

XIX. *On a visit to Ceylon, and the relation of Ceylonese beetles to the vegetation there.* By GEORGE LEWIS.

[Read August 2nd, 1882.]

IN Ceylon the usual outlines of an island divide the country into natural areas, each one of which is distinctly different from another in soil and climate, and consequently in fauna and flora. And if we consider roughly what these features are, we shall understand something of the general characteristics of the insects and their relation to the varying physical conditions under which they live. The differences which are sufficient for this note are primarily traceable to the formation of the earth's surface, and are easily divided into three sections:—

1. The hot plains, or low lands of the coast, with rivers.

2. The intermediate altitudes, with fair-sized streams.

3. The higher altitudes, with elevated plateaux and mountain torrents and rivulets.

Ceylon from very remote times has been almost entirely, if not quite, covered with dense jungle, and as the soil is an extremely poor one, for the best elements of it are carried away by the heavy rains, the vegetation which has arisen has naturally largely derived its nutriment from the moisture in the atmosphere. This is true of the hard-wooded timber which forms the mass of the jungle, and even more dependent on the general humidity are the ferns, orchids, and other parasitic plants which grow upon and often cover the trees. If the south-east monsoon ceased to bring the abundant rain to Ceylon, the island would become a useless desert; the rain alone keeps it verdant, as we see it, and in the north about Hambantota, where the rainfall is only 34 in., there is hardly any verdure on the sandy plains. The district about Colombo, where the vegetation is rich and tropical in every sense of the word, is entirely of a sandy soil, and there is little in it to support the beautiful and strange vegetation growing there, and the secret of the luxuriance

lies in the copious rain. Except in the dry season, when both vegetable and animal life languish for showers, there is daily heavy rain. The level flat lands of the coast lying at the foot of the higher altitudes are a more recent formation than the hills, as they are formed of the accumulation of soil washed down from the mountains during long periods of rain, and it will be seen that these low lands have a fauna intermixed with species essentially distinct from those of the interior of the island. The jungle is not so continuously established on the low lands, nor even at an elevation of 2000 feet, as on the hills, the oldest formation, where the only natural roadways through the forest are the mountain torrents, which make and keep clear a passage by the sheer force of the water in the wet monsoon, and in the dry season you can walk for many miles on the granitic formation which paves these ancient channels. In the intermediate districts (2) the jungle trees attain a height of 100 to 200 feet, and gradually lessen in proportion to the elevations on which they grow. On the Nuwara Eliya plateau most of the trees are about 40 to 50 feet only, but wherever the forest is, the trees are so closely packed together that they rarely attain to any considerable circumference. And another thing is very notable about the jungle trees; they are not like our oaks and elms, of a soil-improving nature; they do not make mould like European deciduous trees; they return apparently to the soil as little as they take from it. The shed leaves are more like those of the holly and laurel, from which our gardeners would expect little assistance in manuring or improving poor soils.

Now, in a country like this the Coleoptera are in by far the greater part such as depend on plants and trees for their general welfare. We find subfamilies and genera taking a prominent place in the fauna whose allies in other countries are truly ground-beetles, but which here are herbaceous or arboreal. There are numbers of species of *Tricondyla* and *Collyris*, *Cicindelidæ* as much adapted for a foliage-life as those of our coast are for a sand existence. *Tricondyla* in Coleoptera, *Mantispa* in Neuroptera, with certain *Mantidæ* (*Pterostenes*) associate together, seeking their food on the undergrowth in the forest, and, being possessed of similar instincts, have acquired an analogous form and structure. They are all carnivorous, and roam about foliage, holding their prey with their fore legs, and

are good types of species which exhibit that most beneficent phase in the laws of Nature which causes animals of widely different orders to assimilate and adapt themselves to special modes of existence. The majority of the *Geodephaga* are of arboreal habits, and live on trees; *Colpodes*, *Demetrius*, and other genera assert themselves in many species, and are instances of those which live on the foliage; while others which replace *Pterostichus*, &c., which live under stones in Europe, are represented by *Physocrotaphus* and others, which reside in the rotten touchwood of prostrate timber. There is almost an absolute tendency in Ceylon for *Geodephaga* to become xylophilous, and with the exception of the *Harpali*, hereafter mentioned, I did not find a dozen beetles under stones, and yet I accumulated over 10,000 specimens. *Morio*, *Catascopus*, *Miscelus* again are several only of a long line of truly bark genera. Stones in situations under 6000 feet elevation in exposed places become too heated for a shelter to Coleoptera, nor are they even useful as such when under the cool shade of the jungle; for the climate does not render it necessary for insects to seek for any but the most scanty protection, which a mere scrap of moss or loosened bark can supply.

