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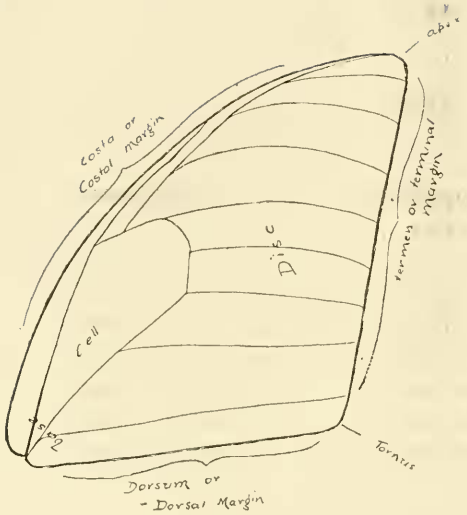
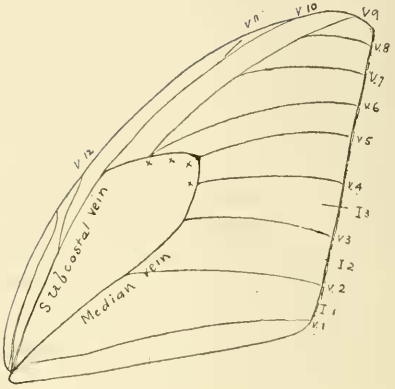
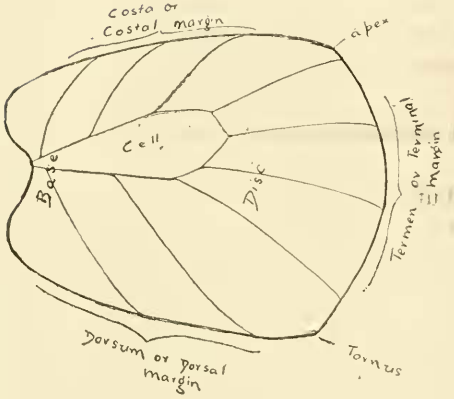
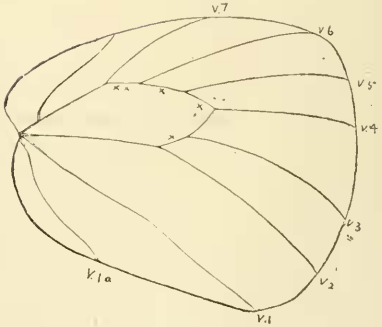








xx = discocellulars
V1 V2 &c = vein 1 vein 2 &c
I1 I2 = Interspace 1. 2 &c

SPOLIA ZEYLANICA.

NOTES ON CEYLON BUTTERFLIES.

By W. Ormiston, F.E.S.

(*With two Plates.*)

AS I have now collected butterflies in Ceylon for nearly thirty years, my notes may prove of some use to other collectors, so I have decided to publish them.

The great majority of my collecting was done at Haldummulla, in the Province of Uva. This is an exceptionally well-situated district: a circle, with its centre at Haldummulla post office and a radius of 5 miles, includes a portion of the Horton Plains (7,200 feet), Ohiya (6,000 feet), Haputale (5,000 feet), Diyatalawa (4,400 feet), and low-country with an elevation of about 600 feet only. In other words, the variation of elevation is at least 6,500 feet. Within this circle I have personally taken over 200 species out of the 244 mentioned in these notes.

Naming the species is not an easy matter. The four leading authorities on Ceylon butterflies, given in order of date of publication, are: 1st, "Lepidoptera of Ceylon," by Moore; 2nd, "The Butterflies of India, Burma, and Ceylon," by Colonel Marshall and De Niceville; 3rd, "Fauna of India: Butterflies," by Colonel Bingham; 4th, "A List of Indian Butterflies," by Captain Evans. In some instances all four authorities name the same insect differently, and still further changes in the names have appeared since Captain Evans's list was published.

Most collectors cannot afford to purchase all the books, but Moore's "Lepidoptera of Ceylon" is the standard work on Ceylon specimens only, and is kept at all the principal kachcheries, for the benefit of collectors. I have therefore, as much as possible, given his names the preference, but mention the others, giving the authority after each.

Butterflies' names may be composed of four parts: genus, sub-genus, species, and race, but it is hardly ever necessary to

use all four. For instance, *Euplœa crastia core asela* is equally well identified if labelled *Euplœa asela*, and as these notes are only published as an assistance to local collectors, I have used two names only, but have mentioned where any of the authorities consider any insect a local race.

In my personal experience the best places for a collector to go to, in order to make a fairly complete collection in a short time, are: (1) Wellawaya resthouse, in the Province of Uva. The best months are usually March, April, July, November, and December. About 160 species may be expected to be taken, including the rarities *S. nais* (abundant), *N. dana*, *C. lithargyria*, *H. nilgirica*, *L. lepitoides*, *A. siamica*, and *B. sena*. (2) Pattipola resthouse, for hill species; best during the north-east monsoon. The special rarity is *L. dynsate*. (3) Murunkan resthouse, near Mannar, for Colotis and other northern and dry-zone species. (4) Kottawa resthouse, near Galle, for wet-zone species. I have also done very well at Elephant Pass (near Jaffna), Anuradhapura, Tissamaharama (Southern Province), and Tanamalwila (Province of Uva).

I understand that the Kandy District is better than Wellawaya, and that Ratnapura is the best centre for wet-zone insects, but I have very little personal experience of either.

Baits.—1. The best I know is small pieces of sponge soaked in toddy, in which a little jaggery has been dissolved. Pin these to trees, or lay them on rocks in likely places. A jam bottle is the best way to carry them. Squirrels are very fond of toddy, and will eat the sponges if left unwatched.

2. Treacle, or jaggery boiled in beer, with a good dash of rum added just before use. This is best for Kallima and Charaxes.

3. Over-ripe fruit, especially jak. This is best for Discophora.

4. A dead specimen pinned on a twig will often attract the males of its species within reach of the net.

Exceedingly little is known of our Ceylon butterflies. It is nearly impossible to decide how many species there are of Nacaduba, Aphnæus, Terias, Parnara, and a few other genera. *Appias paulina* is one of our commonest species, but I believe its larva is still unknown.

The southern half of the Island has been fairly well worked, except in the wettest districts, but practically nothing is known of the north, and new species should still be discovered there. In the Colombo Museum collection I found a pair of an Aphnæus from 20 miles north-east of Mannar which is very distinct from any species in our lists; and there are also two specimens of an Arhopala from Mr. Pole's collection which are certainly new; unfortunately they are not labelled with the locality where they were caught. I would especially impress upon beginners the importance of labelling every specimen with locality and month of capture. An unlabelled collection is nearly valueless for scientific purposes.

I have not quoted the localities given by Moore, as these notes are only intended as a supplement to that work.

In addition to the authorities quoted previously, I am much indebted to the following: "The Common Butterflies of the Plains of India," by T. R. Bell, I.F.S., now being published in the journal of the Bombay Natural History Society; and "Notes on the Butterflies of Ceylon," by L. de Niceville and Colonel N. Manders, R.A.M.C.

Ever since I started collecting I have received the greatest assistance from Mr. F. M. Mackwood, and I am deeply indebted to him for his help while writing these notes, and especially for, in a few instances, adding notes of his own.

