COLOMBO MUSEUM.

GUIDE TO THE COLLECTIONS.

PREFACE.

THE first Guide to the Colombo Museum for the use of visitors was compiled by Mr. Amyrald Haly in 1886; a second, abridged edition of it was printed in 1895.

The present issue may be regarded as an enlarged third edition having the additional advantage of illustrations.

Most of the principal objects will be found mentioned in the text. One rather important omission may be noted here. Among the examples of Tamil jewellery referred to on page 17, attention should have been directed to the "Thali," the marriage emblem of the Tamil race, which is worn round the neck mounted upon a more or less elaborate necklace.

The collection of rocks and minerals has been entirely re-arranged and greatly augmented by the Director of the Mineral Survey, Mr. A. K. Coomaraswamy, B.Sc., who has kindly written the account of the rocks and minerals of Ceylon for this Guide (see page 50).

In the compilation of the rest of the Guide I have had the assistance of the Museum staff, more particularly Mr. Gerard A. Joseph, Secretary and Librarian; Mr. H. M. Gunasekara, Assistant Librarian; and Mr. H. F. Fernando, Taxidermist.

ARTHUR WILLEY,

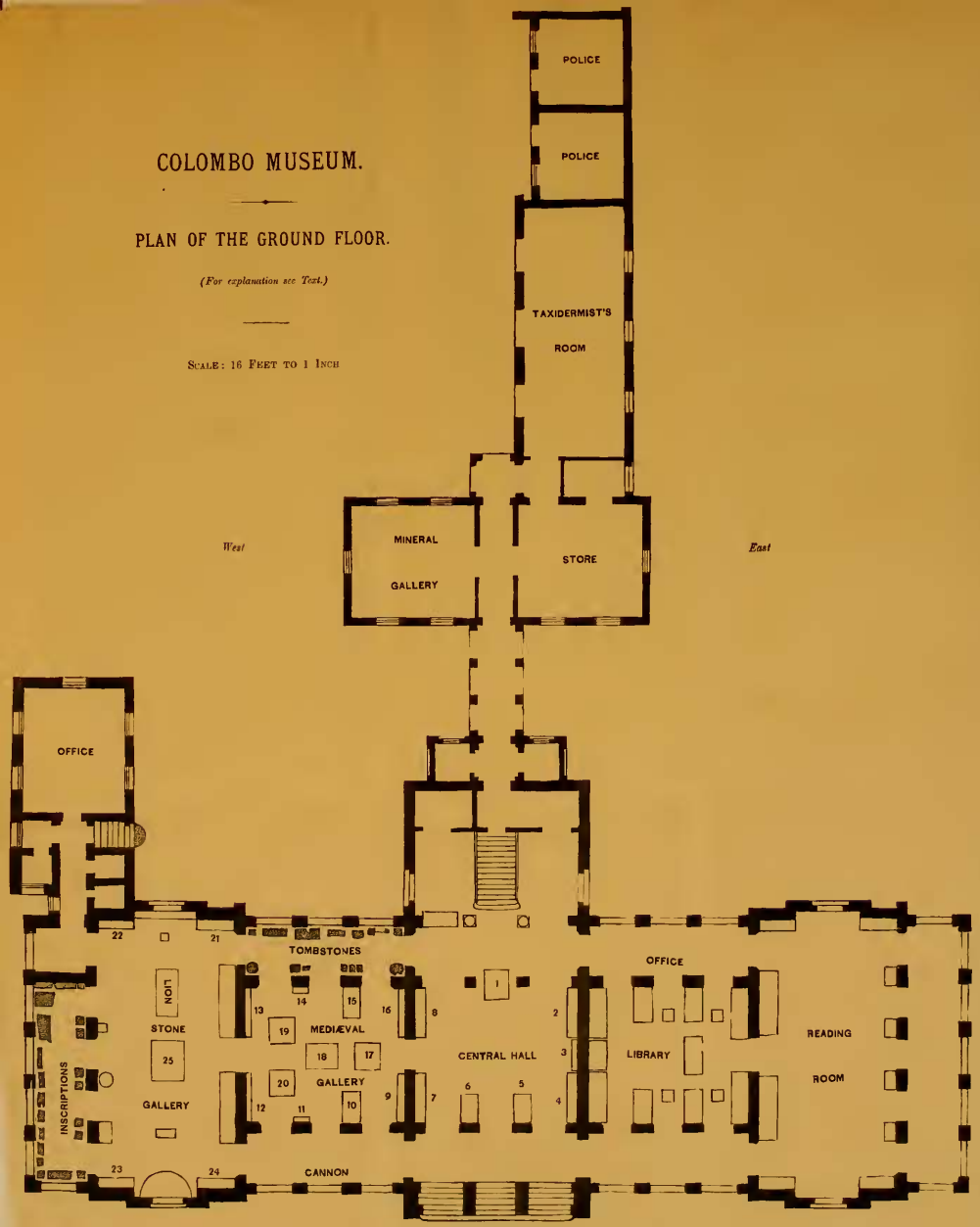
February 9, 1905. *Director, Colombo Museum.*

COLOMBO MUSEUM.

PLAN OF THE GROUND FLOOR.

(For explanation see Text.)

SCALE: 16 FEET TO 1 INCH



COLOMBO MUSEUM.

PLAN OF THE UPPER FLOOR.

(For explanation see Text.)

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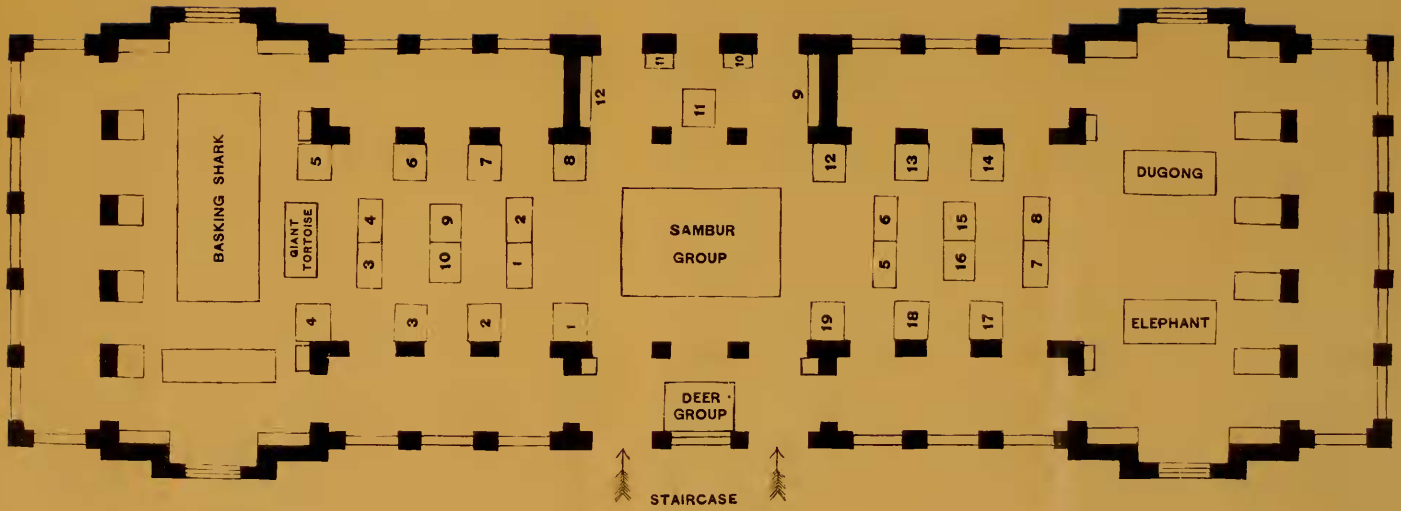


A GUIDE TO THE

COLLECTIONS IN

THE COLOMBO MUSEUM.

INTRODUCTION.

THE collections of objects of antique, local, and general interest which are exhibited in the Colombo Museum are intended to illustrate solely the products of human ingenuity and cultivation, and the forms of nature as manifested in the Island of Ceylon and its dependencies. With few exceptions, which are specially noted where they occur, nothing is shown in the galleries which has not been found in the country or in the surrounding seas.

Owing to considerations of space on the ground floor, the various Buddhistical, Ethnographical, and Archæological exhibits are not arranged in such a strictly systematic manner as could be desired.

The Zoological collections occupy the upper floor of the Museum. The Mineral Gallery is situated at the back of the main building.

If reference be made to the ground plan of the Museum it will be seen that the rooms to the right of the entrance hall are assigned to the Library and Reading Room. The Library contains an exhaustive assemblage of books bearing directly or indirectly upon the religion, agriculture, archæology, and natural history of Ceylon. There is also a valuable collection of native literature in the form of **Ola Manuscripts**, relating in one form or another chiefly to

the Buddhist Scriptures. These documents are written in Sinhalese characters by hand with a pointed iron *stylus*, upon properly prepared slips of palm-leaves called "ola," and are composed either in Sanskrit, in Pali, or in Elu, the pure Sinhalese language.

The ola leaves which are employed for the transcription of the Sinhalese texts are made from the fan-shaped fronds of the Talipot Palm (*Corypha umbraculifera*), which grows principally in the Kandyan Districts; those adapted for Tamil usage by school children and others are commonly made from the similarly shaped leaves of the Palmyra Palm (*Borassus flabelliformis*), which is especially abundant in the northern parts of the Island. The Palmyra Olas are narrower, thicker, and less pliable than the Talipot Olas.

The manuscripts are often consulted by Buddhist priests and other readers who frequent the Library, and may be inspected, if desired, on application being made to the Librarian.

CENTRAL HALL.

The first case to meet the eye of the visitor entering the Museum is that which is placed under the archway before the main staircase. It affords a characteristic display of images of **Gautama Buddha.** These figures are executed in brass, bronze, wood, and ivory, and they represent the Founder of Buddhism (who lived about the fifth century B.C.) in three principal attitudes—sedent, erect, and recumbent. The head is generally surmounted by a five-rayed emblem called "sirispota," which symbolizes the sacred flame.

On the top of the case there is a large wooden **dagaba** or relic case. The ancient dagabas at Anuradhapura and elsewhere are immense structures supposed to have been erected over various relics of Buddha and his disciples. Representations of the dagaba on a small scale, in wood, metal, and ivory, are commonly used as emblems or as reliquaries, just as the small effigies of Buddha are portable copies of the gigantic statues which are scattered about the country.

The lower portion of this case contains, on the front side, a selection of **Matara Jewellery**, dating, at least with regard to the designs, from the Dutch period (1655–1796 A.D.). The collection comprises necklaces, brooches, hair ornaments, &c. Most of the pieces are *parures* of the so-called Matara diamonds (zircons), white sapphires, and black tourmalines, in a silver or silver-gilt setting, manufactured by native jewellers at Matara, Galle, and Colombo.

TALIPOT PALM.

[*To face page 2.*

On the other side of this table case there is a miscellaneous display of Tamil silver waist-bands, charms, a Mudaliyar's dress sword, &c.

Products of the Palmyra Palm.—This palm grows in the low-lying dry parts of the Island. There are extensive native plantations in the Northern Province, especially in the Jaffna Peninsula and the outlying islands. It shares with the Cocoanut Palm and the Date Palm the distinction of providing more serviceable commodities for the use of man than any other single species in the vegetable kingdom. As already mentioned, the leaves are employed in the manufacture of olas ; they are also used for fences, thatching, fans, mats, hats, baskets, water balers, and umbrellas.

The fruits ripen in the months of August and September, when they fall to the ground, and are sometimes eaten raw, but more generally roasted [W. Ferguson]. They vary in qualities of colour, smell, taste, and shape. From the fleshy part of the fruit a sweet farinaceous jelly is prepared, called Palmyra Pulp or "punatoo." The nuts are sown under loose sandy soil, and the very young subterranean saplings, after being cleaned and dried, yield the Palmyra Flour.

Palmyra Toddy is prepared from the sap of the flower buds, which are tapped by the toddy drawers during the months of November and December, the rainy season of the Northern Province.

Sugar or "jaggery" is prepared from sweet toddy, *i.e.*, from the palm juice which has been prevented from undergoing fermentation by coating the inside of the toddy receiver with lime or "chunam."

On the top of the case there are models of a Jaffna bungalow with **Palmyra Roofing**, a shelter for watchers in the paddy fields, a manger, and a platform for grain.

The Palmyra Palm is dicœcious, *i.e.*, the male and female flowers are on different trees. In a plantation half the trees will be male and half female. The female tree yields superior timber and a greater quantity of toddy than the male tree.

The model of the Palmyra Palm and other articles in this case were presented by Sir W. C. Twynam, K.C.M.G.

Commercial Products.—Until 1880 coffee was the staple export since the British occupation. During the Dutch administration the Government held a monopoly of the cultivation of cinnamon, but this industry is fast disappearing under competition with other countries. The Cinnamon Gardens of Colombo are noted for the extreme rarity of the cinnamon shrubs, whole plantations

of which have been removed during the past ten years to make room for building purposes.

From 1880 to 1886 Ceylon passed through a financial crisis in consequence of the failure of the coffee trees, which were destroyed by a fungoid disease caused by an organism named *Hemileia vastatrix*, for which no cure could be found. During this time cinchona and tea planting came into being, and Ceylon is now chiefly famous throughout the world for the excellence of its tea.

Other products of importance are cacao, cinchona, cardamoms, and rubber.

More than sixty varieties of rice or "paddy" are grown in the Island, all of which, with one exception (the variety called "el-vi"), require more or less continual irrigation.

Another grain of great importance to the poorer natives is that which is called millet or "kurakkan" (*Eleusine coracana*). This is grown on waste lands called "chena," a corruption of the Sinhalese word "hena," meaning ground prepared for cultivation at intervals of several years by the cutting and burning of jungle.

The arecanut is the fruit of the Areca Palm, the tall slender stems of which afford a pleasing contrast with the unending groves of cocoanut palms. It is used for chewing with the betel leaf, and also has some medicinal value.

Native tobacco is extensively cultivated in various parts of the Island.

On the top of the case are specimens of the gum of the cashew or caju tree (*Anacardium occidentale*), a common tree yielding an edible nut, but not endemic, having, it is thought, been introduced from Brazil by the Portuguese; and the resin of the tree called "hal" in Sinhalese (*Vateria acuminata*).

Products of the Cocoanut Palm.—The objects exhibited in this case have on the whole a familiar homely appearance, and bear eloquent testimony to the world-wide importance of the tree upon which, in the first instance, the wealth of the Island largely depends. Almost every part of the tree subserves some useful purpose, and its general commercial value far exceeds that of the Palmyra Palm. It begins to bear fruit at about the tenth year, and a single tree may yield about seventy nuts annually. It is monœcious, *i.e.*, male and female flowers are on the same tree, so that every tree in a plantation will be fertile.

Most compounds of bungalows in Colombo are planted with cocoanut palms, which can only be cut down by tenants upon payment of ten rupees for each tree.

The husk of the fruit yields coir fibre, the shell can be used for drinking vessels, bowls often handsomely carved, spoons, charcoal.

&c. The kernel is largely used in cookery, being grated fine by an instrument called a cocoanut scraper, after which milk can be expressed from it; when dried in the sun it is known as copra, from which oil is extracted, the residue being used as cattle food. The leaves are plaited to form cadjans for thatching roofs, also baskets; and the trunk yields good timber. The young fruit, called "kurumba," furnishes food and drink. The sap of the unopened flower supplies toddy, arrack, and jaggery.

The dried frond of the palm is twisted into a bundle and used as a torch. These torches are often employed for purposes of illumination on festival occasions, being known as "chulu" lights, a corruption of the Sinhalese word "huluatta." Torches are also furnished by the spathes of the flowers, called "kolapuwa." The midribs of the leaflets are tied into bundles and form excellent besoms, called "ekel" brooms, a corruption of the Tamil word "irekú," meaning the midrib of a palm leaf.

The preparation of coir fibre is an important industry in the Western and Southern Provinces. The following account taken from Dr. Shortt's Monograph of the Cocoanut Palm applies equally to the methods in use in Ceylon as to the districts in India, to which he refers more particularly :—

"The husks, removed from the nuts, are collected and thrown into pits containing water to soak, and kept there till decomposition sets in." [Along the railway from Colombo to Galle many portions of the backwaters and estuaries are fenced in for this purpose.] "The coir, when taken out of the pit, is beaten with stout sticks to break up the adhesion and free the fibre from impurities. Next it is hand-rubbed" ..... and "subsequently rolled into loose pads of about a finger's thickness preparatory to being twisted into yarn by the palms of the hands."

In the bottom shelf is shown the apparatus employed in the distillation of arrack, and on the top of the case there is a similar apparatus in native pottery.

Fisheries and Transport.—Many of the models in this case were made for the Chicago Exhibition of 1893.

On the top shelf are shown models of a bullock cart, a Kandyan grain store, fish traps, a rattan bridge, and a "chekku" or oil mill for expressing oil from copra and for the manufacture of gingelly oil. The "chekku" consists of a huge mortar sunk deeply into the ground and made of stone in the Western Province, or of tamarind wood in the North-Central Province; in this a heavy pestle revolves, being worked by a horizontal lever driven round by a bull or a pair of bulls. A man usually sits on the lever to increase the weight of the pestle.

On the second shelf there are more models of carts and hackeries, a mud house, and a large native sailing craft called a "dhoney."

On the third shelf there are models of "kattumarams," a Negombo canal "padda" boat, and a boat used in the **Pearl Fishery** with representations of the crew and divers. The white man in the stern holding a suspicious looking bottle in a compromising attitude is the doctor preparing a dose of medicine.

On the last shelf there are models of outrigger boats, fishing and passenger boats, a double canoe, and a river raft. There is also a set of chank shells (*Turbinella pyrum*) and several rings cut from this shell. The chank fishery at Jaffna has been an important source of revenue. During some years as many as three millions of these shells have been exported annually to Calcutta, where they are used for the manufacture of temple conches and of **chank jewellery** which is destroyed at funerals.

Other noteworthy exhibits on this shelf are a pearl diver's coir basket which has been actually in use, presented by J. Hornell, Esq., Marine Biologist, and a pearl diver's sinking stone from the Pearl Fishery of 1904, presented by the Hon. Mr. E. F. im Thurn, C.B., C.M.G., then Lieutenant-Governor.

The chank shells and rings were presented by Sir William Twynam.

Objects from the Maldive Islands.—The Maldive Islands are an archipelago of coral atolls inhabited by a Mohammedan population ruled by a Sultan of ancient lineage, who pays annual tribute to the Ceylon Government. The Maldivians are an artistic people, the commonest articles in daily use being elegantly shaped, carved, and lacquered. They make use of European glassware and earthenware, but protect their dishes and plates and glasses "in boxes or cupholders of the most elegant designs and elaborate carving and colouring. Their boats are also elaborately decorated when new. On State festivals the capital, Malé, presents a most gay appearance, the roofs of the houses being covered with richly coloured cloths, and all the streets profusely decorated with bunting and curious models of modern steam vessels and little kiosks furnished with chess tables, the whole being brilliantly illuminated at night, when the Sultan, amidst a profusion of fireworks, and preceded by his band, visits the numerous mosques" [A. Haly].

The Maldivian sea-going sailing vessels, called buggalows, are often to be seen in Colombo Harbour, and the view from the end of the breakwater of one of these boats entering the harbour during the north-east monsoon is highly picturesque.

MALDIVIAN LACE-MAKING PILLOW AND LACQUERED STAND.

(Total height, 1 foot 2 inches.)

[To face page 6.

RICE MEASURE. PLATE BOX. BOTTLE BOX.

(*Diameter*, 11 *inches.*)

MEDICINE BOX FLOWER BOX. INK BOX.

(*Height*, $8\frac{1}{2}$ *inches.*)

MALDIVIAN LACQUERED BOXES.

To face page 7.]

The model of a ship with a mat sail in Case VI. represents the kind of boat used for traffic between the numerous islands of the Maldive group. The models in Case VIII. were presented by the Sultan of the Maldives, and do not include a copy of the typical Maldivian buggalow, which is built on characteristic lines unlike anything shown in these cases. In Case VIII. there are two finely lacquered drums, spears, and musical instruments. In Case VI. the **chess boards, spinning tops,** stands for lace pillows, Nautilus shell spoons, weighing scales, and **nautical instruments** are among the more noteworthy objects exhibited.

The lac employed in decorating the fancy boxes, dish covers, drums, sticks, spears, and stands is imported into the Maldives from India. The patterns into which it is worked, as well as the designs followed in wood and stone carving (see below, Maldivian Tombstones), appear to be exclusively Maldivian.

Many of the objects in Case VI. were presented by H. C. P. Bell, Esq., C.C.S., Archæological Commissioner. The rest formed part of a collection of Maldivian articles exhibited at the World's Columbian Exposition at Chicago in 1893, and were presented by Sultan Ibrahim Noorudin Iskander, Sultan of the Maldives from 1882 to 1893.

Masks and Musical Instruments.—Masks are used in plays, masquerades, and devil-dancing. Their invention is attributed to the god of curiosities. Those representing various diseases are said to be employed by devil-dancers to exercise the devils who occasion the sickness. Their construction appears to be based upon the principle of eradicating disease from the system by the homœopathic method of counterfeit presentments.

In spite of their grotesque character and of the fact that they can be made to order at the present day, these masks possess a profound interest as affording a clue to the origin of the ancient masks used in the Greek plays. The Oriental masks of the demons have been regarded as the prototypes of the Birds of Aristophanes, the Giants of Pollux, and the frightful forms of Lucian [Upham]. "The mask is the type of the Metempsychosis, the great pivot of Oriental doctrine, exhibiting to the spectator, scenically, the changes and forms which in different stages of mundane existence attach to the vital principle."..... "Had masks originated with the Greeks, it is fair to conclude that, instead of such frightful specimens which abound in every museum, they would have given the human form as they have beautifully embodied it in their painting and sculpture; hence the physiognomical character of the masks may be said to decide their origin and locality to the East" [Upham].

The Maha Kóla Sanni Yaka, or Yaksha, represented by the composite mask in the centre of the case and again over the top of Case VIII.,* is the great Demon of Fatal Diseases, all of which are attributed directly to devilish derangements of the three humours, wind, phlegm, and bile.

The Gopolu, or Gopola Yaka, is the Demon of Cattle, and all cattle sickness is supposed to proceed from him. He is represented with horns and tusks and a garment of leaves.

The Gara, or Garra Yaka, is the demon who possesses newly-built houses, and before a house can be finally occupied a ceremony called Gara Yaka Maduwa is generally performed. This ceremony is presumably equivalent to the European house-warming.

Súniyama or Húniyama is the art of sorcery, bewitching by spells and incantations. The word is sometimes anglicized into Hooniyan, this being the name given to evils inflicted by a man upon his neighbour or enemy by the agency of charms. In Hooniyan charms a small image of wax or wood is made to represent the person whose death or injury is desired. "A few hairs of his head, some chippings of his finger nails, and a thread or two from a cloth worn by him, and sometimes a handful of sand from a place on which he has left his footprint, are required." The image is then submitted to a ceremony called Jíwama ("endowing with life") performed by a Kaṭṭádiya or sorcerer, who recites mystical words over it. Nails made of a composition of five different metals—gold, silver, copper, tin, and lead—are driven into the image through the joints, the heart, and the head, and the name of the victim is marked on the image, which is then buried in the ground under a stile or at some other spot where the victim is likely to pass over it. The passing over, or Panna-wana-wa, is essential to the success of the charm. †

This Hooniyan charm, or **Sunniyan Yaka**, as the specimen is labelled in the case, is of particular interest on account of its world-wide application in the practice of witchcraft.

On the top of the case, besides more demon masks, there are large masks called the King and the Queen. These are used in the native masquerades called Kólama.

The lower portion of the case contains a collection of **musical instruments.** The drums are of various kinds, the more characteristic being the flat drum or timbrel called Rabána; the bobbin-shaped drum called Uḍikkiya or Udakiya; Tammeṭṭama,

* This Kóla Sanni Yaka was presented by Mr. Justice H. L. Wendt.

† The account given above of the Hooniyan charm is taken from an article "On Demonology and Witchcraft in Ceylon," by Dandris de Silva Gooneratne, Mudaliyar, in the Journ. Ceylon R. Asiat. Soc., vol. IV., 1865-6, pp. 1-117.

two drums fastened together as kettle drums ; Demaḷa-beṛé, Tamil tom-tom ; Yak-beṛé, demon tom-tom. The Rabána is beaten by women seated in a group round it on occasions of family rejoicing.

Among the stringed instruments are to be noted the Wéṇáwa or Víṇá, the Indian lute, an instrument with a good twang, the resonator consisting of a cocoanut shell with a skin stretched across it. The Bandarinha and Viola, presented by H. Holsinger, Esq., are used by the Mechanics* of Ceylon to accompany their Lusitanian dances.

There are also a couple of marionettes, employed in a form of entertainment much in vogue among the Sinhalese.

Other exhibits in the Central Hall include two stands of **Kandyan spears** with lacquered shafts, together with Kandyan blunderbusses and processional fans.

On the top of Case VIII. there is an interesting relic of the early conflicts between the British and the Kandyans in the form of a British drum said to have been captured by the latter.

On a small stand at the foot of the staircase there are some antique cannon balls, probably of Portuguese origin, which were unearthed at Medamahanuwara, near Kandy, a place which is noted for the existence of a cave in which the last King of Kandy took refuge after his flight from the British, and where he was captured in 1815.

MEDIÆVAL ROOM.

CASE IX.

Ivory Carvings.—This case contains a varied and valuable collection of objects made principally of ivory. The specimens which are worthy of attention include fan handles in ivory and ebony, combs, panels, dagabas, &c.

The large boxes are carved and shaped after Dutch designs.

The art of making the **compressible scent sprinklers** is said to be a secret confined to one family of ivory workers in the Kegalla District. The little figures of the last King of Kandy, two of his Ministers or Adigars, and the Chief Priest are said to be contemporary portraits. Sri Wikrama Raja Sinha was the last king of the Suluwansa or Lower Dynasty. He came to the throne of Kandy in 1798 and reigned until 1815, when he was deposed chiefly on account of his cruelty. The ivory statuettes of **Ehelapola** and his wife are also of considerable interest. Ehelapola became First Adigar of the King of Kandy in 1812. He

* The Mechanics of Ceylon are a class of artisans, shoemakers, tailors, blacksmiths, craftsmen of Portuguese descent, speaking a lingo of their own, Portuguese with an admixture of Tamil and Sinhalese. *Cf.* Mr. C. M. Fernando's article on the Music of Ceylon in Journ. Ceylon R. Asiat. Soc., vol. XIII., 1893–1894, pp. 183–189.

was also Dissave of Sabaragamuwa. Having disobeyed an order to proceed to Kandy his family was imprisoned by order of the king, and subsequently his children were beheaded in front of the Maha Vishnu Dewale at Kandy and his wife was drowned in the tank at Bogambra, near Kandy. This incident is known as the Ehelapola Tragedy, and constitutes a favourite theme on the modern Sinhalese stage.

On the lowest shelf of this case there are some more ivory statuettes of Buddha, ivory flutes, and a richly carved rattle mounted on a lacquered stick.

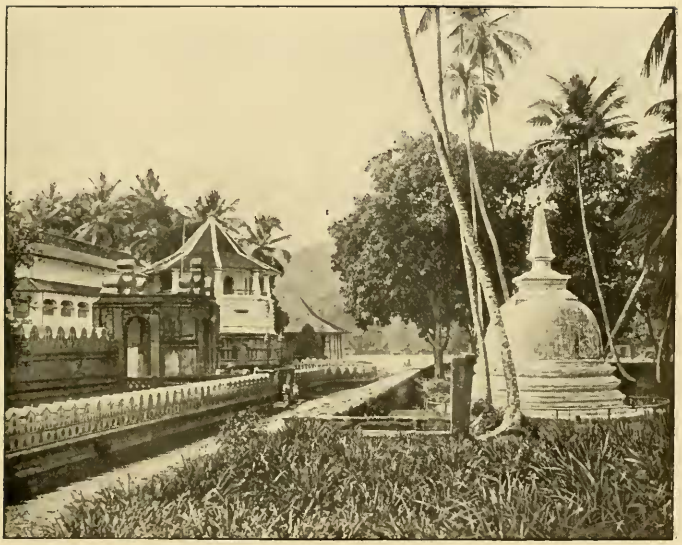
There is also a handsome ivory Udakiya (without skins) lent by P. E. Pieris, Esq., C.C.S., and an antique ivory cigar mouthpiece with receptacle for an extra cigar, presented by Mr. E. R. Gooneratne, Gate Mudaliyar.

The quaintly-shaped and lacquered pill boxes and the ola book covers with the signs of the zodiac deserve notice.

The ivory dagabas are reliquaries or karanduwas, the dome being screwed upon the base so that it can be removed and a cavity disclosed in which any small object of veneration or votive offering can be deposited.

CASE X.

Besides the numerous examples of Kandyan embossed metal work which are exhibited in this case, the most striking object is a silver model of the shrine containing the Dalada or Tooth of Buddha, the reputed original of which is preserved in the Dalada Maligawa at Kandy. This famous **Tooth Relic** has played an important part in the political history of Ceylon. It is esteemed by Buddhists as the palladium of the country and symbolizes the inviolability of the Buddhist religion. It is related that the sacred relic was originally rescued by the sage Khema from the great teacher's funeral pyre at Kusinagara and given by him to Brahmadatta, King of Kalinga, about 2,500 years ago. It was eventually brought to Ceylon from Southern India by a Brahman Princess of Kalinga, concealed in the folds of her hair, about the years 310-313 A.D., during the reign of Sri Megahavarna at Anuradhapura, where it was wont to be publicly exposed on sacred days with gorgeous ceremonies. When the relic was first brought to Ceylon its adventures were recorded in a work called the Dhatuwansa or Chronicle of the Tooth, written in Elu, the classical language of the Sinhalese. The tooth is said to represent the left upper canine or eye-tooth. The legend runs that after all attempts which have been made to destroy the sacred emblem, it has reappeared resting upon a lotus flower, where it now reposes. Parakrama Bahu I., surnamed the Great, built a temple for it at



TEMPLE OF THE TOOTH, KANDY.

[*To face page* 10.

MODEL OF THE TOOTH RELIC.

To face page 11].

Pulastipura, the modern Polonnaruwa, between the years 1190 and 1195. About the year 1246 A.D. Vijaya Bahu III. enshrined it at Dambadeniya, whence some forty years later Bhuvaneka Bahu I. removed it to Yapahu. Thence it followed the fortunes of the Suluwansa Dynasty to successive capitals, Kurunegala, Gampola, and Kotte near Colombo.

In the year 1560 A.D. it is said to have been captured by the Portuguese and taken to Goa, where it was pounded in a mortar and consumed in a brazier, but Phœnix-like it rose again from its ashes and is now at Kandy.*

The vicissitudes of the Tooth Relic are matters of speculation and controversy, but its political importance as a national palladium during the dynastic periods seems to be beyond doubt.

The model here shown was exhibited at Chicago in 1893.

The same shelf contains a handsome display of silverware, amongst which may be specially noted the large silver dagaba exhibited at the Colonial and Indian Exhibition of 1886: two large boxes of beaten silver embossed with deities and scroll work; a large spherical silver box with intricate design in high relief; an elegant silver chatty; a silver chalice for sandalwood; and a silver scent diffuser of the kind used for sprinkling guests at wedding ceremonies and for spraying coffins in funeral processions. There is also a finely worked brass dagaba. The leaf-shaped tassels hanging round the top of the dagabas represent the leaves of the sacred Bo-tree (*Ficus religiosa*).

On the next shelf below a large series of brass bowls called "chembu" is shown. Some of them are further adorned by the inlaying of alternating strips of beaten silver and copper.

The bottom shelf contains further examples of **Kandyan brasswork**, especially betel trays and rice tables, prominent among them being an antique Kandyan rice table presented by A. K. Coomaraswamy, Esq., Director of the Mineralogical Survey of Ceylon.

The upper shelves of the case contain on one side a set of embossed silver and brass plates, and a pair of carved silver ola covers with ola manuscript descriptive of one of the Játakâs or Births of Buddha.

On the other side there are some examples of wood carving, a carved calamander cocoanut scraper from Panadure, between Colombo and Galle; sweetmeat moulds or jaggery boards; game boards called "chonka boards," in which the seeds of the

* *Cf.* Memoir on the History of the Tooth Relic of Ceylon, by J. Gerson da Cunha, 1875.

"olinda" (*Abrus precatorius*) or any other suitable seeds or shells are placed in two depressions at the ends, and the players have to make the circuit of the board from pit to pit along the sides without occupying the same hole at one time. The player who gets the seeds home first wins.

On the end-wall of the case there are some carved wooden sweetmeat pats. Hanging from the top of the case down the middle is a richly embroidered silk cloth said to have been worn by the wife of Molligoda, the Second Adigar of the last King of Kandy.

CASES XI. AND XIV.

Embroidered Cloths.—The narrow wall case contains examples of dress worn by the old aristocracy of the low country.

In the centre is a hat of peculiar shape, somewhat boat-shaped, called "Jagalatta Toppiya," used by Rajapakse, Chief Mudaliyar of Mahabadde, 1701 A.D.

There is also a Mudaliyar's dress sword and a sword with hilt and scabbard of richly carved tortoise-shell dating from the end of the 18th century, lent by Tudor Rajapakse, Esq.

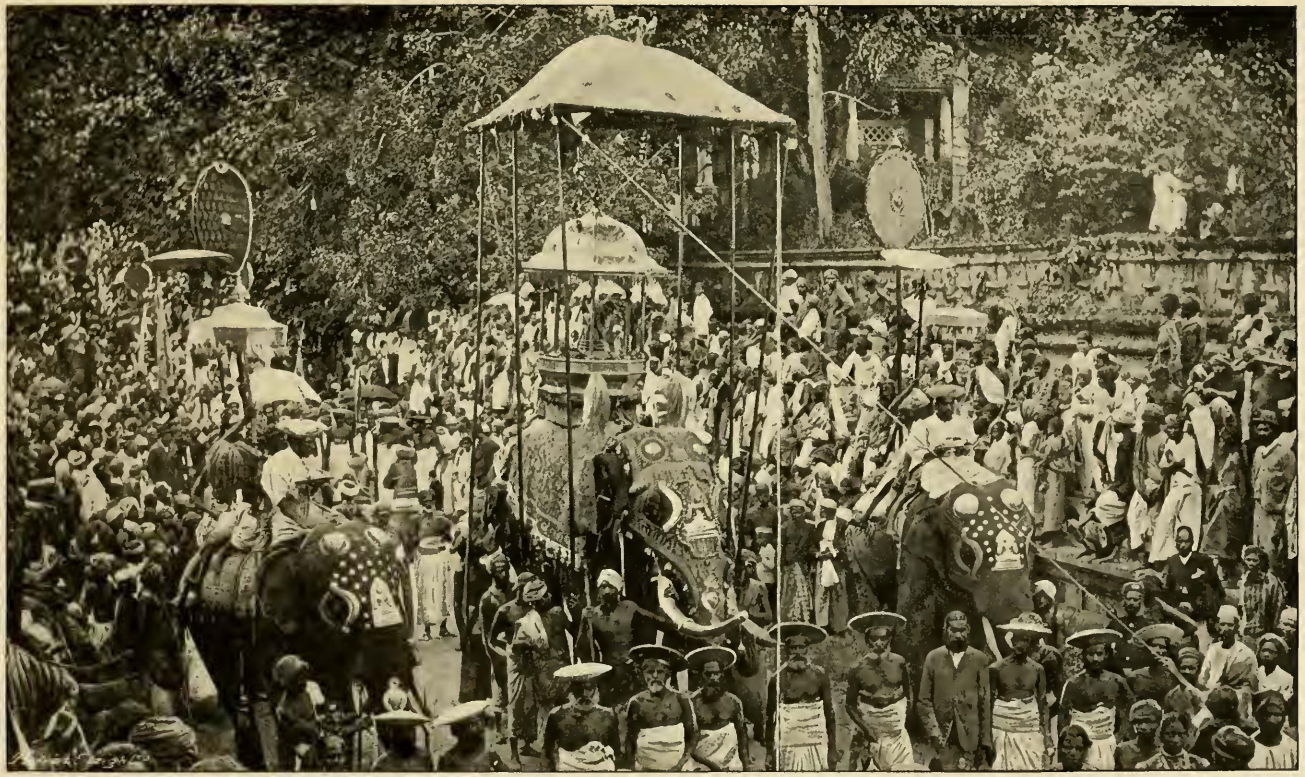
On the top shelf there are some Dutch swords.

In the case corresponding to this on the opposite side of the room (Case XIV.) some further examples of **woven cloths** are shown, including a handsome old embroidered Kandyan betel bag, which was formerly carried slung at the side from the shoulder. There are also some gold embroidered Chetty costumes.

CASE XII.

This case contains an assortment of antique objects in brass and bronze, among the more interesting of which are three Sinhalese water clocks; cocoanut oil lamps; elephant bells; karanduwas (dagabas); Pattini bangles, hollow armlets and anklets with a slot along one side and pellets inside, used in dances on festival occasions such as peraheras, in honour of **Pattini Deviyo**, the goddess of chastity; epaulettes, also worn by dancers.

The **Sinhalese water clock** is a clepsydra, consisting of a copper bowl, of larger and smaller sizes, with a small pinhole in the bottom and with or without silver datum marks let in at the sides. The bowl is set floating in a clay water chatty, the water gradually entering through the pinhole aperture until a datum level is reached, and eventually the bowl sinks. In the larger of the clocks shown with graduations the water reaches the level of the highest datum mark in exactly forty-eight minutes. The Sinhalese hour or "peya" consists of twenty-four minutes,



BUDDHIST PROCESSION IN KANDY: THE ANNUAL PERAHERA.

[*To face page* 12

and the day and night are divided into thirty "pęyas" each. The water clock is called "pę-tęṭiya."*

On the top of the case there are some interesting examples of old Sinhalese domestic wood carving, an art which has almost if not entirely fallen into disuse. The series includes carved cocoanut ladles and spoons with more or less ornate wooden handles, carved wooden **spoon racks**, and a cocoanut scraper.

CASE XIII.

This case contains a large series of boxes and implements employed in the services of the arecanut and tobacco. The arecanut is the principal ingredient in that form of indulgence known as betel chewing. A fragment of a nut with other spices is wrapped up in a betel (pepper) leaf and eaten. Then the finger is dipped in slaked lime called chunam and placed upon the back of the tongue, or sometimes a spoon or spatula may be employed for this purpose. The lime is kept in metal boxes, called **chunam boxes**, which are elegantly shaped, embossed, and inlaid. The box is suspended by a chain, at the end of which, when complete, are carried a small silver or brass earpick, a toothpick, and a spatula. The very large chunam boxes belonged to important personages and were carried by an attendant.

The arecanut is cut into slices by an instrument, resembling a nut cracker in shape, called an **arecanut cutter**. The handles of these cutters afford considerable scope for artistic display, as will be seen by an examination of the large series here shown.

Elderly persons with failing powers of mastication are in the habit of pounding their betel bolus before consuming it. For this purpose they use a small pestle and mortar called a **betel pounder**, several of which are exhibited.

Above the chunam boxes there are some antique jewel boxes made from Dutch designs in brass and copper, embossed and engraved in various patterns. These are known as **Dutch boxes**, other examples of which are to be found in the Ivory Case and in Case XV.

Below the shelf containing the arecanut cutters there is a large series of brass **tobacco boxes**. These have also been made from Dutch designs, some of them having been actually manufactured in Holland, whence they were brought here during the Dutch Administration.

* Further information on "Sinhalese Measures of Time" is contained in an article by Mr. Herbert White, C.C.S., in The Orientalist, vol. III., 1888–1889, p. 75; and in a paper by Mr. F. H. Modder on Sinhalese Weights and Measures, in Journ. Ceylon R. Asiat. Soc., vol. XII., 1892, pp. 173-202.

The bottom shelf of the case contains some more metal bowls, trays, and goblets.

The picture on the wall over the case is a temple drawing representing an incident in the life of Buddha.

CASE XV.

A portion of this case contains a number of "Dutch boxes," many of which, however, have been made in more recent times. They are made with different kinds of wood—satinwood, calamander, and ebony—and are variously carved and inlaid with ivory, brass, tortoise-shell, and porcupine quills.

The original native wood carving has largely given way to the manufacture of these articles and of ebony and cocoanut elephants. There is also shown here a well-executed carving of a tortoise in calamander wood, the most valuable wood in Ceylon.

Besides the boxes there are some examples of carved combs and hairpins in tortoise-shell and in horn.

On the other side of the case some examples of painted **Kandyan pottery** are shown. There are three classes of unglazed pottery in Ceylon, namely, the plain **Village pottery**, comprising the water chatties, cooking bowls, and curry dishes of every-day use; secondly, the painted pottery of Kandy; and lastly, the **Grotesque pottery** of Matara, examples of which are placed upon the top of the case. This pottery possesses features of ethnographic interest in spite of its grotesqueness; it is made and sold chiefly during the time of the Dondra Fair in the summer months.

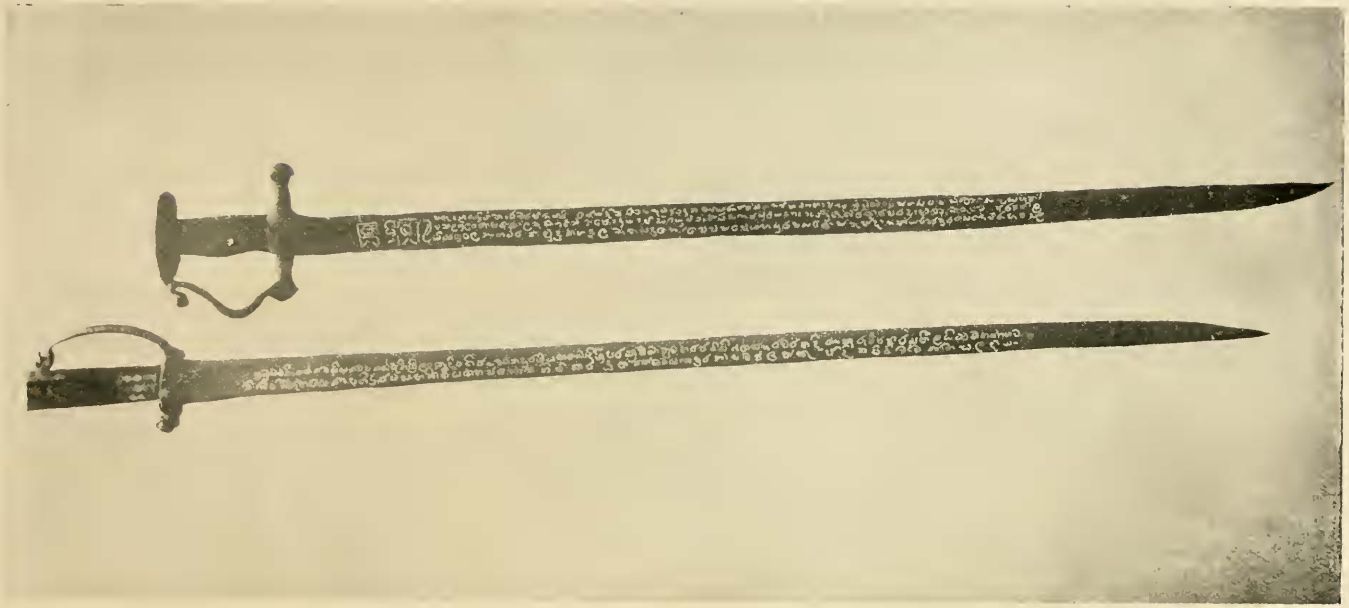
CASE XVI.

Kandyan Knives and Swords.—Here are shown numerous swords and daggers used by the Kandyans during the later Dynastic Period and still worn on State occasions. Many of them are highly ornate at the hilt, and the scabbard and base of the blade are often richly damascened. The handle is frequently carved out of ivory, horn, and black coral, and the sheath in some cases is covered with carved tortoise-shell. At the base of the blade in a few instances the figure of a lion in brass is let into the steel. This seems to be of the nature of heraldry.

Some of the dagger sheaths contain in addition to the dagger a receptacle for a *stylus* for writing upon the ola slip.

On the top shelf there is a set of Kandyan **Village jewellery** in the form of numerous brass and glass bangles; and some old Dutch swords and powder-horns.

On the top of the case are some antique spear heads.



SINHALESE INSCRIBED SWORDS.

To face page 15.]

TABLE CASE XVII.

A rather heterogeneous assortment of ancient odds and ends is provisionally placed in this case, gold and silver fragments, beads, and gems from the ruined cities of Ceylon. The excavations which have been carried on for many years under the direction of the Archæological Commissioner have not led to any sensational discovery of buried treasure. Such precious relics as have been unearthed have on the whole been disappointing so far as their intrinsic value is concerned.

In the reverse half of this case there is an ola horoscope and a copper sannas or deed conveying a grant of land to a Kandyan temple by the last King of Kandy. There is also shown an ebony weighing lever, called Tulâppadi in Tamil, still used by traders in the Vanni and Jaffna, presented by J. P. Lewis, Esq., C.C.S.

In the glass box over the case there are two old swords, with Sinhalese legends dating from the years 1374 and 1416 inscribed upon them. The inscriptions relate that the swords were presented by the Rajas reigning during the years mentioned (1917 in the Buddhist Era = 1374 in the Christian Era ; 1959 A.B. = 1416 A.D.) in the town of Jayawardhanapura (the modern Kotte, which lies in the outskirts of Colombo) to two members of an aristocratic family upon their appointment as generals. These interesting swords were presented to the Museum by Mr. C. M. Fernando, Crown Counsel.

TABLE CASE XVIII.

Containing a valuable collection of coins which have at one time been current in Ceylon. The coins fall into two classes, namely, the ancient Sinhalese currency, comprising the coins of the Kings of Ceylon ; and the foreign coins introduced to this Island by traders from the days of the Roman Emperors down to the establishment of British Rule. The devices on the coins of the Sinhalese Kings represent on the obverse the king standing, holding a lotus flower in his right hand and a kind of sceptre, sometimes called the trisul emblem, of questionable significance, in his left hand. On the reverse the same figure is repeated in a sitting attitude with the name of the king inscribed to the left of the figure in Nagari-Sanskrit characters.

It has been a too common practice to forge counterfeits of the gold coins for the purpose of deceiving collectors.

The most ancient coins represented in the collection are rectangular pieces of silver with or without figures of animals punched upon them, called Eldlings, which have been found during the excavation of the ruined cities.

Among the rarer Sinhalese dynastic coins may be mentioned the Lion Coin and the Setu Bull Coin, examples of both of which are exhibited. To these may be added the very rare gold Lankeswara coin of Vijaya Bahu, lent by P. E. Pieris, Esq., C.C.S.

Among the foreign coins may be noted the Roman and Arabian coins, Venetian gold sequins, Portuguese silver tangas or tangams, and gold San Thomé coin, the Dutch dukatoons and silver and copper stuivers, and challies minted by various States in the Dutch Confederation. Some of the Dutch copper coins were actually minted in Ceylon, at Colombo, Galle, and Trincomalee. These are marked with the letters C, G, and T, respectively.

The establishment of the Dutch United East India Company (Ostindische Vereenigde Compagnie, indicated on the coins by the monogram ℣℈) on the Island of Ceylon dates from the year 1655 and lasted until 1802, when the Island was formally ceded to the British (who had occupied it in 1796) by the Treaty of Amiens.

The copper ingots issued by the Dutch, of the value of $4\frac{3}{4}$ stuivers, are a singular form of money.

The general name applied to the ancient Sinhalese coins is "massa." They appear to date only from the year 1153 A.D. to 1296 A.D.

The common copper coins of the Dutch of small value were called challies, a corruption of the Sinhalese word "salliya" (plural "salli"), meaning money or cash in general. The smallest coin now in use, value half a cent, is still called "tamba-salliya," "tamba" meaning copper. The proper coins of the Sinhalese King during the famous captivity of Robert Knox (1659–1679) were fanams of the size of a spangle.

Another interesting form of money is afforded by the Larins or **Fish-hook money**. These are said to have originated at a place called Lari or Laristan on the Persian Gulf. They were formerly made in the Maldive Islands, and were also in use in Ceylon in Knox's time, anybody being allowed to make them. Portuguese copper tangams were also current.

Further information on the ancient coins of Ceylon is contained in the well-known memoir by Professor T. W. Rhys Davids "On the Ancient Coins and Measures of Ceylon," published in 1877 in the International Numismata Orientalia (London, Trübner & Co.).

The ancient beads, coins, and dice discovered at Anuradhapura, Mihintale, and elsewhere have been described and figured by Mr. H. C. P. Bell, C.C.S., the Archæological Commissioner, in his

Fourth Progress Report on the excavations at Anuradhapura and the North-Central Province (Sessional Papers, 1892).

In the large glass shade over this case are shown numerous ancient images, mostly sedent figures of Buddha, including eight thin gold images of Buddha, filled with clay, from Panduwas Nuwara, and above these a similar gold figure from Tissamaharama and gold and crystal dagabas from Anuradhapura. At each end of the cover inside there is a bronze Buddha on a throne backed by a well executed arch called "makara torana." These are called "Enthroned Buddhas." There are also figures of Krishna playing with a ball, and of the goddess Pattini, the latter from Trincomalee. On the top of the case there is a large sedent bronze Buddha of unique design in the attitude of teaching, holding a flower (?) in the left hand. This was discovered twelve miles from Badulla along the new road to Batticaloa, and was presented by G. F. K. Horsfall, Esq., in 1876. On either side of this image there are two common village coloured wood-carvings, one representing a large cobra, the other Buddha seated upon the folds of a cobra and protected by its expanded hood. The latter is called a "Serpent-canopied Buddha."

TABLE CASE XIX.

A selection of silverware occupies the two halves of this case, and in the glass shade above there is a set of Tamil silver bangles, anklets, and toe rings.

Besides some richly damascened Kandyan knives, embossed silver tobacco boxes, and Dutch relic in the form of a silver plate presented by a former Dutch Governor of Ceylon to the person named in the inscription, the principal object in the case is a pair of handsome silver **ola covers** with bejewelled button. They consist of bars of wood painted with dagaba devices on the under side and overlaid with sheets of beaten silver.

TABLE CASE XX.

Examples of Chetty, Tamil, Sinhalese, and Moorish Jewellery.—The large gold ornaments are represented here by silver-gilt replicas. "Chetty" or "Chitty" is the name applied in India to all members of the trading castes in the Madras Provinces. The Colombo Chetties, a caste from Tinnevelly, emigrated to Ceylon about the middle of the sixteenth century. Their language and customs are Tamil.

From an ethnographical point of view among the most interesting objects in this case are the Sinhalese "nawaratna" rings set with the nine principal gems, or as near an approximation as is possible or can be afforded. The nine gems stand for the nine planets (including sun and moon), and the ring is worn as a corrective

for horoscopic purposes ; for example, it is worn by a person born under an unfavourable star, and its constant usage is supposed to avert disasters.

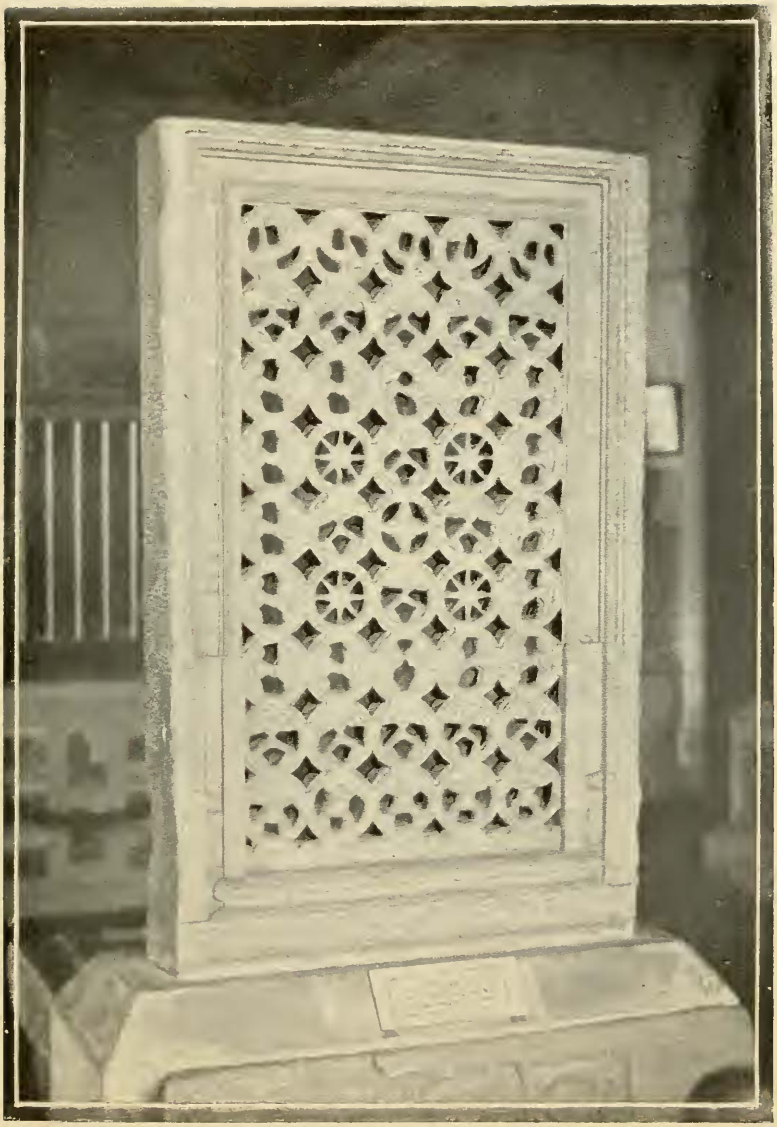
STONE GALLERY.

Many remarkable remains of fallen greatness, illustrating the stupendous grandeur of the ancient religious monuments of Ceylon during the palmy days of militant Buddhism, are exhibited in this gallery. The statues, pillars, friezes, and slabs are carved out of gneiss, the country rock of Ceylon, some of them, however, consisting almost entirely of crystalline limestone.

Among the more notable pieces are the three principal archæological treasures of the Colombo Museum mounted in position along the centre of the room. Facing the south window at the front end of the gallery is a perforated carved slab, 4 feet 8 inches high, 2 feet 10 inches wide, and 7 inches thick, known as the **Yapahu window**, from Yapahu or Yapahuwa, a village in the North-Western Province, about twenty miles north of Kurunegala. It consists of a single block of gneiss cut into the semblance of a frame, which surrounds a composite hieroglyph consisting of forty-five circles in five vertical rows joined together in a moniliform pattern, each circle containing an emblematic figure repeated on both sides of the stone. The matrix of the slab between the carved portions was removed by the artist who designed and executed this unique triumph of stone tracery. In the 13th and 14th centuries there was a royal palace at Yapahu, and the hall of the palace was lighted by two of these tracery windows of exquisite workmanship. We are told by Mr. F. H. Modder that one of these windows "was perfect in 1850, but the other had fallen and its fragments were scattered around. The remaining one would doubtless have soon shared its fate had not Mr. O'Grady, then Government Agent of the North-Western Province, removed it to Kurunegala..... Thence it was transported to Colombo, and now occupies a prominent place among the archæological exhibits at the Museum."

The human figures in the lowest circles represent grotesque manikins, above these are nautch girls, then animals, some of which are provided with a trunk and appear to represent the fabulous "gaja-sinha" or elephant-lion. The star-shaped radiating emblems are the "dharma-chakra" symbols, the wheel or circle of the laws and teaching of Buddha. The birds in the top row are the "hansa" or sacred birds, usually represented by geese, sometimes by conventional representations of birds.*

* For further remarks quoted from an article by Mr. John Bailey, C.C.S., who explored the ruins in 1850, see the paper by Mr. F. H. Modder on "Ancient Cities and Temples in the Kurunegala District : Yapahuwa." Journ. Ceylon R. Asiat. Soc., vol. XIII., 1893, pp. 97–113.



THE YAPAHU STONE WINDOW.

[*To face page* 18.

THE LION OF POLONNARUWA.

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The next megalith which claims attention is the colossal figure of a lion called the **Lion of Polonnaruwa.** This relic of the past is exceptionally valuable and interesting, because there is a Sinhalese inscription on each side near the base giving the date and purport of the monument. Upon it was placed the throne of King Nissanka Malla, a Chakrawarti or Emperor of Kalinga lineage, who was the Lankeswara or Overlord of Lanka (Ceylon) during the years 1187–1196 A.D.

The lion formerly stood in the Council or Audience Hall of the King at Polonnaruwa, whence it was removed to the Colombo Museum about thirty years ago. The ancient name of the city was Pulastipura, the modern name is Topawewa, meaning the tank where the ruined topes or stupas are. It is, however, commonly known as Polonnaruwa, an Elu term of doubtful derivation adopted by Sir Emerson Tennent (*Ceylon*, vol. II., 1847). The ruins were re-discovered in 1820, and all that remained of the Audience Hall where the inscriptions were found were "48 large stone pillars with carved capitals supported on a stone platform, round the base of which are sculptured a row of lions." The great lion-throne "was lying almost entirely buried at some distance from the Hall, and was set up with great difficulty; it had probably been thrown out of the Hall by the Tamils when they took Pulastipura, and may formerly have stood between the inscribed pillars."*

The inscription on the left side of the lion is terminated by the figure of a fish, a symbol of good omen.

The adventures of the lion during its transport from Polonnaruwa to Colombo are recounted by Sir William Gregory (*Autobiography*, second edit., 1894, p. 343), who was at that time (1872–1877) Governor of Ceylon: "Every mishap attended the transfer of this huge stone beast. Its first dray fell to pieces beneath its weight. On descending from the elevated ground where it stood the two elephants attached to it pulled over-vigorously, and the dray and the lion and the elephants flew apart in different directions. It had then to be drawn over a difficult jungle path a distance of fifteen miles from the main road; but the elephants had now learned their business, and these obstacles were surmounted. But

* A facsimile of the inscription on the left of the lion, with translation, is given by Professor T. W. Rhys Davids in his paper on "Inscriptions at the Audience Hall of Parakrama Bahu, Pulastipura, Ceylon," in the Indian Antiquary, vol. II., 1873, pp. 246-249. Pulastipura was the capital of Ceylon from the end of the eighth to the beginning of the fourteenth century. Previously Anuradhapura had been the capital for over a thousand years.

Pulastipura enjoyed its period of greatest magnificence during the long reign of Parakrama Bahu I., surnamed the Great, in the latter half of the twelfth century, preceding the reign of Nissanka Malla.

when it reached the high road the worst of all remained. The wooden bridges, constructed to sustain a moderate load, were quite unable to bear the combined weight of the lion and the dray, and the banks were precipitous and deep. But this, too, was overcome by digging out a sloping passage to the bed of the river and another on the opposite side. The elephants with their immense strength and sagaçity sustained the strain of letting down the lion, and easily drew it up again. Much of this took place in the solitary jungle, but when the inhabited regions were approached, the whole country turned out in amazement.....

"The procession of elephants, the lion decked with wreaths and flowers, was a magnificent sight. The tom-tommer from each village joined the *cortège*. The headman of the district asked permission for his little boy to ride the monster into Matale, whence he was to be conveyed by rail to Colombo. The lion now stands calmly in the Museum, and few know, or could understand if told, all the cares it caused and the excitement it created. It is a most valuable archæological record, and would have been undoubtedly destroyed ere this had it not been removed."

The risk of destruction referred to by Sir William Gregory in the foregoing quotation is demonstrated by the fracture on the left side of the head, which is said to have been perpetrated by enterprising burglars ignorant of the solid nature of dynastic art who hoped to find treasure hidden within the penetralia of the body. From the base of the forefoot to the crown of the head the lion stands six feet.

The third object of distinction is an elaborately carved pillar which has been recently set up behind the great lion. This is called the **Medagoda Pillar**, and formerly stood in the Pattini Dewale at Medagoda, six miles below Ruanwella, in the Province of Sabaragamuwa, not far from Yatiyantota. An excellent drawing of this pillar, accompanied by a lucid description quoted below, is contained in the "Report on the Kegalla District of the Province of Sabaragamuwa," by H. C. P. Bell, Esq., C.C.S., Archæological Commissioner (Sessional Papers, 1892, p. 58): "The monolith must originally have been squared to 1 ft. 2 in., the size it assumes across the lion's breast, lotus bosses, and capital fillet. Rising octagonally from the back of a broad-faced couchant lion of conventional type, with frilled mane and raised tail, the shaft slides gradually into the rectangular by a semi-expanded calyx moulding. Half way up relief is given by a bordered fillet 2 in. in breadth, slightly projecting, carved with a single flower pattern repeated round the pillar. From the fillet depend on each face two concentric ..... pearl-bead strings. A few inches above this

STATUE OF PARAKRAMA BAHU AT POLONNARUWA.

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band stand out from alternate faces full-blown lotus knops, 5 in. in circumference, with ornamentation resembling much the Tudor flower upon the intervening sides. Where the pillar becomes square there are further loops of pearls, four on each side. A lower capital of ogee moulding, separated by narrow horizontal fillets, and finished with ovolos and a rectangular band, is surmounted by a four-faced *makara* and a low abacus. From the centre of the roundlet moulding on all four sides drops the garlanded *chakra* symbol."

Other noteworthy stone carvings in this gallery are the **Janitor Stones** from Hanguranketa presented by C. H. de Soysa, Esq., placed before and behind the cement base upon which the Yapahu window now stands ; a mystic square stone called **yantra-gal,** with twenty-five holes, from Anuradhapura, supposed to be a base stone sometimes called a yogi stone (*cf.* H. C. P. Bell, Seventh Report on Anuradhapura, Sessional Papers, 1896, p. 13) ; the **Naga Stone** from Anuradhapura, mounted against the east wall, portraying a large seven-headed cobra in high relief ; friezes from Horana ; figures of Ganesa, the elephant-god, from Horana, presented by Sir C. P. Layard ; marble statue of Buddha from Tissamaharama, presented by Sir C. P. Layard ; friezes and capitals from Anuradhapura ; statue of Buddha in spongy gneiss from Ambagamuwa, presented by Hon. Mr. R. B. Downall (against the west wall) ; cast of the gigantic statue of Parakrama Bahu the Great at Polonnaruwa ; cast of a remarkable **Processional Moonstone** from Anuradhapura (below the south window). The moonstones, perhaps so called in consequence of their semilunar shape, are employed as steps leading into the porticos of the temples. They are often of fine design and execution, and are characteristic of Sinhalese Buddhist architecture. In the cast exhibited here there is a central lotus flower surrounded by concentric processions of hansas and other animals. In front of the stone lion there is another simple **Lotus Moonstone** from Hanguranketa, presented in 1878 by C. H. de Soysa, Esq.

Attention may now be directed to the four wall cases in this room, three of which contain ethnographical models, and the fourth a valuable collection of ancient bronzes.

CASE XXI.

Models of a Kandyan Chief or Ratemahatmaya and of a Buddhist priest with begging bowl ; a temple tapestry hangs at the back of the case.

CASE XXII.

A Low-country Chief or Mudaliyar and a Sinhalese bride.

CASE XXIII.

A man and woman of the Veddas, the aboriginal hunting caste or hill tribe of Ceylon. The bark-cloth bag hanging against the side of the case is made from the bark of the upas tree, *Antiaris toxicaria*, called "riti" in Sinhalese, "metavil" in Tamil, belonging to the same natural order (Urticaceæ) as the Bread-fruit and Jak-fruit trees.

The Veddas used to be an interesting race of forest haunting nomads, but they are rapidly falling victims to civilization, exchanging their ancient skill as bowmen and woodmen for a more sordid if less precarious existence dwindling towards extinction.

They are chiefly to be found in the Province of Uva, but it is possible to tramp through the Province from top to bottom without seeing a sign of a Vedda. Occasionally persons are paraded as Veddas, but when seen away from their natural environment the effect must be pitiful rather than picturesque.

All the models were executed by a local modeller, Mr. R. G. Andriesz.

CASE XXIV.

Ancient Bronzes.—On the top shelf a three-branched **candelabrum** from Munisseram, presented by Hon. Mr. F. R. Saunders; below this a pair of gold-plated bronze curtain frames from Kotte near Colombo, lent by P. E. Pieris, Esq., C.C.S.; numerous miniature bronze figures of gods and animals from Dondra Head; bronze lamps from Munisseram. On the bottom shelf the central object is a large bronze **Kothali** or drinking goblet, with spout fashioned after the manner of an elephant's head and trunk, from Ratnapura, lent by P. E. Pieris, Esq.; also an ancient bronze tripod from Kurunegala; bronze **hansas** or sacred birds from Munisseram; a heavy bronze **Contemplation Box** with thirty compartments, some of which contain a few coins and other offerings, presented by the Royal Asiatic Society.

SOUTH VERANDAH.

Passing through the doorway at the side of the Bronze Case on to the South Verandah, a Portugese cannon dredged up in the Colombo Harbour in 1888 is an important relic of the Portuguese occupation of the country. Here is also exhibited a polished pillar of Ceylon gneiss from the Mahara quarries employed in the construction of the Colombo Breakwater, presented by John Kyle, Esq.

Returning through the Stone Gallery to the

WEST VERANDAH

a number of inscribed stones will be found, together with two or three Dutch and Portuguese tombstones. The work of collecting and collating the numerous ancient inscriptions scattered over

VEDDAS : THE ABORIGINES OF CEYLON.

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PETIGAMMANA PILLAR.

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the Island was properly organized during the Governorship of Sir William Gregory, when Dr. P. Goldschmidt was appointed Archæological Commissioner to the Government of Ceylon in 1874. His reports were published as Sessional Papers from 1875 until his death in 1877. Dr. Goldschmidt was followed by Dr. Edward Müller, who compiled a valuable manual on "Ancient Inscriptions in Ceylon" (London, 1883), illustrated by a separate quarto book of plates. Dr. Müller left Ceylon in 1881, and was succeeded, after an interval, as Archæological Commissioner by Mr. H. C. P. Bell, C.C.S., under whose direction the work of excavation, discovery, and transcription has been continued from 1890 to the present time.

The great slabs placed against the back wall of the verandah are of interest on account of their antiquity and the characters employed. The first one, propped up lengthwise on the ground, is the oldest inscription that has been discovered at Anuradhapura, from the Ruanweli Dagaba.* It relates to the restoration of certain temples during the reign of King Gaja Bahu (113–125 A.D.).

The upright slab next to the **Ruanweli Slab** is known as the **Tissamaharama Slab**, from Tissamaharama near Hambantota in the Southern Province. It is almost completely preserved, and according to Dr. Müller "is the finest specimen we have of an inscription of the fourth century A.D."†

Adjoining this slab is a narrow flattened stone with an inscription on both faces. The inscription is headed on the obverse side by a symbol of the sun and on the reverse by a crescent representing the moon, the sun and moon being the usual royal signs. It is a grant of land to a temple, and concludes (on the reverse side) with a life-size figure of a crow in sunk relief. This is the **Petigammana Pillar** found half buried in a garden within a few miles of Gampola.‡

Many of these inscribed pillars dating from the tenth century bear, at the top, engravings of the sun and moon as symbols of royalty [Rhys Davids] or eternity and, at the bottom, the dog and crow as symbols of instability [Müller] or meanness; anyone violating the property of the priesthood renders himself liable to the penalty of being re-born in the low condition of one of these animals [Goldschmidt]. The translation of the Petigammana inscription, according to Mr. Bell, ends with the usual curse: "Anyone who disputes this [grant will be born] a crow."

* Müller's Inscriptions, No. 5, p. 27, and Plate 5.

† Müller's Inscriptions, No. 67, p. 43, and Plate 67.

‡ H. C. P. Bell. Report on the Kegalla District, 1892, p. 79, with plate.

In the middle of the outer side of the verandah there is a large slab, the **Dondra Slab**,* recording the grant of land to the Temple of Vishnu at Dondra Head in the fourteenth century. This slab and the **Dondra Pillar**† at the front outer corner of the verandah are of particular interest on account of their association with Dondra Head near Matara in the Southern Province, the most southerly point of Ceylon. "Like Cape Comorin on the Continent of India," says Professor Rhys Davids (Indian Antiquary, I., 1872, p. 329), "Dondra Head has always been a place of pilgrimage, and seems to have derived its sanctity from its being the extreme southerly point of land, where the known and firm earth ceases, and man looks out upon the ocean—the ever-moving, the impassable, the infinite."

Opposite to the Dondra Slab is the **Mahakalattewa Pillar**, from the bund of a tank of that name six miles from Anuradhapura on the road to Galkulam. It is remarkable for its perfect preservation, not a single letter missing; the inscription is on all four sides.‡

Occasionally other symbols besides those mentioned above are engraved upon the pillars, such as a cobra and a priest's fan. The latter occurs, for example, on the **Kongollewa Pillar**§ (placed near to the Dondra Slab).

The stone slab bearing the Royal Arms of Portugal was found at Menikkadawara in the Kegalla District by Mr. H. C. P. Bell (Kegalla Report, 1892, p. 31, and plate).

Leaving now the West Verandah one crosses the Stone Gallery to the

NORTH VERANDAH

at the back of the Museum, where more tombstones, capitals, inscriptions, &c., will be met with. Here may be noted quaint Portuguese tombstones‖; a couple of Maldivian tombstones characteristically carved in coralline limestone; a "dressed stone" with a Tamil inscription of the fifteenth century from the Kotagama vihare, found by Mr. Bell, who remarks upon the singularity of discovering a Tamil inscription in the heart of a Sinhalese district; this is called the **Kotagama Tamil Slab**¶; another stone

* Müller's Inscriptions, No. 163, p. 71. First translated by Rhys Davids. Journ. Ceylon R. Asiat. Soc., vol. V., 1870–1871, p. 25.

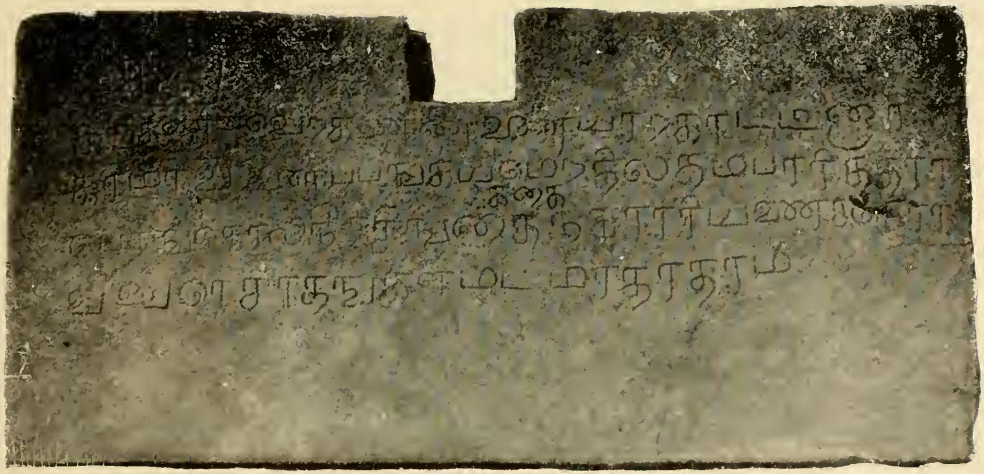
† Müller's Inscriptions, No. 159, p. 69. Rhys Davids, *loc. cit.*, 1872, p. 57.

