x	x	x	x	x	x
80. <i>Euphorbia Atoto</i> ...	—	—	—	—	—	x	x	x	x	—
<i>Macaranga Tanarius</i> ...	—	—	—	—	—	x	x	—	—	—
<i>Cycas Rumphii</i> ...	—	—	—	—	x	x	x	x	x	—
<i>Crinum asiaticum</i> ...	—	—	—	—	—	x	x	x	x	—
<i>Tacca pinnatifida</i> ...	—	x	x	x	x	x	x	x	x	—
85. <i>Dracæna angustifolia</i> ...	—	—	—	—	—	x	x	x	—	—
[ <i>Gloriosa superba</i> ] ...	—	—	—	—	—	x	x	—	—	—
<i>Flagellaria indica</i> ...	—	—	x	x	—	x	x	x	—	—
<i>Caryota sobolifera</i> ...	—	—	—	—	—	x	x	—	—	—
[ <i>Cocos nucifera</i> ] ...	x	x	x	x	—	x	x	x	x	x
90. <i>Pandanus odoratissimus</i> ...	—	—	—	x	x	x	x	x	—	—
<i>Cyperus pennatus</i> ...	—	—	—	—	x	x	x	x	x	—
<i>Fimbristylis ferruginea</i> ...	x	x	x	x	x	x	x	x	x	x
<i>Thuarea sarmentosa</i> ...	—	—	—	x	x	x	x	x	x	—
<i>Ischæmum muticum</i> ...	—	—	—	—	—	x	x	x	—	—

This list includes 94 species for which sea-introduction is conceivable, and for the presence of most of the species it contains this mode of introduction is almost certainly responsible. The list might even be made more extensive than it is, for if *Sterculia rubiginosa*, which is a purely "littoral" species here as it is elsewhere throughout the Andaman and Nicobar groups—to which area the variety found in the Coco Islands is strictly confined,—be sea-introduced, there is no reason why some of the other species of *Sterculia* should not be added. As a matter of fact the writer has collected specimens of species of *Sterculia* in Narcondam and in Batti Malv, the first island a locality where certainly, the second one where probably, every species present has been somehow or other introduced. But no *Sterculia* seeds were recognised in the "drifts" and therefore the whole of the species have been left out except this purely 'littoral' one, while even it has been omitted from consideration in the analysis of the table which follows. Again, *Leea hirta* might well be sea-introduced if *Leea sambucina* is; their fruits are very similar and *Leea* fruits are common in the "drifts." All the fruits found, however, were precisely the same and seemed to be undoubtedly those of *Leea sambucina*, which is a very common species in the mud flats that skirt the mangrove-swamps, where it occurs as a considerable shrub or small tree with stilted roots that imitate the style and appearance of those of the mangroves. Both species, however, may have been introduced by fruit-eating birds; only one therefore, owing to its habitat, is taken as an example of this mode of introduction, the other being relegated to the list of species that are bird-introduced. Another species to which the same remarks apply is *Ardisia humilis*, which is a purely beach-forest species and, as such, is equally common here, on Narcondam, in the Andamans, and in the Nicobars; perhaps it is, on the whole, more likely to have been introduced owing to birds having eaten its purple-berried fruit. *Allophylus Cobbe*, which is almost certainly bird-introduced, may be quoted in support of this, for though it also occurs in the interior it is a common tree in the *Pandanus* fence and in the beach-forest. *Dracontomelum mangiferum* might be a sea-introduced species, for Mr. Hemsley records a *Dracontomelum?* fruit from the New Guinea "drift", with empty seed-cells however (*Challenger Reports; Botany*, vol. i, part 3, p. 290). And if *Dracontomelum* be included so might *Spondias* and *Canarium*, for though birds and bats eat the pulpy fruits of these species they cannot swallow the stone and, as in the case of *Terminalia Catappa*, can hardly do more than assist in dispersing them locally. *Desmodium triquetrum* and *Desmodium polycarpum* are both very common on the rocky parts of the coast just above the spray-line and their fruits therefore are extremely common in the "drifts." But it is not at all clear that they must therefore

be put down in the list of sea-introduced species; they are well-known as weeds of cultivation elsewhere, being diffused because of the readiness with which the indehiscent segments of their fruits attach themselves to the clothes of man and to the fur of his domestic animals. Here they are undoubtedly not weeds introduced by man, but it may well be that they have been introduced by birds, owing to fragments of their pods having attached themselves to their feathers. Another species to which the same remarks apply is *Adenostemma viscosum*, though this is more probably sea-introduced than the other; still another is *Boerhaavia repens*; perhaps all four are distributed at one time by the sea, at another by birds. *Lippia nodiflora* may also be a bird-introduced species; its seeds may have been brought in the pellets of mud that become attached to the feet, and to the feathers at the base of the bill of wading- and swimming-birds. *Achyranthes porphyristachya* which, from its situation in these islands, cannot be a weed introduced by man, and which is a common sea-shore species in the Nicobars and in the Laccadives also, may perhaps be bird-introduced like the *Desmodia*. If, as is suggested, now one agency, now another is responsible for the dispersal of these species, it is easy to understand why those species should all be "littoral" in these islands and yet occur as inland species in other localities. *Mucuna gigantea* will be readily admitted as an unequivocal example of this mode of distribution, as will *Derris sinuata*, for both occur in the beach-forest more commonly than they do on the ridges; so too, will the other *Leguminosæ* of the list except perhaps *Entada scandens*. And yet *Entada scandens* must be sometimes an introduced species, for it is one of the plants that occur on Narcondam, an island for which it seems impossible to postulate any previous land-connection; the writer moreover had the good fortune to find one of its enormous seeds germinating along with those of *Mucuna*, etc., on the sandy islet between Great Coco and Jerry.

*Physalis minima* is a species that at first suggests bird-introduction rather than sea-introduction, and its wide inland dispersal undoubtedly is largely owing to its fruits being eaten and to the subsequent voiding of its hard discoid seeds. But here it is only found close to the sea just above the spray-line and its fruits were found in the "drifts" here and there, the light bladder-like calyx amply accounting for their flotation; the pulp of the fruit probably protects the seeds, if such protection be necessary, from the action of the salt water. Among the *Convolvulaceæ*, for which this means of dispersal is not at all uncommon, the only species now included that calls for remark is *Convolvulus parviflorus*. It is, however, one of the commonest of the sea-face creepers along the west coast of Great Coco, and is equally common on Narcondam, Barren

Island, Rutland Island and Batti Malv, and is included in the list without any feeling of doubt in the mind of the writer. On the other hand, indeed, it is with some diffidence that another species, *Ipomœa Turpethum*, is omitted. All three species of *Vitex* given are "littoral," but while there seems no doubt that *Vitex Negundo* is sea-introduced, it is on the whole more probable that the others are introductions by fruit-eating birds. *Macaranga Tanarius* is also a species that from its habitat the writer has no hesitation in considering a sea-introduced species; another that he would have wished to include is *Blachia andamanica* which occurs on the coast with *Desmodium umbellatum*, *Pluchea indica* and other unequivocally littoral species. Moreover there are several of these shrubby and arboreal *Euphorbiaceæ* on Narcondam; their presence there indicates that some mode of introduction for species of this order must be possible. In the absence, however, of direct experiment with their seeds the others have been left to swell, probably unduly, the list of "remanent" species. *Tacca pinnatifida*, which is an inland as well as a coast species, may be bird-introduced, for its seeds are embedded in a sweet pulp. But though a species of ant is very fond of this fruit and scoops out all the ripe pulp, leaving the seeds bare but uninjured in an otherwise empty bag, no bird, so far as the writer could see, appears to eat them. The two *Pisonias*, one a climber, the other a tree, are both "littoral" and so may well be sea-introduced, but as both have peculiar fruits with glutinous lines along their sides they may equally well be bird-introduced species. The sticky lines along the angles of the fruits of *Pisonia excelsa* in particular have all the tenacity of bird-lime. As this species occurs some way inland as well as along the coast there is little doubt that, even if sea-introduced, its further dispersal is assisted by ground-feeding birds or small mammals. The fruits of two species of *Dipterocarpus* were seen in the "drifts," but the writer has no hesitation, from what is known regarding the delicacy of the seeds in this order and the rapidity with which their power of germinating is lost, in excluding both from the list. From what has already been said regarding "civilized" species it will be seen that though *Cocos nucifera* is undoubtedly capable of being introduced by the sea, it is probably not to this agency that its presence in these islands is due. *Caryota sobolifera*, however, which is throughout the whole Andaman group a very common species, both on flat and on rising ground, and which is as common on Narcondam as in the Cocos, is probably a sea-introduced species.

*Peristrophe acuminata* is another species that affects only the localities in which *Desmodium polycarpum* and its companions are found and ought probably to be included among the littoral species; in the absence

of further evidence, however, it is treated as only doubtfully sea-introduced. Another doubtful species is *Dodonaea viscosa*, a cosmopolitan species. Still another, equally doubtful, is *Gloriosa superba* which is exceedingly common in the coast zone on both the Coco Islands, and which the writer has collected, in the coast zone also and only there, in South Andaman, in Rutland Island, in Batti Malv, in Car Nicobar, in Narcondam, and in Barren Island, and which Dr. Alcock has collected, near the sea, in the Laccadives. On the whole therefore we might feel justified in considering it a sea-introduced species. But it is very abundant also throughout the whole of India; it extends from the Nilghiris and Central India to Rajputana, the Panjab, and the Gangetic plain, as well as to the Himalaya from Kamaon to Bhutan, and is common in Bengal, Assam and Burma. It cannot very easily be bird-introduced and one must therefore incline to the opinion that the agency responsible here is that of winds, a view which is favoured by the nature of its seeds. But even then it is not easy to suppose that winds could carry these as far as some of the islands mentioned and still that its distribution should be limited to South-Eastern Asia. *Oroxylum indicum* might possibly be sea-introduced, but on the whole has more probably been brought by wind. It need not be indigenous for it occurs in abundance in Narcondam. Though its fruits occur in the "drifts" they are always split open and it is unlikely that the seeds could remain attached to the fruit-segments during their transit from any of the neighbouring coasts.

Few of the cryptogams can be considered "littoral" and the statements that have been made of the possibility of *Fungi*, etc., being brought to ocean-islands attached to logs of wood or trunks of trees are not as a rule made by those who have seen and carefully examined ocean-drifts. Even *Polyporus sanguinalis*, which apparently has a predilection for dead or dying trunks of *Cocos nucifera*, being commoner there than in any other situation, was not found growing on any of the trunks that lie on the beaches exposed to the sun after having been soaked in salt water. The logs that are cast up on the beach and the roots that protrude from the sand at those points where denudation is going on, are scrubbed bare by the coral-sand and bleached white by the sun; they harbour no *Fungi* and seem preserved from decay by the treatment to which they have been subjected. There is, however, a striking exception in a "dry-rot" which attacks *Mimusops littoralis* trunks and some other timbers. In the case of the Bullet-wood it was seen both on Great and Little Coco; the same appearance was presented by the remains of a wooden vessel in Little Coco. The appearance and consistence of this "dry-rot" so closely resemble the results of charring that it was difficult to realize that the wood in question had not been subjected to

fire. The effects of actual charring were, however, observed in the hollow trunk of a large *Mimusops* near the shelter huts at the south end of Great Coco; closer comparison shows that the product of the *Fungus* has a facies of its own unlike that of true charcoal. This difference is difficult to express in words, but is very recognisable when the two things are placed side by side. The phenomenon was not noticed in the case of *Erythrina*, *Heritiera*, *Stephegyne*, or other dead trees on the beach.