For the benefit of beginners I give an illustration showing the names of the various parts of a butterfly's wings, as used in Colonel Bingham's work.

I shall be glad to receive any criticisms, corrections, or notes from collectors.

Kalupahani, Haldummulla, June, 1917.

Abbreviations after Names.

M. = Moore: Lepidoptera of Ceylon.

B. = Bingham: Fauna of India: Butterflies.

De N. = De Niceville: The Butterflies of India, Burma, and Ceylon, by Marshall and De Niceville.

E. = Evans: A List of Indian Butterflies.

Nymphalidæ.

Danainæ.

1. Hestia jasonia, De N., B., & E.; *Nectaria jasonia*, M.—Peculiar to Ceylon. Common in forests where there is a fairly heavy rainfall. Occasionally specimens may be seen making long flights over the open country. In my experience these are always females, and are probably hunting for new breeding grounds.

The males are usually smaller and darker than the females, but there is great variation in specimens caught in different localities, those from the wet low-country being far smaller and darker than those from the hills. By far the smallest and darkest series I have ever seen were shown to me by Mr. Mackwood; they were caught at Badura Eliya in the Kaluṭara District in July.

Found at all elevations from sea level to well over 5,000 feet nearly all the year round, and is usually very easy to catch.

"I once caught twelve at one sweep of my net at a small pool in Pundalu-oya, and scores were hovering about" (F. M. Mackwood).

2. Radena exprompta, M.; *Danais exprompta*, De N.; *Danais vulgaris exprompta*, B.; *Radena similis exprompta*, E.—Peculiar to Ceylon, and confined to the south-west of the Island. It is very like *P. aglea*, but can be easily distinguished by its bluer colour, and by having the cell of the fore-wing crossed by a broad black band.

It has a very slow flight and settles often, so is one of the easiest insects to catch.

The male has no sex mark, but has slightly narrower and less rounded wings than the female.

I found it very abundant in the Kottawa forest in February, and at Tebuwana in April. It is not rare at Galle, Bentota, and Labugama, and has been taken as far inland as Ratnapura.

3. Tirumala limniace, E.; *Tirumala limniacæ*, M.; *Danais limniace*, De N. & B.—Also found in India, Burma, and Southern China. A very common low-country fly, but occurs at all elevations during the flights.

Has a strong flight while migrating, but at other times it flies slowly, and settles frequently on wet roads or at flowers. It is then very easy to catch.

Common all over the Island, and may be taken all the year round, but is most abundant during the north-east monsoon.

"Has been taken at Lindula at 5,000 feet" (F. M. Mackwood).

4. TIRUMALA SEPTENTRIONIS, M.; *Danais septentrionis*, B.; *Tirumala melissa musikanos*, E.—Found also in India, Burma, Malaya, &c.

Occurs in the same places, and at the same times as the last, but is far more numerous. It usually shares with *E. asela* the honour of starting the north-east monsoon flights. Its flight while migrating is much slower than that of *T. limniace*, and when not migrating it is not addicted to settling on wet roads; otherwise its habits are similar.

Occasionally, during the flights, hundreds of their wings may be found in places along the roads. I believe this to be mainly the work of the White-bellied Drongo (*Dicrurus leucopygialis*), as I have seen this bird catching them, eating the body, and dropping the wings. I have also seen the blood-sucker lizard (Calotes sp.) eating them.

Found everywhere from Galle to Jaffna at all times, but commonest during the north-east monsoon.

"Taken at Lindula, 5,000 feet, in March and April" (F. M. Mackwood).

5. SALATURA CHRYSIPPUS, M. & E.; *Danais chrysippus*, B.—Found also in South-Eastern Europe, Africa, and Southern Asia.

The most sedentary of all the Ceylon Danaids; it may be found day after day in the same place; if disturbed it flies off, but soon returns. It does not apparently join in the flights.

Specimens from Haldummulla are usually much smaller than those from the low-country, although the food plant is very abundant here.

Found everywhere, all the year round.

Var. *dorippus*.—In this the white sub-apical band is wanting. It is very rare, the only specimens I have seen being four in the Colombo Museum collection.

Var. *alcippus*.—In this the lower wings are suffused with white. The Museum has two specimens, but I have seen no others.

I have a ♀ *chrysippus*, which shows a tendency to approach this form, veins 2, 3, 4, and 5 on the upper side of the hind wing being narrowly edged with white.

6. Salatura plexippus, E.; *Salatura genutia*, M.; *Danais genutia*, De N.; *Danais plexippus*, B.—Found in India, Burma, Malaya, Southern China, &c.

A much more active insect than the last. Joins to a certain extent in the flights.

Common everywhere nearly all the year round.

Bell, in his description, says: "Some specimens from dry regions show a tendency to replace the tawny part of the hind wing by white, thus approaching the next species" (*S. hegesippus*).

I have noticed this variation, to a slight extent, occasionally in Ceylon, but it is not here confined to the dry zone, as I have found it most frequently at Galle and Haldummulla. In Ceylon, however, the dry regions have been, so far, very little worked, and little is known of the variations to be found there.

7. Parantica aglea, E.; *Parantica ceylonica*, M.; *Danais ceylanica*, De N.; *Danais aglea*, B.—Found also in Southern India, and is very near to *P. melanoides*, which occurs in Northern and Eastern India.

Has a very slow flight, and settles often on flowers. Does not seem to join in the flights, though it is commonest when they are on.

Very common all the year round. I have not, however, yet seen it in the Northern Province; otherwise it seems to abound everywhere at all elevations.

Varies in size and the amount of the bluish-white markings.

8. Chittira fumata, M. & E.; *Danais taprobana*, De N.; *Danais fumata*, B.—Peculiar to Ceylon, and confined to high elevations, where it is extremely abundant all the year round. It does not join in the flights. Flies very slowly, and settles frequently on flowers, so is very easy to catch.

It is especially numerous at Nuwara Eliya, Pattipola, and Ohiya, but is not rare, in wet weather, at Haldummulla. I

have never personally seen a specimen below 3,000 feet elevation, but have heard of its occurrence below 2,500 feet.

" The larva of *Danais fumata* feeds on *Allœophania decipiens* Thw., a shrub growing in chenas at the higher elevations. Observer: Mr. F. G. Saunder, Nuwara Eliya."—" Spolia Zeylanica," Vol. X., Part XXXVI.

9. Euplœa asela, M.; *Crastia asela*, De N.; *Crastia core asela*, B. & E.—" More or less confined to Ceylon, though incidentally recorded from Western India " (Bingham). Only an insular race of *E. core* of India. Bingham says it differs from *E. core* in having the terminal and sub-terminal spots on the fore wing smaller. These spots are very variable; in my series they vary from three very indistinct spots to twenty-one in number; in the latter specimen those at the apex are very large and diffuse. They are, however, always very dull white or buff, and never as bright as in the specimens of *E. core* that I have seen. It is common all the year round everywhere, but is particularly abundant in the flights.

Settles readily at certain flowers, particularly *Gynura ceylanica* and a species of wild heliotrope; and I have frequently seen it in clusters, apparently feeding, at an exposed root or dead stick.

10. Euplœa corus, De N., B., & E.; *Macroplœa elisa*, M.—Peculiar to Ceylon, and confined to the south-west of the Island, and apparently does not occur far inland.