‡ Müller's Inscriptions, No. 110, p. 55, with plates 110 A–110 D.

§ Müller's Inscriptions, No. 112, p. 55. Kongollewa lies about two miles north of Madawachchi in the North-Central Province.

‖ A fully illustrated and historical account of these tombstones will be found in a paper on "Portuguese Inscriptions in Ceylon," by Mr. J. P. Lewis, C.C.S., to be published shortly in the Journ. Ceylon R. Asiat. Soc.

¶ H. C. P. Bell. Report, Kegalla District, 1892, pp. 68 and 85, with figure on plate facing p. 72.



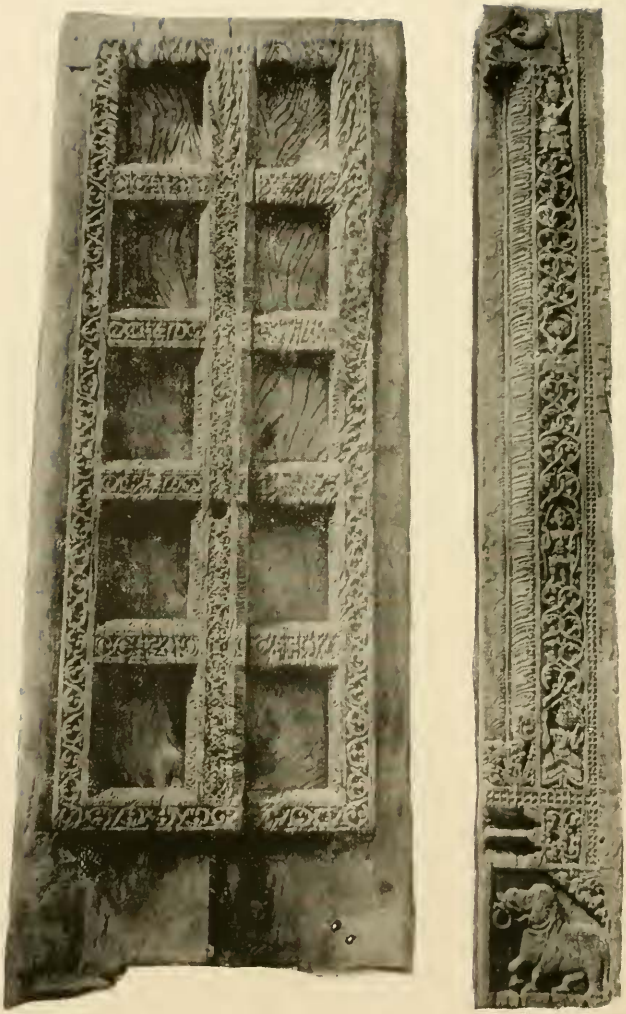
KOTAGAMA TAMIL SLAB.

[*To face page* 24.

EHUNUGALLA SLAB.

(Photograph by H. C. P. Bell, Esq.)

[*To face page* 24



WOODEN DOOR AND JAMB FROM DEVANAGALA VIHARE.

(Photographs by H. C. P. Bell, Esq.)

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slab in a corner of the verandah bearing a short Sinhalese inscription with representations of sun (an orb) and the moon (a crescent) is called the **Ehunugalla Slab***; it records a benefaction to a monastery. Close to this stone is an ancient carved wooden door from Dewanagala in the Kegalla District. The solid wings of this door and the left jamb of its frame were found among the lumber underneath the vihare. There are ten plain panels enclosed by framework in high relief carved in a foliage scroll. The carving of the jamb is described as follows: "Between an outer beading and inner splayed edge of lotus petals runs a long narrow panel with gracefully intertwined double scroll of creeper, separating four figures all different from each other. A space half moulded, half panelled, in flower design, intervenes between it and the base panel, in which is placed beside a tree an elephant with head and right forefoot raised and curled trunk."†

The door, which was presented by F. H. Price, Esq., in 1890, was reconstructed at the Colombo Museum. The cross beam on the top with the drooping lotus capitals was brought from the Pinnawala Vihare.‡

Next to the wooden door are two carved wooden pillars mounted as door posts. They belonged to a set of seven balcony pillars found under the eaves of the porch of the Kumbukgama Vihare.§

Opposite to the wooden door are casts of two Peacock Pillars from Anuradhapura. At the other end of the verandah there is a large wooden rice trough or **paddy pounder**, in which the paddy which has previously been trodden out of the corn by bullocks is beaten and husked. Next to this is an old carved **rice mortar** from Ratnapura, like those in constant use at the present day, in which the rice is pounded into flour.

BUDDHA SHED.

In the palm-thatched shed in the grounds behind the Museum further important stone antiquities are exhibited. Chief among these is the large sedent Buddha found by Mr. Bell in the jungle near the Nuwarawewa tank at Anuradhapura.‖ "This Buddha," wrote Mr. Bell in 1890, "is admittedly the finest yet brought to light at Anuradhapura. The wonderful sharpness

* H. C. P. Bell. Report, Kegalla District, 1892, p. 76, with figure on plate facing p. 72.

† *Id.*, p. 49.

‡ H. C. P. Bell, *op cit.*, p. 38.

§ *Id.*, p. 22, with figure on plate.

‖ H. C. P. Bell. First Report on Archæological Survey of Anuradhapura. Sessional Papers, 1890, p. 4 [742]. It is known as the *Toluwila Buddha*, from the hamlet of Toluwila, which adjoins the Nuwarawewa bund at the spot where the statue was found.

and depth of the features, the softness of expression, the symmetry and repose of the body give the image a *tout ensemble* which contrasts markedly with the stolid 'figure-head' appearance so characteristic of these Buddhas in stone."

In front of the Buddha there is a large moonstone of unique and admirable design, embossed with wreaths, festoons, and garlands, a pair of fabulous creatures (makaras) at the sides, and a pair of two-fold representations of the *Sri-patula* or sacred footprints near the base. This is called the **Floral Moonstone** of Hanguranketa, and was presented to the Museum in 1894 by Lady De Soysa.

The representations of the footprint of Buddha, called *Sri-patula*, or *Sri-pada*, of which there are several in this shed carved in stone, are of considerable interest. The best of them is that which is known as the Koddaikeni Stone, a double Sri-pada (like the rest) covered with symbols. The signs on the toes are called *swastika*, the radiant emblem in the centre is the *dharma-chakra*, in front of which are a couple of flags, at the side a fish-hook behind a flower vase, a conch shell, a fan, a pair of fishes representing Pisces, one of the signs of the zodiac ; a complicated cryptic emblem occupies the centre of the heel, and on one side of this opposite to the fishes are the trisul emblems. The exact interpretation of the symbolism of this stone has not yet been attempted.*

Another curious relic is the limestone image representing a man standing in the jaws of a monster, sent by Mr. C. A. Murray from Tissamaharama in 1892. The moonstone and carved steps, with janitors and terminals, which have been arranged at the entrance to the shed, arrived here from Anuradhapura in the years 1882 and 1884.†

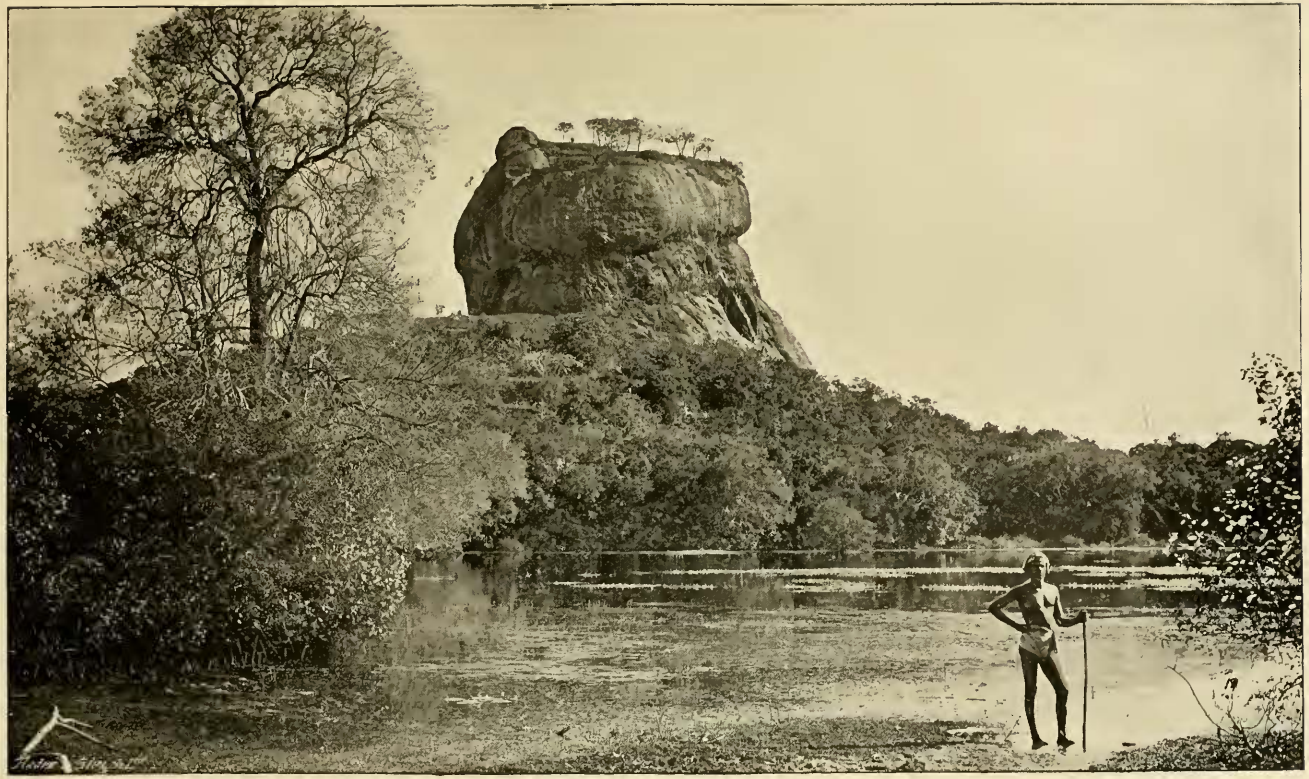
The stone discs placed round the convex side of the large Hanguranketa moonstone are described as **mural ornaments** from Anuradhapura.

SIGIRIYA FRESCOES.

On the walls flanking the main staircase will be found copies of the celebrated frescoes discovered in a cave or pocket of the ancient rock fortress of Sigiriya near Dambulla. Sigiriya, the lion rock, rises abruptly from the plains of the North-Central Province to a height of about four hundred feet, with an area of little more than an acre at the summit. It is said to have been fortified by the Sinhalese parricide King Kasyapa, who ascended the throne 475 A.D. and fled to the rock after having immured his

* *Cf.* Memorandum by Messrs. J. P. Lewis and G. M. Fowler, with plate, in Journ. Ceylon R. Asiat. Soc., vol. XI., 1889-1890, Proceedings, pp. lxii, lxiii.

† *Cf.* Administration Reports of the Museum for 1882 (p. 110 D) and 1884 (p. 18 D).



ANCIENT FORTRESS ROCK OF SIGIRIYA.

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father King Dhatu Sen, whose capital was Anuradhapura. Kasyapa made Sigiriya his capital, and took refuge there for eighteen years.

On the western face of the rock chambers have been scooped out, and in one of these, 160 feet from the ground, protected from sun and rain, ancient frescoes were painted upon stucco plastered upon the smooth surface, and still remain in an excellent state of preservation. The ancient approaches to the summit and to the chambers having fallen into decay, the rock once more became nearly inaccessible and, according to local tradition, the haunt of "yakku" or demons. It was however tackled by more than one adventurous climber during the latter half of last century, and in June, 1889, Mr. Alex. Murray of the Public Works Department succeeded in reaching the pocket containing the frescoes

and in making the tracings of them, which he coloured as nearly as possible like the originals. He has left it upon record that the work of copying took him from sunrise to sunset every day for a week lying at full length on his back. A Buddhist priest who visited the chamber gave it as his opinion that the pictures must be the portraits of some of King Kasyapa's queens. The portraits are arranged singly and in couples, the latter representing a maid offering the sacred lotus on a tray to her mistress.

During the last ten years excavations have been carried on at Sigiriya under the direction of the Archæological Commissioner, and fresh copies of the frescoes have been made under his supervision in oil colours, but these have not yet been exhibited in the Museum.

PART II.

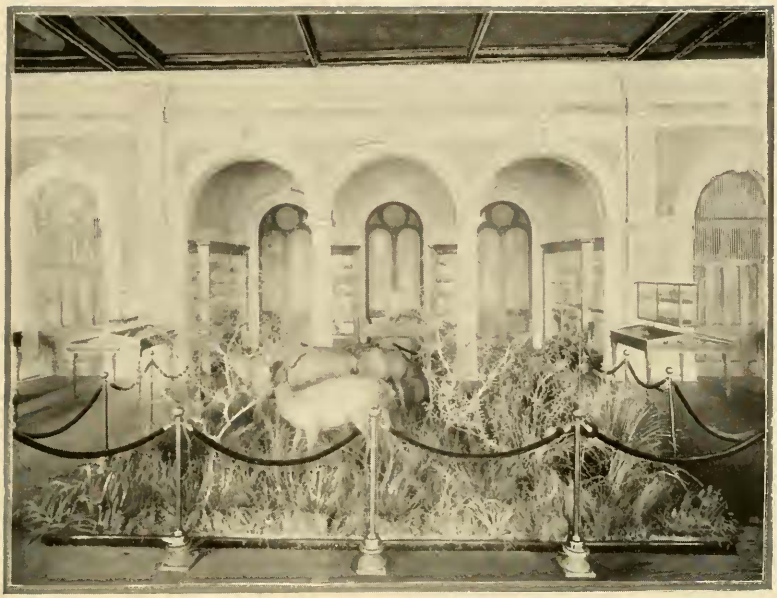
ZOOLOGICAL COLLECTIONS.

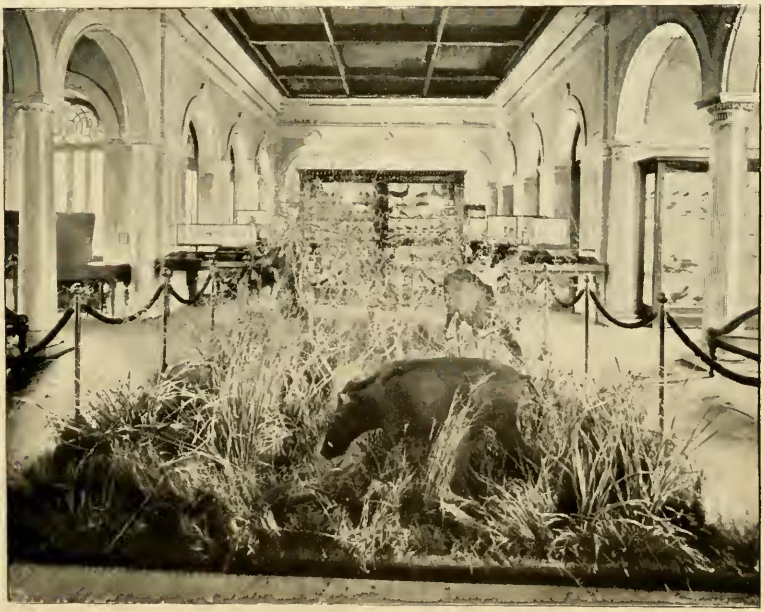
In the grounds at the back of the Museum a few live animals indigenous in Ceylon are placed on exhibition in temporary shelters. The mammals include a leopard, bears, a tiger cat (*Felis viverrina*), a jackal, palm or toddy cats, civet cats, porcupines, a bandicoot rat, mouse deer, hog deer, &c. The birds are represented by a pelican ibis presented by Her Excellency Lady Blake, a pelican, purple herons, Malay bitterns, India koels, Brahminy kites, scops owl, and an Alexandrine paroquet. A young rufous-bellied hawk-eagle has been loaned by His Excellency the Governor (Sir Henry Blake, G.C.M.G., F.Z.S.). A small tank contains some monitors or water lizards, called "kabaragoya" in Sinhalese, and in a small cage there is a chameleon from Chilaw.

On the other side of the block of buildings in which the Mineral Gallery is situated (see plan) there are two sheds containing respectively, the skeleton of a sperm whale or cachalot (*Physeter macrocephalus*) and of the whalebone whale (*Balænoptera indica*). The carcases of whales are stranded from time to time on the shores of Ceylon. Some of them seem to have met their death at the hands of whalers and to have drifted by gale and current to Ceylon. A whalebone whale was washed ashore in Weligam Bay in August, 1884, such bones as were recovered being placed on the front verandah of the Natural History Gallery upstairs; another carcase drifted ashore at Ambalangoda in September, 1894; the almost complete skeleton was brought to the Museum, and is the one now lying in the large cadjan shed; it measured 65 feet in length. This species of whales has the distinction of being the largest of all known animals, living or extinct.

A spermaceti whale or cachalot stranded on the south coast of Mannar in September, 1889; its remains are now exhibited in the smaller shed, with the exception of the lower jaw, which dropped into the sea while the work of salvage was proceeding and was lost. Another carcase arrived at Athuruwila near Bentota in June, 1904, in a high state of decomposition; the lower jaw, which alone carries the functional teeth, was missing. In November, 1904, another decomposed sperm whale minus the lower jaw was stranded at Mount Lavinia. The teeth of the upper jaw of the sperm whale are vestigial structures imbedded in the gum.

At the foot of the main staircase leading to the upper floor of the Museum there may be seen a small glass case containing





GROUP OF SAMBUR (*Cervus unicolor*) AND WILD BOAR (*Sus cristatus*).

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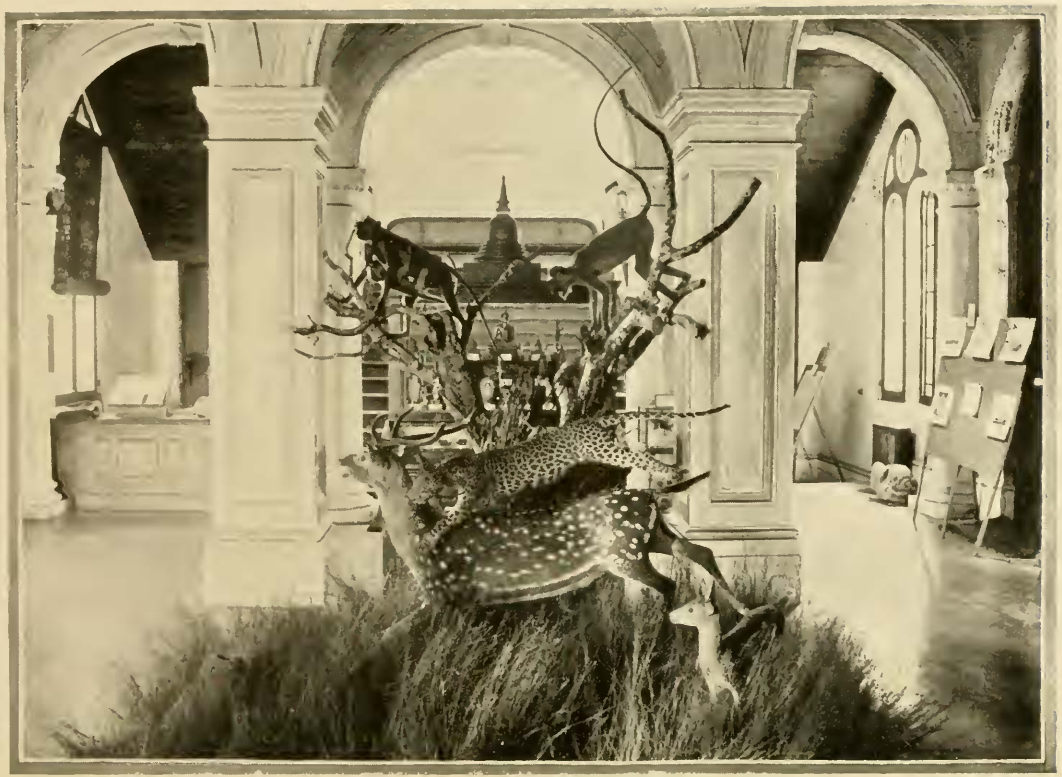

SPOTTED DEER (*Cervus axis*). LEOPARD (*Felis pardus*). AND MONKEYS (*Semnopithecus priamus*).

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living insects, **leaf insects** of the genus *Phyllium*, remarkable for their general resemblance to the leaves of the guava, on which they are fed. The males are smaller than the females, less numerous, and carry two long feelers or antennæ, held backwards, nearly as long as the body. The females lay their eggs, which resemble seeds, freely, and the young hatch out without difficulty.

The Natural History Collection comprises representatives of the fishes, amphibia, reptiles, birds, mammals, insects, crustacea, and mollusca occurring within the zoological province of Ceylon.

The centre of the gallery is occupied by a **jungle scene** containing sambur deer, commonly known as elk, a wild boar, a crocodile, peacock, and several smaller birds. Most of the specimens were obtained from the Hambantota District in the Southern Province, where all of the species are to be found.

Opposite to this group, over the head of the staircase, is a group of spotted deer, leopard, and monkeys, the material for which was also obtained from the same locality. The monkeys on the tree overhead belong to the common low-country species of the Maritime Provinces, *Semnopithecus priamus*.

BIRDS.

The birds of Ceylon comprise large numbers of **migratory species**, which visit the Island during the north-east monsoon, but do not breed here ; the chief bird of this kind is the Flamingo. Then there are numerous **resident species**, which are indigenous to Ceylon, but occur also in the Indian Peninsula and elsewhere ; the chief bird of this kind is the Peafowl. There are no fewer than forty-nine **endemic species**, which are peculiar to Ceylon, not being found beyond the confines of the Island; the chief bird of this kind is the Ceylon Jungle-fowl. Lastly, there are a few **occasional visitors**, which do not come regularly, putting ashore here through stress of weather ; the chief bird of this kind is the Frigate-bird.

BIRD CASE I.

Turning to the left (east) from the staircase the first bird case, beginning from the top shelf in front, contains representatives of the Frogmouths (Podargidæ); the Trogons (Trogonidæ); the Cuckoos, Koels, Malkohas, and Coucals (Cuculidæ); Paroquets and Loriquets (Psittacidæ); Owls (Strigidæ). The Ceylonese Frogmouth (*Batrachostomus moniliger*), which also occurs in Travancore, is a remarkable bird on account of the oddness of its gape, curiously resembling the mouth of a frog. Of the cuckoos, the genus *Surniculus*, represented by the species *S. lugubris*, the Drongo Cuckoo, is remarkable for its extraordinary resemblance to a Drongo or King Crow (*Dicrurus*). It is said to lay its eggs

in the nests of King Crows, and the latter have been actually observed in the act of feeding a young *Surniculus*.* This therefore appears to be an example of natural mimicry.

The Red-faced Malkoha (*Phœnicophaës pyrrhocephalus*) is peculiar to Ceylon,† as is also the Ceylonese Coucal (*Centropus chlororhynchus*). Both of these species inhabit dense and damp forests. The Common Coucal or Crow-pheasant (*Centropus sinensis*) is known locally as the Jungle Crow. It is a familiar bird in the low-country jungles and in the vicinity of villages, its chestnut-coloured wings offering a handsome contrast to the glossy black body. It is a ground-feeding bird, eating insects, lizards, and small snakes.

The Indian Koel (*Eudynamis honorata*) is another familiar Indo-Ceylonese bird. In the breeding season, from March till July, its cry of *ku-il ku-il*, increasing in intensity and ascending in the scale, is to be heard in almost every grove [Blanford, *l.c.*, p. 229]. In Ceylon it is known to Europeans as the Brain-fever bird, on account of the persistency of its cry. It feeds on fruit, and, like the cuckoos, is parasitic in its nesting habits, laying its eggs in May and June in the nests of crows, generally the Indian or Gray Crow (*Corvus splendens*), less frequently in those of the Black Crow (*Corvus macrorhynchus*). The crows bring up the koels, which at times eject the young crows from the nest after they have been hatched [Blanford]. The male is black throughout; the female is spotted with white.

The principal parrot of Ceylon is sometimes called the Alexandrine Paroquet (*Palæornis eupatria*), coloured green, with (in the male) a broad rose-pink collar round the nape. The little Ceylonese Loriquet (*Loriculus indicus*) is peculiar to Ceylon. The parrot which is commonly used as a cage bird by the natives of Ceylon is the Rose-ringed Paroquet (*Palæornis torquatus*).

Of the owls which are shown in the bottom shelf, the Ceylon Bay Owl (*Photodilus assimilis*), peculiar to Ceylon, is to be noted on account of its rarity, being found only in the hills round Kandy. The Demon bird, or "Ulamá" of Ceylon, so-called on account of its dreadful moaning hoot, is commonly identified with *Huhua nepalensis* (= *Bubo nipalensis*) and also with *Syrnium indrani*.

In the other half of this case, commencing at the top, are shown the Barbets (Capitonidæ), of which the Yellow-fronted Barbet (*Cyanops flavifrons*) and the pretty little Ceylon Barbet (*Xantholæma rubricapilla*) are peculiar to the Island; Indian Rollers

* Blanford, W. T. Birds of India, 1895, vol. III., p. 224.

† The distribution of the different species of birds is indicated in red upon the small maps placed below the specimens.

(Coraciadæ) ;* Bee-eaters (Meropidæ) ; Kingfishers (Alcedinidæ) ; Hornbills† (Bucerotidæ), two species, one of which (*Lophoceros gingalensis*) is peculiar ; Hoopoes (Upupidæ) ; Swifts (Cypselidæ), one of which, the Edible-nest Swiftlet (*Collocalia fuciphaga*), builds the well-known edible nests in caves, small cups made of grass, moss, and feathers cemented together by inspissated saliva [Blanford, *l.c.*, p. 177] ; Nightjars (Caprimulgidæ), which lay their eggs on the ground without any nest.

BIRD CASE II.

The second case alongside the first contains some of the Doves and Pigeons (Columbidæ), including *Turtur risorius*, the Ring-dove, and *Columba intermedia*, the Indian Rock Pigeon, from which all the breeds of domestic pigeons peculiar to India are derived. The Galline or true game birds of Ceylon belong to the Pheasant family (Phasianidæ). First in order and importance comes the Peafowl, referred to and exhibited elsewhere ; then the endemic Ceylon Jungle-fowl (*Gallus lafayetti*), characterized by its peculiar call and by the yellow patch in the centre of the comb of the male ; the endemic Ceylon Spur-fowl (*Galloperdix bicalcarata*), which only occurs in the southern half of the Island ; finally the Quails and Partridges. The Gray Partridge (*Francolinus pondicerianus*) is common in India, but is only found in the northern half of Ceylon and in the small islands (Delft, Iranativu, &c.) off the Jaffna Peninsula. The Painted Partridge (*F. pictus*), unrepresented in the Museum collection, is another Indo-Ceylonese bird localized in Ceylon to the highlands or patanas between Nuwara Eliya and Badulla.

The Three-toed Quails, represented here by two female Bustard Quails (*Turnix pugnax*), belong to a separate order, Hemipodii, and family, Turnicidæ. The females are larger and more highly coloured than the males, and "the ordinary conduct of the sexes during the period of incubation is reversed, for the male alone sits on the eggs and tends the young brood, whilst the females wander about, uttering a purring call that serves as a challenge, and fight each other" [Blanford, Faun. Ind. Birds, vol. IV., p. 150].

Of the Rails, Crakes, Moorhens, and Watercocks (Rallidæ), Baillon's Crake (*Porzana pusilla*) is to be noted for its rarity in Ceylon ; the Moorhen (*Gallinula chloropus*) ranges from Great

* The Indian Roller (*Coracias indica*) is common at Jaffna, Anuradhapura, &c., and is known to Europeans as the Low-country Jay, but it is a Picarian bird related to the Bee-eaters and Kingfishers, not a Passerine bird of the Crow family. It is fond of perching on telegraph wires.

† The Hornbills of the Ethiopian, Oriental, and Papuan regions are the representatives of the Toucans (Rhamphastidæ) of South America, and are sometimes popularly confounded with the latter.

Britain through Europe, Asia, and Africa, and occurs in the tanks of Ceylon, though rare; finally, the Purple Moorhen (*Porphyrio poliocephalus*) is a handsome Indo-Ceylonese bird common in parts of the low-country.

The bottom shelf in front commences the series of Limicoline birds, Plovers and Snipes and their allies. The Stone Curlew (*Œdicnemus scolopax*) is a north-east migrant to Ceylon, the Great Stone Plover (*Esacus recurvirostris*) is a resident shore bird; both belong to one family, the Œdicnemidæ. The Crab Plover (*Dromas ardeola*), another shore bird, which also breeds in Ceylon, is the sole type of the family Dromadidæ.

In the reverse half of this case, commencing from the top, will be found Courier Plovers and Swallow Plovers, shore birds of the family Glareolidæ; Water Pheasants (*Hydrophasianus chirurgus*), Parridæ, a common low-country bird: the Turnstone, Lapwings, Plovers, Oyster-catcher, Stilt,* Avocet,† Curlew, Whimbrel, Sandpipers,‡ and Stints, all shore birds and waders belonging to the family Charadriidæ; Woodcock (*Scolopax rusticula*), a rare migrant, and Snipes (Scolopacidæ), of which the best known are the Pintail Snipe (*Gallinago stenura*), a north-east migrant common from September to April, and the Painted Snipe (*Rostratula capensis*), a resident of the low country, widely distributed in South Asia and Africa.

Many of the shore birds, like the sea birds, gulls, and terns, have a very wide distribution. The circum-littoral range of the Turnstone (*Strepsilas interpres*) throughout both hemispheres is remarkable. The Oyster-catcher (*Hæmatopus ostralegus*) is confined to the Old World. The range of the Gray Plover (*Squatarola helvetica*) is world-wide; it breeds in the far north and is a winter visitor to India, Ceylon, and Burma [Blanford].

BIRD CASES III. AND IV.

The next couple of bird cases contain the one a group of Accipitrine birds,§ Eagles, Hawks, Falcons, and Kestrels; the other a group of Peafowl (*Pavo cristatus*). This latter is the principal game bird of Ceylon, and in fact the most stately bird in the Island. A frequent ornament in parks and gardens in Europe, it lives here in its native haunts. It feeds and nests upon the ground, but roosts in the topmost branches of trees, whence it

* Shown in another case (see below).

† An occasional migrant, not in the Museum collection.

‡ The Sandpipers are well known locally by the colloquial Sinhalese name "siri-biri"; they are also sometimes called Snippets, because they somewhat resemble Snipes in their habits.

§ Other Accipitrine birds, Harriers and Falcons, are shown in another case (see below).

PEAFOWL.

[*To face page* 32.

surveys the country round and is consequently difficult to approach. A male in perfect plumage is shown perched upon a tree ; a dun-coloured female and a partridge-like young are placed on the floor of the case.

BIRD CASE V.

Passing now towards the other side of the gallery the remaining bird cases may be inspected, commencing with the case next to the stairs facing the Sambur and Boar Group. Here are some of the Passerine birds. The order Passeres comprises about one-third of the entire avian fauna of Ceylon. The front half of this case contains Orioles (Oriolidæ), represented by the brilliant yellow-bodied black-headed *Oriolus melanocephalus ;* Mynas and Starlings (Sturnidæ), of which three are peculiar, namely, the Ceylon Myna, known to ornithologists as the Ceylon Grackle* (*Eulabes ptilogenys*), the common Ceylonese Myna (*Acridotheres melanosternus*), which is used extensively as a cage bird by the boutique-keepers and other residents, and the White-headed Myna or Starling (*Sturnornis senex*), an inhabitant of the mountain forests of Ceylon ; Thrushes and Black-birds (Turdidæ), of which the Ceylon Black-bird (*Merula kinnisi*), a resident of the forests above 2,500 feet, the Buff-breasted Ceylon Thrush (*Oreocincla imbricata*), and the Spotted Thrush (*Oreocincla spiloptera*) are peculiar ; Flycatchers (Muscicapidæ), of which the Ceylonese Blue Flycatcher (*Stoparola sordida*) is endemic, while the Paradise Flycatcher (*Terpsiphone paradisi*), locally known as the Ceylon Bird of Paradise, is an exquisite and highly characteristic Indo-Ceylonese resident. The Paradise Flycatcher is not uncommon, though it is rarely seen about Colombo. The male bird undergoes remarkable changes of plumage, which are illustrated by the specimens exhibited.

After the autumn moult of the second year the male has the whole head and crest glossy black [throat brown, breast ashy, belly white], and the whole upper plumage rich chestnut; the median tail feathers grow to a great length, and are retained till May or June, when they are cast. After the autumn moult of the third year the chestnut plumage is again assumed, and also the long median tail feathers, but the whole lower plumage from the throat downwards is pure white, the breast being sharply demarcated from the black throat. After this moult a gradual transition to the white upper plumage takes place, the wings and tail being the first parts to be affected, but the change to a complete white plumage is not affected till the moult of the fourth autumn. After this moult the male bird is fully adult, and permanently retains the white plumage ; the head, neck, and crest are glossy bluish black ; the whole body plumage white.†

* This species is placed by Mr. E. W. Oates (Fauna Brit. Ind., Birds. vol. I., p. 513) in a separate family, the Eulabetidæ.

† Oates, E. W. Fauna Brit. Ind., Birds, vol. II., 1890, p. 46.

Just as the Indo-Ceylonese Peafowl is replaced in Burma by a distinct species (*Pavo muticus*) which ranges southwards to Java, so the Paradise Flycatcher of India and Ceylon is represented in Burma by an allied species (*Terpsiphone affinis*).

The robins are closely related to the flycatchers on the one hand and to the thrushes on the other. The Black Robin (*Thamnobia fulicata*) and the Magpie Robin (*Copsychus saularis*) are, next to the crows, the sparrows, and the babblers, the commonest birds in Colombo and throughout the Island: the Long-tailed Robin, known to ornithologists by its Hindustani name "Shama," is a shy jungle-bird.

In the reverse half of the case are shown Weaver birds and Munia Finches (Ploceidæ), the Hill Munia (*Uroloncha kelaarti*) being peculiar; Sparrows (Fringillidæ), the House Sparrow (*Passer domesticus*) ranging from Great Britain to South Asia; Swallows (Hirundinidæ); Wagtails and Pipits (Motacillidæ): the Gray-headed Wagtail (*Motacilla borealis*) ranges all over Europe, Asia, and North Africa, and may be seen on the Galle Face Parade during the north-east season from September to May; Larks (Alaudidæ); Sun birds* (Nectariniidæ) and Flower-peckers (Dicæidæ), the former with long bills, the latter with short bills, both families being distinguished from all other Passerine birds by the serration of both mandibles of the beak; the Indian Pitta or Ground Thrush (Pittidæ), a characteristic north-east migrant. Finally, the bottom shelf of the case contains the Woodpeckers† (Picidæ), a very distinct family of birds well represented in Ceylon. The type skins of Legge's Woodpecker (*Brachypternus intermedius*) were presented by Sir W. H. Gregory. This variety is believed to be a hybrid between the Golden-backed Woodpecker (*B. aurantius*), and the common Red-backed Woodpecker (*B. erythronotus*), which is peculiar to Ceylon. Layard's Woodpecker (*Chrysocolaptes stricklandi*) is also confined to Ceylon.

BIRD CASE VI.

The case adjoining the one just described, commencing from the top of the reverse side, contains more Passerine birds, namely, the Crows, Jays, and Titmice (Corvidæ), the Ceylonese Jay (*Cissa ornata*), coloured chestnut and blue, being endemic. This bird is sometimes known as the Ceylon Magpie. It is a forest bird of shy habits, feeding a good deal on the ground [Oates].

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* The Sun birds are the representatives in the Old World of the Humming birds of the New World, and like the latter can poise themselves on the wing while extracting nectar from flowers. They are frequently seen in Colombo feeding upon the *Hibiscus* flowers.

† The Woodpeckers are Picarian birds, not Passerine.

The Babblers (Crateropodidæ) of Ceylon are remarkable for the large number of endemic species, namely, the Ceylonese Rufous Babbler (*Crateropus rufescens*), the Ashy-headed Babbler (*C. cinereifrons*), the Ceylonese Scimitar Babbler (*Pomatorhinus melanurus*), the Ceylon Yellow-eyed, black-billed Babbler (*Pyctorhis nasalis*), the Brown-capped or Quaker Babbler (*Pellorneum fuscicapillum*) occurring between 5,000 and 6,000 feet elevation, the Ceylon Black-fronted Wren Babbler (*Rhopocichla nigrifrons*), the Ceylon Arrenga or Whistling Thrush (*Arrenga blighi*), rare at 4,000 feet, the Ceylon Shortwing or Ant Thrush (*Elaphrornis palliseri*), and the Ceylon White-eye (*Zosterops ceylonensis*) occurring above 1,500 feet.

The Bulbuls also belong to the Crateropodidæ, of which they form a sub-family, Brachypodinæ. They are shown at the bottom and continued on the top shelf of the front side of the case. The Yellow-eared Bulbul (*Kelaartia penicillata*) is endemic.

Next follow the Drongos or King Crows (Dicruridæ), so called because of their remarkable habit of persecuting the crows, which are double their size. They pursue and chivvy the crows on the wing with no other apparent object than pure love of mischief: they also frequently perch upon the backs of cattle. The species which is especially tyrannical with regard to the crows is the Black Drongo (*Dicrurus ater*). Another exhibited species (*D. leucopygialis*) is confined to Ceylon, while the Racket-tailed Drongo (*Dissemurus paradiseus*) is distinguished by the great elongation of the lateral tail feathers with their spatulate tips.

The Warblers (Sylviidæ) represent another extensive family of small birds, the most remarkable of those which occur in Ceylon being the Indian Tailor bird (*Orthotomus sutorius*), a nest of which with the leaf-edges sewn together is exhibited.

Lastly, the Shrikes and Minivets (Laniidæ) complete the display in this case. The Orange Minivet (*Pericrocotus flammeus*) bears a strong resemblance to the oriole in the general colour-pattern of the plumage.

BIRD CASES VII. AND VIII.

These cases contain groups of birds arranged according to habits and distribution, but without reference to their position in classification. One of them consists of a selection of birds from the Vanni District of the Northern Province, that portion of the Province which stretches between the settlements of Mullaittivu and Vavuniya. The other is a group of Waders and Divers, comprising Flamingoes, Stilts, Herons, Darter, &c.* The Flamingo

* The Cormorants (exhibited in the adjoining case and also in Bird Case XII., see below) of the genus *Phalacrocorax* are allied to the Darters, and form with the latter the family Phalacrocoracidæ, diving and fishing birds.

(*Phœnicopterus roseus*) is a north-east migrant to Ceylon frequenting the salt lakes of the Hambantota and Mullaittivu Districts. It is essentially gregarious, living and breeding in large colonies. The movements of a flock are remarkably concerted, and at the least alarm they rise with one consent like a pink cloud across the horizon. The three specimens exhibited are females in different stages of plumage.

The Darter (*Plotus melanogaster*) is sometimes called the Snake bird, on account of its long serpentine neck, which is persistently kinked. The method of feeding was described by Mr. W. A. Forbes as follows* :—"The darters feed entirely under water. Swimming with its wings half-expanded, though locomotion is effected entirely by the feet, the bird pursues its prey with a peculiar darting or jerky action of the head and neck, which may be compared to that of a man poising a spear or harpoon before throwing it. Arrived within striking distance the darter suddenly transfixes the fish on the tip of its beak with marvellous dexterity, and then immediately comes to the surface, where the fish is shaken off the beak, thrown upwards, and swallowed, usually head first." When swimming at the surface the body is submerged, only the head and neck projecting above the water. The darters are common about the tanks of Ceylon. When resting on a tree the wings are held expanded as shown. The stomach of this bird is provided with a dense hairy plug or sieve guarding the entrance to the small intestine.

BIRD CASES IX. - XII.

The remaining birds which are placed on exhibition are shown in the recess facing the Sambur and Boar Group. In Case IX. are the birds of largest bulk occurring in the Island, gigantesque Storks and Herons, Spoonbills, and Pelican Ibis or Painted Stork. Case X. contains Harriers (Falconidæ) and Bitterns (Ardeidæ, the Heron family). The Malay Bittern (*Gorsachius melanolophus*) is a north-east migrant to Ceylon, arriving towards the end of October and beginning of November, and fugitive specimens are frequently captured about this time in Colombo, sometimes landing in the streets of the Fort and in the ball-room of Queen's House.

Case XI. contains Gannets or Boobies (Sulidæ), oceanic birds sometimes taken here, and Ibis (Ibididæ), tank birds. Finally, Case XII. contains Ducks and Teals (Anatidæ), Terns and Gulls (Laridæ), Frigate birds (Fregatidæ), Cormorants and Darters (Phalacrocoracidæ), Pelicans (Pelecanidæ).

* W. A. Forbes. On some points on the Anatomy of the Indian Darter (*Plotus melanogaster*) and on the Mechanism of the Neck in the Darters (*Plotus*), in connection with their habits. P. Zool. Soc., London, 1882, pp. 208-212.

FLAMINGOES AND OTHER WADERS.

[*To face page* 36.

MAMMALS.

Besides the mammals living in the grounds and those which have been mentioned above in connection with the groups in the centre of the gallery, further examples are shown in the western alcove. Several of the eighty species of mammals recorded from Ceylon possess insular characteristics ; even such a large creature as the sambur is said to differ in some respects from its Indian co-type, but there is nothing like the same degree of endemicity among the mammals as has been remarked for the birds. As distinctive Ceylonese mammals may be mentioned the Golden Paradoxure or Palm Civet (*Paradoxurus aureus*) and the Ruddy Mungoose (*Herpestes smithi*), both of which are called by the same Sinhalese name " Hotambuwa."

There are two principal kinds of monkeys in Ceylon, called respectively in the native language "Rilawa" and "Wandura," referred to by Knox in the anglicized terms " Rillows" and " Wanderows." The former are the Macaques (*Macacus pileatus*), with cheek pouches ; the latter are the Langurs, comprising several species of the genus *Semnopithecus*, monkeys destitute of cheek pouches. Troops of " Rillows" and " Wanderows" may sometimes be seen on the same tree, but as a rule they keep to themselves.

There are three distinct species of "Wanderows" in Ceylon. The commonest is the Madras Langur or Crested Monkey (*Semnopithecus priamus*), which frequents the low-lying forests of the dry maritime districts of the North, East, and South. In addition to the crest of hair on the head this monkey is further distinguished by the fringe of long black hairs of the eyebrows, known as the supra-orbital fringe.

The Purple-faced Monkey (*S. cephalopterus*) is without the crest and fringe ; it inhabits the damp forests of the West at low and moderate elevations up to about 1,000 feet.

Finally, the Bear Monkey (*S. ursinus*), described as endemic, is the monkey of the mountains, occurring in the country round Nuwara Eliya. It is closely related to *S. cephalopterus*,* of which it may be a hill variety, and from which it is distinguished by its longer and denser fur.

The remarkable Prosimian family of the Lemurs, whose headquarters are in Madagascar, is represented in Ceylon by a single species, *Loris gracilis*, a small tailless, large-eyed, nocturnal, arboreal creature of retiring habits, sometimes called the Ceylon Sloth. It is omnivorous, feeding upon young leaves, insects,

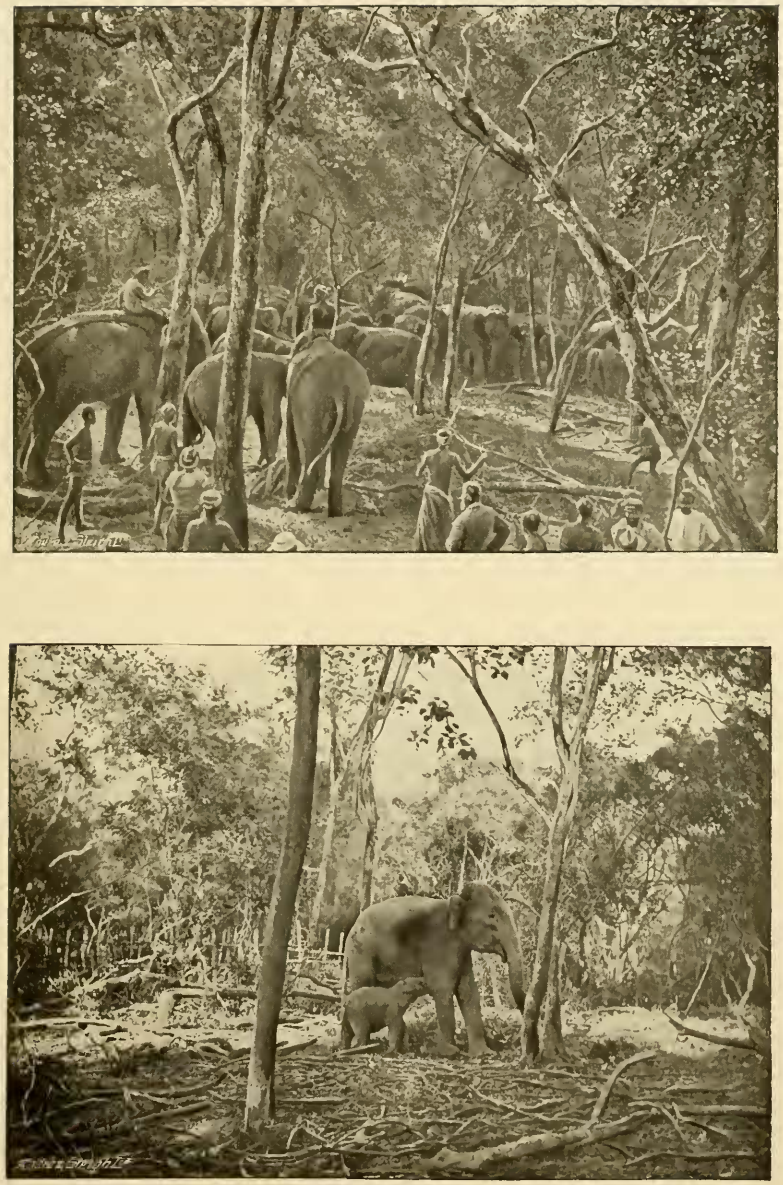
* A young live Bear Monkey presented by J. Spearman Armstrong, Esq., from Kotagala, and a Purple-faced Monkey from Horana, are exhibited in the grounds at the back of the Museum.

spiders, birds' eggs, birds, and lizards. It will also eat plantains and boiled rice, and will drink milk, but is not easy to keep alive in captivity unless taken young and reared with great care.

The skeleton of an elephant shot by H. W. Varian, Esq., said to be the largest recorded from Ceylon, is remarkable for the small size of the tusks, which are reduced to mere tushes. The skull of a large tusker is, however, shown below. Tuskers are rare in Ceylon, and are believed to be the descendants of imported Indian elephants. Another elephant skull in section is lying on the floor next to the skeleton of the sambur. There are also skeletons of the wild buffalo, wild boar, and the bear. Of the other stuffed animals, a pair of large leopards, the bear, the otter, and the pangolin may be noted specially. The Indian Pangolin or Scaly Ant-eater (*Manis pentadactyla*) is one of the most curious mammals found in Ceylon. It is a nocturnal burrowing animal not often seen; its jaws are destitute of teeth (Edentata), and its tongue is exceedingly long and vermiform, adapted for penetrating into the burrows of termites or white ants, upon which it feeds. Its scales are sometimes employed for making imitation tortoise-shell combs. One such comb, presented by H. J. V. Ekanayake. Esq., of Balapitiya, is exhibited. The Indian Pangolin is represented in Burma by an allied species *M. javanica*, which ranges through the Malay Peninsula, Sumatra, Java, Borneo, and Celebes. There is also a Chinese Pangolin (*M. aurita*) in Nepal, Assam, Southern China, and Formosa. Several species of the same genus occur in Africa.

There are three sorts of flying mammals in Ceylon, namely, the Fruit Bats or Flying Foxes (Pteropodidæ), the small Insectivorous Bats (Microchiroptera), and the Flying Squirrel, *Pteromys oral* (Rodentia Sciuridæ). The Insectivorous Bats comprise the Leaf-nosed Bats (Rhinolophidæ); the Vampire Bats (Nycteridæ), which feed upon frogs, rats, and smaller bats, as well as insects; the Pipistrelles (Vespertilionidæ); and the Sheath-tailed Bats (Emballonuridæ). The Flying Squirrel has approximately the same general distribution throughout India, Burma, and Ceylon as the Flying Fox (*Pteropus medius*), inhabits the same districts, and is also frugivorous and nocturnal. It is not however gregarious, and does not suspend itself head downwards, as do the fruit bats and other bats, but rests in the ordinary attitudes of arboreal mammals.

The aquatic mammalia (Whales, Dolphins, Porpoises, and Dugongs) are represented by an excellent set of dugongs, male. female, and young, and a skeleton. The female specimen exhibited is 10 ft. long: it was captured at Kayts near Jaffna. The Dugong



ELEPHANT KRAALING.

[*To face page* 38

(*Halicore dugong*) is a gentle creature feeding on seaweeds ; it allows itself to be handled and killed without resistance. It occurs off the north-west coast of Ceylon near Jaffna and Mannar, and ranges from East Africa to Australia. Kelaart, one of the pioneer naturalists of Ceylon, says that he saw shoals of them on the coast of Arippu during the Ceylon pearl fisheries of 1835 and 1836, but they are now scarce. The order Sirenia, to which the dugong belongs, is represented in tropical America by the manatee. The tusks of the dugong are the two upper incisors, which, with two or three molars on each side of both jaws, are the only teeth found in adults.

On the top of the Dugong Case is the skeleton of a rare cetacean, *Pseudorca crassidens*, the Lincolnshire Killer, prepared from a specimen caught at Moratuwa in 1891, the first recorded from Indian seas. It is said to feed on cuttle fish, whereas the true grampus or killer attacks and kills the largest whales. The Lincolnshire Killer owes its common name to the circumstance that its skeleton was first discovered in a Lincolnshire fen.

Besides this skeleton there is a stuffed specimen of a dolphin caught at Negombo in 1883. Its identification is somewhat uncertain, but it appears to be closely similar to Elliot's Dolphin (*Steno perniger*).

The smaller mammals of Ceylon (apart from the bats and lemur) comprise many species of the Rodent order (Squirrels, Rats, Mice, Hares, and Porcupines). The little squirrel which is a familiar figure on the trunks and branches of trees in Colombo is called *Sciurus palmarum*. The larger tree-squirrel of the low-country jungles in dry districts is *Sciurus macrurus*, locally known as the Rock Squirrel or " Danduléna." The largest rat is the Bandicoot or Pig Rat (*Nesocia bandicota*), found in all parts of the Island from the sea-level to Nuwara Eliya. It exceeds a foot in length, exclusive of the tail. Next to this in size and interest comes the Gerbille or Antelope Rat (*Gerbillus indicus*), a field rat. The common House Rat and the Mouse have been introduced here as to all other parts of the world. The Musk Rat is more properly called the Musk Shrew (*Crocidura murina*) ; it is not a Rodent, but belongs to the family of Shrews (Soricidæ) in the order Insectivora. It is common in bungalows, outhouses, and compounds in Colombo, and often it appears in the roads at nightfall. It is pale gray in colour, utters a characteristic squeak, and has a long, tapering snout. Finally, the Black-naped Hare (*Lepus nigricollis*), the Chevrotain or Mouse Deer (*Tragulus meminna*), and the Muntjac or Rib-faced Barking Deer (*Cervulus muntjac*), commonly called the Red Deer, must be mentioned.

REPTILES AND AMPHIBIA.

The collection of reptiles and amphibia is contained under glass shades over the table cases. The largest reptiles are the Crocodiles, Monitors, and the Python. There are two species of crocodiles in Ceylon, the Tank Crocodile (*Crocodilus palustris*), with a comparatively short snout, and the River Crocodile (*C. porosus*), with a longer and narrower snout. The former is represented by the skull of a large specimen from the Minneri tank,* the latter by a young stuffed specimen in the Sambur and Boar Group. There are also two species of monitors, the large Water Lizard or "Kabaragoya" (*Varanus salvator*), of which a skeleton is exhibited in the gallery and some live specimens in the grounds; and secondly, the Land Monitor (*V. bengalensis*), a smaller species, which lays its eggs in the nests of termites.

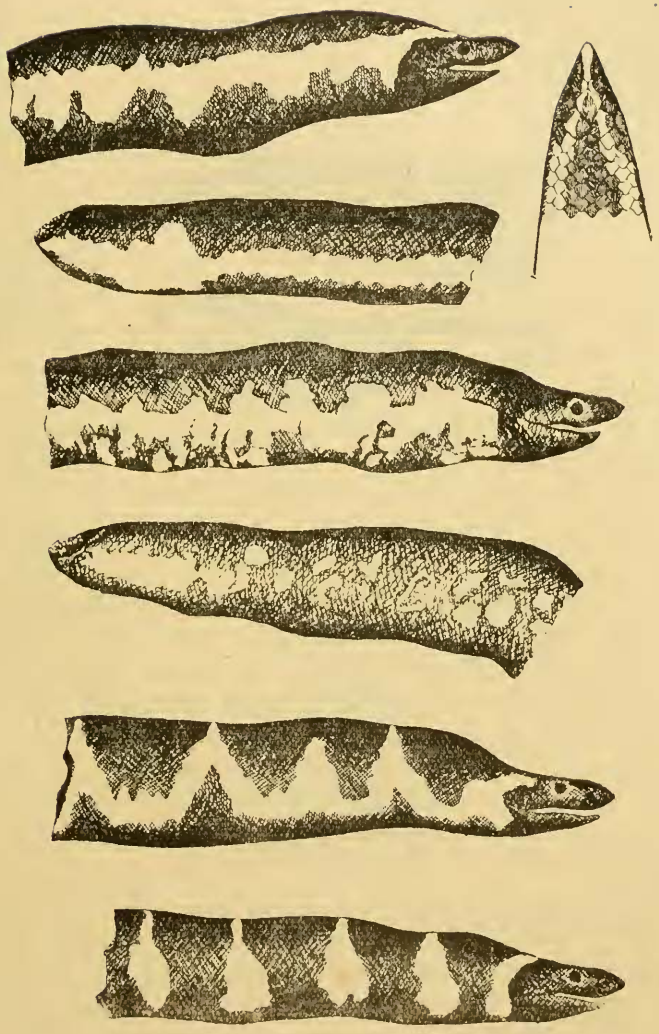
Some eighty-one species of snakes have been recorded from Ceylon, including twenty-six sea snakes (Hydrophidæ). The latter are all poisonous, but of the land snakes only six or seven are poisonous, the most deadly being the Cobra (*Naia tripudians*), the Tic Polonga or Russell's Viper (*Vipera russelli*), and the Bungarums or Kraits (*Bungarus ceylonicus* and *B. cæruleus*).† Examples of these are shown over the second table case to the left of the staircase. The Crotaline or Pit Vipers, so called on account of the existence of a deep pit of unknown significance on each side of the snout between the eyes and the nostrils, are not fatal to man. They are represented in Ceylon by the "Karawala" (*Ancistrodon hypnale*) and the Green Polonga (*Trimeresurus trigonocephalus*).

There is a very common non-poisonous snake which mimics the dreaded *Bungarus ceylonicus* in its scheme of coloration, namely, white transverse bands upon a dark ground colour, and is sometimes mistaken for it when seen at a distance or when examined casually. This is *Lycodon aulicus*, a snake which is frequently found trespassing in bungalows in Colombo. The *Bungarus* occurs chiefly up-country in the country round Peradeniya, Dimbula, Balangoda, and elsewhere.

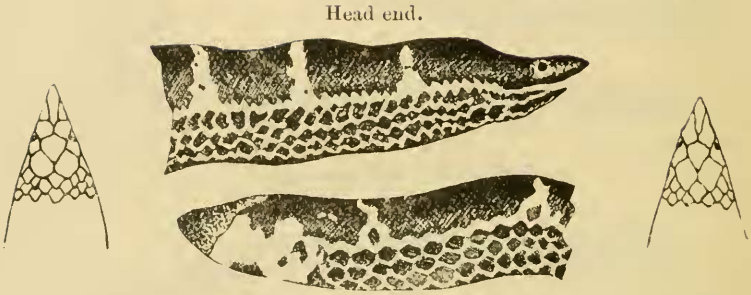
A large *Python molurus* is mounted in the east alcove; some Hydrophidæ are shown over the third case; the snakes on the fifth case include a large Green Polonga and a large Tic Polonga, somewhat faded; over the sixth case are the Whip snakes (*Dryophis*); the "Pol-mal Karawala" (*Chrysopelea ornata*), which when fresh shows bright red spots along the back, reputed poisonous, but in reality harmless and of gentle disposition; the fresh-water

* Placed on a bench in the east alcove.

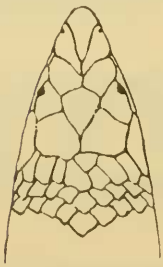
† *B. cæruleus* has only been recorded from Jaffna.



Colour variations of *Rhinophis blythii*.



Rhinophis trevelyanus.



Head-shields of *Uropeltis grandis.*

UROPELTIDÆ.

or estuarine snake (*Cerberus rhynchops*,) which, like another fresh-water snake, *Tropidonotus plumbicolor*, has a viperine look but is quite harmless; and a rare fresh-water snake, *Gerardia prevostiana*, from the Kelani river, caught twenty years ago. Over the seventh case will be found a large specimen of the common Rat-snake (*Zamenis mucosus*); another snake which attains a length of five feet and a wide girth is *Dipsas forstenii*, of which only a half-sized example is shown. This snake is represented in Ceylon by two varieties, the typical variety, brown with angular oblique black bars, and the red variety, uniformly rich reddish-chocolate above without black bars, paler roseate flush below; a fine example obtained from Nambapana in September, 1904, is shown. It is called locally the Lé-polonga (Blood-polonga), and is reputed poisonous.

On a bench in the fish-gallery or east alcove there are skeletons of the python, of a sea snake, *Distira stokesii*, from the Pearl Banks, presented by Captain Donnan, and of a monitor lizard.

The remaining smaller snakes and lizards are placed over table cases near the western end of the gallery. These are chiefly interesting on account of the relatively large number of endemic forms, species of lizards of the genera *Ceratophora*, *Lyriocephalus*, *Otocryptis*, *Cophotis*, and *Acontias* being peculiar to the Island; examples of these are shown over Table Case XVII. Endemic species of snakes belonging to the genera *Aspidura* and *Rhinophis*, as well as specimens of *Lycodon aulicus*, to which reference has been made above, are exhibited over Case XVIII. The snake *Cylindrophis maculatus* is also a peculiar species, and is the one to which the native name "Depat-naya" (two-headed snake) is specially applied, though the term is equally applicable to *Rhinophis* and allied snakes. The hinder end of the body of these snakes is truncated, and bears superficial resemblance to a head. The colour, yellowish on dark brown, varies considerably, especially in the case of *Rhinophis blythii* (see illustrations).

The **giant tortoise** from Aldabra, *Testudo elephantina*, shown on the far side of the Peacock Case, does not belong to Ceylon, but lived here for many years in the grounds of the villa called "Uplands" in Mutwal, near Colombo. It was found here at the time of the British occupation in 1796, and had become thoroughly acclimatized.* It died in March, 1894.

A striking display of large marine turtles caught off the coast of Ceylon is to be seen under the large platform in the eastern or

* The Hog-deer (*Cervus porcinus*), of which two living specimens are shown in the grounds, is another example of an acclimatized animal, introduced from India during the Dutch administration into the Kalutara District, where it now occurs.

fish alcove. The edible turtle, *Chelone mydas*, attaining a length of four feet, is herbivorous.* The loggerhead turtle, *Thalassochelys caretta*, is obtained by harpooning and netting by the natives of Iranativu and elsewhere off the coast; it is carnivorous, feeding on crustaceans and molluscs. The leathery turtle, *Dermochelys coriacea*, was presented by C. H. de Soysa, Esq.; it is not common. Finally, a specimen of the tortoise-shell turtle, *Chelone imbricata*, and a young edible turtle, are shown in small tanks on either side of the staircase.

Some of the Amphibians of Ceylon are shown over Table Case IV., next to the Eagle Group. The large bull-frog is *Rana tigrina*, the common toad *Bufo melanostictus*. The common frog of the Colombo lake is *Rana hexadactyla*. The tree-frog,† *Ixalus adspersus*, peculiar to Ceylon, has been found at Pattipola, 6,200 feet, and is one of the rarest frogs existing. The climbing frogs of the genus *Rhacophorus* attach their foam-like nests to the leaves of shrubs and trees overhanging water, into which the tadpoles drop when they hatch. The most singular batrachian occurring in the hills of Ceylon above 2,000 or 3,000 feet is the worm-like, legless "salamander,"‡ *Ichthyophis glutinosus*. It burrows in soft mud; the female lays eggs of large size, and coils round the clump of eggs until they are hatched. The larvæ are aquatic, and are provided with a respiratory orifice or *spiraculum* on each side of the neck. The development has been worked out by two Swiss naturalists, Drs. Fritz and Paul Sarasin.

FISHES.

A large series of sharks and bony fishes is shown in the eastern alcove of the gallery. The largest and rarest is the huge shark which rests upon the platform along the centre of the room. This is a specimen of the Basking Shark (*Rhinodon typicus*), 23 feet long, caught at Moratuwa in 1883. This species has also been obtained off the Seychelles and the Cape of Good Hope; it was first recorded from the west coast of Ceylon by Mr. Amyrald Haly, the former Director of the Colombo Museum. In spite of its bulk the specimen shown is not full-size, and it is a harmless shark. It is regarded as one of the gems of the entire collection.

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* *Chelonia virgata* is synonymous with *Chelone mydas* [Boulenger].

† The true tree-frogs of the family Hylidæ are not represented in Ceylon.

‡ The tailed batrachians (newts and salamanders) form the order Urodela, which is unrepresented in Ceylon; the tailless batrachians (frogs and toads) form the order Anura: the legless batrachians or the cæcilians belong to the order Apoda.

NEST OF CLIMBING FROG. (COLOMBO.)

(*Rhacophorus maculatus.*)

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Unfortunately the form of the mouth is lost in the mounted specimen; when fresh the width of the mouth was 3 feet, but shrunk to 1 ft. 11 in. in drying. "When fresh the lower jaw was quite straight and flat.....and considerably in advance of the upper, so that the band of teeth in the lower jaw was quite uncovered."

The teeth in both jaws consisted of eleven (in the upper) to fourteen (in the lower) rows of minute, sharp, recurved denticles, of equal size, 2 millimeters long.* Another specimen, 18 feet long, was taken at Negombo in March, 1889, and was presented to the British Museum by the Government of Ceylon. In the same year one was caught, 22 feet long, off Madras, and is now exhibited in the Madras Museum.

At the end of the platform three other stuffed sharks are lying on their sides; that to the right of the Rhinodon is a fine specimen of the Hammer-headed Shark (*Zygæna malleus*), characterized by the shape of the rostrum, which is drawn out sideways into two hammer-shaped lobes, at the ends of which are the eyes with the nostrils near to the eyes; that to the left of the Rhinodon is the Tiger Shark or Tope (*Galeocerdo rayneri*), distinguished by its formidable notched teeth. This shark is said to be exceedingly fierce and very cunning, swelling itself out so as to appear like a floating mass of animal substance, in order to decoy its prey. Behind the Rhinodon there lies another shark, 9 feet long, named *Ginglymostoma mülleri*, Günther. Below the front window, at the back of the Rhinodon, is another interesting shark, *Alopecias*, or *Alopias vulpes*, the Fox or Thresher Shark, which was rescued by Mr. Haly from the Colombo market in February, 1884.‡

Against the adjoining north window are two sharks of the saw-fish family; the larger specimen is an example of *Pristis cuspidatus*, the smaller is *Pristis perrotteti*. These differ from one another in the position of the first dorsal fin and in the armature of the rostrum, a considerable portion of the base of which is destitute of teeth in *P. cuspidatus*.

A few more sharks are preserved in spirits in the adjacent wall case. The skates and rays next invite attention. Over the wall cases beside the north window are two examples of a large Sting Ray (*Trygon uarnak*), and in the bottom shelf of the left wall case is a Thorny-backed Ray, said to be common in the Indian Ocean, called *Urogymnus asperrimus*. In a trough on the

* *Cf.* A. Haly. Occurrence of *Rhinodon typicus*, Smith, on the West Coast of Ceylon. Ann. Nat. Hist. (fifth series), vol. XII., 1883, pp. 48-49.

† *Cf.* Day, F. Faun. Brit. Ind., Fishes, vol. I., p. 33.

‡ *Cf.* Note by A. Haly in the "Taprobanian," 1886, vol. I., p. 167.

south-east verandah is a young specimen of the "Two-horned" Skate (*Dicerobatus eregoodoo*), exhibited with the lower side up displaying the gill-clefts with the gills showing through. In another trough on the opposite north-east verandah is another well-preserved Sting Ray of the species *Trygon sephen*, and near to this is a young Beaked Ray (*Aëtobatis narinari*). The skates and rays feed largely upon crabs and molluscs.

The fairly numerous specimens of Teleostean or bony fishes which are exhibited in the wall cases are somewhat remarkable on account of the well-preserved colour markings, which in many cases have retained their freshness after the lapse of several years, in a gum and glycerine mixture adopted by Mr. Haly. Against the window beside the Thresher Shark is a good example of the Swordfish (*Histiophorus gladius*). The large stuffed fish in the bottom shelf of the adjoining wall case is a Wrasse (Labridæ). The parrot wrasses, fishes of brilliant colours, feeding in the neighbourhood of coral reefs at Galle, for example, with parrot-like beak consisting of teeth soldered together, belong to the genus *Pseudoscarus* of the Wrasse family. The "Red Mullet" of the Colombo market is *Serranus sonnerati*, of the Perch family. The Seirfish, the staple fish food of Colombo, belongs to the Mackerel family (Scombridæ), and is named *Cybium guttatum*.*

The jumping fishes to be seen about the rocks at Mount Lavinia and Galle are blennies of the genus *Salarias;* and the mud-skippers of Negombo are gobies of the genus *Periophthalmus*.

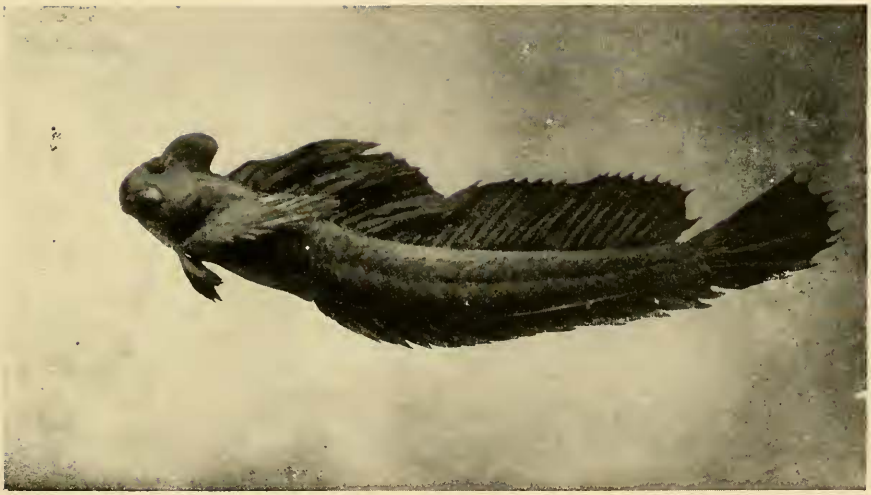
The principal fresh-water fishes of Ceylon are the Carps (Cyprinidæ), including the Indian game fish called the Mahseer (*Barbus tor*), the Ophiocephali, tank-fishes, the Labyrinthici or "climbing perches" (*Anabas scandens* and *Polyacanthus signatus*), and the Catfishes (Siluridæ). One genus of catfishes, *Arius*, called "anguluwa" in Sinhalese, occurring at Panadure, Kalutara, and elsewhere, has the remarkable peculiarity that the males carry the eggs, 15–20 in number, in their mouths until they are hatched.

INSECTS.

The Lepidoptera (butterflies and moths) are shown in eight table cases placed near the Eagle and Peacock Groups.

The Moths or Nocturnal Lepidoptera commence in Table Case II. with the family Saturniidæ, the caterpillars of which spin silken cocoons in which they pupate and from which they emerge in the adult or imago phase of their life-history. This family comprises the largest moths found in Ceylon, namely, the Lunar Moth

* Not exhibited. There is an extensive tunny fishery (*Thynnus thunnina*) off Balapitiya during the north-east monsoon, and the fish are daily sent to Colombo.



Salarias Andersoni.

[*To face page* 46.

(*Actias selene*), green with a dark bordered whitish circle in the centre of each wing and with long swallow-tailed hind wings ; the Atlas Moth (*Attacus atlas*), deep chocolate with oblique translucent windows in each wing ; the Tussur Silk Moth (*Antheræa paphia*), rich yellow with a transparent round window in each wing. The Bombycidæ and Eupterotidæ complete this side of the case. The other side contains the Sphingidæ, which include among many species the Death's Head Moths of the genus *Acherontia*, the caterpillars of which stridulate, uttering a clicking sound by rubbing their jaws together ; and the Clear-wing Moths (*Cephonodes hylas*), which sometimes become a pest in cultivated districts. All the caterpillars of this family are provided with a horn-like appendage on the back near the end of the abdomen.

Case III. opens with the Notodontidæ and closes with the Arctiidæ. The Syntomidæ, which follow the Notodontidæ, include some very common species, while the Zygænidæ bear the appearance of butterflies, which they further resemble by their habit of flying about during the day.

Case IV. continues the Arctiidæ and commences the extensive family of the Noctuidæ, the latter being continued in Case V., which contains several handsome moths, *e.g.*, *Phyllodes consobrina* with leaf-shaped forewings, and *Ophideres salaminia*, which seems to mimic a Sphingid moth.

Case VI. contains Uraniidæ, Epiplemidæ, Geometridæ, and the commencement of the Pyralidæ or shining moths. Case VII. continues the Pyralidæ and concludes with a few Microlepidoptera of the family Tineidæ. On the other side of this case are shown some dragon-flies (Neuroptera).

Finally, Cases IX. and X., placed alongside in the central space, are devoted to the butterflies, which include a fine series of the Leaf Butterfly, *Kallima philarchus*.

In addition to the exhibited Lepidoptera the Museum possesses a large duplicate students' collection containing many rare species not shown in the cases. This may be inspected on application. There are, on the other hand, many moths recorded from Ceylon which have not yet found their way to the Museum collection.

The other orders of the insects of Ceylon have not been worked out so thoroughly as the Lepidoptera. They are represented in the table cases near the west end of the gallery, and are subject to re-arrangement. Orthoptera (locusts, stick insects, cockroaches, and mantids) and Coccidæ (mealy bugs) are shown in Cases XV. and XVI ; Coleoptera in Case XVII. ; Hymenoptera (ants, bees, and wasps), with a couple of black flies mimicking a wasp and a bee respectively, in Case XVIII.