Excluding from consideration all the doubtful species enclosed in brackets we find that there are 80 unequivocally sea-introduced plants, or more than one-fourth of the phanerogamic species and over 22 per cent. of the entire flora. On consulting the distribution it is seen how greatly the coast flora is one characteristic of the Indian Ocean and of Malayan Seas, particularly the latter, since 76 species, or 97 per cent., occur on the shores of the Malay Islands, whereas only 66, or 83 per cent., occur on the Indian coasts of the Sea of Bengal. Moreover one of these, *Sarcolobus globosus*, might almost be omitted, its only Indian locality being the Sunderbuns, at the head of the Bay of Bengal. Another, *Ipomœa denticulata*, though extending up the eastern side of the Bay to the coast of Arracan, is, on the western side, confined to Ceylon. This indication of a tendency to extension eastward is borne out by the features of the further distribution of these species, for 60 species, or 76 per cent., extend south-eastward to the shores of northern Australia, while only 47, or 59 per cent., extend south-west to the Mascarene Islands; and 51 species, or 64 per cent., occur in one or other of the Polynesian groups, while only 36, or 46 per cent., reach continental East Africa. But, while this is the case, it is interesting to note that 21 species, or 24 per cent., occur on the African Atlantic coast, and 15 species, or 19 per cent., cross the Atlantic to the Eastern coasts of America, whereas only 13 species, or 16 per cent., extend across the Pacific from Polynesia to the Western American coasts. These features of the littoral flora are given more compactly in the subjoined table.

TABLE XV. *Extension of "littoral" species present in the Coco Group.*

Species extending westward to					Species present in the	Species extending eastward to			
America. (Atlantic Coasts.)	West Africa. (Atlantic Coasts.)	Eastern Africa.	Mascarene.	India and Ceylon.	COCO GROUP.	Malay Archipelago.	North Australia.	Polynesia.	America. (Pacific Coasts.)
15	21	36	47	66	80	76	60	51	13
19%	24%	46%	59%	83%	100%	97%	76%	64%	16%

An analysis of the table of distribution from the opposite point of view is given below ; from it we learn that 11 species, or 14 per cent., are cosmopolitan on tropical sea-shores ; that four more are nearly cosmopolitan, being present in both hemispheres ; that only four, so far as is known, are limited to the coasts of these islands, the Andamans and the Nicobars ; and that, excepting these four, every one of the species is found on the Malayan Coasts. So far then as the "littoral" species are concerned we must conclude that the flora of the Coco Group is decidedly Malayan.

TABLE XVI. *Analysis of distribution of "Littoral" species.*

Present on both Pacific and Atlantic coasts :—	19
Cosmopolitan on tropical sea-shores :—	11
Almost ditto, (present in both hemispheres) :—	4
Absent from Pacific American coasts only :—	2
Absent from Pacific Polynesian coasts only	1
Absent from Eastern African and Mascarene coasts only	1
Absent from New World entirely :—	4
Present on Atlantic and Indian Ocean (not on Pacific) coasts	1
Present on Pacific and Indian Ocean (not on Atlantic) coasts	33
Extending from Africa to Polynesia :—	15
On all intervening shores :—	14
Absent only from Northern Anstralia	1
Extending from Mascarene islands to Polynesia :—	9
Extending from India to Polynesia	8
Extending from Coco Islands to Polynesia	1
Confined to Indian Ocean and Malayan Seas	27
Western species :—	4
Extending from Africa to Australia :—	2
In both Africa and Mascarenes	1
In Mascarenes, not in Africa	1
Extending from Africa to Malaya only	2
In Continental Africa, not in Mascarenes	1
In Mascarenes, not in Africa	1
Eastern species :—	6
Extending from Australia to India	3
Extending from Australia to the Coco Group	3
Central species :—	17
Extending from India to Malaya	8
Extending from Coco Group to Malaya	5
Extending from Coco Group to Nicobars only	4
 TOTAL number of "Littoral" species.	 80

In discussing the inland "immigrant" species the first agency to be considered is that of winds. This influence must here be stronger

than in many places, for though the south-west monsoon, which blows for half the year, sweeps only over a wide expanse of sea before it reaches the islands, there is a very distinct and tolerably powerful north-east monsoon which, during a considerable part of the remaining half-year, blows from the direction of the adjacent Burmese coast.

It is, however, easy to overrate the effect of this agency and however well adapted certain fruits, such as those of the two *Dipterocarpi*, *Terminalia bialata*, *Pterocarpus indicus*, *Sterculia companulata*, *Porana spectabilis*, *Illigera conyzadenia*, *Ventilago calyculata*, or seeds, such as those of *Sterculia alata*, *Gloriosa superba*, *Aristolochia tagala*, may at first sight appear to be for transmission by wind, it seems very doubtful on further consideration if any of those mentioned could possibly be carried so far as from the nearest mainland to these islands. In most of these cases the wings of the fruits or seeds can only, as in that of *Gyrocarpus*, assist in local dispersal. Regard must be paid, too, to the usual situation of the species, and in the case of *Orchids*, for example, the seeds of which are light, and well adapted for carriage in this way, it is doubtful if *Calanthe veratrifolia*, which is always found in densely shady places, could have been brought in this way. Similarly among the inland *Cryptogams*, for all of which except *Chara* this means of dispersal is doubtless possible, it seems more probable that *Acrostichum appendiculatum*, which affects the same localities as *Calanthe*, and *Ceratopteris thalictroides*, which undoubtedly is sometimes, if not always, bird-introduced, ought to be excluded from this list.

The table below gives the whole of the possibly "wind-introduced" species present in the group.

TABLE XVII. *Distribution of Wind-introduced "inland" species present in the Coco Group.*

SPECIES.	S. E. Asia.								
	Africa.	India.	Indo-China.	Malaya.	Australia.	Polynesia.	America.	Narcondam.	Barren Island.
<i>Bombax insigne</i> ...	—	x	x	x	—	—	—	—	—
<i>Eriodendron anfractuosum</i> ...	x	x	x	x	—	—	x	—	—
<i>Dodonæa viscosa</i> ...	x	x	x	x	x	x	x	—	—
[ <i>Vernonia cinerea</i> ] ...	x	x	x	x	x	x	x	—	x
5. <i>Vernonia divergens</i> ...	—	x	x	—	—	—	—	x	—
<i>Bumea virens</i> ...	—	x	x	—	—	—	—	x	—
[ <i>Strophanthus Wallichii</i> ]...	—	—	[x]	—	—	—	—	—	—

SPECIES.	Africa.	S. E. Asia.				Australia.	Polynesia.	America.	Narcondam.	Barren Island.
		India.	Indo-China.	Malaya.						
Anodendron paniculatum ...	—	x	x	x	—	—	—	—	x	—
Chonemorpha macrophylla ...	—	x	[x]	x	—	—	—	—	x	—
10. Hoya parasitica ...	—	—	—	x	—	—	—	—	x	x
Hoya diversifolia ...	—	—	—	x	—	—	—	—	x	x
Dischidia nummularia ...	—	—	—	x	x	—	—	—	x	x
Oroxylum indicum ...	—	—	x	x	—	—	—	—	x	x
Heterophragma adenophyllum ...	—	—	—	x	—	—	—	—	x	—
15. Aristolochia tagala ...	—	—	x	x	—	—	—	—	x	x
Dendrobium secundum ...	—	—	—	x	—	—	—	—	—	—
[Calanthe veratrifolia] ...	—	—	x	[x]	x	x	—	—	—	—
Dorites Wightii ...	—	—	x	x	—	—	—	—	—	—
Aërides multiflorum ...	—	—	x	x	—	—	—	—	—	—
20. Pholidota imbricata ...	—	—	x	x	x	—	—	—	—	x
Dioscorea glabra ...	—	—	x	x	x	—	—	—	x	x
Dioscorea pentaphylla ...	—	—	x	x	x	—	—	—	x	x
Gloriosa superba ...	—	—	x	x	x	—	—	—	x	x
[Ischæmum ciliare] ...	—	—	x	x	x	x	—	—	—	x
25. [Andropogon contortus] ...	x	x	x	x	x	x	x	—	—	x
Davallia solida ...	—	—	—	[x]	x	x	x	x	—	—
Adiantum lunulatum ...	x	x	x	x	x	x	x	—	—	—
Polypodium irioides ...	x	x	x	x	x	x	x	x	—	—
Polypodium adnascens ...	x	x	x	x	—	x	x	—	—	—
30. Polypodium quercifolium ...	—	—	x	x	x	x	x	—	—	x
Vittaria elongata ...	x	x	x	x	x	x	—	—	x	—
Acrostichum scandens ...	—	—	x	x	x	x	—	—	x	x
[Acrostichum appendiculatum] ...	—	—	x	x	x	x	—	—	x	x
Lygodium flexuosum ...	x	x	x	x	x	—	—	—	x	—
35. Calymperes Dozyanum ...	—	—	[x]	[x]	x	x	—	—	p	—
Bryum coronatum ...	x	x	x	x	x	x	x	x	x	x
Collema nigrescens ...	x	x	x	x	x	x	x	x	x	—
Physcia obscura ...	x	x	x	x	x	x	x	—	—	—
Lentinus leucochrous ...	—	—	—	[x]	x	—	—	—	—	—
40. Lenzites deplanata ...	—	—	x	x	x	—	—	—	—	—
Lenzites subferruginea ...	—	—	x	x	x	—	—	—	—	—
Polyporus fulvus ...	—	—	—	[x]	x	—	—	—	—	—
Polyporus xanthopus ...	x	x	x	x	x	x	x	p	—	—
Polyporus sanguineus ...	x	x	x	x	x	x	x	p	—	—
45. Polyporus grammatocephalus ...	—	—	x	x	x	x	x	—	—	—
Polyporus australis ...	x	x	x	x	x	x	x	x	—	—
Hexagona pergamenea ...	—	—	[x]	[x]	—	—	—	—	—	—
Hexagona sericeo-hirsuta ...	—	—	—	[x]	—	—	—	—	—	—
Hexagona tenuis ...	x	x	—	[x]	—	—	—	—	—	—
50. Dedælea flabellum ...	—	—	x	[x]	—	—	—	—	—	—
Dedælea sanguinea ...	—	—	x	[x]	—	—	—	—	—	—
Dedælea quercina ...	x	x	x	x	x	x	x	p	—	—
Dedælea concentrica ...	x	x	x	x	x	x	x	x	—	—
Thelephora incrustans ...	x	x	x	x	x	x	x	x	x	x
55. Bovista lilacina ...	x	x	x	x	x	x	x	—	—	—
Hirneola polytricha ...	x	x	x	x	—	—	x	—	—	—
Daldinia vernicosa ...	—	—	—	[x]	—	—	—	—	—	—
Rhytisma sp. ...	—	—	—	[x]	—	—	—	—	x	x

It will be seen that the majority of the species in this table are actually present in one or other of the two volcanic islands of the Andaman Sea, Narcondam and Barren Island, and even in these cases where they are not present allied species are. There is a *Bombax* in Narcondam and though its specific identity or otherwise with the Andamans one cannot be here discussed, it is evident that any *Bombax* may be wind-introduced. And whatever agency explains the presence of *Bombax* will, *pari passu*, explain that of *Eriodendron*.