Out of six species of *Scarites*, I found only one came from beneath stones, and that occurred at an elevation of 7000 feet; the others were habitually secreted under logs or fallen timber. And in the allied genus *Clivina*, the commonest species on the coast mixes with the *Aphodii*, and clusters like them together in groups of six or eight at a time.

In all families we find the most curiously formed species (and these are many) are, with a few exceptions, dependent on leaves, plants, or trees. The paucity of what we consider ordinary forms in Europe is also remarkable, and those found are such as may occur almost anywhere in a ditch, or by a river side, and include *Bembidia*, *Dyschirii*, and the commonest forms of *Hydradephaga* and *Staphylinidæ*. The whole of these may be classed as immigrants, and are not, as I believe, even local modifications of Indian forms. There is nothing grand or striking in the fauna, as exhibited in my five months' collection, which does not live on dead timber or living vegetation.

Some of the recorded *Paussidæ* are very fine, and these prove no exception, as they are indirectly connected with

the vegetation, for the *Formicidæ* are arboreal. The nests are seen everywhere under bark, or in the trunks of trees, and some draw the foliage together some feet from the ground for an habitation. And *Paussidæ* are the associates of ants.

As some of my captures (about 1200 species) are likely in due time to be described, I give for the information of authors and others a table of the localities I visited, and the dates of my sojourn:—

	Altitude.	
Galle	On coast level	Nov. 27 to Dec. 4, 1881.
Dikoya	3800 to 4200.	Dec. 6 to Jan. 16, 1882.
Kitulgalle . . .	1700	Jan. 17 to Jan. 20, ,,
Dikoya	3800 to 4200.	Jan. 21 to Feb. 7, ,,
Nuwara Eliya . .	6234 to 8000.	Feb. 8 to Feb. 11, ,,
Dikoya ,	3800 to 4200.	Feb. 13 to Feb. 16, ,,
Kandy	1546 to 1727.	Feb. 17 to Feb. 23, ,,
Dikoya	3800 to 4200.	Feb. 25 to Feb. 27, ,,
Bogawantalawa .	4900 to 5200.	Feb. 28 to Mar. 12, ,,
Balangoda	1776	Mar. 13 to Mar. 16, ,,
Horton-Plains . .	6000 approx.	Mar. 18 to Mar. 20, ,,
Bogawantalawa .	4900 to 5200.	Mar. 21 to Apl. 4, ,,
Kandy	1546 to 1727.	Apl. 6.
Colombo	On coast level	Apl. 7 to Apl. 27, ,,

Section I.—Galle and Colombo lie on the shore, and the neighbourhoods of both these ports are rich in species, and the majority of them can be put into three classes:—

(a). The arboreal and herbaceous species, of which many occur also “up-country,” and others which infest the palms and vegetation peculiar to the coast.

(b). The ordinary forms of marsh species, which assimilate to those of more northern regions, and which also occur generally throughout Ceylon.

(c). Some curious sand and river species (*Selina Westermanni*, Mots., &c.), none of which could exist with their present instincts and habits in dense jungle, for they are fitted for open places of mud and sand, such as estuaries of rivers or banks by the sea. They are far removed from the *Bembidia*, *Dyschirii*, &c., classed here as immigrants, and of their origin two questions arise. Have their ancestors come from India? or are they endemic, modified from ancient forms during the forma-

tion of the alluvial soil where they reside? Nature does not at present supply us with such handy data as the latter for ascertaining the age of a species, but I am not inclined to favour the suggestion of migration. I believe they are descendants of forms which resided in primeval times in the open spaces of the mountains while the jungle was yet forming on the hills, and that they have gradually occupied the plains as they were formed by the rains. *Ophionea* and *Casnonia* I give as examples of genera abundant at Colombo, and which extend to the extreme east of equinoctial Asia, and which are, as the *Bembidia*, undoubtedly introduced by the ordinary methods of natural conveyance.