The Museum is largely indebted for many specimens in the Insect Department to Mr. E. E. Green, the Government Entomologist, and to Messrs. F. M. Mackwood and O. S. Wickwar, who have also devoted much time to the arrangement of the duplicate collections of Butterflies, Moths, and Hymenoptera.

CRUSTACEANS AND MOLLUSCS.

Some Crustaceans (crabs, hermit crabs, prawns, barnacles) will be found among the table cases, chiefly on the tops of the cases. Marine Shells and Land Shells are contained in the table cases surrounding the central group. The marine shells of Ceylon are not remarkable for their exceptional variety and abundance. Ceylon follows far behind many other localities of the Indo-Pacific Region in the richness of its Marine Molluscan Fauna, but a sufficient compensation is afforded by the presence of the celebrated pearl banks.

On the other hand, the land shells of Ceylon are highly peculiar, and comprise many endemic species. The largest snails of the Island belong to a genus, *Acavus*, which is confined to Ceylon. Mr. Oliver Collett, F.R.M.S., who lived for some years at Ambagamuwa, was a great collector and connoisseur of the land-shells of Ceylon, and published three "Contributions to Ceylon Malacology" in the Journal of the Ceylon Branch of the Royal Asiatic Society (vols. XV.–XVI., 1897–1900). On his death, which occurred prematurely in 1902, his collection was purchased by the Government of Ceylon for the Colombo Museum and forms a valuable students' collection, which can be viewed on application. It contains several species still unnamed.

PEARL BANKS AND CORAL REEFS.

A number of specimens in Table Cases I. and VIII., some of which were presented long ago by Captain Donnan, many more having been added recently by Mr. James Hornell, Marine Biologist and Inspector of Pearl Banks, illustrate the natural history of the banks or paars which afford anchorage to the pearl oyster. Prior to the year 1903 there had been no pearl fishery for twelve years, and in 1902 a special mission, consisting of Professor W. A. Herdman, F.R.S., assisted by Mr. James Hornell, was appointed to report on the Pearl Oyster Fisheries of the Gulf of Mannar. "The animal (*Margaritifera vulgaris*, Schum.=*Avicula fucata*, Gould) is not a true oyster, but belongs to the family Aviculidæ, and is therefore more nearly related to the Mussels (*Mytilus*) than to the Oysters (*Ostrea*) of our British seas. One very notable character of great practical importance, in which it differs from

Ostrea, is that the pearl oyster, like our common mussels, has a 'byssus' or bundle of tough threads by which it can attach itself to rocks or other foreign objects." *

The collection shows pearl oysters from several paars in various stages of growth, and other organisms, corals, pennatulids, sponges, sea urchins, &c., which also grow on the pearl banks in association with the pearl oysters. Of special interest are the specimens prepared in spirits showing pearls *in situ*.

Large specimens of stone corals (Madreporaria), sea shrubs (Gorgonacea), black corals (Antipatharia), and leathery corals (Alcyonacea) from Galle and the Maldive Islands are exhibited in wall cases in the fish alcove and on the south verandah. Those from the Maldive Islands were presented by Mr. J. Stanley Gardiner, M.A., who organized an expedition for the investigation of the coral atolls of the Maldives in the years 1899–1900.†

The dried corals which are exhibited are the basal and axial skeletons secreted by the soft parts of the living coral polyps. These form large colonies by a peculiar process of budding and branching, and deposit the mineral substances which they have absorbed from the sea water so as to form the wonderful growths which remain after the living tissues have been removed.

The Madreporaria are the reef-building corals forming extensive reefs at Galle and off Jaffna, and especially at the Maldive Islands, which are themselves partially elevated coral reefs. The pearl banks are not coral reefs, but sandbanks, formed of sandstone and concretions upon which isolated corals grow without forming reefs.

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* *Cf.* Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Mannar, by W. A. Herdman, D.Sc., F.R.S., with supplementary reports upon the Marine Biology of Ceylon by other naturalists. Published by the Royal Society, Part I., London, 1903. Professor Herdman and Mr. Hornell arrived in Ceylon in January, 1902, and the former left in the following April. Since then the work has been carried on locally by Mr. Hornell.

§ The Fauna and Geography of the Maldive and Laccadive Archipelagoes. Edited by J. Stanely Gardiner. Vols. I. and II., 1901–1905 (Cambridge University Press).

THE ROCKS AND MINERALS OF CEYLON.

By A. K. Coomaraswamy, B.Sc..

Director, Mineralogical Survey of Ceylon.

I.—ROCKS.

The rocks of Ceylon are known as **Granulites**, or, using the term in its widest sense, as Gneisses; they belong to the same series as that which Mr. Holland has named in Southern India the **Charnockite Series.** The rocks are crystalline and show conspicuous mineral banding (foliation), and are very varied in mineral composition. Rocks of igneous origin form by far the greater part of the Charnockite Series in Ceylon, although it is possible that amongst these rocks there are some of sedimentary origin now highly metamorphosed and incorporated with the others. The bedded appearance so suggestive of sedimentary rocks is in this respect deceptive, and is due to the banded structure produced by flowing movements in the heterogeneous magma during its consolidation. No fossils occur in any of the crystalline rocks.

The most characteristic types of rock exhibited include **granular quartz rock**, consisting essentially of quartz, but often with minute quantities of felspar and garnet; **leptynites**, composed of quartz and felspar, and very often containing an abundance of garnet; typical **charnockite**, essentially composed of felspar quartz and hypersthene; **pyroxene** granulites, characterized by the presence of pyroxene (hypersthene or augite or both) with felspar (usually triclinic) and with or without orthoclase, quartz, or garnet; amongst these are rocks with the mineral composition of **norites, diorites**, and **gabbros**; there are also more basic types consisting almost entirely of pyroxene, amphibole, and garnet; these dark heavy rocks frequently occur as lenticular bands and inclusions in the more acid types. Coarse-grained pegmatites of an intrusive character are found in dykes and veins crossing or parallel to the foliation of the other rocks; in them the minerals quartz, orthoclase, mica, and hornblende are most characteristic; the quartz and felspar are often intergrown as in **graphic granite.**

The **crystalline limestones** are found in wide or narrow bands interbedded with the other rocks, often separated from them by a zone of heavy dark green rocks composed essentially of pyroxene and mica, often with spinel. The limestones

themselves vary much in purity and in dolomitic character ; the minerals most frequently occurring and indeed nearly always present are forsterite and phlogopite ; graphite is frequently abundant in small flakes ; other accessory minerals include pyrite, blue apatite, spinel, amphibole, chondrodite, scapolite, &c. Of inclusions in the limestones there are (*a*) aggregates of the characteristic accessory minerals ; (*b*) inclusions of rocks indistinguishable from the pyroxene granulites except for the usual presence of scapolite and sphene.

Certain rocks composed essentially of pyroxene with scapolite, amphibole, mica, calcite, and sphene occur sparingly in bands interbedded with the other rocks ; separating limestone from granulite ; or as inclusions in the limestones.

The Galle Group.—A group of rocks allied to these but distinguished by the presence of wollastonite is found at Galle. These rocks include types composed of pyroxene, scapolite, sphene, wollastonite, and graphite, and all transitions from these to rocks composed of quartz and felspars. There are also remarkably coarse dykes composed essentially of orthoclase, quartz, and wollastonite, crossing the foliation ; the individuals of wollastonite, moulding the idiomorphic crystals of quartz and orthoclase, are sometimes as much as 3 feet in length.

The name **Balangoda group** is given to a series of granitic rocks, intrusive in the Charnockite Series or granulites : the granites occur in dykes and lenticular masses, the best exposures so far known being in the Balangoda district. The principal types include zircon granite, allanite-granite or pegmatite, magnetite granite, and granite without accessory minerals. But although not yet discovered *in situ* (except thorianite, which occurred very sparingly in a pegmatite vein at Gampola, and ilmenite, which is common in several types), the following additional minerals are almost certainly derived from rocks of the Balangoda group : baddeleyite, beryl, cassiterite, chrysoberyl, fergusonite, geikielite, ilmenite, rutile, some spinels, thorianite, thorite, topaz, and some tourmaline.

Rocks which are alteration products of those already mentioned include bands of **chert** (opaline chalcedonic rock), which usually occurs replacing the carbonates of the crystalline limestones, minerals such as spinel and graphite remaining in the chert unaltered. **Laterite** (cabook) is a typical decomposition product of the granulites, and is of interest on account of its use as a building material, and on account of its chemical composition, consisting largely of aluminium hydrate. Various **clays**, including **kaolin** (china clay, "kirimeti," "makul") are derived from the

decomposition of the granulites, especially from their felspathic elements.

Volcanic rocks are very sparingly represented in Ceylon. A typical **dolerite** (probably occurring as a dyke) from Kallodai, Eastern Province, is represented in the collection. A few other dykes are said to have been met with in Ceylon. No lavas or tuffs occur, and, with the exception of a few hot springs, no signs of volcanic activity are found. Denudation has been so long at work that only the most deep-seated rocks are now exposed at the surface. Of sedimentary rocks, we have (*a*) **river gravels, sands,** and alluvial **clays** (used for brick making) deposited by rivers. In the gravels are found the gems which have been derived from the crystalline rocks ; many have not yet been found *in situ*. (*b*) **Marine deposits**, including coralline raised beaches, blown sand, &c. Fossil shells and corals are abundant in the raised beaches which are found all round the coast and often some little way inland, but never very far above the present level of the sea.

II.—MINERALS.

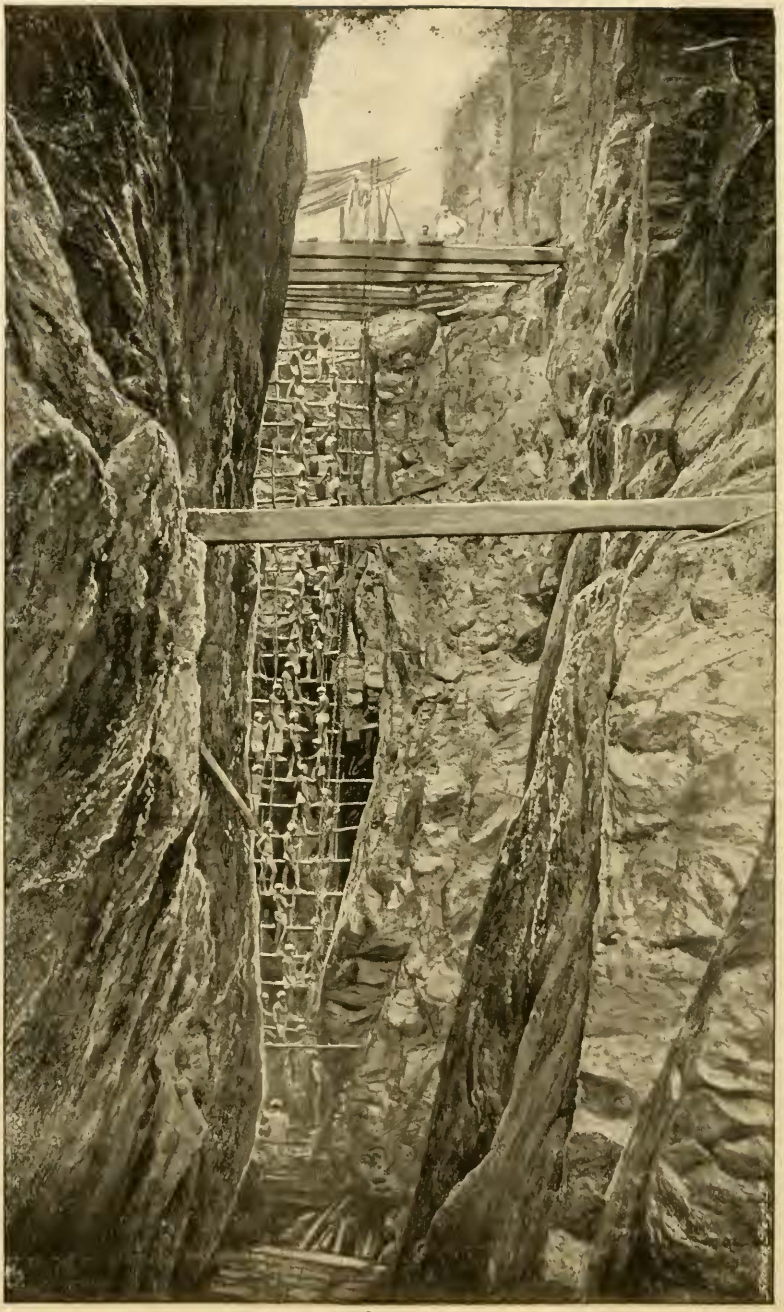
Before proceeding to refer in systematic order to the nature and mode of occurrence of particular minerals it will be useful to consider briefly their nature and mode of formation. Regarded from this point of view the minerals of Ceylon fall into three main groups, which are not, however, separated from each other by any rigid line of demarcation :—

A.—Minerals composing or associated with the crystalline rocks.

B.—Vein minerals.

C.—Minerals which are alteration products of other minerals and rocks.

The first class includes those whose origin is for the most part directly igneous (*i.e.*, the majority of Ceylonese minerals), and which occur as original minerals in the granulites and crystalline limestones. Many of these have crystallized from an actually molten or viscous magma, others perhaps from masses of rocks existing merely in a state akin to fusion, some being developed as the result of contact interaction between the limestones and granulites when both possessed a high temperature, whilst others forming pegmatite veins may even have crystallized from heated vapours or liquids saturated with mineral matter. When suitable conditions prevail, these minerals each assume definite and characteristic crystalline forms ; this has, however, rarely been the case in the granulites themselves, where an irregular "granulitic" structure usually prevails : in the crystalline limestones, however,



PLUMBAGO MINE.

To face page 53.]

the accessory minerals have more often been able to crystallize in their own forms ; for an example see Fig. 1, an octahedral crystal of spinel. Such "idiomorphic" crystals are commonly known in Ceylon as "devil-cut."

It is interesting to note that of all the gem minerals so famous in Ceylon few have yet been found *in situ*. New records of the occurrence of these minerals in their parent rock is much desired. Nearly all the gems of Ceylon, moonstone excepted, are obtained from the river gravels of the Ratnapura, Rakwana, Galle, and Morawak Korale Districts ; but some are found in superficial deposits whose situation on hill slopes shows that the contained minerals must occur *in situ* at no very distant spot.

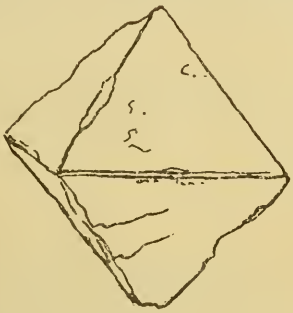


Fig 1.—Octahedral crystal of spinel.

Minerals of the second class include the greater part of the graphite of Ceylon and perhaps a considerable part of the mica. Associated with the graphite are often found some of the minerals characteristic of the granulites, such as quartz and felspar. True veins of pure quartz are rarely met with in Ceylon. Minerals of the third class include the deposits of iron ore (limonite) and manganese ore (psilomelane), which are everywhere common as decomposition products of the granulites ; and also the minerals hydrargillite and limonite composing laterite.

A few minerals occur in Ceylon which have not been found elsewhere ; these are thorianite, geikielite, and serendibite. The mineral baddeleyite was first found in Ceylon, but has since been met with in Brazil.

Further notes on the more important minerals will be found below, where a list of all the minerals known to occur in Ceylon is given.

Graphite, C.—Graphite or plumbago is the most important mineral product of Ceylon. Its composition is pure carbon. It is found in veins and nests in the crystalline rocks, occurring often

in a fibrous or flaky form, the flakes being arranged at right angles to the wall of the vein (see Fig. 2). The veins vary in width from less than an eighth of an inch to several feet. Some are found to follow the foliation planes of the various rocks, others cross them and ramify in all directions. Much smaller quantities of graphite occur as flakes in many of the granulites and in the crystalline limestones, when it usually forms small tabular six-sided crystals with well-developed basal cleavage. In these cases the graphite behaves like the other accessory minerals, and there is no reason to suppose that it has been subsequently introduced.

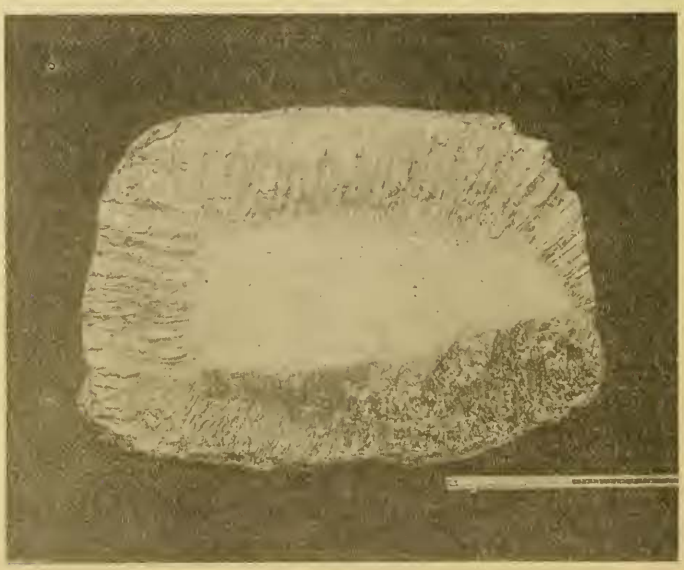


Fig. 2.—Vein graphite surrounding a portion of included matrix (white leptynite).

It is clear, however, that the graphite occurring in veins has been deposited at a time posterior to the consolidation of the granulites. The veins are often of the most typical character. Usually they consist of pure graphite (sometimes there is evidence of more than one period of deposition in a zoned structure of the vein); sometimes the vein shows a central zone of quartz or pyrite with graphite on either hand, sometimes the graphite is more irregularly associated with minerals such as felspar quartz and mica and with fragments of the surrounding rock.

Metamorphism of the surrounding rocks near the veins is found only on a very small scale; the rock surfaces in immediate contact with the veins are not impregnated with scales and flakes of graphite to a greater depth than half an inch. Nor do we find that the quartz and other minerals associated with the graphite veins

are filled with disseminated graphite; the latter occurs only in strings or scales occupying obvious cavities or cracks in the quartz. It seems that the deposition of graphite has been subsequent to the formation of the pegmatite veins, though following the same or similar paths in some cases.

As regards the source of the graphite, we see at once that its presence cannot be ascribed to the metamorphism of beds of coal or other carbonaceous deposits, and indeed that the graphite can have had no direct organic source and is most probably of entirely inorganic origin. Like other minerals found in veins, it must have been deposited from vapours or liquids saturated with mineral (in this case carboniferous) matter; for we cannot suppose that the graphite was introduced in the form of dykes of molten carbon.

Sulphur, S.—Occurs as a decomposition product of pyrite in small quantities.

Gold, Au.—Small quantities of native gold are of rare occurrence in streams, sands, and alluvial deposits, but there is little prospect of its ever becoming of commercial importance.

Salt, NaCl.—Obtained by the evaporation of sea water in natural and artificial lakes, known as "lewaya."

Cinnabar, HgS.

Pyrite, FeS_2.—Common as an accessory mineral in granulites and crystalline limestones.

Marcasite, FeS_2.

Pyrrhotite, $Fe_{11}S_{12}$.—Occasionally as an accessory mineral in crystalline limestones and in charnockite.

Ice, H_2O.—Frost is sometimes experienced in the hills.

Fig 3.—Corundum.

Corundum, Al_2O_3.—Corundum is the most important of the gem minerals of Ceylon. When red it is known as ruby; when blue as sapphire; when purple as oriental amethyst; when yellow as oriental topaz; colourless varieties are also found. The peculiar

character of "star sapphires" is due to the presence of regularly distributed minute inclusions arranged along the lines of growth, producing the appearance known as "silk;" a six-rayed star is seen when the crystal is viewed in the direction of its vertical axis. Coarser varieties of corundum are used as emery, for which purpose a good deal is obtained in Southern India. Corundum is found in the river gravels of Ceylon in more or less rounded and waterworn six-sided crystals, which are either prismatic or doubly pyramidal in character.

Only two localities are known in Ceylon where corundum occurs in the parent rock. In one case (Talatu-oya) blue hexagonal crystals occurred in a narrow band of rock composed essentially of orthoclase, microperthite, and oligoclase. In the other (Haldummulla) violet or purplish hexagonal crystals are found in a corundum-sillimanite rock (of which a large specimen is exhibited), but not actually *in situ*.

In Southern India corundum occurs (*a*) in felspathic rocks as a direct product of the magma; (*b*) in certain aluminous rocks, probably as the result of contact metamorphism. Specimens of these rocks are shown in the collection. In Burma rubies are found in the crystalline limestones, which in other respects closely resemble those of Ceylon.

Hematite, Fe_2O_3.—Less usual than limonite as an iron ore derived from the decomposition of the granulitic rocks.

Limonite, $2Fe_2O_3 3H_2O$.—The common ore of iron in Ceylon, and formerly extensively worked. Almost always found as a product of the decomposition of the granulites.

Hydrargillite, $Al_2O_3 3H_2O$.—Forms, with limonite, the greater part of ordinary laterite (cabook).

Cassiterite, SnO_2.

Rutile, TiO_2.

Thorianite, $ThO_2 + UO_3$. — This newly-discovered mineral, peculiar to Ceylon, is of great commercial importance owing to the use of thoria in the manufacture of incandescent gas mantles. It occurs in very heavy black cubic crystals at Bambarabotuwa, where over a ton has been obtained. It is valued at £600 sterling per ton. It is of great scientific interest too, on account of its chemical composition, one or more new elements being possibly present; it contains also a large amount of occluded helium. Though radio-active, there is no more than a trace of radium present.

Baddeleyite, ZrO_2.

Quartz, SiO_2.—Very abundant throughout the Charnockite Series. The purple variety is amethyst. Drusy groups from

cavities in crystalline limestone at Welimada. Doubly terminated crystals not rare in gem washings.

Fig. 4 shows the ordinary hexagonal prisms of quartz.

Fig. 4.—Quartz hexagonal prisms.

Chert, SiO_2.—An opaline chalcedonic rock usually replacing crystalline limestone.

Chalcedony, SiO_2.

Opal, $SiO_2 + H_2O$.—In some cases a rock consisting entirely of common opal is found with the less pure cherty varieties.

Psilomelane, $MnO + MnO_2H_2O$.—Commonly associated with limonite and hematite in veins and aggregates resulting from the decomposition of the granulites.

Spinel, $(MgFe)OAl_2O_3$.—Blue, green, and red spinels (especially the latter, known as Balas ruby) are used as gems. Small well-formed octahedra (see Fig. 1, page 53) of spinel, usually pink, are common in the crystalline limestones. Green spinel occasionally occurs in granulites, and frequently in the heavy dark green rocks associated with junctions of limestone and granulite. The gem spinels are obtained from the gravels, but are probably derived from the crystalline limestones.

Magnetite, $FeOFe_2O_3$.—Common as an accessory mineral in the granulites; also in limestones.

Chromite, $FeOCr_2O_3$.

Chrysoberyl, $BeOAl_2O_3$.—Includes cat's-eye and alexandrite. This important gem stone sometimes occurs in large individuals, exhibiting characteristic twinning. The beautiful chatoyance of the cat's-eye is perhaps due to the presence of fine tubular cavities arranged symmetrically in the crystal. (The much less valuable

"coast" or quartz cat's-eye is of a quite different character, consisting of quartz with included silky fibres of asbestos.) The green alexandrite appears red by transmitted light and generally also by candle light, but green by reflected light or daylight.

Calcite, $CaCO_3$.—In the crystalline limestones.

Dolomite $(CaMg)CO_3$.—In the crystalline limestone; sometimes forming with calcite parallel or ramifying intergrowths.

Forsterite, Mg_2SiO_4.—This colourless mineral is characteristic of the crystalline limestones, where it is extremely abundant. The individuals are usually small. An unusually large crystal in limestone is exhibited; also some very flattened crystals of a superficially dark colour. Incipient superficial decomposition often gives a dark colour to the crystals.

Clinohumite, $Mg_7(MgF)_2(SiO_4)_4$.—This beautiful yellow mineral is of rare occurrence in the crystalline limestones.

Pyroxenes:

(1) *Hypersthene* $(FeMg)SiO_3$.—One of the most characteristic minerals of the Charnockite Series.

(2) *Diopside* $(CaMg)SiO_3$.—A colourless to pale green pyroxene characteristic of the crystalline limestones.

(3) *Manganhedenbergite*, $Ca(FeMn(SiO_3)_2$.—Characteristic of the Galle group, and probably common in similar rocks elsewhere.

(4) *Augite*, $CaMgFe(SiO_3)_2 + MgFe(AlFe)_2(SiO_3)_2$. — Characteristic of many pyroxene granulites.

(5) *Wollastonite*, $CaSiO_3$.—Characteristic of the rocks of Galle, in which it occurs disseminated, and also in very large individuals in coarse pegmatite veins. It has not yet been found elsewhere in Ceylon.

Amphiboles:

(1) *Tremolite*, $CaMg_3(SiO_3)_4$.—Includes colourless and pale amphiboles associated with the crystalline limestones.

(2) *Horneblende*, $Ca(MgFe)_3(SiO_3)_4$ &c.—Includes dark amphiboles occurring in the crystalline limestones and the dark green amphiboles characteristic of many of the more basic varieties or granulites and of contact zones.

Ilmenite, $FeTiO_3$.—Of widespread occurrence; the commonest ingredient of *námbu* and black sand. One exceptional and very large specimen is shown.

Geikielite, $MgTiO_3$.—Not known except in Ceylon, where it was found in gem refuse.

Titanite (*Sphene*), $CaTiSiO_5$.—Characteristic of the rocks of the Galle group; common in junction rocks, &c.

Talc (*Steatite*), $H_2Mg_3(SiO_3)_4$.—To be distinguished from mica. Rare as an accessory mineral in crystalline limestones.

Serpentine, $H_4Mg_3Si_2O_9$.—Not infrequent as a decomposition product of forsterite.

Apophyllite, $(HK)_2Ca(SiO_3)_2H_2O$.

Topaz, $(AlF)_2SiO_4$.—Commonly found in gem gravels; yellow, colourless, or pink, the latter variety known as king topaz. The colourless varieties are wrongly known as water sapphires. The pale greenish-blue varieties are cut as aquamarine. Not met with *in situ*.

Andalusite, $Al(AlO)SiO_4$.

Kyanite, $(AlO)_2SiO_3$.—Has only been found in dredgings made by Professor Herdman off the coast of Ceylon.

Sillimanite, Al_2SiO_5.—Very rarely in good crystals in gem gravels. Sillimanite is in some districts a common constituent of the garnetiferous leptynites, the rocks then resembling the khondalites of Southern India, of which specimens are exhibited. Fine coarse sillimanite rocks occur near Haldummulla, the sillimanite being disposed in sheaf-like and radiating aggregates. The associated minerals are corundum, garnet, orthoclase-microperthite, ilmenite, and rutile. See also under Corundum.

Kaolinite (*China Clay*), $H_4Al_2Si_2O_9$.—Common as a decomposition product of orthoclase.

Felspars:

(1) *Orthoclase*, $KAlSi_3O_8$ affords the well-known moonstone; it occurs in large but well-cleaved crystals in certain acid granulites associated with crystalline limestones in the Dumbara district, Central Province. Various pegmatites also, consisting of quartz and orthoclase, yield moonstone of a poor quality. Large individuals of idiomorphic orthoclase occur in pegmatite veins at Galle. An intergrowth of orthoclase with albite is the most usual felspar of the less basic granulites. The silvery sheen so characteristic of moonstone is probably the result of the presence of excessively minute inclusions of kaolin, the products of incipient decomposition. The bluish-white opalescence of moonstone is best seen when the crystal is viewed in a direction at right angles to the basal plane, *i.e.*, when regarding one of the planes of easy cleavage; the stone should always be so cut that the flat base of the finished cabochon gem is parallel to this surface, in order that the opalescence may be central and as conspicuous as possible.

(2) *Plagioclase* (*Lime-Soda Felspars*).—These are commonly characteristic of many of the granulites, but are rarely of large size. A fine blue opalescence has occasionally been observed in the plagioclase felspars, but none of size suitable for yielding gems have been found.

(3) *Microcline*, $KAlSi_3O_8$.—Rarer than orthoclase in the granulites.

Micas.—Ceylonese micas are of some importance from a commercial point of view. They include muscovite, biotite, and phlogopite :—

(1) *Muscovite*, $H_2KAl_3(SiO_4)_3$ occurs but sparingly in Ceylon, and not in crystals large or flawless enough to be of commercial value.

(2) *Biotite*, $(KH)_2(MgFe)_2(AlFe)_2(SiO_4)_3$ is chiefly found in small crystals as a microscopic constituent of various rocks belonging to the Charnockite Series ; but a part of vein mica also belongs to biotite.

(3) *Phlogopite*, $(K,H,Mg,F)_3Mg_3Al(SiO_4)_3$ is by far the most important of Ceylonese micas. Minute pale or golden crystals are almost always common in the crystalline limestones. Larger mica crystals occur in veins and bands associated usually with junction of granulite and crystalline limestone. These micas are rarely colourless, being more usually brown, reddish, bottle-green, or amber-coloured. The largest crystals found have been two or three feet in diameter. The veins are usually one or two feet in width, and are composed of numerous "books" or crystals of mica which are generally more or less idiomorphic, having a clear-cut hexagonal outline. Mica is used for the peepholes of stoves, for lamp chimneys, and very largely for electrical appliances, &c. ; comminuted mica dust is of use as a non-conducting packing. Mica has long been used in the East for ornamental purposes, also for medicine. Fine crystals of mica from the Kandy District are exhibited.

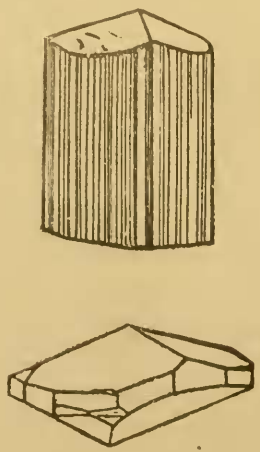


Fig. 5.—Tourmaline.

Tourmaline.—A borosilicate of alumina with magnesia iron and alkalis. Black varieties associated with quartz are not uncommon.

The greater part of the *toramalli* of gemmers belongs properly to zircon.

Serendibite.—A borosilicate of alumina and lime with magnesia and alkalis. Found only in Ceylon. In small crystals in diopside rock at the junction of limestone and granulite. Dumbara district, Central Province.

Scapolite, $Ca_4Al_6Si_6O_{25}Na_4Al_3Si_9O_{24}Cl$.—Abundant in the wollastonite-scapolite gneisses of Galle; common in limestone-granulite junction rocks. Sometimes an accessory mineral in limestones.

Stilbite, $(Na_2Ca)Al_2Si_6O_{16}6H_2O$.—In minute crystals; from Nilhene, near Baddegama, Southern Province.

Zoisite, $Ca_2Al_2(AlOH)(SiO_4)_3$.

Allanite, $(CaFe)_2(AlCeFe)_2(AlOH)(SiO_4)_3$.—In coarse granitic dykes near Balangoda.

Beryl, $Be_3Al_2(SiO_3)_6$.—The pale varieties of emerald known as aquamarine are abundant in gem gravels. Ceylon specimens with the true emerald colour have been very rarely met with.

Cordierite (*Iolite*), $(MgFe)_4Al_4Si_5O_{18}$.—In rolled crystals known as water sapphire. Many stones, however, known as water sapphire belong to topaz, and are colourless.

Garnets.—Several types of garnet occur in Ceylon. Amongst these are probably—

Cinnamon stone, $Ca_3Al_2(SiO_4)_3$.—Not known *in situ*.

Pyrope, $Mg_3Al_2(SiO_4)_3$.
Almandite, $Fe_3Al_2(SiO_4)_3$.
Spessartite, $Mn_3Al_2(SiO_4)_3$.

} These include the red and pinkish-red garnets so common in and characteristic of the granulites.

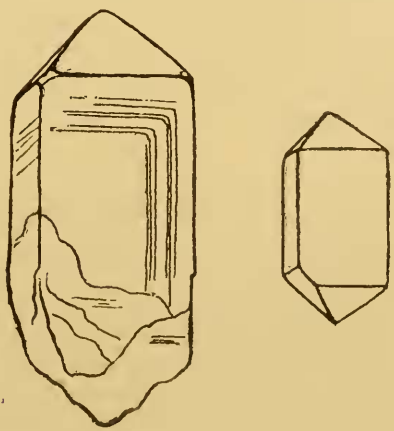


Fig. 6.—Zircon.

Zircon, $ZrSiO_4$.—A very abundant mineral in Ceylon; occurs in the granulites as a microscopic constituent; near Balangoda

occurs abundantly in large idiomorphic crystals in a zircon granite. Common in gem washings, and usually well crystallized. Colour various : brown, yellowish, green. The colourless varieties are known as Matara diamonds ; the coloured as jargoon and hyacinth, used as gems.

Thorite, $ThSiO_4$.

Apatite, $Ca_4(CaF)(PO_4)_3$.—A microscopic constituent of many granulites. Blue apatite is very characteristic of the crystalline limestones.

Fergusonite, (YErCe)(NbTa)O_4.

Anhydrite, $CaSO_4$.

Uraninite (*Pitchblende*).—Uranate of lead, the chief source of radium. Not certainly known to occur in Ceylon, as all supposed specimens may be thorianite.

The above forms a complete list of the minerals at present known to occur in Ceylon ; the discovery of others may be expected ; minerals of the samarskite and æschynite groups are probably present.

For further information as to the rocks and minerals the following works may be consulted, amongst others :—

Weinschenck, E. Zur Kenntniss der Graphitlagerstätten ; Die Graphitlagerstätten der Insel Ceylons. Zeit. fur prakt. Geol.: 1900, p. 174.

Grünling, F. Ueber die Mineralvorkommen von Ceylon. Zeit fur Kryst, vol. XXXIII., 1900, heft 3.5, pp. 209–239.

Coomaraswamy, A. K. The Crystalline Limestones of Ceylon. Quart. Journ. Geol. Soc., vol. LVIII., 1902, pp. 399–422.

Coomaraswamy, A. K. The Point de Galle Group (Ceylon); Wollastonite-scapolite Gneisses. Quart. Journ. Geol. Soc., vol. LVIII., 1902, pp. 680–689.

III.—ROCKS OF SECONDARY ORIGIN.

Of these, **Laterite** (cabook) is perhaps the most important. It commonly occurs overlying quite unaltered granulites, forming a mantle varying from a few feet to many yards in thickness in different places, but is of rather local distribution. When dug it is soft, but as it hardens on exposure it forms a useful building stone. Typical laterite is a decomposition product of the rocks beneath, and is especially characteristic of tropical lands. Laterites are usually found to consist of a fine-grained scaly aggregate of hydrargillite or similar aluminium hydrate, with also ferrous

hydrate varying in amount according to the nature of the parent rock. When the latter contained free quartz, it is found in the laterite in angular grains.

Various **Clays**, including kaolin (China clay), are also found, and are also decomposition products of the granulitic rocks. They differ chiefly from laterite in consisting rather of aluminium silicates than of aluminium hydrate.

Cherts and common-opal rock are sparingly found, often in association with crystalline limestones, and can sometimes be shown to have been formed by pseudo-morphous replacement of the latter; specimens occur containing the phlogopite, graphite, and spinel of the original crystalline limestone, as well as others in which remains of the partially disintegrated carbonates can still be seen.

Travertine (tufa) is a secondary deposit of carbonate of lime (apparently sometimes containing magnesium carbonate as well) removed in solution from the beds of crystalline limestone; but these deposits are but rarely found in large quantity.

IV.—FOSSILS AND RECENT SEDIMENTARY ROCKS.

Even less is known of these than of the crystalline rocks. A belt of raised beach deposits is almost everywhere to be traced around the coast, extending to no great height above sea level. The material composing the deposit varies from a sandstone cemented by calcareous material to a rubbly rock composed entirely of the *débris* of corals and other calcareous organisms.

A series of recent marine fossils from Palanti-aar is exhibited, and includes shells in a calcareous breccia, and well-preserved remains of crabs in nodules of mud. There are also fossil chank shells from the Kadurawala coast; the latter are regularly quarried in the recent deposits of the Jaffna District.

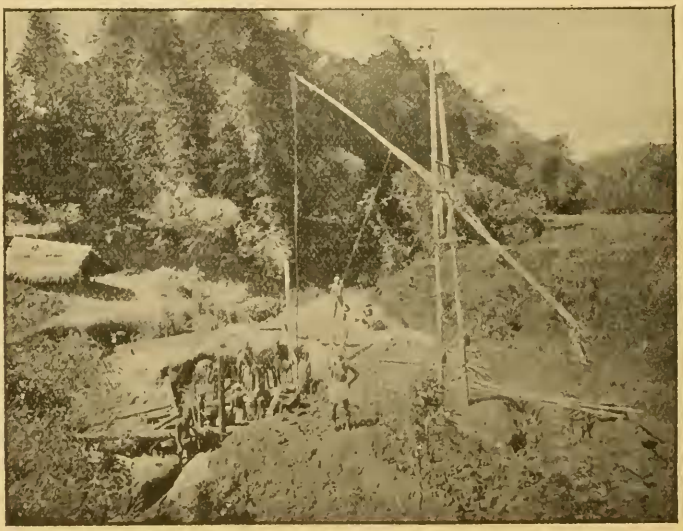
An interesting specimen of a bone and shell breccia from the floor of a Vedda cave is exhibited; but little is known, however, as to the occurrence of really ancient cave deposits; masses of stalactite are rarely found in caves in the crystalline limestones.

In addition to the recent marine sedimentary deposits, there are river gravels and alluviums. Thick beds of the former are of somewhat rare occurrence, but rivers, large or small, are not infrequently bordered by strips of alluvial deposits, and when they leave behind the mountain country, and with it their often torrential character, debouch upon extensive alluvial plains where fine silty muds are still deposited in times of flood. The fine muds thus laid down are of great value in the manufacture of bricks and the coarser kinds of earthenware.

V.—GEMS AND GEMMING.

The gems of Ceylon are of such general interest that it will be worth while to give a brief account of the manner in which they are obtained. With the exception of moonstone and some garnets, none are obtained *in situ*, though all of course are derived from the crystalline rocks where they originally crystallized, like the other minerals accompanying them. It is however popularly and erroneously supposed that they have grown where found, and that small and flawed gems are merely immature.

The gems (of which a tabulated list is given below) are obtained from gravels which have been deposited by streams and rivers; gemming is now only carried on in the Ratnapura District of the



A GEM PIT.

Province of Sabaragamuwa and the Galle District of the Southern Province; but a little is done near Hatton in the Central Province, and a good many gems were formerly obtained near Nuwara Eliya and in the Horton Plains. Many districts are now more or less exhausted. The process of gemming is briefly as follows:— A pit is sunk where gem-bearing deposits of gravels are known to occur; a typical section would show five or six feet of muddy alluvium, resting on a deposit of gem-bearing gravel not more than one or two feet thick, and called the *illam*, below which is the *malawa*, the decomposed (usually kaolinized) country rock, but gravels are of course obtained at various depths, from the actual surface to fifty or sixty feet below. Occasionally two beds of *illam*

are found, separated by a band of clay. However this may be, the *illam* is removed from the pit and subsequently washed in a "gemming basket." This is made of cane, and is of conical form, about 2 feet wide and 1 foot deep, and has a rim about 2½ inches wide. The washer stands in about 2 feet of water, and holding the basket in the water gives it a turning movement, depressing the rim below the water once in every turn, so that the lighter stones are washed over its edge by the centrifugal movement. Fifteen or twenty basketfuls are thus washed, and the residue, consisting only of gems and other heavy minerals, examined. The remaining material, usually thrown away, is called *námbu;* it often contains minerals of scientific interest, and further, it is in this way that the heavy minerals such as thorianite, containing rare elements, are obtained.

Tabular List of Gems found in Ceylon.

Corundum.—Includes sapphire (blue), ruby (red), star sapphire, and star ruby. White sapphires have had their original pale blue or yellow colour discharged by burning. Rubies are almost always burnt in order to discharge in the same way any trace of blue colour. Yellow sapphires are "oriental topaz," and violet coloured ones oriental amethyst. Pinkish-yellow stones are called "king topaz."

Quartz.—Includes rock crystal, amethyst, cairngorm, smoky quartz, &c.

Spinel.—Green, blue, red. The pink and red varieties are called balas ruby; the blue, spinel sapphire.

Chrysoberyl.—Green and yellow; includes cat's-eye and alexandrite.

Topaz.—Colourless, erroneously called water sapphire; rarely yellow; pale sea-green, cut as aquamarine.

Othoclase-Feldspar.—Includes moonstone, quarried from the matrix in the Central Province.

Tourmaline.—Brown and brownish-green and yellow; see zircon.

Beryl.—Pale sea-green, cut as aquamarine (true aquamarine); the true emerald colour is extremely rare in Ceylon.

Cordierite.—Blue, the true water sapphire; rarely seen.

Garnet.—Red, pinkish-red, and brownish-yellow (cinnamon stone).

Zircon.—Green, yellow; the colourless "Matara diamonds" are got by burning pale zircons and so driving off the colour. Most of the material called *toramalli* by gemmers is actually zircon, and not tourmaline.

VI.—ARRANGEMENT OF THE MINERAL GALLERY.

Of the four wall cases, those facing the entrance are devoted to rocks; the two right and left of the door to plumbago, iron ores, mica, kaolin, &c. Of the seven table cases, the five window cases contain the systematic collection of Ceylon minerals, beginning with the elements in the first case on the left-hand, and ending with zircons, &c., in the fifth case on the right. The two central cases contain the recent fossils, and collections of a general character illustrating the geology and mineralogy of Ceylon. Some large and interesting specimens are also accommodated on the floor. Geological photographs and others illustrating the processes of gemming and iron smelting are hung upon the walls. The collection has been arranged and largely added to by the staff of the Mineralogical Survey in 1903 and 1904.

GIANT TORTOISE OF ALDABRA.
(*See page 43.*)

ON THE PHYTOPHAGOUS AND PARASITIC HYMENOPTERA COLLECTED BY MR. E. ERNEST GREEN IN CEYLON.

By P. Cameron.

Plates A and B.

Introduction.

THE Ichneumonidæ and other Parasitic Hymenoptera are—as Dr. Sharp remarks in his volume on Insects (Cambridge Nat. Hist. Series)—"One of the most neglected of the great groups of Insects, though perhaps of greater economic importance to mankind than any other." Besides the truly parasitic families, the group is usually made to include the gall-flies—insects which must be considered as inimical to mankind. It is, however, with the former families—those that prey upon the vegetarian insects—that we are chiefly concerned and that form the principal subject-matter of Mr. Cameron's paper.

The importance of the Parasitic Hymenoptera will be recognized when it is understood that there is probably not a single vegetarian insect that does not constitute the host of one or more species of these parasites. Dr. Sharp states (*loc. cit.*) that the destructive "winter moth" (a serious pest of fruit trees) is known to be attacked by sixty-three distinct species of Hymenopterous parasites.

This neglect—by the generality of entomologists—must be attributed partly to the difficulties of determination and partly to their somewhat uninteresting exterior, for the family does not rank among its members many beautiful or remarkable forms. But the lack of conspicuous external beauty is amply compensated by the interest and complexity of their habits and development.

In spite of this comparative neglect, nearly 6,000 species of Ichneumonidæ have been described. By far the greater number of species undergo their early development inside the bodies of their hosts. The adult female is usually provided with a prominent slender ovipositor, by means of which the eggs are inserted into the tissues of the victim. The resulting larvæ subsist upon the juices (the lymph or blood), taking up all the

nourishment that should go to the building up of the tissues of the host, until eventually the latter dies of inanition. This collapse seldom occurs until the contained parasite (or parasites) is ready to undergo transformation into the pupal state. In the Ichneumonidæ proper the full-grown larva usually spins a compact cocoon either within the carcass of its victim or by the side of it.

The early stages of these parasites are not invariably passed within the body of the host. Three distinct conditions have been noticed :—

(1) Both egg and larva may be interior.

(2) The egg may be exterior and the larva interior.

(3) Egg and larva may both be completely exterior.

This last condition may be observed in the case of the parasite of one of our principal tea pests, the "Tea Tortrix" (*Capua coffearia*, Niet.) The egg of this useful little parasite is attached to the back of the caterpillar, just behind the head. The young grub fixes itself in the same position and completes its growth, fully exposed, except for the leafy shelter constructed by the host. It is noticeable that even those species that attach their eggs to the surface of the caterpillars are still provided with a well-developed piercing ovipositor. With the parasite of the Tortrix this weapon is employed in piercing the leafy covering which conceals the victim. It is remarkable, also, that the periodical moulting of the caterpillar does not dislodge the parasite.

Besides true insects, spiders are subject to the attacks of Ichneumon flies.

E. E. G.

FIRST PAPER.

Our knowledge of the Hymenoptera of Ceylon, and more particularly of the plant-feeding and parasitic species, is very limited. There is a paper by the Russian Entomologist V. Motsulsky in the Bull. de la Soc. Imp. des Natur. de Moscow, XXXVI., 1863, wherein sixty-one parasitic species are described, including many new genera. The descriptions, however, leave much to be desired, while it is doubtful if many of the species have been referred to their proper genera. Motsulsky, for example, describes two species of *Microgaster*, but all the species I have seen, or have been described by recent writers, belong, not to *Microgaster*, but to the allied genus *Apanteles*. Consequently one is in doubt if the species described by Motsulsky belong to *Microgaster* as now limited, or to *Apanteles*, or even to some new genus ; as is probably the case with the species I have in this

paper doubtfully referred to *Microgaster*. The same remark applies to the species of *Microgaster* described by Walker. The systematic position of some of the genera described by the Russian Hymenopterist is also doubtful in some cases. Thus his genus *Calliopteroma*, referred by him to the *Ichneumonidæ*, belongs to the *Encyrtidæ* (*Chalcididæ*) according to that eminent authority Dr. Wm. H. Ashmead, *cf.* Proc. U. S. Nat. Mus. XXIII., 152. The late Mr. Francis Walker described (Ann. Mag. Nat. Hist. 1860, VI.), a number of species and some new genera, none of which I have been able to identify, nor has Dr. Ashmead, *l.c.*, been able to refer them to their proper tribes. I do not know where Walker's types are. Apparently they are not in the British Museum, otherwise Col. C. T. Bingham would have described the aculeates in his work on the Aculeate Hymenoptera of British India and Ceylon. In that work he has merely reproduced Walker's descriptions. I have myself (Manchester Memoirs) described a few species taken by Mr. G. A. J. Rothney and by Col. Yerbury, and in Proc. U. S. Nat. Mus. XVIII., Dr. Ashmead has described some species, mostly reared from Lepidoptera and Coccidæ, taken or bred by Mr. Green. And some species have been described by J. O. Westwood in his Thesaurus Entomologicus Oxoniensis. From what I have said it is evident that our information regarding the Hymenoptera of Ceylon is of a very restricted nature—a remark that applies with even more force to Southern India.

The following species are here described :—

SIRICIDÆ.

1. Xiphydria striatifrons, n. sp.

BETHYLINÆ.

2. Epyris foveatus, n. sp.
3. Rhacoteleia pilosa, n. g. et sp.

CHALCIDIDÆ.

4. Spilomegastigmus ruficeps, n. g. et sp.

EVANIIDÆ.

5. Evania interstitialis, n. sp.
6. Evania peradeniyæ, n. sp.
7. Gasteruption tricoloratum, n. sp.
6. Gasteruption ceylonicum, n. sp.

AGATHIDINÆ.

9. Agathis kandyensis, n. sp.
10. Agathis oya, n. sp.
11. Agathis ceylonicus, n. sp.
12. Microdus greeni, n. sp.

CHELONINÆ.

13. Chelonus tricoloratus, n. sp.
14. Phomerotoma hendecasisella, n. sp.

CARDIOCHILINÆ.

15. Ernestiella nigromaculata, n. g. et sp.

MICROGASTERINÆ.

16. Microgaster carinicollis, n. sp.

BRACONINÆ.

17. Iphiaulax xanthopsis, n. sp.
18. Iphiaulax fulvopilosus, n. sp.
19. Iphiaulax greeni, n. sp.
20. Iphiaulax ernesti, n. sp.
21. Iphiaulax kirbyi, n. sp.
22. Iphiaulax erythroura, n. sp.
23. Iphiaulax haragamensis, n. sp.
24. Rhacospathius striolatus, n. g. et sp.
25. Philomacroplœa basimacula, n. g. et sp.

RHOGADINÆ.

26. Paraspinaria pilosa, n. g. et sp.
27. Holcobracon fulvus, n. g. et sp.
28. Tropobracon luteus, n. g. et sp.
29. Troporhogas spilonotus, n. g. et sp.
30. Troporhogas albipes, n. sp.
31. Troporhogas maculipennis, n. sp.
32. Troporhogas tricolor, n. sp.
33. Troporhogas ruficeps, n. sp.
34. Troporhogas lateralis, n. sp.
35. Troporhogas trimaculata, n. sp.

CRYPTINÆ.

36. Bathycrisis striaticollis, n. g. et sp.

SIRICIDÆ.

1.—*Xiphydria striatifrons*, sp. nov.

Plate A, fig. 1.

Black, a large irregular mark, broader than long, on the face, two small irregular oblique marks above the antennæ, a line on the inner eye orbits, with a rounded projecting point in the middle and dilated above; on the outer side the line is continued half way up the eyes, the upper part projecting obliquely outwards, a large mark on the top of the temples, irregularly narrowed on the inner side, the base and lower side of the propleuræ, the apex, two small spots on the base of the scutellum, a small and a large mark

closely united on the sides of the post-scutellum, a longish mark on the sides of the first abdominal segment, a small one on the third and fifth, a slightly larger one on the fourth, a large, long, oblique one on the penultimate, and an oblique mark, transverse behind, more irregular at the base, and narrowed to a point below on the last abdominal segment, and a thin curved narrow line on the top of the mesopleuræ, white. Legs dark red, the coxæ marked with white; the hind tibiæ darker, their base and the metatarsus white, the other joints of the hind tarsi, blackish. The inner side of the mandibles dark rufous. Wings hyaline, highly iridescent, the nervures and stigma black, ♀.

Length 11·5 mm.

Pundalu-oya, February.

Front furrowed in the middle, the furrow widest above: closely, distinctly striated, the striæ becoming strongest below and extending on to the face. Vertex smooth, shining. Middle lobe of mesonotum closely rugose; the apex reticulated; the lateral lobes irregularly transversely striated. Scutellum coarsely rugose at the base, the rest smooth and shining. Apex of propleuræ sparsely, the mesopleuræ more closely and strongly punctured throughout. Transverse marginal nervure received very shortly beyond the second transverse cubital, which is roundly curved towards the base of the wings; both the recurrent nervures are received near the apex of the basal third of the cellule.

The antennæ are 15-jointed, have the flagellum thickly covered with a short, black, stiff pubescence and taper distinctly and gradually towards the apex.

This species may be known from the two known Indian species (*X. 4-maculata*, Cam. & *orientalis*, West.) by the antennæ being 15-jointed, in addition to the other specific differences.

Bethylinæ.

2.—*Epyris* (?) *foveatus*, sp. nov.

Black, shining, the mandibles, antennæ, and legs rufotestaceous; wings hyaline, the basal nervures and costa testaceous, the stigma and stigmal branch darker coloured; the head, thorax, and ventral surface covered with longish fuscous hair, ♂.

Length 4 mm.

Peradeniya, May.

Flagellum of antennæ densely covered with long white pubescence, as long as the thorax; scape about four times as long as its thickness at the apex; pedicle longer than wide fully half the length of the first flagellar joint, which is of the length of the second; the last two joints are darker coloured, about three times

longer than thick. Parapsidal furrows and the transverse furrow at the base of scutellum wide and deep. Post-scutellum with a deep, semi-circular fovea in the centre at the base. A deep transverse furrow at the base of the metanotum, widened laterally and bounded at the apex by a stout keel. Metanotum with a stout keel down the middle, stoutly transversely striated; the apical slope finely transversely striated in the middle. Pro- and meso-pleuræ smooth; a deep oval fovea near the centre of the mesopleuræ, with a smaller one below; shortly beyond the middle is a deep depression finely striated in the centre, rounded below, where it is wider than it is above. Metapleuræ finely, closely striated. First abdominal stoutly keeled in the middle at the base and with a narrower keel on either side; the apex testaceous. Fore legs and femora slender. Apical tooth of mandibles long, sharply pointed, the others indistinct. Clypeus projecting, roundly narrowed at the apex. Basal abscissa of radius straight, obliquely sloped; the apical roundly curved.

This is not a true *Epyris;* but having only a single ♂, I do not care to found a new genus on it. It has practically only one long tooth on the mandibles, and in the clypeus projecting at the apex it differs from the typical species.

Rhacoteleia, gen. nov.

Sub-marginal nervure long, longer than the others united, marginal nervure very short, half the length of the stigmal, which has a knob at the end, the post marginal about three times the length of stigmal branch. Antennæ 13-jointed, the last six forming a club. Mesonotum and scutellum flat, the parapsidal furrows distinct, crenulated. Abdomen longish, longer than the head and thorax united, convex above and below, the sides margined; sessile, the basal segment strongly striated, the striæ distinct and clearly separated; the base of the second segment depressed, stoutly striated; the base of the first clearly margined. Mesopleuræ largely and deeply excavated. Scutellum broader than long, transverse at the base and apex, where there is a crenulated furrow. The third abdominal segment is longer than the second and fourth, which are about the same size. Antennæ inserted immediately over the mouth; the scape long. Legs slender, all the tibiæ one-spurred, the basal joint of hind tibiæ as long as the others united, about three times longer than the second. Metanotum rugosely punctured, shorter than the scutellum, depressed and transverse at the apex.

The head is large, rounded in front, transverse behind; the occiput margined; temples wide; ocelli in a triangle, the hinder

almost touching the eyes. Prothorax small. Malar space large. Eyes gradually narrowed from above downwards. The wings, when folded, do not reach to the apex of the abdomen.

Allied to *Macroteleia* and *Chromoteleia*; from the former it may be known by the stigmal vein issuing from near the submarginal, the marginal being very short as it is in *Chromoteleia*, but that has two distinct basal cellules; from both it may be known by the strongly striated basal segments of the abdomen.

3.—*Rhacoteleia pilosa*, sp. nov.

Plate A, fig. 2.

Black, covered with white pubescence, the antennæ except the apical five or six joints and the legs, except the coxæ rufo-testaceous, wings hyaline, the nervures testaceous, ♂ and ♀.

Length 4 mm.

Peradeniya, August.

Vertex finely, closely aciculated; the front irregularly rugosely punctured; malar space closely, obliquely striated. Apex of mandibles broadly rufous. Hind edge of vertex closely, finely reticulated; occiput shining, finely closely, transversely striated. Mesonotum and scutellum with shallow moderately close, round punctures, thickly covered with white pubescence; lateral lobes of mesonotum clearly separated from the middle one; on the outer side they are bordered by a crenulated furrow. Apex of scutellum bordered by a smooth, shining keel. The depression bordering its sides with stout clearly-separated keels. Pleuræ finely rugose, the mesopleural depression shining, bare, its sides obscurely striated. The third and following abdominal segments distinctly closely punctured. Mesosternum strongly closely punctured. Ventral surface of abdomen closely punctured, thickly covered with white pubescence.

The pedicle of the antennæ is about three times longer than thick; the first joint of flagellum is longer than the second and not quite double the length of the pedicle. The club is clearly defined; its last joint conical. The apices of the abdominal segments are smooth and shining; the ovipositor is longer than usual. The ♂ appears to have the front more strongly rugosely reticulated than the ♀.

Chalcididæ.

Spilomegastigmus, gen. nov.

Mandibles bidentate, the teeth blunt. Head and thorax smooth, the mesonotum only slightly transversely striated. Scutellum smooth, without a transverse furrow. Antennæ long, the scape

slender, its apex reaching to the hinder ocelli. Hypopygium long, plough-share shaped. Legs long and slender. Apex of clypeus roundly incised.

This new genus cannot well be confounded with any of the described genera of *Megastigminæ*. It comes nearest to *Megastigmus*, which may be known from it by the punctured scutellum with a transverse furrow at the apex, by the distinctly 3-dentate mandibles and by the shorter antennal scape, the top of which does not reach to the ocelli. Characteristic is the spotted abdomen, the red head and the thorax, and the projecting cultriform hypopygium.

4.—*Spilomegastigmus ruficeps*, sp. nov.

Plate A, fig. 3.

Black, the head, antennal scape, prothorax, mesonotum, the upper part of the mesopleuræ at the base, and scutellum, red; the legs yellow, the femora slightly tinged with rufous; on the sides of the abdomen are four yellow marks, the second is larger and rounder than the others, the apical two longer and narrower than the basal, the wings hyaline, the nervures and stigma black; there is a slightly oblique cloud, narrowed below, at the stigma, ♀.

Length 6; ovipositor 11 mm.

Kandy, July.

Front excavated in the middle with a keel down the centre, the sides roundly convex, projecting beyond the eyes; infuscated. Head much wider than the thorax. Mandibles and sides of clypeus black. Mesonotum transversely striated, but not closely or strongly. Scutellum perfectly smooth. Mesopleuræ obscurely striated. Sheath of ovipositor fringed with long black hair.

EVANIIDÆ.

5.—*Evania interstitialis*, sp. nov.

Red; the head and abdomen, except the petiole, black, the four front legs and hind coxæ rufous, the rest of hind legs black, except the trochanters which are red, mixed with black, the basal half of metatarsus and calcaria which are testaceous and a broad band on the base of the tibiæ, which is white; wings hyaline, the nervures black, the seven or eight basal joints of antennæ testaceous beneath, ♂.

Length 5 mm.

Pundalu-oya, October.

Antennal scape as long as the following two joints united; the pedicle and first joint of flagellum as long as the second united. Head thickly covered with white pile; the front and vertex smooth and shining; the face, oral region and malar space closely,

strongly striated. Apex of clypeus and of cheeks rufo-testaceous. Mandibles yellow, tinged with testaceous, the teeth black. Hind ocelli separated from each other by a distinctly greater distance than they are from the eyes, which very slightly converge above. Middle lobe of mesonotum with some large scattered punctures; the lateral lobes more closely and finely punctured. Scutellum smooth in the centre, the rest bearing large, round, clearly separated punctures. Metanotum closely, reticulated, punctured. Propleuræ smooth, the apex closely striated, the base below with a few short keels. The dilated lower part of the mesopleuræ with shallow, clearly separated round punctures: the edges crenulated. Sternal process distinctly diverging: the branches stout and rounded at the apex. Abdominal petiole longer than the rest of the abdomen, its apical half with scattered punctures, which give it a rough appearance. On the base of the hind coxæ behind is a smooth shining, raised, elongate space, clearly defined from the punctured parts and having at the apex a projecting keel, when pressed together the coxæ appear to be united. Tibiæ minutely, sparsely spinose. The long spur of the hind tibiæ reaches to shortly beyond the middle of the metatarsus.

Pronotum transverse in the middle at the base; the sides broadly rounded, slightly projecting. Cheeks not quite so long as the antennal scape, parapsidal furrows deep, smooth clearly defined. Apical abscissa of radius broadly rounded; recurrent nervure interstitial, as is also the transverse median; the cubitus is largely bullated at the transverse cubital nervure. There is a keel on the upper two-thirds of the face, down the centre.

Allied to *E. dolichopus*, Schl.

6.—*Evania peradeniyæ*, sp. nov.

Length 4 mm. ♂.

Peradeniya, August.

This species is black with the thorax red as in the preceding species. The two may be separated thus :—

Recurrent nervure interstitial, oral region rufous at the apex, face strongly striated and weakly keeled in the middle, hind coxæ rufous above, *interstitialis*.

Recurrent nervure received beyond the transverse cubital, oral region entirely black, face weakly striated and strongly keeled in the centre, hind coxæ black above, *peradeniyæ*.

Scape and pedicle of antennæ rufous. Scape of antennæ not much longer than the first joint of flagellum, which is, with the pedicle, as long as the second. Face closely, weakly striated; a stout keel on the upper two-thirds; malar space rather strongly, obliquely striated; thickly covered with white pubescence.

Front and vertex smooth and shining. Hind ocelli separated from each other by a slightly greater distance than they are from the eyes, which converge very slightly above. Shoulders broadly rounded. Mesonotum with a regular row of punctures on the inner side of the furrows and a less regular one on the outer; the lateral lobes minutely closely punctured in the centre. Scutellum with a broad smooth band in the middle, the sides strongly punctured. Hinder division of propleuræ rugosely punctured. Mesopleuræ with round closely pressed punctures, except for an oblique smooth band in the middle and a smaller triangular space on the upper side at the apex. Anterior tibiæ and tarsi testaceous, middle trochanters pale testaceous; the middle coxæ and the underside of the hinder pair at the base rufous; the base of the hind tibiæ and of the hind tarsi white; the spurs testaceous; the long spur of the hinder about two-thirds of the length of the metatarsus; tibiæ and tarsi sparsely spinose. Recurrent nervure received shortly beyond the transverse cubital; lower part of the apical abscissa of the radius broadly, roundly curved. Abdominal petiole above finely closely striated; the sides with two stout keels, which become stouter towards the apex. Hind coxæ above at the base coarsely punctured, the middle closely obliquely striated. Apical branches of metasternal process, straight, obliquely diverging.

Comes close to *E. erythrosoma*, Sch., also from Ceylon. It may be known *inter alia* from our species by its perfectly smooth abdominal petiole.

7.—*Gasteruption tricoloratum*, sp. nov.

Black, densely covered with silvery pubescence; the four front coxæ black, the femora rufo-testaceous, the tibiæ fuscous, broadly white at the base, the fore tarsi white, the middle white, infuscated at the apex, the hind legs black, except for a narrow white band near the base of the tibiæ. Mandibles testaceous, tinged with yellow in the middle, the teeth darker coloured; palpi pale testaceous, wings clear hyaline, the nervures black; apex of ovipositor testaceous, ♀.

Length 12 mm.; ovipositor 12 mm.

Peradeniya, May.

Head smooth and shining, covered with a silvery pile. Hind ocelli separated from each other by the length of the antennal scape. Thorax thickly covered with silvery pubescence; the pro- and mesonotum with round, clearly separated shallow punctures; opaque, granular. Scutellum with a row of round, deep foveæ along the sides. Metanotum with a deep shining

furrow down the middle: the rest irregularly reticulated. The third joint of the antennæ is about one half the length of the fourth, and twice the length of the pedicle. Apical half of mesopleuræ obscurely reticulated; on the apex is a deep, shining, smooth furrow. Second discoidal cellule divided.

8.—*Gasteruption ceylonicum*, sp. nov.

Black, the mesopleuræ and mesosternum ferruginous; the legs black, the fore coxæ ferruginous, the fore femora fuscous; the base of the fore tibiæ and of the tarsi more broadly, white; the hind tibiæ white on the under side at the base. Wings clear hyaline, the nervures black, the second discoidal cellule divided, ♀.

Length 13 mm.; terebra 13 mm.

Pundalu-oya. February.

Third joint of antennæ as long as the scape, more than half the length of the fourth and not twice the length of the pedicle. Mandibles rufous. Centre of clypeus covered with pale golden pubescence. Hind ocelli separated by the length of the third antennal joint. Thorax thickly covered with silvery pubescence. Pronotum stoutly keeled down the middle. Middle lobe of mesonotum closely finely transversely striated; the apex coarsely, irregularly reticulated; the furrows bordering the middle lobe crenulated; the furrows bordering the scutellum indistinct. Metanotum closely transversely reticulated and with a smooth line down the middle. Shoulders with strong, stout teeth; the part behind these closely, irregularly reticulated, the middle depression crenulated. Lower half of mesopleuræ reticulated.

AGATHIDINÆ.

9.—*Agathis kandyensis*, sp. nov.

Luteous, the antennæ, the hind tibiæ and the hind tarsi black: wings hyaline, the base tinged with yellow, a large cloud at the base of the stigma, broadest behind and the apex from near the second cubital cellule dark smoky, the hind wings with a faint smoky cloud at the apex, ♂.

Length 7 mm.

Kandy, May to August.

Head covered with short fuscous hair, lower part of occiput and the malar space distinctly keeled. Pro- and mesothorax closely and rather strongly punctured; the middle lobe raised in the centre, depressed on either side. Scutellum strongly and closely punctured; its apex roundly projecting. Base of metanotum obliquely depressed, irregularly reticulated; the middle strongly irregularly areolated; the central area irregular;

that next to the spiracular triangular, with a curved keel on the innerside; the apical slope bordered by areæ which are widest below; the centre with some irregular keels. Pleuræ strongly and closely punctured; the crenulated furrow on the mesopleuræ wide, with strong striæ; there is an oblique keel on the centre of the metapleuræ.

10.—*Agathis oya*, sp. nov.

Length 7·8 mm., ♀ and ♂.

Kandy, July and August. Pundalu-oya, May.

This species is very similar to the preceding; it may be known by the apex only of the hind tibiæ being black; by the middle lobe of mesonotum being smooth and not raised in the centre, by the central area on the metanotum being distinctly divided into a large basal and a smaller apical area; it is joined to the base of the metanotum by a V-shaped area; the lateral area is triangular; on the apical slope is a V-shaped area bordered by a more irregular V-shaped one. Wings yellowish hyaline, with the costa, stigma, and nervures yellow on the hyaline parts: the first cloud commences at the transverse basal and median nervures, and is narrowed in front, the apical at the end of the stigma; the nervures in the hind wings are yellow, with a slight cloud at the apex. Parapsidal furrows faintly striated.

11.—*Agathis ceylonicus*, sp. nov.

Luteous, the greater part of the vertex, upper part of occiput, the third and following segments of abdomen and the hind tibiæ and tarsi, black; the wings yellowish hyaline, the apex with a fuscous cloud, commencing at the end of the radial cellule; there is a small square black mark at the base of the stigma, ♀.

Length 7 mm.

Kandy, July.

The black antennæ thickly covered with short, stiff pubescence: they are brownish towards the apex. Face and clypeus thickly covered with white, the upper part of vertex and occiput with fuscous pubescence. Thorax smooth and shining, above thickly covered with white pubescence. Apex of scutellum bifoveate, the foveæ shallow. On the base of the metanotum are three small areæ, the central the smaller, with the sides rounded narrowed towards the base, the lateral longer, obliquely narrowed towards the apex; outside these is a triangular area with the apex on the inner side; the central area on the apical slope is triangular; the two areæ outside this are open below; the outer area large, with three angles on the outer side.

12.—*Microdus greeni*, sp. nov.

Ferruginous, the vertex and more or less of mesonotum may be infuscated or blackish, antennal scape rufous ; the basal half of the flagellum black, the apical testaceous, tinged with yellow : wings yellowish hyaline to the base of the stigma, beyond that dark fuscous, the first and second cubital cellules and a curved cloud below hyaline ; the stigma and apical nervures black ; the hind tarsi infuscated; the basal three segments of abdomen and the base of the fourth strongly closely longitudinally, striated.♀

Length 10 mm. terebra 9 mm.

Kandy, July and August.

Head smooth, sparsely pilose ; the lower part of the front deeply bifoveate ; the space separating the two foveæ triangular. Thorax smooth and shining ; the parapsidal furrows deep, smooth. On the base of the metanotum is a curved furrow forming a closed area and having a straight keel in the centre, dividing it into two. From its centre two stout keels run to the apex of the segment forming an elongated area, obliquely narrowed at the base. Pleuræ smooth, the metapleuræ densely pilose, the lower edge bordered by a stout waved furrow. Mesosternal furrow wide, deep, widened at the apex and with some stout transverse keels.

This species is probably variable as regards the amount of black on the vertex, thorax, and apex of abdomen. The antennæ are longer than the body.

CHELONINÆ.

13.—*Chelonus tricoloratus*, sp. nov.

Black, the antennal scape, and pedicle rufous : the anterior legs, middle coxæ and trochanters, and posterior trochanters rufo-testaceous, two spots near the base of the abdomen and a broad band at the base of the hind tibiæ pale testaceous. Wings hyaline to the base of the radius, fuscous beyond it ; the nervures and stigma black. Antennæ 23-jointed, ♀.

Length 4 mm.

Trincomalee Col. Yerbury.

Head and thorax closely finely rugose, covered with a minute white pubescence. Mesonotum closely reticulated. Scutellum with some, not very distinct longitudinal striæ. Metanotum irregularly reticulated, more strongly on the apex than on the base of the basal division ; the apical slope shining, smooth, reticulated above. Base of abdomen longitudinally striated ; the striæ are not numerous and become weaker towards the apex. Pleuræ closely reticulated.

14.—*Phanerotoma hendecasisella*, sp. nov.

Pallid ferruginous to pale testaceous, the apical segment ferruginous: antennæ infuscated at the apex: wings clear hyaline, the stigma and nervures fuscous, the former paler at the base and apex, ♂ and ♀.

Length 3 to 4 mm.

Peradeniya July to December.

Bred from beans (*Canavalia*, sp.) bored by minute pyralid (?) and from buds of *Jasminum pubescens* infested by larvæ of *Hendecasis duplifascialis*, Hmpsn.

Antennæ 23-jointed, longer than the body. Head shagreened; temples roundly narrowed, occiput deeply roundly incised; clypeus shining, almost smooth, thickly covered with long pale hair; its sides above with a large, deep fovea. Mesonotum coarsely shagreened, its apex obscurely striated; parapsidal furrows only indicated. The suture at the base of scutellum crenulated. Scutellum triangular; its lateral slope stoutly obliquely striated; at its apex is a broad shining black transverse stripe. Metanotum more coarsely shagreened—almost punctured—than the mesonotum; there is a not very strong transverse keel across the middle, above the apical slope; the sides below this project into a blunt tooth or tubercle. Apex of propleuræ obscurely striated; the lower part, at the apex, depressed, with a few distinct short keels. Basal two segments of abdomen shagreened; the apical at the base finely, closely reticulated—punctured, the middle and, to a less extent, the apex, finely, closely, longitudinally striated; the dorsal sutures obscurely crenulated. Second cubital cellule much narrowed at the apex, the nervures almost touching there; the basal abscissa of the radius bounding it is straight and sharply oblique, the abscissa of the cubitus broadly roundly curved, pale at the base; the recurrent nervure interstitial; it and the first transverse cubital nervure are pale, but quite clearly defined. The apex of the hind femora and the hind tibiæ ferruginous; the extreme base of the latter and a broad band above the middle are pallid, almost white. The basal depression of the abdomen is bordered by a keel, which is very faint, if not absent from the middle.

The first and second abscissæ of the radius are roundly curved downwards, the two forming an arc of a circle; the first transverse cubital nervure is straight, oblique to the stigma, then bends to run along side it to the radius, which it joins close to its base, quite close to the stigma. The wings are unclouded and highly iridescent. The second transverse cubital nervure is very faint and not half the length of the recurrent nervure.