Not a single orchid was found on Narcondam though on Barren Island two were found—a species of *Dendrobium* on trees on the outer cone, and *Pholidota imbricata*, which occurs at the top of the inner cone within the crater-cup where the ground is kept moist by the condensation of escaping steam. Then the *Hoyas* are both present in great abundance on the exposed rocks and tall trees of both islands. The most doubtful species undoubtedly are *Aristolochia tagala*, *Gloriosa superba*, and, especially, the two species of *Dioscorea*. Yet these must all be immigrant. The writer has collected *Aristolochia tagala* on Batti Malv, a small outlying uninhabited fragment of the Nicobar Group, on Barren Island, and on Narcondam. And even if it be claimed that on Batti Malv the species may be a remanent one on the other two islands it, like every other species, *must* be immigrant. The case of *Gloriosa superba* has already been discussed when dealing with the species introduced by the sea. The *Dioscoreas* are still more difficult to explain, but it hardly seems as if they could be bird-introduced, and it is almost as difficult to think that they have been introduced by the sea. They are never littoral, being even in these islands strictly confined to the higher dry ridges. Yet they are certainly not necessarily remanent, for the writer has collected not these only but a third species, *Dioscorea bulbifera*, or at all events a bulbiferous one, which is present along with these two in great quantity in Narcondam and especially in Barren Island. In both these islands the species must all be immigrant and from the physiographical history of Barren Island should there be, biologically speaking, extremely recently so. Though no *Strophanthus* occurs in Barren Island, an *Aganosma* is common there. The distribution of the *Cryptogams* of this class calls for little remark, the peculiarities displayed in this respect by the *Fungi* being probably altogether owing to this class being imperfectly known in most floras. The presence, for instance, of two species here that are recorded only from North America probably implies that they are both in reality cosmopolitan or nearly so.

To the 58 species enumerated above should be added six imperfectly represented *Cryptogams*, giving a total of 64 species; the following table contains an analysis of their distribution.

TABLE XVIII. *Analysis of the distribution of Wind-introduced species.*

Species present in both hemispheres :—	21
Cosmopolitan in the tropics ( <i>Phanerog.</i> 3 ; <i>Cryptog.</i> 12)	15
Almost Cosmopolitan ( <i>Phanerog.</i> 1 ; <i>Cryptog.</i> 5)	6
In Africa, Asia, Polynesia, America ( <i>Cryptog.</i> )	2
In Africa, Asia, America ( <i>Phanerog.</i> )	1
In Asia, Australia, America ( <i>Cryptog.</i> )	1
In Asia, America ( <i>Cryptog.</i> )	2
Confined to Old World :—	43
{ In Africa, Asia, Anstralia, Polynesia ( <i>Cryptog.</i> )	1
{ In Africa, Asia, Australia ( <i>Cryptog.</i> )	1
{ In Africa, Asia ( <i>Cryptog.</i> )	1
{ In Asia, Australia, Polynesia ( <i>Cryptog.</i> )	3
{ In Asia, Australia, ( <i>Phanerog.</i> )	2
{ In Asia, Polynesia ( <i>Cryptog.</i> )	1
Confined to Asia, ( <i>Phanerog.</i> 18 ; <i>Cryptog.</i> 16)	34
 TOTAL of possibly wind-introduced species :—	 64
Phanerogams	25
Cryptogams	39

We thus see that 32 per cent. of the species are cosmopolitan, but that at the same time as many as 53 per cent. are confined to South-Eastern Asia, figures which tend to shew that the agency of wind appears to be less active than we might expect. So far as the more local distribution is concerned we find that 40 species, or 62 per cent., may have reached the islands either from Indo-China or from Malaya ; 10 species, or 15 per cent., appear to be local species ; 3 species appear to have reached the islands from Malaya and one must have come either from Malaya or Ceylon, these four are, however, all *Cryptogams* and may possibly yet be found in Indo-China. Even if it be assumed that these do not occur in Burma, it leaves the south-west monsoon responsible for the introduction of only  $6\frac{1}{2}$  per cent. of this group of species. The remaining 10 species, or about 16 per cent. of the class, have more probably been introduced by the north-east monsoon, a circumstance that might be expected, seeing that this monsoon blows from the direction of the nearest land. And as this is the case it will follow that the probability is strong that most of the species which may, so far as their present distribution indicates, have come either from Indo-China or Malaya have in reality come from the north-east. The only species of the kind for which this is doubtful is *Chonemorpha macrophylla*, which, though abundant in India and in the Himalaya, and equally so in Malaya and in the Andamans, has not yet been recorded from any part of Indo-China to the east of Khasia and Sylhet.

The last group of introduced species—those carried by birds—has now to be considered. In discussing this it its necessary to distinguish

between species the seeds or fruits of which may arrive attached to the bodies of birds, and species of which the fruits and seeds have been eaten. The species carried externally will be first considered and may further be conveniently subdivided into two sub-groups, *viz.*, species that have probably been introduced only by swimming- or wading-birds, and species introduced by birds of any kind. The species of the first kind give a sub-group distinguished by an aquatic or paludine habitat, and characterised by small inconspicuous fruits or seeds that readily become attached, along with pellets of mud, to the feet, the leg-feathers, or the feathers at the base of the bill, of birds frequenting pools and marshes. The following table exhibits the whole of this kind present in the Coco Group.

TABLE XIX. *Distribution of the species probably introduced by swimming or wading birds.*

			S. E. ASIA.						
			Africa.	India.	Indo-China.	Malaya.	Australia.	Polynesia.	America.
<i>Nymphaea Lotus</i>	...	...	x	x	x	x	—	—	—
<i>Limnanthemum indicum</i>	...	...	x	x	x	x	x	x	x
<i>Hygrophila quadrivalvis</i>	...	...	—	x	x	—	—	—	—
<i>Lippia nodiflora</i>	...	...	x	x	x	x	x	x	x
5. <i>Polygonum barbatum</i>	...	...	x	x	x	x	x	—	—
<i>Zanichellia palustris</i>	...	...	x	x	x	x	x	x	x
<i>Cyperus polystachyus</i>	..	..	x	x	x	x	x	x	x
<i>Cyperus elegans</i>	...	...	—	x	x	x	—	—	—
<i>Cyperus dilutus</i>	...	...	—	x	x	x	—	—	—
10. <i>Fimbristylis quinqueangularis</i>	...	...	x	x	x	x	x	—	—
<i>Fimbristylis miliacea</i>	...	...	x	x	x	x	x	—	x
<i>Scirpus subulatus</i>	...	...	x	x	x	—	—	—	—
<i>Paspalum scrobiculatum</i>	...	...	x	x	x	x	x	—	—
<i>Panicum Myurus</i>	...	...	x	x	x	x	x	x	x
15. <i>Ceratopteris thalictroides</i>	...	...	x	x	x	x	x	x	x
<i>Chara foetida</i>	...	...	—	x	x	x	—	—	—

The next table gives the analysis of this distribution; the most striking feature the two tables reveal is the extent to which species of this kind are cosmopolitan. Among the non-cosmopolitan species the indications are altogether in favour of introduction from the northward and westward, for while only 10 of the species occur in Australia, and only the 6, which are all cosmopolitan, occur in Polynesia, 12 occur in Africa and 7 in America. Of the more local distribution we learn that none need necessarily have been introduced from Malaya since the 14 that occur

there all occur in India and Indo-China also, while two that occur in India and Indo-China but do not occur in Malaya must have been introduced from the north. This being the case the probability is that the others have mainly been introduced from the same direction, a circumstance quite in accordance with expectation, since it is from the north that the stream of migration of marsh- and water-birds annually flows. During our visits to the islands snipe were found in the meadow near the lake on Great Coco, while teal and other water-birds frequented the lake itself and abounded in the lagoon on Little Coco.

TABLE XX. *Analysis of distribution of Marsh and Aquatic species.*

Present in both Hemispheres :—	7
Cosmopolitan in the tropics:.....	6
Nearly cosmopolitan (absent from <i>Polynesia</i> ) .....	1
Confined to Eastern Hemisphere .....	9
Africa, Asia, Australia .....	3
Africa, Asia .....	2
Confined to South-eastern Asia .....	4
TOTAL species probably introduced by water-birds .....	16

The second kind of species that may be introduced by becoming attached externally to birds is somewhat more difficult to deal with. *Urena lobata*, which is here clearly not a weed, may have been introduced in this way: its fruits sticking, burr-like, to the feathers of some bird; *Buettneria andamanensis*, might also have been thus introduced, though this is not so probable as in the other case. Three of the *Desmodia*—*Desmodium triquetrum*, *D. laxiflorum* and *D. polycarpon*—may very well owe their introduction to this mode of dispersal. *Boerhaavia repens*, as has already been said, is probably sea-introduced, though there is no reason why it may not partly owe its dispersal to bird-agency. Its habitat on these islands is always the rocky headlands or isolated rocks along the coast on which sea-birds sit to devour the *Grapsus* crabs they capture on the wave-washed ledges below, and nothing is more likely than that the fruits may become at times attached to their feet and be carried at least from point to point along the coast. The *Pisonias* may both very well have been introduced in this fashion, though it is less likely as regards *P. aculeata* than as regards *P. excelsa*. From what has been already said of this tree in discussing it among the “littoral” species, it will be evident that its fruits are of such a nature as to admit of their being carried for great distances attached to a bird’s feet or body, if only the bird should happen to come in contact with them, and the objection that scraping-birds, which might do so, are not often migratory, while frugivorous birds, which are migratory, would not come in contact with the fruits because they are not likely to alight on a *Pisonia*, is not a valid one.

Though many such birds, as for instance *Carpophaga bicolor*, appear always to feed on trees and therefore would probably very rarely come in contact with *Pisonia* fruits, many others, as for instance *Calænas nicobarica*, appear to feed as much or more on the ground, on fallen ripe fruits, as on the trees that bear the fruits they eat.\* And in such a case there is no doubt that they might very easily come in contact with *Pisonia* fruits. Though essentially a beach-forest tree, the writer has collected specimens of *Pisonia excelsa* (and the tree was plentiful where he did so) three or four miles inland and 250—300 feet above sea-level; some mode of dispersal other than, or at any rate supplementing, ocean-dispersal, must therefore, as has already been pointed out, be postulated as regards this species. Of the grasses placed in this list *Andropogon contortus* already mentioned as possibly wind-introduced, much more probably owes its presence to this mode of introduction *Oplismenus compositus* is also sufficiently well endowed to render this mode of introduction likely. The only *Cryptogam* likely to have been thus introduced is *Acrostichum appendiculatum*, the spores of which might easily get brushed off by the feathers of a bird walking through a patch of it. This would also apply to the seeds of *Calanthe*.