It is said to have been formerly common at Colombo and Galle, but seems to be getting much scarcer. I have hunted for it at all seasons of the year at Galle, but, except on one occasion, have only seen single specimens. The furthest inland I have seen it is at Kottawa, ten miles from Galle.

Its flight is slow, and it settles often, so it is very easy to catch.

11. Salpinx sinhala, De N.; *Isamia sinhala*, M.; *Salpinx kollari sinhala*, B.; *Salpinx klugii sinhala*, E.—Peculiar to Ceylon, but is only an insular race of *S. kollari* of India, from which it differs in the same way that *asela* differs from *core*, and it varies almost as much as *asela* in the number and size of the spots.

A common insect in the drier low-country. It often joins in the flights, and in December, 1902, it was for a few days by far the commonest Euplœa in the flight.

It is very common at Wellawaya, in the low-country of Uva, and at Anuradhapura. I have also taken it at Galle and Jaffna.

It is not found at high elevations, except during the flights.

12. Sticloplœa montana, De N.; *Narmada montana*, M.; *Stictoplœa coreta montana*, B. & E.—Peculiar to Ceylon, but is only a race of the Indian *S. coreta*, from which it differs in the same way as *asela* from *core* and *sinhala* from *kollari*.

It is almost as abundant as *asela* in the flights, but does not usually appear till they have been on for some days.

Like *sinhala*, it does not seem to remain at high elevations after the flights end, but it is then common in many parts of the low-country, particularly in the dry zone.

The females of the three species *asela*, *sinhala*, *and montana* are difficult to distinguish. The usual rule is—

A.—Under side fore wing: no spot in cell = *sinhala*.

B.—Under side fore wing: white spot in cell:

A 1.—No spots outside cell above veins 5 and 6 = *asela*.

B 1.—Complete series of spots between nerves immediately outside cell = *montana*.

I have specimens of both *asela* and *montana* without the spot in the cell. This variety is quite common. I have also—

Montana: Only 4 spots outside cell; no spot above vein 5.

Asela: 6 spots outside cell; spot above vein 6.

In my series of *montana*, the spots outside cell vary from 4 to 7. In *asela* from 3 to 6.

Mr. A. C. Hayley has called my attention to another means of distinguishing them, which, to judge from the specimens in my collection, seems reliable.

In interspace 1 on the under side of the fore wing—

♀ *asela* has one long milky white streak (about 10 mm. long).

♀ *montana* has two similar streaks.

♀ *sinhala* has a very minute white streak, or narrow spot, seldom over 2 mm. in length.

The males can be easily distinguished by the sex mark, which is a black shiny mark in interspace 1 of the upper side of the fore wing, as follows :—

One short narrow streak = *asela*.
Two long rather broad streaks = *montana*.
One short oval spot = *sinhala*.

Satyrinæ.

13. Orsotriœna mandata, M. & De N. ; *Orsotriœna meda mandata*, B. & E.—Found also in Southern India.

" It differs from *O. meda* in the white discal band on the under side being very much broader, and proportionately more attenuate apically " (Bingham).

It is very common here nearly all the year round in grass by the road sides or near jungle, but it does not usually frequent the open patanas away from jungle. It is common in growing paddy.

It usually varies very little in the wet or dry seasons, or at high or low elevations. I have, however, one specimen caught at Kumbukkan (500 feet) after a severe drought.

In this the white band is only half the usual width, the ocelli are much smaller, and the white marginal and sub-marginal bands on the hind wing are further apart. Others caught at the same time were quite normal.

It is common all over the southern part of the Island from sea level to over 4,000 feet, but I have not yet seen it in the Northern or North-Central Provinces.

It sometimes comes to sugar.

" Taken at Lindula, 5,000 feet, in October " (F. M. Mackwood).

14. Calysisme perseus.—Moore also gives *C. blasius*, which is the wet season form.—Found in India, Burma, Malaya, Southern China, &c. Very common at Haldummulla on grass by the road sides, or on patanas, especially above 3,000 feet.

I have found it equally plentiful at Elpitiya, in the Southern Province, on patana very little above sea level, and have taken it at Galle and Kumbukkan (Uva, 500 feet). I have never seen it in the Northern Province.

The wet and dry season forms fly together here, but all my Elpitiya specimens are wet season.

Varies very greatly in the ocelli, both on upper and under sides, and seems to grade into the next species (*C. polydecta*).

Comes to sugar occasionally.

15. CALYSISME POLYDECTA, De N.; *Calysisme mineus*, M.; *Calysisme mineus polydecta*, B. & E.—Also found in Southern and Central India. Bingham says: "There are no constant characters by which this race may be distinguished from *M. mineus*." Common in grass by the road sides, but especially an insect of the patanas. Those taken on patanas in Uva, from 500 to 2,000 feet elevation, are usually larger and more conspicuously marked than those from higher elevations.

I have no specimens from outside the Province of Uva, and have no notes of its occurrence, but believe it occurs everywhere in the hills.

It is very easy to breed, as the females lay eggs freely in captivity.

"Ratnapura and Kandy" (F. M. Mackwood).

16. CALYSISME SUBDITA, B.; *Calysisme perseoides subdita*, E.—Also found in Southern India. Not mentioned by Moore, as it only differs from *polydecta* in the sex mark of the male being much larger, and this was not regarded as a distinguishing mark when the "Lepidoptera of Ceylon" was published.

Common on the road sides at Haldummulla, especially in May, June, and July, but I have not yet taken it above 3,000 feet.

It is the only Calysisme I have taken in the Northern Province. It is common at Anuradhapura, and occurs sparingly in the Jaffna Peninsula. Rare at Galle.

It seems to come to sugar more readily than *perseus* or *polydecta*, and is very easy to breed.

"Kandy and Ratnapura" (F. M. Mackwood).

The last three species are exceedingly difficult to distinguish. The males of *perseus* and *polydecta* have a small dark brown sex mark near the dorsal margin of the under side of the fore

wing; *subdita* has a much larger ochreous one. Bingham discriminates the two former by hind wing under side :—

Posterior *three* ocelli only in a straight line = *perseus*.

Posterior *four* ocelli straight = *polydecta*.

From my specimens this does not seem entirely reliable, as I have very typical *polydecta* in which the last four ocelli are not straight, though not so much out of line as in typical *perseus*.

Personally I know no rule by which I can separate the two with certainty, as they grade almost perfectly into one another.

C. subdita has a far larger and lighter sex mark than either, but the female is, so far as I can see, quite indistinguishable from *polydecta* ♀.

The breeding experiments I have carried out so far are quite inconclusive. Being bred where the female was caught, they have, as was to be expected, bred fairly true. The very small number of collectors in the Island prohibits experiments being carried out on a large enough scale to settle the question.

17. Calysisme rama, E. ; *Calysisme drusia*, M.—Peculiar to Ceylon, and only found in the wet zone. Moore describes *C. drusia* from a single specimen taken in the Kottawa forest. *C. rama* has been taken there, and Moore's description agrees fairly well with it.

I procured specimens of the dry season form from Ratnapura in March, 1917. It differs in having the ocelli and other markings on the under side more or less obsolescent and the ground colour paler. The upper side is almost identical with that of the wet season form in both sexes.