CARDIOCHILINÆ.

Ernestiella, gen. nov.

Eyes pilose. Malar space large. Front not much excavated, without keels. Second cubital cellule large, much longer than wide, wider at the base that at the apex; radius roundly curved towards the costa. Transverse median nervure received in the first cubital cellule, clearly distant from the transverse basal; the recurrent nervure received in the first cubital cellule. Radial cellule in hind wings divided. Metanotum areolated. Suturiform articulation distinct. Abdomen short: ovipositor short. Trophi elongate.

The first and second cubital cellules are separated. Parapsidal furrows deep, the mesonotum distinctly trilobate: the scutellum raised, not keeled. Areola large, 7-angled. The face is not so much lengthened as in *Agathis*, the malar space being about one-third of the length of the eyes. Apex of clypeus broadly rounded: it is separated from the face by a furrow and is broader than long. Anal nervure in fore wings interstitial. Antennæ about 40-jointed. Prodiscoidal cellule open at apex; there is a large cellule at the base of hind wings. Hind calcaria long.

15.—*Ernestiella nigromaculata*, sp. nov.

Luteous, a large broad mark enclosing the ocelli, three large marks on the mesonotum, the central the larger, the greater part of the mesosternum, the antennæ and mandibular teeth, black; wings hyaline, the apex broadly infuscated, stigma black, yellowish at the base; the nervures testaceous, the radius pale at the base. Smooth, shining covered with pale hair. Parapsidal furrows crenulated at the apex. Scutellar depression with six stout keels. Behind the large 7-angled area on the metanotum are two small ones obliquely narrowed behind; on the sides three large irregular ones; on the sides of the apical slope a large one, obliquely narrowed on the outer side, the apex of the middle transverse. Metapleuræ obscurely reticulated. First discoidal cellule at apex half the width it is at the base. Propleuræ deeply excavated, striated below.

Length 6 mm.

Pundalu-oya, March.

MICROGASTERINÆ.

16.—*Microgaster* (?) *carinicollis*, sp. nov.

Areolet large, rounded in front, transverse below; cubitus distinct, radius faint at the base; three cubital cells. Antennæ stout, longer than the body, 19-jointed. Clypeus not separated from the face, foveate at the sides above. Scutellar depression, with a row of stout keels; the apex is bordered by a similar row of keels.

Metanotum keeled down the middle ; the apical slope stoutly reticulated, almost areolated ; eyes villose ; malar space large. First abdominal segment with the central area bordered by keels and with a shorter keel in the centre. Suturiform articulation distinct. Mesopleural furrow wanting. Tibial spurs short, about one-fourth of the length of the metatarsus. There is a narrow, but distinct keel round the centre of the prothorax. Radius and cubitus in hind wings indistinct. Shortly below the middle of the mesopleuræ is a furrow which bifurcates at the apex. On the mesonotum, in the centre, are three furrows, central being the shorter and it is also less distinct. Apices of tarsal joints spinose.

Black ; palpi and four front legs testaceous ; the hind femora and the abdomen, except at the base, red ; the basal two-thirds of the hind tibiæ and the calcaria white, wings hyaline, the nervures and stigma black, the latter white at the base. Head and thorax densely covered with white pubescence, almost opaque. Metanotum depressed at the base. The depression at base of post-scutellum with four stout keels. Post-scutellum depressed at the base. Frontal depression clearly separated, deep, stoutly keeled in the middle. Last joint of tarsi one-half longer than penultimate.

Length nearly 5 mm.

This species comes closest to *Microgaster* as now defined, but is not quite typical.

Bred from larva of *Dasychira securis*. June.

Braconinæ.

17.—*Iphiaulax xanthopsis*, sp. nov.

Luteous, the face, oral region, malar space and inner upper eye orbits, yellow; the antennæ very long, black ; hind tarsi fuscous ; wings yellowish hyaline to the middle of the transverse basal nervure ; beyond that blackish-fuscous ; the upper part of the first cubital cellule and a spot below the first transverse cubital nervure hyaline ; basal half of stigma luteous, ♀.

Length 11; terebra 4 mm.

Elephant Pass, March.

Face smooth, densely covered with long pale hair. Frontal furrow narrow ; vertex thickly covered with long fuscous hair. Thorax smooth ; impunctate, the median segment thickly covered with long pale hair. Abdomen ovate, broader than the thorax, short ; the area on the first segment longitudinally rugosely striolated ; a keel in the centre; basal depression smooth. Basal area on the second segment closely striated, not much narrowed towards the apex ; not limited at the apex ; the rest of the segment and the third closely, strongly, rugosely, punctured ; the lateral depression

oblique, large, deep, striated ; suturiform articulation, wide, deep, striated ; the third segment is closely rugosely punctured ; the furrow on its apex is obscurely striated ; the fourth segment is punctured, but not closely or strongly; the furrow at its base wide, deep, striated ; that on its apex crenulated. The fifth and following segments smooth ; the apical two are yellowish ; on the centre of the fifth is a deep wide furrow on the apical half ; on the sides, at the base, is a wide curved striated furrow.

18.—*Iphiaulax fulvopilosus*, sp. nov.

Luteous, the antennæ black ; wings yellowish-hyaline, to near the transverse basal nervure, beyond that dark fulvous; a hyaline cloud occupying the greater part of the first cubital cellule and a smaller one along the outer side of the recurrent nervure ; the base of the stigma fulvous. Pubescence dense, fulvous, ♀.

Length 17 ; terebra 6 mm.

Kandy, June.

Front and vertex sparsely, the face thickly covered with long fulvous pubescence. Tips of mandibles black. Palpi fulvous, covered with fulvous hair. Middle of raised part of first abdominal segment stoutly keeled from near the base ; its apex strongly punctured. Basal area on second segment large, triangular, obliquely striated, the oblique striæ, united by curved short ones, forming irregular reticulations ; the sides of the segment at the base depressed, without oblique furrows ; its apical part and the other segments all over closely, longitudinally striated. Suturiform articulation narrow, deep, striated, not cleft at the sides ; the furrows on the following three segments are wider and more dilated in the middle ; the basal four segments together are as long as the thorax. Legs stout ; the basal four joints of the fore tarsi as long as the tibiæ. The abdomen thickly covered with fulvous pubescence.

19.—*Iphiaulax greeni*, sp. nov.

Black, the scape of antennæ, head, thorax, and four front legs red ; wings dark fuscous, the nervures and stigma black, ♀.

Length 11 ; terebra 17 to 18 mm.

Peradeniya, August and November.

Face rugosely punctured, a smooth line, gradually widened towards the apex in the centre ; sparsely covered with long fuscous hair ; frontal furrow shallow. First abdominal segment in the centre with four stout irregular longitudinal keels ; the outer two unite into one which goes to the apex ; the sides of the raised central part margined ; on the sides of the central keels are irregular, more or less transverse keels ; the lateral depressions irregularly transversely striated. The area on the second segment is long,

reaching beyond the middle of the segment, becoming gradually narrowed to a fine point and continued to the apex by a keel; its base is irregularly longitudinally striated; the depression bordering it closely strongly transversely striated; on the outer side is a long pyriform fovea. Suturiform articulation wide, closely, strongly striated; the furrow on the apex of the third segment and on the base of the fourth are striated; on the apex of the fourth is a smooth furrow; the third segment is strongly and closely striated, but not so strongly, as the second; the fourth is more finely and closely striated. Hind tibiæ and tarsi densely covered with black hair. Apex of sheaths of ovipositor white. Apical abscissa of radius curved, slightly longer than the basal two united; received in the apex of the first cubital cellule, clearly distant from the first transverse cubital nervure.

20.—*Iphiaulax ernesti*, sp. nov.

Head and thorax red; the four front legs yellow, their coxæ tinged with rufous, hind legs fuscous black; wings fuscous, hyaline, highly iridescent, the nervures and stigma black, ♀.

Length 8; terebra 12 mm.

Peradeniya, October.

Face rugose, thickly covered with long fuscous hair. Temples obliquely narrowed. Antennal scape rufous, about four times longer than thick, of equal width throughout. Front deeply furrowed. Middle area of first segment with two keels, which unite into one shortly beyond the middle; its sides margined and there is a curved keel which runs from the central two before they unite; the lateral furrows with some scattered transverse keels. The area on the second segment becomes gradually narrowed to a fine point shortly beyond the middle; the base finely, distinctly striated; the depression bordering it has some transverse, not very distinct, striæ; outside it are four curved longitudinal striæ; the fovea on the outer side is rounded at the apex and is of equal width. The third segment is closely, strongly longitudinally striated; the suturiform articulation, the furrow at the apex of the third and at the base of the fourth are striated; that on the apex of the fourth is smooth; there is a J-shaped striated furrow on the sides of the second segment at the base; the basal two-thirds of the fourth segment is finely, longitudinally striated.

A much smaller and more slenderly-built species than *I. greeni;* the fore legs are yellow, not rufous; the antennal scape is more slender and does not project at the apex, and the first and second abdominal segments are finely sparsely striated, not coarsely striated and reticulated.

21.—*Iphiaulax Kirbyi*, sp. nov.

Luteous; antennæ black; wings yellowish-hyaline, the apex with a fuscous border; the base and apex of stigma black, the rest of it and the nervures yellow, a small black cloud at the base of the first cubital cellule, between the radius and the cubitus, ♀.

Length 9 mm.; terebra 7 mm.

Kandy.

Sparsely covered with fulvous pubescence. Face irregularly rugose, covered with pale pubescence. Front and vertex smooth and shining, bare; the former deeply depressed with a deep, clearly defined furrow in the centre. First and second abscissa of radius united equal in length to the third; the cloud at the stigma may be continued along the basal abscissa of cubitus. Middle area of first abdominal segment irregularly, longitudinally striated, intermixed with some transverse striæ; the lateral depression with some transverse keels; the second segment coarsely reticulated in the middle; the basal area triangular, smooth; the oblique furrow on the lateral depression crenulated; the keel at the basal area short, indistinct. Suturiform articulation stoutly crenulated, as are also the furrows on the apex of the third and fourth segments; they are closely punctured.

22.—*Iphiaulax erythroura*, sp. nov.

Plate A, fig. 7.

Head, thorax, antennal scape and four front legs rufotestaceous; the abdomen black, the fifth and following segments bright ferruginous, the hypopygium paler, more yellowish at the base; wings yellowish-hyaline, paler at the apex; the middle tibiæ covered thickly with pale pubescence; the hinder still more thickly with longer black hair, ♀.

Length 12 mm.; terebra 17 mm.

Kandy.

Antennal scape thickly covered with long fulvous hair. Face coarsely rugosely reticulated. Thorax smooth and shining; the apex of median segment black. The central area of basal segment of abdomen stoutly keeled in the middle; the keel bordered by stout oblique striæ. The second segment is strongly longitudinally striated; the basal area small, triangular, smooth, followed by a stout keel which runs to the smooth apex; the third is similarly striated, but with a broader smooth apical area; both segments are depressed laterally; the suturiform articulation wide, deep; on the fourth segment, shortly behind the middle, is a transverse furrow which is irregularly striated in the middle. The basal abscissa of the radius is broadly roundly curved towards

the stigma ; transverse median nervure received shortly beyond the transverse basal. Occiput transverse in the middle, the sides broadly rounded.

Characteristic of this species is the broadly rounded basal abscissa—not straight and oblique as usual—of the radius and the fact of the transverse median nervure being received shortly beyond the transverse basal. The recurrent nervure is interstitial. The densely haired hind tibiæ are also noteworthy.

23.—*Iphiaulax haragamensis*, sp. nov.

Black ; the base and basal half of the sides of the ventral surface lacteous ; wings fuscous-hyaline, the nervures and stigma black, ♀.

Length 7 ; terebra 1·5 mm.

Haragam, July.

Head covered with longish hair, fuscous, silvery on the lower part of the face. Front and vertex smooth : the former deeply furrowed. A reddish spot above each antenna. Palpi black, covered with white pubescence. The pleuræ and the scutellar region marked with rufous. The first and basal half of the second abdominal segment coarsely rugosely punctured ; the following three strongly, closely, longitudinally striated ; the furrows are more closely striated ; the last segment white-lead coloured, finely, closely, transversely striated. Abdomen broad, ovate, as long as the head and thorax united ; the area on the base of second segment indistinct, smooth at the base, the apex finely striated.

Rhacospathius, gen. nov.

Plate A, fig. 4.

Transverse median nervure in fore wings received beyond the transverse basal. Metanotum with three large closed areæ at the base ; the central keel bifurcates at the apex, forming a triangular area open at the apex ; the rest of the segment and the pleuræ striated. Otherwise as in *Spathius*.

24.—*Rhacospathius striolatus*, sp. nov.

Black, the basal two-thirds of the second abdominal segment and the legs red, the fore legs paler, more yellowish in tint. Wings hyaline, the stigma and nervures fuscous, ♀.

Length 7 ; terebra 5 mm.

Kandy, October.

Mesonotum, except at the base of the central lobe, closely, strongly, irregularly reticulated. Scutellum minutely aciculated, the sides with a row of foveæ. Metanotum irregularly striated and

reticulated ; the basal areæ smooth at the base, the sides furrowed ; the inner side finely, closely striated along the central keel ; the apical slope irregularly rugosely striated. Propleuræ strongly obliquely, the upper part of the mesopleuræ longitudinally striated; the lower part, near the base, finely, closely, slightly, obliquely striated ; the apex rugosely punctured. Basal two-thirds of mesosternum bordered by a deep furrow. Abdominal petiole closely, strongly striated. Probrachial nervure in hind wings interstitial ; the third abscissa of radius longer than the basal two united. Face, except for a smooth shining line in the centre, closely transversely striated ; the front closely striated, except at the sides ; the vertex and temples smooth and shining. Legs sparsely haired ; the hind coxæ striated on the outer side.

Philomacroplœa, gen. nov.

Apex of sixth abdominal segment broadly, deeply, roundly incised in the middle. First abdominal segment sessile, excavated at the base, keeled on the top ; it, and the second segment, keeled down the middle ; the sutures of the segments narrow ; the apical segments are curled downwards ; the abdomen short, broad, not unlike the abdomen of *Chelonus*. Metanotum smooth and shining, stoutly keeled down the middle. Parapsidal furrows distinct, deep, crenulated. Last joint of hind tarsi not much dilated, as long as the second. Ovipositor short, broad. Antennæ longer than the body, the second joint of flagellum about twice longer than thick. Malar space large, furrowed down the middle. Third abscissa of radius about three or four times longer than the basal two united. Temples obliquely narrowed. A broad furrow behind the ocelli.

The abdomen is more like what it is in the *Cheloninæ* than in the *Braconinæ*. It is allied to *Tropidobracon*, *Baryproctus*, and *Plesiobracon*, all of which have a stout keel in the centre of the metanotum ; but, among other differences, the present genus should be readily separated from them by the keeled base of the first abdominal segment, by the first and second being keeled down the centre ; by the last segment being roundly broadly incised, and by the very long third abscissa of the radius.

25.—*Philomacroplœa basimacula*, sp. nov.

Head, thorax and the middle of the first and second abdominal segments broadly rufo-testaceous, the mesosternum and the base of metapleuræ above blackish ; wings hyaline, the nervures and stigma fuscous ; the legs pale testaceous, almost white, ♀ and ♂.

Length 3·5 mm.

Bred from *Macroplœa elisa*.

The long black antennæ densely covered with a short white microscopic pile, as are also the thorax and abdomen. The upper half of pleuræ closely, minutely punctured; the scutellum is less distinctly punctured, its sides densely pilose. Metanotum very smooth and shining. Abdomen very closely, uniformly, and rather strongly punctured; the apices of the third and following segments narrowly rufous at the apex. Scutellum triangular, broad at the base. The second cubital cellule is widened at the base, the first transverse cubital nervure being very obliquely sloped. The anal nervure in the fore wing issues from shortly below the middle of the transverse nervure. The lower half of the base of the mesopleuræ is depressed compared with the upper.

Rhogadinæ.

Paraspinaria, gen. nov.

Abdomen with seven segments; the first longer than broad, the central area large, wide; the second segment without an area; the sides depressed at the basal half; ovipositor short, hardly projecting. Metanotum irregularly reticulated; the sides at the apex, with a long stout tooth. Hind wings with an enclosed probrachial cellule, reaching shortly beyond the middle of the basal abscissa of the cubitus; the nervure broadly rounded at the apex; the cubitus and radius complete; there are no other apical nervures. Lower part of mesopleuræ depressed, clearly separated from the upper; the hind edge of mesosternum has a stout conical tooth. Radial cellule long reaching to the apex of the wing; apical abscissa of cubitus longer than the basal two united; recurrent nervure received in the first cubital cellule. Antennæ longer than the body; temples obliquely narrowed; occiput almost transverse, margined. Palpi long.

The affinities of this genus are clearly with *Spinaria*. That genus may be known from it by the abdomen having only five segments, these being spined and longitudinally striated; its anal nervure is interstitial and the prothorax has a spine as a rule. The antennæ in my genus are placed opposite the middle of the eyes, which are incised. The pronotum is large; its centre at the base is triangular, the rest is depressed at the sides and apex. Abdomen as long as the head and thorax united.

26.—*Paraspinaria pilosa*, sp. nov.

Plate A, fig. 9.

Luteous; antennal flagellum, apical third of hind tibiæ and the hind tarsi black; wings hyaline; the nervures and stigma yellow; the costa near the stigma and a small square cloud below it black, ♀.

Length 9 mm.

Kandy, June.

Shining, thickly covered with white pubescence. Parapsidal furrows deep, the middle lobe of mesonotum clearly raised. Base of propleuræ with three stout keels, the middle one not reaching, like the others, to the lower edge. Scutellar depression large, deep, with a stout central keel and a narrower oblique one on either side. Metanotum with four areæ on the centre of the basal region; the basal large, longer than broad, the apical smaller, dilated on the outer side; the other areæ not clearly defined. The apical lateral teeth are large, longer than the width at the base; they become gradually narrowed, with the apex rounded. First abdominal segment irregularly reticulated, the sides less strongly than the centre; the second is also irregularly reticulated; there is a keel down the centre, reaching to the apex; the lateral keels are stouter and shorter. Suturiform articulation stoutly, closely striated. The apical depression of the middle lobe of mesonotum is reticulated; there is a distinct furrow on the apex of the middle lobe. Metasternum bordered by a stout keel.

Holcobracon, gen. nov.

Lower part of mesopleuræ with a distinct crenulated furrow. Median segment closely reticulated, keeled down the middle; the sides at the apex below projecting into a blunt tubercle. Mandibles stout, edentate, the apex transverse in front, oblique, the basal half slightly roundly incised. Clypeus separated from the face by a depression, roundly convex, thickly covered with long hair. Malar space longer than the eyes. Temples broad. Occiput margined, more distinctly on the sides than above; roundly incised. Scutellum flat, legs stout; the fore coxæ largely project below, the trochanters issuing from the upper part; fore tibiæ stoutly toothed. Anal nervure in fore wings interstitial; in the hind wings there is a discoidal nervure which runs from the prædiscoidal to the apex, there being thus three longitudinal nervures in the hind wings; there is a large closed præbrachial cellule, which becomes gradually wider towards the apex. Abdomen broad, the basal segments closely striated; suturiform articulation deep, roundly curved.

The apical abscissa of radius reaches to the apex of the wings and is twice the length of the second; the transverse median nervure is received distinctly beyond the transverse basal; the recurrent in the first cubital cellule.

There are three genera known to me which possess the anomalous character of having a curved nervure issuing from the præbrachial

transverse nervure to the apex of the hind wings. These genera may be separated as follows :—

(*a*) Hind coxæ with two teeth...*Acanthobracon*, Cam. (Szep.).

(*b*) Hind coxæ toothless. Apex of mandibles stoutly toothed ; sides of median segment toothed at the sides above the apex, the scutellum convex...*Trichiobracon*.

Apex of mandibles not toothed, transverse ; sides of metanotum not toothed above ; the scutellum quite flat...*Holcobracon*.

These three genera form a natural tribe, *Holcobraconini*, allied to *Doryctini*, which should be readily known by the hind wings having three longitudinal nervures running to the apex of the wings; the abdomen sessile, the mesopleuræ with a distinct crenulated furrow along the lower border, the metanotum toothed or tuberculated above or below, closely reticulated and the basal three segments of abdomen longitudinally striated, with a distinct curved crenulated suturiform articulation and oblique furrows as in *Iphiaulax*, and stoutly toothed fore tibiæ.

27.—*Holcobracon fulvus*, sp. nov.

Plate A, fig. 6.

Rufo-fulvous, the antennæ black; wings yellowish-hyaline to near the apex of the transverse basal nervure, with an oblique, irregular cloud in the first cubital cellule, extending below into the discoidal ; the stigma luteous ; hind wings yellowish-hyaline, the apical third smoky, ♀.

Length 18 mm.

Kandy, November.

Body and legs thickly covered with long pale pubescence. Face and oral region closely, finely rugose, thickly covered with fuscous pubescence, the clypeus with long fuscous hair. Front and vertex smooth, shining, almost bare. Pronotum punctured, the punctures large, clearly separated, and each with a longish hair. Mesonotum and scutellum smooth, sparsely haired. The scutellar depression with five stout keels ; the central the larger. Metanotum with a keel down the centre, closely reticulated, the reticulations shallow, irregular in shape, some hexagonal. The centre of propleuræ with some irregular keels. The lower furrow on the mesonotum closely crenulated ; the oblique furrow below the tubercles wide, deep, and with some stout keels. The upper part of the metapleuræ irregularly, coarsely reticulated ; below the furrow strongly, irregularly punctured. Legs thickly covered with long pale pubescence. Basal three segments of abdomen strongly closely striated ; the suturiform articulation deep, roundly

curved, crenulated; there is an oblique furrow on the base of the second segment; the base of the fourth and fifth segments are closely striated.

The metapleuræ and base of abdomen are yellowish; the mandibles and ocellar region are black.

Tropobracon, gen. nov.

First abscissa of radius slightly longer than the second, both together as long as the first transverse cubital nervure. Recurrent nervure widely distant from the apex of the cellule. Second cubital cellule much narrowed in front, being there less than half the length it is posteriorly; apical abscissa four times the length of the basal two united, reaching to the apex of the wing. Parapsidal furrows deep, clearly defined, not reaching to the apex. Basal two joints of flagellum equal in length. Last joint of hind tarsi longer than the third, as long as the first. First segment of abdomen short, broader than long, the sides and top of the apical slope margined.

Abdomen coriaceous, short, broad; the area on the second segment large, reaching to the apex; the ovipositor short, not much longer than half the length of the abdomen.

This genus should be readily known by the recurrent nervure being received at a distinct distance from the apex of the cubital cellule, by the deep, clearly defined parapsidal furrows, keeled basal slope of first abdominal segment, by the short basal two abscissæ of radius, and by the second cubital cellule being narrowed in front and short. *Habrobracon*, Ashm., seems to be its nearest ally, but *inter alia*, that genus should be known by the "basal joint of hind tarsi being about the length of the third, shorter than the second," while in my genus it is double the length of the third and much longer than the second. The parapsidal furrows are much deeper and more clearly separated than usual.

28.—*Tropobracon luteus*, sp. nov.

Luteous, the antennæ black, the hind tibiæ and tarsi infuscated; wings hyaline, highly iridescent, the nervures and stigma black; the recurrent nervure received shortly beyond the middle of the cellule, ♀.

Length 4 mm.; terebra 1 mm.

Pundalu-oya, March.

Face shining, aciculated, covered with a white pile; a distinct curved furrow over the clypeus. Malar space long, two-thirds of the length of the eyes. Front and vertex smooth. Temples

oblique, rounded. Occiput rounded, not transverse. Mesonotum and scutellum shining ; its middle lobe reaches to the base of the apical third, is then united to the apex by a stout keel, with a narrow striated border on either side. Metanotum closely rugose. First abdominal segment short ; its base rather abruptly sloped, its sides and apex margined. The segments are closely, finely punctured ; the area on the second segment large, becoming gradually narrowed towards the apex ; the furrows striated, not uniting at the apex ; there are no lateral furrows at the base. Suturiform articulation striated : there are no furrows on the other segments. There is a distinct curved furrow below the middle of the propleuræ.

Troporhogas, gen. nov.

Transverse median nervure received near the base of the cellule, close to the transverse median ; recurrent nervure received near the apex of the cellule ; second cubital cellule twice longer than wide, of equal width throughout ; anal nervure not interstitial. Eyes large, clearly incised on the inner side ; malar space small. Temples short, oblique. Occiput sharply margined, transverse. Palpi very long, slender, pilose, 4- and 5-jointed. Metanotum with two roundly diverging keels on the base. A depression on the lower side of the mesopleuræ. Basal three segments of abdomen closely longitudinally striated ; the basal two with a keel down the centre ; suturiform articulation crenulated ; there are crenulated furrows on the fourth, fifth, and sixth segments ; the base of these segments is depressed, the apex of the segments being raised and clearly separated from the base of the following. Hypopygium large, cultriform ; ovipositor shortly projecting, the sheaths stout ; antennæ longer than the body, slender, pilose, over 50-jointed. The abdomen is fully twice the length of the thorax ; the legs long and slender ; the femora narrowed at the base. The first abscissa of the radius is not half the length of the second ; the third is the longest and is curved upwards. The tarsi longer than the tibiæ ; the metatarsus longer than the two following joints united.

In Dr. Ashmead's system (*l.c.*) this genus could only be confounded with *Rhogas* ; that genus may be known from it by the transverse median nervure being widely distant from the transverse basal, by the metanotum having a stout keel down the centre, not two at the base, by the shorter abdomen, with the segments not sharply separated ; the shorter and stouter legs with the tarsi not longer than the tibiæ ; and the hypopygium is not large and cultriform.

29.—*Troporhogas spilonotus*, sp. nov.

Pallid testaceous, the legs paler in tint; the ocellar region, marks, more or less distinct, on the mesonotum, the metanotum to the top of the apical slope, the base of the mesopleuræ and large marks on the base of the abdominal segments, the penultimate segment entirely, black. Wings clear hyaline, the nervures pallid testaceous, the basal half of the stigma fuscous, ♀.

Length 7 to 8 mm.

Peradeniya.

The amount of black on the thorax varies; the hind coxæ and trochanters may be marked with black. The entire body and legs thickly covered with white pubescence. First and second abdominal segments strongly and closely striated throughout; the third is less strongly and closely striated, the striæ becoming fainter towards the apex. The pleuræ may be largely marked with black: the mesopleural furrow is striated. Parapsidal furrows wide and deep; the apex of the middle lobe of the mesonotum is depressed and with a distinct furrow in the centre. Scutellar depression large, deep; a stout keel in the centre and a narrower oblique one on the sides. Scutellum narrowed towards the apex. Metanotum finely, irregularly rugose; the apex with some irregular keels.

30.—*Troporhogas albipes*, sp. nov.

Rufo-testaceous, the oral region, lower outer orbits, and legs white; the four hind coxæ brownish-red: a broad band on the thickened apex of the hind femora (but not reaching to the apex) black; scape of antennæ rufous, the flagellum yellowish-white. Wings hyaline, slightly suffused with fuscous; the apex with a fuscous narrow cloud round the edges; the stigma testaceous, the nervures fuscous, ♂.

Length 9 mm.

Kandy.

Sides of front stoutly, obliquely striated; face irregularly wrinkled. Propleuræ stoutly striated; the mesopleuræ wrinkled and irregularly striated, closely and strongly below; the metapleuræ closely, finely, rugosely punctured. Prosternum yellowish, depressed in the middle and with a longitudinal keel there, which is bordered by a row of foveæ. Parapsidal furrows striated; the apex of the middle lobe closely striated and reticulated. Scutellum convex, roundly narrowed towards the apex, which is rounded; a keel runs from the sides of the apex to the wings; the space inside this is depressed and striated in the middle. Median segment closely rugosely punctured, the punctures running into reticulations. Back of abdomen closely rugosely striated; the furrows are more strongly and distinctly striated.

31.—*Troporhogas maculipennis*, sp. nov.

Plate A, fig. 5.

Testaceous, the part between the ocelli, the greater part of the mesopleuræ, and the apical two segments of the abdomen blackish; the upper part of the thorax infuscated. Wings hyaline; the apex smoky, before and behind from before the second transverse cubital nervure, the middle from beyond it; there is a narrow cloud along the anal nervure, which is thick and black, the apex white and thinner. ♀.

Length 12 mm.

Kandy, July and August.

Vertex at the sides of the ocelli closely, the front more strongly obliquely striated. Face thickly covered with long fuscous hair. Mesonotum with a few scattered punctures, shining, covered with a short blackish pubescence. Scutellar depression not very deep; the central keel not very stout. Metanotum at the sides of the base closely rugose, the centre and the rest to the middle of the apical slope irregularly reticulated. Propleuræ with some stout oblique striæ; the mesopleuræ obscurely punctured, the centre with an oblique depression; metapleuræ closely rugosely punctured. Basal four segments of the abdomen closely longitudinally striated; the fifth closely and strongly, the others sparsely punctured.

32.—*Troporhogas tricolor*, sp. nov.

Plate A, fig. 8.

Antennæ black. Head rufo-testaceous, the vertex behind and the occiput black; the oral region, mandibles, and palpi pale yellow. Thorax black, the mesonotum, scutellum, and upper part of pleuræ rufo-testaceous. The first abdominal segment, the base and the sides, more broadly, especially behind, of the second, the sides of the third and fourth, the fifth, except for a line on the sides at the apex, and the apical, entirely yellow, this being also the case with the ventral surface. Four front legs whitish yellow; the middle tarsi infuscated; the hind legs black. Wings hyaline; the stigma and nervures black, ♀.

Length 7 to 8 mm.

Kandy, June.

Face closely punctured, the middle at the sides of the raised part striated. The vertex at the sides of the lower ocellus transversely, the front more coarsely, obliquely striated. Mesonotum and scutellum smooth, neither punctured nor striated. The basal keels on the metanotum are stout and have two transverse ones between them; the part on either side, almost smooth, on the

outer side distinctly striated ; the apical slope strongly, irregularly reticulated. Base of propleuræ and of mesopleuræ strongly striated ; the metapleuræ rugose, the apex striated. First abdominal segment closely punctured, finely striated on either side of the keel ; the second strongly, irregularly striated ; the suturiform articulation strongly, regularly striated ; the third and fourth, except at the apex, closely striated ; the other segments closely punctured. The radius and cubitus from the transverse cubital nervure are white.

33.—*Troporhogas ruficeps*, sp. nov.

Head and thorax rufo-testaceous, the antennæ dark fuscous ; the abdomen pale yellow, the first segment except round the apex and more narrowly on the sides, a curved mark on the apex of the second segment, and the greater part of the third, fourth, and fifth on the back, black ; the four front legs yellow, tinged with rufous ; the hind coxæ, femora, except at the base, and the apex of the tibiæ broadly, black, the rest of them whitish yellow ; the tarsi infuscated ; wings hyaline, the stigma and nervures fuscous, ♀.

Length 6·5 mm.

Peradeniya, December.

Face thickly covered with white pubescence ; the sides striated ; clypeal foveæ deep. Vertex behind the ocelli closely, finely striated. Pro- and mesonotum smooth, not striated, a furrow on the apex of the latter ; scutellum impunctate. The two keels on the base of metanotum form a ∧-shaped area, with a thin transverse keel at the apex. Basal five segments of abdomen closely longitudinally striated.

34.—*Troporhogas lateralis*, sp. nov.

Rufo-testaceous, the upper part of the pleuræ, the sides of metanotum broadly, the sides of the first abdominal segment broadly on the basal, more narrowly on the apical half, a line on the sides of the second, the line becoming gradually wider from the base to the apex, the third at the sides and its apex from shortly behind the middle, black. Legs pale yellow ; the apex of middle femora infuscated, the apical half of posterior black. Wings hyaline, the nervures and stigma black, ♀.

Length 5 mm.

Peradeniya, August.

Face raised in the centre, striated on either side. Side of front obscurely striated. Pro- and mesonotum shagreened ; parapsidal furrows shallow ; an indistinct transverse furrow at the apex.

Scutellar depression wide, roundly curved, deep, obscurely striated. Metanotum closely rugose, the basal keels indistinct, the sides with some oblique striæ. Pro-and mesopleuræ for the greater part closely reticulated; the metapleuræ finely rugose. The first and second abdominal segments are closely striated, the third obscurely so, the other segments smooth; the suturiform articulation indistinct, only indicated through the apex of the second being raised. The first abscissa of the radius is half the length of the second; the second cubital cellule is half the length of the third.

35.—*Troporhogas trimaculata*, sp. nov.

Rufo-testaceous, the pleuræ paler, more yellowish in colour, the ocellar region and three large marks on the mesonotum black: wings hyaline, highly iridescent, the nervures and stigma black: the costa, base and apex of stigma, and the transverse basal nervure testaceous. ♀.

Length 8 mm.

Kandy, July.

Smooth, shining, impunctate. Scutellar depression large, shallow, divided by a keel. Scutellum smooth, rufous at the apex. Post-scutellum rounded, conspicuous, smooth, dark rufous. Metanotum weakly punctured, a keel down its centre, the keel indistinct at the base. The basal four segments of abdomen closely punctured; the fifth indistinctly so; there is no keel on the basal segments.

A new Genus of Cryptinæ from Ceylon.

Bathycrisis, gen. nov.

Abdominal petiole of equal width throughout, the post-petiole not being dilated; it is long and slender. Median segment with two transverse keels; its spiracles about three times longer than wide. Transverse median nervure in hind wings broken below the middle. Disco-cubital nervure broken by a stump of a nervure. Areolet of almost equal width throughout. Apex of clypeus depressed, broadly rounded, above clearly separated from the face, which is dilated in the centre above, there being thus a depression between its apex and the clypeus. Flagellum of antennæ densely pilose, the first joint longer than the second. Front deeply excavated; a stout keel above each antenna. Eyes distinctly, roundly incised on the inner side; the malar space moderate. Parapsidal furrows deep, wide, reaching to the middle. There is a wide, deep, curved furrow on the base of the metanotum; there is no area there. Thorax strongly rugosely punctured. The abdomen is more slender than usual.

I only know the ♂ of this genus. It comes near to *Ospryncho-tus*, which may be known from it by the rostriform head, with long malar space, and by the disco-cubital nervure not being broken by a stump of a nervure. In *The Entomologist*, 1903, 182, I described an *Osprynchotus peronatus* from India. I was not then acquainted with the type of *Osprynchotus* from the Cape. Now that I have seen it, I find that my Indian species is a *Linnoceras*, Tasch.=*Osprynchotus* Schmied. *non* Spin. (Ent. Nachr. XVI., 85). *Linnoceras* may be known from the genus here described by the transverse median nervure in hind wings being broken at, not below, the middle, by the more elongate clypeus, not separated from the face, large projecting labrum, longer, more slender, mandibles, of which the upper tooth is much the longer. In *Bathycrisis* the mandibles are short, thick, with two short stout teeth of equal length. In Dr. Ashmead's tables, Bull. U. S. Nat. Mus. XXIII., 40, *Osprynchotus* is placed in the division with the transverse median nervure in hind wings "broken distinctly below the middle, usually *far* below the middle," whereas it is broken shortly *above* the middle.

36.—*Bathycrisis striaticollis*, sp. nov.

Black, the inner orbits, broadly below, narrowly above, a narrow line in the centre of the outer, a mark, longer than broad, transverse at the apex and interrupted in the middle above by a fovea, a mark in the centre of the clypeus, mandibles, except at the apex, a small mark on either side of the pronotum, a smaller one in front of the tegulæ and tubercles, lemon-yellow; legs, with the greater part of the femora, the tibiæ and the tarsi, except at the apex, rufo-testaceous; the coxæ and femora marked below with yellow. Wings hyaline, the nervures and stigma black, ♂.

Length 9 mm.

Trincomalee, Col. Yerbury.

Head covered with long white hair. Face closely punctured, the clypeus smooth, the lower part smooth and shining; the part immediately below the ocelli strongly transversely striated, and the striæ curved.

The vertex behind the ocelli closely punctured; the occiput margined, the temples wide, obliquely narrowed. Pronotum strongly irregularly striated. Mesonotum closely punctured; in the depressed centre the punctuation is closer and runs into reticulations. The scutellum is less closely punctured and more shining than the mesonotum. Metanotum closely rugosely reticulated. Pleuræ closely strongly punctured.

ON THE PHYTOPHAGOUS AND PARASITIC HYMENOPTERA COLLECTED BY MR. E. ERNEST GREEN IN CEYLON.

SECOND PAPER.

By P. Cameron.

THE following species are described in this paper :—

Ichneumoninæ.

1. Melanichneumon kandyensis, n. sp.
2. Hoplismenus ceylonicus, n. sp.
3. Haliphera fulvipes, n. sp.
4. Aluina erythropus, n. g. et sp.
5. Deniya pleuralis, n. g. et sp.
6. Tanyphatnus multimaculatus, n. g. et sp.
7. Stictichneumon macariæ, n. g. et sp.

Cryptinæ.

8. Buodias rufipes, n. sp.
9. Melcha cinctipes, n. sp.
10. Melcha annulipes, n. sp.
11. Melcha varibalteata, n. sp.
12. Melcha reticulata, n. sp.
13. Melcha erythropus, n. sp.
14. Melcha maculiceps, n. sp.
15. Friona rufipes, n. sp.
16. Friona bituberculata, n. sp.
17. Fenenias erythropus, n. sp.
18. Skeatia acutilineata, n. sp.
19. Skeatia cyclosiæ, n. sp.
20. Skeatia panthonæ, n. sp.
21. Bathythrix rubriornatus, n. sp.
22. Bathythrix striatus, n. sp.
23. Clitiga excavata, n. g. et sp.
24. Clitiga forticornis, n. sp.
25. Earıana lutea, n. g. et sp.

OPHIONIDÆ.

26. Ophion bicarinatus, n. sp.
27. Pleuroneurophion erythrocerus, n. sp.
28. Eniscospilus spilonotus, n. sp.
29. Eniscospilus melanocarpus, n. sp.
30. Eniscospilus xanthocephalus, n. sp.
31. Eniscospilus unilineatus, n. sp.
32. Eniscospilus dasychiræ, n. sp.
33. Eniscospilus horsfieldi, n. sp.
34. Spilophion maculipennis, n. g. et sp.
35. Paniscus intermedius, n. sp.
36. Paniscus orientalis, n. sp.
37. Paniscus lævis, n. sp.
38. Campoplex greeni, n. sp.
39. Limnerium taprobanicum, n. sp.
40. Nototrachys reticulatus, n. sp.
41. Clatha longipes, n. g. et sp.
42. Trichomma nigricans, n. sp.

TRYPHONINÆ.

43. Bassus orientalis, n. sp.
44. Rhorus spinipes, n. sp.

PIMPLINÆ.

45. Epirhyssa ornatipes, n. sp.
46. Theronia maskeliyæ, n. sp.
47. Erythrotheronia flavolineata, n. g. et sp.
48. Echthromorpha ornatipes, Cam.
49. Xanthopimpla taprobanica, n. sp.
50. Xanthopimpla kandyensis, n. sp.
51. Xanthopimpla parva, n. sp.
52. Xanthopimpla minuta, n. sp.
53. Philopsyche albobalteata, n. g. et sp.
54. Lissotheronia flavipes, n. g. et sp.
55. Charitopimpla annulipes, n. sp.
56. Lissopimpla rufipes, n. sp.
57. Tanera annulipes, n. g. et sp.
58. Lissonota greeni, n. sp.

ICHNEUMONINÆ.

1.—*Melanichneumon kandyensis*, sp. nov.

Black, the upper inner orbits, narrowly below, more broadly above, the line extending round the top and narrowly down the upper part of the outer, a short line at the bottom ; a line on the pronotum, two

lines, narrowed in front, on the centre of the mesonotum, the apical half of the scutellum, the mark dilated laterally at the base, post-scutellum and the apices of the second to fifth abdominal segments narrowly, the penultimate more broadly, and the last entirely, yellow; the second segments broadly at the base rufous; antennæ with a broad white band in the middle; legs red; the four front coxæ and trochanters yellow; the hind black, red, and yellow. Wings hyaline, slightly tinged with fulvous, the nervures and stigma black, ♀.

Length 15–16 mm.

Kandy, July.

Head smooth, mandibles red, black at apex. On the centre and on the sides of the clypeus is a reddish mark. Prothorax and mesothorax closely punctured; the scutellum smooth. Median segment more closely and strongly punctured; the apical slope thickly covered with white hair; the areola open at the base, twice longer than broad; the inner side furrowed; it is of equal width throughout and has the apex roundly curved inwardly. Disco-cubital and recurrent nervures broken by a stump of a nervure. Apical half of post-petiole strongly punctured; the gastrocœli shallow, yellowish. Agrees fairly well with *Melanichneumon*. Scutellum not quite flat, depressed at base and apex round, longer than the width at the base.

2.—*Hoplismenus ceylonicus*, sp. nov.

Black; the face, clypeus, the orbits all round, mandibles, palpi, a line on the pronotum, tubercles, two lines on the centre of the mesonotum, the apical half of scutellum, the base of the mark transverse, apex of post-scutellum, and the apices of all the abdominal segments, pale yellow; the apex of the first segment has the line broader than it is on the third and following; on the apex of the second the band is twice the width it is on the first and there is a broader band on its base. Legs red; the four front coxæ and trochanters yellow; the hind coxæ black, the apex red below, above they are yellow. Wings hyaline, the stigma and nervures black. Antennal scape and a broad band on the centre of the flagellum white; the flagellum brownish beneath, especially on the basal half, ♂.

Length 14 mm.

Kandy.

Face and clypeus thickly covered with short, white pubescence and sparsely punctured; labrum white, largely projecting. Promesonotum and scutellum smooth, the latter obliquely sloped at the base and apex. Propleuræ and mesopleuræ smooth. Base of metanotum and areola smooth, the rest strongly punctured; the posterior median area irregularly rugose; the apical slope and metapleuræ

thickly covered with white hair, the latter strongly punctured. Abdomen smooth, except the second segment, which is weakly punctured ; gastrocœli smooth, shallow.

This species agrees fairly well with *Hoplismenus*, having the scutellum as in that genus ; but the areola is not "wider than long" as in the diagnosis of Ashmead : it is fully longer than wide, open at the base, and the posterior median area projects roundly into it. The lateral teeth are small, but distinct. The clypeus is short, transverse at the apex ; the labrum projects.

3.—*Haliphera fulvipes*, sp. nov.

Black ; the face, clypeus, mandibles, palpi, upper inner orbits narrowly, the lower half of the outer broadly—more broadly below than above—a narrow line on the pronotum, tubercles, a mark on the tegulæ, scutellum, a line on the centre of the metanotum, rounded and narrowed at the top and bottom, one-third of it in the areola, two-thirds on the posterior median area, a broad line on the first and a narrower line on the second abdominal segment, lemon-yellow. Legs fulvous, the coxæ black ; the fore trochanters yellow, the middle yellow, black behind, the hinder entirely black. Wings hyaline, highly iridescent, the nervures and stigma black. Antennal scape yellow, the flagellum fuscous beneath, ♂.

Length 12 mm.

Maskeliya, August.

Face and clypeus distinct, but not very closely punctured, sparsely covered with white pubescence ; front and vertex wrinkled irregularly. Mesonotum closely, finely, but distinctly punctured ; the scutellum with some scattered punctures. The basal three areæ of metanotum finely, closely, irregularly, transversely striated ; the lateral almost smooth at the base ; the posterior median obscurely striated at the base, the rest strongly transversely striated ; the lateral areæ with some stout oblique irregular striæ. Propleuræ indistinctly, the mesopleuræ more strongly and closely and the metapleuræ still more closely and strongly punctured, the latter two more or less closely striated. Petiole smooth ; the second and third segments closely, but not strongly punctured ; the gastrocœli longish, smooth, and shining ; the apical segments densely covered with short blackish pubescence ; the apical half of the last yellow.

Aluina, gen. nov.

Scutellum rounded, not flat, its basal three-fourths stoutly keeled. Areola longer than broad, wider at the base than at the apex ; the keels roundly curved, the apex slightly rounded inwardly ; its

surface stoutly striated. Abdominal petiole smooth, shining, impunctate. Ovipositor long, as long as the apical three segments united. Base of flagellum slender, the joints elongate; occiput deeply, widely, roundly incised, sloping above obliquely from the ocelli. Disco-cubital nervure angled in the middle, broken there by a stump of a nervure; the two abscissæ straight, oblique, not rounded.

The head is large; the eyes large, projecting, distinctly narrowed below; the malar space moderate. Apex of clypeus transverse; labrum hidden. Scutellum longer than broad, rounded at the base and apex. Face flat, only slightly dilated in the middle, not separated from the clypeus. Abdomen with the second and third segments punctured; longer than the head and thorax united, its apex acutely pointed.

Allied, in some respects, to *Cillimus* and *Exephanes*. It has the long, projecting ovipositor of the latter, but not its filiform antennæ; but *Exephanes* has not the scutellum stoutly keeled; *Cillimus* has the ovipositor short, has the face tumid, not narrowed behind the eyes; the clypeus is armed at the apex with a small tooth and the scutellum short.

4.—*Aluina erythropus*, sp. nov.

Plate A, fig. 11.

Black; the face, clypeus, the orbits all round, the outer broadly below, a line on the raised centre of the pronotum, scutellar keels, the sides of the scutellum narrowly, the apex more broadly, post-scutellum, the apex of the petiolar area, a broad line on the sides of the apical slope of metanotum, a triangular spot behind the spiracles, the lower edge of the propleuræ, tubercles, a large mark, narrowed in the middle on the lower part of the mesopleuræ, a large oblique mark on the centre of metapleuræ, the base of the first abdominal segment, two spots on its apex, the apex of the second broadly, two broad lines of almost equal width on the third, two shorter, smaller ones, obliquely narrowed on the inner side, the greater part of the sixth and the whole of the apical two, pale yellow. Antennæ black, the under side of the scape and a broad band on the flagellum white. Legs red, the four front coxæ and trochanters yellow. Wings hyaline, the stigma and nervures black, the costa at the base of the stigma fuscous, ♀.

Length 11–12 mm.

Pundalu-oya.

Head smooth and shining, the face and centre of clypeus sparsely weakly punctured; the front in the centre slightly raised, almost keeled. Mesonotum closely punctured, the furrows distinct on the

basal half. Scutellum sparsely punctured. Base of metanotum almost smooth ; the areola with four stout, curved, transverse keels, the base and apex with a few broken ones, the lateral areæ stoutly obliquely, the posterior median transversely striated ; the base of the spiracular area punctured, the rest closely, obliquely striated. Apex of propleuræ below stoutly striated, above and at the base punctured ; the base in the middle with some stout, clearly separated striæ, the lower part smooth and shining. Abdomen very smooth and shining except the second and third segments, which are closely punctured ; the former stoutly striated at the base.

In the example described, one mandible is black, the other yellow.

Deniya, gen. nov.

Temples almost obsolete ; occiput almost transverse. Eyes large, projecting. Apex of clypeus rounded, behind not separated from the face. Antennæ dilated beyond the middle. Parapsidal furrows distinct, crenulated. Apex of mesonotum reticulated. Scutellum longer than its width at the base, convex, stoutly keeled to beyond the middle ; the apex with an oblique slope. At the base of the post-scutellum are two triangular depressions, bordered by stout keels. Base of metanotum, deeply obliquely depressed at the base. Areola longer than wide, transverse at the base, the apex angularly turned inwardly ; the sides near the apex angled. Post petiole and the following four segments closely punctured ; gastrocœli large, deep. Areolet 4-angled ; disco-cubital nervure not broken by a stump of a nervure ; transverse median nervure received behind tranverse basal. Sheaths of ovipositor broad, projecting.

This genus comes close to *Aluina*. The two may be separated thus :—

Temples wide, occiput widely, deeply incised, apex of clypeus transverse, transverse basal nervure interstitial ; sides of areola rounded, not angled, parapsidal furrows indistinct, the apex of mesonotum smooth, post-petiole smooth, *Aluina*.

Temples very narrow, occiput transverse, apex of clypeus rounded ; sides of areola not rounded, angled ; parapsidal furrows distinct, apex of mesonotum reticulated, post-petiole punctured, *Deniya*.

5.—*Deniya pleuralis*, sp. nov.

Plate A, fig. 10.

Black ; face, clypeus, mandibles, except at apex, palpi, the inner and upper orbits, the lower half of outer broadly, a broad line on the pronotum, tegulæ, scutellum, the sides of the apical slope of the metanotum, a line on the lower edge of the propleuræ, mesopleuræ

from shortly above the middle, mesosternum, tubercles, the apices of all the abdominal segments—the line on the fourth interrupted—pale yellow. Legs pale fulvous, the anterior largely tinged with yellow, the apex of the hind femora, base of hind tibiæ, their apex broadly and the tarsi, black. Wings hyaline, the stigma and nervures black, ♀.

Length 10 mm.

Peradeniya.

Scape below and a broad ring on the flagellum white. Head smooth and shining, the face and clypeus sparsely punctured and haired. Thorax smooth and shining, except the metapleuræ and the spiracular area which are closely strongly reticulated, punctured ; the areola with a stout keel in the centre of the apical two-thirds ; the metapleuræ thickly covered with white pubescence. Post-petiole and the second to fourth abdominal segments closely punctured.

Tanyphatnus, gen. nov.

♂. Areola open behind, more than twice longer than wide, separated from the lateral areæ, the apex almost transverse, the top of the posterior median area being bluntly rounded. Apex of metanotum with a gradually rounded slope. Scutellum not flat, roundly depressed at the base and apex. Post-petiole in the centre finely, closely, longitudinally striated ; gastrocœli deep; there are no thyridia. There are eight abdominal segments ; cerci long, stout ; the genital armature much larger than usual ; the ventral fold extends to the apex of the fourth segment. Areolet 5-angled ; the disco-cubital nervure almost broken by a stump of a nervure. Apex of clypeus transverse, not separated from the face ; labrum largely projecting. Upper tooth of mandibles much longer than lower, projecting twice the length of the latter beyond it ; it is sharply pointed. Spiracles about four times longer than wide.

The temples are moderately broad, rounded ; malar space short ; the antennæ are not much longer than the abdomen, serrate. Abdominal petiole slender, longish, the post-petiole not clearly separated. Legs moderately stout. Abdomen slender, more than twice the length of the head and thorax united ; the sides of the segments spotted with yellow ; the last segments not spotted.

This genus, or sub-genus, has the striated post-petiole of *Ichneumon sensu str.* Comparing it with *I. luctatorius*, the type given for *Ichneumon s. str.*, its areola is longer, narrower, and not of equal width, it being wider at the base and narrowed roundly in the middle ; the metanotum has a more gradually rounded slope ; the first segment of the abdomen is more slender, especially at the apex; the

scutellum is much more distinctly raised—more convex, and clearly longer than wide ; the temples are shorter and not so obliquely narrowed, the malar space smaller, the eyes being longer, and the upper tooth of the mandibles is longer and more sharply pointed.

6.—*Tanyphatnus multimaculatus*, sp. nov.

Black, the face, clypeus, mandibles, palpi, the inner orbits, the outer, narrowly above, broadly below, the upper and lower edge of prothorax, prosternum, the sides of scutellum, narrowly at the base, more broadly towards the apex, scutellum, a broad band of equal width on the base of metanotum, extending from the base to the posterior median area ; the apical slope, except the latter area, the yellow extending on to the pleuræ, a mark behind the spiracles, the lower third of the mesopleuræ, the apex of the first abdominal segment and broad marks, closely continuous, on the apices of the other segments, yellow. Four front legs rufo-yellow, their coxæ and trochanters yellow; the hind legs rufous, the coxæ black, broadly yellow at the base above, the base of the tibiæ broadly yellow. Wings hyaline, the stigma and nervures black, ♂.

Length 13 mm.

Pundalu-oya.

Face and clypeus punctured, but not strongly or closely. Front with some minute punctures. Mesonotum sparsely, irregularly punctured. Base and areola of metanotum smooth ; the rest closely and strongly punctured, thickly covered with long fuscous hair. Pleuræ closely and strongly punctured, the meta irregularly striated. Basal segment with the post-petiole closely finely striated in the middle ; the second to fourth more strongly on the basal half.

The gastrocœli are large, deep, smooth. Transverse median nervure interstitial. The areola is not separated behind, where there is no oblique depression ; it is clearly separated from the lateral areæ, is slightly narrowed in the middle, more than twice longer than wide, and transverse at the apex ; the apex of the segment has a gradually rounded slope, without teeth. The ventral fold is on segments two to four.

Stictichneumon, gen. nov.

Clypeus separated from the face by a deep, wide furrow which unites with the lateral foveæ ; its apex not quite transverse. Areola horseshoe-shaped, longer than wide, clearly separated behind; the petiolar area confluent with lateral. Scutellum roundly convex ; roundly sloped at the base and apex ; its basal half keeled. Petiole

strongly, closely punctured, as are also the following three segments; gastrocœli deep, widely separated. Areolet 5-angled; transverse median nervure interstitial; disco-cubital nervure slightly broken. There is a distinct malar space. The upper tooth of the mandible is distinctly longer than the lower. Antennæ shorter than the body. Temples obliquely, roundly narrowed. Post-petiole not clearly separated, becoming gradually wider towards the apex; it is strongly punctured. There is a distinct depression at the base of the metanotum. Legs short and stout.

The body is black, spotted with yellow; it is more closely and strongly punctured than usual. Temples obliquely narrowed.

This genus should be readily known by the roundly convex scutellum, keeled to the middle, and by the clypeus being separated from the face by a deep transverse furrow. The middle area of the petiole is raised, separated from the sides. The apex of the clypeus is not quite transverse, the middle being slightly dilated

7.—*Stictichneumon macariæ*, sp. nov.

Black, the face, except for a large mark on its lower half, its sides produced above, the sides of clypeus, inner eye orbits, lower two-thirds of outer, base of mandibles, palpi, a line round the base of the prothorax, one on the pronotum, tegulæ, two lines on the mesonotum, scutellar keels, two small spots on the base of scutellum, a line on its apex, post-scutellum, two oblique spots on the apical slope of metanotum, tubercles, a mark on the lower part of the mesopleuræ, contracted in the middle, the apical part shorter and more oval than the basal, which is narrowed at the apex, an irregular spot on the apex of the metapleuræ, transverse marks on the sides of the basal four abdominal segments, the centre of the penultimate and the whole of the last, yellow. Legs black, the four front coxæ and trochanters yellow; their femora and tibiæ obscure testaceous in front. Wings clear hyaline, the stigma and nervures black. ♂.

Length 10 mm.

Maskeliya, July.

Bred from pupa of *Macaria*, sp.

CRYPTINÆ.

8.—*Buodias rufipes*, sp. nov.

Plate A, fig. 13.

Black, the legs red; a broad band on the antennæ, the upper eye inner orbits, an interrupted line on the base of the pronotum, scutellar keels, scutellum, metanotal spines and the apices of the basal

three abdominal segments and of the sixth more broadly, whitish yellow. Wings hyaline, the nervures and stigma black, ♀.

Length 14 mm.; terebra 4 mm.

Kandy, July.

Face and, to a less extent, the base of clypeus irregularly rugose; the apex of clypeus smooth and shining. Sides of front coarsely, obliquely striated. Mesonotum smooth, shortly, densely pilose. Base of metanotum finely irregularly striated; the rest stoutly reticulated—striated; the spines long, stout. Propleuræ stoutly, closely striated; the mesopleuræ irregularly striated at the base, the rest finely striated—reticulated, but not closely; the metapleuræ obliquely striated.

9.—*Melcha cinctipes*, sp. nov.

Black, face, clypeus, mandibles except at the apex, palpi, the upper inner orbits, malar space, the upper and lower sides of prothorax broadly, metapleuræ and apical half of metanotum, the apices of the basal three segments of the abdomen and the apical pale yellow; the scutellum and the keels lemon-yellow. Four front legs pale yellow; the hind coxæ pale yellow, black above, the trochanters black; the femora red, the extreme apex black; the tibiæ black, with a white band near the base, tarsi white, the basal joint to near the apex, and the apical joint, black. Wings hyaline, the stigma and nervures black, ♂.

Length 7·5 mm.

Peradeniya, August.

Base of metanotum smooth, irregularly punctured to the keel: the rest closely reticulated. Propleuræ with some stout striæ in the middle behind. Mesopleuræ obscurely punctured, with a striated band in the centre above. Lower part of metapleuræ irregularly punctured—reticulated. The second and following segments of the abdomen are closely punctured. Tarsi spinose.

Antennal scape fulvous; flagellum densely covered with short, thick, black pubescence. There is a yellow line on the centre of the outer orbits.

10.—*Melcha annulipes*, sp. nov.

Black, an ovoid mark on the centre of the face, the broad end above and rounded, clypeus, palpi, mandibles except the teeth, the upper inner orbits from the antennæ, pronotum broadly, tegulæ, tubercles, scutellum, metanotum from shortly behind the basal keel, the top forming two rounded lobes, the yellow extending on to the metapleuræ below the bottom of the lobes and being dilated at the base below, the apex of the first and second abdominal segments

broadly and the apical four segments entirely, yellow ; the petiole rufous. Legs rufous, the four front coxæ and trochanters white ; the hind tibiæ fuscous, with a broad ring near the base, the hind tarsi, except the apical joint, white. Wings hyaline, the stigma fuscous, the nervures darker, ♀.

Length 6–7 mm. ; terebra 2 mm.

Peradeniya, September.

Antennæ broadly ringed with white ; the scape and base of flagellum rufo-testaceous. The part below the ocelli closely, irregularly, longitudinally striated, keeled in the middle ; the depressed front with two stout smooth keels. Face finely, irregularly rugose. Mesonotum finely, closely, rugosely punctured. Scutellum smooth. Base of metanotum irregularly rugose ; the apex distinctly transversely striated, the striæ clearly separated. The centre of propleuræ stoutly striated, the mesopleuræ closely, irregularly, obliquely striated and aciculated ; the metapleuræ closely, strongly, obliquely striated. The second and third segments of the abdomen closely, uniformly punctured.

11.—*Melcha varibalteata*, sp. nov.

Black, the median segment, apex of mesopleuræ below, and petiole rufous ; face, clypeus, mandibles, palpi, lower third of outer orbits, base of propleuræ, pronotum, mesosternum, tegulæ, tubercles, the usual plate under the hind wings, the apices of the five abdominal segments and marks in the centre of the apical two, yellow, the yellow on the abdominal segments backed with testaceous behind. Four front legs pale fulvous, the coxæ and trochanters white ; the hind coxæ fulvous, their trochanters black ; femora rufous, tibiæ and tarsi fuscous, the tibiæ broadly rufous at the base. Wings hyaline, the apex slightly smoky, the stigma fuscous, the nervures darker, ♂.

Length 5 mm.

Kandy, July.

Head smooth and shining. Thorax smooth, except the apical slope and sides of metanotum behind the keel, which are irregularly rugose. Middle lobe of mesonotum depressed in the centre, and having a distinct fovea, longer than wide ; the apex at the end of the parapsidal furrows with a row of foveæ. The petiole is black at the apex, the centre yellowish, as compared with the sides.

12.—*Melcha reticulata*, sp. nov.

Black, the face, clypeus, mandibles, palpi, the lower fourth of the outer orbits, malar space, the inner orbits to near the antennæ, a broad line on the apical two-thirds of the pronotum, tegulæ,

tubercles, antennal keels, scutellum, the usual mark behind the wings, the apical slope of the metanotum except for a black mark in the centre, the apices of the basal four abdominal segments and the apical entirely, yellow. The four front legs yellow, tinged with fulvous, the hinder rufo-testaceous, the apex of the coxæ, trochanters, apical half of tibiæ, and the tarsi blackish. Under side of antennal scape testaceous. Wings hyaline, the nervures and stigma black, ♂.

Length 7 mm.

Matale, July.—Reared from *Psyche subteralbata*.

Head shining, impunctate. Mesonotum minutely punctured. Parapsidal furrows closely, transversely striated ; the part where they end irregularly punctate—reticulated. The base of metanotum smooth, the rest strongly, closely reticulated. Propleuræ and mesopleuræ smooth ; the metapleuræ irregularly reticulated. The second and third segments of the abdomen are closely punctured ; the others smooth, densely pilose.

13.—*Melcha erythropus*, sp. nov.

Plate B, fig. 2.

Black, the upper inner orbits broadly, more broadly below than above, a line on the lower part of the inner, the greater part of the clypeus, labrum, mandibles except the teeth, palpi, a line on the apical three-fourths of the pronotum, tegulæ, tubercles, scutellum, a large crescent-shaped mark behind the wings, the apices of the basal three abdominal segments and a narrower line on the apex of the sixth, yellowish-white. Legs rufous, the anterior coxæ and trochanters white ; the greater part of the hind tarsi blackish. Wings clear hyaline, the nervures and stigma black. Median segment, apex of mesosternum and base of metapleuræ. rufous, ♀.

Length 7 mm.; terebra 2 mm.

Peradeniya, August.

The sixth to twelfth joints of the antennæ are ringed with white except above. Face closely, irregularly, rugosely striated. Clypeus obscurely punctured. Front with a distinct keel down the centre, striated on either side, the striæ stronger and more irregular above.

Pronotum and mesonotum smooth and shining ; the propleuræ in the middle stoutly striated ; the mesopleuræ except behind, closely, finely reticulated. Metanotum behind the keel smooth and shining : the rest closely, rugosely reticulated. Metapleuræ closely, obliquely striated, more strongly above than below the furrow. The second and third segments of the abdomen are finely, closely punctured ; the others smooth and shining. Tarsi closely spinose. Areolet square, the apical nervure faint. Base of mesosternum yellow, the

rest black ; the second transverse cubital nervure faint. The base of the first abdominal segment is rufous.

A specimen from Kandy is 12 mm. long, has a stripe on the sides of the fourth abdominal segment, and the penultimate is entirely white.

14.—*Melcha maculiceps*, sp. nov.

Black ; the upper inner orbits, a somewhat pyriform mark on the centre of the face, the thickened end at the top and rounded, the clypeus except on the sides and apex, mandibles broadly at the base, tegulæ, tubercles, scutellum, the apical slope of the metanotum, the top of the yellow part narrowed, transverse above, with the sides slightly oblique, and the apices of the abdominal segments, yellow. Legs rufous, the fore coxæ and trochanters yellow, the apical joint of the tarsi black. Wings hyaline, the nervures and stigma black, ♀.

Length 8 mm. ; terebra 2 mm.

Peradeniya, October. Bred from cocoons of *Chrysomelid* beetle feeding on orchid.

The sixth to tenth joints of antennæ white below. Face closely and distinctly punctured. The upper part of the front closely, longitudinally, irregularly striated—reticulated. Mesonotum minutely, closely punctured ; the apex of the middle lobe closely, strongly, longitudinally striated, the striated part broad and transverse at the apex ; separated from the scutellar depression by a smooth raised part. The scutellar depression is deep and bears stout keels. Base of metanotum irregularly, closely, rugosely punctured ; the area with a stout irregular keel in the centre ; the rest is closely reticulated. Pleuræ closely punctured, the propleuræ on the lower half stoutly striated ; the sternum bordering the furrow is on the basal half, closely, finely, transversely striated. Sides of postpetiole closely, longitudinally striated.

15.—*Friona rufipes*, sp. nov.

Plate B, fig. 1.

Black, the face, except for a triangular large black mark in the centre, clypeus, except for a black line, dilated in the middle, at the apex, labrum, base of mandibles, palpi, the upper orbits to the end of the top, the lower half of the outer more broadly, malar space, a line on the pronotum, tegulæ, scutellum, a reversed T-shaped line on the apical, striated part of the metanotum, the cross pieces being on the apical slope, a semi-circular mark on the lower, apical part of the mesopleuræ, a smaller mark, longish, rounded above, transverse below, under and in front of it ; a large mark, rounded in front, gradually widened towards the outer side behind the wings, an

elongated mark, narrowest behind, on the metapleuræ and the apices of the abdominal segments, pale yellow. Legs rufous; the four front coxæ and trochanters yellow; the hind tarsi white, fuscous at the base, the apical joints black. Wings hyaline, the nervures and stigma black, ♀.

Kandy, July.

Length 13 mm.; terebra 4 mm.

Antennæ black, broadly ringed with white. Front with a distinct central keel; on the top and bottom it has, on either side, three or four irregular, curved keels. Face punctured, the centre irregularly, weakly striated. Thorax smooth and shining. The metanotum behind the keel and the pleuræ closely, distinctly striated as usual. Median segment and hind coxæ and trochanters covered with long black hair. Areolet one half longer than the width at the base.

The hind coxæ are marked above at the base with yellow: in the ♂ they are black, except at the base above, the middle coxæ have a large black mark on the outer side at the apex above. The apex of the metanotum at the white transverse line is roundly dilated.

16.—*Friona bituberculata*, sp. nov.

Length 13 mm. ♂.

Kandy, July.

In colouration this species resembles closely *F. rufipes*, but the pleuræ are not marked with yellow, the hind coxæ are red, without black or yellow, and the face wants the black central mark. Otherwise the two may be separated thus:

Apex of metanotum not raised, near the apex armed with two stout teeth or tubercles, which are enclosed by the yellow apical band; the apical transverse band as long as the basal central line, this being narrowed towards the base; pleuræ immaculate, not strongly or closely striated; the base of the first and the whole of the apical two segments white, *bituberculata*, Cam.

Apex of metanotum raised transversely, not tuberculated; the apical transverse line narrow, the longitudinal one widest at the top, pleuræ marked with yellow, distinctly striated face; the base of the first abdominal segment not yellow; the apical two segments only yellow at the apices, *rufipes*, Cam.

There is a triangular mark on the centre of the metanotum, the narrow end at the apex; the striæ on it are irregular and run into reticulations. The striation on the front is not very strong. Face yellow. Clypeus black, with a yellow mark, transverse, rounded at the sides in the centre. Legs red; the hind trochanters black. Areolet not very large, almost square (smaller than in *rufipes*, which receives the recurrent nervure shortly behind the middle).

17.—*Fenenias erythropus*, sp. nov.

Plate A, fig. 14.

Black, very shining, the centre of the face and clypeus, the latter more widely than the former; the inner orbits narrowly from near the bottom and round the top, the lower two-thirds of the outer, base of mandibles and palpi, a narrow line on the apical half of the pronotum, the base below, a transverse small mark on the apex of the middle lobe of the mesonotum, scutellar keels, apex of scutellum, the mark longer than broad; a line on the centre of the apical slope of the metanotum, followed downwards, on either side, by a similar line of the same length and united to a mark on the middle, which is longer than broad and of equal width; tubercles, a pyriform mark on the lower part of the mesopleuræ near the base, a smaller, somewhat similar mark on the lower side at the apex, a stripe along the lower side of the furrow, the usual mark under the hind wings, an oblique mark near the apex of the metapleuræ and narrow lines on the apices of the abdominal segments (the apical interrupted), pale yellow. Legs red; the anterior at the base and the hind tarsi yellowish. Wings hyaline, the nervures and stigma black, ♀.

Length 8 mm.; terebra 4 mm.

Peradeniya, September.

Face and upper part of clypeus distinctly punctured, the former more closely and rugosely above. Vertex punctured in the centre; the front clearly separated from it and with a steep slope. Mesonotum distinctly, but not very closely or coarsely, punctured; the furrows deep, wider and striated towards the apex; they do not extend near to the scutellum, which is finely, very sparsely punctured, its lateral slope is stoutly, obliquely striated at the base, the rest with some elongated punctures. Base of metanotum with a smooth, deep, oblique depression; in the middle is an indistinct U-shaped keel; the centre is irregularly reticulated; the sides much more finely and regularly reticulated. The apical slope is depressed in the centre and closely, transversely, irregularly striated—reticulated; there is no transverse basal keel; the apical is not very distinctly defined, especially in the centre; the teeth are broad and blunt. Propleuræ strongly striated except for a punctured space above and the base below, which is smooth. Mesopleuræ closely punctured, coarsely, irregularly, longitudinally striated at the base above, irregularly, closely reticulated in the middle; the apex with a large smooth and shining space. First abdominal segment smooth, shining, the apex with some minute scattered punctures; the second segment closely and distinctly punctured, except at the apex; the basal half of the third is more closely and finely punctured.

The areolet is minute, closed at the apex ; the transverse median nervure is received behind the transverse basal ; the transverse median nervure in hind wings broken below the middle. Antennæ long, ringed with white, slender. Metapleural keel reaching close to the hind coxæ. Temples very short, obliquely narrowed. Head not much wider than the thorax. The basal transverse keel on the metanotum is only indicated in the middle.

This species may be separated from the type of the genus thus :—

Metanotal teeth stout ; metanotum with three yellow marks in a triangle ; the mark on the mesonotum oval, longer than broad, hind tarsi fuscous, *albomaculatus*, Cam.

Metanotal teeth small ; metanotum with the upper part of the apical slope margined with yellow ; the mark on the mesonotum transverse, small, broader than long, *erythropus*, Cam.

In *albomaculatus* the clypeus is more convex and not so transverse at the apex. In *Fenenias* the front is more deeply and widely depressed, the depression reaching closer to the ocelli, than in *Skeatia*.

18.—*Skeatia acutilineata*, sp. nov.

Plate A, fig. 12.

Black, face, clypeus, base of mandibles, palpi, the inner eye orbits to the end of their top, the outer from near the top, the yellow line becoming gradually wider, malar space, the base of the prothorax narrowly, the middle of pronotum broadly, tegulæ, a mark, longer than broad and of equal width in the centre of the mesonotum, scutellar keels, scutellum, a triangular mark—the narrow end above—its base shorter than the sides and laterally united by a short line to a large mark on the sides of the apical slope, enclosing the spines and going on to the pleuræ, the apices of all the abdominal segments, tubercles, a large oblique mark on the centre of the mesopleuræ, roundly contracted above and below and narrowed at the apex, mesosternum, and a mark on the metapleuræ below the keel, widest and oblique at the apex, yellow. Antennæ broadly ringed with white in the middle. Legs rufous, the coxæ and trochanters yellow, the hind coxæ broadly black at the apex above, this part joined to the base on the lower side by a broad curved line ; the apex of the hind femora narrowly, the base of the tibiæ still more narrowly, their apex more broadly and the apical joints of their tarsi, black : the hind tibiæ are infuscated. Wings hyaline, the nervures and stigma black ; areolet minute, longer than wide, ♀.

Length 12 mm.: terebra 3–4 mm.

Kandy, July.

Front irregularly rugosely punctured except below the ocelli: the centre keeled. Face distinctly, but not very closely, punctured: the clypeus more sparsely punctured above, smooth below. Thorax

closely and strongly punctured ; the metapleuræ more strongly than the rest, the metanotum closely reticulated, most strongly and more irregularly on the apex. The first abdominal segments sparsely, the others closely and uniformly punctured.

Characteristic of this species is the acutely narrowed top of the mark on the metanotum; in the other species it is rounded.

19.—*Skeatia cyclosiæ*, sp. nov.