The following table gives the names and distribution of the species likely to be thus introduced or likely to have their local dispersion assisted by this means.

TABLE XXI. *Distribution of species probably introduced attached to the feet or feathers of land-birds.*

SPECIES.	Africa.	S. E. ASIA.				Australia.	Polynesia.	America.
		India.	Indo-China.	Malaya.				
<i>Urena lobata</i> ...	x	x	[x]	x	x	x	x	
[ <i>Buettneria andamanensis</i> ] ...	—	—	[x]	—	—	—	—	
<i>Desmodium triquetrum</i> ...	x	x	x	x	—	—	—	
<i>Desmodium laxiflorum</i> ...	x	—	x	x	—	—	—	
5. <i>Desmodium polycarpum</i> ...	x	x	x	x	x	x	—	
[ <i>Loranthus longiflorus</i> ] ...	—	x	x	x	—	—	—	
[ <i>Boerhaavia repens</i> ] ...	x	x	x	x	x	x	—	
[ <i>Pisonia aculeata</i> ] ...	x	x	x	x	—	—	x	
<i>Pisonia excelsa</i> ...	—	—	[x]	x	—	—	—	
10. <i>Calanthe veratrifolia</i> ...	—	x	[x]	x	x	—	—	
<i>Oplismenus compositus</i> ...	x	x	x	x	x	x	—	
<i>Andropogon contortus</i> ...	x	x	x	x	x	x	x	
<i>Acrostichum appendiculatum</i> ...	—	x	x	x	—	—	—	

\* This at least was the writer's experience in Batti Malv, the small uninhabited almost inaccessible island of the Nicobar Group already referred to, where *Calænas nicobarica* breeds, and on which thousands of individuals of this species congregate.

The list is so short that an analysis of it is unnecessary; it is sufficient to note that the possibility of introduction from Malaya or from Indo-China is, so far as its evidence goes, evenly balanced.

While the two lists probably include all the species usually introduced by being attached externally to birds they do not exhaust all the possibilities of the case. For, if the mud of a marsh may fix the seeds or fruits of paludine species to the feet or head of wading-birds, other substances may fix the seeds of forest species to the bodies of forest-birds. There is almost no limit to the number of species that might be suggested as introduced in this way, provided their seeds be sufficiently small; this very circumstance, combined with the necessarily hypothetical nature of the subject, makes it impossible to attempt the suggestion of this mode of dispersal in connection with any particular species.\*

The next kind of "bird-introduced" species to be considered—those introduced in consequence of having been eaten—may also be conveniently divided into two sub-groups; one consisting of species where dissemination by birds is an every-day process, the other consisting of species that can only be occasionally disseminated in this fashion since the process implies the destruction of the bird itself.

The first sub-group corresponds fairly closely with those species

\* The following facts will shew that, though necessarily hypothetical, the subject is not far-fetched but is, on the contrary, highly deserving of attention. When in Narcondam the writer was particularly anxious to obtain the seeds of a species of *Bombax* present there, for sowing at Calcutta; for some days the search was hopeless because the capsules as they ripen are broken open and the seeds are eaten by a species of Horn-bill that is common in the island, while any seeds that escape the birds and fall to the ground are devoured by the rats that swarm in the place. At length under one tree, where there happened to be on the under-growth one or two large spider's webs, four seeds were found sticking in these webs; these were the only seeds he was fortunate enough to obtain; they were brought to Calcutta, germinated there, and the four young trees are now alive in the Botanic Garden. This will shew that seeds easily may, and at times do, stick in spider's webs.

In spring 1890 a Barbet was found lying on the ground in the Botanic Garden unable to fly; on being picked up and examined it was found that its left wing and left leg were fixed together by means of a spider's web; on freeing these it was found that the toes of its left foot were further bound up in a ball and the flight-feathers were firmly tied together. When finally completely freed from its entanglement the bird flew away, frightened, but physically uninjured. This will shew that birds do sometimes come in contact with spider's webs and that these are capable not merely of fixing objects to a bird's feathers but of fixing these feathers so that the bird itself cannot move them.

All that is therefore required in order to establish the truth of the hypothesis is direct observation of a bird having come in contact with a spider's web which happened to have seeds lodged in it at the time, and of its carrying away seeds and web together.

that have pulpy fruits with a hard stone or with hard indigestible seeds. It cannot, however, be held to include all these, for though birds *do* eat the pulpy part of the fruits of *Canarium*, *Spondias* and *Dracontomelum*, the stones of these are too large to be swallowed; probably therefore some other mode of dispersal must be held accountable for the presence in these islands of species of those genera. For *Dracontomelum* introduction by the sea has been suggested, though doubtfully; the others are left, with some reluctance, among the "remanent" species. There are other species for which this agency is only doubtful, such as *Milium*, the fruits of which do not look very inviting—some *polyalthias* are, however, so dispersed, *e. g.*, *P. longifolia* by frugivorous bats; *Physalis minima* might well enough have been introduced in this way, but is, all things considered, more probably sea-introduced; some of the *Convolvulaceæ* may also have been thus introduced. Moreover it must not be forgotten that indirect introduction in this way is not impossible. As has been pointed out, some of the fruit-eating pigeons are ground-feeding creatures, and if a sticky pulpy fruit should fall into a patch of *Oplismenus*, *Panicum*, *Aneilema*, or other small-fruited or -seeded herbaceous ground-species, the seeds or fruits of these may become attached to the fruits in question and, if then swallowed unnoticed by a fruit-eating bird, be voided uninjured along with the stone or seeds of the fruit itself and subsequently germinate. The subjoined table gives a list of all the species probably directly introduced; the indirect method, as being too hypothetical for discussion here, is not mentioned in connection with any particular species.

As in the case of species introduced by wind the occurrence of species of this kind in the islands of Narcondam and Barren Island is given; these being islands for which it is necessary at the outset to exclude from consideration any hypothetical "remanent" element.\*

\* This part of the list is not so complete as it might be, since owing to the pressure of other duties the writer has not yet been able to complete the examination of the species collected by him in those islands in April 1891. This much may be said, that all the species quoted as occurring there do occur. But many of the others though not present are represented by nearly allied species and by species of this kind. There is for example at least one *Grewia* in Narcondam, there are several *Rubiaceæ* and there is an *Amorphophallus*. In Narcondam too there is a species of *Strychnos*, while a species of *Eugenia* is common in Barren Island. These two isolated localities therefore present two genera, with species that have fruits of the kind now discussed, of which no representatives were met with in the Coco Group. Similarly Batti Malv, equally isolated, and quite uninhabited, has an *Alangium* and a *Datura*; it may therefore be repeated that this list by no means overstates the possibilities of the agency in such a locality as this.

TABLE XXII. *Species probably introduced by fruit-eating birds.*

SPECIES.	Africa.	S. E. ASIA.				Australia.	Polynesia.	America.	Narcondam.	Barren Island.
		India.	Indo-China.	Malaya.						
[ <i>Miliusa</i> sp.] ...	...	—	[x]	—	—	—	—	—	—	
<i>Capparis sepiaria</i> ...	...	x	x	x	—	—	—	—	x	
<i>Capparis tenera</i> ...	...	—	x	x	—	—	—	—	x	
<i>Grewia lævigata</i> ...	...	x	x	x	x	—	—	—	x	
5. <i>Grewia Microcos</i> ...	...	—	x	x	x	—	—	—	—	
<i>Glycosmis pentaphylla</i> ...	...	—	x	x	x	—	—	—	—	
<i>Garuga pinnata</i> ...	...	—	x	x	x	—	—	—	—	
<i>Aglaia andamanica</i> ...	...	—	—	[x]	—	—	—	—	—	
<i>Cansjera Rheedii</i> ...	...	—	x	[x]	x	—	—	x	—	
10. <i>Sarcostigma edule</i> ...	...	—	—	[x]	—	—	—	—	—	
<i>Salacia prinoides</i> ...	...	—	x	x	x	—	—	x	—	
<i>Zizyphus CEnoplia</i> ...	...	—	x	x	x	—	—	—	—	
<i>Vitis pentagona</i> ...	...	—	—	x	—	—	—	—	—	
<i>Vitis carnosæ</i> ...	...	—	x	x	x	—	—	—	—	
15. <i>Vitis pedata</i> ...	...	—	x	x	x	—	—	x	—	
<i>Leea hirta</i> ...	...	—	x	x	x	—	—	x	—	
<i>Erioglossum edule</i> ...	...	—	x	x	x	—	—	x	—	
<i>Allophylus Cobbe</i> ...	...	—	x	x	x	—	—	x	—	
<i>Sapindus Danura</i> ...	...	—	x	x	—	—	—	—	—	
20. <i>Pometia tomentosa</i> ...	...	—	[x]	x	x	—	—	—	—	
<i>Odina Wodier</i> ...	...	—	x	x	—	—	—	x	—	
<i>Semecarpus subpanduriformis</i>	...	—	—	x	—	—	—	—	—	
<i>Semecarpus heterophylla</i>	...	—	—	[x]	x	—	—	x	x	
<i>Memexylon edule</i> ...	...	—	[x]	x	x	—	—	x	—	
25. <i>Modecca cordifolia</i> ...	...	—	—	[x]	x	—	—	—	—	
<i>Trichosanthes palmata</i> ...	...	—	x	x	x	—	—	x	—	
<i>Mussaenda calycina</i> ...	...	—	x	x	x	—	—	—	?	
<i>Pavetta indica</i> ...	...	—	x	x	x	x	—	—	—	
<i>Psychotria adenophylla</i> ...	...	—	—	x	—	—	—	—	—	
30. <i>Pæderia foetida</i> ...	...	—	—	x	x	—	—	—	x	
<i>Ardisia humilis</i> ...	...	—	x	x	x	—	—	x	—	
<i>Rauwolfia serpentina</i> ...	...	—	x	x	x	—	—	—	—	
<i>Erycibe paniculata</i> ...	...	—	x	x	x	—	—	—	—	
[ <i>Physalis minima</i> ] ...	...	x	x	x	x	x	x	—	x	
<i>Myristica Irya</i> ...	...	—	[x]	x	x	—	—	—	—	
35. <i>Myristica glauca</i> ...	...	—	—	[x]	x	—	—	x	—	
<i>Dehaasia Kurzii</i> ...	...	—	—	[x]	—	—	—	—	—	
<i>Bridelia tomentosa</i> ...	...	—	x	x	x	—	—	x	—	
<i>Bridelia Kurzii</i> ...	...	—	—	[x]	—	—	—	—	—	
<i>Flueggea microcarpa</i> ...	...	x	x	x	x	—	—	x	—	
40. <i>Phyllocllamys spinosa</i> ...	...	—	x	x	x	—	—	—	—	
<i>Plecosperrnum andamanicum</i>	...	—	—	[x]	—	—	—	—	—	
<i>Ficus Benjamina</i> ...	...	—	x	x	x	—	—	—	—	
<i>Ficus Rumphii</i> ...	...	—	x	x	x	—	—	x	x	
<i>Ficus retusa</i> ...	...	—	x	x	x	x	—	x	x	