Till recently it was only known from specimens taken at Udagama (near Kottawa) by the late Mr. John Pole. It has now been discovered to be quite common in bamboo jungle at Ratnapura.

I have never taken it personally, but have specimens given to me by Mr. Mackwood from Ratnapura, and some caught by a native collector at Kottawa.

It can be distinguished at once by the colour of the under side, which is *ochreous* brown, viz., far more yellow than in any other Ceylon *Calysisme*.

" Also Kelani Valley " (F. M. Mackwood).

18. Nissanga patnia, M. & E.; *Mycalesis patnia*, B.—Peculiar to Ceylon. Very common at Haldummulla all the year round. Frequents jungle or shady road sides. Swarms on the fallen fruit of Ficus and other trees, and comes readily to toddy or sugar, but is easily alarmed.

The dry and wet season forms at Haldummulla vary very little, those caught during the drought, June–September, being only a little brighter in colour than those taken during the November–December rains. Very dark forms may be taken in some wet districts, and I procured a fine series at Kandy in June, after a very wet May, and at Deniyaya (Southern Province) in April.

I have never seen it in the Northern Province, but it is very common in the south, at Galle and other places.

19. Lethe dynsate, B. & De N.; *Debis dynsate*, E.; *Hanipha dynsate and sihala*, M.—Peculiar to Ceylon, and a great rarity. Moore separates the variety from the hills as *H. sihala*. He says the ♀ differs from ♀ *dynsate* as follows: Narrower discal band on fore wing, more defined apical white and black spots on fore wing, under side fore wing has five sub-marginal spots instead of four, hind wing has all the spots smaller.

I find in my specimens that all the apical white and black spots on the fore wing, upper side, are better developed in my low-country specimen, which also has the fifth sub-marginal spot on the under side, though it is partly obliterated by the extra width of the white discal band.

The male of the hill form is not described by Moore.

Mine have the terminal margin of the fore wing less concave than my Ratnapura specimens; and the ocelli on the under side of the hind wing are exceedingly minute.

I have no personal experience of the habits of the low-country form, as I owe my specimens to Mr. Mackwood's generosity, but I have seen a fair number of the males of the hill form in the jungles from Haputale to Ohiya and the Horton Plains. On a fine morning they fly rapidly round the tree tops, usually settling high up. Occasionally they descend within reach, and a very quick stroke will catch them. Unfortunately their wings are very fragile, and the stroke must be quick, so I have damaged all I have caught.

I have tried sugaring for them, without result so far, but am confident that they will come, if I can find the right bait.

20. LETHE DRYPETIS, M., De N., & B.; *Lethe drypetis todara*, E.—De Niceville thought *drypetis* and *todara* were identical, *todara* being a name given to South Indian specimens, and *drypetis* to Ceylon ones. Evans gives the name *todara* to Ceylon specimens, which he thinks a distinct race. It varies very little in Ceylon, specimens from Ratnapura, taken during the rains, being almost identical with those from Haputale, taken during the drought.

Apparently found in all bamboo jungle where there is a good rainfall, and occurs at all elevations from sea level to the Horton Plains. Very common at Haputale, there being apparently many broods in the course of the year.

It comes readily to toddy, treacle, &c.

Localities: Haldummulla, Haputale, Ohiya, Kandy, Kegalla, Ratnapura, and Galle.

" Pundalu-oya " (F. M. Mackwood).

21. LETHE NEELGHERIENSIS, M. & De N.; *Lethe rohria nilgiriensis*, B.; *Lethe dyrta nilgiriensis*, E.—Also found in Southern India.

De Niceville considers it " notably distinct " from *L. dyrta* (= *rohria*).

The male differs from ♂ *rohria* in having a fourth white spot on the upper side of the fore wing, in interspace 2. I have two specimens, taken at Kandy and Haldummulla respectively, in which this spot is practically obsolete.

The female differs in having the white pre-apical band on the fore wing broken up into three white spots. I have noticed no tendency in these spots to unite and form a band.

The larva feeds on grasses; the butterfly is very common at Haldummulla in grass fields and chenas, and is very easy to catch, as it only flies a very short distance at a time. It comes occasionally to sugar.

Taken from 1,000 to 5,000 feet elevation in Uva, but I have no notes of its capture out of the Province, except the one specimen from Kandy. I believe it to be common everywhere in the hills. Flies all the year round.

" Puttalam, Kandy, Ratnapura, common at Lindula " (F. M. Mackwood).

22. LETHE DARETIS.—Peculiar to Ceylon, and confined to high elevations. Personally I have never taken it below 4,500 feet.

It is nearly always to be found settled on the banks where the earth has been cut away to make a road, and never very far from a bamboo clump.

If disturbed, it flies away rapidly, but soon settles again. Its wings are very fragile, and it is easily damaged by the net. It comes readily to toddy, &c.

February and August are, in my experience, the best months for fresh-hatched specimens, but a few may be taken all the year round.

Localities : Nuwara Eliya, Horton Plains, Ohiya, &c.

23. YPTHIMA SINGALA, M. & De N.; *Ypthima avanta singala*, B.; *Thymipa avanta singala*, E.—Also found in India.

Moore also gives *Y. thora*, but it is certainly only a variety. It differs only in having a minute sub-apical bi-pupilled ocellus on the upper side of the fore wing of the male.

The number of ocelli on the under side of the hind wing varies in my specimens from 4 to 7, and is not always the same on both wings. They also vary as much in size as in number; but this does not seem to depend on season or climate, except that I have only taken a variety with the ocelli reduced to mere specks at the highest elevations.

Specimens from Elpitiya, near Galle, taken during the rains, agree very well with those taken at Haldummulla during the drought, except that var. *thora* was proportionately more abundant at the lower elevation.

Common all over the Uva patanas from 500 to over 5,000 feet; Galaha, near Kandy; and Elpitiya, near Galle. Flies all the year round at Haldummulla.

" Also Galboda and Pundalu-oya " (F. M. Mackwood).

24. YPTHIMA CEYLONICA, M., De N., & E.; *Ypthima huebneri ceylonica*, B.—Also found in Southern India.

Common everywhere all the year round, especially along road sides. The variation in the size of the ocelli in this species seems largely to depend on temperature. I have taken

specimens with exceptionally large ocelli at Kottawa (wet zone) and Jaffna (dry zone). They vary slightly, according to the season, at Haldummulla.

I have noticed swallows eating them. I have a variety of the female in which the ground colour is very pale ochreous brown.

25. MELANITIS ISMENE, M. & B.; *Melanitis leda ismene*, E.—Also found in Africa, Asia, and Australia.

Moore divides *ismene* and *leda* as two species. Bingham says *ismene* is the dry and *leda* the wet season form; *leda* I have found commonest in growing paddy; elsewhere *ismene* is far more plentiful, at any rate in Uva.

As regards the under side, this is the most variable butterfly in Ceylon, and the variations, in the *ismene* form, do not seem to be dependent on climate or elevation.

Flies very little in the day time, but starts at dusk, when it has a very jerky and fairly rapid flight, and is not easy to catch. The bad light, of course, is against success. Comes very readily to sugar after dark till, at any rate, 9 P.M. It also comes in the day time in shady places, but is very shy then.