Black, the face, clypeus, mandibles at base, palpi, the upper eye orbits to the end of the top, the outer from shortly above the middle, malar space, a broad line on the pronotum, a line on the lower edge of the propleuræ, a small mark, longer than broad, transverse at the base, rounded at the apex on the centre of the mesonotum, scutellar keels, scutellum, the sides of the metanotum at the apex broadly, united above by a rounded line, which has the rounded top broader than the sides ; tubercles, a large mark on the mesopleuræ, sharply contracted in the middle, the basal portion being the larger, mesosternum and a large mark in the centre of the metapleuræ, and the apices of the abdominal segments, yellow. Legs fulvous ; the coxæ and trochanters yellow; the base and a mark on the outer side of the hind coxæ, under side of trochanters, apex of hind femora, the base of their tibiæ more narrowly and their apex more broadly, black ; the hind tarsi white. Antennæ broadly ringed with white. Wings clear hyaline, the stigma and nervures black, ♀.

Length 12 mm.; terebra 2–3 mm.

Kandy. Bred from cocoon of *Cyclosia panthona*, a zygænid moth.

Front with a distinct keel ; the part next to the keel finely rugose, outside obscurely striated. Face and top of clypeus punctured, strongly, but not closely. Mesonotum closely, finely, rugosely punctured. Scutellum smooth; a small triangular black mark at the base. Metanotum closely, rugosely reticulated ; the basal area smooth, wider than long. Propleuræ stoutly striated, obliquely above, below more strongly longitudinally; the mesopleuræ and metapleuræ closely punctured. Base and centre of first abdominal segment aciculated, the sides of post-petiole closely punctured and striated ; the other segments closely punctured.

The Malay *S. varipes* closely resembles this species. They may be separated as follows :—

The metanotal area small, greatly narrowed at the apex, the top of the yellow line not dilated, the large line on mesopleuræ not contracted in the middle, at apex united to the yellow on the mesosternum, *varipes*, Cam.

The metanotal area large, not greatly narrowed at apex, the top of yellow line greatly dilated ; the large line on mesopleuræ contracted in the middle, not united to the yellow on the sternum, *cyclosiæ*.

20.—*Skeatia panthonæ*, sp. nov.

Black ; face, clypeus, mandibles at the base, palpi, inner orbits, their top, the lower two-thirds of the outer more broadly, malar space, the edge of the pronotum, the lower edge of the propleuræ more broadly, an irregular small mark on the middle of the mesonotum, scutellum, post-scutellum, scutellar keels, the sides of the apical slope of the metanotum, united above by a narrow line to a spot which is longer than broad, rounded above, transverse below, tubercles, a moderately sized roundish mark on the lower part of the mesopleuræ at the base, a smaller—half the size—somewhat conical one on the lower side of the apex, a large mark behind the wings, partly on the top, partly on the pleuræ, a quadrangular mark twice longer than broad on the centre of the metapleuræ, the mesopleuræ and the apices of the abdominal segments, pale yellow. Legs : the four anterior yellow, tinged with fulvous, the hinder fulvous. the coxæ yellowish, black at the base and with a black large mark on the apex above, the lower half the larger, and projecting beyond it at the apex ; the trochanters, apex of femora, the base of tibiæ more narrowly, their apex more broadly, black ; the tarsi yellowish. Wings hyaline, the stigma and nervures black, ♂.

Length 11 mm.

Kandy. Bred from *Cyclosia panthona*.

Face and upper half of clypeus strongly punctured. Front stoutly irregularly striated. Mesonotum strongly, closely, the scutellum sparsely punctured. Metanotum behind the keel closely rugosely punctured, the rest closely strongly reticulated, the reticulations converging into striæ at the apex. Propleuræ, except at the base, strongly, closely striated. Mesopleuræ closely striated (more closely and less strongly than the propleuræ) obliquely above at the base, running from the tubercles to the base of the pleuræ ; the striæ on the lower half are not so oblique and run from the base to the apex. Base of the metapleuræ with some irregular widely separated keels. the rest closely, strongly, obliquely striated. Petiole obscurely aciculated ; post-petiole smooth and shining ; the second segment thickly covered with round, clearly separated punctures ; the third similarly but much less strongly punctured. The area on the base of the metanotum is wide at the base, not separated from the basal furrow ; it becomes obliquely narrowed towards the apex.

Although this species has the same host as *S. cyclosiæ* it is not, I believe, its male. The two may be separated thus :

Post-petiole strongly aciculated and punctured ; the mark on the centre of metanotum broader than long; one long mark on the mesopleuræ, *cyclosiæ*.

Post-petiole smooth, shining, impunctate, the mark on the centre of the metanotum longer than broad ; two widely separated marks on the mesopleuræ, *panthonæ*.

21.—*Bathythrix ? rubriornatus*, sp. nov.

Plate B, fig. 4.

Black, the upper part of the propleuræ and mesopleuræ, the mesonotum, and the scutellum dark red ; the lower part of the propleuræ yellowish; the apex of the first abdominal segment at the sides broadly testaceous ; the apex of the third and fourth yellow, the latter only narrowly. Four front legs dark fuscous, the hinder blackish, the coxæ behind, trochanters, and the base of tibiæ white. Wings hyaline, a broad cloud, rounded and narrowed in front behind the transverse median and the transverse basal, and a much broader one extending from near the base of the stigma to the end of the radial cellule, the centre of the apex of the wings, being hyaline ; the apex of the hind wings smoky. Antennæ fuscous, darker at the apex, ♀.

Length 6 mm.; terebra 1 mm.

Peradeniya, April.

In Ashmead's tables this species would run into the genus *Bathythrix*, but not having a specimen of that genus for comparison I cannot say if it be really identical with it or not. In my species the parapsidal furrows are deep, striated, and broadly rounded behind, not reaching to the scutellar depression. The areolar is 6-angled, narrowed behind and much longer than wide ; there is a distinct petiolar area ; the base of the segment is deeply depressed. The head (including the clypeus) and thorax are thickly covered with white long pubescence. Mesonotum aciculated. Scutellum laterally keeled to near the middle. Median segment closely, finely punctured. Petiole closely, distinctly, ongitudinally striated ; the second and third segments are closely punctured. First joint of flagellum as long as the second.

22.—*Bathythrix ? striatus*, sp. nov.

Plate B, fig. 5.

Black, the antennal scape, the base of prothorax, tegulæ, tubercles, the base of the basal four segments of the abdomen broadly and of the last narrowly, yellow. Legs rufo-testaceous, the apical four coxæ and trochanters and the base of the hind tibiæ yellow. Wings hyaline, a black cloud behind the transverse median nervure and a large one beginning at the base of the radial cellule, extending to near its apex and more dilated on the outer side below than on the upper ; there is a fuscous cloud near the apex of the hind wings, ♀.

Length 7 mm.; terebra 1 mm.

Kandy.

Head closely rugose; the vertex closely striated in the centre, closely covered with white pubescence; the centre of the face roundly tuberculate. Mesonotum very finely and closely transversely striated; the furrows crenulated. Metanotum closely rugosely reticulated, the basal central area is wide at the base, becomes gradually narrowed to the apex, where the keels almost unite; the areola is open at the apex, being continuous with the posterior median area; the lateral basal areæ are large and of equal width. Except at the apex the basal three abdominal and the basal half of the fourth segments are closely, regularly, finely, longitudinally striated.

This is a larger and stouter species than *B. rubriornatus;* the abdominal segments are closely longitudinally striated, the metanotum less regularly areolated, there being no regularly defined areola, and the face is more distinctly tuberculated in the centre.

Clitiga, gen. nov.

♂. Antennæ as long as the body, 26-jointed, the first joint of the flagellum longer than the second. Parapsidal furrows indicated at base only. Scutellum laterally stoutly keeled to near the apex. Median segment short, smooth, and shining, the apex with a straight, steep slope; completely areolated, the areola wider than long, rounded behind, transverse at the apex; there are five areæ on the apex; spiracles small, oval; the sides at the apex toothed. Mesopleuræ largely, deeply excavated in the centre. Areolet 5-angled, the apical nervure faint, but distinct; disco-cubital nervure rounded, not angled or broken; the transverse median nervure received beyond the transverse basal; transverse median nervure in hind wings broken below the middle. First abdominal segment greatly dilated at the apex, the base stoutly, angularly projecting; the base of second segment depressed, the apex of the depression transverse, clearly separated. Legs moderately stout. Face flat, not separated from the clypeus, which is transverse at the apex. Mandibles with a long apical and a short sub-apical tooth.

♀ Antennæ stout, dilated towards the apex, longer than the body, the basal joints of flagellum elongated. The post-petiole is not so markedly tuberculated on the sides; the apex of the abdomen is bluntly pointed; the ovipositor projects and has stout sheaths. The areola is not wider than long, as it is in the ♂ I have described, it being nearly as long as wide; the base of the second abdominal segment is not tuberculate laterally, but it is depressed at the base, as in the ♂. The abdomen is short, bluntly pointed at the apex.

The difference between the *Hemitelini* and the *Phygadeuonini* appears to be somewhat shadowy, and practically consists in the absence in the former of the second transverse cubital nervure and in its presence in the latter. It is clear enough in the present genus, although bullated in the middle. In Ashmead's arrangement of the *Phygadeuonini* it would come in near *Leptodermas*, having five areæ on the apex of the metanotum, but it has no keels on the first abdominal segment. The deeply excavated mesopleura is noteworthy. The pleural furrow is wide, deep, curved.

23.—*Clitiga excavata*, sp. nov.

Plate B, fig. 6.

Black, shining; the face, except for a line in the centre above, clypeus, and mandibles except at the apex, palpi, the base of the prothorax, tegulæ, tubercles, the lower part of the mesopleural depression, the mark roundly narrowed above and the apex of the scutellum, pale yellow. Wings hyaline, the nervures and stigma black. Front legs fuscous—testaceous; the coxæ and trochanters white; the middle fuscous, the coxæ at the apex and above white; the hind legs with the coxæ black, the rest fuscous, tinged with black, ♂.

Length 5 mm.

Haputale, ex pupæ of *Michrœseus oblatarius*.

January.

Mesonotum clearly, but not closely punctured. The central excavated part of the mesopleuræ is smooth, its edges punctured; the lower part and the sternum rather strongly punctured. The upper part of the metapleuræ strongly, but not closely punctured; the lower part smooth and bounded by stout, curved keels. The posterior median area of the metanotum is surrounded on the inner side by a row of foveæ; the outer area is stoutly closely striated, the inner with two or three irregular keels, the central quite smooth; the outer is whitish above and there is a white spot on the apex of the spiracular.

24.—*Clitiga forticornis*, sp. nov.

Plate B, fig. 7.

Black, the face, except for a black line broad and narrowed below, a line on the centre of the clypeus broadly dilated at the apex, the orbits (broadly above) except on the centre of the malar space, basal half of mandibles, palpi, a broad line on the apical half of the pronotum, the lower part of propleuræ, tegulæ, tubercles, scutellums, the sides of the median segment from shortly above the spines, about

the lower third of the mesopleuræ, the mark rounded at the base and apex, a large oblique mark on the apical half of the metapleuræ, united to the lateral mark on the metanotum, the apices of the basal two abdominal segments broadly, a large mark on the sides of the third segment, its apical half dilated inwardly, a line, narrowed at the apex on the sides of the fourth and the apical segments, pale yellow. Legs rufo-fulvous, the four front coxæ and trochanters yellow, the hind coxæ black, tinged with brown at the apex, yellow for the greater part above, trochanters black below, yellow above, their tibiæ and tarsi infuscated at the apex. Wings hyaline, the nervures and stigma black. Antennæ longer than the body, the middle broadly clear white, ♀.

Length 5–6 mm.

Ex pupæ of *Michrœseus oblatarius*.

Haputale, January.

Face punctured, but not closely or strongly; the clypeus smooth, with some scattered punctures above. Front and vertex smooth. Mesonotum, lower half of mesopleuræ and mesosternum closely punctured. Base and centre of metanotum smooth, the edges of the areola and the posterior median areæ with a narrow striated border, the other areæ aciculated. Metapleuræ more strongly punctured than the mesopleuræ. Post-petiole closely rugose and finely striated; the second and third segments closely punctured. Gastrocœli moderately deep, smooth, yellowish testaceous.

Earrana, gen. nov.

Median segment smooth, with one transverse keel behind the middle; long, gradually rounded towards the apex; the spiracles large, about three times longer than wide. Abdominal petiole long, slender, not much dilated at the apex, the spiracles placed immediately behind the middle; the segments smooth; the ovipositor projecting. Areolet punctiform as in *Mesostenus*, open in front; transverse median nervure received behind the transverse basal; the transverse median nervure in hind wings broken in the middle. Parapsidal furrows deep. Thorax more than three times longer than wide. Legs long and slender; the hind coxæ three times longer than wide; the fore tarsi twice the length of tibiæ; claws moderately long, slender. Head slightly wider than the thorax. Metapleural keels stout, reaching to the hind coxæ. Eyes large, reaching to the base of the clypeus, there being a clear malar space. Mandibles edentate, gradually narrowed towards the apex.

The type of this genus is a peculiar insect. It has the deep parapsidal furrows and the furrow on the lower part of the mesopleuræ of

the *Cryptinæ*, and its minute areolet would place it in the *Mesostenini*, but its uniform rufo-testaceous colour is very different from anything found in that group. It might in fact be readily mistaken for a *Paniscus* or an *Ophionid*. It differs from the *Cryptinæ* in the spiracles on the first abdominal segment being placed quite close to, almost at the middle—further back than in *Ophion*, but not so far back as in *Paniscus*. In the position in which the spiracles are placed it agrees with the Malay genus *Cæsula*. From the resemblance of the species to *Paniscus* and *Ophion* I have no doubt that observation will show that it is, like the genera mentioned, nocturnal in habits. The ocelli, too, are large as in these genera.

25.—*Earrana lutea*, sp. nov.

Plate B, fig. 3.

Luteous, smooth, and shining, the face, inner orbits to the ocelli and mandibles, except at the apex, lemon-yellow; the four front legs at the base yellowish, the hind tibiæ and tarsi fuscous; wings clear hyaline, the nervures black; antennæ longer than the body, black, the scape luteous; it is short, thick, not much longer than broad. Pleural sutures crenulated; on the median segment, between the hind coxæ, are three stout transverse keels, bordered on the outer side by a keel which runs down to the base of the hind coxæ. Mesopleural furrow deep, obscurely crenulated, ♀.

Length 10 mm.; terebra 2 mm.

Kandy, October.

Ophionidæ.

26.—*Ophion bicarinatus*, sp. nov.

Dark rufous, the eye orbits broadly, face, scutellum, and pleuræ pallid yellow; antennæ pale rufous, wings hyaline, the costa and stigma rufous, the nervures darker; the recurrent nervure received twice the length of the transverse cubital nervure behind the base of the apical abcissa of the radius; the stump of a nervure as long as the transverse cubital. On the apical slope of the metanotum, commencing at the transverse keel, are two stout longitudinal keels; the sides of the apical slope are bordered by a stout, waved keel, which extends to the base of the hind coxæ. Face minutely punctured; clypeal foveæ large, deep. Thorax impunctate, mesonotum covered with a fuscous pubescence; the parapsidal furrows distinct on basal half, ♀.

Length 21 mm.

Maskeliya, November.

The depression at the base of the metanotum is deep, roundly narrowed towards the apex; its width at the base longer than the total length. This species is much larger than any of the recorded British Indian species. It has keels on the metanotum as in *O. areolatus*, Cam., but, apart from the smaller size of the latter (15 mm.), *areolatus* has the basal depression on the metanotum semicircular, not dilated distinctly at the apex as in the Ceylonese species. *O. fuscomaculatus*, Cam., is also smaller and may readily be known by the recurrent nervure being received opposite the end of the basal abcissa of the radius. In one specimen there are indications of three fuscous lines on the mesonotum.

27.—*Pleuroneurophion erythrocerus*, sp. nov.

Head pale lemon-yellow, the thorax pale testaceous, the mesonotum more rufous in tint; the abdomen, except at the base, rufo-testaceous, darker towards the apex; legs testaceous, the anterior paler. Wings hyaline, the stigma testaceous, the nervures blackish; the basal abcissa of the disco-cubital nervure slightly roundly curved downwards at the apex; there is hardly an indication of a stump of a nervure on the disco-cubital nervure; its apical abcissa is slightly but distinctly longer than the basal abcissa of the cubitus, which is slightly shorter than the recurrent nervure; the disco-cubital is thickened in the middle, with a long bulla beyond. Prothorax and mesothorax closely punctured, the propleuræ obscurely striated. Basal depression of metanotum with two stout and some indistinct keels; the base smooth, the rest with broadly rounded striæ Metapleural keel broad, rounded at base and apex, the middle slightly turned upwards, ♀.

Except that there can hardly be said to be a stump of a nervure on the disco-cubital nervure this species fits into *Pleuroneurophion*. It has the thickened base of the radius of that genus and of *Eniscospilus*, but it wants the horny points found always in the latter genus.

The transverse median nervure is placed behind the transverse basal; the median nervure in hind wings is broken far below the middle. The ocelli are not in a black patch. The antennæ are much more reddish in tint than the body.

Length 14–15 mm.

Peradeniya.

28.—*Eniscospilus spilonotus*, sp. nov.

Rufo-testaceous, the head, except the ocellar region which is black, yellow; the mesonotum with three large black lines, the fifth and following segments of the abdomen black. Antennæ black, fuscous towards the apex. Wings hyaline, the stigma and nervures

black; there is one dark horny point, broadly transverse below, roundly narrowed in front, the base rounded, the apex slightly rounded inwardly. Transverse cubital nervure two-thirds of the length of the recurrent, which is more than twice its length from it. Scutellum yellow, its apical half irregularly striated. Base of metanotum smooth; the base of the apical part smooth, except for a few irregular striæ; the centre with roundly curved irregular striæ; the apex smooth. Propleuræ almost smooth, the centre of the mesopleuræ finely, closely striated except above; metapleuræ below the keel finely, irregularly striated; the spiracular area coarsely, irregularly, obliquely striated, much more strongly towards the apex than at the base. Metasternal keel stout, curved at base and apex, the base dilated.

Brulle (Hymen. IV., 145) describes an *O. plicatus* from Java which has three black marks on the mesonotum; but it is an *Ophion*, not an *Eniscospilus*, it having no horny points in the wings.

29.—*Eniscospilus melanocarpus*, sp. nov.

Rufous: the fifth and following segments of the abdomen black: the antennæ black, broadly rufous at the base: wings hyaline, the stigma and nervures black; the horny point triangular, the sides rounded, large, and with a long curved tail; there is a small point beyond the middle of the latter, about twice longer than wide, rounded behind, transverse at the apex. Transverse cubital nervure one-third of the length of the apical branch of the disco-cubital and about one-fourth shorter than the recurrent. Scutellar keels stouter than usual. Basal depression of metanotum stoutly closely striated, more closely in the centre than on the sides; the base smooth; the rest closely reticulated, less closely at the base, where there are some irregular longitudinal keels. Pleuræ closely, but not strongly punctured; the metapleuræ more strongly than the rest; the propleuræ striated closely in the centre.

Length 12 mm.

Kandy, August.

30.—*Eniscospilus xanthocephalus*, sp. nov.

Testaceous, the head and scutellum pallid lemon-yellow; the ocellar region and the fifth and following abdominal segments black; the occiput and a line in the centre of the face rufous. Antennæ rufo-testaceous; the basal two-thirds of the first abdominal segment yellow. Wings clear hyaline, the stigma clear testaceous, the costa and nervures black; transverse cubital nervure straight, oblique, slightly more than one-half the length of the recurrent

nervure, which is about one-fourth shorter than the apical abcissa of the disco-cubital nervure ; third discoidal cellule short and wide, in length not much more than twice its width at the apex. Transverse basal nervure interstitial. The horny spot is broadly rounded above, slightly, gradually narrowed to the apex which is transverse ; the apical spot is much smaller, about three times longer than wide, oblique at the base, narrowed at the apex, ♀.

Length 11–12 mm.

Peradeniya, June.

Smooth and shining ; the upper half of the mesopleuræ finely punctured, the lower finely, closely, longitudinally striated. Basal slope of metanotum with a keel in the centre and one on the sides ; the basal region smooth, the apical almost smooth in the centre, the sides transversely striated. Apex of clypeus broadly rounded.

This species is readily known from the other species here described by the wide, as compared with its length, third discoidal cellule

31.—*Eniscospilus unilineatus*, sp. nov

Pallid testaceous, the head pale lemon-yellow ; the third and following segments of the abdomen fuscous ; a deep, black, broad line in the centre of the middle lobe of the mesonotum, the mesosternum black ; the apex of the first and the second abdominal segments are more rufous in colour. Legs coloured like the thorax, the femora deeper in tint. Wings hyaline, the nervures and stigma black ; the basal horny point is pyriform and is followed by a less distinct curved line ; beyond it is a small square spot, ♀.

Length 17 mm.

Peradeniya, July

Antennæ rufous, the scape and the basal 10–11 joints of flagellum blackish. Head shining, impunctate ; the apex of clypeus broadly rounded. Mesonotum shining, covered with a pale pubescence. Basal half of scutellum keeled laterally. Base of metanotum smooth, irregularly transversely striated laterally, the centre irregularly stoutly reticulated ; the apical slope with some stout, irregular, roundly curved keels. Propleuræ smooth, indistinctly obliquely striated below. Mesopleuræ closely, finely punctured. Metapleuræ finely rugose, the upper part with some stout, oblique striæ.

32.—*Eniscospilus dasychirœ*, sp. nov

Pallid luteous, the abdomen darker coloured, especially towards the apex ; the head pallid yellow ; antennæ rufous. Wings hyaline, the stigma, costa, and basal abcissa of radius testaceous ; there is one small pyriform horny point ; the transverse cubital nervure

slightly roundly curved, as long as the recurrent nervure. Scutellum keeled laterally to the apex. Base of metanotum smooth; the basal depression with a stout central and two or three keels on either side of it; the base, behind the keel, is irregularly striated; the striæ in the centre longitudinal, the others irregularly transversely, the rest of the segment with close, rather strong, regularly roundly curved striæ. Propleuræ closely, obliquely striated. Mesopleuræ closely punctured. Metapleuræ closely, coarsely, obliquely striated.

The disco-cubital nervure is roundly curved and thickened in the centre and with a large bulla beyond the thickened part. Legs densely pilose; the pile on the femora longer, paler, softer, and sparser than on the tibiæ or tarsi, ♀.

Length 21 mm.

Pundalu-oya, January.

Bred from *Dasychira horsfieldi*.

33.—*Eniscospilus horsfieldi*, sp. nov.

Length 18 mm., ♀.

This species is very similar to the above described, but is smaller, more slenderly built, and paler in colour. The two may be separated thus :—

Length 18 mm.; transverse cubital nervure straight, oblique, not distinctly rounded; distinctly shorter than the recurrent nervure, *horsfieldi*.

Length 21 mm.; transverse cubital nervure with a distinct, rounded curve, as long as the recurrent nervure, *dasychiræ*.

Base of metanotum shagreened; the base of the apical part has one or two longitudinal keels; the rest with irregular, curved keels pointing towards the apex; the rest is closely covered with roundly curved backwards, striæ, which, at the apex, extend on to the pleuræ. Propleuræ rather strongly obliquely striated in the middle; the mesopleuræ in the centre above broadly, and below entirely striated; the upper part of the metapleuræ coarsely, irregularly reticulated; the rest closely, somewhat strongly, obliquely striated. Stigma, costa, and basal abcissa of radius, rufo-testaceous; there is only one small, somewhat pyriform horny point. Legs densely pilose. The middle lobe of the mesonotum is darker than the latter.

Spilophion, gen. nov.

Transverse median nervure broken shortly, but distinctly, below the middle. Base of radius thickened. Disco-cubital nervure roundly, broadly curved, without a stump; originating before the

discoidal nervure. Transverse median nervure interstitial. Abdomen strongly compressed, more than twice as long as the head and thorax united. Apex of clypeus transverse; labrum projecting, roundly narrowed towards the apex, more than half the length of the clypeus.

This genus has the thickened base of radius of *Pleuroneurophion* and *Enicospilus;* the former may be known from it by the not interstitial transverse basal nervure and by the angled, almost broken disco-cubital nervure; the latter by the presence of blister spots and by the transverse median nervure in hind wings being broken far below the middle. Characteristic are the projecting labrum and the spotted wings.

34.—*Spilophion maculipennis*, sp. nov.

Plate B, fig. 13.

Testaceous, largely marked with yellow; three large marks, narrowly separated, on the mesonotum, apex of metanotum, a large mark, obliquely narrowed at the base, on the lower half of the mesopleuræ, a large ovoid mark on the metapleuræ; the third abdominal segment above and the greater part fifth and sixth black; wings hyaline, the base of radial cellule smoky; the stigma and the nervures black; the former pale at the base; face, oral region, and orbits lemon-yellow; antennæ rufo-testaceous, ♀.

Length 15–17 mm.

Peradeniya, September.

Basal abcissa of radius thickened at the base. Disco-cubital nervure roundly curved downwards, the apex broadly, roundly curved upwards; the cellule bare above, but without horny points. Head smooth and shining, almost entirely yellow. Prothorax and mesothorax impunctate. Scutellum laterally keeled to near the apex. Metanotum behind the keel smooth; the base depressed, with two stout keels in the middle; down the centre of the smooth part is a fine longitudinal keel. The basal part is smooth laterally; the centre with three or four irregular keels; the central stoutly irregularly reticulated, its sides obliquely stoutly striated, the striæ clearly separated; the apical slope has some widely separated irregular longitudinal striæ. Pleuræ smooth and shining.

35.—*Paniscus intermedius*, sp. nov.

Fulvous, the thorax slightly tinged with yellow, the face, oral region, and orbits pale yellow; antennæ rufous, darker towards the apex, wings hyaline, the stigma fuscous, the nervures blackish. Scutellum stoutly keeled, the keels uniting at the apex in a sharply

pointed angle. Areolet oblique, almost appendiculated above; the second nervure largely bullated; the recurrent nervure above and shortly below the middle widely bullated. Disco-cubital nervure roundly, broadly curved, not broken by a stump of a nervure. Transverse median nervure in hind wings broken near the bottom of the upper fourth. Median segment smooth at the base, the rest closely transversely striated, the striæ running into reticulations at the apex. Pronotum and mesonotum closely, minutely punctured; parapsidal furrows distinctly defined, especially in the middle. Legs coloured like the body, the anterior paler than the posterior; tarsal joints spinose at the apex and more sparsely on the rest, ♀ and ♂.

Length 10–11 mm.

Maskeliya; Pundalu-oya.

Owing to their uniform colouration the species of *Paniscus* are difficult to define. The present species appears to be sufficiently distinguished from the known Oriental forms by (1) its smaller size; (2) by the transverse median nervure in hind wings being broken higher up, nearer the upper fourth than the upper third as with the others; (3) by the keels on the scutellum uniting in a sharp angle, while in the others they do not unite, but are widely separated. As with the other species the ocellar region is black. The apex of the clypeus is more transverse, less rounded than it is in the other species. The second joint of the hind tarsi is distinctly shorter than the third and fourth united. The temples are little developed and obliquely, sharply, roundly narrowed.

36.—*Paniscus orientalis*, sp. nov

Rufous, the orbits narrowly pale yellow; stigma testaceous, the nervures black. Scutellum more strongly punctured than the mesonotum, whose furrows are distinct on its basal two-thirds only; the scutellar keels are stout and do not unite at the apex. Metanotum smooth at the base only, the rest closely, strongly, transversely striated. Pleuræ closely, distinctly punctured; the lower part of the propleuræ and metapleuræ closely, distinctly, obliquely striated. Transverse median nervure in hind wings broken shortly above the middle; disco-cubital nervure not broken by a stump of a nervure. Ocellar region black. Face strongly and closely, the clypeus sparsely punctured, the apex of the latter bluntly rounded. Wings hyaline, the stigma testaceous, the nervures black. Tarsal spines long, ♀.

Length 13 mm.

The pleuræ are much more strongly punctured than the mesonotum, which is almost smooth.

This is a larger species than *intermedius*, but still smaller than the other Indian species; from *intermedius* it may be known by its

deeper rufous colour; by the transverse median nervure in hind wings being broken lower down, by the scutellar keels not converging at the apex, by the temples being more largely developed and not so obliquely narrowed, and by the metapleural keel being much more broadly developed, especially at the base. Antennæ dark rufous, darker towards the apex.

Pundalu-oya, October.

Paniscus ceylonicus, Cam., is a much larger (nearly 25 mm.) and stouter species than the two I have described here; the stigma is dark fuscous; the disco-cubital nervure is broken distinctly by a stump of a nervure; the recurrent nervure forms two rounded curves, the upper being more broadly rounded, while in those here described it forms one curve only.

37.—*Paniscus lævis*, sp. nov.

Pallid yellow, entirely smooth and shining; the antennæ with a rufous tinge, not darkened towards the apex, wings hyaline, the stigma pallid yellow, the nervures blackish, ♀.

Length 8 mm.

Kandy, July.

This species differs from the other Oriental species in being perfectly smooth, the head and thorax being impunctate and the metanotum not striated. It differs also in the transverse median nervure being received at a greater distance from the transverse basal, and the eyes below are separated by the same distance as they are at the top, while in the others, *e.g.*, *orientalis* and *intermedius*, the distance is clearly greater below than it is above. The parapsidal furrows, too, are much less strongly indicated.

The scutellar keels do not unite at the apex. Apex of clypeus rounded; above it is not separated from the face. There is no malar space, the eyes touching the base of the mandibles. Temples distinct, obliquely narrowed. Transverse median nervure in hind wings broken close to the bottom of the upper fourth, the lower part with a more sharply oblique slope than usual. The antennæ are much more densely pilose than usual, the pile being close, long, and white. The metasternal keel is wider at the base than at the apex. It is a more slenderly built species than the others.

38.—*Campoplex greeni*, sp. nov.

Black, the third, fourth, and fifth abdominal segments red; the apex of the fore femora, tibiæ, and tarsi testaceous; the middle femora near the apex and the tibiæ more broadly at the base,

obscure testaceous; calcaria dark testaceous. Wings hyaline, the nervures and stigma black, ♀.

Length 10 mm.

Hatton; Pundalu-oya, February.

Head and thorax thickly covered with silvery pubescence. Head closely punctured. Mandibles uniformly dark rufous including the teeth, their base thickly covered with white pubescence. Palpi dark testaceous. Thorax closely, distinctly punctured, the pleuræ less closely than the mesonotum; the middle and lower part of the propleuræ with curved, oblique, clearly separated striæ; the apical central depression on the mesopleuræ closely, regularly striated. On the base of the metanotum are two roundly curved keels, forming two areæ, which are as long as wide; the centre is depressed and transversely striated closely above, more widely and broadly below. Areolet small, oblique, shortly appendiculated.

39.—*Limnerium taprobanicum*, sp. nov.

Black; the mandibles and palpi pale testaceous; the four front legs dark rufous, the coxæ black at the base, trochanters pale yellow; the hinder darker red, their coxæ and basal joint of trochanters, apex of tibiæ, and the tarsi black; wings hyaline, the nervures fuscous black; the stigma paler below, ♀.

Length 6 mm.

Maskeliya.

Head and thorax opaque, covered with white pubescence finely closely punctured. In the centre of the base of the metanotum is a clearly defined area about three times longer than wide and of equal width throughout; from the apex of this two keels run; they are at the base roundly curved outwardly, then run obliquely to the outer side of the apical slope, uniting with the pleural keel above the middle of the coxæ. Propleuræ closely, and rather strongly obliquely striated. Areolet shortly appendiculated, 4-angled, its width at the angles as long as its length; the recurrent nervure is received in the middle.

40.—*Nototrachys reticulatus*, sp. nov.

Black, the four anterior legs and the antennal scape testaceous tinged with fuscous, wings hyaline, the apex slightly fuscous, the nervures and stigma black, ♀.

Length 7–9 mm.

Peradeniya, January.

Antennæ 20-jointed, the last joint as long as the preceding two united, densely covered with a microscopic pile; testaceous towards the apex; the first joint of flagellum distinctly longer

than the second. Front and vertex shining, the former transversely finely striated, keeled down the middle. Face and clypeus closely punctured. Mandibles rufous. Mesonotum closely, irregularly reticulated, the sides closely strongly punctured. Scutellum more widely and irregularly reticulated, its sides stoutly keeled. Metanotum reticulated, more widely and distinctly on the basal than on the apical slope; the base bordered by a keel and with a small area, longer than broad and of equal width in the centre. Propleuræ smooth, the apex with a stoutly striated border. Mesopleuræ finely rugose and irregularly obliquely striated. Metapleuræ rugose and irregularly reticulated. Abdomen smooth and shining; the basal two segments as long as the head and thorax united; the first shorter than the second and dilated at the apex.

Transverse basal nervure interstitial; disco-cubital roundly curved; third discoidal cellule at base more than half the width at the apex; transverse median nervure in hind wings unbroken. Hind tarsi longer than tibiæ, claws minute, the calcaria of moderate length; tarsi minutely spinose, slender. Antennæ, slender, as long as the head, thorax, and first segment of the abdomen. Scutellar depression large, wide, deep.

I have, unfortunately, not an example of *Nototrachys* for comparison, but the species I have described agrees fairly well with the descriptions of that genus.

Clatha, gen. nov.

Hind wings with only two cellules, a large anterior, reaching to shortly beyond the middle, and with the apex broadly rounded, and a posterior, not reaching to the middle of the anterior and with its apex straight and slightly oblique. Disco-cubital nervure interstitial with the discoidal, rounded at the base, the third discoidal cellule narrowed and pointed at the base; second discoidal cellule one-third wider at apex than at base. Hind tibiæ as long as the trochanters and femora united, curved and narrowed at the base; the basal joint of the trochanters about four times longer than the apical. Mandibular teeth large, unequal. Hind metatarsus as long as the other joints united.

The transverse median nervure interstitial. Claws small, simple; apex of clypeus rounded. Eyes bare, converging below. Occiput transverse, margined.

This genus comes close to *Agrypon*, Foer., as defined by Ashmead (Bull. U. S. Nat. Mus., XXIII., 89), which apparently is identical with *Atrometus*, Schmied. (Zeits. für Hymen. u. Dipt. 1902, 361) non. Ashm. The total absence of apical nervures in the hind wings should

readily separate the present genus. In them the anterior nervure forms one piece, it being in one continuous rounded curve; the second nervure is joined to it by a transverse nervure. The hind legs are very long.

41.—*Clatha longipes*, sp. nov.

Rufo-testaceous, a line of equal width, enclosing the ocelli, across the vertex, a line on the centre of the mesonotum extending from the base to near the apex, a shorter, broader line on the sides, more irregular in form, not commencing at the base, but reaching to the apex, the scutellar depression, the base and apex of the scutellum, the base of the metanotum, a line down its centre and one of similar size on the sides, a band on the centre of the propleuræ, a smaller one on the mesopleuræ, and one on the base of the metapleuræ, black. Four front legs yellowish testaceous, the hinder black, their coxæ testaceous, with a black line on the outer side. Antennæ filiform, longer than the body, black, the base testaceous below. Wings hyaline, the nervures and stigma black, ♂ (?)

Length to apex of second abdominal segment 9 mm. (the other segments missing).

Kandy, July.

Head smooth and shining; the lower part of the face, clypeus, mandibles, the parts behind and before the ocelli, yellow. Mesonotum and scutellum rugosely punctured; the metanotum closely reticulated. Pleuræ coarsely, rugosely reticulated, the centre of the propleuræ and mesopleuræ striated. Legs densely shortly pilose; the hind femora streaked with testaceous below. The basal two segments of the abdomen are as long as the thorax; are thin, of equal length, and the first is dilated at the apex.

42.—*Trichomma nigricans*, sp. nov.

Black; face, clypeus, mandibles, orbits all round, a broad band narrowed at the base on the pronotum, tegulæ, scutellum, four front coxæ and trochanters, the fore femora and the four front femora and tibiæ anteriorly, the calcaria and the hind coxæ broadly at the base above, yellow. Wings hyaline, the nervures and stigma black, ♀.

Length 16 mm.

Kandy, August.

Head covered with white pubescence, smooth; the front with a striated band which gets narrower below. Mesonotum opaque, the furrows and the part at their apex irregularly reticulated; the apex in the middle finely, closely, transversely striated. Scutellum smooth. Metanotum coarsely reticulated, as are also the pleuræ.

The apex of the propleuræ from above the middle stoutly striated ; the mesopleuræ more finely, closely striated. Thorax except the mesonotum thickly covered with silvery pubescence.

Eyes large, pilose, converging below, incised on inner side, reaching close to the base of the mandibles. Transverse median nervure in hind wings unbroken. Second recurrent nervure received beyond the transverse cubitus ; the transverse median about the same distance beyond the transverse basal. Mesonotal furrows distinct. Second discoidal cellule not much wider at apex than at base ; the third half the width at the base it is at the apex. Scutellum laterally keeled. Mesopleuræ strongly, closely, longitudinally striated. The second discoidal cellule not much wider at the base than at the apex ; the third half the width at the base it is at the apex. Ovipositor half the length of the abdomen. Occiput margined, not quite transverse. Temples not narrowed. Mandibular teeth of equal length. Basal joint of hind trochanters more than twice the length of the apical ; the hind femora narrowed at the base.

TRYPHONINÆ.

43.—*Bassus orientalis*, sp. nov.

Black ; the face, clypeus, mandibles, palpi, the eye orbits to near the ocelli, a large mark on the sides of the mesonotum reaching to the tegulæ, broad in front, becoming gradually narrowed towards the apex, the upper hinder edge of the propleuræ touching the tegulæ, tubercles, tegulæ, scutellum, post-scutellum, and a small triangular mark below the hind wings, lemon-yellow. The apices of the basal three segments of the abdomen narrowly lined with pale yellow ; the apical two lines widely interrupted in the middle. Four front legs yellow, their femora tinged with fulvous ; the hind coxæ yellow, tinged with fulvous ; the femora fulvous ; the hind tibiæ yellow to shortly beyond the middle, the rest of them and the tarsi black. Scape of antennæ yellow, the flagellum brownish beneath. Wings hyaline, the stigma and nervures black, ♂.

Length 6 mm.

Peradeniya.—Bred from Syrphid larvæ feeding on the tea aphis. April.

The lateral sutures bounding the clypeus straight, oblique, the top rounded, the apical half narrowed, the sides roundly curved, the apex slightly, but distinctly roundly incised ; the face and oral region covered with short white pubescence. Vertex punctured but not strongly or closely ; the front less strongly punctured and distinctly furrowed down the centre. Thorax closely punctured ; the metanotum is more closely, more rugosely punctured ; the central apical

part is bounded by a rounded keel and is closely distinctly reticulated. The basal three segments of the abdomen are closely, distinctly, rugosely punctured, as is also the basal half of the fourth and less strongly the basal third of the fifth; the apical half of the fourth is sparsely punctured; in both segments the punctured basal part is bounded by a transverse furrow, there being also a similar furrow on the third and a less distinct one on the second. The raised central part of the first segment of the abdomen is depressed in the centre. The metapleuræ below the keel are smooth, above it rugosely punctured.

Allied to the European *B. multicolor*. The now cosmopolitan, *B. lætatorius*, Gr., probably is found in Ceylon. I have seen it from India, and lately from South Africa.

44.—*Rhorus spinipes*, sp. nov.

Black; face, apex of clypeus, mandibles, malar space, inner orbits, a mark on either side of the mesonotum, the mark triangularly dilated on the inner side at the apex, scutellum, a broad band on the apex of the metanotum, a roundish mark on the upper side of the base of mesopleuræ, a larger quadrangular one on the apex below, the usual mark under the hind wings, the apex of metapleuræ, the mark united to that on the metanotum and the apices of the abdominal segments, yellow. Four front legs yellow, the hind coxæ black, yellow above, the trochanters for the greater part black, femora rufous, tibiæ dark red, blackish at the apex, tarsi black. Wings hyaline, the stigma fuscous, ♀.

Length 7 mm.; terebra 2 mm.

Kandy.

Antennæ longer than the body, the scape marked with yellow, the flagellum brownish below. Smooth and shining; the metanotum obscurely, finely, transversely striated, the basal half furrowed down the middle. Abdomen smooth, shining, densely, shortly pilose. Areolet oblique, triangular, shortly appendiculated. Four hind tibiæ and tarsi thickly spinose.

This is probably not a typical *Rhorus*, but there is no other genus into which I can make it enter. I do not know the type of the genus. In my species the transverse median nervure in hind wings is broken near the bottom, the transverse median nervure is interstitial, and the recurrent nervure is interstitial with the second transverse cubital.

Pimplinæ.

45.—*Epirhyssa ornatipes*, sp. nov.

Pale fulvous yellow; the middle of front, the ocellar region, the mark united to the eyes by a black band of equal width throughout,

the occiput in the centre, its black mark united to the black on the vertex by a short line ; mesonotum except for a large mark in the centre, longer than broad, of equal width and transverse at the base and apex, post scutellum, a narrow line on the base of metanotum, a large, somewhat triangular mark on the apical half, a line on its apex, a conical mark on the lower side of the propleuræ, the lower side and apex of metapleuræ and bands on the base and apex of the back of the abdominal segments, deep shining black. Wings hyaline, their apex smoky, the nervures and stigma black. Legs coloured like the body, the base of the four hinder trochanters, a broad band on all the femora behind in the centre above, a shorter line on the hinder pair in front; the base and apex of the hind tibiæ broadly and the four hinder tarsi, black, ♂.

Length 10 mm.

Hantane, March.

Antennæ black. Mandibles and the parts at their base black. Head and thorax shining, smooth, except for the usual striation on the mesonotum and the scutellum which is finely transversely striated. Head and pleuræ covered with a short, white pubescence. The black basal and apical bands on the penultimate abdominal segments are united with a black line down the centre. The apical joint of the fore tarsi is black.

46.—*Theronia maskeliyæ*, sp. nov.

Pallid yellow, the ocellar region, the mesonotum except for two lines on the basal three-fourths in the centre and the outer side, a mark in the centre of the scutellum, dilated roundly at the apex, the base of the metanotum, narrowly in the centre, broadly at the sides, a large mark roundly narrowed at the apex, incised at the base, and broad bands on the base of the other segments, black. Antennæ stout, as long as the body, black, the scape yellow below, the base of flagellum fuscous. The femora broadly marked with black above, the middle tibiæ infuscated behind ; the base of the hind tibiæ and a broad band below it, fuscous black ; the four hinder tarsi blackish. Wings clear hyaline, the nervures and stigma black, ♀ and ♂.

Length 10 mm.; terebra 3 mm.

Kandy, August ; Maskeliya, April.

Smooth and shining, covered with a short, white down. There is no central area on the base of the metanotum, but two lateral ones, longer than wide, narrowed towards the apex ; the outer keel is straight, oblique, the inner rounded ; from its outer side a keel runs along the sides of the segment to its apex, there being thus a

large central area extending from the base to the apex of the metanotum, the base being narrowed owing to the basal areæ. There is a curved black line on the occiput.

A variable species as regards the size of the black markings. The scutellum may have no black mark ; the size of the black lines on the legs varies, that on the hind femora may be cleft, wholly or in part, the pleuræ may be marked with black, and, as is the case with many *Pimplides*, there is a considerable variation in size.

Erythrotheronia, gen. nov.

Median segment areolated, not toothed ; the spiracles longer than wide. Scutellum raised, stoutly keeled laterally to near the apex. Abdomen smooth, without furrows. Eyes incised, but not deeply on the inner side ; malar space almost absent. Last joint of antennæ shorter than the preceding two united. Areolet oblique, 5-angled ; the transverse median nervure interstitial. Transverse median nervure in hind wings broken distinctly above the middle. Temples moderately large, obliquely narrowed. Legs stout ; the claws large, edentate.

The type of this genus looks like a red *Xanthopimpla* or *Theronia*. In Dr. Ashmead's system it comes near to the New Zealand genus *Allotheronia*, from which it differs in the regularly areolated, not dentate median segment. *Theronia* and *Neotheronia* differ, *inter alia*, in having pectinated claws.

47.—*Erythrotheronia flavolineata*, sp. nov.

Plate B, fig. 12.

Ferruginous, smooth, and shining ; the face, clypeus, mandibles, palpi, lower outer orbits, malar space, lower half of propleuræ, two lines on the mesonotum, inner side of tegulæ, the edges of mesonotum at the base, scutellar keels, apex of scutellum, post-scutellum, apical slope of metanotum, pleuræ except above and the apices of the abdominal segments, yellow. Legs ferruginous, the four anterior coxæ and trochanters yellow, as are also the hinder trochanters. Wings hyaline, with a slight fuscous-violaceous tinge and highly iridescent ; the stigma testaceous, the nervures black, ♀ and ♂.

Length 14 mm.; terebra 3 mm.

Kandy, July.

Antennæ black, the scape yellow, the flagellum brownish beneath. Face sparsely, but distinctly punctured, the sides raised. Thorax and abdomen smooth, shining, impunctate ; the mesonotum thickly covered with fuscous pubescence. On the base of the metanotum are five large areæ, a large central, twice longer than wide, with two

wider than long on either side of it, the basal being the larger, the keel bordering it being broadly rounded at the apex; the apical are widest on the outer side; there is only one larger area on the apical slope, on the sides is a large spiracular area, followed by a much smaller, somewhat triangular one at the apex.

48.—*Echthromorpha ornatipes*, Cam.

Plate B, fig. 8.

This species (described from the Khasia Hills, Assam) has been taken at Peradeniya by Mr. Green.

49.—*Xanthopimpla taprobanica*, sp. nov.

Pale yellow, a triangular mark enclosing the ocelli, a broad band, irregularly trilobate—one on each lobe—across the base of the mesonotum at the tegulæ, a mark on the tegulæ continuous with it, a large transverse mark, roundly curved at the base and extending on to the scutellar depression, a broad band, narrowed in the centre, on the base of the metanotum, two large oblique marks on the centre of the first abdominal segment, dilated in the centre at the base, a small oblique mark, obliquely narrowed at the base and apex on the second, a large broad band on the third, irregularly narrowed laterally and slightly incised in the middle at the base and apex, two large broad bands, rounded on the outer side on the fifth, a broad band on the basal half of the penultimate and two marks on the last, black. Legs coloured like the body; the middle knees, base of middle tarsi, the greater part of hinder trochanters, a broad band on the lower part of the hind femora, apex of femora narrowly above, base of tibiæ, and the tarsi (the middle joints paler in colour), black. Wings hyaline, their apex with a fuscous cloud, ♀.

Length 10 mm.; terebra 2 mm.

Kandy.

Face rugosely punctured; the upper part of the clypeus sparsely punctured. Mesonotum smooth, impunctate; parapsidal furrows reaching shortly beyond the middle. Scutellum roundly convex, the keels not very stout. Areola large, open at the base, transverse at the apex, longer than broad, the sides angled shortly behind the middle; the basal lateral area wider on the outer side, the sides roundly curved; the second large, broad, oblique, of equal width throughout; the apical lateral area triangular; the apex on the outer side, the upper angle longer than the lower. First segment of abdomen in length clearly longer than its width at the apex, smooth, except for some punctures in the middle, the second to

fourth segments closely and strongly punctured, the furrows crenulated. Areolet small, oblique, triangular, shortly appendiculated.

The occiput is immaculate, except that the ocellar black spot slightly projects into it. Pleuræ impunctate. Ovipositor as long as the hind tarsi.

In Professor Krieger's work on *Xanthopimpla* this species would come in near *X. splendens*. *Cf.* Bericht d. Naturf. Ges. zu Leipzig, 1898, 69.

50.—*Xanthopimpla kandyensis*, sp. nov.

Yellow; the ocellar region, the mark longer than broad, three almost continuous marks on the mesonotum at the base, the central placed more in advance than the others, longer than broad, transverse at the base, rounded behind, the lateral longer compared with the width, more irregular, slightly incised in the middle at the base, rounded and narrowed at the apex; two irregular, slightly oblique marks, narrowed on the inner side, on the first segment; two large marks, broader than long, with the sides rounded, on the third; two somewhat similar ones on the fifth, but broader, more slender compared with the length, and two similar but larger (the largest of all) on the seventh and two marks on the base of the metanotum, broader than long, transverse behind, rounded at the apex, black. Antennæ black, the flagellum brownish, the scape yellow below. Wings clear hyaline, the nervures and stigma black, ♀.

Length 11 mm.; terebra 4 mm.

Kandy, July.

Face and clypeus closely, distinctly, but not very strongly punctured. Thorax smooth and shining. The areola on metanotum broader than long, slightly obliquely narrowed from the apex to the base; the lateral areæ are of almost the same width, the outer side obliquely narrowed; following them is an area which becomes obliquely narrowed from the base on the inner to the apex on the outer. Basal two segments of abdomen smooth, the others closely but not strongly punctured; the furrows closely striated.

The occiput has no black.

Allied to *X. punctata*, F.

51.—*Xanthopimpla parva*, sp. nov.

Pallid yellow, a triangular mark enclosing the ocelli, an irregular transverse line on the base of mesonotum, with ragged edges, a mark at the base of the scutellum, two marks, narrowed from the outer to the inner side, on the base of the metanotum, and marks, broader than long, on the first, third, and following segments, black. Legs coloured like the body, two small marks on the hind trochanters, a

mark on the base of the hind tibiæ, and a smaller one on the base of the hind tarsi, black. Wings clear hyaline, the nervures blackish, ♂.

Length 6 mm.

Peradeniya, August.

Face closely punctured. Thorax impunctate; the parapsidal furrows indicated only at the base. There is no central area on the base of the metanotum, but two semicircular large lateral ones enclosing the black spots; there is none on the apex. The basal two abdominal segments smooth; the furrows striated; the other segments are closely punctured. The apex of the wings slightly infuscated. Base of mesonotum rounded.

This and the following species are very much smaller than any of those described hitherto.

52.—*Xanthopimpla minuta*, sp. nov.

Yellow; a triangular mark enclosing the ocelli, the scutellar depression, two marks on the first abdominal segment, a transverse line on the third, two closely continuous ones on the fourth, two more widely separated ones on the fifth, two still more widely separated marks on the sixth, and a line on the seventh, black. The base of the hind tibiæ marked with black. Wings hyaline, the nervures and stigma black, ♀.

Length 5 mm.

Kandy, July.

Face minutely punctured. Base of mesonotum transverse, the parapsidal furrows distinct, the middle lobe clearly separated. Smooth and shining. There is no area on the base of metanotum; there is a clearly defined lateral area, broader than long, broad on the outer, becoming gradually narrowed to a fine point on the inner side; the sides of the metanotum are keeled. Abdomen closely punctured, with distinct, striated furrows. The apical half of the first segment is raised, clearly separated, smooth, of equal width and twice longer than wide. Antennal scape for the greater part yellow, the flagellum brownish beneath. The antennæ are clearly longer than the body. The ovipositor short.

This species can easily be distinguished from *X. parva* by the distinct parapsidal furrows and by the mesonotum being transverse, not rounded at the base.

Philopsyche, gen. nov.

Eyes very large, reaching to the base of the mandibles, there being no malar space; on the inner side they are distinctly incised. Face keeled down the middle, clearly separated from the clypeus by a

furrow; the extreme apex of clypeus depressed, not quite transverse. Last joint of antennæ as long as the preceding two united. Scutellum roundly convex. Transverse median nervure in hind wings broken far below the middle. Areolet triangular, small, appendiculated. Transverse median nervure in fore wings placed immediately behind the transverse basal, almost interstitial. Abdomen and legs as in *Pimpla*. Metathoracic spiracles round. Claws slender, curved, untoothed. The sharp lateral ridges of the mesonotum do not extend on to the scutellum. The eyes do not converge anteriorly The last joint of hind tarsi about three times longer than the preceding.

If the apex of the clypeus is to be considered "impressed anteriorly at apex" this genus, in Dr. Ashmead's arrangement, would come in near *Itoplectis* and *Eremochila*, with neither of which can it be confounded; if "not impressed" then it would come nearest to *Tromatobia*, which is easily known from it by the entire eyes. The metapleural keel is distinct, complete. The disco-cubital nervure is angled beyond the middle, but not broken by the stump of a nervure. The genus should be readily known by the large, clearly incised eyes, reaching close to the base of the mandibles, round metathoracic spiracles, angled disco-cubital nervure, transverse median nervure in hind wings broken near the bottom, and smooth, white-banded apex of abdominal segments

53.—*Philopsyche albobalteata*, sp. nov.

Plate B, fig. 10.

Black; the antennal scape except above, palpi, hind edge of pronotum, tegulæ, and the apices of the basal six abdominal segments, white. Four front legs white, the hind coxæ and femora red; the basal joint of trochanters red, the apical white; the hind tibiæ at extreme base, and broadly in the middle, white, the rest black; the hind tarsi black, the basal joint white to near the apex, ♂.

Length 7–8 mm

Bred from *Psyche albipes* and *P. subteralbata*.

Matale; Peradeniya, August.

Head smooth and shining, the face covered with white, the clypeus with longer white hair; the former obscurely shagreened. Mesonotum and scutellum closely punctured, thickly covered with white pubescence. Metanotum smooth, shining, and bare at the base and apex, the middle punctured and thickly covered with long white hair. Abdomen closely and strongly punctured except on the white apices of the segments and thickly covered with black pubescence. Pleuræ smooth, almost bare, except on the metapleuræ above the keel.

Lissotheronia, gen. nov.

Abdominal segments broader than long, perfectly smooth, shining, impunctate; the first segment bituberculate at the base. Median segment strongly, closely, transversely striated, the spiracles about three times longer than wide, broader below than above. Eyes large, incised on the inner side; malar space small. Clypeus clearly separated, its apex obliquely depressed. Transverse median nervure in hind wings broken distinctly above the middle. Transverse median nervure received beyond the transverse basal. Discocubital nervure broadly rounded, unbroken. Claws simple; tarsi thickly spinose. Antennæ slender, longer than the body, the last joint nearly as long as the preceding two united.

This genus might be mistaken for a *Pimpla*, from which, however, it can be readily known by the perfectly smooth, shining abdomen. In Dr. Ashmead's system it would come in near *Allotheronia*, which may be known from it by the metathorax having a strong transverse apical area, with the upper angles dentate or tuberculate, the whole thorax, too, being "closely, finely, rugosely punctate" except for a spot on the middle of the mesopleuræ. It has the metanotum closely transversely striated as in *Lissopimpla*, having also the smooth abdomen of that genus; but otherwise is readily separated from it by the absence of parapsidal furrows and of a tooth on the hind femora.

54.—*Lissotheronia flavipes*, sp. nov.

Black, shining, except the median segment which is closely striated, the pleuræ more closely and obliquely than the dorsal surface; the legs yellow, except the fore coxæ in the middle below, and the four hind coxæ and trochanters, which are black; wings hyaline, slightly suffused with yellow. A spot on the scutellum in the centre, a curved one on the post-scutellum, and one on the base of the tegulæ are yellow. The depressed apex of the clypeus is smooth and shining; the raised upper part sparsely punctured. Face closely punctured; the sides of the lower part roundly convex. Tarsi spinose, much longer than the tibiæ. Sternum and under side of coxæ thickly covered with fulvous pubescence, ♀.

Length 15 mm.; terebra 4 mm.

Pundalu-oya, February.

55.—*Charitopimpla annulipes*, sp. nov.

Plate B, fig. 9.

Black; antennal scape except above, tegulæ, hind edge of pronotum, and palpi, yellow; the apex of the abdominal segments narrowly yellow; the yellow lines dilated at the sides and tinged with rufous

there. Four anterior legs yellow, tinged slightly with rufous; the hind coxæ and femora rufous, their trochanters yellow; hind tibiæ black, their base narrowly and the middle broadly white; hind tarsi black, the metatarsus to near the apex black. Wings hyaline, the nervures and stigma black, the areolet small, triangular, with a long pedicle, it being as long as the branch of the first transverse cubital nervure, ♀.

Length 12 mm.; terebra 5 mm.

Pundalu-oya.

Face sparsely pilose and punctured, the middle keeled. Apex of clypeus brown round the central incision. Mandibular teeth piceous. Front and vertex smooth and shining. Prothorax smooth, except along the upper edges. Mesothorax and metathorax closely punctured, thickly covered with pale pubescence; on the metanotum the pubescence is longer and more fulvous in tint. Except at the apices of the segments the back of the abdomen is closely and strongly punctured; the apical segments are only slightly punctured.

The antennæ are stout, as long as the abdomen; the last joint is as long as the preceding two joints united. The apices of the tarsal joints are spinose. The metapleuræ below the keel are smooth. The hind coxæ below and the extreme apex of the hind femora are black.

Charitopimpla was described by me in the Journ. Str. Br. Royal Asiatic Society, 1902, 48.

56.—*Lissopimpla rufipes*, sp. nov.

Plate B, fig. 14.

Black; the upper orbits broadly, the outer narrowly above, broadly below, the malar space, face, clypeus, labrum, mandibles, palpi, a raised line on the basal half of the pronotum, interrupted by the parapsidal furrows, a mark on the apex of the middle lobe of the mesonotum, transverse at the base, gradually roundly narrowed to the apex, scutellar keels to shortly beyond the middle, the apex of scutellum, the lateral keels, post-scutellum, the three tubercles on the apex of metanotum, a line on either side of the base of pronotum, the lower edge of propleuræ, tubercles, a small roundish mark on the base of mesopleuræ above the middle, the basal half below, a large mark, roundly narrowed at the apex, obliquely truncated at the base on the apex of the metapleuræ, the apex above the hind coxæ, two narrow lines on the centre of the first abdominal segment and about the apical third of the others, yellow. Legs rufous, the four coxæ and trochanters yellowish, the apex of the hind coxæ marked with black, as is also the base. Wings clear hyaline, highly

iridescent, the nervures and stigma black or fuscous black. The hind tibiæ are darker coloured, the hind tarsi fuscous, ♀.

Length 9–12 mm.; terebra 3–4 mm.

Maskeliya, April; Peradeniya, August.

Antennæ longer than the body, slender; the 8–12 joints of flagellum white. Labrum and clypeus closely and rather strongly punctured. Face depressed, stoutly keeled in the centre, the sides of the depression roundly curved. Prothorax and mesothorax smooth, shining; the pleural sutures closely striated. Metanotum, except in the centre at the base, closely transversely, the upper part of the metapleuræ obliquely, striated. Areolet, as in the typical species of the genus, oblique, the nervures uniting above. Femoral tooth small, but distinct.

The occurrence of *Lissopimpla* in Ceylon is of great interest, the genus hitherto having been regarded as Australian.

Tanera, gen. nov.

Abdominal petiole long and slender, narrowed at the base, as long as the following two segments united; the segments smooth and shining, longer than wide; there is a projecting ovipositor. Median segment uniformly coriaceous, without a transverse keel; there is a stout metapleural keel. Legs slender; the claws not pectinated; hind coxæ three times longer than wide. Areolet with a long pedicle, the cubital nervures roundly curved; the recurrent nervure is received at its apex; transverse median nervure received behind the transverse basal. Clypeus roundly convex, separated from the face; its apex broadly rounded. Occiput transverse; the ocelli placed close to the edge. Temples very short, almost obsolete behind the eyes. Antennæ nearly as long as the body; the last joint longer than the penultimate, but not so long as the preceding two united.

The eyes are large, converging slightly above; there is a distinct malar space; the ocelli are on the outer edge of the vertex. The keel on the edge of the metasternum projects at the apex into a distinct tooth. Metathoracic spiracles small, oval. The abdominal petiole is longer, more slender and narrower at the base than it is in *Lissonota*. If it is to be called "sessile," in Ashmead's table (U. S. Nat. Mus. XXIII., 49) it would fit in near *Trevoria*, with which it cannot be confounded; if "petiolate" then it would come in near *Atropha*.

57.—*Tanera annulipes*, sp. nov.

Plate B, fig. 11.

Black, smooth, and shining, except the pleuræ and metanotum, which are closely and strongly punctured; the latter more coarsely

than the former ; the clypeus, mandibles, palpi, a spot on the malar space, the inner orbits, more broadly above than below, scutellum, a line on the centre of the pronotum, tegulæ, tubercles, the apex of metapleuræ ; the basal third of the first abdominal segment, about the basal third of the second and third, the apex of the third more narrowly, and the apical segments, yellow. Legs rufous, the four front coxæ and trochanters tinged with yellow ; the hind tibiæ and tarsi fuscous, tinged with rufous, their base white. Wings hyaline, the apex of the radial and of the third cubital smoky ; the stigma fuscous, ♀.

Length 8 mm. ; terebra 5 mm.

Hatton.

58.—*Lissonota greeni*, sp. nov.

Black ; the clypeus broadly at the apex, more broadly in the centre, mandibles except the teeth, palpi, underside of the antennal scape, and the lower edge of the propleuræ, yellow ; first abdominal segment, basal third of the second, the base of the third narrowly, and of the fourth still more narrowly, red ; the apices of the second and third yellow, tinged with rufous. Legs red ; the anterior coxæ and trochanters and the middle coxæ at the base, yellow ; the hind tibiæ and tarsi black. Wings hyaline, the stigma and nervures dark fuscous, ♀.

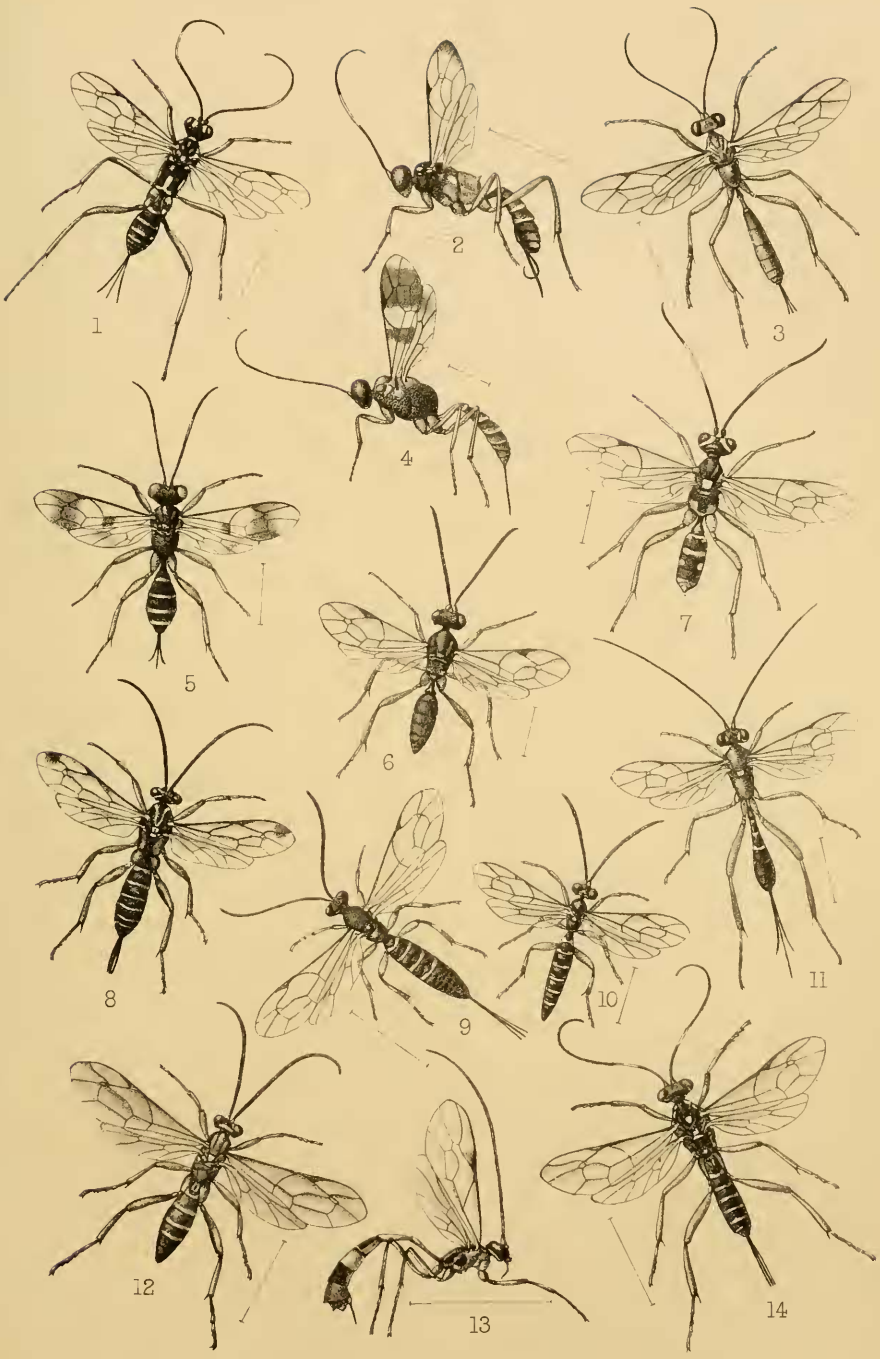
Length 8 mm. ; terebra 5 mm.

Peradeniya, March.

Closely and regularly punctured. First segment of abdomen closely, distinctly, longitudinally striated, except in the middle at the apex ; the second and third segments and the base of the fourth closely and regularly punctured ; the apical smooth and shining ; the last and the apex of the penultimate white. Areolet not appendiculated.

West, Newman ad.nat lith

HYMENOPTERA



West, Newman ad. nat. lith

HYMENOPTERA.

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illustrating Mr. P. Cameron's Paper on Phytophagous and Parasitic Hymenoptera.

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NOTES ON SNAKES COLLECTED AT HAKGALA, CEYLON.

By F. Wall, C.M.Z.S., Captain, I.M.S.

Fyzabad, United Provinces, India.

THROUGH the kindness of Mr. Nock I have received two collections of snakes at different times from Hakgala, Ceylon (5,600 feet).

The number of species included is small (6), and all are common; nevertheless, collections such as these are of distinct value with reference to distribution. It will be seen also that some very interesting information has been gleaned from the numerous specimens of *Aspidura trachyprocta* and *Ancistrodon hypnale*. I have omitted to give measurements, as the specimens were all preserved in spirit, and under these conditions do not lend themselves to accurate investigation.

Aspidura trachyprocta.

(48 specimens.)

With reference to this species I notice Günther says (Rept. Brit. Ind., p. 203): "This species is nearly as common in Ceylon as *A. brachyorrhos*." In the locality of Hakgala *A. trachyprocta* is evidently not only vastly more numerous than *A. brachyorrhos*, but by far the commonest snake to be met with at all. No single specimen of *A. brachyorrhos* was included.

Food.—Several specimens had their stomachs distended with a soft putty-like mass, the nature of which I could not determine. Once I thought I could distinguish a slug, and once a grub. On four occasions without doubt the ingested material consisted of earth-worms. I never found traces of any hard-cased insects.

Breeding.—The ovarian follicles are normally about $\frac{1}{8}$ inch in length. In one specimen I found 8 follicles (4 in each ovary), about $\frac{1}{5}$ inch long, and in another 6 (3 in each ovary) about the same size, and these appeared to be impregnated. The dates of both are not known. A third specimen obtained on the 10th of August, 1904, had 14 follicles (6 in one ovary and 8 in the other) enlarged to $\frac{9}{16}$ of an inch. The smallest specimens, which I believe were hatchlings, measured $4\frac{1}{4}$ and $4\frac{5}{16}$ inches. The latter were found in company with an adult female on the 10th of

August. The adult, however, showed nothing unusual upon anatomical investigation. The navel involved 2 shields in both cases. In the ♂ 10 ventrals intervened between the navel and the anal shield, in the ♀ 7.

Sexes.—Of the 48 specimens collected, 21 were males and 27 females. Without actually measuring them, I think there is no doubt that the females were usually larger. Adult males had all the scales about the anal region keeled. In the median rows these were tuberculate, and often bi, tri, or pluridentate, and in the lowest lateral rows markedly spinose, with the points directed backwards. The spines were hooked, reminding one forcibly of rose-thorns, and were attached by a long base to the anterior three-fifths of each scale.

In young males, or at least in some, the keels were obtusely tuberculate as in females. The tails of the males were longer, and the subcaudals varied from 21–26, whereas in females these shields numbered from 11–16. The ventrals in males were however 135–148, against 139–151 in females.

Scale peculiarities.—The scales anteriorly (two head-lengths behind the head) number 15, mid-body 15, posteriorly (two head-lengths before vent) 15, keels were absent in all these situations. The vertebral row was the narrowest of the series, and the ultimate row very slightly largest. The supracaudals were in odd rows, as is the rule where the subcaudals are entire. The first subcaudal was as often divided as entire.

Abnormalities.—One specimen had no præocular. The upper postocular was confluent with the parietal in one. The labials were 7, of which the 4th only touched the eye on one side in one specimen ; 7 with the 5th only touching the eye on the left side in two specimens.

One very aberrant specimen requires special remark, viz., a male in which the subcaudals numbered only 16. In addition the scales anteriorly (two head-lengths behind the head were 15 or 14, mid-body 13, posteriorly (two head-lengths before the vent) 13. Investigation showed that the 2nd and 3rd rows above the ventrals blended on both sides, one rather before the other, at the site I select to count the scales anteriorly. The large row occasioned by this coalescence divided and blended two or three times before the rows were finally established as 13. One sees the same vacillation frequently exhibited in snakes whose scales normally reduce in number, as for instance in *Tropidonotus piscator*, where the scales number 19 in the anterior and mid-body, and 17 posteriorly. In all other respects this specimen was normal, and so probably does not deserve specific isolation.

Colour.—Uniform or nearly uniform black, or blackish dorsally, or varying shades of brown, olive-brown, or olive-green more or less spotted or speckled blackish. The spots vertebrally and laterally have a tendency to confluence, and may form lines. Belly pale yellowish, yellow, ochraceous, or ruddy, sparsely or profusely spotted, speckled, or marbled with black.

Tropidonotus stolatus.

One female killed on the 12th September, 1904, besides containing a much digested frog was found to be pregnant. There were 8 eggs (6 in one ovary and 2 in the other). The ventrals were 139, subcaudals 66, of which the 32nd, 50th, 51st, 59th, and 60th were entire. As in Malabar specimens the labials were 8, with the 3rd, 4th, and 5th touching the eye. The nasals were in contact with the 1st and 2nd labials, a very unusual character in Indian examples of this species. Usually it is only the 1st labial that is apposed to the nasal.

Zamenis mucosus.

One specimen about one-third grown, with nothing remarkable to mention.

Naia tripudians.

I received the head of one of this species, which is uncommon at the same altitude in India.

Ancistrodon hypnale.

Twenty-seven specimens of this species were collected, so that it must be a very common snake in this locality.