SPECIES.	Africa.	S. E. ASIA.				Australia.	Polynesia.	America.	Narcondam.	Barren Island.
		India.	Indo-China.	Malaya.						
45. <i>Ficus brevicuspis</i> ...	—	—	[ x ]	x	—	—	—	—	—	
<i>Ficus callosa</i> ...	—	—	x	x	x	—	—	—	—	
<i>Ficus hispida</i> ...	—	—	x	x	x	x	—	—	—	
<i>Ficus grisea</i> ...	—	—	—	x	[	—	—	—	—	
<i>Antiaris toxicaria</i> ...	—	—	x	x	x	—	—	—	—	
50. <i>Artocarpus Gomeziana</i> ...	—	—	—	[ x ]	x	—	—	—	x	
<i>Zingiber</i> sp. ...	—	—	—	[ x ]	—	—	—	—	—	
<i>Costus speciosus</i> ...	—	—	x	x	x	—	—	—	—	
<i>Smilax macrophyllus</i> ...	—	—	x	x	—	—	—	—	—	
<i>Asparagus racemosus</i> ...	—	—	x	x	x	—	—	—	—	
55. <i>Dracæna spicata</i> ...	—	—	x	x	x	—	—	—	—	
<i>Amorphophallus</i> sp. ...	—	—	—	[ x ]	—	—	—	—	—	
<i>Pothos scandens</i> ...	—	—	x	x	x	—	—	x	—	

The most remarkable feature of the list is that it gives us for the first time a well-defined group of species none of which extend to America or even to Polynesia, and only two of which extend to Africa, though no fewer than 15, or 27 per cent., extend to Australia. The remaining 40 are confined to South-Eastern Asia. As regards their more local distribution there, 17, or 31 per cent., are confined to lands lying to the east of the Sea of Bengal, while 3 more occur in Ceylon but not in India, a circumstance which perhaps indicates that birds which feed on these species pass from Malaya to Ceylon but do not visit India. If this be the case the agency of frugivorous birds may partly explain the existence of a Ceylon element in the flora of the Andamans generally, a circumstance that has, as already said, been made the subject of remark by the late Mr. Kurz, (*Report on the Vegetation of the Andaman Islands*, p. 15); this point will be more fully discussed below.

As many as 36 species, or 64 per cent., occur both in Indo-China and in Malaya; as 15 pass southward to Australia while 14 pass northward to South China, and 5 pass southward to Malaya without going north to Indo-China, while 5 reach the islands from Indo-China without extending to Malaya, we may conclude that, though this element in the flora is distinctly non-Indian, the Indo-Chinese and Malay-Australian influences are, so far as it is concerned, evenly balanced.

Since the active agency in the dispersal of these species is that of

fruit-eating birds, it ought to be possible to show that the known migrations of these creatures sufficiently explain their distribution. For all the species that occur in the Malay Archipelago this is extremely easy to do. The western half of the Malay Archipelago is particularly rich in fruit-eating pigeons and, as this area lies on both sides of the equator, the annual changes of season must cause the fruit-eating species, following the fruits on which they feed as these become mature, to oscillate from side to side of the equator. The same condition will ensure further migration from Southern Malaya to North Australia and *vice versa* on the one hand, and from Northern Malaya to the Nicobars and Andamans and *vice versa* on the other. It is not necessary to suppose that any particular fruit-eating bird must range from one end to the other of the area here considered, though some species, like *Caloenas nicobarica*, which extends from these islands to New Guinea, nearly or altogether do so; it is sufficient to know that such birds are seasonal visitants in any given locality, as is true of *Carpophaga bicolor*, *Carpophaga insularis*, *Caloenas nicobarica*, and many other species in those very islands; the region depleted of one set of species by the migration of these towards the north is filled with individuals representing another set coming from an area still further south. By the necessary over-lapping of the ranges of migration of different birds a continuous chain of dispersal is kept up and, even if Malayan birds never go further north than these islands, the process is continued by the arrival from and departure to the opposite point of the compass, of Indo-Chinese species; it is therefore not surprising to find that, where the climatic conditions still continue favourable, the same bird-distributed species of *Phanerogams* extend from North Australia through all the intervening areas to Southern China. This being so, the appearance of the same species in India and in Malaya, which is the case in 33 species, or 58 per cent., of the group, is simply explained. Certain species of birds, instead of only passing southward from China to Indo-China, pass also south-westward to the Eastern Himalaya or to the Assam valley, from whence these, or other, species of birds carry the seeds of the plants in question still further south-westward into peninsular India. This may explain also why certain species, like *Pæderia foetida*, extend from Malaya northwards to Indo-China on the eastern line of migration, but on the western extend only southward to the Eastern Himalaya and not into India; the species of birds that eat their fruits may perhaps not migrate on the more western line of migration further south than the Himalayan slopes. The same reasoning applies to those species, of which there are 3, or about 5 per cent., that extend to Southern India on the western line of migration but do not go as far as Malaya on the

eastern line. The species that are common to these islands and to Ceylon are more difficult to explain. If we felt certain that they are species of distinctively Ceylonese type and that they occur, out of Ceylon, only in these islands, we might suppose that Ceylon birds are occasionally driven by storms as far as the Coco Group and consider the dispersal of the seeds of such species as one of the indirect sequels of cyclones of unusual severity. The birds even need not be different, as regards species, from those commonly found in the Andamans; they need only be individuals that have followed the western instead of the eastern line of migration southward, and that under exceptional circumstances have passed directly from one line of migration to the other, carrying in their crops seeds or fruits that are characteristic of the line of migration from which they have been driven. If the species are not of Ceylonese type, their occurrence both in Ceylon and the Cocos may, as has been said already, only indicate that they have been brought directly from Malaya or Australia by southern birds that migrate to Ceylon as well as to the Coco Group but do not go as far north as peninsular India.

The remaining sub-group consists of species with seeds or fruits that are eaten by birds of different kinds, not for the sake of any pulpy portion, but on account of the nutritious properties of the whole fruit or seed. We have to realize that the dispersal in this case is not, as in the case of pulpy fruits the seeds of which are afterwards voided, an ordinary circumstance, inasmuch as the seeds are eaten for their own sake and are of necessity digested by the birds that eat them. But though it is not perhaps a common occurrence—the numbers of migrating grain- or seed-eating individuals considered—for newly-arrived birds to be killed, there is no doubt that a certain proportion, tired out by their long flight, must fall victims to raptorial birds immediately on their arrival, the grains or seeds that their crops may contain falling aside and possibly germinating. Besides this means of introducing such species, and, even if the results be slight, it must nevertheless be in constant operation, there is the further possibility of similar species being introduced during severe cyclones, owing to birds that have been driven to land being captured and devoured, while exhausted by the buffeting of the tempest, by birds or beasts of prey. In this way not only the grain- or seed-eating species that ordinarily visit the islands, but species both of this and of the fruit-eating class that do not usually reach the group, may conceivably arrive and as conceivably bring with them the seeds of plants that birds which are normal visitants have no opportunity of meeting with or may not care to eat. It has to be admitted, however, that species for which this mode of introduction

is claimed may with some degree of reason be looked upon as distinctly, though indirectly, introduced by wind.\*

The species for which this mode of introduction is conceivable are given below. That many of them *must* be introduced species their presence in Narcondam and Barren Island testifies ; it is therefore, as regards these, somewhat on the principle of exclusion that they are referred to this class, and for some of them, such as *Abrus precatorius*, it is doubtful if it be not rather the sea that is responsible for their appearance.

TABLE XXIII. *Species perhaps introduced by seed- and grain-eating birds.*

SPECIES.	S. E. ASIA.						
	Africa.	India.	Indo-China.	Malaya.	Australia.	Polynesia.	America.
<i>Cyclea peltata</i> ...	—	x	x	x	—	—	—
<i>Abrus precatorius</i> ...	x	x	x	x	x	x	x
<i>Abrus pulchellus</i> ...	—	x	x	x	—	—	—
<i>Mucuna pruriens</i> ...	x	x	x	x	x	x	x
5. <i>Acacia pennata</i> ...	x	x	x	x	—	—	—
<i>Albizzia Lebbek</i> ...	x	x	x	x	x	—	—
<i>Albizzia procera</i> ...	—	x	x	x	—	—	—
<i>Ipomæa Turpethum</i> ...	x	x	x	x	x	x	—
<i>Pollia zorzogonensis</i> var. ...	—	—	[x]	x	—	—	—
10. <i>Commelina obliqua</i> ...	—	x	x	x	—	—	—
[ <i>Aneilema ovatum</i> ] ...	—	—	x	x	—	—	—
<i>Panicum colonum</i> ...	x	x	x	x	x	x	x
<i>Panicum Helopus</i> ...	x	x	x	x	x	—	—
<i>Panicum javanicum</i> ...	—	—	[x]	x	—	—	—
15. [ <i>Panicum ciliare</i> ] ...	x	x	x	x	x	x	x
[ <i>Ischæmum ciliare</i> ] ...	—	x	x	x	x	—	—
[ <i>Elysiene indica</i> ] ...	+	x	x	x	x	x	x
[ <i>Dendrocalamus strictus</i> ] ...	—	x	x	—	—	—	—

\* That there is nothing extravagant in claiming this as a possible means of introduction, the following passage (which refers, as it happens, to one of the islands under discussion), will sufficiently prove:—"Mr. Hawkins told us that when "the storm was over \* \* \* \* \* "every hollow of the island was tenanted by hundreds of numbed or wounded "sea-birds of all descriptions (such as he had never seen near the island before or "since) so terrified or exhausted that he picked up or took home several of them to "the light-house to show to his wife. Mixed with these were a certain number "of pigeons, parrots, and other land-birds, but the great majority were Petrels, "Terns, Whale-birds and such like sea-fowl with which his experience as a sailor "in southern seas had made him familiar. Most of these birds ultimately recovered "and left the island, but many of them hung about it for weeks, and for many "days remained so tame that they would not move from the ground or the rocks,

Of the above, *Cyclea peltata*, *Abrus precatorius*, *Acacia pennata*, *Albizia Lebbek*, *Albizia procera*, *Ipomœa Turpethum*, and *Pollia zorzogonensis* occur in Narcondam. With few exceptions they are widely distributed species; five are cosmopolitan, one extends throughout the Eastern Hemisphere and thence to Australia and Polynesia, two extend from Africa and Asia to Australia, one occurs in Asia and Africa, one in Asia and Australia; only eight species, or less than half of the group, are confined to South-Eastern Asia. Of these latter, three are confined to the countries east of the Bay of Bengal; two of them, *Panicum javanicum*, and the particular variety of *Pollia zorzogonensis* that occurs, are moreover distinctively Malayan, as opposed to Indo-Chinese, plants. On the other hand one species, *Dendrocalamus strictus*, is as distinctively an Indian or Indo-Chinese plant.