Very common, and flies all the year round. I have taken a few specimens in the Jaffna peninsula (all *ismene* form).

26. MELANITIS TAMBRA, M.; *Melanitis bela tambra*, B.; *Melanitis phedima tambra*, E.—Peculiar to Ceylon.

Much more a jungle butterfly than the last, especially the black, or wet season, form. The red, or dry season, form seems particularly fond of the shade of jak trees, and its under side, when settled, matches the dead leaves well. The black form is much the rarer here, and always settles on the ground in the thickest undergrowth, so is difficult to capture, except at sugar.

In habits otherwise they are similar to *ismene*, flying little by day, but coming out at dusk. They come to sugar in the same manner, but are, perhaps, even more shy in the day time. I have not yet succeeded in getting the female to lay eggs in captivity. I have specimens from Haldummulla, Kandy, Ratnapura, and Kottawa.

" Caught also at Hambantota " (F. M. Mackwood).

27. ELYMNIAS FRATERNA, M.; *Elymnias undularis fraterna* B., *Elymnias hypermnestra fraterna*, E.—Peculiar to Ceylon but De Niceville thinks it only a local variety of *E. undularis*. He says the female is identical, and the male only differs in the narrower ferruginous border of the hind wing, and in having scarcely any traces of the blue marks on the fore wing.

Bingham says the ♂ differs in having the terminal margin of hind wing ochraceous, not chestnut. ♀ has the oblique preapical white band on fore wing narrow, its margins even.

The males in Ceylon are extremely variable. In those in my collection the width of the ferruginous band, taken at the widest spot, viz., vein 4, varies from 6 to 10 mm. In one the fore wing is entirely blackish-brown, with no trace of blue. In a second the colour is the same, with three very conspicuous elongated sub-apical blue spots. In a third there is a terminal marginal border of ferruginous, narrowing from the apex to the tornus, and two faint sub-apical blue streaks. In a fourth there is a complete row of sub-terminal blue spots, much elongated at the apex, thus approaching very near to *undularis*, but the terminal border on the hind wing is exceptionally pale and wide, and has white sub-terminal spots in interspaces 2, 3, and 4.

The female varies much in the width of the sub-apical white band.

The flight is slow, and it always settles low down, though very seldom actually on the ground. The female is a mimic of *S. plexippus*. In most cases of mimicry in Ceylon an experienced collector can usually distinguish the mimic by its different flight. *E. fraterna*, however, is far better as a mimic on the wing than in the cabinet, and very frequently deceives me. Possibly this may be due to the fact that it usually flies low, and is seen from above, as a bird would probably see it. If seen from below the under side would, of course, destroy the illusion.

Rare at Haldummulla, but very common in the coconut districts, especially where the palms are low, in new clearings, &c. The larvæ and pupæ may often be found on pot palms in low-country verandahs.

Found from sea level up to at least 3,000 feet. I have found it commonest at Kurunegala, Polgahawela, and the southern sea coast from Ambalangoda to Weligama.

28. Elymnias singhala, M. & B.; *Dyctis singhala*, De N.; *Melynias singhala*, E.—Peculiar to Ceylon.

Peradeniya is the headquarters of this insect, but it occurs sparingly in widely scattered localities. I have caught four specimens only at Haldummulla, two in 1889, when I was starting my Ceylon collection, and therefore catching everything, and one each in November of 1914 and 1915.

It is very like an *Euplœa* on the wing, and so I believe often escapes notice. It is very easy to catch when identified.

It is rare in the Kottawa forest.

" Numerous in Ratnapura District " (F. M. Mackwood).

Morphinæ.

29. Discophora lepida.—Also found in Southern India.

The male varies much in the number and size of the ocelli on the under side of the hind wing. I have one specimen with five perfectly formed and fairly large ocelli.

A great rarity till its habits became known; the male is now easily obtainable, but the female is a prize.

The male flies all the year round, but does not appear till dusk. It has its particular haunts, and a few may be found there any evening, flying backwards and forwards, with a very jerky and rather fast flight. Thanks to the bad light, they are then difficult to catch. I have searched frequently in a small jungle where I knew there were plenty, but have never succeeded in putting up a male in the day time. The only two females I have seen on the wing were both flying in the middle of the day. The ♂ comes readily to sugar as soon as it is dark; the ♀ is said to come in the day time (especially to over-ripe jak fruit), but is very shy. Possibly, like *M. ismene*, both would come better at night, and be easier to catch. Personally I have not yet tried sugaring for them after 7 P.M.

Bell says the females come to meet the males in their evening flight, and thinks they are attracted by the strong scent the males are notorious for. He describes the scent as that of a mixture of apples and lemons. (" Common Butterflies of the

Plains of India.") If this is so, the females might be caught by enclosing a few males in a muslin cage, and watching near, preferably after dark.

A well-known haunt of the males is behind Kottawa rest-house, where the stream leaves the jungle.

Common at Galle, Ratnapura, Balangoda, Avissawella, and probably in all bamboo jungle in the south-west of the Island.

Nymphalinæ.

30. Haridra psaphon, M. & E.; *Charaxes psaphon*, B.—Moore describes the ♀ as *Haridra serendiba*. Peculiar to Ceylon, but allied to *H. imna* of Southern India.

Not at all a rare fly in the low-country, but it is difficult to capture, especially the female.

The male is very fond of settling on wet roads, and can also be taken feeding on sap exuding from the trees, or on sugar. It is rather shy when settled on the roads, but I caught half a dozen at one patch of sap, and it was difficult to make them fly.

The female is far more often seen at Haldummulla than the male. It is then nearly always flying straight and very fast; it never seems to settle, and is almost impossible to catch. It is evidently migrating in search of fresh breeding grounds. I have seen it once at sugar; the moment the net approached it shammed dead and fell into the undergrowth and escaped.

It is commonest in Uva during the south-west monsoon, but may be taken in March and April. It does not seem to fly above an elevation of about 3,000 feet.

"Caught at Kandy, Dambool, and Trincomalee" (F. M. Mackwood).

31. Charaxes fabius, M., De N., & B.; *Haridra fabius*, E.—Also found in India and Burma.

In habits it is very much like the ♂ *psaphon*.

It is very frequently seen on the wet roads in the low-country of Uva, and comes readily to sugar. It is rather rare at Haldummulla, and I have never seen it above 3,000 feet.

May be found all the year round. I have taken it at Jaffna, Anuradhapura, and Trincomalee, and it is probably to be found wherever the tamarind tree flourishes.

32. Eulepis athamas, B. & De N.; *Eulepis samatha*, M.; *Eulepis athamas agrarius*, E.

E. athamas is found all over India and Burma. Messrs. Rothschild and Jordan, however, separate *agrarius* as a race occurring in Southern India and Ceylon. It varies a great deal in the width of the yellow band and the size of the two pre-apical spots.

Very common at Haldummulla, especially during the south-west monsoon, and I have taken it at Haputale (5,000 feet).

It may be found day after day in the same place. It settles high up on a leaf, and flies round very fast, returning to the same place, and is very difficult to catch. It comes occasionally to sugar, especially if mixed with well-fermented toddy, but it much prefers carrion.

I have noted it at Haldummulla all the year round, except in the strong wind in January and February, and have also taken it at Kandy, Rambukkana, and Trincomalee.