Food.—It evidently subsists mainly upon the skink, *Lygosoma taprobanense*, as no fewer than 11 specimens contained one or more of these lizards, or in some instances the tails only. I also found in the stomach of 5 examples small soft-shelled eggs about half an inch long, probably lacertine, but possibly ophidian. From one male specimen one such was seen protruding from the anus, which I extracted and examined. It consisted of the egg envelope only, compressed, and wrinkled longitudinally, but with no opening that I could discover, so that it was a mystery to me how the contents had been absorbed unless by a process of exosmosis. I floated it in water, teased out the wrinkles, and examined it most closely, then cut it carefully from pole to pole and re-examined it from the interior, but could find no suspicion of a breach in its continuity. Birds' eggs are occasionally passed entire " per anum," but are more frequently, I believe, wholly dissolved by the digestive juices. Perhaps the coriaceous investment of ova such as this offers a greater resistance to the

action of the alimentary secretions than the calcareous envelope of the former. One specimen contained about two inches of the tail of a lizard such as a *Calotes*. Two others contained frogs in a condition too dissolved to identify, and in one example I found a snake *Aspidura* (*trachyprocta*).

Breeding.—Three specimens were pregnant, but unfortunately the dates of capture were not noted in any instance. The prospective mothers measured 1 ft. 2 in., 11¼ in., and 11¼ in. Two contained 6, and one 4 immature eggs.

Sexes.—Of the 27 specimens 10 were males, 13 females, and in 4 the sex was doubtful owing to mutilation. Both sexes appear to grow to about the same length, and the tails also show little, if any, disparity. The ventrals and subcaudals were as follows :—

Ventrals ♂ 123–131 (?); subcaudals 29–37
Ventrals ♀ 121–138 ; subcaudals 27–36

In 7 at least out of 9 males the tails were bent over ventrally in a hook-like manner, but in no single female was this seen. The clasper of the male was bifid on each side as in other members of the family *Viperidæ*, and was surmounted with the usual array of falciform tentacles. The testicles were not nearly so elongate as is the rule in snakes, but, as in some other vipers I know, were oval in form. I could discern no difference in colouration between the sexes, nor were the keels more pronounced in the scales of males.

Scale peculiarities.—One or two things deserve notice. The *nasal* shield touches only one labial, viz., the first, and this often is produced upwards behind the nasal to meet the supraloreal, or when this is not the case one or more minute intercalary scales occupy this situation. The lowest *præocular* is often entire, often broken up into two. The *subocular* may be entire, in which case it meets the 3rd and 4th labials, or a small portion is often detached anteriorly. The 2nd *labial* variably contributes to the formation of the loreal pit, often it does not do so, a separate furrowed scale lying above furnishing a floor to the pit. The scales are anteriorly (2 head lengths behind the head) 17, midbody 17, and posteriorly (2 head lengths in front of the vent) 17.

Abnormalities.—In one example there were 9 *labials* on the left side. The *sublinguals* touched 2 infralabials only in 3 specimens. The 5th *subcaudal* was entire in one example, and the 8th, 9th, and 10th in another.

Vipera russelli.

Two small specimens were procured, showing that in Ceylon as in India this species sometimes ascends to a considerable elevation, though really an inhabitant of the plains.

NOTES CHIEFLY ON BIRDS SEEN AT THE PEARL FISHERY CAMP, MARCH AND APRIL, 1905.

By W. E. Wait.

BIRD-LIFE in the dry littoral zone of the north-western part of the Island possesses many distinctive features, and as the birds which for three-quarters of the year are left in undisturbed possession of the camp site do not appear to be scared away by the bustle during the fishery, one constantly saw forms or marked habits unnoticed elsewhere.

Among the flocks of Brahminy Kites and Gray Crows which gathered over the offal on the beach, one generally saw two or three Marsh Harriers (*Circus æruginosus*). The Common and Blue-tailed Bee-eaters (*Merops viridis* and *phillipensis*) chose the same unsavoury haunts to feast on the swarms of flies. There was a fœtid pool fed by the drain which carried off the refuse water from Mr. Dixon's oyster-washing machine. Here they might be seen not only hawking for insects on the surface, but dipping their beaks into the water, probably to fish out the drowned maggots which were carried down in myriads.

On the short walk from my bungalow just above the beach to the Kachcheri a few hundred yards inland I invariably met with the Rufous Rumped Shrike (*Lanius caniceps*) flitting among the mustard trees. This bird, which is I believe almost confined to the Manaar District, was one of the commonest in camp. Towards the end of the Fishery while out on an evening stroll with Mr. Ferguson we saw one attack a large rat-snake.

The bird swooped down into some high grass near the road, and we watched to see what it had caught. Immediately a six-foot rat-snake came out into the open, followed by the shrike, which pecked viciously at its head. The snake made straight for a hollow tree close by, up which it disappeared, and the bird, catching sight of us, flew away. It had probably been driving off the intruder from its nest, but the wonder is that a bird no larger than a thrush cowed such a big snake.

Between the Governor's and the Government Agent's bungalows lay a small open space on which stood two or three gnarled trees. These were frequently occupied by a few Chestnut-headed Bee-eaters (*M. Swinhoii*) and a pair of Hoopoes (*Upupa ceylonensis*).

Close by was a sandy bank, in the side of which a pariah belonging to Mr. Dixon had excavated some burrows wherein she brought up a litter of puppies. I noticed that another pariah had dug a similar burrow in the bluff above the Government kottu. They were doubtless made for the sake of coolness and shade, which could not be obtained otherwise. I wonder whether the jackal, or any species of wild dog, is ever in the habit of making such lairs : whether in fact this was a reversion to the instincts of the fox or an adaptation to environment. No one that I asked had noticed pariahs elsewhere make burrows like these.

The neighbourhood of the tank set apart for drinking water was a favourite roosting-place for a large flock of the Lesser White Egret. A few Whistling Teal occasionally came there, while the strip of jungle on the north sheltered several pairs of the Gray Indian Dove (*Turtur risorius*). A solitary Grey Heron (*A. cinerea*) used often to fish in the shallows at the head of the tank.

To the south of this tank on the opposite side of the cart track leading to the Manaar road lay several insignificant little tanks irrigating a small tract of fields which during the fishery lay fallow. In the small trees and bushes which fringed the water the Black Drongos (*D. atra*) had their headquarters, while on two occasions I saw a pair of the pretty little Yellow-fronted Woodpecker (*Picus mahrattensis*) round some Euphorbias which grew near one of the tiny bunds.

South of the camp, the bare tidal flats of the lagoon at the river mouth were the happy hunting grounds of innumerable waders, from the Large Stone Plover to the Little Stint. Several species of tern flocked here, sometimes accompanied by a colony of the beautiful Brown-headed Gull, which usually kept to the sand-spit on the south side of the bar. On the northern bank, in the face of the sand cliff just under the Governor's bungalow, a large Fish Owl (*Ketupa ceylonensis*) had his burrow, at the entrance of which he used to sit of an evening blinking and ruffing his plumage until it was time for him to fly off on his rounds. A little further up the river I occasionally met with the Pied Kingfisher (*Ceryle rudis*) skimming along under the bank.

Of other noticeable birds, a species of Sky-lark could be heard twittering in the air any morning, and a Gray Partridge (*Ortygornis pondiceriana*) might be found on the outskirts of the camp. A large Fish-eagle came several times to the lagoon ; whether it was *H. leucogaster*, or *P. ichthyœtus* I never got close enough to ascertain. I also heard of the occurrence of a Pariah Kite (*Milvus govinda*), but did not see it myself.

In conclusion I would express the hope that some one possessing a good knowledge of ornithology could spare a visit to the camp when a pearl fishery is in progress. My observations were made at odd intervals during two very busy months ; my knowledge of birds is limited, and if it had not been for Mr. Ferguson, who knows the Natural History of the district well, and in whose company I saw practically all the species mentioned, I should have been, in many cases, uncertain of my identification.

The circumstances are particularly favourable for observation. Most of the birds have paired before their quiet is invaded. They are unwilling to leave the breeding-places they have chosen, and soon become accustomed to the busy crowd, which passes them by unheeded. For the species that feed on insects and carrion there is the attraction of a food supply, the like of which they can find nowhere else.

An official at the camp, however good his knowledge of the subject might be, has but little leisure. To the ornithologist an interesting but out-of-the-way district is rendered easily accessible by the steamers which during the fishery run from Colombo to the camp. His visit could not fail to be of interest to himself, and would, I feel sure, add considerably to the knowledge of the avi-fauna of Ceylon.

KANDYAN HORN COMBS.

By Ananda K. Coomaraswamy, B.Sc., and Ethel M. Coomaraswamy.

With three Plates and two text-figures.

As its title shows, the present paper has no reference to the merely ornamental *tortoise-shell* combs now worn by the low-country Sinhalese (a comparatively modern fashion), nor to the practical and beautifully carved *ivory* combs formerly used, and still often preserved in Kandyan families; these ivory combs are pretty well known and are seen in most collections; there is a fine series of them in the Colombo Museum. *Horn combs*, though more generally used, are less familiar, but in some respects even more interesting than the ivory ones; for the latter, though for the most part certainly made in Ceylon, sometimes seem to show Dravidian influence, and at any rate are often very like Indian combs of the same type, while the horn combs are more purely native in form and decoration.

A short account of the making of the ordinary 10-cent horn comb (Pl. B, fig. 3), used even by the poorest classes,* will now be given. The horn comb-makers are men of low caste, Rodiyas in the Bandarawela district for example, and blacksmiths (áchári caste) near Kandy. At Ratnapura and Balangoda the work is done by Beruwayas and Durayas; it is never done by goiyás, who would consider it very degrading. The pictures and description apply specially to the manufacture of combs by Rodiyas near Bandarawela.

The combs are made of buffalo horn cut transversely, the tops of the horns being used for tool and knife handles and the like. The usual tools of the horn comb-maker include a small adze ($1\frac{1}{2}$ inch cutting edge), a coarse rasp, one or two knives, a marking awl, a vice, two or three saws, a file, and one or two tools for incising patterns; the iron tools are made by local blacksmiths.

A flat piece of horn is sawn off and cut roughly into the shape of the comb, and then made thinner with adze and rasp (Pl. A, fig. 1), and the shaping then finished with a knife. Next the guide lines for the inner ends of the teeth and for the patterns

* Those who are better off would now use ordinary European-made combs, instead of decorated horn or ivory ones of native make.

are scored with the marking awl, which is a small bone tool with a sharp point inserted near one end. The comb is now set in the vice, which is held conveniently against a stone by pressure of the worker's leg (Pl. A, fig. 2).

The vice (fig. I.) consists of two pieces of wood tied together near one end, and having a wedge inserted at the other, which, when it is driven in, causes the short ends to grip very tightly whatever is placed between them. The vice is usually ornamented with a little primitive carving. The teeth are now cut (Pl. A, fig. 2), first on one side, small teeth with a fine saw, then on the other, coarse teeth with a thicker saw ; these teeth are cut very regularly and with astonishing quickness. Each tooth is next filed back and front to make its edges smooth. Finally the comb is taken out of the vice and a simple pattern incised with a chisel-shaped iron tool, as in the upper comb (Pl. B, fig. 3), or

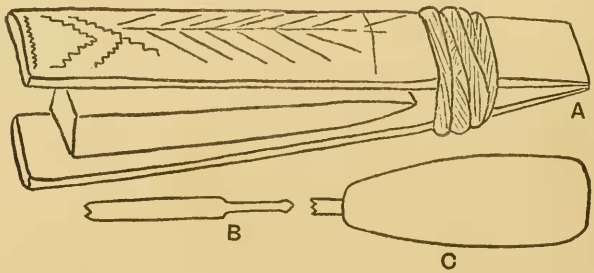


Fig. I.

A, the vice, length 11½ inches (Bandarawela District).
B and C, two pattern-marking tools (Pallebedde, Atakalan Korale, Province of Sabaragamuwa) (reduced).

with a two or three-pointed tool as in the lower comb (Pl. B, fig. 3). The pointed tools (B and C) in fig. I. were used in ornamenting the comb last referred to, which was made at Pallebedde, Atakalan Korale, Province of Sabaragamuwa. Last of all the comb is polished by rubbing with wood ashes and horn shavings.

More elaborately carved and pierced horn combs are sometimes met with, but their actual manufacture has not been seen by us, and it is very doubtful if they are any longer made.

The comb shown in fig. II. is pierced, and deeply carved with a characteristic Kandyan pattern. Fig. 4, Pl. B, shows a more elaborate comb, carved and pierced with the *nári latá* (woman creeper) design. The *nári latá* is a well known and interesting Kandyan pattern, consisting essentially of a female figure holding a creeper in each hand. In the horn comb shown the figure seems almost to spring from the tree itself, suggesting a possible origin of the design in the idea of a sacred tree with its

in-dwelling or guardian spirit ; but in other examples the lower part of the figure is fully developed, and the dress carefully indicated (as for example on an embroidered betel bag in our possession), and the pattern is a good deal less suggestive of a mythological origin ; it seems likely, however, that it may once have had a symbolical significance of the sort suggested. The design is a very usual one and is found on all sorts of Kandyan decorative work.

A still more elaborate comb is seen in fig. 5, Pl. C ; this unusually large comb is carved and pierced with a *haṇsa puṭuva* design (geese with intertwined necks), and four heads of *makaras* in the corners, and inlaid as well with ivory pegs, square for one bird and round for the other. This *haṇsa puṭuva* is also a well known Kandyan design ; it may be found for example on such

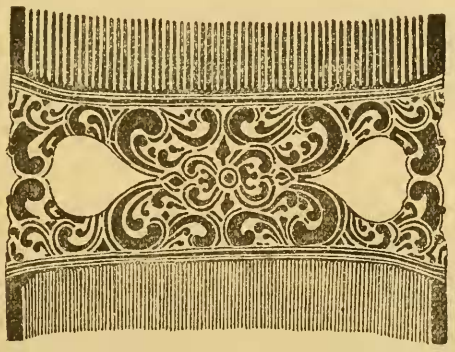


Fig. II.—Carved and pierced horn comb, Ratnapura District, × $\frac{2}{3}$.

various things as key plates, embroidered betel bags, and painted pottery. It will be seen that these decorated horn combs are striking and appropriate in character, and varied and individual in their ornamentation, and it is a reproach to the modern Sinhalese that there is now-a-days so little demand for good home-made wares of this or any kind.

NOTE.—Since this paper on Horn Combs was written it has occurred to us that the *nári latá* design so frequently seen in Kandyan decorative art may possibly be derived from the early representations of the goddess Sirí (Lakshmi), seated on a lotus and holding lotus flowers in either hand. If so, the abundance of foliage is a late rather than a primitive feature ; but its

development from the original simple sprays appears quite natural considering the fondness for "creeper" decoration shown in Kandyan design. On this view the most elaborate types, in which human faces appear like flowers amongst the foliage (the main stems of which are always grasped in the two hands of the seated figure), would be a still later development.

A. K. C.

E. M. C.

DESCRIPTION OF PLATES.

PLATE A.

Rodiyas making Horn Combs at Ella, near Bandarawela.

Fig. 1.—Using the rasp; a vice, knives, and other tools are seen in the foreground, ready for use.

Fig. 2.—Cutting the teeth; an adze is seen on the right.

PLATE B.

Fig. 3.—Above: horn comb made by Rodiyas at Ella; incised pattern done with a chisel-shaped tool. Below: horn comb made at Pallebedde (Sab.); incised pattern done with the three-pointed tool shown in the text, fig. I. × $\frac{5}{8}$. Authors' collection.

Fig. 4.—Horn comb carved and pierced with *nári latá* design. × $\frac{3}{4}$. Kegalla Kachcheri collection.

PLATE C.

Fig. 5.—Horn comb carved and pierced with *haṇsa puṭuva* design and four heads of *makaras*, and inlaid with ivory pegs. × $\frac{5}{9}$. Authors' collection.

Fig. 6.—Another example of the *nári latá* design, from an embroidered betel bag. × $\frac{1}{6}$. Authors' collection. The embroidery is chain stitch in red and white cotton on (Kandyan) blue cotton. Compare this with fig. 4, Pl. B.

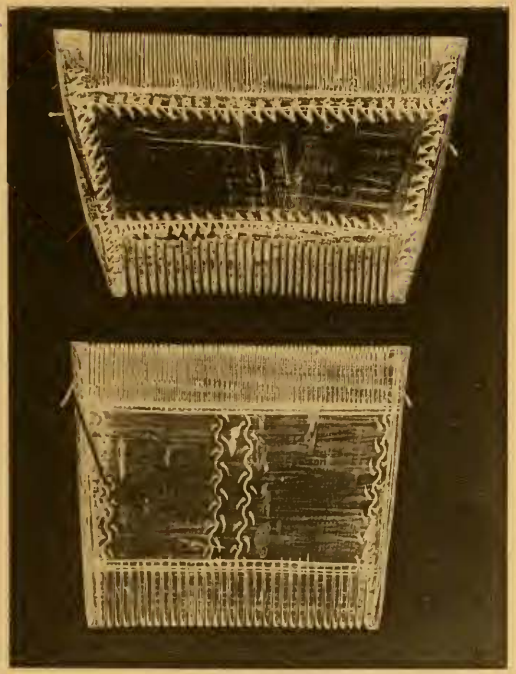
Fig. 1.

Fig. 2

RODIYAS MAKING HORN COMBS AT ELLA (UVA).

Bonnar Lith. Perth, Engr.

Fig. 3.



COMMON HORN COMBS.

Fig. 4.

CARVED AND PIERCED HORN COMB WITH NÁRI LATÁ DESIGN.

Kegalla Kachcheri Collection.

Bemrose Ltd., Derby, Eng.

Fig. 5.

CARVED AND PIERCED HORN COMB WITH HAṆSA PUṬUVA AND MAKARAS.

Fig. 6.

NÁRI LATÁ DESIGN ON EMBROIDERED BETEL BAG.

To be compared with fig. 4, Plate B.

Bemrose Ltd., Derby, Eng.

NOTES.

1. *On the Loris in captivity.*—With any wild animal in captivity the first and most important thing to find out is what food is most likely to suit its taste. And with a very small nocturnal beast, such as the Loris, concerning whose habits I imagine that but little is known, this is not at first easy. A list of what I have found Loris eat and thrive on, and of what I have known him eat and not thrive on, may therefore be of interest.

First of all, I am convinced that the Loris is by nature purely insectivorous, and even carnivorous. If not fed for a day or so he will eat plantains, pumpkins, boiled rice, &c., so will a hungry leopard eat rice, or a starving man his boots, but not with any marked gusto.

What a Loris really enjoys is a heavy meal of grasshoppers; all varieties seem to be equally appreciated, from the large brown red-underwinged *pièce de résistance* to the thin pale green "salad." I have known a Loris eat 60 mixed grasshoppers at a sitting. Crickets, moths, ordinary flies, most beetles, and cockroaches are all accepted eagerly; while the rather horrid skill with which a loris seizes and manipulates a strongly struggling gecko seems to suggest that this is a not unfamiliar prey.

Worms, brightly-coloured butterflies, certain evil-coloured beetles, and meat, such as chicken, beef, &c., are rejected, sometimes rather indignantly, and I have known the brown shell-backed variety of cockroach (I do not know its name) make a Loris very sick.

About a teaspoonful of water a day seems to be the correct quantity of liquid, but I fancy the little beast can go for a long time without any drink at all; he must often have to do without it in the hot windy weather from June to September.

After food, perhaps the next most important subject is medicine. With the Loris I have only experienced two forms of ill-health, diarrhœa and cramp, and both seem curable by the same remedy, viz., opium, taken in the form of laudanum; three drops in a teaspoonful of milk and water is in my experience a safe dose, and it can be repeated twice in a day if the patient can be got to take it; he can be forced to do so of course, but he is rather frail.

If moral characteristics be added to physical, the Loris is very high in the scale ; for his manners are excellent, rather like those of an old-fashioned child who does not play, but takes his pleasure in some more dignified manner. For the Loris never plays ; life is for him a very serious matter. Except the Pangolin, all other animals I have kept or known, play, all but the Loris. If one comes to think of it, any Loris who in his natural haunts attracted attention by frisking about and playing, would very soon be snapped up by an owl or other enemy, for he is very weak, and very slow, and his safety, like that of a new boy in a public school, must depend almost entirely on unostentatious self-effacement. Hence his good manners.

But besides modesty he has one other means of defence, and a very curious one indeed it is. For he imitates a cobra. Before relating the instance in which I saw this done, I must support my testimony by the only reference to this habit that I know of. Sinhalese of the North-Central Province have several times told me little stories about the "Unahapuluwa," and I have thought them far-fetched and absurd. And among the stories of its habits told me by jungle men has been this : "That the Loris copies the sound of the cobra as a means of self-defence."

Now that I have had an opportunity of testing this story and of finding it true, the other yarns do not seem so absurd. It happened this way.

I was sitting in the verandah spoiling my eyes by reading by the last flicker of afterglow, when I heard the regular breathing sound made by a cobra when he inflates and deflates his body. A cobra moving ordinarily, or hunting anything much weaker than himself, does not make this sound, but only when with expanded hood he sits up to fight.

With the breathing sound came the occasional quick hiss of a strike. So I got up and took a stick, for I thought that a cobra might be attacking my Loris, who was not in his cage, but only tethered to the top of it.

The sound came from my room, where, although it was dusk, there was plenty of light to kill a snake.

As I went into the room I looked at the cage, which was on the floor, and on the top of it I saw the outline of a cobra sitting up with hood expanded, and threatening a cat who crouched about six feet away. This was the Loris, who, with his arms and shoulders hunched up, was a sufficiently good imitation of a cobra to take me in, as he swayed on his long legs, and every now and then let out a perfect cobra's hiss. As I have said, it was dusk at the time, but the Loris is nocturnal, so that his expedient would rarely be

required except in the dusk or dark ; and the sound was a perfect imitation. I may mention that I have kept snakes, including a cobra, and am therefore the less likely to be easily deceived by a bad imitation.

And, as I said above, the native legend bears me out.

Another native legend concerning the Loris, which obtains universal acceptation in the North-Central Province, is that he kills peafowl by creeping slowly up their backs when they are roosting, and then, twining his long arms round the poor bird's neck, clings on until he has bitten to the brain.

The Loris is a charming and most original pet ; his fault is peevishness. But any one who has seen one thrust his long arm into a bottle full of grasshoppers, pick one out and eat it like a radish ; who has seen one sit on the table at dinner and catch the moths and " poochies " that fly against the lamp ; or has felt one climb up his face and pounce into his moustache as into an insect—will agree with me that our not so very distant cousin is as fascinating a being as any in the forests of Ceylon.

JOHN STILL.

Anuradhapura, February 27, 1905.

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2. *On the larval habits of the butterfly, Parata alexis*, Fabr. Peradeniya, 27th March, 1905.—It is not often that the larvæ of *Hesperidæ* (" Skipper " butterflies) occur in large numbers in close proximity to each other. *Parata alexis* appears to be an exception in this respect. On the 19th March I observed a fair-sized tree of *Pongamia glabra* that had been completely defoliated by the larvæ of this butterfly. So much so that they had been compelled to descend and pupate amongst the foliage of the shrubs below, for lack of shelter on the tree itself. There must have been many hundreds of these pupæ within a space of a few square yards. From 50 pupæ—collected at haphazard—there emerged 18 males and 16 females ; the remainder failed. The flies were disclosed on two successive days (March 24 and 25). On the first day 5 males and 12 females appeared ; on the second day, 13 males and 4 females, the proportion of the sexes being almost exactly reversed.

E. ERNEST GREEN.

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3. *Curious behaviour of a snake in captivity.* Peradeniya, 27th March, 1905.—A small example of *Coluber helena* which has been an occupant of my vivarium for several weeks, and has

hitherto exhibited a gentle and even timid disposition, commenced to behave in a quite extraordinary manner to-day. On looking into the cage I found it tightly coiled round a toad many times too large for its capacity, visibly constricting it, but not attempting to swallow it. It presently abandoned the toad and then struck out wildly at anything that approached it, including my hand, though I have previously repeatedly handled it with impunity. The excited *helena* then—without any provocation—seized a large "Whip-snake" by the middle of the body, around which it instantly coiled itself in a tight knot, remaining in that position for half an hour—its head free, but its body tightly constricted—defying all attempts of the whip-snake (which appeared greatly inconvenienced) to dislodge it. When offered a small lizard—as a distraction—it bit at it viciously, but would not retain it. A large *Tropidonotus stolatus* was next assailed in the same manner, but that snake easily threw it off. In the intervals of these attacks it moved about the cage with the anterior part of its body laterally compressed and twisted to one side, thereby displaying to unusual advantage the white lateral ocelli. The constricting habit was most marked, and is probably employed when capturing prey; but I have not yet detected it in the act of feeding.

E. ERNEST GREEN.

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4. *On the nesting of the snake, Bungarus ceylonicus.*—I have received specimens of some eggs and young snakes which I have identified as *Bungarus ceylonicus*, Günth. My correspondent tells me that they were found in a shallow depression, beneath a wood-pile, in the month of January, 1905. "Both parents were curled up in the hollow (made like a duck's nest, but not lined in any way, just scooped and hollowed out of earth), and under them were lots of eggs and little snakes."

The eggs have a soft leathery shell and are lightly agglutinated together. They are cylindrical, with rounded ends, varying in length from 29 to 35 mm., with a breadth of 17 mm. The young snakes are brownish black above, with well-defined white annuli; white beneath. The two specimens in my possession show 24 and 16 annuli respectively, exclusive of the broad fascia across the head and the white tip to the tail. They measure 230 and 260 mm. in length. Even at this early age the vertebral row of broad hexagonal scales is well demarked. The parent snakes were unfortunately destroyed without any measurements being taken.

E. ERNEST GREEN.

5. *Millipede killed by Reduviid bug.*—While watching a large millipede crawling over my lawn I noticed an immature specimen (nymph) of the Reduviid bug (*Physorhynchus linnœi*, Stal.) following and manœuvring about it. Suddenly the bug closed and fastened upon the hinder extremity of the millipede, plunging its proboscis into the intersegmental tissue on the ventral surface between the legs. The millipede immediately writhed about apparently in great pain, but failed to dislodge its enemy. It tried to crawl away, but rather more than half the body and limbs were paralyzed. After feeding for about a minute the bug left its victim, which I then picked up and confined in a box, meaning to note how soon the paralyzing effects would pass off. Twelve hours later the millipede, instead of having recovered, was found to be quite dead. The victim measures $5\frac{3}{4}$ inches in length with a proportionate thickness. The predatory bug was scarcely $\frac{3}{4}$ of an inch long. The bite of many of the Reduviid bugs is—as I have experienced—extremely painful; but I was astonished to find its action so fatal in this case. The poison evidently acted directly upon the ventral nerve cord.

Peradeniya, May, 1905. E. ERNEST GREEN.

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6. *Remedies adopted against the Paddy Fly.*—One of the greatest enemies of the paddy plant (*Oryza sativa*) is the so-called rice sapper or paddy fly (*Leptocorisa varicornis*), called in the vernacular goyan-messa.

The common remedy adopted against this pest is smoking the fields by smother-burning vegetable refuse to windward. The suffocating effect of the dense smoke that is thus raised is sometimes intensified by adding to the burning mass such substances as tar, sulphur, tobacco leaf, and margosa oil (from *Azadirachta indica*).

The paddy fly is believed to object strongly to the odour of resin, and for this reason cultivators often draw a rope saturated in melted resin across the field.

The flies are sometimes captured by means of "bird-lime," in the following manner. A winnow smeared with the sticky latex of the jak tree (*Artocarpus integrifolia*) is fixed to the end of a pole and drawn over the tips of the plants. The flies as they are captured are collected in a pot strung to the waist of the operator and afterwards destroyed. The process is carried on in the early morning or late in the evening.

A method of decoy is also employed thus. An earthenware

pot riddled with holes is set up in the field with a burning lamp inside. The flies collect round the heated pot and are thus destroyed.

But there are often extraordinary "remedies" (favoured by the more superstitious) carried out through the agency of the village soothsayer. One form of this is where the soothsayer, choosing his day and hour, enters the field with some tender cocoanut leaves plaited into a rough mat or "ola," and supervises the erection of a tiny booth or "mal-messa" on which a floral offering is placed. In this booth the soothsayer burns some camphor, while he indulges in a weird incantation. The final act in this ceremony consists of the stretching of ropes from the mal-messa to various points in the boundaries of the field.

The following is another form of charming. The soothsayer, as before choosing his day and hour, proceeds to the field clothed in spotless white, erects a mal-messa on which he gets some rice boiled in cocoanut milk (the expressed juice of the kernel of the cocoanut), and not the liquid contents of the cocoanut as generally understood, and then with a branch from the inflorescence of the areca palm proceeds to sprinkle the liquid from the boiling pot over the field, muttering incantations the while.

A variation of this last consists in sprinkling charmed water from a new clay pot by means of the twig of a lime tree.

In some Catholic villages it is the custom to carry a few paddy flies to the nearest church, there to be anathematized, and let loose again in the field to influence the colony of pests to quit.

For much of the information in this note I am indebted to Mr. P. Samaranayaka, late Agricultural Instructor, now of the Veterinary Department.

C. DRIEBERG.

Government Stock Garden,
June 15, 1905.

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7. *The Lacteal Tract of Loris gracilis.*—In Flower and Lydekker's well-known "Introduction to the Study of Mammals" (London, 1891) it is pointed out that in the order Primates "there are always two mammæ in the pectoral region, except in *Chiromys*" (*l.c.*, p. 681).

The long-tailed African lemurs of the genus *Galago* have four teats, namely, two pectoral and two inguinal (*l.c.*, p. 690).

In the tailless Oriental lemurs belonging to the sub-family Lorisinæ there are said to be two pectoral mammæ only (*l.c.*, p. 691).

Chiromys, the Aye-aye of Madagascar, has two inguinal mammæ only (*l.c.*, p. 695).

In a much more recent treatise on Mammalia by Dr. Max Weber (Die Säugetiere, Jena, 1904) the statement that the Lorisinæ are distinguished from the Galaginæ, among other characters, by the possession of two pectoral teats only, is repeated on p. 760 of that work.

Situs mammarum of *Loris gracilis*, Ceylon.

The villagers who, I am told, procure the *Loris* in Ceylon, while snaring monkeys for purposes of trade, occasionally bring them alive to Colombo for sale. I have recently procured two females, each carrying a young Lorisine clasped to her bosom. Each of

the mothers had four equal pendulous mammæ placed consecutively in two pairs in the posterior pectoral (below the last rib) and in the anterior abdominal regions, surrounded by a nearly hairless tract.

Each teat is about a quarter of an inch in length; the anterior pair is distant about one inch and a quarter from the axillary region; the posterior pair is about two and a half inches from the inguinal region.

The tetramerous arrangement of the teats in the *Loris gracilis* of Ceylon is a constant character, and may be observed in young females as well as in females during lactation. The more primitive mammals of the orders Edentata and Sirenia, represented in Ceylon by the pangolin and the dugong respectively, have only one pair of teats in the axillary region, but this fact does not militate against the idea that the four teats of *Loris* may be a primitive feature, at least within the limits of its own order.

Not only the organization but the strictly arboreal habits of the *Loris* suggest that it is a creature of remote antiquity. Whether the character of the lacteal tract affords a further indication of this may be a matter of opinion, but the numerical data should be correctly given. The plurality of teats is remarkable also on account of the fact that the *Loris*, like bats and monkeys generally, only produces one young at a birth, which remains clamped to the parent by its extraordinary prehensile limbs until able to look after itself.

ARTHUR WILLEY.

Colombo, July, 1905.

HELMINTHES FROM THE COLLECTION OF THE COLOMBO MUSEUM.

By Dr. O. von Linstow.

(*Göttingen.*)

With three Plates.

THIS report on Parasitic Worms from Ceylon is a continuation of my description of Nematodes in *Spolia Zeylanica*, vol. I., part IV. (1904). There are altogether in the second consignment which was sent to me fifty-one species, of which thirty belong to the Nematoda, one to the Acanthocephala, seven to the Trematoda, and thirteen to the Cestoda; of these, thirty are described as new, and three new genera of Cestoda have had to be established.

The following species are dealt with :—

Nematoda.

1. *Ascaris spiculigera*, Rud., from *Plotus melanogaster*.
2. *Ascaris fissicollis*, n.sp., from *Haliastur indus*.
3. *Ascaris coronata*, n.sp., from *Ardeola Grayi*.
4. *Ascaris brachycheilos*, n.sp., from *Tropidonotus asperrimus*.
5. *Physaloptera brevispiculum*, n.sp., from *Felis rubiginosa*.
6. *Spiroptera secretoria*, n.sp., from *Plotus melanogaster*.
7. *Spiroptera orca*, n.sp., from *Manis pentadactyla*.
8. *Spiroptera sanguinolenta*, Rud., from *Canis familiaris*.
9. *Spiroptera*, spec. ? from *Cittacincla macroura*.
10. *Spiroptera*, spec. ? from *Pavo cristatus*.
11. *Spiroptera*, spec. ? from *Sciurus palmarum*.
12. *Heterakis pusilla*, n.sp., from *Gallus Lafayetti*.
13. *Heterakis granulosa*, n.sp., from *Gallus gallinaceus*.
14. *Strongylus digitatus*, n.sp., from *Bos taurus*.
15. *Kalicephalus willeyi*, v. Linst., from *Typhlops braminus*.
16. *Oxyuris megaloon*, n.sp., from *Hemidactylus Leschenaultii*.
17. *Oxysoma falcatum*, n.sp., from *Nicoria trijuga*.
18. *Dispharagus macrolaimus*, n.sp., from *Plotus melanogaster*.
19. *Sclerostomum equinum*, Müller, from *Equus caballus*.
20. *Ankylostomum minimum*, n.sp., from *Felis rubiginosa*.
21. *Ankylostomum trigonocephalum*, Rud., from *Canis familiaris*.
22. *Syngamus trachealis*, v. Sieb., from *Gallus gallinaceus*.
23. *Filaria ? Zschokkei*, Meyer, from *Manis pentadactyla*.
24. *Filaria immitis*, Leidy, from *Canis familiaris*.

25. *Filaria piscicola*, n.sp., from Marine Fish.
26. *Filaria equina*, Abilg., from *Equus caballus*.
27. *Filaria digitata*, n.sp., from *Bos indicus*.
28. *Filaria tuberosa*, v. Linst., from *Mabuia carinata*.
29. *Filaria flavescens*, Castellani and Willey, from *Calotes versicolor*.
30. *Trichocephalus discolor*, n.sp., from *Bos indicus*.
Tetradenos tiara, v. Linstow = *Ctenocephalus tiara*, v. *Linst*.

ACANTHOCEPHALA.

31. *Echinorhynchus tener*, n.sp., from *Spilornis cheela*.

TREMATODA.

32. *Lyperosomum squamatum*, n.sp., from *Dissura episcopus*.
33. *Distomum*, spec. ? from *Plotus melanogaster*.
34. *Distomum hepaticum*, L., from *Bos indicus*.
35. *Paramphistomum calicophoron*, Fisch., from *Bos indicus*.
36. *Paramphistomum gracile*, Fisch., from *Bos indicus*.
37. *Gastrothylax crumenifer*, Crepl., from *Bos bubalus*.
38. *Tristomum megacotyle*, n.sp., from *Histiophorus*.

CESTODA.

39. *Hymenolepis septaria*, n.sp., from *Upupa ceylonensis*.
40. *Hymenolepis clausa*, n.sp., from *Dendrocygna javanica*.
41. *Hymenolepis spinosa*, n.sp., from *Rostratula capensis*.
42. *Dipylidium caninum*, L., from *Canis familiaris*.
43. *Tænia*, spec. ? from *Haliastur indus*.
44. *Diorchis occlusa*, n.sp., from *Phœnicopterus roseus*.
45. *Davainea polycalcaria*, n.sp., from *Corvus macrorhynchus*.
46. *Diplochetos volvulus*, n.gen. et sp., from *Lobipluvia malabarica*.
47. *Ophryocotyle ceylonica*, n.sp., from *Lophoceros gingalensis*.
48 *Brochocephalus paradoxus*, n.gen. et sp., from *Ægialitis mongolica*.
49. *Cittotænia bursaria*, n.sp., from *Lepus nigricollis*.
50. *Ichthyotænia cryptobothrium*, n.sp., from *Chrysopelea ornata*.
51. *Aphanobothrium catenatum*, n.gen. et sp., from *Phœnicopterus roseus*.

I.—NEMATODA.

Ascaris.

The definition given previously (*S. Z.*, part IV., p. 91) is to be amended in so far that the intestinal cœcum lies dorsad of the œsophagus ; the œsophageal gland is produced backwards ventral to the intestine.

1.—*Ascaris spiculigera*, Rud.

From the œsophagus and stomach of the Darter, *Plotus melanogaster*, L.; Wirawila, Southern Province.

2.—*Ascaris fissicollis*, n.sp.

Pl. I., figs. 1–2.

From intestine of the Brahminy Kite, *Haliastur indus*, Bodd.; Nedunkeni, Northern Province.

Three females, 15, 34, and 36 mm. long, 0·79–1·25 mm. wide. Cuticle annulate; behind the lips the annulation is so deep that the contours appear fringed. Lips with intermediate lips; without teeth; dorsal lip semi-circular, ·083 mm. × ·11 mm.* the two papillæ lie in front; intermediate lips obtusely conical, attenuate from the middle, with an outer groove. Œsophagus $\frac{1}{6}$, acuminate tail $\frac{1}{49}$.† Eggs thin-shelled, spherical, ·065 mm.; the small vitellus distant from the shell.

3.—*Ascaris coronata*, n.sp.

Pl. I., fig. 3.

From the œsophagus and stomach of the Nestling Pond Heron, *Ardeola Grayi*, Sykes; Tissamaharama.

Cuticle narrowly annulate; lips edentulous with large triangular interlabia; dorsal lips nearly circular, ·065 × ·078, with two inner anterior prominences; papillæ anterior; œsophagus $\frac{1}{6}$.

Male, 17 × ·79; tail conical, very short, $\frac{1}{183}$. On each side of the caudal extremity 17 præ-anal papillæ in a row becoming more closely placed behind; post-anal papillæ absent; the cirri are 2·37 mm. long, straight, the end bent falciform.

Female, 26 × 1·5; tail rounded, anus nearly terminal; at the posterior end a small finger-shaped appendix; the vulva lies in front of the middle, dividing the body in the ratio 7 : 15; eggs immature.

4.—*Ascaris brachycheilos*, n.sp.

Pl. III., fig. 48.

From intestine of *Tropidonotus asperrimus*, Boulenger; Colombo.

Cuticle smooth; lips depressed, dentiferous, with small conical interlabia; pulp emarginate; papillæ large; dorsal lip ·078 × ·177; œsophagus $\frac{1}{15} - \frac{1}{16}$; tail in male $\frac{1}{233}$, in female $\frac{1}{520}$, rounded in both sexes carrying a small terminal appendix.

Male, 55 × ·83; cirri broad, curved like a sabre, rounded at the end, 1·19 × ·035; at each side of the tail three very small præ-anal and two post-anal papillæ; the last of the latter lies dorsally exactly at the hinder end of the body dorsad of the styliform appendix.

Female, 104 × 1·58; anus nearly terminal; vulva near the end of the anterior third, dividing the length in the ratio 14 : 39; eggs spherical, thick-shelled, closely beset with small granules, ·086 mm.

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* All measurements are in millimetres, and the length always precedes the breadth.

† These are fractions of the total body length throughout.

5.—*Physaloptera brevispiculum*, n.sp.

Pl. I., fig. 4.

From stomach of *Felis rubiginosa*, Geoffr.; Kandy.

Cuticle finely annulate; head end with a thickened cuticular collar from which two round lips protrude, each of which carries three small peaks at the summit; at the tail end there is a similar præputium-like cuticular ring from which the tail emerges; œsophagus $\frac{1}{6\cdot5}$.

Male, 11·1 × ·95, with rounded tail $\frac{1}{9\cdot4}$; at each side of the cloacal orifice four stalked papillæ; behind these four paired ventral post-anal papillæ, unstalked, in successive couples; cirri very short, feebly curved, ·79–·81.

Female, 11·4 × 1·06; tail conical, $\frac{1}{22\cdot3}$; eggs thick-shelled. ·036 × ·031.

P. præputialis, v. Linst., which occurs in *Felis catus* in Brazil, has a similar caudal sheath with a body length of 21–30 mm.

6.—*Spiroptera secretoria*, n.sp.

Pl. I., fig. 5.

From œsophagus and stomach of *Plotus melanogaster*, L.; Wirawila; in company with *Ascaris spiculigera*.

Dimensions up to 32 × 1·6, but all specimens immature; both ends strongly attenuated; cuticle annulate: some are larvæ in process of exuviation. At the head a dorsally placed obtusely conical papilla; in a circle behind this are six roundish papillæ, and behind these in the submedian lines four truncate papillæ with a very small one at the inner side. Alongside the œsophagus runs a long gland containing a long granular secretion often projecting through the orifice which lies close behind the papillæ. Tail short with small finger-shaped appendix; lateral lines strongly developed, one-fifth of the diameter of the body, enclosing a lateral canal.

7.—*Spiroptera orca*, n.sp.

Pl. I., figs. 6–8.

From stomach of *Manis pentadactyla*, L.; Horana.

Cuticle annulate; head with two large lips placed dorsal and ventral, expanded in front; behind these in the submedian lines four finger-shaped procumbent processes.

The mouth leads into a vestibule, ·2 mm. long; œsophagus in the male $\frac{1}{3}$, in the female $\frac{1}{3\cdot5}$; coarse cuticular rings ·053 apart, fine rings ·0054 mm. apart.

Male, 25 × ·71; tail involute; cirri long; the left cirrus measured 3·74 mm. in a young specimen of 11·8 mm., *i.e.* nearly one-third of the body length; the right cirrus is broader and much shorter, ·57 mm.; on each side there are four præ-anal and two post-anal papillæ, large and round; tail rounded, $\frac{1}{5\cdot2}$.

Female, 32 × ·95; tail rounded, $\frac{1}{6\cdot6}$; vulva lies behind the middle dividing the body in the ratio 7 : 5; immature eggs elliptical, ·044 × ·026; mature, flattened at the poles, ·047 × ·029, barrel-shaped, surrounded in front and behind by a raised hoop.

8.—*Spiroptera sanguinolenta*, Rud.

From œsophagus of *Canis familiaris*, L.; Colombo.

Cf. A. Railliet, Traité de zoologie médicale, Paris, 1895, pp. 536–538, figs. 373–375.

9.—*Spiroptera*, spec. ?

From intestine of Long-tailed Robin, *Cittacincla macroura*, Gmel.; Nedunkeni.

One entire and one half specimen spirally wound, not to be identified.

10.—*Spiroptera*, spec. ?

From œsophagus of *Pavo cristatus*, L.; Buttuwa.

Three imperfectly preserved fragments.

11.—*Spiroptera*, spec. ?

From peritoneum of *Sciurus palmarum*, L.; Colombo.

Fragments of a female.

12.—*Heterakis pusilla*, n.sp.

Pl. I., fig. 9.

From rectal cœca of Jungle Fowl, *Gallus Lafayetti*; Mamadu, Northern Province.

Head with small roundish lips; cuticle smooth; œsophagus thickened, club-shaped behind, in the male $\frac{1}{5}$, in the female $\frac{1}{5\cdot8}$.

Male, 5 × 0·19; tail $\frac{1}{12}$, finely pointed, adhering to the ventral side by a granular, opaque cement; cirri very unequal, the left 0·53, the right 0·15; in front of the cloacal orifice a round sucker, and behind this, on each side, four large post-anal papillæ, of which the last lies at a greater distance from the third than the three anterior from each other.

Female, 5·13 × 0·24; tail $\frac{1}{9\cdot5}$, very long and pointed; vulva far behind the middle, the præ-genital region to the post-genital region as 12 : 5; eggs, thick-shelled, 0·065 × 0·031.

13.—*Heterakis granulosa*, n.sp.

Pl. III., fig. 49.

Intestine of domestic fowl, *Gallus gallinaceus*, L. ; Colombo.

Cuticle annulate ; head with three low semi-circular lips ; tail pointed.

Male, 27 × 0·59 ; œsophagus $\frac{1}{13}$; tail $\frac{1}{9}$; the two straight rod-shaped cirri, 0·57 ; sucker long, oval, with a small circular groove behind, and surrounded by granulations ; on each side three præ-anal and six post-anal papillæ, of which the most anterior is transversely elliptical, the fourth, seventh, and ninth spherical and marginal ; radial muscles pass to the sucker.

Female, 55 × 0·79 ; œsophagus $\frac{1}{14}$; tail $\frac{1}{40}$; vaginal orifice immediately in front of the middle dividing the body in the proportion 16 : 17 ; eggs thick-shelled, 0·078 × 0·042.

14.—*Strongylus digitatus*, n.sp.

Pl. I., fig. 10.

Stomach of *Bos indicus ;* Colombo.

Cuticle without longitudinal lines, but with very fine annulation ; head attenuate, mouth surrounded by four papillæ ; œsophagus of male $\frac{1}{14}$, of female $\frac{1}{17}$; the nerve ring surrounds the œsophagus at the limit of the first and second quarters and below it the *porus excretorius* opens.

Male, 24 × 0·36 ; cirri very long, 4·54, coalescent throughout their entire length and thickened fusiform at the end ; the lateral lobes of the *bursa* are curved claw-like inwardly; each lobe is supported by six ribs, of which one lies at the inner margin, two side by side at the hinder border, and three in a group at the outer margin ; there is no median lobe ; the end of the body is rounded with a pair of finger-shaped, slightly curved hyaline cuticular lobes.

Female, 29 × 0·47 ; genital orifice lies far back dividing the body in the ratio 8 : 1 ; tail pointed, $\frac{1}{18}$; eggs 0·097 × 0·053.

Eleven species of *Strongylus* have been found in *Bos taurus*, the European domestic ox ; ten of them have short cirri; only *Strongylus filicollis*, Rud., has long cirri, but in this species the cuticle shows 18 longitudinal ridges.

15.—*Kalicephalus willeyi*, v. Linst.

Rectum of *Typhlops braminus*, Russell ; Colombo.

Cf. O. v. Linstow, *Spol. Zeyl.*, vol. I., part IV., 1904, pp. 99–100 pl. I., figs. 14–18.

16.—*Oxyuris megaloon*, n.sp.

Intestine of Gecko, *Hemidactylus leschenaultii*, Dum. et Bibr. Mamadu.

Females only in the collection, 6·52 × 0·91 ; cuticle deeply annulate ; head with three small lips ; œsophagus $\frac{1}{6\cdot6}$, narrow, ending behind in a spheroidal bulb ; tail conically pointed, $\frac{1}{1\cdot6}$; eggs very large, 0·083 × 0·047.

Oxysoma.

Head with three or more lips ; œsophagus with a spheroidal bulb behind ; male with two equal cirri and three paired præ-anal papillæ ; number of post-anal papillæ variable ; tail in both sexes finely pointed ; Secernentes-Meromyaria ; in reptiles and amphibia.

17.—*Oxysoma falcatum*, n.sp.

Pl. III., figs. 50–51.

Intestine of the Tortoise, *Nicoria trijuga*, Schweigg. ; Colombo.

Cuticle smooth ; head broadly rounded with six stalked papillæ ; the stalks are divided giving off an inner branch ; behind the head are four large papillæ in the submedian lines ; œsophagus thin, in the male $\frac{1}{6\cdot6}$, female $\frac{1}{6\cdot9}$; the bulb is embraced by the cup-shaped commencement of the intestine ; excretory pore behind the middle of the œsophagus dividing the latter in the ratio 21 : 16.

Male, 11·6 × 0·55 ; tail $\frac{1}{2\cdot0}$, bent hook-like towards the ventral surface ; cirri equal, falciform, very broad before the middle, 0·44, pointed at the end ; three præ-anal and five post-anal papillæ (paired).

Female, 14·1 × 0·56 ; tail $\frac{1}{1\cdot4}$; genital orifice behind the middle dividing the body as 5 : 3 ; the vagina runs forwards ; eggs 0·14 × 0·097.

Dispharagus.

Head with two lips ; in the region of the so-called neck the cuticle shows four longitudinal pleats ; male with two unequal cirri ; on each side of the tail four præ-anal papillæ ; it belongs to the Secernentes-Polymyaria ; occurring in the œsophagus, stomach, and gastric submucosa of birds.

18.—*Dispharagus macrolaimus*, n.sp.

Stomach of the Darter, *Plotus melanogaster*, L. ; Wirawila.

Females only in the collection, 7·3–11·4 × 0·28–0·47 ; cuticle annulate, with elevated lateral lines ; head with two small, conical, rounded lips ; the mouth leads into a long vestibule ;

œsophagus very long, $\frac{1}{2\cdot6}$; tail $\frac{1}{3\cdot7}$, terminating in a small finger-shaped point ; the nuchal pleats run 0·80 mm. backwards, rather beyond the first section of the œsophagus ; immediately before their termination there is on each side a cone-shaped nuchal papilla ; eggs very numerous, with a double shell, 0·031 × 0·011.

Sclerostomum.

Head with buccal orifice set with one or several rows of teeth ; male with two equal cirri and trilobate costiferous *bursa ;* female genital orifice posterior ; Secernentes-Meromyaria ; in mammals and birds.

19.—*Sclerostomum equinum*, Müller.

Intestine of horse ; Colombo.

Cf. A. Looss, The Sclerostomidæ, Records Egyptian Government School of Medicine, 1901, pp. 76–77, pl. I., figs. 1–5.

Ankylostomum.

Head with chitinous buccal capsule, bent and open towards the dorsal side ; often with teeth in its fundus ; male with trilobate *bursa* and two equal *cirri ;* bursal lobes supported by ribs ; female genital orifice behind the middle ; Secernentes-Meromyaria ; in the intestine of mammals.

20.—*Ankylostomum minimum*, n.sp.

Pl. I., figs. 11–12.

Stomach of *Felis rubiginosa*, Geoffr.; Kandy.

Cuticle thick and annulate ; buccal capsule dorsally inclined with four ventral longitudinal "ribs" and a tooth at the bottom.

Male, 2·38 × 0·24 ; œsophagus $\frac{1}{4}$; cirri brown and very short, 0·062 ; lateral lobes of bursa rounded, supported by six ribs, of which the two anterior lie close together, the third, fourth, and fifth form a group, and the sixth lies isolated.

Female, 4·46 × 0·20 ; œsophagus $\frac{1}{5\cdot8}$; tail $\frac{1}{3\cdot4}$; genital organs almost confined to hinder half of body ; genital orifice posterior, dividing the body as 31 : 12 ; eggs not numerous, 0·088 × 0·053 ; one branch of the uterus runs forwards, the other backwards.

21.—*Ankylostomum trigonocephalum*, Rud.

Intestine of dog ; Colombo.

Cf. A. Railliet Traité de Zoologie Médicale, Paris, 1895, pp. 470–473, figs. 327–330.

Syngamus.

Mouth with a chitinous capsule, the wall of which is enlarged disc-like in front ; male small with a *bursa* and two equal cirri ; female orifice anterior : male and female in permanent *copula ;* Secernentes-Meromyaria ; in the trachea, bronchi, and nose of birds and mammals.

22.—*Syngamus trachealis*, v. Sieb.

Trachea of domestic fowl ; Colombo.

Cf. A. Railliet, *op. cit.*, pp. 453–455, fig. 312, also Neumann's Parasites of Domesticated Animals, p. 607, fig. 318.

23.—*Filaria ? Zschokkei*, Meyer.

Peritoneum of *Manis pentadactyla*, L.

Cf. Meyer, Archiv f. Naturgesch. Jahrg. 61, Berlin, 1896, pp. 56–69, Taf. IV., figs. 1–9. Sexually immature.

24.—*Filaria immitis*, Leidy.

Pleural cavity of dog ; Ragama.

Cf. A. Railliet, *op. cit.*, pp. 509–513, figs. 354–356.

25.—*Filaria piscicola*, n.sp.

From supraorbital region of a marine fish (*? Lethrinus*, sp.).

One incomplete female, 225 × 0·57 ; the diameter at the head is 0·13 ; the head is rounded, destitute of lips, teeth, and papillæ ; the tail is lost from the specimen ; genital orifice quite anterior, only 0·79 from cephalic extremity ; eggs 0·031 × 0·023 ; it is ovo-viviparous ; the embryos with acuminate tail measure 0·53 × 0·016.

Filariæ are very rare in fishes, and it is therefore to be regretted that only an imperfect description of this species can be given.

26.—*Filaria equina*, Abildg.

From eye of horse.

Cf. A. Railliet, *op. cit.*, pp. 524–526, figs. 364–366.

27.—*Filaria digitata*, n.sp.

Pl. III., figs. 52–55.

Peritoneum of *Bos indicus ;* Colombo.

Head with two straight teeth notched at the summit, thereafter four papillæ in the submedian lines ; cuticle finely annulate ; a long vestibule (in the female 0·59) leads into the œsophagus, ⅓

in the male, $\frac{1}{9}$ in the female; tail rounded, carrying in the female a spherical appendix; in the male the tail is coiled in a close spiral, in the female a loose spiral; in the male $\frac{1}{260}$; in the female $\frac{1}{96}$; in both sexes in front of the extremity on each side a finger-shaped appendage, 0·044 long in male, 0·10 in female.

Male, 42·5 × 0·35; the curved cirri 0·16 and 0·065 respectively; four præ-anal* and four post-anal* elongated papillæ; in front of the former on each side about 140 small rod-shaped, close-set papillæ reaching forwards 1·9 mm. from the tail end.

Female, 56·9 × 0·55; genital orifice anterior dividing the body as 1 : 71; eggs 0·039 × 0·026.

28.—*Filaria tuberosa*, n.sp.

Filaria Mansoni, Castellani and Willey, *Spol. Zeyl.*, vol. II., 1904, pp. 79–80, pl. VI., figs. 1–6.

In the peritoneum of *Mabuia carinata*, Schneid., the Brahminy Lizard; Colombo. Larvæ in the blood.

Only two females in the collection, of which the larger measures 34 × 0·37; tail attenuate, ending with a hemispherical dilatation, in front of which there is a papilla on each side; anus absent; head rounded without teeth and papillæ; œsophagus very short $\frac{1}{15}$; genital orifice 0·44 from head end; thin-shelled eggs 0·018 × 0·013; ovoviviparous.

The original name of the species must be altered because Cobbold named one *F. Mansoni*, from the orbit of *Gallus gallinaceus* in 1880.

29.—*Filaria flavescens*, Castellani and Willey.

From *Calotes versicolor*, Dum. et Bibr.; Colombo.

Cf. Castellani and Willey, *imprim.*

Head rounded without teeth and lips; body attenuate and rounded behind; anus absent; œsophagus very short, $\frac{1}{17}$ in male, $\frac{1}{38}$ in female. Male, 19 × 0·33; tail, $\frac{1}{11}$, with five very small post-anal papillæ; cirri, 0·16, conical with very broad base.

Female, 56 × 0·63; genital orifice 1·97 from head end; eggs 0·021 × 0·016; ovoviviparous.

Trichocephalus.

Body strongly attenuate, œsophagus cellular, hind body thickened, anus terminal. Male with one spiculum; female genital orifice at the end of the œsophagus at the limit between the

* These papillæ are always paired unless otherwise given.

thin fore body and thick hind body; eggs barrel-shaped; belongs to the *Pleuromyaria*, with muscles in place of the lateral fields; in the cœcum of mammals.

30.—*Trichocephalus discolor*, n.sp.

Pl. I., figs. 13–14.

From *Bos indicus*, Colombo; said to have occurred in the stomach.

Cuticle annulate at intervals of 0·0091 mm.; contours, at the fore body, serrate.

Male white, 45 × 0·14 in front, 0·55 behind; cirrus sheath spinose; cirrus long and narrow, of even width except at the rounded apex, 1·76 × 0·011; hence not to be confounded with *T. affinis*, Rud., from *Bos taurus*.

Female, 50 × 0·13 in front, 0·67 behind; fore body white, hind body yellow; eggs 0·065 × 0·031, with large spherical opercula at the poles.

Tetradenos tiara, v. Linst.

In *Spolia Zeylanica*, vol. I., 1904, p. 102, I described a Nematode from *Varanus bengalensis* under the name *Ctenocephalus tiara*. It happens that Tholenati gave the name *Ctenocephalus* to a Dipteron in the year 1857, and I have therefore altered the generic name of the Nematode to *Tetradenos*.

Cf. Arch. f. Naturg., Berlin, 1904, p. 301.

II.—ACANTHOCEPHALA.

Echinorhynchus.

Nemathelminthes without intestine; at the head a proboscis beset with hooks which can be retracted into a proboscis sheath, alongside which are two lemnisci (fluid reservoirs); male with two testes, six cement glands ("prostate"), and a protrusible, bell-shaped bursa with penis; female with a ligament in which the placentulæ arise; the mature eggs are passed through the sphincter apparatus of the bell-shaped uterus into the vagina; the species live in the adult condition in the alimentary canal of vertebrates.

31.—*Echinorhynchus tener*, n.sp.

Pl. I., figs. 15–17.

Intestine of the Serpent Eagle, *Spilornis cheela*, Daud.; Nedunkeni, Northern Province.

Body extended very long, delicate and fragile, head feebly thickened; rostellum broad and short, thickened in front, 0·43 × 0·39 (in front), the so-called "neck," 0·28, closely covered with

hooks; rostellum hooks in forty-five transverse rings with twenty hooks in each ring; hooks of the twelve anterior rings, 0·042, with a long root, those of the thirty-three posterior rings, 0·021, thorn-like without root.

Male, 39 × 0·52; the group of genital organs extends forwards 9·48 mm. from the thickened tail end.

Female, 72 × 0·79; placentulæ ovate, 0·17 × ·097; eggs with double shell, the outer shell showing wavy longitudinal lines, 0·053 × 0·023; tail end after copulation carries a layer of cement substance.

III.—TREMATODA.

Lyperosomum.

Distomids with long intestinal rami; testes behind one another and behind them lies the ovary; vitellarium on each side laterally behind the ventral sucker; genital orifice in front of latter.

32.—*Lyperosomum squamatum*, n.sp.

Pl. I., fig. 18.

Œsophagus of the White-necked Stork, *Dissura episcopus*; Gould; Palatupana.

Length 4·86, breadth 1·78. Oral sucker 0·59; ventral sucker 0·87, its middle point lying at the limit of the second and third fifths of the body; the cuticle of the ventral surface alone closely beset with scales; cuticle everywhere very thick; the thickness of the body is to the width as 1 : 2; the œsophagus divides after a short course into two intestinal diverticula, the epithelium of which is strongly developed; they extend to the hinder end; the genital orifice lies immediately in front of the anterior margin of the ventral sucker; behind this the two testes follow one behind the other and, behind the last testis, the small ovary with the shell-gland; the vitellaria occur as two tracts behind the ventral sucker occupying about $\frac{1}{3}$ of the body length; the coils of the uterus lie in the posterior half of the body; the eggs are small and numerous, narrow and elongate, 0·083 × 0·036; they present a large double black spot which corresponds with the two ocelli of the embryo; the cirrus sac is small, destitute of a cirrus.

33.—*Distomum*, spec. ?

Œsophagus of the Darter, *Plotus melanogaster*, Lin.; Wirawila.

Only one opaque specimen which could not be determined without sections, thus destroying it; moreover a single individual would not have sufficed for the investigation. The genus could therefore not be ascertained since the old genus *Distomum* has been broken up into more than 80 genera.

34.—*Distomum hepaticum*, Lin.

Liver of *Bos indicus*, [Scinde Cow]; Colombo.

Cf. A. Railliet, Traité de Zoologie médicale, Paris, 1895, pp. 342–356, figs. 219–235.

The generic name *Distomum* is here adopted instead of *Fasciola*, which was established by Linnæus in 1746 for *Distomum hepaticum*, *Dendrocœlum lacteum*, and *Schistocephalus solidus*, these being taken to be one and the same species. *Fasciola*, L., is therefore a scientific impossibility, incapable of being diagnosed. The definition of *Distomum*, s. str., is as follows:—

The two intestinal rami richly branched towards the outside; ventral sucker lying well forwards with the *porus genitalis* in front of it, the uterus and branched ovary behind; farther back the much-branched testis and the vitellarium at the margin of the body; parasitic in the liver of mammals.

Paramphistomum.

A small sucker in front, a large sucker behind; intestinal rami long; two testes lying obliquely one behind the other, lobate, without cirrus sac; *porus genitalis* in front in the median ventral line with the *ductus ejaculatorius* and the uterus opening into it; ovary and shell-gland behind the last testis; vitellaria lateral close beneath the surface of the body; parasitic in the stomach and bile passages of ruminants.

35.—*Paramphistomum calicophorum*, Fisch.

Stomach of *Bos indicus;* Colombo.

Cf. F. Fischoeder, Die Paramphistomiden der Säugethiere, Zool., Jahrb. Syst. XVII., Jena, 1903, pp. 541–546.

36.—*Paramphistomum gracile*, Fisch.

Stomach of Ceylon black cattle (*Bos indicus*).

Cf. Fischoeder, *op. cit.*, pp. 520–524.

Gastrothylax.

Amphistomids with ventral pouch which commences as a transverse groove shortly behind the mouth; genital pore inside the ventral pouch, male and female genitalia immediately in front of the caudal sucker.

37.—*Gastrothylax crumenifer*, Crepl.

Stomach of *Bos bubalus*, the country-bred buffalo of Ceylon.

Cf. Fischoeder, *op. cit.*, pp. 557–563.

Tristomum.

Body ovate or circular, flat, with two round suckers in front and a large, disc-shaped posterior sucker with seven rays and small rods; cerebral commissure with four ocelli; genital orifices and vagina in front on the left ventral side; testes numerous; ectoparasitic on the gills and surface of the body of marine fishes.

38.—*Tristomum megacotyle*, n.sp.

Pl. I., figs. 19–20.

From the surface of the body of a sword fish, *Histiophorus*, sp.; Beruwala, February 5, 1904.

Length 7·5, breadth 6 mm.; ventral cuticle, except on the suckers and head, thickly beset with circular papillæ, measuring 0·31 mm.

The two anterior suckers are equal to $\frac{1}{5}$ of the body length; the caudal sucker has a diameter equal to $\frac{1}{2}$ the body length, and shows seven radial ribs (pl. 1, fig. 19) which abut upon a central roundish area produced backwards; the sucker is bounded at the periphery by a striated border; in the posterior region of the sucker there are two straight undivided rods attenuated at the ends, 0·48 mm. long; these rods are always described as hooks in the definition of the genus *Tristomum*, but they do not deserve this name since they do not serve for attachment, but, on the contrary, for releasing the sucker from its adhesion, assuming a vertical position by the action of special muscles for this purpose.

A similar, though much larger species, also living upon *Histiophorus*, is *Tristomum lævæ*, Verrill=*Tr. ovale*, Goto; the length of this species amounts to 13 mm. and its breadth 12 mm.; the diameter of the anterior suckers equals $\frac{1}{7}$ of the body length; the rays of the caudal sucker are narrow, its margin is unstriated, and the rods are expanded and irregularly laciniate at the roots.

Cf. S. Goto, Studies on the Ectoparasitic Trematodes of Japan. Journ. Coll. Science, Japan, VIII., part 1, Tokyo, 1894, pp. 241–244.

IV.—CESTODA.

Hymenolepis.

Tæniids with armed scolex; proglottids generally broader than long; genital orifices marginal and unilateral; in each segment three testes; the mature uterus completely fills the proglottids: parasitic in mammals and birds.

39.—*Hymenolepis septaria*, n.sp.

Pl. II., fig. 21.

Intestine of *Upupa ceylonensis*, Reich.; Weligatta.

Length 25; the proglottids begin directly behind the scolex and measure, in front, 0·13 broad × 0·022 long, farther back, 0·79 broad × 0·18 long; towards the end of the chain they become longer than broad, 0·35 broad × 0·48 long, the last member rounded; the dorsoventral diameter is to the transverse as 2 : 3.

The scolex is short, 0·13 long × 0·22 broad, truncate in front; suckers 0·089; rostellum small and knob-shaped; hooks absent, no doubt through casual loss. On each side are two vessels, a large dorsal and a small ventral; outside these occurs the nerve.

Bundles of longitudinal muscles appearing circular in transverse section course beneath the thick cuticle; calcareous bodies absent.

Cirrus-sac with inner side directed obliquely ventrally; three small oval testes lie in a row in the middle of the proglottids at the dorsal side. Vagina dorsad of cirrus sac, expanding to a large roundish *receptaculum seminis*, reaching the middle line and touching the anterior margin of the segment. Ovary strongly developed occupying the whole longitudinal extent of the segments; ventrally a broad transverse branch from which right and left two broad cornua extend horseshoe-shaped towards the dorsal side, leaving room for the testes, the vitellarium, and the shell-gland; the roundish vitellarium ("Dotterstock") lies in the middle line ventrad of the testes; the small shell-gland is still more ventral in position. The uterus fills the last segments completely and is subdivided by dorsoventral septa; the eggs have a triple membrane, the outer 0·073 × 0·064, the inner 0·031 × 0·023.

40.—*Hymenolepis clausa*, n.sp.

Pl. II., figs. 22–23.

Intestine of the Whistling Teal, *Dendrocygna javanica*, Horsf.: Tissamaharama.

Length 18; proglottids commence at once behind scolex, measuring in front 0·053 long × 0·35 broad, behind 0·47 × 1·56.

Scolex small, 0·10 × 0·23; suckers 0·10; rostellum hemispherical, carrying eight hooks of 0·057 length. In the parenchyme are to be found two layers of longitudinal muscles, outer small numerous bundles, inner large sparser bundles; calcareous bodies not present; two very large vessels traverse the chain: outside them the nerves.

Genital pores absent; on one and the same side in each proglottid, $\frac{1}{7}$ of the cross-diameter distant from the margin, the

cirrus-sac (*bursa*) and vagina merge into one another directly; three testes lie dorsally and posteriorly in each segment, the central one somewhat backwards: cirrus-sac very large, about $\frac{3}{5}$ of the cross-diameter of the body, containing a very long cirrus, a uniformly thin chitinous tube coiled several times; the orifice of the cirrus-sac where it passes into the vagina is closely beset with small equal hooks. The ovary lies unsymmetrically ventrad of the vagina and cirrus-sac, a racemose body, in the centre of each follicle a black granular nucleus; vitellarium ventral, median, transversely elongate, in front of it the round shell gland; no eggs developed.

I agree with Wolffhügel in the opinion that the absence of genital pores is not of systematic importance, and therefore the species is assigned to *Hymenolepis*.

41.—*Hymenolepis spinosa*, n.sp.

Pl. II., figs. 24-25.

Intestine of the Painted Snipe, *Rostratula capensis*, Lin.; Vavuniya.

Length 15 mm., anterior proglottids 0·12 broad × 0·044 long; hindmost proglottids greatly expanded at the hinder margin, 0·62 broad × 0·35 long; all are therefore broader than long.

Scolex thickened towards the fore-body with breadth of 0·22, the foremost portion of the chain being 0·11 broad.

The rostellum carries ten hooks 0·028 long; the hooks are slender and have a long root and small hook and lever; genital orifices marginal and unilateral, approximately at the end of the first quarter of each member of the chain. The cirri are remarkably large, 0·14 long, 0·018 broad at the base, closely spinose. The broad cortical layer occupies on each side $\frac{1}{4}$ of the dorsoventral diameter; a layer of transverse muscles occurs at its inner side and inside these numerous small groups of longitudinal muscle-bundles, inside these again eight stronger bundles of longitudinal muscles; on each side a large ventral and a smaller dorsal vessel, ectad of these, the nerve.

The large cirrus-sac occupies nearly $\frac{2}{3}$ of the transverse diameter; dorsad in the middle of the proglottis, three large testes, one in front beside the cirrus-sac, the two others side by side farther back. The coiled vagina lies below the cirrus-sac and expands to form a small *receptaculum seminis* which does not reach to the middle line; the ovary lies in the middle third of the transverse diameter, behind it the vitellarium, a transverse strand of about $\frac{1}{4}$ the cross-diameter; the ovate shell-gland

occurs in the middle between the second and third testes. The eggs have a triple membrane, the outer irregular, 0·047 ; the oncosphere is 0·026 long × 0·018 broad.

Dipylidium.

Rostellum with several circlets of rosethorn-shaped hooks ; genital pores marginal and bilateral ; genital organs in each proglottid duplicated ; testes numerous ; parasitic in mammals.

42.—*Dipylidium caninum*, Lin.

Intestine of *Canis familiaris ;* Colombo.
Cf. A. Railliet, *op. cit.*, pp. 284–290.

43.—*Tænia*, spec. ?

Intestine of *Haliastur indus*, Bodd.; Nedunkeni.
Defective fragments without scolex, indeterminable.

Diorchis.

Scolex with simple crown of hooks ; in each member two testes ; genital pores marginal and unilateral ; the mature uterus fills the proglottids completely ; parasitic in birds.

44.—*Diorchis occlusa*, n.sp.

Pl. II., figs. 26–27.

Intestine of the Flamingo, *Phœnicopterus roseus*, Pall.; Weligatta.

Length 75 mm. ; the body is thick, ovate in cross section, the dorsoventral diameter is to the transverse as 7 : 9 ; formation of proglottids commences at once behind the scolex ; anterior proglottids 0·40 broad × 0·018 long, posterior 0·97 broad × 0·18 long, the breadth always exceeding the length and the contours serrate.

The scolex, 0·53 broad, is triangular in profile ; the rostellum is in some cases retracted, in others protracted, appearing short and broad ; it carries eight hooks, 0·14 mm. long ; the root-branch is shorter than the hook, in the proportion 25 : 29 ; at the base there is a small finger-shaped prolongation, and the concavity thus produced articulates with a roundish body, eight of which occur in a circle at the summit of the rostellum.

Genital pores absent ; male and female ducts fuse together on the same side in all segments at a distance of 0·03 from the margin ; radial bundles of longitudinal muscles occur not far from the cuticle ; calcareous bodies are present in small quantity ; on each

side a large ventral and small dorsal vessel, the latter strongly and regularly sinuate, outside these the usual nerve, round in section.

A long thin convoluted chitinous cirrus lies in the cirrus-sac, the duct is finely spinulose, and a seminal vesicle leads into the cirrus-sac ; two small oval testes, 0·10 × 0·06 lie dorsally.

The wide vagina is ventral to the cirrus-sac ; it is finely spinulose internally and presents a forcipate apparatus ; it leads into a *receptaculum seminis* reaching to the middle line ; the fusiform dilatation of the vagina is 0·042 wide. The ovary lies ventrally in the middle third and consists of separate aggregates ; the horseshoe-shaped vitellarium lies near the dorsal side and dorsad of it, the shell-gland.

Eggs not present.

Davainea.

Scolex with hundreds of very small, generally hammer-shaped hooks in two circles ; suckers generally beset with hooks at the margin ; genital pores unilateral or irregularly alternating ; numerous testes ; eggs in capsules ; parasitic in mammals and birds.

45.—*Davainea polycalcaria*, n.sp.

Pl. II., figs. 28–29.

Intestine of *Corvus macrorhynchus*, Tem. ; Colombo.