We have now in conclusion to consider the "remanent" species, a list of which is given in the subjoined table; in a few cases where introduction is remotely possible the agency that may have been responsible is indicated.

"where they happened to alight, to make way for the keeper or his men." (*Hume; Stray Feathers*, vol. ii, p. 113-4.)

In this passage we have all the evidence that is required to show that not merely the usual visitants but even unusual ones may at times be driven to, or seek shelter on, these islands when in an exhausted or injured condition, and to show that this is as likely to happen to grain-, pulse-, and seed-eating species as to fruit-, or fish-, crustacean- or molluso-eating ones. It is of little moment that the fish- or crustacean-eating species must always be the more numerous, if we know that species of the other kind are at any time driven to the islands in this state. All of these exhausted and injured creatures certainly do not recover or escape destruction. As regards those that simply die, when the insects that abound have eaten all but their bones, the seeds that may have been contained in their crops must fall aside and may germinate and grow. And as regards those that are killed and devoured it would be remarkable if a few of the seeds in their crops did not thus fall aside and obtain an opportunity of germinating.

Even if no other creature that exists in these islands were capable of, or likely to, catch and eat such exhausted birds, the presence of a large lizard—*Hydrosaurus salvator*—which is very common, is sufficient to account for the destruction of many of them. During our visit to Little Coco one of the officers of the "Investigator" shot two *Carpophaga bicolor*—right and left—by the side of the lagoon near the south end of the island. Before his attendant could reach the birds, which had fallen among the *Pandanus* bushes of the sea-fence, one of these lizards had already eaten all but the wings and head of one pigeon and had torn open the breast of the second ere it could be interrupted in its feast. On a previous occasion a *Hydrosaurus* was killed as it was apparently about to seize a Teal that had just been shot and had been laid down on a rock in the same lagoon. On opening up this creature its stomach was found to contain already a large land crab, two fishes, and a quantity of grassy roots (apparently those of *Scirpus subulatus*).

TABLE XXIV. Possibly "Remanent" species of the Coco Island flora.

SPECIES.	Africa.	S. E. ASIA.				Australia.	Polynesia.	America.	Possibly introduced by
		India.	Indo-China.	Malaya.					
* <i>Miliusa</i> sp. ...	-	-	[x]	-	-	-	-	-	
[ <i>Cyclea peltata</i> ] ...	-	x	[x]	x	-	-	-	-	? Birds.
* <i>Antitaxis calocarpa</i> ...	-	-	[x]	-	-	-	-	-	
<i>Alsodeia bengalensis</i> ...	-	-	x	-	-	-	-	-	
5. <i>Dipterocarpus pilosus</i> ...	-	-	-	x	-	-	-	-	
<i>Dipterocarpus alatus</i> ...	-	-	-	x	-	-	-	-	
<i>Sterculia villosa</i> ...	-	-	x	[x]	-	-	-	-	
*[ <i>Sterculia rubiginosa var.</i> ] ...	-	-	[x]	-	-	-	-	-	? Ocean.
<i>Sterculia parviflora</i> ...	-	-	-	x	-	-	-	-	
10. <i>Sterculia alata</i> ...	-	-	-	x	-	-	-	-	
<i>Sterculia colorata</i> ...	-	-	x	x	-	-	-	-	
<i>Sterculia campanulata</i> ...	-	-	-	x	-	-	-	-	
<i>Buettneria andamanensis</i> ...	-	-	[x]	-	-	-	-	-	
<i>Berrya Ammonilla</i> ...	-	-	x	x	+	-	-	-	
15. * <i>Grewia calophylla</i> ...	-	-	-	[x]	-	-	-	-	? Birds.
* <i>Canarium euphyllum</i> ...	-	-	-	[x]	-	-	-	-	
<i>Amoora Rohituka</i> ...	-	-	x	x	x	-	-	-	? Birds.
<i>Chiocrassia tabularis</i> ...	-	-	x	[x]	x	-	-	-	
<i>Phlebocalymna Lobbiana</i> ...	-	-	-	[x]	-	-	-	-	
20. <i>Glyptopetalum calocarpum</i> ...	-	-	-	[x]	-	-	-	-	
<i>Siphonodon celastrineus</i> ...	-	-	-	[x]	x	-	-	-	
<i>Ventilago calyculata</i> ...	-	-	-	x	x	-	-	-	
<i>Parishia insignis</i> ...	-	-	-	[x]	-	-	-	-	
<i>Spondias mangifera</i> ...	-	-	x	x	x	-	-	-	
25. [ <i>Dracontomelum mangiferum</i> ] ...	-	-	x	x	x	-	x	-	? Ocean.
<i>Connarus gibbosus</i> ...	-	-	-	[x]	x	-	-	-	
<i>Pueraria Candollei</i> ...	-	-	-	x	-	-	-	-	
<i>Pueraria phaseoloides</i> ...	-	-	-	x	x	-	-	-	
<i>Pterocarpus indicus</i> ...	-	-	x	x	x	-	-	-	
30. <i>Derris scandens</i> ...	-	-	-	x	x	x	-	-	
<i>Mezoneuron enneaphyllum</i> ...	-	-	[x]	x	-	-	-	-	
<i>Adenantha pavonina</i> ...	-	-	-	x	x	-	-	-	
<i>Acacia concinna</i> ...	-	-	x	x	x	-	-	-	
<i>Terminalia bialata</i> ...	-	-	-	[x]	-	-	-	-	
35. * <i>Lagerstroemia hypoleuca</i> ...	-	-	-	[x]	-	-	-	-	
* <i>Lagerstroemia</i> sp. ...	-	-	-	[x]	-	-	-	-	
<i>Illigera conyzadenia</i> ...	-	-	-	[x]	-	-	-	-	
* <i>Webera Kurzii</i> ...	-	-	-	[x]	-	-	-	-	
<i>Randia longiflora</i> ...	-	-	-	x	x	-	-	-	
40. <i>Diplospora singularis</i> ...	-	-	-	-	x	-	-	-	
<i>Ixora grandifolia</i> ...	-	-	-	[x]	x	-	-	-	
<i>Ixora cuneifolia</i> ...	-	-	-	-	x	-	-	-	
<i>Strophanthus Wallichii</i> ...	-	-	x	x	-	-	-	-	? Wind.
<i>Argyrea Hookeri</i> ...	-	-	-	x	-	-	-	-	
45. <i>Argyrea lanceolata</i> ...	-	-	-	[x]	-	-	-	-	
<i>Lettsomia peguensis</i> ...	-	-	-	-	x	-	-	-	
<i>Porana spectabilis</i> ...	-	-	-	[x]	-	-	-	-	
<i>Thunbergia laurifolia</i> ...	-	-	-	x	x	-	-	-	

SPECIES.	Africa.	S. E. ASIA.				Australia.	Polynesia.	America.	Possibly introduced by
		India.	Indo-China.	Malaya.					
<i>Strobilanthes phyllostachyus</i> ...	-	-	x	-	-	-	-	-	
50. <i>Eranthemum album</i> ...	-	[x]	x	x	-	-	-	-	
<i>Peristrophe acuminata</i> ...	-	-	[x]	x	-	-	-	-	
<i>Bragantia tomentosa</i> ...	-	-	-	x	-	-	-	-	
<i>Loranthus longiflorus</i> ...	-	x	x	x	-	-	-	-	? Birds.
<i>Phyllanthus columnaris</i> ...	-	-	x	-	-	-	-	-	
55. <i>Cyclostemon assamicus</i> ...	-	-	x	-	-	-	-	-	
<i>Aporosa villosula</i> ...	-	-	x	-	-	-	-	-	
<i>Croton sublyratus</i> ...	-	-	[x]	-	-	-	-	-	
* <i>Blachia andamanica</i> ...	-	-	[x]	-	-	-	-	-	? Ocean.
<i>Claoxylon longifolium</i> ...	-	-	[x]	x	-	-	-	-	
60. <i>Mallotus acuminatus</i> ...	-	-	[x]	x	-	-	-	-	
* <i>Mallotus andamanicus</i> ...	-	-	[x]	-	-	-	-	-	
<i>Cnesmone javanica</i> ...	-	-	[x]	x	-	-	-	-	
* <i>Livistona</i> sp ...	-	-	[x]	-	-	-	-	-	
* <i>Corypha elata</i> ...	-	-	[x]	-	-	-	-	-	
65. * <i>Calamus andamanicus</i> ...	-	-	[x]	-	-	-	-	-	
* <i>Calamus tigrinus</i> ...	-	-	x	-	-	-	-	-	
<i>Alocasia fornicata</i> ...	-	x	x	x	-	-	-	-	? Birds.
<i>Scindapsus officinalis</i> ...	-	x	x	x	-	-	-	-	? Birds.
<i>Dendrocalamus strictus</i> ...	-	x	x	-	-	-	-	-	
70. * <i>Xylaria clavarioides</i> ...	-	-	[x]	-	-	-	-	-	

To the 67 unequivocal species of this list 3 other apparently local *Fungi* should perhaps be added; it is, however, extremely probable that when they are better known they will be found to exist elsewhere, in which case they might be added to the list of wind-distributed species; the proportion that results is therefore:—

Migrant sp: Remanent sp:: 4: 1.

It will be noted that not a single species which seems unquestionably "remanent" extends beyond South-Eastern Asia, and that the species which are here treated as such are only 67 in number, constituting no more than 20 per cent. of the flora. Of these species only 21, or 32 per cent., occur in India or Ceylon or both, and of these only one (*Sterculia villosa*) has not hitherto been found elsewhere to the east of the Sea of Bengal. This "remanent" section of the flora may therefore be looked upon as distinctly non-Indian. The point to be ascertained further is whether this element indicates more strongly an Indo-Chinese or a Malayan influence. Thirteen of the species, indicated in the table by an (\*) occur only in the Andamans or Nicobars, while seven more occur only in Tenasserim on the opposite shores of the Andaman Sea. But Tenasserim bears to the Malay Peninsula and Indo-China very much the

relationship that the Andaman-Nicobar chain bears to Indo-China and the Malay Archipelago, and perhaps neither it nor the Andamans ought to be spoken of as physiographically a part either of Indo-China or of Malaya;\* these 20 species cannot therefore be cited as indicating either an Indo-Chinese or a Malayan influence. The purely Indian *Sterculia villosa* must obviously be similarly excluded; there are therefore 21 species, or 32 per cent. of this group, that afford no evidence either way.

Of the remaining species, one-half, *i. e.*, 23 species, or 35 per cent. of the whole, occur both in Indo-China and Malaya; these also give no evidence as regards this question. Of the other 23, 15 extend from Indo-China to these islands (some of them, like *Dendrocalamus strictus*, not going further than the Coco Group), without extending to Malaya; while only 8 extend from Malaya to these islands without occurring in Indo-China. The "remanent" species, therefore, so far as this evidence goes, indicate the predominance of an Indo-Chinese element, a fact that is altogether in accordance with what we should expect from our knowledge of the configuration of the sea-bottom along the line of islands from Cape Negrals in Arracan to the Nias Islands and Sumatra.