"In my experience the ♀ is exceedingly rare, as regards captures" (F. M. Mackwood).

33. Rohana camiba, M.; *Apatura camiba*, De N.; *Rohana parisatis camiba*, E.; *Apatura parisatis camiba*, B.—The race *camiba* is also found in Southern India. *Parisatis* is found in Northern India, Burma, Indo-China, and Southern China.

It differs from *parisatis* in the number of the very minute pre-apical white spots in both sexes. In the ♂, *camiba* has three spots, *parisatis* only one. In the female, *camiba* has four or five spots, *parisatis* usually three.

Two of the four specimens of ♂ *camiba* in my collection have four white spots, but the fourth is minute, and may escape notice; another has four on one wing and three on the other.

The females are extremely variable in colour and clearness of markings.

The male is common and easy to capture, but it nearly always manages to rub its wings badly in the net. The female is much scarcer, and is usually found in jungle; it also seems very hard to capture in good condition.

Found up to 6,000 feet elevation, or higher.

Localities: Haldummulla, Haputale, Ohiya, Kandy, Kegalla, Trincomalee, &c.

34. PARTHENOS CYANEUS, M.; *Parthenos virens cyaneus*, B.; *Parthenos gambrisius cyaneus*, E.—Peculiar to Ceylon. It varies very little, and seems to be a well-established race or sub-species.

Above 2,500 feet it seems rarely to settle, but is always seen flying fast and straight across country. In the low-country its behaviour is quite different; it is usually found in jungle, and settles high up in the trees, going off occasionally for a rapid fly round, but nearly always returning to the same spot. From this I fancy that the up-country specimens are probably all females searching for new breeding grounds. Unfortunately they are very hard to catch, so I cannot be certain.

Occurs at Haldummulla all the year round. In December and January the high wind sometimes forces them to settle in the tea, and they are then easy to catch.

I have taken them on the Horton Plains (7,200 feet), and at Haputale (5,000 feet), Wellawaya (600 feet), Ratnapura, Kottawa, and Kegalla, and believe they are common wherever there is a fair rainfall.

"Plentiful at Henaratgoda Gardens at times and at Kandy" (F. M. Mackwood).

35. SYMPHÆDRA NAIS, M. & De N.; *Euthalia nais*, B. & E.—Also found in Southern India and the Himalayas.

Very variable in the amount of black on the upper side and white below.

Very unlike the other *Euthalias* in Ceylon, both in appearance and habits, except that both sexes come readily to toddy. The latter are far more like those of a *Junonia*. It almost invariably settles on the ground, and if disturbed, flies very quickly for a short distance, returning to the original spot, usually in a few minutes. Very rarely individuals seem to be afflicted with the migrating mania, and may be met a few miles from their haunts, flying very fast and straight. These sometimes settle, but if disturbed go on straight away. I have noticed them in March and August on this estate, going straight in the direction of Adam's Peak. If these are efforts to find new breeding grounds, they do not appear to be very successful.

They are, so far as I am aware, only common in one very limited area in Ceylon, viz., a stretch of quartzy patana, reaching from Ranungahawa, four miles below Haldummulla, to Kumbukkan (25 to 30 miles).

This patana crosses the Wellawaya-Haldummulla road near the 127th milepost; the butterfly can nearly always be taken there. I have found it abundant there in March, May, and August, and at other parts of the patana in July and November.

36. Dophla evelina, M., B., & E.; *Euthalia evelina*, De N.—Peculiar to Ceylon, but very near *D. laudabilis* of Southern India.

Occasionally very common in parts of the low-country of Uva, but very rarely comes above 2,000 feet. It is fond of settling in wet sand on the river beds, or where sap is exuding from a tree, and both sexes come very readily to toddy.

The largest numbers I have ever seen were at Hambegama tank in June. It is not rare at Wellawaya, and I have taken it once at Haldummulla, 2,500 feet. Very plentiful at the hot springs near Trincomalee in November.

"Anuradhapura, Labugama, Ratnapura" (F. M. Mackwood).

37. Euthalia lubentina.—Also found in India, Burma, Malaya, China, &c.

The Ceylon race is now said to be distinct, and has been named *psittacus*.

The larva feeds on *Loranthus*, and the insect is nearly as widely distributed as the food plant, but it seems to be common nowhere. I have taken it on fallen nutmegs near Galle, in sandy river beds in the low-country of Uva, on a Duranta hedge in my garden (3,000 feet), and in jungle above Haputale (over 5,000 feet). I have specimens from Kandy and Ratnapura, and know of its capture at Badulla.

The sexes seem to occur in about equal numbers, and both come to sugar, or settle on wet sand. In this latter characteristic the *Euthalias* differ from the majority of Ceylon butterflies, as, in other genera, those settling on wet roads or in sandy river beds are almost invariably males. *Appias*, *Catopsilia*, and *Libythea* are the only others I can remember that agree with the *Euthalias* in this respect.

"Comes to fallen fruit under lime trees" (F. M. Mackwood).

38. Euthalia garuda, M., B., & De N.; *Euthalia garuda diversa*, E.—Found in India, Burma, Malaya, &c.

Bingham says the ♂ *vasanta* differs from the ♂ *garuda* in having no white spots on the fore wing. If this is correct, *garuda* has a certain claim to a place in a Ceylon list. My experience is that at least 20 per cent. of the males I have seen have shown signs of these white spots, many having a complete series of four discal and two sub-apical spots. Mr. Mackwood, who has been collecting for fifty years in the Island, has never seen a Ceylon specimen of a ♀ *garuda*, so I think there can be no doubt that it does not exist, but that the ♂ *vasanta* is variable, and approaches very near to *garuda* in markings. Four males in the Museum collection show the white spots well; they are labelled *garuda*.

39. Euthalia vasanta, M., De N., & E.; *Euthalia garuda vasanta*, B.—Peculiar to Ceylon.

The larva feeds on mango and cashew-nut trees, and the butterfly is to be found wherever these grow, though I have not yet seen it in Jaffna.

Both sexes are equally common and have the same habits. They are fond of settling on wet roads, and come readily to decaying fruit or sugar. They are rather shy and have a very strong flight, so are not easy to catch in perfect condition.

The male varies as already stated (see remarks on *garuda*); the female varies in the width of the white discal band, but it is always straight from the costa to interspace 2, not at all resembling that of the ♀ *garuda*.

Localities: Colombo, Kandy, Galle, Kegalla, Trincomalee, Haldummulla, &c.

40. Moduza calidasa, M.; *Moduza calidosa*, De N.; *Moduza procris calidasa*, B. & E.—Peculiar to Ceylon.

De Niceville thought it "quite distinct" from *procris*. It differs from it in its quite different ground colour, different shape of the white discal band, and entire absence of the white spot at the end of the cell. Moreover, in no specimen that I have seen is there any tendency to grade.

May be found at Haldummulla all the year round, but is commonest during the south-west monsoon.

It settles frequently on flowers, but is extremely shy and difficult to catch. In the dry low-country it settles on the wet roads; I have never known it come to sugar.

Localities: from sea level to over 5,000 feet. Common at Haputale and Namunukula (high), Haldummulla and Badulla (medium), and Wellawaya (low), in the Province of Uva. Common at Kottawa.