Length 65 mm. ; in front the proglottids measure 0·03 long × 0·25 broad, in the middle 0·20 × 1·78, behind 0·99 × 1·34 ; they become at the end slightly narrower and longer, but always broader than long ; the scolex is button-shaped and very short, 0·31 broad by 0·088 long ; the suckers, 0·10, carry several hundreds of small hooks at the margin ; the likewise very numerous hooks of the rostellum are closely packed in circlets, they are pointed and measure 0·015. A transverse muscular layer marks off the broad cortical zone from the medullary layer ; ectad of the transverse muscles are numerous longitudinal muscles which do not form bundles ; calcareous corpuscles are closely packed throughout the body ; two large vessels run $\frac{22}{100}$ of cross-diameter distant from margin and are connected by a transverse *ramus communicans* in the posterior part of the segment ; close beside them outside is the nerve. The pyriform cirrus-sac occupies $\frac{1}{12}$ of the cross-diameter ; numerous testes occur in the medullary substance ; they are oval, about 0·039 by 0·026 ; female organs not yet developed.

Diplochetos, n.gen.

Genital pores marginal bilateral ; genital glands in only one group ; at the scolex a double crown of hooks ; testes numerous ; three layers of longitudinal muscles ; segments much broader than long ; uterus with ventral orifice right and left of the middle line.

46.—*Diplochetos volvulus*, n.sp.

Pl. II., figs. 30–31.

Intestine of Yellow-wattled Lapwing, *Sarciophorus malabaricus*, Bodd.; Weligatta.

Length 8·5 ; anterior segments 0·018 long × 0·21 broad, middle segments 0·10 × 0·40, posterior 0·37 × 0·70, always broader than long. The pyriform scolex is 0·35 broad × 0·26 long ; the rostellum carries twenty-four hooks in two circles of twelve, the hooks 0·047 long ; in the parenchyme are three layers of longitudinal muscle-bundles, which become stronger towards the interior ; on each side two strongly sinuate vessels, the dorsal larger ; the nerve runs along much nearer the margin ; calcareous deposits not present. Genital pores marginal, right and left in each proglottid ; the cirrus-sac occupies $\frac{1}{5}$ of the cross-diameter and contains coils of the *vas deferens ;* entad of the cirrus-sac occur extensive convolutions of the *vas deferens ;* the vagina lies ventral to the cirrus-sac and expands into an irregularly shaped *receptaculum seminis* which reaches about $\frac{1}{3}$ of the cross-diameter. In each transverse section about ten oval testes are to be found. The ovary lies in the inner third of the medullary substance and consists of separate follicles ; the round vitellarium lies ventrally in the middle ; the site of the uterus breaks through the musculature and parenchyme ventrally about $\frac{1}{3}$ of the cross-diameter from the margin, sometimes to the right, sometimes to the left without opening to the exterior ; I have not found it in full development. The eggs are 0·016 long × 0·013 broad. Other Tæniid genera with biserial genital pores are the following :—

Diploposthe, with simple hook-crown and three testes in each segment.

Amabilia, with double cirrus-sac and simple vagina opening ventrally.

Diplophallus, with double male organs and simple female organs.

Dipylidium, with several rings of hooks on the rostellum and elongate segments.

The large genera from ruminants and rodents do not concern the question.

Ophryocotyle.

Scolex without rostellum, with five depressions, the margins of which are beset with numerous small hooks; the margins of the suckers are also armed with numerous small hooks; genital pores marginal, irregularly alternating or bilateral; parasitic in birds.

47.—*Ophryocotyle zeylanica*, n.sp.

Pl. II., figs. 32–34.

Intestine of the Ceylonese Hornbill, *Lophoceros gingalensis*, Shaw; Nedunkeni, Northern Province.

Length 55; anterior proglottids 0·035 long × 0·097 broad, posterior 0·12 long × 0·70 broad. Scolex, 0·29 long × 0·19 broad, club-shaped, the so-called neck behind it, strongly attenuate, 0·079 broad; no rostellum; the suckers occur laterally behind the middle of the scolex; the inner ring enclosing the lumen is beset with very numerous hooks; at the apex two parallel loops forming five finger-shaped rays whose margins are beset with very numerous small thorn-like hooks without root and lever, measuring 0·0053.

The cortical zone is very wide and separated from the medullary zone by a transverse muscular layer, outside of which are regularly placed large bundles of longitudinal muscles and farther outside numerous, irregularly grouped, smaller bundles; two large vessels run ventral in the medullary layer forming a posterior anastomosis in each segment; the nerve occurs near the transverse muscles. In the layer between the subcuticular cells and the outer longitudinal muscles lie calcareous bodies. Genital pores marginal bilateral at the anterior lateral margin of the segment; cirri protruded, 0·19 long and 0·035 broad at the base, they are finely spinulose; cirrus-sac carries outwardly longitudinal muscles, thereunder circular muscles: it occupies almost $\frac{1}{4}$ of the cross-diameter; numerous testes lie in the medullary substance, about twelve appearing in a transverse section; the *vas deferens* is coiled and leads into a sigmoid seminal vesicle which has a narrow lumen and a very thick hyaline wall.

The vagina courses ventral from the cirrus-sac and the *receptaculum seminis* reaches almost to the middle of the segment; the ovary consists of large isolated cells and occupies a large place in the medullary substance, not forming a closed body; the vitellarium abuts ventrally upon the transverse muscles and is a roundish body of $\frac{1}{12}$ the size of the cross-diameter; the eggs are 0·036 by 0·029.

The genus *Ophryocotyle* hitherto comprised three species:—*O. proteus*, Friis (1869), from *Tringa*, *Callidris*, *Charadrius*, and

Larus ; *O. Lacazei*, Villot (1875), from *Limosa* ; and *O. insignis*, Lönnberg (1880), from *Hæmatopus* and *Mergus*.

Friis and Villot describe at the apex of the scolex five distinct suckers in a row armed with hooks, whereas Lönnberg speaks of undulating loops ; in *O. proteus* and *O. insignis* the genital pores alternate irregularly ; the similarity in the formation of the scolex seemed to require that the species here described should be placed in the genus *Ophryocotyle*.

Brochocephalus, n.gen.

Scolex with long rostellum with six backwardly directed loops of hooks ; genital pores marginal, regularly alternating ; cirri large, strongly and closely spinulose ; no *receptaculum seminis* ; three testes in each segment ; segments (proglottids) broader than long ; eggs two-shelled, the inner shell narrowed at the poles.

48.—*Brochocephalus paradoxus*. n.sp.

Pl. II., figs. 36 and 38; Pl. III., figs. 35 and 37.

Duodenum of the Lesser Sand Plover, *Ægialitis mongolica*, Pall. ; Weligatta.

Length 85 mm. ; without "neck ;" anterior proglottids 0·062 broad × 0·0088 long, posterior 0·75 broad × 0·18 long, always much shorter than wide ; scolex with four suckers and long protruded knobbed rostellum, 0·10 long × 0·062 broad in front ; at the apex six backwardly directed tracts of thirteen hooks each, *i.e.*, seventy-eight hooks in all ; the hooks are slender with very small hook and lever, measuring 0·029.

Two layers of longitudinal muscle-bundles are seen in cross-section under the cuticle ; on each side two vessels, the larger forming a posterior anastomosis in each segment ; the nerve runs near the margin. Genital pores marginal and almost regularly alternating, rarely two follow on the same side ; no calcareous deposits. Cirri very large, broad and spinulose, as long as half the cross-diameter of the proglottid ; the large muscular cirrus-sac is expanded outwardly and occupies about $\frac{1}{3}$ of the cross-diameter ; three small ovate testes in the middle line, one in front, the others symmetrical behind it ; behind the testes a transverse vitellarium occupying $\frac{1}{8}$ of the cross-diameter ; the ovary surrounds the testes in the middle third ; vagina and cirrus-sac lie between the two vessels ; the eggs are elliptical and two-shelled ; outer membrane 0·081 × 0·047, oncosphere spherical ; the inner thick shell is narrowed at the poles.

The genus *Gyrocœlia* shows a zigzag line, interrupted at eight points, with forty hooks on the rostellum ; four testes in each segment, and the spherical eggs have two appendices.

Cittotænia.

Both the genital organs and their ducts are duplicated in each segment; proglottids broader than long; scolex unarmed; uterus transverse; eggs with pyriform apparatus; parasitic in rodents.

49.—*Cittotænia bursaria*, n.sp.

Pl. II., figs. 39-40.

Intestine of *Lepus nigricollis*, Cuv.: Nedunkeni.

No complete examples were present in the collection, the largest fragments measuring 55 mm. in length. The body is broad, rounded in front; no "neck"; anterior segments 0·20 long × 5 broad, posterior 1·34 long × 7 broad. The scolex is not protruding: the four suckers measure 0·14 in diameter; rostellum absent. In the parenchyme, two layers of longitudinal muscles, transverse muscles and many dorsoventral muscles; on each side two longitudinal vessels, ventral larger, dorsal smaller; outside these, the nerve; no calcareous bodies. In each segment there are two groups of genital organs, each occupying $\frac{1}{5}$ of the cross-diameter and having their several ducts The cirri protrude behind the middle of the margin of the proglottid; they measure 0·44 long × 0·035 broad at the base; the cirrus-sacs are short and club-shaped; entad of them lies a fusiform *bursa ejaculatoria* provided with longitudinal and circular muscles; entad of this a fusiform seminal vesicle and still further inwards a convoluted *vas deferens*; the very numerous spherical testes, 0·044 diameter, are distributed through the entire proglottids without forming two lateral groups. The vagina is broad, with high endothelium, expanding to a large *receptaculum seminis*; it runs ventrad of the cirrus-sac: entad of the receptaculum and ventral in position lies the roundish ovary surrounding the vitellarium.

The uterus traverses the proglottid from right to left and has roundish protuberances in front and behind; eggs round, 0·078, with triple membrane; the inner membrane forms the so-called pyriform apparatus; the spherical oncosphere measures 0·014.

Ichthyotænia.

Scolex unarmed with four suckers, and often a fifth apical sucker; genital pores marginal, irregularly alternating, testes numerous; the vagina forms coils at the posterior margin of the proglottids in the middle, which replace a *receptaculum seminis*: parasitic in fishes and reptiles.

50.—*Ichthyotœnia cryptobothrium*, n.sp.

Pl. III., figs. 41–42.

Intestine of *Chrysopelea ornata*, Russell, a tree-snake ; Kurunegala.

Length 130 mm. ; head end rounded, scolex retracted, the four suckers being found only in transverse sections surrounded by a parenchyme-ring with eight vessels ; the suckers extend 0·40 mm. backwards ; their lumen communicates outwardly by two lacunæ, a dorsal and a ventral, which ceases in the midst of the suckers ; a median plug projects freely.

The anterior proglottids are very short, 0·02 long × 1·00 broad ; the middle are 0·59 long × 1·69 broad ; the posterior 2·48 long × 0·87 broad, much longer than broad ; the last proglottid is rounded behind.

Calcareous bodies sparsely distributed ; two layers of longitudinal muscle-bundles parallel with the cuticle traverse the parenchyme, outer thinner numerous bundles, inner thicker and sparser ; at the margin on each side run two vessels, ventral stronger, dorsal thin and highly sinuous ; outside these the stout nerve.

The genital pores are marginal and irregularly alternating in the anterior third of the margin of the proglottid. The cirrus is small, rod-shaped and plain ; the cirrus-sac occupies $\frac{1}{7}$ of the cross-diameter ; the genital sinus is retracted ; the *vas deferens* forms abundant coils reaching to the middle of the cross-diameter ; the numerous testes lie in a transverse row in the dorsal half of the medullary substance and measure 0·052 to 0·065. The vagina runs ventral straight inwards ; ventrad of the ovary it forms numerous coils as equivalent of a *receptaculum seminis*.

The ovary consists of very large cells and occupies scarcely $\frac{1}{4}$ of the cross-diameter ; dorsal lies the roundish *vitellarium* ventral to which the shell-gland is applied and ventral to this a *haustorium* (Schluckapparat). The spherical eggs have a double membranous shell, measuring 0·047 to 0·052.

Aphanobothrium, n.gen.

Body broad and thick like a *Schistocephalus* larva, with short posteriorly acute-angled proglottids ; in the frontal region a dorsoventral slit leading to five suckers ; destitute of scolex and hooks ; genital organs simple, ducts double, marginal ; the uterus discharges ventral in the middle line ; cortical layer broad ; cirrus closely beset with hooks ; on each side two vessels, the larger with transverse anastomosis ; ovary resolved into coils which lie dorsoventral and transverse ; belongs to the Anoplocephalinæ.

51.—*Aphanobothrium catenatum*, n.sp.

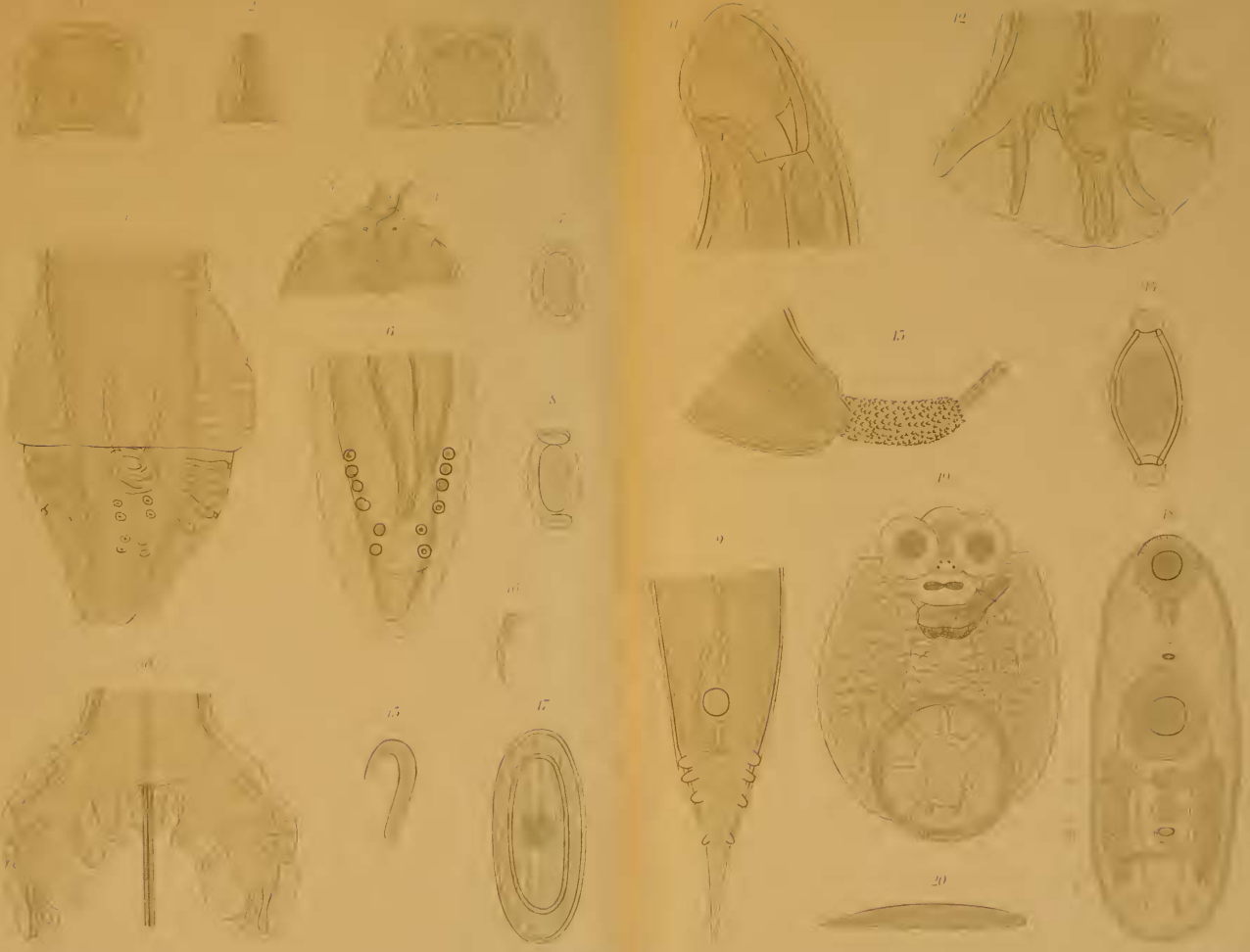
Pl. II., figs. 43 and 46; Pl. III., figs. 44, 45, and 47.

Duodenum of the Flamingo, *Phœnicopterus roseus*, Pall.; Weligatta.

Length up to 135 mm.; breadth 9–10 mm.; body attenuated in front, truncate behind and very thick; the dorsoventral diameter is to the cross-diameter as 9 : 20; anterior end rounded and retracted in the middle and confined by arching cross lines; scolex not visible externally; proglottids sharply delimited, at first 0·20, then 0·27, behind 1·18 long. The middle $\frac{2}{3}$ of the body width are, dorsally and ventrally, occupied by five longitudinal rows of flat cells which are also disposed in transverse rows; posteriorly these deepen into small grooves; the cortical layer is to the medullary substance dorsoventral as 2 : 5; in the tissue occur oval calcareous bodies measuring on the average 0·018 × 0·012. Under the cuticle are circular and longitudinal muscles; a strong transverse muscular layer divides the cortex from the medullary substance; in the cortex run radial bundles of longitudinal muscles; on each side two vessels run close together, dorsal a smaller thick-walled vessel, ventral a larger thin-walled; the latter forms in each proglottid a strongly sinuous cross-anastomosis; the longitudinal nerve-trunk runs close outside the vessels.

The scolex is retractile; in transverse sections 0·05 to 0·07 mm. from the frontal point are found four suckers of 0·10 diameter, and a fifth in the middle; these are circular and open outwards through a dorsoventral slit. The cirrus, 0·39 × 0·079 (0·12 broad at the base), is regularly beset with hooks like the rostellum of an *Echinorhynchus*, arranged in transverse rings of sixteen each; it protrudes from a hemispherical protuberance; the cirrus-sac occupies $\frac{1}{7}$ of the cross-diameter; the numerous round testes of 0·26 diameter lie in the medullary substance approximated to the transverse muscles.

The vagina runs dorsad of the cirrus-sac; both lie between the vessels. The ovary consists of strands extending from the dorsal to the ventral side and then bending inwards where they unite in a short transverse branch; dorsad of this lies the radiate shell-gland, and dorsad of the latter the small vitellarium consisting of nodular strands; the ovarian cells are 0·013 large, those of the vitellarium 0·0052; only the efferent duct of the uterus was developed, perforating the transverse muscles ventral in the middle line; eggs not yet present.



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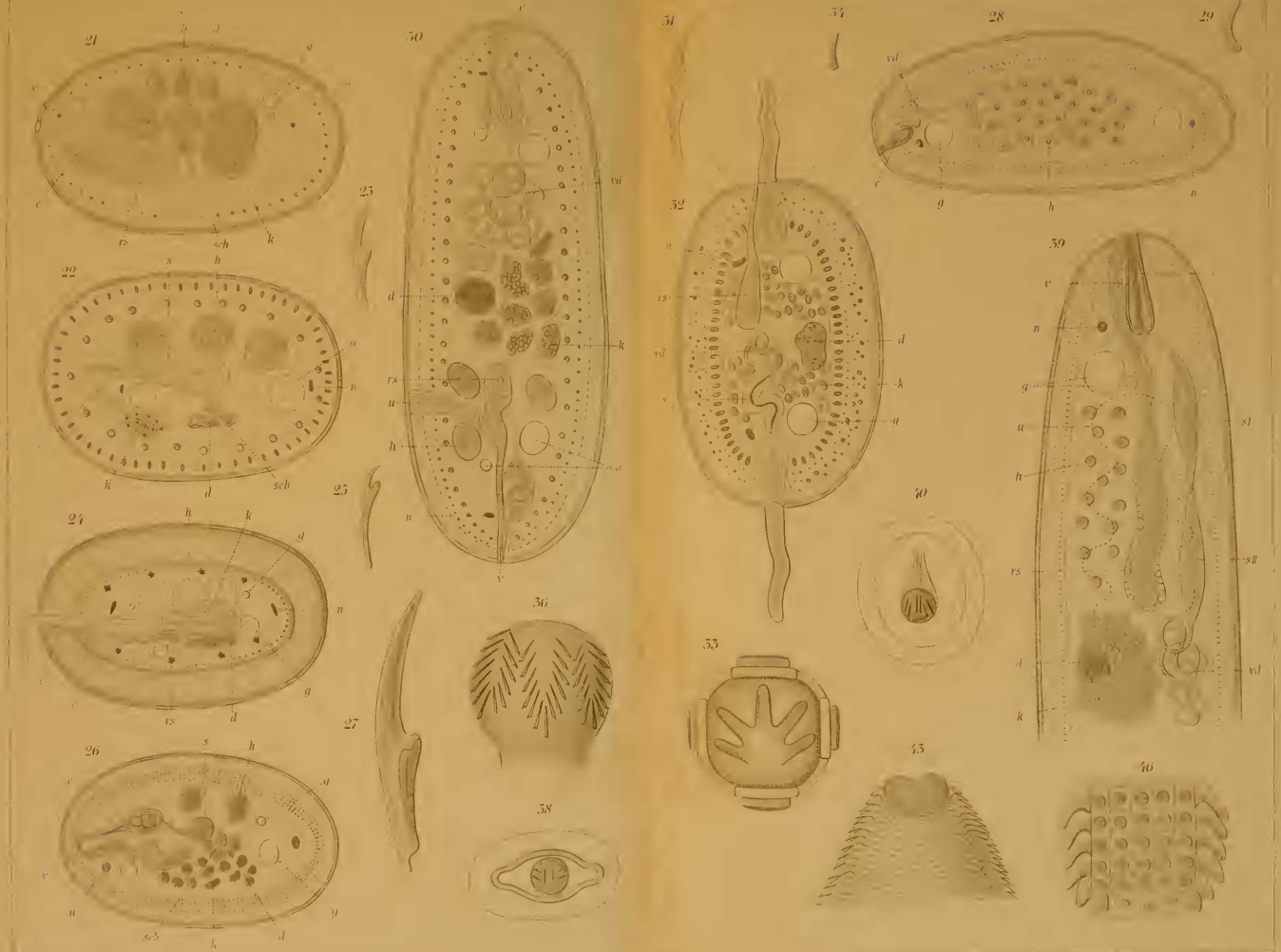
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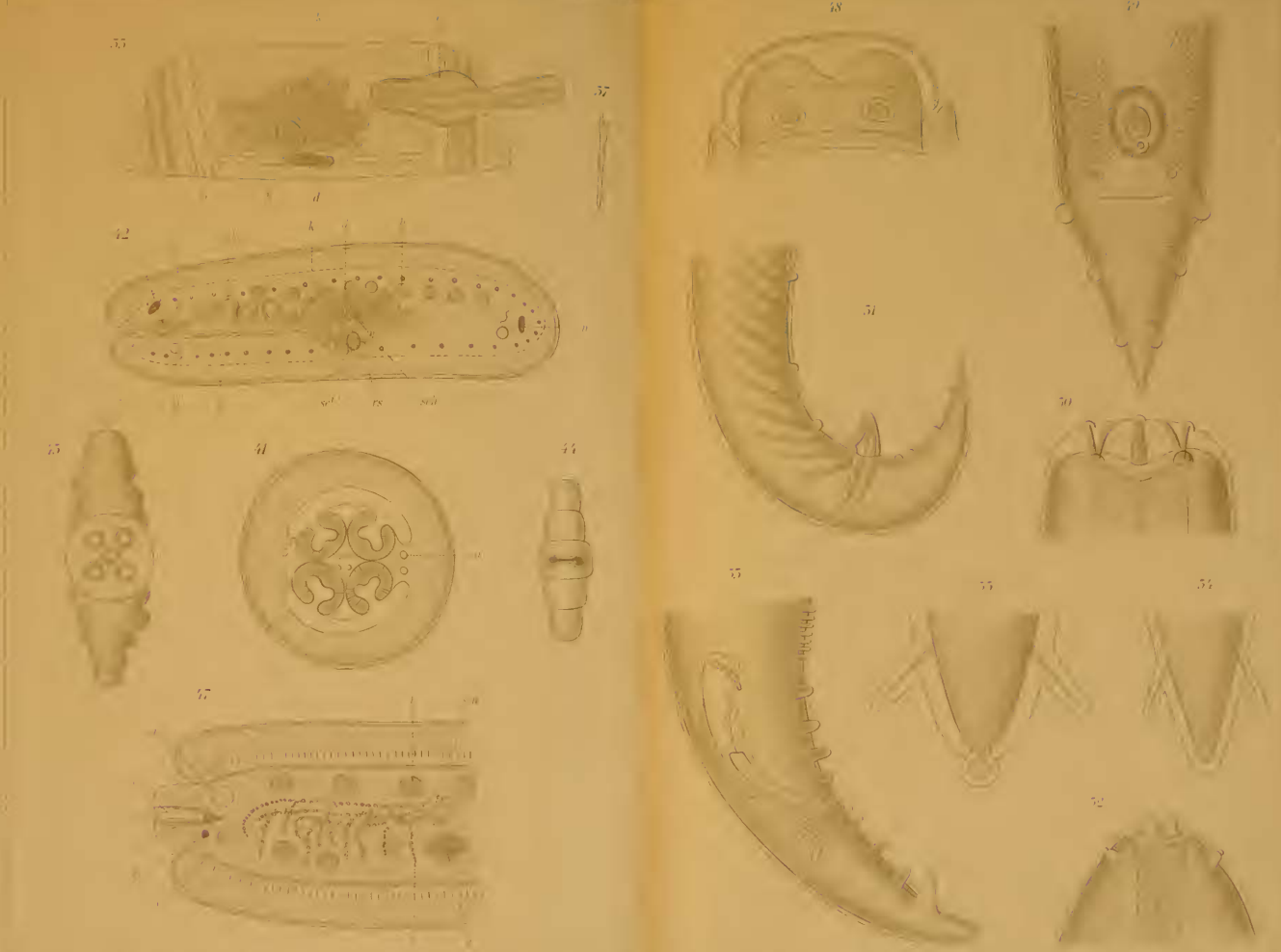
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EXPLANATION OF PLATES

Illustrating Dr. von Linstow's Paper on Helminthes of Ceylon.

g. vessel ; *n.* nerve ; *c.* cirrus-sac ; *vd.* vas deferens ; *h.* testis ; *v.* vagina ; *rs. receptaculum seminis ; k.* ovary ; *d.* vitellarium ; *u.* uterus ; *s.* male seminal vesicle ; *sch.* shell-gland ; *schl.* haustorium.

Plate I.

Fig. 1.—*Ascaris fissicollis.* Dorsal lip.

Fig. 2.—Same. Accessory lip.

Fig. 3.—*Ascaris coronata.* Dorsal lip with accessory lips.

Fig. 4.—*Physaloptera brevispiculum*, ♂. Tail from below.

Fig. 5.—*Spiroptera secretoria.* Head ; *f.* free projecting secretory filament.

Fig. 6.—*Spiroptera orca*, ♂. Tail from below.

Fig. 7.—Same, ♀. Immature egg.

Fig. 8.—Same. Mature egg.

Fig. 9.—*Heterakis pusilla*, ♂. Tail from below.

Fig. 10.—*Strongylus digitatus*, ♂. Tail from below.

Fig. 11.—*Ankylostomum minimum.* Head from the right side.

Fig. 12.—Same, ♂. Tail from the right side.

Fig. 13.—*Trichocephalus discolor*, ♂. Tail from right side.

Fig. 14.—Same, ♀. An egg.

Fig. 15.—*Echinorhynchus tener.* Anterior hook of rostellum.

Fig. 16.—Same. Posterior hook.

Fig. 17.—Same. An egg.

Fig. 18.—*Lyperosomum squamatum*, from below.

Fig. 19.—*Tristomum megacotyle*, from below.

Fig. 20.—Same. Rod from the caudal sucker.

Plates II. and III.

Fig. 21.—*Hymenolepis septaria.* Transverse section.

Fig. 22.—*Hymenolepis clausa.* Transverse section.

Fig. 23.—Same. Hook.

Fig. 24.—*Hymenolepis spinosa.* Transverse section.

Fig. 25.—Same. Hook.

Fig. 26.—*Diorchis occlusa.* Transverse section.

Fig. 27.—Same. Hook.

Fig. 28.—*Davainea polycalcaria.* Transverse section.

Fig. 29.—Same. Hook.

Fig. 30.—*Diplochetos volvulus.* Transverse section ; on one side the vas deferens is figured, on the other the vagina.

Fig. 31.—Same. Hook.

Fig. 32.—*Ophryocotyle zeylanica.* Transverse section ; on the one side the male organs are figured, on the other the female.

Fig. 33.—Same. Scolex from the frontal surface.

Fig. 34.—Same. Hook.

Fig. 35.—*Brochocephalus paradoxus.* Horizontal section ; this figure is reproduced on Plate III.

Fig. 36.—Same. Rostellum in side view.

Fig. 37.—Same. Hook (on Pl. III.).

Fig. 38.—Same. An egg.

Fig. 39.—(Pl. II.). *Cittotænia bursaria.* Portion of a transverse section ; *s. I.* Bursa ejaculatoria ; *s. II.* Seminal vesicle.

Fig. 40.—(Pl. II.). Same. An egg.

Fig. 41.—(Pl. III.) *Ichthyotænia cryptobothrium.* Transverse section through the scolex, 0·30 mm. from the apical point.

Fig. 42.—(Pl. III.). Same. Transverse section.

Fig. 43.—(Pl. II.) *Aphanobothrium catenatum.* Head end in flat view.

Fig. 44.—(Pl. III.). Same. Head end in frontal view.

Fig. 45.—(Pl. III.) Same. Transverse section through the retracted suckers.

Fig. 46.—(Pl. II.). Same. Surface view of posterior end.

Fig. 47.—(Pl. III.). Same. Portion of a transverse section.

N.B.—The remaining figures are on Pl. III.

Fig. 48.—*Ascaris brachycheilos.* Dorsal lip.

Fig. 49.—*Heterakis granulosa*, ♂. Tail from below.

Fig. 50.—*Oxysoma falcatum.* Head end.

Fig. 51.—Same, ♂. Tail from right side.

Fig. 52.—*Filaria digitata.* Head end.

Fig. 53.—Same. Tail end of male from right side.

Fig. 54.—Same. Tail points of male from below.

Fig. 55.—Same. Tail points of female from below.

NEW AND INTERESTING LIZARDS IN COLOMBO MUSEUM.

By N. ANNANDALE, D.Sc.

(*Deputy Superintendent of the Indian Museum.*)

THANKS to Dr. A. Willey I have lately had an opportunity of examining the Lizards in the collection of the Colombo Museum, the specimens in which are, without exception, from Ceylon. Notes on many of them have been published in Mr. A. Haly's "Report on the Collection of Reptilia and Batrachia in the Colombo Museum" (1891); but several additions have been made more recently, while a re-examination of some specimens has had interesting results, the most important of which is the establishment of a new genus for the reception of Nevill's *Euprepes halianus*.* Another new Skink is also described.

GECKONIDÆ.

GYMNODACTYLUS NEBULOSUS, Bedd.

The collection contains a half-grown specimen of this species from a locality 18 miles north of Kandy (see A. Haly, Administration Report, Colombo Museum, 1900). Boulenger records another Ceylonese example in the British Museum; but the species, common in some parts of Southern India, must be rare in Ceylon.

GYMNODACTYLUS FRENATUS, Gthr.

An examination of the two males and two females in the collection enables me to point out a peculiarity of the adult male which is possibly assumed at the breeding season and is quite absent in the female. The ventral surface of the base of the tail is swollen in the former sex, and there are two large closely adjacent papillæ close behind the opening of the penis on each side.

* H. Nevill. Taprobanian, II., 1887, p. 56; also Boulenger, Reptiles, Fauna Brit. India, 1890, p. 213.

AGAMIDÆ.

Calotes ophiomachus, Merr.

Judging from a young specimen from Kandy in the collection and from an adult lately captured by myself in Colombo, the "two groups of spines on each side of the head" noted by Boulenger may be united into a single series.

SCINCIDÆ.

Mabuia bibronii (Gray).

Though Boulenger only records this species from the Carnatic in the "Fauna," it is probably not uncommon in some parts of Ceylon, whence there are several specimens in the Colombo Museum which I have re-examined (see Haly's Report on Reptilia, &c., Colombo, 1891, p. 14, where the species is recorded from Mullaittivu).

Lygosoma megalops, sp. nov.

Sub-genus *Keneuxia*, Gray (see G. A. Boulenger, Catalogue of the Lizards in the British Museum, Second Edition, vol. III., 1887, pp. 210 and 214).

Habit lacertiform; length from snout to fore-limb contained about $1\frac{1}{2}$ times in the length from axilla to groin; limbs well developed, pentadactyle, overlapping when adpressed; snout short, obtusely pointed; eye large; diameter of orbit as great as length of snout; distance from orbit to ear-opening much longer than snout; ear-opening much smaller than eye, circular, without denticulations.

Rostral much broader than deep, forming a straight suture with the frontonasal; no supranasals; nasal undivided. Frontal nearly as long as the frontoparietals and the interparietal together; interparietal completely separating the parietals; no distinct nuchals. Four large, subequal supraoculars; seven or eight superciliaries; six upper and five lower labials. Dorsals and laterals smooth, ventrals feebly keeled; body scales subequal, imbricate, in twenty-four to twenty-six rows round the body; anals and caudals not enlarged; no enlarged scale on the heel; middle toe with twelve to fourteen subdigital plates. Colour almost uniform dark brown. Length of head and body, 2 inches; length of tail, $2\frac{3}{8}$ inches.

Localities.—One specimen from Puttalam; another from Kitulgala.

THECONYX, gen. nov.

Limbs well developed, pentadactyle ; claws retractile ; other characters as in *Lygosoma*. This new genus is intermediate between *Lygosoma* and *Ristella*, from the latter of which it differs in having five digits on each foot and in the other points which separate the former genus from the latter, except as regards the claws.

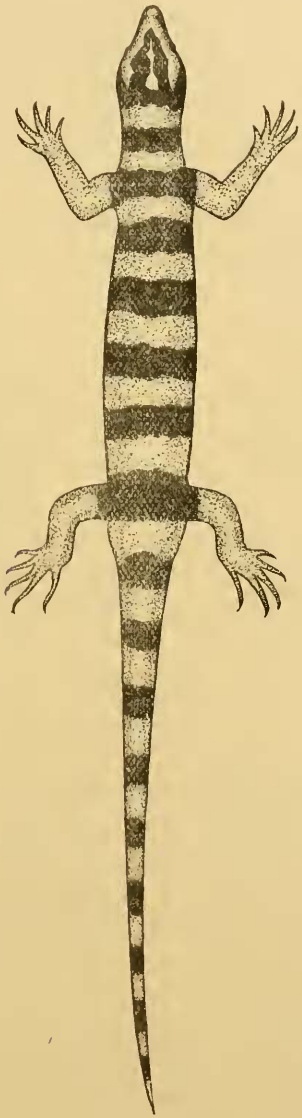


Fig. 1.—Young *Theconyx halianus* showing general form and coloration, from above. × 3.

THECONYX HALIANUS (Nevill).

As the description of this species drawn up by Haly and published by Nevill, who gave it its name *(Euprepes halianus)*, is not very clear, I have based the following diagnosis on three specimens in the Colombo Museum.

Habit lacertiform, rather stout; limbs approaching one another or slightly overlapping when adpressed; tail cylindrical, of the same length as the head and body. Tympanum as small as nostril, deeply sunk. No postnasal; a narrow supranasal which does not meet its fellow; rostral much broader than deep; frontal three times as long as broad, much longer than interparietal, from which it is completely separated: four large supraoculars, seven or eight superciliaries; no distinct nuchals. Lower eyelid scaly; body scales large, imbricate; dorsals with three or five indistinct keels; laterals smooth; twenty-four scale round the body; anals slightly enlarged.

Fig. 2.—Left hand from below. × about 4.

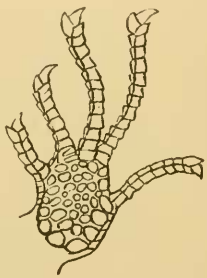


Fig. 3.—Left foot from below. × about 4.

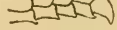


Fig. 4.—Claw. × 12.

Coloration.—Dorsal surface olive (yellow in young) with six or seven dark transverse bars on the body which are narrower than the interspaces, and eight or nine on the tail. These are much more conspicuous in the young than in the adult and equal to the interspaces. Head variously marked with olive and dark brown. Ventral surface dirty yellow. Length of head and body $1\frac{3}{4}$ inch: length of tail $1\frac{3}{4}$ inch.

Localities.—In addition to Nevill's types (an adult from the Western Province and a young specimen from Anuradhapura) the Colombo Museum possesses a third example (half-grown) from Horana, collected and presented by G. H. Swayne, Esq., 8th November, 1901. It is this specimen I have measured, as the tail is injured in the adult, which is at least twice as large.

STALKED BARNACLES (CIRRIPEDIA PEDUNCULATA) IN THE COLOMBO MUSEUM.

By N. ANNANDALE, D.Sc.

(*Deputy Superintendent of the Indian Museum.*)

AMONG the Cirripedes in the Colombo Museum I have been able to identify the following :—(1) *Lepas anserifera*, Linn., the commonest pedunculate form on floating objects in this part of the Indian Ocean ; (2) *Dichelaspis pellucida*, Darwin, a somewhat scarce species only taken on sea-snakes ; and (3) *Dichelaspis equina*, Lanchester, which was not described until about three years ago [Lanchester, P. Zool. Soc., London, 1902 (2), p. 375] but appears to be common on shallow-water crabs of the east coast of India as well as in some parts of Malaya.

The specimens of *L. anserifera* are attached in dense masses to pieces of wood and to a bottle ; those of *D. pellucida* are scattered on the body of a sea-snake (*Hydrus platurus*) ; while *D. equina* is represented by numerous individuals crowded together on the posterior walking legs and carapace of a *Dorippe dorsipes* (Linn.), and by others scattered on the dorsal and ventral surfaces and mouth parts of *Scylla serrata* (Forsk.).

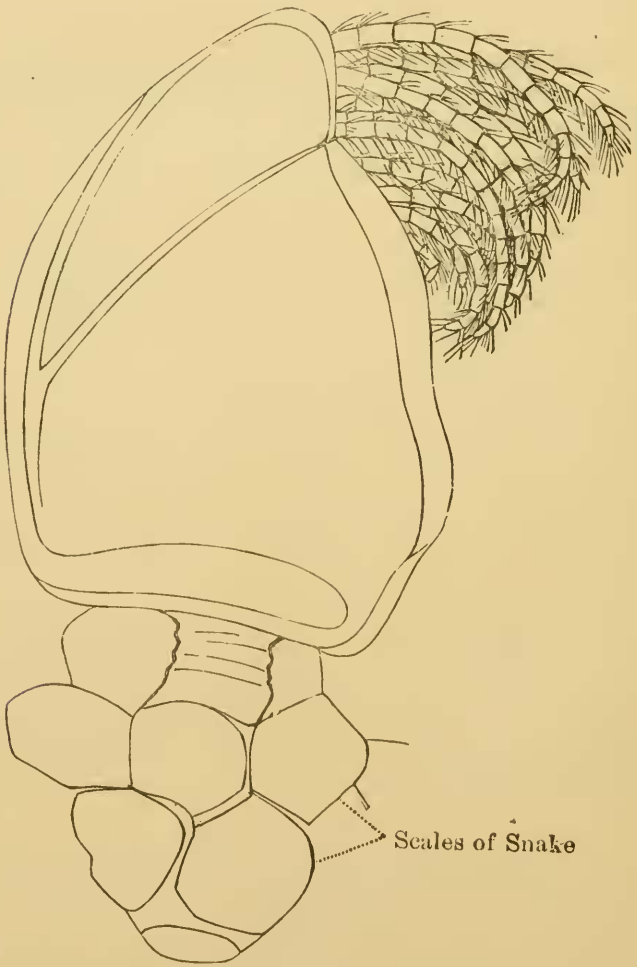
The distribution of *L. anserifera* is world-wide. So far as I am aware, neither species of *Dichelaspis* has been reported hitherto from the immediate neighbourhood of Ceylon. *D. equina* was described from the east coast of the Malay Peninsula, while *D. pellucida* is an Oriental species which probably has a fairly extensive distribution.

DICHELASPIS TENUIVALVATA, sp. nov.

Diagnosis.

Capitulum compressed ; carinal edge rounded ; occludent edge sinuous, slanting outwards from above ; lower edge straight, horizontal ; opening large. Five imperfectly calcified plates ; carina not reaching the upper edge of the capitulum above.

furcate below, the two rami extending along the base of the capitulum; tergum large, triangular, almost entirely covering the upper part of the membrane between the carina and the opening; scutum large but very imperfectly developed inferiorly (the lower border being quite indistinct), in contact with the tergum along the tergal margin above, feebly separated from the carina behind, not cleft. *Peduncle* very short, transversely wrinkled. *Mouth-parts* well developed; the mandible very large, with five teeth; the labrum feebly bullate; the maxilla furnished with stout bristles along its free edge, the inner half of which is almost straight, while the outer half is deeply concave.



D. tenuiralvata Annand. × 30. The specimen has been removed from the body of the snake to which it was attached, some of the scales of the snake still adhering to the short stalk of the barnacle.

Measurements.

Length of capitulum	...	... 5 mm.
Breadth of capitulum	...	... 4 mm.
Length of peduncle	...	... 1·5 mm.

This interesting species is represented by several specimens, growing, side by side with *D. equina*, on the ventral surface of a sea-snake (*Hydrus platurus*) from the coast of Ceylon.

All the members of the genus *Dichelaspis* are notable for the reduction of the capitular plates which they exhibit. In *D. tenuivalvata*, however, the degeneracy is of structure rather than of form. The five plates represented are all large, but their calcification is so imperfect that although the mantle is very transparent, I was unable to see their limits without staining the specimens. Even when thus prepared they were by no means easy to examine critically, and failed entirely to discern the lower termination of the scuta. On the whole, the affinities of the new form would seem to lie with Lanchester's *D. occlusa* (*P. Z. S.*, 1902 (2)) from the east coast of the Malay Peninsula. From this species it may be distinguished by its extremely short peduncle and imperfectly differentiated but undivided scuta.

NOTES.

1. *Lacteal Tract of Oriental Lorisinæ.*—Dr. Nelson Annandale Deputy Superintendent of the Indian Museum, writes from Calcutta under date September 25, 1905 :—

"In connection with what you told me regarding the mammæ of *Loris gracilis** I have examined the only two specimens we have in spirit in the Indian Museum of *Nycticebus tardigradus*, viz., (1) a male fœtus 55 mm. long, and (2) a large female. The first is quite hairless, and I had no difficulty in detecting two pairs of mammæ as minute tubercles on its skin. The first lies in a line with the centre of the upper arm when the limb is pressed down along the side ; the second only a short distance above the umbilicus, but in the same position relative to the sides of the body as the first.

"A somewhat prolonged search among the hair of the large female, which was not in lactation, also resulted in the discovery of four mammæ in the same position. One pair therefore may be said to be pectoral and one abdominal, though there is not any very great separation between the two pairs."

N. ANNANDALE.

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2. *Curious action of a Toad when confronted by a Snake.*—I have in my vivarium a "striped ground snake" (*Tropidonotus stolatus*, L.) which feeds exclusively upon toads and is always ready for a meal. Under ordinary circumstances it seizes its prey before the latter is aware of its presence. But, if the toad catches sight of the snake in time, it can always (temporarily) avert its doom by assuming a very characteristic attitude that seems to completely disconcert its would-be captor. The toad faces its enemy, depresses its head till the snout almost touches the ground, erects itself on tip-toe, in which position—owing to the superior length of the hind limbs—the rump is elevated ; at the same time inflating its abdomen to its utmost extent. If the snake does not immediately move off (which it usually does), the toad alternately lowers and raises the hinder part of the body, a movement which finally routs the enemy. This curious action is taken by even quite small toads and cannot be the result of individual experience. It would appear to be an inherited instinct.

E. ERNEST GREEN.

Peradeniya, October 26, 1905.

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* Willey in *Spolia Zeylanica*, part X., 1905.

3. *On the constricting habit of* Coluber helena.—With reference to my note (vol. III., part X., p. 157) on the constricting habit of *Coluber helena*, I have since been able to prove the correctness of my supposition that this action is normally employed in the capture of its prey. I have several times observed its capture of a small skink (*Lygosoma*, sp.). On one occasion the Coluber had captured a lizard and was tightly constricting it, the whole body of the snake being twisted into a complicated knot. It commenced work upon the tail, which became detached from the body of the lizard and was promptly swallowed. The snake then apparently forgot that the largest part of its captive was still enclosed in the folds of its body, and began looking about for another victim. Eventually it re-discovered its original capture and commenced to engulph it, drawing it gradually through the encompassing coils.

In hunting the lizards it seems to be very inexpert, and repeatedly failed to effect a capture. As soon as the lizard stopped the snake lost interest in it and was attracted only by moving objects.

E. ERNEST GREEN.

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4. *Scorpion stings.*—The sting of the small gray scorpions (*Isometrus*, spp.) is popularly reputed to be more virulent than that of the large black—or rather, dark blue-green—scorpion (*Palamnæus*, sp.). If this is really the case the sting of the latter must be almost negligible. I have been recently stung on the palm of my hand by a full-grown male *Isometrus europæus*. The pain was by no means intense—not nearly as severe as that caused by the sting of a bee or wasp—and completely passed off within a very few minutes, without the application of any remedy, leaving no trace or mark of any kind. It is possible that the poison spine could not fully penetrate the thick skin, though the puncture was in the median softer area of the palm. But I have observed a case in which a child of three years old was stung on the finger. The skin of a child at such a tender age cannot afford any serious obstacle to penetration. In this case also the pain was very transient. Though productive of momentary tears, within ten minutes the incident had been quite forgotten. I have been assured by other persons that no seriously unpleasant effects have followed the sting of *Palamnæus*.

Are these cases exceptional, or is the popular apprehension of scorpion stings greatly exaggerated? It would be interesting to collect evidence on this question. Will readers of this Journal, who may have had personal experience in the matter, come forward with particulars of their sensations under such circumstances?

E. ERNEST GREEN.

5. *Minerals new or rare in Ceylon.*—Of the following minerals, some were omitted from the list of Ceylon minerals given in *Spolia Zeylanica*, part IX., 1905; the remainder have been discovered since.

A.—*Minerals new to Ceylon.*

Galena.—Occurs in small cubes and rolled fragments in nambu from the Getaheta-oya at Murutangala in Getaheta. Reported from other localities.

Cassiterite.—Occurs as small black pebbles in nambu at Niriella and Noragala, and in larger fragments at Kuruwita.

Selenite.—Massive at Kukulawalakanda, Ratmale, Pasdun Korale, intergrown with pyrite between veins of graphite [James Parsons]; also in crystals in fossiliferous marine clays, Matti-aru, Kuchaveli, north of Tricomalee.

Monazite.—Occurs in waxy yellow well-worn grains in sands of the Getaheta-oya and other rivers near Avisawella; but was first detected by Dr. J. W. Evans in specimens of heavy sands from the Niriella-ganga sent to the Imperial Institute by the Mineralogical Survey.

Orangite.—It has been pointed out that the "thorite" of Ceylon really belongs to the variety known as orangite, distinguished by slightly greater specific gravity and orange colour. The apparently orthorhombic form of the mineral however remains unexplained. The crystals are not good enough to give satisfactory measurements, and too much altered internally for optical examination.

Platinum.—Occurs very sparingly, associated with gold in river sands at Dombagomuwa and Karawita, Sabaragamuwa. [James Parsons].

The following minerals have been reported, but on present evidence cannot be accepted as found in Ceylon. The sulphides are quite likely to be found:—*Cinnabar*, *Stibnite*, *Realgar*: *Epsomite*, *Olivine* [see Bertha Vukits Centralblatt für. Min. etc., 1904, No. 23, p. 715]. Minerals sent by the Mineralogical Survey to the Imperial Institute were provisionally identified as Annerodite and Æschynite or Polycrase.

B.—*Mineral names omitted in the List.*

Molybdenite.—Recorded by Dr. Gygax, and in Gustav Leonhard's "Handwörterbuch der topographischen Mineralogie," 1843. I re-discovered this mineral this year in the Kegalla District, where it occurs [at Hettimulla] in a vein of pegmatite cutting the granulites.

Wolframite is also recorded by Leonhard, as well as *Saltpetre* and *Rose quartz*, both of which latter are certainly found in Ceylon.

"Oriental Emerald" is mentioned by Max Bauer in his "Edelsteinkunde," which is however totally unreliable as regards Ceylon. Greenish sapphires do occur, but rarely, and hardly deserve the name of Oriental Emerald. N.B.—Max Bauer states erroneously that Beryl does not occur in Ceylon.

Beccarite.—A biaxial variety of Zircon from Ceylon.

Andesine.—(Des cloiseaux, 1884).

Borax.—(Mentioned by Dana).

I am indebted to Mr. L. J. Spencer for several of these references.

C.—*Some early Records.*

Nicolo Conti, who travelled in the East between 1419 and 1444, speaks of a "very noble island, called Zeilan, in which they find by digging, rubies, saffares, garnets, and those stones which are called cat's-eyes."

Albanasius Nilikin, who travelled between 1468 and 1474, speaks thus of Ceylon: "Ceylon is another not inconsiderable port of the Indian sea. There, on a hill, is the tomb of Adam, and in the vicinity are found precious stones, antimony, fastisses, agate, cinchai, crystal, sumbada." A little after he says: "At Ceylon you find ammone, antimony, fatisses." Of these, antimony is not known to occur in Ceylon; cinchai doubtless refers to spinel (*kirinchi*). Agate of a sort does occur sparingly in Ceylon, but it is more likely that agate of Indian origin is here referred to.

Ludovico de Varthema, who travelled from 1503 to 1508, speaks of the rubies, garnets, sapphires, jacinths, and topazes of Ceylon.

These references are extracted from Sir George Birdwood's "Report on the Old Records of the India Office," London, 1891.

A. K. COOMARASWAMY.

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6. *Recent Marine Clays at Kuchaveli, Ceylon: Ananda K. Coomaraswamy.*

Note on some Post Tertiary Mollusca from Ceylon: R. Bullen Newton.

Geol. Mag., Dec. v. vol. II., No. XI., November, 1905.

A recent marine clay is exposed near Nachchiarmalai on the Matti-aru (near Kuchaveli, 22 miles north of Trincomalee) about

1½ mile from the coast, at about sea level. The section shows about 9 feet of alluvium resting on the clay bed which is about 2½ feet thick, the lower part being under water. The bed is full of marine shells, and contains also concretionary nodules with shells, serpulæ, and crab remains. All these also occur commonly washed out and scattered over the sand banks of the Matti-aru. The common crab, used medicinally, is *Macropthalmus Latreillei* (Desmarest), the "medicine" crab of the Chinese pharmacopœia; it has been found in the Post-tertiary clays of Southern China. A single chelate pincer belonged to *Scylla serrata* (De Haan), the great Indian swimming crab. The following shells together with annelid tubes, Balani, fossil wood, and the crabs complete the list of organisms collected :—

Telescopium telescopium (Linnæus).
Potamides fluviatilis (Potiez and Michaud).
Purpura carinifera (Lamarck).
Nassa ornata (Kiener).
Melongena pugilina (Bour).
Natria, sp.
Scapharca rhombea (Bour).
Arca, sp.
Placuna placenta (Linnæus). This is the "window-pane oyster," and it is exceedingly abundant in the bed.
Tapes undulata (Bour).
Tapes textrix (Chemintz).
Diplodonta, cf. oblonga (Hanley).
Tellina, sp.
Dosinia salebrosa (Roemer).
Chione allied *imbricata* (Sowerby).

Three points in Mr. Bullen Newton's paper must be noticed :—

(1) As stated in my paper, nodules occur in the clay bed, and one crab-nodule was found *in situ*; there is therefore no foundation for his suggestion that the fossils in the nodules may be younger than those in the clay.

(2) It does not appear how the identity of littoral fauna can prove the recent connection of Ceylon with India.

(3) The particular specimens examined were not presented as stated.

ANANDA K. COOMARASWAMY.

7. "*Contributions to the Geology of Ceylon. 4. Intrusive Pyroxenites, Mica-pyroxenites, and Mica-rocks in the Charnockite Series or Granulites in Ceylon*": *Ananda K. Coomaraswamy*

Geol. Mag., Dec. v., vol. II., p. 363, August, 1905.

The following is a summary of the observations recorded in this paper. A group of pyroxenites in which the minerals diopside, phlogopite, horneblende, and scapolite predominate, while sphene, plagioclase, pyrite, apatite, calcite, and spinel are often accessory, occurs in small sills and dykes intrusive in the charnockite series or granulites of Ceylon, and in one case apparently also in a zircon granite of the Balangoda group. The pyroxenic intrusions have usually a zoned or laterally symmetrical structure analogous to that of mineral veins. The intrusions rarely exceed 6 feet in thickness, and are usually smaller; they are widely distributed in Ceylon. The intrusive material never shows a chilled edge, but there is a rapid transition from the pyroxenite to the granulite. The course of the small sills and dykes of pyroxenic material is usually determined by the foliation planes and joints of the granulites.

ANANDA K. COOMARASWAMY.

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8. *Snake lore.*—Some extraordinary ideas about the cobra are entertained by the Sinhalese—at least in some parts of the Island, as will be gathered from the following :—

(1) The cobra drops a segment of its body—beginning of course at the tail end—after every bite it inflicts, and is ultimately reduced to a mere head or "hood," when it is known as "Kobonayi," in which form it is capable of great activity and is able to perch, bird-like, on the branches of trees.

(2) The cobra grows shorter and thicker as it grows older, and finally attains to gigantic proportions, "as thick as the stem of a full-grown arecanut palm." An ancient reptile of great age and size is believed to be in occupation of the cave to be found in Elakande, Horana, where a princess of the Sinhalese dynasty, who was afflicted with an incurable disease, is said to have lived in retirement. The trail of this cobra is described as like that of a log drawn over the surface of the ground."

(3) When honey bees work for many years in the same spot they build in the centre of their hive a dome-shaped comb resembling, in shape, the ash-pumpkin, and hence referred to as "puhul." To such hives the cobra finds its way, and coiling

itself round the "pumpkin" feasts upon bee larvæ and honey. The colour of the reptile found in such situations is reddish-brown, and its sting is innocuous.

C. DRIEBERG.

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9. *Snakes and fowls.*—While sitting on the verandah of Gokarella resthouse, some 12 miles from Kurunegala, I observed a pullet pursuing a snake 12 to 15 inches in length. At intervals the latter turned upon its antagonist, and attempted to entwine itself round the neck of the bird, which, however, snatched it away without much difficulty with its claws, and proceeded to peck at its head, when the snake would again try to get away. In the end, when the snake was about half dead, the fowl started to swallow it, taking the head first, and after persistent efforts the reptile, wriggling to the last, disappeared down the throat of the bird.

To me this was a novel experience, but I subsequently learned from the resthouse-keeper and others that it was a common enough occurrence in the countryside, and that village poultry as a rule attack and make a meal of such snakes as Haldanda,* Aharakuka,† and Ehetuwa.‡

C. DRIEBERG.

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10. *Moths at sea.*—During the forenoon of November 18, 1905, when about sixty miles from the coast of Ceylon, several specimens of *Ophideres fullonica* were found on board H.M.S. Sealark and were brought to me. The noon position of the ship was 6° 11·5′ N., 79° 01′ E., Colombo Clock Tower bearing N. 49 E. 67 miles; so that the nearest land was the coast about Barberyn. The wind was northerly and light (force about 2). It seems probable that these specimens came off with the land breeze of the preceding night, but the distance from land which they had attained appears noteworthy.

Several specimens of *Cephonodes hylas* were also flying about the ship at the same time, but this species is a well-known migrant.

THOS. BAINBRIGGE FLETCHER,
H.M.S. Sealark.

December 4, 1905.

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* *Dendrophis pictus.* † *Tropidonotus stolatus.* ‡ *Dryophis mycterizans.*

TERMITE TRUFFLES.*

By Dr. F. Doflein (Munich).

AMONG social insects the Termites [or "white ants"] have been the object of the least amount of biological investigation. What has become known concerning their life and political organization is to be found scattered chiefly in systematic works. So it happened that one of the most interesting discoveries connected with Termite life was hardly recognized in Science although the analogous conditions among the ants had awakened the highest regard.

The faculty possessed by certain Termites of cultivating fungi in their hillocks has been remarked and more or less clearly portrayed by a succession of naturalists from the time of Smeathman, 1781. I will not review the literature here as I shall do this in a more detailed work. It may be mentioned that hitherto no one has investigated the phenomenon in all its aspects and that consequently, in spite of its importance, it has hardly been touched upon in general biological literature.

Thus I was completely taken by surprise as I opened a Termite hillock in Ceylon not far from Colombo in order to procure well-preserved material of Termite brains which I had promised to a colleague. The nest had the form of a high arched dome, terminating above in two chimney-like funnels. The height amounted to 1–1½ metre ; the funnels had a length of about 20–30 centimetres.

Upon opening the hillock it was at once evident that its thick, solid clay mass was traversed by a large number of chambers. Each of these chambers had approximately the size of a cocoanut. The walls were smooth and several or many narrow passages connected each chamber with the neighbouring compartments. Every chamber was filled with peculiar formations, namely, brown cakes of a moist, friable substance which in form, size, and structure strongly resembled middle-sized bath-sponges. One

* Translation of an article by Dr. Doflein entitled "Die Pilzkulturen der Termiten," published in the Verhandlungen der Deutschen Zoologischen Gesellschaft (xv., Breslau, 1905), Leipzig, 1905, pp. 140-149, two text-figures.

or several of such cakes were present in each chamber; when several occurred they were piled one over the other like dishes.

These cakes were occupied by thousands of Termites. The plan of composition of the "cake" consisted of a multitude of small cells each of which had its numerous inhabitants; especially the passages between the cells seethed with larvæ and nymphs of all stages.

The framework of the cake was furthermore beset with relatively numerous white nodules, about the size of a pin's head, 1–2 mm. diameter, which at first I took to be Termite eggs. Microscope examination showed me however that they were structures of quite a different nature.

One could perceive with the unaided eye that the entire "cake" was covered, inside and outside, with a fine felt of fungus hyphæ These associated themselves in masses at certain places and as their terminal parts branched and expanded in a particular manner globular aggregates of club-shaped bodies—in other words, the white nodules, which I will henceforth designate *mycelial nodules*—were produced. At present I will not discuss the botanical side of the question.

The resemblance to the growths observed by Möller in the fungus gardens of ants of the genus *Atta* in Brazil, immediately occurred to me. As a matter of fact the mycelial nodules serve the same purpose to the Termites that Möller's nodules do to the South American ants. At the same time there are certain biological peculiarities to be mentioned which are of interest and have not hitherto been observed.

I was able to prove by different ways that the mycelial nodules are eaten. In the first place I opened the intestine of numerous individuals and found them in the crops of all the larvæ and nymphs which I examined. Indeed the crops were completely filled with them, and nothing besides. The cells of the mycelial nodules were all quite uninjured. The foregoing applies alike to the larvæ of workers and soldiers and to the larvæ and nymphs of the sexual individuals.

I also succeeded in actually feeding the larvæ of the workers and soldiers as well as the larvæ and nymphs of the sexual insects with the mycelial nodules. By offering a single nodule on the point of a needle to animals which had hungered for some hours or for a day, they accepted the proffered diet. It was interesting to observe how they first of all investigated it with their palps, then took it between the mouth-parts, and slowly turned it round for a long time working it with the points of the mandibles. It is not easy to observe these operations because the

insects are readily disturbed by the breath, and it is necessary to watch them through a fairly strong lens. It is remarkable that a nodule exactly fills the space between the mouth-parts when these are fully open. Even the queen accepted a nodule and consumed it in the same way as the others.

On the contrary, I have never succeeded in inducing an adult soldier or worker to accept a nodule. Indeed I found their stomachs to be always filled with vegetable detritus, consisting exclusively of finely divided particles of wood. In spite of careful examination I could detect no trace of mycelial nodules.

My experiments are not sufficiently numerous to permit a final opinion as to the mode of feeding of the Termite species investigated by me. Meanwhile it seems reasonable to suppose that with this species the larvæ receive a concentrated and easily digested food in the form of the mycelial nodules and that these constitute the permanent food of the sexual forms, while the larvæ of workers and soldiers after a certain age obtain other fodder. Through this consideration the further inference is suggested that the fodder plays an important part in the differentiation of the "cells" in the community of *Termes obscuriceps*, Wasm.

I may here add some remarks upon the structure of the nest, the material of the fungus plantations and the bringing of the latter within the Termite enclosure, which I have investigated partly in Colombo, partly in Peradeniya and in the Northern Province.

It has been mentioned above that the dome-shaped nest with its chimney-like terminals consists of a clayey substance. In its construction the Termites employ earth, sand, clay from the neighbourhood, and mix these materials together with their glutinous saliva. They eject this saliva upon the human skin when they bite, whereby viscid, brown, tenacious spots arise. The bite is hardly painful.

For the purpose of observation I placed portions of a nest into a large glass receptacle and covered the entire mass which comprised fragments of the wall, fungus cakes, and thousands of Termites, with a bell-jar in such a way to allow access of air. The whole apparatus was exposed to diffuse daylight. It is well-known that the majority of Termite species, especially the blind workers, avoid the light. They immediately commenced in a methodical manner to construct a roof over the fungus plantations, using the débris of the nest for this purpose, notwithstanding the fact that the royal cell with king and queen had been taken away from them. Within a few hours they had roofed over the

space of a square foot by unceasingly applying small clumps of masonry mixed with their saliva.

An interesting observation could now be made. Owing to the fact that evaporation was greatly reduced under the bell-jar, the newly built roof remained soft and unstable and retained this consistency for several days until I exposed it to the free air, when it completely hardened after a few hours.

The mixing of the building material with the saliva of the Termites not only ensures a very firm construction, but makes the walls in a high degree resistent towards wetting. The Termite buildings brought by me to Munich still show this property with great clearness. When I tried to saturate one of the nests with lime water in order to strengthen it, it could not be wetted, whereas this method was constantly employed with advantage to the nests of European Hymenoptera, &c. The Termite nest showed an equal resistance against being wetted with alcoholic solution of shellac.

From this observation something may be inferred which otherwise the inspection of the internal disposition of the Termite nest reveals. For this purpose I will first describe the fungus cakes in regard to their structure and in their relations to the nest.

Upon opening a Termite nest one finds that the substance of the "truffle"* is friable and soft. Only when this is the case are the recesses of the truffle covered with mycelial nodules and the entire structure populated by numerous Termites with their larvæ. Sometimes I came across places in the nests where the truffles were hard and dry; then they were destitute of nodules and were not inhabited, except for a few scattered workers in the cells. Fresh "cakes" dry rather readily when exposed to a current of air. It is thus very easy to prepare them for transport, and they have frequently been received into zoological collections, although their actual nature has not been recognized. They become as hard as wood, but always remain brittle and very fragile owing to their delicate composition.

Microscopic examination of their substance shows that the fine brown scaffolding of which they are composed consists exclusively of finely chewed wood. Thus the great wood-hunger of the Termites and the cause of their extraordinary destructiveness became clear to me. Just as the species of *Atta* in South America occasion great damage to the leaves of living plants in that they employ their substance for their fungus plantations, so the

* The term truffle is used in the translation as an alternative term for fungus cake.

Termites are the destroyers of wood. It appears that only a few species attack living wood ; most kinds content themselves with dead wood or such as has been in any way already damaged by fungi. In the open therefore they are beneficial rather than injurious, since they act as scavengers of rotten wood. But when they come into contact with man they become some of the most injurious insects of the tropics, since woodwork which is adapted for their purposes forms an important constituent of human dwellings and furniture.

The wood is bitten up quite fine, in the substance of the fungus cakes and in the intestinal contents of the workers one finds the finest vessels of the wood isolated. This wood-brew is discharged through the vent as a small clump which is evidently mixed with saliva and used in building the fungus cakes. It is interesting to note that in other cases where Termites build their dwelling or the main part of it out of dung, the same fundamental arrangement of walls and passages recurs, as here, where they build for the purpose of the fungus cultivation.

If a fungus cake from a Termite nest be exposed to the light under a bell-jar to protect it from draught and evaporation, the fructification of the Termite fungus can be easily induced, a property which distinguishes it markedly from the *Rhozites* forms cultivated by the *Atta* species. After a few days numerous long club-shaped fructifications grow forth from the thick felt of hyphæ which has meanwhile developed. I will say no more about the species and form of the fungus in this place as my studies are not yet completed. I need only point out that other species of fungi appeared very gradually on the cake, whereas other objects in the vicinity were subject to a daily coating of mould. The tendency of the fungus cultures of the Termites to grow in pure culture appears to be very strong, even when the cake contains scarcely any Termites. The purity of the culture cannot therefore be placed to the account of the tireless weeding by the workers, as is done by Möller for the fungus plantations of *Atta*. At the conclusion I will revert to this point once more.

When a Termite truffle is kept under a bell-jar with moderate access of air, in very short time the inner surface of the jar is covered with water drops which after some hours run in small streams down the glass and form small accumulations of water in which the Termites can be drowned. The fungus cake therefore gives off a quantity of water by evaporation. Under such great moisture the fructification of the fungus takes place and the formation of mycelial nodules is stopped and the entire structure tends in high degree to mouldiness.

There is a further point worthy of note in the cultivation under the bell-jar. After a short time, 1–2 days, one sees the Termites in large numbers lying upon their backs and realizes that they are suffocated. Termites taken from the same culture and kept between two hermetically closing watch-glasses without pieces of cake, which were kept during the same time, lived and were perfectly active. It follows from this that the suffocation of the former was not due to lack of air, especially since access of air to the main culture was not entirely prevented.

Upon raising the bell-jar it was noticeable that the space was filled with a gas mixture which was clearly very different in its composition from the atmospheric air. In breathing it one experienced a strong oppression, as well as a very remarkable odour like that of the gas proceeding from fermenting substances. In any case a large amount of carbonic acid gas had formed, if not other gases, perhaps as a collateral result of the growth of the fungus at the expense of the wood.

All those appearances which are observed under the special conditions of culture outside the Termite nest are naturally absent inside the hillock. There, through the special construction of the nest, it is arranged that necessary temperature and moisture for the development of the fungus remains constant. The building material is up to a certain point waterproof, so that neither an excessive evaporation from the fungus cake through the wall of the chamber, nor the entrance of rain from without, ensues.

What however is most important is that the entire method of construction of the hillock ensures the elaborate ventilation of its inner spaces; the Termite hillocks with their chimney flues are hygienic dwellings.

The chimneys are air shafts which conduct away moisture, carbonic acid gas, and other injurious gases, while fresh air can enter through the lower openings. These ventilation flues can at any time according to the increase of the stock, climatic variations, &c., be altered and adapted. Thus is explained the quite different number of chimneys which arise from a Termite hillock, and it would be of interest to undertake a comparative study of the size and number of chimneys, size of hillock, number of fungus chambers, climate and locality, building material, population, and systematic position of the Termite species under question.

That the draught in these chimneys can, under circumstances, be considerable, is indicated by the application which travellers have frequently found for the Termite nests. Quite recently it has been repeatedly reported that our troops in South-West Africa have used the Termite nests as ovens, selecting those forms

in which chimneys open into a great central dome chamber. In the case of the form investigated by me in Ceylon I found the chimneys communicating directly with the fungus chambers, although the design is generally such that rain cannot directly reach the fungus-cultures. Whether there is any arrangement for the disposal of water I was unable to ascertain.

In conclusion, I should like to discuss one point briefly. It is a remarkable fact that we find the cultivation of fungi practised by ants and termites: that is to say, by the two orders of social insects which are farthest removed from one another in point of affinity. How is such a wonderful convergence to be explained? In the history of the social insects there are many phenomena whose first appearance will always remain inexplicable. More interesting and important is the question whether we can in any way conceive and analyse the phenomenon. At first sight the convergence as between Termites and Ants is quite wonderful and could lead to the rashest hypotheses, like the convergence between the ant species *Oecophylla smaragdina* and *Campanotus senex*, both of which use their larvæ as spinning machines in weaving their nests. Is their any means of tracing the causal relations in the origin of the fungus cultures of the Termites and eventually of investigating them experimentally?

I think that the biology of Termites gives us points which will support a hypothesis, and I very much regret that the thought did not occur to me while I was in Ceylon so that I might undertake the not very difficult testing of its principles. My suspicion is that the fungus which grows in the fungus cakes is a common fungus occurring in rotten wood in the neighbourhood, and that it is conveyed with the chewed wood quite unconsciously by the insects into the nest. The fact that it grows there almost in pure culture could be explained by supposing that the wood-brew is partially sterilized by the action of the saliva or gastric juice, so that the chewed wood becomes a medium for the exclusive growth of the particular fungus, all others being suppressed. Thus the structures automatically become fungus gardens (although, as in many other cases, originally intended only as passages and resting places for the larvæ, &c.), which are then methodically utilized by the Termites. It is not excluded from possibility that the inhabitants acquire a weeding habit, as Möller assumes for the species of *Atta*.

Such an explanation still leaves riddles to be answered in connection with the cultivation of fungi by Termites; but perhaps it helps to elucidate part of the problem and points to the solid ground of natural law.

DESCRIPTION OF A NEW SPECIES OF "OPIUS" FROM CEYLON.

By P. Cameron.

Opius dacusii, sp. nov.

LUTEOUS, the flagellum of antennæ and the hinder tibiæ and tarsi black; the wings hyaline, with black stigma and nervures; ♀. Length near 5 mm.; terebra fully 5 mm., Peradeniya; bred by Mr. E. E. Green from Dipterous maggots infesting fruit of Cucurbitaceæ.

Antennæ longer than the body, over 60-jointed, towards the apex minutely haired. Head smooth and shining, the face covered with white pubescence. Prothorax and mesothorax smooth and shining, the parapsidal furrows deep; middle lobe of mesonotum clearly separated, long, gradually narrowed from the base to the apex which reaches close to the scutellum. Scutellar depression wide and deep; a stout keel in its centre. Metanotum areolated; the areola large, its base narrowed to a sharp point; the rest slightly, gradually narrowed towards the apex, which does not reach to the end of the segment; it is closed and transverse there; there is a somewhat triangular area bordering the base of the areola; the other areæ are not very clearly defined. The basal two segments of the abdomen are closely, regularly, longitudinally striated; the other segments are smooth and shining; the first is longer (but not much) than its width at the apex; the second is wider than long. Pleuræ smooth. Mandibles black on the apical half. First abscissa of radius very short, basal abscissa of radius curved; the recurrent nervure is received in the second cubital cellute; the transverse median nervure is received distinctly beyond the transverse basal. Malar space as long as the antennal scape; the clypeal foveæ large, deep. There is a stout keel down the centre of the basal abdominal segment, the lateral striæ being weak compared with it. The abdomen is slightly shorter than the thorax, broad and sessile at the base; the apex is bluntly rounded. Mesopleural furrow smooth.

NOTES.

1. *Historic Trees.*—The substance of this Note appeared in the correspondence columns of the *Ceylon Observer* on December 29, 1905, and January 6, 1906.