Reviewing the results of the preceding paragraphs we conclude that 288 species, or 80 per cent. of the flora, may conceivably have been introduced: 33 species, or 9 per cent., by human agency; 9+ species, or 28 per cent., by birds; 60 species, or 17 per cent., by winds and 101 species, or 28 per cent., by the sea. We find moreover that the evidence is in favour of the bird-introduced species having, so far as those brought by wading- and water-birds are concerned, been introduced from the north, and so far as those brought by frugivorous and by seed- or grain-eating birds are concerned, having come in almost equal numbers from Malaya or the Andamans to the south, and from Indo-China to the north. So far as wind-introduced species are concerned the influence of the north-east monsoon is apparently the more active; so far as the sea-introduced species are concerned the influence of currents from Malayan seas to the south-east has been paramount.

The subjoined table gives a synoptic view of the probable origin of the Coco Island flora.

\* The writer has proposed the name "Malay Isthmus" for the conjoint area that includes Tenasserim, the Andamans and the Nicobars, and believes that it will be found convenient to recognise this as a distinct phytogeographical subdistrict. See *Ann. Roy. Bot. Garden, Calcutta*, iii, 238.

TABLE XXV. *Synopsis of origin of Coco Island flora.*

Species possibly introduced, for the presence of which no former land connection need be necessary:—.....	288
Introduced by living creatures .....	127
By human agency; (largely cosmopolitan species) .....	33
Intentionally; (cultivated plants) .....	15
Unintentionally; (weeds) .....	18
By birds, (perhaps also to a small extent by bats) .....	94
Attached externally to their bodies .....	25
Immediately; (viscous- or prickly-fruited sp.) 9	
By mud; (species introduced by water-birds, mainly from the northward) .....	16
Carried in crops of birds; (almost in equal proportion from northward and from southward) .....	69
As a natural sequence of their mode of life; (fleshy-fruited species) .....	55
Accidentally, where bird must have been destroyed to admit of germination of seeds; (by seed- and grain-eating birds): [indirectly due to agency of wind] .....	14
By other natural agencies .....	161
By wind directly; (sp. with seeds specialised for wind-carriage; also small-spored <i>Cryptogams</i> ) .....	60
By the sea; (mainly Malayan species) .....	101
Marine species; (mainly <i>Algæ</i> ) .....	21
Littoral species; (mangrove-vegetation and beach-forest species) .....	80
Species probably remanent and indicating former connection with adjacent land, (apparently Indo-China):—.....	70
TOTAL of Coco Island species .....	358

*Notes on some native Ephemeriðæ in the Indian Museum, Calcutta.—*

By THE REV. A. E. EATON, M. A., F. E. S., communicated by  
THE SUPERINTENDENT OF THE INDIAN MUSEUM.

[Received 17th November, 1891: Read 2nd December, 1891.]

The following notes concern a collection of 27 specimens of *Ephemeriðæ* received from Calcutta in April 1889, comprising representatives of 10 species or 6 genera, viz.:—3 sp. of *Palingenia*, 1 of *Polymitarceys*, 1 of doubtful genus allied to *Hexagenia*, 2 of *Ephemeræ*, 1 of *Ephemerella* and 2 of *Epeorus*,—all of ordinary dimensions. From the absence of lesser species it may be inferred that these are the results of random

captures rather than of careful collecting. A series of 21 specimens from the Tenasserim valley, in Mr. McLachlan's collection, yields representatives of 9 species in 8 genera, all (except one) of small size, and some of them remarkably beautiful.

PALINGENIA LATA, Walker.

Seven adult ♂ specimens, labelled respectively "Sibs  $\frac{6306}{1}$  to  $\frac{6311}{1}$ ."<sup>1</sup> Their wings are in a very slight degree warmer in tint than the "light vandyke brown" of the typical specimens in the British Museum, and vary in unimportant detail from the wing-neuration figured in Trans. Lin. Soc. London, 2nd series, Zool. iii. pt. i. 1 b (1884). Fore tarsus ♂ rather shorter than the tibia: joint 1 short, 2 or 5 the longest, 3 subequal to 4; unguis nearly of one length, each with a minute hook. For other particulars *vide op. cit.* p. 26. This is the only dark-winged species found hitherto in Hindostan.

The next two species have wings of a light colour.

PALINGENIA ROBUSTA sp. nov.

Two adult ♂ specimens labelled "Cachar;" both mutilated and perhaps faded. Wings defective, brownish white, dusky where bruised, their stronger nervures light, raw umber brown, the weaker nervures paler; neuration similar in style to that of *P. lata*, but with fewer and more distant veinlets distributed to the hinder half of the terminal margin. Head and notum light raw umber brown, the former blackish around the ocelli: pronotum varied with blackish or dusky markings comprising,—in front, an impressed sinuate transverse line ending opposite the middle of the backs of the eyes,—on each side, the border of a protuberance in front of the deep lateral depression,—behind a fine line along the transverse crease at the hind margin. Pleura, sternum, femora and fore tibiæ, dull, light yellowish brown (intermediate in tint between raw umber and brown ochre); fore tarsus and hinder tibiæ and tarsi paler or duller in colour, and transversely rugose: a short dusky line on the mesopleuron, between the root of the costa and the spiracle. Dorsum faded: the last 3 or 4 segments largely suffused with light, raw umber brown, the anterior segments less and less so; the joinings sometimes pale. Venter and forceps dull, light, yellowish brown. Setæ dirty whitish yellow, uniformly pilose. Fore tarsus shorter than the tibia: joint, 1 short; 2 subequal to, or very little longer than 5, 3 shorter than 5 but subequal to 4; unguis nearly of one length. Hinder

<sup>1</sup> Presented to the Indian Museum by Mr. S. E. Peal, and collected in Sibsagar, Assam.

tarsi uni-unguiculate. Terminal jointlets of the forceps-limbs nearly of one length, or the last a little longer. Length of body 25 m. m.

POLINGENIA MINOR, sp. nov.

Three adult ♂ specimens much damaged by cabinet pests: 2 labelled "Karachi Mus." and 1 labelled "Nattor." Wings dull white, with sub-opaque neuration; under a lense, in some lights, the cross-veinlets are bordered with milk-white. Neuration fairly comparable to that of *P. ampla* (cf., Trans. Linn. Soc. London, 2nd Series, Zool. iii. pl. i. l c) but with the veinlets that end in the posterior half of the terminal margin shorter. Head brown ochre, blackish around the ocelli. Mesonotum light brown ochre, darker than the pronotum. Legs from some stand-points concolorous with the venter, the tarsi and hinder tibiæ shifting, with change of posture, to whitish. Colouring of abdomen effaced by pests, in the larger (Karachi) specimens; in the smaller (Nattor) one the dorsum is whitish ochre with whitish joinings anteriorly, but posteriorly is very light brown ochre, clouded in segments 6 and 7 to a small extent, and to a larger extent (half across the back) posteriorly in segments 8 and 9 with dark grey. Setæ extremely light brownish ochre in tint, uniformly pubescent. Fore tarsus little shorter than the tibia: joint 1 short, 5 rather longer than 2, 3 subequal to or little shorter than 2 and rather longer than 4; tibiæ and tarsi finely and transversely rugose. Terminal jointlets of the forceps-limbs of one length in the Nattor specimen, but in those from Karachi Mus. the last jointlet is rather the longer. Length of wing (Karachi exempl.) about 17, setæ about 50 m. m.

POLYMITARCYS sp.—

A single fragmentary ♀ of undescribed species, labelled "Raneganj." In this genus discrimination is at present unsatisfactory owing to the meagreness of published descriptions. The specimen now under consideration differs from *P. indicus*, Piotet, in the colouring of the thorax and hinder legs. Whether his species can ever be identified is excessively doubtful in the absence of precise record of locality of capture. Reference to the "East Indies" as the domicile of an insect is of little use to any but the general reader.

Genus——(unascertainable).

One defective ♀ subimago labelled "Sibs. S. E. P.," lacking the fore legs and the last 3 segments of the body, and having the fore wings badly folded up out of shape. This insect, judging from the wings,

should be ranked as one of the *Ephemera* Type. The costal shoulder of the hind wings is rounded off obtusely, just as in *Hexagenia*, but the pronotum resembles that of a *Pentagenia*. Precise identification of the genus is precluded by the ruinous condition of the specimen.

Until now only three species of *Ephemera* have been described from India,—*E. immaculata*, Etn., from Cuna, *E. expectans*, Walker, from "Hindustan," and *E. supposita*, Etn., from Ceylon. Of these the first has no abdominal markings, but the others have linear dorsal and ventral markings. Two other species of Indian Mayflies, also with linear markings, have long been represented by single specimens in Mr. McLachlan's cabinet; and in the present collection there is sufficient additional material for their description. They are nearly related to *E. supposita*, which therefore may advantageously be treated of in this paper, although wanting in the Calcutta Museum.

#### EPHEMERA SUPPOSITA, Eaton.

Described from ♀ subimago in Baron E. de Selys-Longchamps's Museum; 1 ♂ im. in McLach. Mus.; compared with the ♀ subim. standing with the type-specimen of *Potamanthus* [= *Atolophlebia*] *fasciatus* in Hagen's collection, and with ♂ specimens in the British Museum: cf. Trans. Linn. Soc. London, 2nd Series, Zool. iii. 73, pl. viii. 12° (1883) or [for pattern of dorsal markings] Trans. Ent. Soc. London, (1871) p. 75. The following notes are supplementary to these earlier descriptions of the ♂ imago.

Neuration of the forewing distinct to the unaided eye when held over white paper, with perhaps the exception of only the branchlets of the intercalar veins annexed to the anal nervure; over a dark background, when viewed under a lense facing the light, the radius and the stronger parts of the subcosta of the forewing, and the cross veinlets in both wings remain dark, but the other nervures become pale; in transmitted light the nervures assume an amber tint. Membrane of the forewing (excepting the distinctly coloured parts) perfectly transparent in direct view: but held obliquely at a moderate distance, fronting the light, the finer of the longitudinal nervures transmit to it a faint yellowish grey; or pointing towards the light, the cross veinlets transmit to it a faint reddish grey: in proximity to the costa, the pterostigmatic portion of the marginal area is rather deficient in colour. I was probably mistaken in 1883 when I described the dorsal vessel as dark; but the ravages of cabinet pests preclude certitude on this point.

The dorsal abdominal markings of the best marked segments comprise six black longitudinal stripes or streaks united to one another by the burnt umber brown apical border of the segments,—three on each

side of the back. In segments 9 to 7 two of the streaks, linear and subparallel with each other, lie close together beside the dorsal vessel, extending the whole length of the segment (the outer streak is rather broader than the other), while the third streak lies apart from them close by the pleuron. In the more anterior segments (*e. g.*, in the 3rd segment) the main trachea in front of the spiracle is dark, and the three streaks, in mutual contact at the apical margin, constitute a tripartite marking: the streak nearest to the dorsal vessel becomes abbreviated and subulate, but the other two combining either in the form of a V or as a pair of conjugate triangular streaks, extend nearly to the base of the segment. In the first segment, a quadrangular spot seems to be substituted for the streaks: the 9th ventral segment is bilineate lengthwise.