"Extremely plentiful at times in the Kandy District at lantana" (F. M. Mackwood).

41. NEPTIS JUMBAH, B. & De N.; *Neptis jumba*, M.; *Andrapana jumbah*, E.—Also found in India and Burma. Ceylon specimens have recently been named *nalanda*, as a separate race. It varies extremely in the amount of white on the upper side and the black shadings below.

Common at Haldummulla all the year round, except during the heavy winds in January and February. It joins in the flights in large numbers, and when these are on it can be easily captured by walking it up in the tea in the early morning, as it then only flies a short distance. Later, when the sun gets hot, it flies straight and seldom settles. When not flighting it settles freely on *Lantana* and other flowers.

Localities: from sea level to the Horton Plains, and from Galle to Vavuniya. I have, so far, no notes of its occurrence north of the latter place.

42. NEPTIS VARMONA, M. & De N.; *Neptis eurynome*, B.; *Neptis hylas varmona*, E.—Also in India. It differs mainly from *eurynome* in being smaller.

Extremely abundant everywhere, though more so in the south than in the north. Freshly-hatched specimens can be taken in every month of the year at Haldummulla. It does not join the flights.

Considering its abundance at all seasons and elevations, it varies extremely little, but aberrations, such as *N. disrupta*, Moore, are occasionally met with. *Disrupta* and *kamarupa* are now given as the names of the extreme wet and dry season forms respectively of the Ceylon race. Personally I have failed to observe any tendency to seasonal variation here, and consider *disrupta* to be only an aberration. I do not know *kamarupa*.

In *Neptis* the males can be distinguished from the females by the enlargement of the costa of the hind wings, the distance between vein 8 and the costa being twice as broad in the male as in the female.

43. Rahinda sinuata, M. & De N.; *Rahinda hordonia sinuata*, B. & E.—Peculiar to Ceylon. It differs constantly from *hordonia* "in the margins of the discal markings (especially the outer margins) on the upper side of the fore wing and the margins of the sub-basal and post-discal bands of the hind wing being more sinuous" (Bingham). It varies considerably in the amount of yellow on the upper side.

Very common at Haldummulla in jungles or chenas where there are plenty of thorny Acacias. It is fond of settling rather high up on these, but if disturbed only flies a short distance, so can usually be driven to a more favourable spot for capture. Especially common in May and June.

Found from 500 to over 5,000 feet elevation in Uva. I have also taken it at Madampe and Ratnapura, and believe it to be common everywhere in the hills.

44. Junonia iphita, B. & E.; *Precis iphita*, M. & De N.—Also found in India, Burma, Malaya, and China. Very abundant everywhere nearly all the year round. Appears in great numbers in the flights, especially in November-December. Except during these flights, specimens taken in the hills are usually ragged and faded. I have seen it in thousands in the sandy beds of low-country rivers, when practically every specimen appeared to be newly hatched out. From this I imagine it mainly breeds at low elevations.

45. Junonia atlites, B., De N., & E.; *Precis laomedia*, M.—*Laomedia* is the wet season form. Also found in India, Burma, Malaya, &c.

In habits it is very much like the last, but it is rather scarcer up-country, and even fair specimens are much harder to get in the hills. I have seen it plentiful on the sea beach in the south, particularly at Galle in September. These all appeared to be freshly hatched. It appears up-country usually in October, before the regular flights begin, and the swarm only lasts a few days. Stragglers are fairly plentiful in November and December, but for the rest of the year they are scarce.

I have no records of its occurrence in the Northern Province, or at any very high elevation. It is extremely abundant at Kurunegala and Polgahawela in November.

" I have caught it at Anuradhapura and Pattipola " (F. M. Mackwood).

46. JUNONIA ORITHYA, M. & B.; *Junonia orithyia*, De N. & E.—Found also in India, Burma, Southern China, &c.

Does not join in the flights. It is extremely common all the year round in the grass fields on this estate, and all places round Haldummulla where the grass is fairly short. It is easily alarmed, and flies fast for a short distance. It never seems to fly far, but can be found in the same spots day after day. It usually settles on the ground, except when roosting for the night, when it selects a low plant about a foot or less in height. It can be walked up in the late evening, and is then very easy to catch.

It is extremely variable. Specimens from the Northern Province are much smaller than those from Haldummulla. The costa and apical markings on the fore wing are nearly pure white, whereas in the hill specimens they are pale buff; the under side also is much lighter. Specimens from the low-country of Uva taken during the dry season are intermediate between the two forms. The female is also extremely variable, at all seasons and localities, in the amount of blue on the lower wings.

Found everywhere from Galle to Jaffna, and from sea level to over 6,000 feet.

47. JUNONIA HIERTA, De N., B., & E.; *Junonia œnone*, M.—Also found in India, Burma, and Southern China. Mainly confined to the Northern Province.

I have seen it in great numbers at Kankesanturai in December and January. It is common at Elephant Pass, but specimens there are much smaller than those from the north coast. I have also taken it at Giant's tank, and two specimens at Anuradhapura. Its habits are similar to those of *J. orithya*.

In 1916 this butterfly appeared at Trincomalee, Kandy, Colombo, Galle, and Tangalla, where it had not been seen for many years past. Specimens I caught were in perfect condition,

and certainly did not look as if they had " flighted " for any great distance.

The female varies a great deal, especially as regards the blue spot on the lower wing. Often it is entirely absent, while in other specimens it is as large as that of the male, but of a more lilac shade.

48. JUNONIA LEMONIAS.—Also in India, Burma, Malaya, China, &c. Occasionally very numerous at Haldummulla during the flights in November-December, but does not appear as regularly as *J. iphita* or *atlites*.

In the low-country of Uva it is common nearly all the year round. It is particularly fond of settling on wet roads or in the sandy beds of rivers.

The under side is extremely variable, and the variation does not seem to depend much upon season.

I have one specimen caught at Haldummulla, in which the under side is of a bright peach colour.

Found everywhere, though I have no records of its capture at the highest elevations. It is extremely plentiful in the Northern Province.

49. JUNONIA ALMANA, B. & E.; *Junonia asterie*, M.—Also found in India, Burma, Malaya, China, Japan, Dutch Indies, &c.

J. asterie is the wet season form of *J. almana*. The dry season form is rare in Ceylon, and I have never caught it, but Mr. Mackwood has shown me one or two specimens. It should be plentiful in the Northern Province.

Almana is rather rare at Haldummulla, though single ones sometimes appear, chiefly in the south-west monsoon. These are almost invariably poor specimens. It is very abundant all over the low-country from Galle to Jaffna, especially in chenas, paddy fields, and the borders of tanks.

50. CUPHA PLACIDA, M. & B.; *Cupha erymanthis placida*. E.—Peculiar to Ceylon.

It differs from *erymanthis* as follows: " Fore wing: discal band distinctly darker yellow, with its inner and outer margins much less sinuous and irregular, the black line defining the inner margin more slender; the spots on the band in interspaces 1, 2, and 3 much smaller, especially the spot in interspace 1, which is no larger than the others, and is

diffuse and ill-defined. The sub-apical yellow spots on the black area entirely wanting, or, if present, diffuse and indistinct" (Bingham).