The cocoa-nut palm, which is necessarily confined to the coast, as the bulky nut requires human agencies to carry it beyond the area of littoral inundations, here nourishes a few species, notably the large *Sphenophorus*. And the Wedas, and other early races of Ceylon, have always been confined to the lowlands, and, even had they reached the higher altitudes, they would not probably have carried the palm with them, for their civilisation has hardly led them to even the most simple horticulture. The palm, therefore, has had no chance of undergoing those hardening processes which might enable it to stand the colder climate of the higher districts. *Batocera* is erroneously called the cocoa-nut beetle, but this genus feeds both here and in Japan on the half-embedded branch-like roots of the larger forest trees. Speaking of *Longicornia*, it may be well to note that they are rarer in the lowlands than in the higher regions of dense forests, for they are not attached to the palms which grow largely in the area of the coast-level to the exclusion of the trees suited to them. There are only a few land-leeches near Colombo, which is an immense comfort to any one wishing to roam in the jungle.

Section II.—Kandy, Balangoda, and Kitulgalle are places of an intermediate altitude, which I visited. At the first place is the botanical garden of Peradeniya, supported by our Government; it is bounded on one side by a fair-sized river, and the trees in it are isolated and well grown. In the middle of the garden stood a very large fig, eight or ten feet in diameter, which had been dead about three years, and by the kindness of the superintendent I was permitted to bark it. After the lower part had been examined, a Singhalese was sent up

into the higher branches, and large sheets of bark were thrown down on to my cloth. In four or five hours I obtained about eighty species of Coleoptera, but this was the only good tree it was my fortune to find in the intermediate or low country. On the sand-banks of the river I obtained some nice *Geodephaga*, *Selina Westermanni*, *Planetes*, and others which will probably come into new genera, and some *Staphylinidæ*, the latter mainly agreeing with the "up-country" species.

The Bombax, or cotton tree, remarkable for its straight stem and vigorous parallel branches, is a good tree when dead for bark species, and is deciduous, giving large red flowers in February before the leaves appear. It grows up to an altitude of 1500 to 2000 feet, but not higher. A large black species of *Elateridæ* is especially attached to it. The cacao tree (*Theobroma cacao*), the tender leaves of which hardly bear a breath of wind, is cultivated near Peradeniya with fair success. The low grass and herbage under the trees in the garden was not too rank to permit sweeping, and I took a great many phytophagous insects in my net.

Section III.—In the Dikoya and Bogawantalawa districts, where I spent most of my time, on the "Hadley" and "Lynford" estates respectively, most of the land has been cleared of jungle, and is now under cultivation for coffee and chinchona. Jungle-belts are left here and there as a protection in the south-west monsoon, and also on the mountain ridges to insure an abundant rainfall. When the jungle or forest is to be cleared for planting, it is cut down in October and left till February, and then burnt after the longest interval of rain. The trunks of the largest trees are not consumed by the fire, nor are their stumps uprooted; both are simply left among the coffee, and, many being of iron-wood and other hard kinds, it is likely they will remain much in the condition of to-day for the next fifty years. The time between the felling of a new clearing and the burning is the coleopterist's best chance for collecting, but even after the fire a large number of insects infest the logs where bark happens to remain, or fungi and boleti grow out from the crevices in the timber. After some years the hard clean trunks, bleached by the sun, are impervious alike to the attacks of insects and the changes of the seasons. The thermometer there generally ranges about 56° to 58° at 6 a.m., and in the afternoon rises to

78° to 82° Fah. I obtained the greater part of my collection on the edges of the jungle-belts, or where the forest remained on the ridges, for, as I have noticed before, this province has been from the earliest time simply dense jungle, and I cannot call to mind at this moment more than one species which is essentially a ground insect, living in open places. The solitary instance is a species of *Apristus*, which I took running on banks in the midday sun, when the thermometer registered 123° Fah.