Terminal jointlets of the forceps-limbs short for an *Ephemeræ*; the last of them smaller, but little if at all shorter than the penultimate. The figure of 1883, cited above, is exact, and correctly leaves their proportions in the dried insect uncertain. Penis lobes subcylindrical. The admeasurement of setæ of ♀ im. stated in 1871 [*cf. E. faciata*] was spurious, being based upon a specimen of the next species, referred to in 1883 with an expression of doubt as to identity of the species.

*Hab.* Rainbodde, Ceylon.

EPHEMERA REMENSA, sp. nov.

Five ♂ imagos labelled "Kulu  $\frac{6942-4, \& '6, \& '8}{1}$ ," in Indian Museum;

and 1 ♀ imago labelled "Musuri," 7,000 ft., June, Long, in McLach. Mus.

Imago (dried) ♂.—Genitalia similar to the ordinary European pattern in this genus: the last jointlet of the forceps-limb rather shorter than the penultimate. A pair of very broad black stripes, diminishing a little in breadth anteriorly, extend from the tip nearly to the base of the 9th ventral segment and end abruptly: the other ventral segments are bilineate longitudinally, excepting the first segment which is unmarked. Neuration of the fore wing distinct to the naked eye throughout (over white paper) excepting the branchlets of the intercalar veins annexed to the anal nervure, and the base-ward extremities of the longitudinal nervures posterior to the radius: under a lense, the portions thus visible, and the neuration of the hind wing, from certain standpoints only, appears of a uniform light pitch brown, but in most positions the finer of the longitudinal nervures acquire a brown amber tint, the stronger neuration and the cross veinlets remaining pitch brown or changing to pitch black. Wings transparent, tinted distinctly with very light raw umber grey throughout, with markings of raw umber brown. The markings of the fore wing comprise the submarginal area

together with the extremity of the area next behind it, and narrow cloudy bordering along the subcosta in front and the radius behind (the former more extensive in the beginning of the pterostigmatic space) as well as along the cross veinlets; in addition to spots: in this sex the spots are larger than in the ♀ (but not much larger) and therefore are hardly so small as in *E. supposita*; the best marked are three in the usual positions in the midst of the wing, viz:—one at the præbrachial fork and the others on the cubitus and the first sector, but occasionally cross veinlets or the ends of nervures are clouded in the usual places of other spots found in species of *Ephemeræ*, such as at the inner ends of the shortest of the sectorial intercalar nervures, or at the junction of the pobrachial with the 2nd or 3rd cross veinlet beyond the fork of the præbrachial nervure, or near the base of the wing between the pobrochial and anal nervures either on the nearest cross-veinlet or at the extremity of the foremost intercalar nervure. The terminal margin of the hind wing is narrowly bordered with a light, raw umber grey cloud and several of the cross veinlets are pitch black.

The abdominal markings resemble those of *E. supposita* in most respects: those of the 1st segment are not well shewn in the specimens at hand: the 2nd segment in place of dorsal streaks has on each side an irregular transverse quadrangular blotch, narrowed upwards and obliquely truncate above; the 3rd to the 5th segments have two streaks and the 6th to the 8th segments three dorsal streaks on each side, all longitudinal and sub-parallel, the lowest of which is linear and narrow, the next to it double the width and usually more curved, and the innermost (where there are three) narrow and tapering at both ends. In the 9th segment a broad stripe takes the place of the lowest and the intermediate streak combined. On the pleura, in nearly every segment, is a short black dash at the base; but the 10th segment has a black blotch. Setæ light raw umber brown; the joinings mostly (excepting in the basal half of the median seta) narrowly dark brown. Fore femur in opaque view either raw umber brown or rufo-piceous: tibiæ dark pitch brown; tarsus lighter; trochanter and coxa subochreous. Hinder legs in opaque view, translucent yellow ochre, with the obtuse claw pitch brown. In transmitted light, the fore femur and tarsus become ferruginous amber, and the hinder legs yellow amber.

♀ Very similar to the ♂. Thorax brown ochreous, with a black spot in front of each tegula, a black longitudinal stripe on each side of the pronotum, and a black irregular line down the outer side of the fore coxa. Fore femur brown ochreous; fore tibiæ bistre brown or light pitch brown; fore tarsus paler. Wings nearly colourless, with indistinct and minute spots, placed singly at the bulla of the sub-costa, behind

that on the cubitus, and at the fork of the præbrachial; another further out on the pobrachial; and one near the base of the fore wing at the commencement of the next intercalary vein. Hindwings spotless or with spots only faintly indicated.

Length of body ♂ 15, ♀ 18; wing ♂ 13-15, ♀ 21; setæ ♂ im. 26 & 28 to 30 & 34 m. m.

EPHEMERA CONSORS, sp. nov.

Two ♂ imagos labelled "Kulu  $\frac{5854}{5}$  and  $\frac{5855}{5}$ ," and two ♀ subimagos labelled "Kulu  $\frac{5852}{5}$  and  $\frac{5853}{5}$ " in the Indian Museum; and 1 ♀ subimago labelled "Sikkim, 4,000 feet, 7 [*i. e.*, July] 80, H. J. Elwes, in McLachl. Mus."

Subimago (dried) ♀.—Wings transparent, very faintly tinted with extremely light brown ochreous grey, or in the sub-marginal area of the fore wing with very light amber, with a small, blackish grey spot at the fork of the præbrachial nervure, another at the bulla of the sub-costa, and single greyish dots nearly in a straight line with them on the sector and cubitus of the fore wing. Hind wing spotless. Neuration of the fore-wing distinct to the naked eye (over white paper) from the costa to the sector, and then hardly discernible onwards to the pobrachial nervure: after that the minor neuration and the neuration of the hind wing cannot be distinguished. When magnified, the neuration of the hind wings and of the greater portion of the fore-wing is opaque and concolorous with the membrane: but many of the cross veinlets in the basal half of the wing shift in colour to picuous in certain postures, and all of them (excepting the greater cross-vein) anterior to the sector are pitch black. The pronotum is marked as in *E. remensa*, with a small oval black spot anteriorly on each side in a furrow: and in both species there is a small acute triangular black spot in front of the posterior coxa.

Imago (dried) ♂.—Terminal jointlets of forceps proportionally longer than in *E. remensa*, and more slender; the last jointlet shorter than the penultimate in the dried specimen: basal joint relatively short. Venter bilineate lengthwise interruptedly in the posterior segments: the lines are narrow and as far apart from each other in the 9th as in the preceding segments, and in the 5th, 4th and perhaps the 3rd segments become greatly abbreviated or even reduced to dots; but the 2nd and 1st segments are spotless. Wings much as in the ♀ subimago, but of course more transparent: the spots in the fore wing are similar but less distinct; the greater part of the neuration is (in opaque view) light raw umber brown changing (in transmitted light) either to brown-

ish amber or (in the finer parts) to very light or whitish amber; but where visible without a lense, the cross veinlets when magnified appear pitch black or pitch brown in opaque view, and this colour remains fairly constant from most stand-points; the subcosta and radius and also in some positions the great cross vein are likewise piceous. Hind wing spotless, and clear throughout. Fore leg raw umber brown, blackened at the tip of the femur and at the base and tip of the tibia. Hinder legs light yellowish amber colour.

Abdomen pale ochraceous or whitish raw umber grey in the first 5 segments, and light brownish ochre in the hinder segments, marked with black lines and streaks disposed mainly in two longitudinal series: segment 1, spotless; segment 2, with a faint dot near the base on each side of the dorsal vessel, and a larger spot below the dot just above the main trachea, which spot is not represented in the other segments; in segments 3 to 9 the markings corresponding with the said dots take the forms of an oval spot in the 3rd segment, an abbreviated tapering streak in the 4th, a tapering streak produced to the hind margin in the 5th segment, and apparently continuous lines from the 6th to the 9th segment. Venter marked longitudinally, in segments 3 to 5 with two abbreviated tapering streaks; in segments 6 to 8 with two thin tapering lines; and in segment 9 with two linear stripes. Setæ ochraceous, with opaque joinings.

Dorsum of ♀ in segments 3 to 6 longitudinally bilineate, with an additional black line on each side in segments 7 to 9 parallel with and exterior to the principal lines in the hinder  $\frac{3}{4}$  of each segment: on the pleura of most of the segments is a short marginal streak at the base, and a longer streak just inside the margin near the tip; on each side of the 2nd segment is an erect spot like a mark of exclamation. Hind wing spotless; neuration indistinct to the naked eye.

Length of body 12; wing ♂ 12, ♀ 15–21; setæ ♀ subim. about 17 m. m. The specimens are infested with encysted parasites.

EPEMERELLA sp.—

One ♀ subimago labelled “Kulu  $\frac{5852}{5}$ .”

EPEORUS PSI, Eaton.

*Epeorus psi*, Etn., Trans. Linn. Soc., 2nd Ser. Zool. iii. 242 (1885).

Two ♀ subimagos labelled “Kulu” respectively. The larger specimen measures:—wing 24, setæ about 35 m. m.

EPEORUS sp.—

One subimago labelled “Kulu  $\frac{5349}{5}$ .”



ERRATA IN MR. THEOBALD'S PAPER ON PUNCH-  
MARKED COINS IN JOURNAL, AS. SOC.  
BENG., VOL. LIX, FOR 1890.

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- p. 204 line 8 Transpose words 'Bulls' and 'Balls.'  
" " 13 after 'Assyrian' insert the word 'male.'  
p. 206 " 10 for 'except' read 'expect.'  
" " 16 for 'and' read 'to need.'  
" " 17 for 'twined' read 'twinned.'  
p. 215 " 4 for 'seem most' read 'appears.'  
p. 227 " 29 for 'subtileties' read 'subtleties.'  
p. 260 " 6 from bottom for 'river' read 'rim.'  
p. 266 " 4 for 'pegs' read 'legs.'  
" " 8 from bottom after Myceno a full stop, and for 'the' read 'The.'  
p. 268 " 4 from bottom for 'reasonably' read 'seasonally.'
-



JOURNAL  
OF THE  
ASIATIC SOCIETY OF BENGAL.  
PART II.

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TITLE PAGE AND INDEX

FOR  
1891.



THE  
MUSEUM OF  
COMPARATIVE ZOOLOGY  
CAMBRIDGE, MASS.

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PART II. (NATURAL HISTORY, &c.)

(Nos. I to IV.—1891.)

EDITED BY

W. J. SCLATER, ESQ., M. A., F. Z. S.

AND

SURGEON-CAPTAIN J. H. TULL WALSH, J. M. S.

NATURAL HISTORY SECRETARIES.

---

It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease." SIR WM. JONES.

---

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- No. II.—Containing pp. 141—210, with Plates II and III, was issued on July 16th, 1891.
- No. III.—Containing pp. 211—282, with Pls. IV, V and VI, was issued on September 28th, 1891.
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