It is probably due to Sir James Emerson Tennent that an idea prevails that Baldæus preached his first sermon in Ceylon under the big tamarind tree which still flourishes at Point Pedro. Tennent says: "Close by the beach there is still standing the tamarind tree" commemorated by Baldæus, who preached under its shade to the first Protestant converts in Ceylon (vol. II., p. 535).

It is no doubt due to this passage in Tennent that Mr. J. J. Cotton, M.C.S., in his "History of Monumental Inscriptions in the Madras Presidency," recently published, refers to "the tree at Point Pedro under which the celebrated Baldæus preached his first discourse to the natives."

But Baldæus, though he certainly commemorates the tree by recording that "just before the church stands a tall Tamarin Tree," which affords "a very agreeable shadow in the heat of the day," says nothing about having preached under it himself, but merely that "the people are often instructed by the Minister to the number of 3,000" under it (pp. 806–7).

It is certainly not true that he preached his first sermon in Ceylon at Point Pedro, for that he had done at Mannar on 24th February, 1658, and it is recorded that in the same year, "in the church at Telippalai, Baldæus began the introduction of the reformed religion into the Jaffna Peninsula." This being the case, it seems hardly likely that he preached his first sermon to converts at Point Pedro; at any rate, there is nothing that I know of to warrant the statement. Perhaps Mr. Donald Ferguson may be able to throw a light on the subject. (See "Baldæus and his Book on Ceylon," by Donald Ferguson, p. 6.)

Tennent goes on to state that "this historical tree" was in his day 42 feet in circumference at the base of the trunk. I have had the tree measured at the base of the trunk; it is now 31 feet. This is doubtless explained by the fact that until 50 years ago the

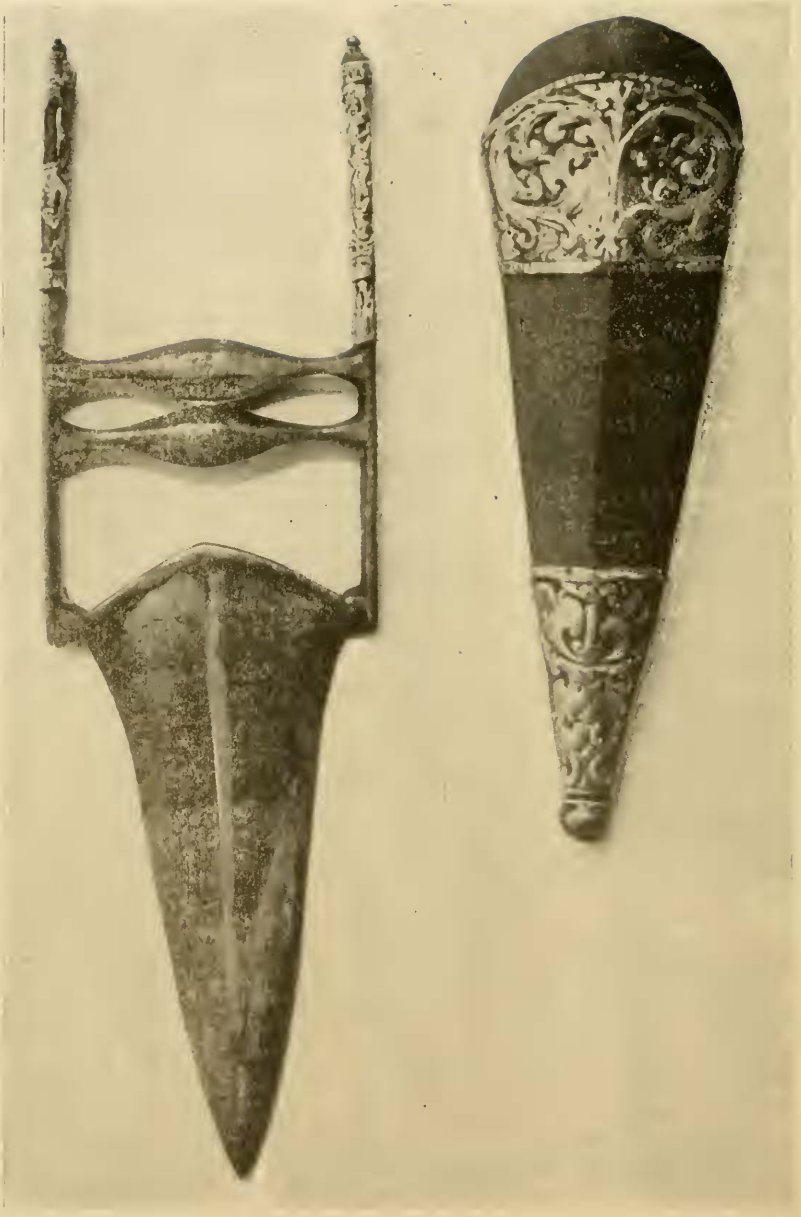
tree was surrounded by a masonry platform, built right up to the trunk. This platform was three or four feet high, and as many wide, so that in measuring the tree, Tennent's informant must have included the platform.

There is no doubt that the tree still existing is the tree referred to by Baldæus and Tennent. It is situated about 300 yards from the seashore, and was evidently at one time fully visible from the landing place. The whole intervening space has since been built over with the high stone-walled houses, godowns, and temples that are characteristic of Point Pedro, but the top of the tree can still be seen from the Customs, and the tree is a conspicuous landmark for vessels approaching the harbour. It is, I think, the tallest tamarind tree I have ever seen. I have ascertained from the oldest inhabitants that there were never any old tamarind trees of any size in the neighourhood, but that this tree was always said to be a very old one. I should think it might easily be 300 years old. The tamarind is a slow growing tree. Opposite it used to stand, until they were removed by Mr. Dyke to the present sites, the Police Magistrate's house and the Police Court, and near them the Dutch church. There is no trace of any of these buildings now. The square open space behind the tree is now occupied by the market. A good many years ago, but within living memory, the tree and the adjoining Police Court were frequented by monkeys (the wandura). These have long since disappeared.

Baldæus alludes to the grateful shade of the tree. There is a Tamil proverb that a "widow's son should not sleep in the shade of a tamarind tree." It is supposed to be more pleasant than that of any other tree, and, therefore, calculated to make any one, who lies down in its shade, disinclined to move or to bestir himself as is necessary in the case of the son of a widow.

Christian Frederick Schwarz, the well-known Missionary of Tanjore, whose monument by Flaxman is in Schwarz's Church at Tanjore, visited Point Pedro on 5th September, 1760, for the express purpose of seeing this tree (see "List of Monumental Inscriptions of Madras, by J. J. Cotton). In any case it deserves the title of "a historical tree."

As to the age to which tamarind trees attain, I think there can be no doubt that like the oak they live for some hundreds of years. I have seen a tamarind tree at Kachchilamadu in the Mullaittivu District, which is still known as "Pandara's tree." Pandara was a Vanni chieftain, who entered into a league with the Sinhalese chiefs of Nuwarakalawiya who were hostile to the British, and was defeated here by Captain Driberg on 31st October, 1803. (See



MOORISH DAGGER AND SHEATH × ½.

To face p. 213.]

"Vanni Manual," pp. 19–63.) The tradition is that after the fight the arms of the defeated Sinhalese (for they were chiefly Sinhalese of Nuwarakalawiya) were piled under this tree. I had it measured the other day; the trunk was 21 feet in girth, 4 feet from the ground, so that it is 10 feet less than Baldæus's tree. There is no doubt that this tree was in existence 102 years ago, and in all probability it was even then a large tree. Native opinion is that a tamarind tree may live two or three hundred years. I have seen very large trees in the Vanni, and they always indicate the sites of abandoned villages—villages abandoned perhaps 100 years ago or more.

The Park, Jaffna. J. P. LEWIS.

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2. *The Moormen's Weapon.*—I annex a photograph of a curious kind of dagger with its wooden sheath from the collection of the late Mr. R. W. Ievers, C.M.G., C.C.S., which has been acquired for the Museum. It is known as a *samusadu* or *jamijadu*, for both forms of the word are used, and it appears to be the distinctive weapon of the Moormen of Ceylon, for a representation of it is one of their brandmarks for cattle. There are two forms of this brandmark given in the paper on "Brandmarks on Cattle," by the late Mr. James de Alwis, published in the Journal of the Ceylon Branch of the Royal Asiatic Society for 1874 (vol. V., p. 60). In one (No. 51) it is represented as of the shape (fig. 1), which shows that the weapon itself was hardly familiar to the people who used its shape for a brandmark.

In the other (No. 53), which is given as the brandmark of the Moormen of Chilaw it has become an ordinary dagger (fig. 2), but in the Tangalla District, where I also found it used as a brandmark by the Moormen, the shape was nearer to the original. I met with three forms.

Here (fig. 3) the idea of a weapon also seems to have been lost, and this particular brandmark was described to me as *tambu jadiya* (a copper jar) into which the word *samusadu* had been corrupted in the course of time—another proof that the true origin of the mark had been forgotten. The other shapes were known as *ulmadakku samusadu* (samusadu with an inwards bend) (fig. 4), and *pera-madakku-samusadu* (samusadu with an outwards bend) (fig. 5).

I do not know where Mr. Ievers came across this specimen. Possibly specimens of the weapon might be found in India,

where in all probability this particular form of dagger had its origin.

1

2

3

4

5

This specimen is rather an elaborate one, the handle and sheath having on them silver work of artistic design. It is a foot in length. It is noteworthy that the handle is rather too narrow for a European hand to grasp comfortably, as I have found to be the case also with Ceylon knuckle dusters.

January 1906. J. P. LEWIS.

[The weapon described in the foregoing note has the same form as the Katar or Indian dagger, which has been described as the national weapon of the Hindu and "is mentioned by Ibn Batuta, who lived in the days of Mohamed Toghluk—that is, about 1332 A.D."

Examples of it, beautifully damascened, are figured by T. Holbein Hendley, C.I.E., in his work entitled "Damascening on Steel or Iron, as practised in India;" London, 1892.]

3. *Scorpion stings.*—In connection with my Note on this subject in Part XI. of this Journal, the following extracts from letters which I have received from Dr. A. K. Coomaraswamy, speak for themselves.

E. E. GREEN.

Extract referred to.

"You know scorpion and centipede stings and bites are supposed not to be bad, except on "*Pohoya*" days, four times a month. The bite of venomous serpents is also worse on those days. Another point of interest is that one should not kill the animal that inflicts the wound (snake, scorpion, or centipede) until the next day, as there is an idea that in some way it can take back the poison if it remains alive."

"I was stung in the foot one evening at Avisawella by the small species of scorpion and it hurt badly, and I expected to have a bad time. I rubbed in ammonia and chunam. The pain went off soon and in ten minutes there was scarcely any. No trace next day. Mr. W. D. Holland tells me the scorpion stings are of no account too. I have told you about bad days for bites. People rely on *mantrams* as a cure a good deal. Here is one given by the Kadadeka Pansala Priest to Mr. Saxton as a *sastri* for snake bite:—

ඕන් තුරි තුරි යේස්වඃ
ඕන් ජය ජය අනන්නත්‍යා නේස්වඃ
ඕන් ජය ජයං ඛපා ලෙස්වඃ

I. e.—Ón turi turi yéswaḥ
Ón jaya jaya annatyánéswaḥ
Ón jaya jayaṇ khapáléswaḥ

"If the snake bites you on the left side, you must stroke yourself with the left hand downwards from top of head right down the arm, and touch the ground with your right hand; do this many times. If the snake bites you on the right side, do the same with the other hand. The above (*mantram*) is to be learnt by heart and repeated".

"When I was stung by the scorpion they would not let me kill it till the next day. Probably it was considered that, as with snakes, the animal withdraws the poison to itself if not killed."

A. K. COOMARASWAMY.

4. *Flight of white and yellow butterflies.*—This well-known phenomenon takes place twice annually, in the months of February and November, and is always a source of interest, not only to entomologists but to all who have eyes to see, and many are the remarks of wonderment at this curious and pretty sight which enlivens the monotony of the streets and byways of Colombo. I am not going to explain this bi-annual migration, for I cannot, but these few lines are based upon observations taken during the flights, more especially the flight of November last, which commenced on the 1st November and lasted practically till the end of that month, although a few stragglers are still to be found laying eggs which will give rise to the February flight. The butterflies are almost exclusively composed of different species of *Catopsilia*, and as these show a variety of forms and phases the whole makes up a very varied collection of yellows and whites.

I have taken great interest in these flights for several years, but never before have I seen the numbers so prolific as during last November in Colombo.

At 2 P.M. on the 21st November, when the flight was at its highest, I counted during one minute 150, during another minute 170, and during a third minute 148 butterflies passing between two points 30 feet apart and 12 feet high, making an average of 156 per minute. At two other places I made similar reckonings, resulting in an all round average of about 150 per minute traversing a given space. In many different parts of the Cinnamon Gardens I observed equally large quantities in flight so that, according to my computation, the number of butterflies passing in one direction between two points, a mile apart and 12 feet from the ground, would be 26,400 per minute, 1,584,000 per hour, and 6,336,000 between the hours of 11 A.M. and 3 P.M. on the one day alone.

They were flying particularly fast and in constant procession; rarely one would stop for a few seconds to alight on some

conspicuous flower, such as the *Hibiscus* and *Cosmos*, as though to quench its thirst, then away again in greater haste than ever as if to make up for lost time.

As usual in Colombo, the flights were northwards, but this does not appear to be the case all over the Island, for Major Manders* observed that they followed the coast line, starting somewhere north of Trincomalee and working right round the south coast to Negombo. Major Manders does not record the direction of the flights in the more central portions of the Island, for instance, Nuwara Eliya, Kandy, Diyatalawa, &c. In Nuwara Eliya and Diyatalawa a westerly direction is taken and this is probably maintained all over the central portion of the Island; it would therefore be interesting to know the direction taken by flights between the central provinces and the east coast, namely, whether they strike east and join the circuminsular flight or strike west passing over Diyatalawa, Horton Plains, Nuwara Eliya, &c.

Major Manders, in his interesting notes, deals with the direction of flight of those proceeding from Trincomalee to Negombo, *i.e.*, in the maritime regions only, so that we have still to ascertain where the butterflies come from which pass over the central provinces.

The abrupt manner in which the flight starts is very remarkable. For instance, last November a few straggling *Catopsilias* were to be seen on the first of that month; on the following day the flight was in full swing, the numbers gradually increasing until the 21st, then diminishing to quite a few on the 31st. Before the 2nd November there was no regular flight in one direction.

In the case of *Catopsilia pyranthe* I have carefully observed that the females begin laying their eggs towards the end of the rush, the few straggling females being then responsible for the next or February flight. In November of last year oviposition commenced towards the end of the month and is still going on up to the time of writing, as an examination of the food plant (*Cassia occidentalis*) will show.

The question now arises—*When and where are the eggs laid which produce the prolific November flight?* The eggs laid towards the end of November flight are undoubtedly responsible for the February flight—the period normally occupied from egg to imago being from three to four weeks. (In countries having a winter many insects hibernate, but I have not observed

* Trans. Entom. Soc., London, 1904, No. 26.

such a dormant period in any Ceylon butterflies). If the females of the February flight lay the eggs for the November flight, presuming they are to hatch in November, the chances are that the heavy rains of S.W. monsoon (May to August) would destroy the majority, leaving few for the November flight, whereas the latter is the more prolific ; but supposing the feeding grounds of the larvæ of the latter are in districts not effected by S.W. monsoon then it is difficult to understand why they, apparently, do not emerge and form a flight similar to the other two, somewhere about March, April, or May, but, in Colombo, at any rate, practically no *Catopsilias* are to be seen during the seven or eight months preceding the November flight. I can only arrive at two explanations : –

(1) The offspring of the February flight must lie in a dormant state during one or other of their stages, for several months ; or (2) the species must breed throughout the year in some favourable locality as regards food-plant and weather. The reason they do not migrate at regular intervals is most probably due to the habit of their favourite food plant, which is an annual leguminous shrub ; it dies off during the first dry months of the year after shedding its seeds ; these spring up again with the commencement of the rains, and about September-October the plant is plentiful and vigorous, thus forming ample food supply for immense numbers of the larvæ. Their numbers increase so rapidly and to such an extent that the females, prompted by some natural instinct, migrate, followed by males, and seek pastures new whereon to deposit their eggs. Thus the bi-annual migration seems to arise from the abundance of food plant available, which is greatest shortly before the November flight takes place, gradually diminishing as the dry weather approaches.

The species *Catopsilia* chiefly concerned in these flights are *Catopsilia pomona* and its variety *crocale*, and *C. pyranthe* with its varieties *gnoma*, *ilea*, and *chryseis*. *C. pomona* was most predominant, but I did not secure a sufficient number during the flight to ascertain which sex was most abundant. In the case of *C. pyranthe* the males appeared to predominate during the November flight, for out of 100 specimens secured in one day, 87 per cent. were males, although towards the end of the flight the remaining stragglers were almost entirely females. In a previous capture during a February flight in Colombo (referred to by Manders) 75 per cent. were females.

OSWIN S. WICKWAR.

Colombo, January 20, 1906.

5. *Notes by the Way.*—In company with two Entomologist friends I have recently visited the low-country below Koslanda (in the Province of Uva); making Telulla resthouse our head-quarters. These notes cover a period extending from November 15 to 24.

On a section of the road between Koslanda and Wellawaya a few examples of the rare and local butterfly *Symphædra nais* were observed and captured. I am told that it always haunts this particular locality. I have previously taken the species only on the road to Batticaloa. Manders quotes "the eastern side of the Island near Trincomalee and the grassy country near Haldummulla" as localities for this insect.

The annual migration of butterflies was in full progress. Large numbers of them were following the cart road, appearing to find it a convenient route for travel. They were moving in a northerly direction. *Catopsilia crocale* and *Appias paulina* were most in evidence. But *Hebomoia glaucippe*, *Ixias ceylonica*, *Papilio erithonius*, *jason*, *crino*, and *aristolochiæ* were associated with them. *Euplœa asela* was also on the move, but not in very large numbers. It was distinctly a flight of Pieridæ, more particularly of the genus *Catopsilia*. They settled in dense array at every damp spot in the road, and rose up in whirling clouds when disturbed by passing carts or pedestrians. Various species of Cassia along the route had evidently provided food for their larvæ. *P. aristolochiæ* appeared to be more exclusive, having its separate congregating spots. *Crino* usually settled singly. The other butterflies, noticed above, might be seen mingled in the same group. A very remarkable abnormality of *erithonius* was captured by one of my companions and has been presented by him to the Colombo Museum. The area beyond the postmedial band on both wings is almost uniformly black.

We collected moths, each night, pitching our powerful acetylene lamps in different spots—often in the heart of the jungle, and secured a prodigious number of moths and miscellaneous insects, including such rarities as *Azygophleps scalaris*, *Gunda apicalis*, *Stauropus viridescens* and *S. grisea*, *Mimeusemia ceylonica*, and *Ægocera bimacula*; with many smaller species probably new to our lists. My attention was drawn, one night, to an insect that, to outward appearances, was an ordinary "Daddy-long-legs" (*Tipula*). It had captured a small Pyralid moth, which it was holding with its *hind* legs and devouring. On closer examination it proved to be one of the so-called "Scorpion Flies" (*Panorpidæ*) and appears to be a species of *Bittacus*. To the best of my belief, this family of insects has not previously been

recognized in Ceylon. A long series of this species was taken in the moth traps.

In the last number of the Journal of the Bombay Nat. Hist. Soc. (vol. XVI., No. 4, p. 747) is a note by Capt. Nangle, describing an attack by flies upon flying Termites in India. A similar occurrence was noticed one night at Telulla, when a flight of winged Termites invaded the tent of my moth trap. Immediately following the "White Ants" came a number of Muscid flies which proceeded to pounce upon them. They did not attempt to carry away their prey, but commenced to feed upon them there and then, piercing their helpless victims between the segments of the abdomen. Specimens of this fly have been sent to Europe for determination.

Beating for moths, in the daytime, was made difficult by the presence of enormous numbers of the common Noctuid *Amyna selenampha*, which rose in clouds whenever the undergrowth was disturbed. We saw several trees stripped of their leaves by the larvæ of this moth. Fortunately this species did not fly at night or—at any rate—respected our moth traps.

Our traps were pitched, one night, on the bund of the Telulla tank. Behind us was an abandoned paddy field. As soon as the lamps were lighted myriads of frogs joined in a deafening chorus which soon became so intolerable that we had to stop our ears with cotton wool.

Reptiles were not much in evidence. But we surprised a large specimen of *Dendrophis pictus* swallowing a full-grown lizard (*Calotes versicolor*). Younger examples of this snake are said to feed upon grasshoppers. A fine example of the large rough tailed snake—*Uropeltis grandis*—was picked up on the cart road where it was engaged in extracting grubs from a pat of cow dung.

E. ERNEST GREEN.

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6. *On the Species of Leaf Insects* (*Phyllinæ*) *occurring in Ceylon.*—Mr. W. F. Kirby, in his recently issued "Synonymic Catalogue of Orthoptera," credits Ceylon with three distinct species of this subfamily of *Phasmidæ*. These are,—*Pulchriphyllium agathyrsus*, Gray; *Pulchriphyllium crurifolium*, Serv., and *Phyllium athanysus*, Westw.

I have recently submitted specimens of our commoner species to Mr. Kirby, for an authentic determination. There has hitherto been considerable confusion in the nomenclature; the commonest Ceylon species having been variously referred to under the names

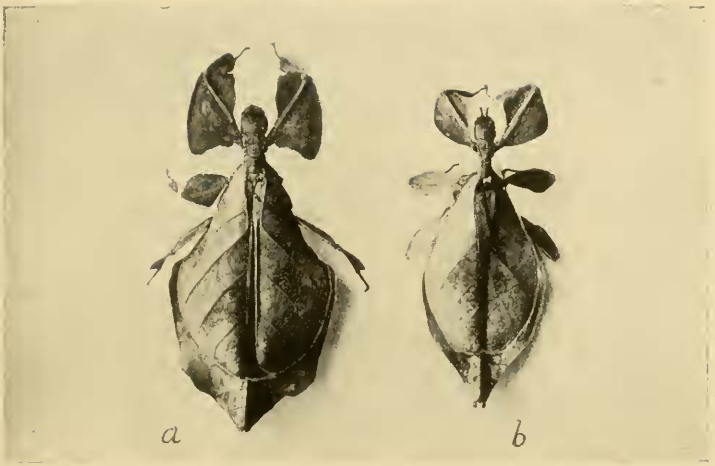

FIG. 1.—*a* PULCHRIPHYLLIUM CRURIFOLIUM. *b* PHYLLIUM ATHANYSUS.
× ½

To face p. 220

of *siccifolium*, *scythe*, *pulchrifolium*, and *bioculatum*. In reply, Mr. Kirby tells me that this species is apparently *crurifolium*, which Gray confused with his previously described *bioculatum*. "It has nothing to do with *Phyllium siccifolium*, which does not occur in Ceylon." He also states that *P. athanysus* can be recognized at once by the hinder edge of the front femora being entire, and that *P. agathyrsus* "seems to differ from *P. crurifolium* in having the hinder edge of the front femora more deeply and irregularly excavated."

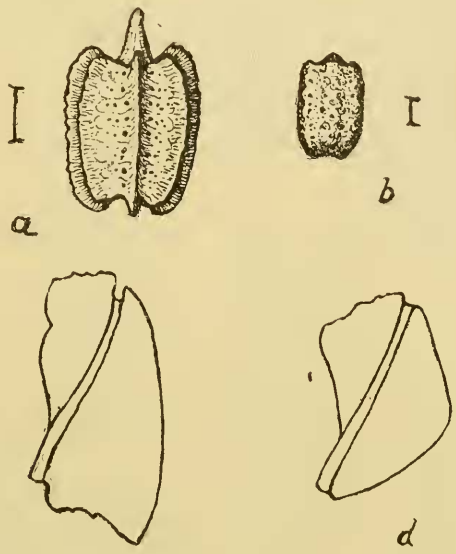

Fig 2. (*a*) Egg of *Pulchriphyllium crurifolium* } × 4
(*b*) Do. *Phyllium athanysus* }
Fig 3. (*c*) Femur of front right limb of *P.crurifolium* } × 1⅔
(*d*) Do. do. *Phyllium athanysus* }

Of these three species, *crurifolium* is comparatively abundant. Native boys collect them in considerable numbers, in the neighbourhood of Kandy. They find them by waiting under the trees that they are known to affect and watching for falling pieces of green leaves dropped by the feeding insects. This species is very easily raised from eggs laid by captive females.

I have met with very few examples of *athanysus*.

Agathyrsus is quite unknown to me, though it is recorded only from Ceylon. If the "more deeply and irregularly excavated hinder edge of the front femora" is the only distinction between this species and *crurifolium*, then a great number of bred examples of the latter might be classed as *agathyrsus*, for very few

individuals reach maturity without having this part of the limb more or less extensively nibbled away by their comrades in captivity. Can this accidental erosion have led to the supposed distinction of the species? The slender individuals in the lower right hand corner of the figure (4) are the males, which have functional wings and very small wing-covers, the reverse being the case with the female insects.

There is a well marked difference in the eggs of *crurifolium* and *athanysus*. That of the former has five winged lateral ridges and a prominent spiked cap. The egg of *athanysus* is very much smaller, has only a small tubercle on the cap, and the lateral ridges are low and inconspicuous, merely giving to the eggs a slightly angular appearance.

In the accompanying photograph, the second and third insects in the middle row, show signs of having been nibbled by their companions.

E. ERNEST GREEN.

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7. *A Harbour Worm and a Boxing Crab.*—Ever since the visit of Professor Haeckel to these shores in 1881 it has been recognized that Colombo offers few inducements to biologists who cumber themselves about things of the sea. Nevertheless, if time and opportunity allowed, a great deal might be gleaned from the outer reaches of the Colombo Harbour; and the Northern Arm of the Breakwater is already attracting a host of creatures from the surrounding depths. Amongst these there comes occasionally a remarkably fine Annelid worm belonging to the family Amphinomidæ. Its name is *Chloëia flava* (Pallas); it is particularly characteristic of the Indian Ocean and has been known to naturalists for nearly a century and a half. It attains a length of nearly five inches or more when fully extended and an inclusive breadth of about one inch. The number of segments is limited, not exceeding forty, and this number is only reached in the fully mature condition. Smaller and therefore younger individuals have fewer segments, the number of the latter being roughly correlated with the size; thus examples about half to three-quarters of an inch in length will have 24–26 segments. The head region is characterized by the presence of a peculiar organ called the caruncle, which stretches back over several of the anterior segments. Behind this region, each segment

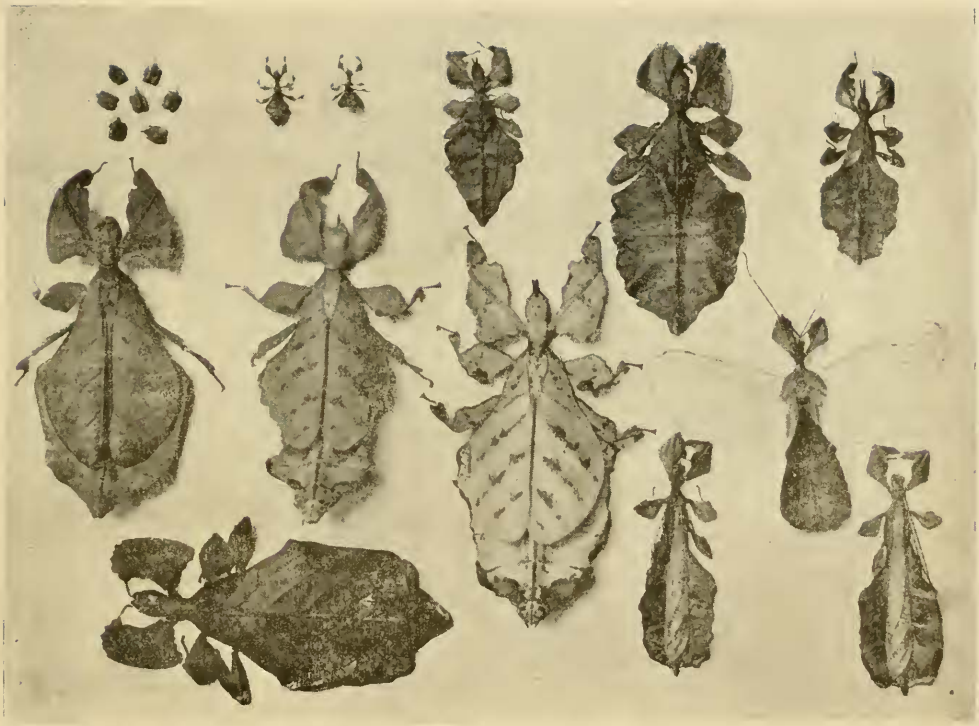
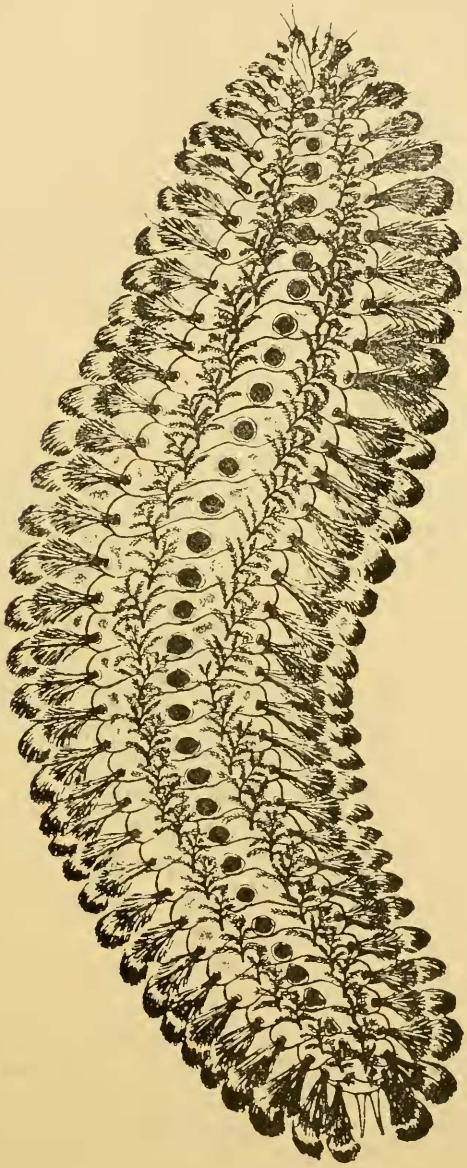


FIG. 4.—EGGS, LARVÆ, NYMPH, AND ADULT (♂ AND ♀) OF "PULCHRIPHYLLIUM CRURIFOLIUM."

(*To face p* 222.

carries along the dorsal side a large purplish violet spot, a pair of arborescent gills* and, at the sides, two dense tufts (upper and



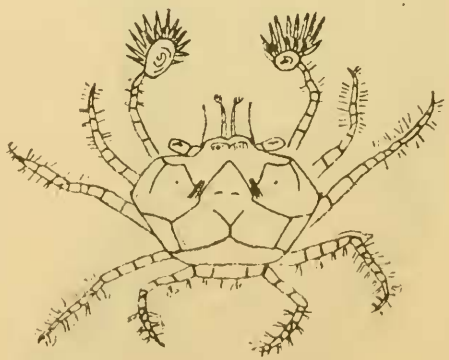
Chlocia flava.

lower) of long, hair-like, golden yellow bristles or setæ, with which are associated dorsal and ventral sensory cirri. In

* The gills are coloured a dark sepia with rose-coloured rhachis. Violet bands may also occur laterally between the bases of the gills and the dorsal bristles, which appear pale, golden-tipped. The colour is of course subject to some variation.

preserved specimens it often happens that most of the setæ are lost; they are deciduous, those of the dorsal tuft being provided with recurved barbs by which they remain attached to foreign bodies when touched or handled. The function of the setæ is therefore partly defensive, but during what may be called the swarming period the tufts of setæ act as paddles or swimmerets, working to and fro in succession like the legs of a centipede, accompanying the swaying movements of the body when swimming. It is not common to obtain full-sized specimens of this worm, and the three which the Museum has acquired in recent years have been kindly sent by Mr. A. D. Prouse from the Harbour Works, one in March, 1904, another in January, 1905, and a third in January, 1906.

The small crab which I have called the Boxing Crab was taken by me last November at Weligama from under a rock close to the shore at the northern end of the bay. It affords a singular and by no means widely known example of symbiosis or commensalism between a crab and sea-anemones or Actinians. In each claw the crab holds a small white sea-anemone in full



activity, tentacles expanded, which it presents with great science in true boxing attitude to the observer, when alarmed. It is impossible to exaggerate the singularity of the action. The ground colour of the crab is whitish with a delicate roseate flush in the anterior half of the carapace, and a characteristic pattern formed by blackish lines; there are tufts of bristles behind the frontal margin and on the surface of the carapace.

I forwarded a sketch of the living crab and its two guests to the Indian Museum, Calcutta, and was favoured by Major A. Alcock, F.R.S., with the name of the crab and references to the literature dealing with it. It is not mentioned in Dr. J. G. de Man's Crustacea of the Mergui Archipelago (Journ. Linn. Soc., London,

XXII., 1888), nor in the same author's work on the Crustacea of the Malay Archipelago (Decapoden des Indischen Archipels, 1892), nor in Dr. J. R. Henderson's Contribution to Indian Carcinology (Trans. Linn. Soc., London, vol. V., part 10, 1893). It was described from Mauritius under the name *Melia tresselata* by H. Milne Edwards in 1834 (Hist. Nat. Crust., Paris, vol. I., p. 431, pl. 18, f. 8) and figured though without the actinians. Its correct name is *Melia tessellata* (Latreille) and a capital figure of it is given by L. A. Borradaile in his Report on the Marine Crustaceans in Stanley Gardiner's Fauna and Geography of the Maldive and Laccadive Archipelagoes, vol. I., Cambridge, 1903, p. 249.

Borradaile places this crab in the subfamily Menippinæ of the family Xanthidæ and points out that its habit of holding actinians was noted in 1880 by Richter in Mobius' Meeresfauna, Mauritius, but since then the fact has been generally overlooked.

Probably both crab and actinians benefit by the association, the actinians enjoying an increased mobility and the crab sheltering and defending itself with the living gloves with which it is provided ; all sea-anemones, coral polyps, hydroid polyps, and medusæ possess microscopic weapons of offence called urticating or stinging threads, and no doubt these come into play in this case when occasion requires it, although I was unable to detect their presence by the sense of touch. On this subject I may quote from Mr. Borradaile's work (*l.c.*, p. 250). He says : "The object of this habit is not known, but it is certainly a voluntary act on the part of the crab, for the actinian is not attached, but held between the fingers of the *Melia*, and, if it be taken away, will be again seized. Usually there is an anemone in each hand, but sometimes one or both hands are empty. The actinians, which are grasped firmly round the middle below the tentacles, may be useful, by means of their stinging cells, either for defence or to 'fish' for food with, or perhaps for both purposes. The chelipeds are slender and feeble, ill-suited for defence, but at the same time mobile and well adapted to wield the anemones they carry, and, if the crab be threatened, it will stretch out its arms towards the aggressor, as though it would ward him off with the disagreeable obstacles it thus presents to his attack."

The crab from Weligama is small, measuring only 10mm. in width between the lateral angles of the carapace ; the actinians are retained in position in the preserved state, but the ground-colour has darkened to a reddish brown.

Finally, it must be mentioned that two other species of *Melia* have been recorded from these seas by Major Alcock, namely, *M.*

cæstifer (J. A. S. Bengal, vol. LXVII., pt. 2, 1898, p. 231) and *M. pugil* (*ibid.*).

I desire to express my thanks to Major Alcock for his kindness in referring me to the above sources of information concerning *Melia*.

A. WILLEY.

Colombo, January 23, 1906.

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8. *Stridulation of Gongylus gongylodes.*—During a recent visit (December) to Anuradhapura as I was descending the bund of Tissa tank behind Isurumuniya, I espied a dark brown Mantid upon a low green shrub, and upon bending closer found that it was a male *Gongylus*. Its actions upon being alarmed by my approach arrested my attention. Its colour and general appearance were those of a brown shrivelled leaf, but it appeared to be intent upon a foraging expedition with no idea of mimicry or of any conformity to its surroundings. The under surface of the flattened prothorax had a dull neutral tint paler in the centre, but not glistening nor in any way attractive. Such mimicry and protective coloration as carnivorous animals—of which *Gongylus* is one—frequently exhibit appear to be closely correlated with their infinite capacity for lying motionless in wait for passing prey.

As I drew near to the Mantid several times in succession, on each occasion it dressed itself for the fray, squaring the elbows of its forelimbs nearly at a right angle to the body as shown in the upper figure of the second plate illustrating this species in *Spolia Zeylanica*, part VIII. (vol. II.), 1905, page 198. The alert defensive attitude which it assumed was evidently intended to be terrifying in the sense in which this term has become familiar to students of mimicry, and the terrifying effect was enhanced by a loud rasping sound which it produced by rubbing the borders of its hind femora against the rim of the forewings.

The male is distinguished from the female by greater slenderness and length of body and wings, by the smaller size of the foliaceous expansions of prothorax and limbs, and above all by the feathery antennæ, these being hair-like in the female. The outer free border of each forewing is thickened by a distinct chitinous rim which is finely serrate. In the region of the hind femur, on each side, the border of the wing is slightly concave, allowing free play to the thigh under ordinary circumstances. The femur itself is smooth, carrying a few minute hairs but without any rough edge.

When the insect is alarmed each hind femur is deliberately rubbed to and fro against the saw-like edge presented to it along the concave border of the wings and a very effective stridulating sound results from the friction. The sound can be approximately reproduced upon the dead insect by gently passing a porcupine quill backwards and forwards along the wing-border.

The serrate border of the wing is also present in the female where the concavity is more pronounced ; and it seems likely that the sound can also be emitted, on occasion, by the female.

Many other insects, especially beetles, produce sounds by rasping. The stridulation of the caterpillar of the Death's Head Moth has been alluded to on page 47 of this volume. Many grasshoppers emit a loud clicking sound when rising from the ground in flight, but I have not yet succeeded in ascertaining how this is produced. The vocal apparatus of male locusts and cicadas belongs to a different category of sound-producing organs, and the object of the call is also different.

What may perhaps lend particular interest to the habit of stridulation as manifested in *Gongylus* is the deliberation with which the action is performed by an insect which is well known in other ways for its defensive and offensive tactics.

A. WILLEY.

Colombo. January. 1906.

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9. *Terrestrial Colubridæ of Ceylon.*—In his admirable systematic work on the Reptiles of British India, Ceylon, and Burma (1890), Mr. G. A. Boulenger notes the existence of a general desire felt by those not well acquainted with snakes to know at least how they may distinguish poisonous from harmless kinds. It is not a simple matter and there is no way of rendering it simple. The examination of the teeth is the fundamental test, but they are often broken and some snakes, the Dipsadinæ, possess grooved fangs and yet are not poisonous. It is in fact necessary to know the snake before pronouncing upon its character.

In an island like Great Britain where only three species of snakes occur, one of which—the adder—is poisonous though not deadly, their identification is not a matter of daily or frequent necessity. In Ceylon, which covers an area of some 25,331 square miles, smaller in extent than that of Ireland and yet possesses an ophidian fauna comprising, exclusive of the sea-snakes, upwards of fifty species, of which eight are poisonous and three or four

fatal, their determination not only stands in constant request, but may even assume a medico-legal or statistical importance.

In the Vital Statistics issued by the Registrar-General of Ceylon for the year 1903, the number of deaths attributed to snake-bite during that year amounted to 217, and the average from 1898 to 1902 is given as 198. In 1904 the number of deaths from snake-bite was 174, and the average from 1898 to 1903, 201·2, or in round numbers 200 per annum.

In the Indian Empire, which is roughly about seventy times as large as Ceylon both in area and population, there is only a slightly greater proportion of deaths attributed to snake-bite annually; namely, about 20,000.

I believe it rarely happens that the offending reptile is caught and identified, so that statistical tables give little or no information concerning the number of victims claimed by different species of poisonous snakes.

Last September a Malay woman living in Colombo was bitten by a snake during the night while she was asleep. She must have unconsciously alarmed the snake in some way, otherwise it would not have bitten her. A *vedarala* was called in, but the woman was beyond help, and died within twelve hours. The snake had been caught and killed at the time of the accident and was subsequently sent to the Museum by the Coroner for identification. It proved to be a dangerous poisonous snake of the kind called "bungarum" or, in Northern India, 'krait," in Sinhalese "karawala."

Two months later, in November (1905), another snake was sent to me from Mullaittivu by Mr. R. A. G. Festing, C.C.S., with the information that it had bitten and killed a woman two nights previously. This time the snake was a harmless one and very common in Ceylon, *Lycodon aulicus*, often called "karawala" or "tel-karawala" through confusion with *Bungarus*, since it resembles the latter very strikingly and may be said to mimic it. It was generally believed that the victim in this case had died of fright, since it appeared from the evidence at the inquest that she had been bitten, twelve small punctures being visible on the right forearm.

Bungarus may be recognized at once by the circumstance that the median dorsal or vertebral scales are much enlarged; in *Lycodon* the scales are equal. It is, however, partly owing to the extraordinary parallel series of colour variations in poisonous and harmless snakes, giving the impression of a natural mimicry, that so much confusion exists with regard to the vernacular names in this country. There are also other sources of confusion. The

late Mr. William Ferguson, F.L.S., pointed out in 1877,* that the common Pit-viper, well known here as the "kunukatuwá," was originally figured by Dr. Davey as the "karawala," and the latter erroneous name has adhered to it in English writings ever since.

There are three or four kinds of so-called "karawala" in Ceylon, namely, the "dunu-karawala," *Bungarus ceylonicus*, the "mal-karawala" or "pol-mal-karawala," *Chrysopelea ornata*; and the "mudu-karawala," *Coluber helena*. The expression "tel-karawala" is sometimes applied indifferently to varieties of *Bungarus ceylonicus* and *Lycodon aulicus*,† in allusion to the oil-like gloss of the scales. The term "mápilá" belongs to certain snakes which have a suspicious look but are not dangerous, namely, species of the genus *Dipsas* (*cf. Spol. Zeyl.*, vol. I., part III., 1903, pp. 81–84).

The most convincing evidence of mimicry as between harmless and poisonous snakes is afforded by the specimens of a white-ringed variety of *Bungarus ceylonicus* and the white-ringed species of *Lycodon*, *L. carinatus*, which have been kept in the same jar in the Museum. The similarity between these two forms was remarked upon in 1877 by Mr. William Ferguson. To the unaided eye the resemblance is quite deceptive, but with a lens it will be seen at once that the scales of the *Lycodon carinatus* are keeled, besides being equal.

Precisely analogous examples of mimicry are known to occur among the so-called coral-snakes of Brazil, of which there are four genera, one (*Elaps*) poisonous, a second suspicious, the two others harmless. The colour is described as a "rich red with black and yellow transverse bands," and the species of these snakes inhabiting the same districts are so like each other that only a naturalist could distinguish the harmless from the poisonous kinds (*cf.* Darwin, Descent of Man, Second Edition, p. 353).

The accompanying schedule, which is based primarily upon Mr. Boulenger's Monograph, is intended to serve as a guide to the identification of a section of the snakes of Ceylon. It is complete so far as it goes, including as it does all the members of the three subfamilies of Colubridæ mentioned, namely, the Colubrinæ, Dipsadinæ, and Elapinæ, which are known to occur in Ceylon. The sea-snakes (which are poisonous) and two other small sub-families of water-snakes (Acrochordinæ and Homalopsinæ)

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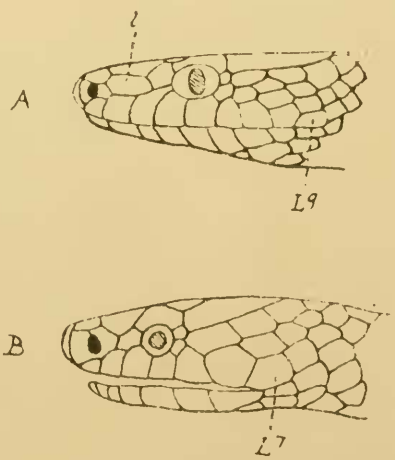
* Wm. Ferguson, Reptile Fauna of Ceylon. Letter on a collection sent to the Colombo Museum. Colombo, 1877 (printed by the Government Printer).

† *Lycodon aulicus* is also called "alu-polonga" at times.

are omitted. The earth-snakes ("depat-naya"), the Python or rock-snake ("pimbura"), and the Vipers ("polonga") are not included within the scope of the schedule.

Two points may be noted in connection with the guiding characters which I have selected in the index. All the species mentioned have less than thirty rows of scales round the body (excluding the ventral shields) and in all cases the general condition of the head-shields is normal and remarkably constant on the whole. Seen from above there is a rostral shield in front (usually barely visible in dorsal view) followed by a pair of internasal shields between the nostrils, then a pair of præfrontals, a median frontal between two supraoculars and a pair of parietals behind. The shields which appear in side view of the head are less constant, the most important feature being the presence or absence of a loreal shield between the præocular and the nasal, this being one great distinction between *Lycodon* and *Bungarus*.

When once a character has been observed all the species which are shown by the index not to possess this character are excluded, and thus by continuing the process of exclusion at least the genus of the specimen can be fixed with certainty, and this is enough for practical purposes.



A. Side view of head of *Lycodon aulicus*; *l*. Loreal shield; L^9. Ninth upper labial.

B. Side view of head of *Bungarus ceylonicus*; showing absence of loreal shield; L^7. Seventh upper labial.

The species which offers the most generalized characters is No. XII., *Polyodontophis subpunctatus*, a harmless snake which may

be found under logs. I took one recently near Puttalam,* and it occurs round Colombo and Kalutara.

The regularity with which snake-bite returns appear in Vital Statistics demonstrates the necessity for a more detailed analysis than is usually given. What is wanted is information concerning the snakes which are alleged to have inflicted bites on human subjects. Like as not many of them would prove to be harmless.

In the schedule the numbers prefixed by the letter B refer to the numbers of the species in Mr. Boulenger's volume on Reptilia and Batrachia in the Fauna of British India; *S. Z.* refers to *Spolia Zeylanica*; *Tropidonotus asperrimus*, No. XXVI., the Ceylon representative of *T. piscator* was named by Mr. Boulenger subsequently to the publication of the volume (see Ann. Mag. Nat. Hist. vol. VII., 1891, p. 281).

By way of coincidence it is to be noted that the principal and proper food of *Lycodon aulicus* consists of the Brahminy Lizard or "hikanella" (*Mabuia carinata*) which is swallowed entire by the snake and may be removed practically uninjured from the stomach of the latter, if taken at the right time. The size of the ingested lizard in comparison with the snake is sometimes astonishing. This lizard is believed both here and in South India to inflict a poisonous bite, and in the Vital Statistics for 1904 (Ceylon) one death is attributed to injury caused by Brahmin Lizard. In reality the "hikanella" is harmless. A similar tradition of folklore is recorded by Dr. Gadow (Cambridge Nat. Hist. Amphibia and Reptiles, 1901, p. 506) from the South of Spain and Portugal where geckos, called "osga," are abundant and are considered to be dreadfully poisonous by the country folk. Dr. Gadow points out that geckos are absolutely harmless; they cannot even inflict painful bites, but in many countries they are feared as much as the most poisonous snakes.

There are special difficulties in the way of identifying snakes which have inflicted bites upon the person. Firstly there is the difficulty of catching the snake and of making certain that the one caught is the culprit. Then again in the country districts of Ceylon, as all residents in the Island are aware, there is a reluctance to kill the snake, and if killed in some cases, notably in regard to "mapila" and "karawala," the snake must be burnt in accordance with immemorial custom. Because the "mapila" and

* At Karawalagaswewa, on the road from Puttalam to Anuradhapura. This snake was quoted by Bateson (Materials for the Study of Variation, London, 1894, p. 123) as an example of maximum variation in the number of ventral shields which correspond with the number of vertebræ, as may be easily seen by observing the ribs pressing against them during locomotion. In this case the number of ventral shields has been observed to vary from 151 to 240.

"karawala" are believed to travel in flocks of seven, and when one is killed and burnt the smoke is supposed to keep away the other six. This incineration of snakes is an actual and definite practice in Ceylon and the burning of a "pol-mal-karawala" (*Chrysopelea ornata*) under the conditions indicated has been witnessed by my friend Mr. James Parsons of the Mineralogical Survey, as he has been good enough to inform me.

Another difficulty in connection with the casual identification of snakes is more apt to trouble those who know something about snakes to begin with than those to whom they are a *terra incognita*. I refer to the occasional capture of snakes of unusual size belonging to well-known species. A case in point has quite recently occurred to me as concerning the snake *Aspidura copii*. The specimens of *Aspidura* which I have seen are slender snakes of rather small size, a length of two feet being exceptional; and the head is long and tapering (compare this Journal, vol. II., part VII., plate facing p. 96).

The other day (January, 1906), a bulky snake was sent to the Museum from Avisawella by Mr. William Ferguson, Jr., which severely tested the merits of my schedule. The last genus to which it might belong seemed to be *Aspidura*. It had a single internasal, short frontal, no præocular,* 6 upper labials, 17 smooth scales round the middle of the body, 137 ventral shields mottled with the dark ground colour, anal entire, 20 unpaired caudals: in short, it was a female example of *Aspidura copii*. Its size however, and therewith its general appearance, was remarkable; the length, as nearly as it could be measured in the coiled condition in which the snake had been preserved and hardened, amounted to rather more than 25 inches, of which the tail only occupied two inches; the girth was as much as $3\frac{3}{8}$ inches, giving an appearance of great bulk; the head was widest in the occipital region, close upon one inch across and greatly flattened, the small eyes occupying a dorsal position and the snout rapidly tapering in front of the eyes. In the Fauna of British India, Mr. Boulenger gives the following dimensions of *A. copii*: Total length 16·5 inches, tail 2·8, these figures probably relating to a male.

Upon opening the snake now under consideration, the ovaries proved to be full of large eggs, three-quarters of an inch long by about half an inch wide, seven in the left ovary, fourteen in the right. From what has been said it will be clear that this is quite

* The præocular shields are shown in the text-figures A and B. *Aspidura copii* and *Drummondhayi* are the only Colubrine snakes in Ceylon which have no præocular.

a noteworthy individual. In Mr. Haly's Report on the Reptiles, &c., in the Colombo Museum (1891) *A. copii* is recorded from Dikoya and Balangoda and is said to range between 2,000 and 7,000 feet.

SCHEDULE OF THE TERRESTRIAL COLUBRIDÆ OF CEYLON.

	Names.		Remarks.
	A.—*Colubrinæ*.		*Harmless.*
I.	Aspidura brachyorrhos ...	B342 ...	Ceylon Hill-snakes, sometimes brightly coloured.
II.	„ copii ...	B343 ...	
III.	„ guentheri ...	B344 ...	
IV.	„ trachyprocta ...	B345 ...	
V.	„ drummondhayi	B.S.Z. ...	
VI.	Haplocercus ceylonensis	B346 ...	
VII.	Lycodon striatus ...	B347 ...	Striated Wolf-snake, Peradeniya.
VIII.	„ aulicus ...	B351 ...	Bungalow Wolf-snake, "Telkarawala."
IX.	„ carinatus ...	B356 ...	White-ringed Wolf-snake.
X.	Hydrophobus nympha ...	B357 ...	Jaffna, Anuradhapura.
XI.	„ gracilis ...	B358 ...	"Ceylon."
XII.	Polyodontophis subpunctatus	B364 ...	Collared Sand-snake.
XIII.	Ablabes calamaria ...	B367 ...	Rare.
XIV.	Simotes arnensis ...	B380 ...	Black-banded snake.
XV.	Oligodon templetonii ...	B391 ...	Paucidentate Dwarf snakes.
XVI.	„ sublineatus ...	B392 ...	
XVII.	„ subgriseus ...	B394 ...	
XVIII.	Zamenis mucosus ...	B397 ...	Rat-snake, "Garandiya."
XIX.	„ fasciolatus...	B402 ...	Jaffna.
XX.	Coluber helena ...	B406 ...	Ocellated Land-snake, "Mudukarawala."
XXI.	Dendrophis pictus ...	B417 ...	Tree-snakes, "Haldanda."
XXII.	„ bifrenalis...	B419 ...	
XXIII.	„ caudolineatus	B420 ...	
XXIV.	Tropidonotus ceylonensis	B430 ...	Ceylon Ground-snake.
XXV.	„ stolatus ...	B434 ..	Striped Ground-snake. "Aharakukka."
XXVI.	„ asperrimus	B1891 ...	Amphibious Ground-snake. "Diya-polonga."
XXVII.	„ plumbicolor	B439 ...	Viperine Ground-snake.
XXVIII.	Helicops schistosus	B440 ...	Freshwater snake.
	B.—*Dipsadinæ*.		*Non-poisonous.*
XXIX.	Dipsas barnesii ...	B445 ...	Nocturnal Tree-snakes, "Mapila."
XXX.	„ ceylonensis ...	B446 ...	
XXXI.	„ forstenii ...	B451 ...	
XXXII.	Dryophis mycterizans	B461 ...	Green Whip-snake, "Ehetulla."
XXXIII.	„ pulverulentus	B462 ...	Brown Whip-snake, "Henakandaya."
XXXIV.	Chrysopelea ornata	B463 ...	Florid Tree-snake, "Pol-malkarawala."
	C.—*Elapinæ*.		*Poisonous.*
XXXV.	Callophis trimaculatus	B474 ...	Dwarf Bungarum.
XXXVI.	Bungarus ceylonicus	B481 ...	Ceylon Bungarum, "Dunukarawala."
XXXVII.	„ cœruleus	B482 ...	Indian Krait (Jaffna).
XXXVIII.	Naia tripudians ...	B485 ...	Cobra.

NOTE.—Nos. VIII. and XXV. are the commonest snakes in Ceylon; next in abundance is XXVI., and then follow the Tree-snakes and Whip-snakes.

INDEX.

N.B.—The following common characters may be regarded as occurring normally since they are presented with great frequency and are therefore not specially noted in the index ; they are to be presumed unless otherwise stated :—

(*a*) Anal Shield divided ; (*b*) Head not clearly distinct from neck ; (*c*) Internasals paired ; (*d*) Loreal single, separated from eye ; (*e*) Præocular single ; (*f*) Pupil round ; (*g*) Rostral barely visible from above ; (*h*) Scales equal and smooth ; (*i*) Subcaudals paired.

Anal shield entire i to v.. vi., ix., xi.. xx.

Head distinct from neck. x., xi., xviii., xix., xx.. xxi to xxiii., xxiv to xxvii., xxix to xxxi., xxxii., xxxiii.. xxxiv . xxxviii.

Internasal single. i to v.. vi.. xxviii.

Labials* six. i to v., xxxv.
Labials seven. vi., x., xi., xiii., xiv., xv to xvii., xxvii., xxxvi., xxxvii., xxxviii.
Labials eight. vii., xviii.. xix., xxiv.. xxv.. xxix., xxx., xxxii., xxxiii.
Labials nine. viii., ix., xii., (9–10), xx., xxi. (9–10)., xxii., xxiii, (8–9), xxvi., xxviii., (8–9) xxxiv.,(9–10).
Labials indefinite, xxxi., (8–11).

Loreal absent, i to v., vi., xxxii., xxxiii.. xxxv., xxxvi., xxxvii., xxxviii.
Loreal entering the eye. x. xi. xv.
Loreals two, xxii.
Loreals three, xviii.

Maxillary teeth equal, i to v.. (20)., vi. (10)., xii. (40).. xiii. xx., xxi to xxiii.
Maxillary teeth enlarged in front, vii to ix.
Maxillary teeth enlarged behind. x., xi., xiv., xv to xvii., xviii., xix., xxiv to xxvii., xxviii.
Maxillary teeth fanged behind. xxix to xxxi.. xxxii., xxxiii., xxxiv.
Maxillary teeth fanged in front, xxxv.. xxxvi.. xxxvii., xxxviii.

Præocular absent, ii., v.
Præoculars two, xxiv., xxvi., xxxii.. xxxiii.
Præoculars three. xxix.
Præoculars variable (1 or 2).. x., xxx.

Pupil horizontal, xxxii., xxxiii.
Pupil vertical, vii to ix., x., xi.. xxix. to xxxi.

Rostral† large, xiv., xv to xvii.
Rostral produced.. xxxii., xxxiii.

Scales in 13 rows, x., xxiii., xxxv.
Scales in 15 rows, iv., v., xi., xiii., xv., xvi., xvii., xxi., xxii., xxxii., xxxiii., xxxvi., xxxvii.
Scales in 17 rows, i., ii., iii., vi., vii., viii., xii., xiv. xviii., xxxiv.
Scales in 19 rows, ix., xxiv.. xxv.. xxvi , xxviii., xxix.
Scales in 19 or 21 rows, xxx.
Scales in 21 or 23 rows, xix.
Scales in 23 to 27 rows, xx.. xxvii.. xxxviii.
Scales in 25 to 29 rows, xxxi.
Scales keeled, vi., ix., xxiv.. xxv.. xxvi., xxvii., xxviii.
Scales keeled in posterior part of body only, ii.. iv., v., xviii.‡

Subcaudal shields in single row, i to iv., vi.. ix.
Subocular present, xviii., xix., xxxii.. xxxiii.

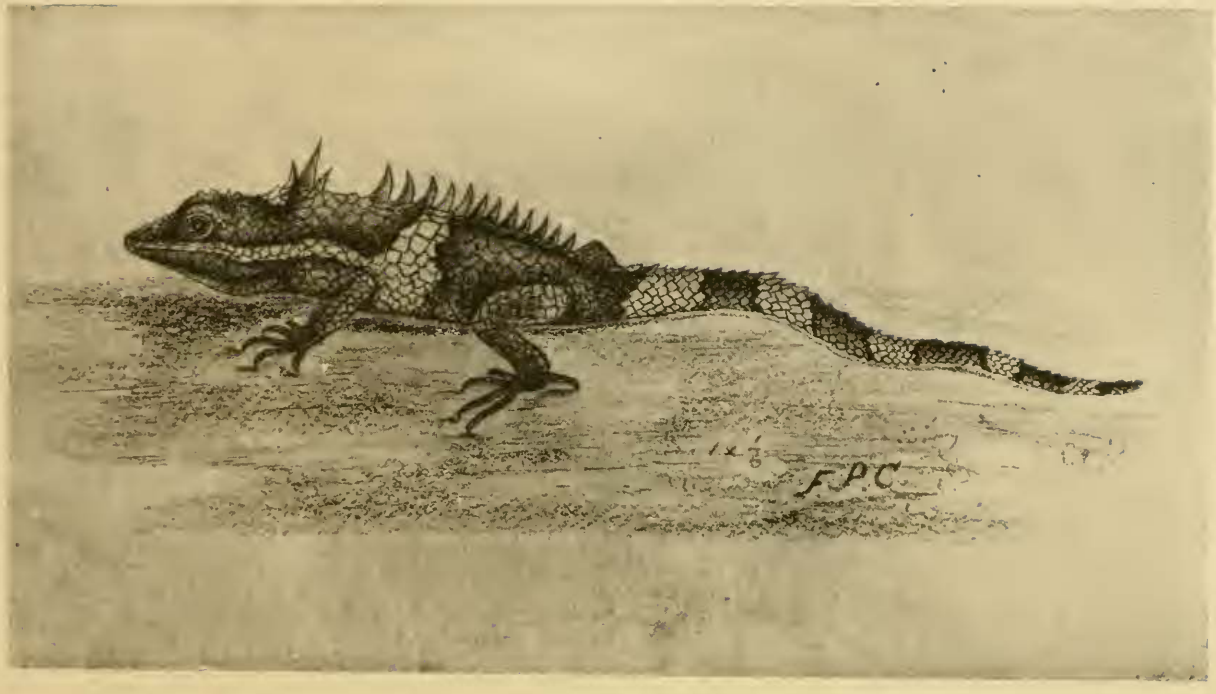
Ventral shields keeled laterally x., xi., xxi., xxiii., xxxiv.
Ventral shields with dark spots at the sides, xii.. xxv., xxx., xxxiv.
Ventral shields with dark spots along sides and middle, xv., xvi.
Vertebral scales enlarged, xxi to xxiii., xxx., xxxii., xxxiii., xxxvi.. xxxvii.

Colombo, January 23, 1906. A. WILLEY.

* Upper labials or shields bordering the upper lip.

† The rostral shield covers the front of the snout.

‡ In the young rat-snake the keeling of the scales may be absent.



MALE COPHOTIS CEYLANICA. (Partly after Guenther.)

[*To face p.* 235.

10. *Viviparity of Cophotis ceylanica and Oviparity of Ceratophora stoddartii.*—*Cophotis* and *Ceratophora* are two genera of Agamoid lizards containing species which are peculiar to Ceylon.* *Cophotis ceylanica* and *Ceratophora stoddartii* are found in the districts of Nuwara Eliya (6,200 ft.) and Hakgala (5,580 ft.); the former species is distinguished by the possession of a prehensile tail, the latter by its rostral appendage (*cf. Spolia Zeyl.*, part I., opposite p. 11). Another species belonging to the same family (Agamidæ), also peculiar to Ceylon, is common at Hakgala on wayside bushes; this is *Calotes nigrilabris.*

The other families of lizards which are represented in Ceylon are the Geckonidæ, Varanidæ, Scincidæ, and Chameleodontidæ. Here I am only concerned with the Agamidæ and Scincidæ.

It is well known that most of the Agamoid lizards are oviparous, laying their eggs in small holes in the ground. The occurrence of viviparity or ovoviviparity, where the eggs undergo their development within the oviducts so that the young are born active with the characters of the parent, is both rare and exceptional among Agamoids. The only case noted in the Fauna of British India, &c., of a viviparous Agamoid is that of the genus *Phrynocephalus*, not found in Ceylon (*op. cit.*, Boulenger, Reptiles and Batrachians, p. 110).

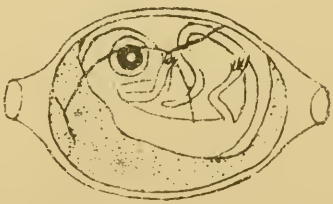
During a recent visit to Hakgala, where I occupied the Botanical Laboratory by kind permission of Dr. J. C. Willis, at the end of January and beginning of February, I ascertained that the tree-dwelling lizard, *Cophotis ceylanica*, is viviparous. At the proper season the ripe eggs pass into the oviducts and there undergo their development without any shell being formed, so that the half-formed embryo is clearly visible through the thin transparent wall of the oviduct. One female showed three whitish embryos lying upon the yolk in the right oviduct and two in the left, all in the same stage of development; a second had two advanced embryos in each oviduct, with scales and dark pigment appearing.

The size of the eggs, 13 mm. in major diameter, causes the wall of the oviduct to stretch and to invest each egg closely. After removal of an egg from the oviduct, the embryo with the yolk is still surrounded by three membranes, which I interpret as follows from the examination of flat preparations :—(1) a very thin, translucent, finely fibrous, non-cellular, vitelline membrane; (2) an equally thin and transparent chorionic membrane which is cellular

* All species of *Ceratophora* are endemic. *Cophotis* has another species in Sumatra (Boulenger).

but non-vascular ; this membrane, which I take to be the epidermal tract of the outer amnion, consists of a pavement-epithelium in which the cell-boundaries, vesicular nuclei and nucleoli are clearly visible without staining ; (3) a thicker, though still transparent, vascular allantoic membrane traversed by blood-vessels which give rise to dense capillary networks over the surface of the egg.

From the above description it is evident that, from a reptilian standpoint, the viviparity of *Cophotis* is very complete. In this connection it may be noted that the wall of the oviduct is also well-supplied with blood-vessels, a large trunk proceeding along the mesometric line. It seems almost certain that gaseous and probably also liquid transfusion from parent to embryo takesplace through the thin intervening membranes. It is not always easy to suggest an explanation for the exceptional occurrence of viviparity in groups of normally oviparous animals. It seems to depend upon various conditions which may react upon the organism separately or in combination. Of these conditions the most obvious are habits and habitat (whether arboreal, desert-colous, subterranean), temperature and moisture. There are



Embryo of *Cophotis ceylanica* lying in a dilatation of the oviduct. The dotted portion indicates the yolk. At each side of the figure is the cut end of the oviduct.

several parallel examples which may help to throw light on this subject. *Cophotis* is arboreal as shown bionomically by its actual occurrence as well as structurally by its prehensile tail, but less so than the *Chameleon* which has modified hands and feet in addition to its prehensile tail. Nevertheless most Chameleons lay eggs, an exception being afforded by *Chameleon pumilus*, the Dwarf Chameleon of South Africa which is ovoviviparous. This species is described by Dr. Gadow (Cambridge Nat. Hist. Amphibia and Reptiles, 1901, p. 580) as "relatively hardy, being as a native of South Africa, accustomed to cold nights." In this respect it offers an analogy to *Cophotis ceylanica*, which has almost exactly the same size as the South African Chameleon, namely, 5–6 inches, and is accustomed to the cold nights of the upper montane zone of Ceylon.

Another parallel example is afforded by the Agamoid genus *Phrynocephalus* (referred to above) which inhabits the desert regions of Central Asia, as compared with the viviparous Iguanoid genus *Phrynosoma** which inhabits the desert regions of Central America.

In many or most cases of viviparity among reptiles an egg-shell is formed round the vitellus, but the egg is not laid, the young hatching out *in situ* in the oviducts. In *Cophotis* there is no trace of an egg-shell.

With regard to *Ceratophora* the eggs are laid in small holes in the ground after the manner of *Calotes*. I came across such a hole containing four freshly-laid, soft-shelled eggs in the Hakgala jungle in January and disturbed the female who was apparently attending to it. *Ceratophora stoddartii* is usually found clinging to the trunks of trees or the stems of shrubs and saplings in a vertical attitude with the rostral appendage directed upwards. This appears to be its normal resting attitude and it remains motionless for hours together. Its food consists in large part of earthworms, to obtain which it descends to the ground. The female descends to the ground also for the purpose of egg-laying, the mating taking place on the stem of a young or small tree. The existence of the rostral appendage is, I think, more or less closely correlated with the vertical resting attitude of the lizard.

In contrast with the Agamidæ most of the Scincoid lizards are viviparous, but an exception occurs in the species, *Mabuia macularia*,† which is oviparous. Some eggs which I found in the month of December at the base of a kumbuk tree at Karawalagaswewa, between Puttalam and Anuradhapura, no doubt belonged to this species. I placed them in a match-box, and within an hour or two young skinks hatched out which by an oversight I omitted to identify. The species however occurs in Ceylon as well as in India and Burma. It is closely allied to the well known Brahminy Lizard which is viviparous (Boulenger *op. cit.*, p. 190).

There is an Australian skink, *Trachysaurus*,‡ which is strictly viviparous in so far that like *Cophotis* no egg-shell is formed, and the embryos "are ripened in uterus-like dilatations of the oviducts."

In conclusion, it may be noted that the geckos (Geckonidæ) are oviparous lizards; "the only species at present known to be ovoviviparous are the New Zealand *Naultinus elegans* and *Hoplodactylus pacificus*" (Boulenger, *op. cit.*, p. 55).

Colombo, February, 1906. A. WILLEY.

* See Gadow, *op. cit.*, p. 533. † See Boulenger, *op. cit.*, 180.
‡ See Gadow, *op. cit.*, p. 560.

11. *Subsidence at Kokkilay on the East Coast.*—The village of Kokkutoduvay lies on the narrow strip of land which separates Kokkilay lagoon from the sea and is some half a mile from the latter. Across a small "villu" from the village and right on the sands just above highwater mark, where a very moderate north-east gale would carry the waves, is a large area containing a deposit of ancient pottery *débris*, undoubtedly the site of an old settlement. This, in conjunction with an existing tradition that Kokkilay lagoon was once a stretch of paddy fields, is very strong evidence of the land having subsided.

The pottery is old—how old it is impossible to say ; perhaps a thousand years, perhaps more. But the land hereabouts must have also risen and that long before the time of the potters. For the coast is strewn with fossils, sea-shells imbedded in sandstone which was formed I suppose in a considerable depth of water. Thus at this little village we have evidence, natural and artificial, of two alterations, in opposite directions, from the present level.

JOHN STILL.

Anuradhapura, April 19, 1905.

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12. *Association of a crocodile with a tortoise.*—Early in March, 1905, I was at a village named Kanjuramotai, a few miles south of Nedunkeni in the Mullaittivu District. Two of the villagers showed me a few ruins in the jungle, just by the edge of their paddy fields ; and among them was an old well. This had been dug out six or eight years ago, and then abandoned, after which the sides had collapsed inwards leaving a hollow about 10 feet deep, circular in shape, and 12 or 15 feet in diameter. Its sides are perpendicular save at the very top where they overhang, held up by the matted roots of the undergrowth, so that the place is a regular trap.

In the well there are two captives, both well known to the villagers : one a crocodile, about six feet long, the other a very large mud tortoise (*Nicoria trijuga*). The villagers aver that the crocodile got in during the rainy weather three years ago and that the tortoise has been there for six months. Neither can get food (except perhaps frogs), neither can get out; and in the dry weather they must go without water for months on end.

The turtle has no fear of the crocodile, but when stirred up will walk up to his snout. The crocodile, which is miserably thin, resents being stirred up by hissing and snapping his jaws, but

makes no attack on the tortoise. The villagers say he is afraid of being left alone if he eats the tortoise, but perhaps the shell is too much for him in his enfeebled state.

JOHN STILL.

Anuradhapura, March, 1905.

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13. *Distribution of flying squirrels in Ceylon.*—The squirrel called *Pteromys oral* which possesses a dermal parachute by means of which it can travel through the air for limited distances, and on this account is always called the flying squirrel, belongs to the Rodent family Sciuridæ, which is the squirrel family. This information is given in a condensed form on p. 38 of this volume.

An illustration showing the animal at rest and in flight is given on p. 361 of Blanford's Mammalia (Fauna Brit. Ind.) Another species called the "Small Travancore Flying Squirrel," *Sciuropterus fuscicapillus*, is recorded by Dr. Blanford from the hills of Ceylon, but no information concerning it is available locally.

The Flying Fox (*Pteropus medius*) which, as stated on p. 38 (this volume), is a Fruit-eating Bat, occurs in the low-country, forming "camps" during the daytime at such places as Beruwala (Barberyn), Henaratgoda, and Peradeniya. The flying squirrel also occurs at Peradeniya, whence several examples have been sent to the Museum by Mr. E. E. Green. This is an example of a local overlapping in distribution, since the flying squirrel hardly occurs below the elevation of Peradeniya and the flying fox does not go much above it. Mr. Edgar Turner has kindly written to say that he has never seen "flying foxes" in the up-country jungles, but has often seen the "flying squirrels" in the jungles up to 5,000 feet or more, particularly in the Hewaheta jungles by Rookwood estate.

Ed. S. Z.

END OF VOLUME III.

SPOLIA ZEYLANICA.

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THE COLOMBO MUSEUM,

CEYLON.

VOLUME III.

COLOMBO:
G. J. A. SKEEN, GOVERNMENT PRINTER, CEYLON.

1906.

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