I found the elephant paths, which strike straight through the jungle, led into too dense forest for insects, but when I passed into the ravines with flowing water, the only other roads, I now and then came to open spaces cleared by the falling of trees, and there insects were abundant. The districts of Dikoya and Bogawantalawa lie beneath the Nuwara Eliya and Horton Plains, the altitudes of which range from 6000 to 8000 feet. These plains exhibit one very peculiar feature; the jungle is often broken up by the "patenas," or open grass-lands, and there a few, very few, Euro-asiatic forms occur. In hunting over these plains an entomologist will, from old associations, look for *Leistus*, *Carabus*, and *Pecilus*, for the patenas are like Wimbledon Common on a large scale, with rhododendrons dotted about instead of gorse. Broom and furze both grow freely, having been brought from England, and mullein and mint thrive by the roadside, while the streams are blocked up with imported watercress. But insect-life is scarce, and all I found fell into a few genera—*Scarites*, 1; *Anchomenus*, 2; *Harpalus*, 2; *Dromius*, 1; and some *Staphylinidæ* of European type. The temperature of the lake and tarns was too low for aquatics, and there is often indications of frost on the grass, although snow never lies there.

If *Carabi* were introduced they would assuredly thrive, but the tropical heat of the zone on the coast, which surrounds these high plateaux, is a barrier against the intrusion of northern forms less easy to surmount than an ocean belt or many degrees of arid desert. It is very curious to find even the few I have mentioned, and these may be looked upon as evidences of the great distances small flying Coleoptera are borne on the wind. In the high jungle, which here continually encroached on the patenas, the beetles are nearly identical with those of Dikoya and Bogawantalawa, but they are much less abundant.

To close with a few more general remarks. There are two seasons in Ceylon, but there is nothing which corresponds in any way to spring; there is no simultaneous or perceptible movement in either animal or vegetable life. The north-east monsoon blows from October to May, and the south-west from May to October. The first is the dry season, with rain at intervals; the second brings heavy and almost daily rain, and it is in the still evenings, or in the interval of bright sunshine of the latter period, when most Coleoptera appear. Of the wet season I saw nothing, but I had this advantage, my collection, made in the comparative dry weather, kept as clean as if made in England. There are parts of Ceylon, in the north and east coasts, which differ materially, although not essentially, to the parts I describe; there are sandy dry plains and low swampy jungle, which are rarely visited except by natives, and the difficulty of journeying thither is considerable. A bullock-cart is the best mode of transit, and a few weeks would hardly be sufficient time to obtain much insight into the fauna.

There is one very important family unrepresented in my collection, and I have not noticed any members of it amongst any other Ceylonese captures. Of the *Necrophaga* I do not possess a single species, and this may be accounted for by the presence of the multitudinous ants which are ever ready to carry away the smallest particle of organic matter, and of the numerous *Corvi*, which seize upon the larger animals. In this land of forest the *Lucanidae* are also remarkably scarce; one *Aegus*, two *Figuli*, and the large *Odontolabis* are all I found, and examples of the last only occurred abundantly under special and almost artificial circumstances. The ebonies and hard iron-woods give out little sap, not enough to supply food for these large beetles, and they are driven to the gum exuded from the *Eucalypti* which are now planted in numbers on the estates and near bungalows. There are no stercoraceous beetles in the tracts of the elephants, and the droppings of these herbaceous animals have been analysed, and prove of little value for manure. Ceylon does not appear to be sufficiently isolated to produce many very distinct or peculiar species, and I cannot say I have come across any trace of special or endemic forms. Indigenous species are of course very numerous in such genera as *Morio*, *Catascopus*, *Colpodes*, &c., but then these are allies of others which occur in a country

even so far distant as Japan, and I can select a long series of cognate forms from both places which would agree with and run close to each other, and the resemblance between the forms in adjacent countries must be greater. Amongst the smaller Coleoptera I have obtained much of interest in species, unknown as yet in museums, but there is no reason for supposing these are purely local forms, for it must be remembered the small Coleoptera of India are quite unknown.

Entomologists will be aware that most of my remarks will apply in a great part to South India, and perhaps even in a greater degree still to some of the isles of the great Eastern Archipelago, and then more generally to all tropical and subtropical parts of the globe where copious rain covers the land with dense vegetation, and where a xylophilous fauna in Coleoptera takes the place of the geophilous. But until my collection has been carefully examined, and the species referred to their right genera, it is impossible to tabulate them with any clear arrangement which would add much to the interest of this note. Enough has been shown to stamp the Ceylonese fauna generally as one intimately associated with, and dependent on, the flora, and that both have grown up together, each gradually acquiring habits or developing instincts as the propensities of each have been enforced by the innate progression of their natures, by the changing conditions of the globe, or by their mutual necessities and advantages as present in their common relations to each other.