My specimens vary greatly in all these respects. In nearly all my specimens the spot in interspace 1 is far larger than those in 2 and 3, though not so large as in Bingham's figure of *erymanthis*.

Common wherever there is a fair rainfall. It always seems abundant at Watering Point, Galle, but is found at all elevations, and apparently all the year round. I have never seen it north of Vavuniya.

It settles on bushes usually about 5 to 8 feet from the ground. If disturbed, it dives into the thickest growth, and is therefore very difficult to capture in first class condition.

51. CETHOSIA NIETNERI.—Peculiar to Ceylon.

I have records of its occurrence at Haldummulla in every month but January, but it is most numerous during the south-west monsoon.

It is one of the easiest insects to catch, owing to its slow hovering flight; its wings are not so delicate as they look, and are seldom damaged in the net.

It usually varies little, except in size, but I have one male in which the ochraceous patch on both wings is missing.

Found all over the low-country from Galle to Vavuniya, and up to 6,000 feet (Ohiya) at least, but it seems to be most plentiful at a fair elevation, say 2,000 to 4,000 feet.

52. CYNTHIA ASELA, M., De N., & B.; *Cynthia erota asela*, E.—Peculiar to Ceylon.

"♂ absolutely indistinguishable from the wet season form of *E. erota*" (Bingham). The female differs in having the white discal band very much narrower and only extending to vein 6 on the hind wing, whereas in *erota* it extends to vein 2. The series of females in the Colombo Museum vary extremely in the width of this white band. In some it is almost obsolete on the hind wing, in others it extends to vein 5. In two of my specimens it just extends over vein 6.

The male is common at Haldummulla from May to August. It usually basks high up on trees, taking short flights and returning to the same spot. It is also very frequently found

settled on wet patches on the roads. It is then very easy to approach and capture. The female is rarer, and is usually seen flying fast and straight; it, however, stops at flowers occasionally. I once saw a large number at the blossom of *Acacia cæsia* while travelling in the coach from Kegalla to Polgahawela.

Localities: Galle, Kandy, Wellawaya, Nuwara Eliya. "Ratnapura" (F. M. Mackwood).

53. CIRROCHROA LANKA; *Cirrochroa thais lanka*, E.—Moore separates it into *thais*, *lanka*, and *cognata*, and De Niceville added *swinhœi*.

It is very questionable whether our Ceylon specimens are distinct from the South Indian *thais*. Bingham says: "After carefully examining a long series of specimens from Southern India and Ceylon, I am quite unable to find any constant characters that would serve to distinguish *C. lanka*, Moore, from *C. thais*, Fabr."

He entirely ignores *cognata* and *swinhœi*.

Personally I agree with him that there is only one species in Ceylon. The more specimens I examine, the greater difficulty I find in splitting up the species. It is exceedingly variable, but all varieties seem to grade.

The males can be usually distinguished by the entirely different shape of the fore wings. They also have a sex-mark, the terminal half of veins 5, 6, and 7 being coloured black, with a narrow yellow margin of specialized scales.

On one occasion, in November, I was walking from Wellawaya to Koslanda, and on the first five miles of the road there were many thousands of the males settled on the wet patches. Both sexes often settle at flowers, but I have not found it easy to catch perfect females.

About twelve years ago I found a small tree on Eadella estate, Polgahawela, entirely defoliated by the larvæ. I collected a few pupæ, but they had evidently been starved, as all hatched out dwarfed or deformed.

I have notes of its occurrence in every month at Haldummulla, but it is only plentiful in the flights.

Other localities: Galle, Kegalla, Wellawaya, Anuradhapura, Trincomalee, &c. "Matale and Ratnapura" (F. M. Mackwood).

54. HYPOLIMNAS BOLINA.—Moore also gives *jacintha*, which is only a variety. Found also in Southern Asia and Australia.

In his key to the genus *Hypolimnas*, Bingham says *Bolina* can be distinguished by having "fore and hind wings with a post-discal series of white spots always present." Specimens can be found in Ceylon with no trace of these spots on the fore wing, and only very minute specks on the hind wing.

Common at Haldummulla all the year round, but especially in December, when it appears in swarms in the tea. By walking it up in the evening, after it has gone to roost, it can easily be captured in any number, and a fine series of varieties selected. As is usual in Ceylon, both dry and wet season forms fly together.

The male is an exceptionally long-lived fly. A battered specimen will take up its position on one branch for several weeks, flying off to attack any fair-sized butterfly that passes. I have known them drive away *Kallimas* that wished to settle on sugar. They do not seem to be attacked at all by birds, or to take the slightest notice of them.

Localities: everywhere from sea level to Nuwara Eliya.

55. HYPOLIMNAS MISIPPUS, De N., B., & E.; *Apatura misippus*, M.—Found in Asia, Africa, Australia, and North America.

Usually rather rare at Haldummulla, except at one spot in the tea here, where there is frequently a single male. In December, however, it often appears in great numbers. In these swarms the females are much commoner than the males, which is unusual at other times. The *chrysippus* form is always much commoner than the *dorippus* one, though the latter is often plentiful. On one occasion I was walking to Tanamalwila, on the Wellawaya-Hambantota road, and *misippus* was in thousands, both males and females, settling on the road from about the 36th to the 28th mile. I could have caught any number of the *dorippus* variety, but could not find one perfect specimen. In the north, where the *chrysippus* form is abundant, I have only twice seen the *dorippus* form.

The *alcippus* form, with white lower wings, is not, I believe, found in Ceylon, but I have caught a specimen at Jaffna with a small but conspicuous white patch on the upper side of the lower wing.

Localities: it seems to prefer the drier portions of the Island, though it occasionally visits the wet zone.

56. VANESSA CARDUI, B. & E.; *Pyrameis cardui*, M. & De N.—Commonly known as the Painted Lady.

Found all over the world, from New York to Nuwara Eliya.

Single specimens may be seen anywhere all the year round, but in many localities great numbers suddenly appear, though it does not seem to flight.

I have noticed these big hatches at Galle (twice) and Jaffna. I have also found the larvæ in great abundance at Galaha, near Kandy.

"Caught on the very top of Pedrotalagala" (F. M. Mackwood).

57. VANESSA INDICA, B.; *Pyrameis indica*, M. & De N.; *Vanessa indica nubicola*, E.—The form *nubicola* is restricted to Southern India and Ceylon, but it is doubtful if it is distinct from *indica*, which is found in Southern Europe, Canaries, China, Japan, &c.

It is said to differ from *indica*, in that "the outer margin of the hind wing is comparatively much more broadly black."

I have never caught this butterfly below 4,500 feet, but it is very common at times above that elevation.

It is not difficult to catch, but the easiest way to get perfect specimens is to collect the pupæ.

The larvæ feed on *Heterophylla palmata*, and tie the leaves into a ball about the size of an orange; the pupæ can be found inside these balls, which are very conspicuous. The best implements for collecting them are a pair of scissors and a biscuit tin, as the sting of the nettle is painful, though it passes off quickly.

In Vol. VII., Part 38, of "Spolia Zeylanica," Mr. E. E. Green describes two abnormal varieties of this hatched from larvæ brought down from Diyatalawa to Peradeniya, where they pupated. He thought the aberration might be due to

change of climate. I have taken pupæ from Haputale to Galle in the hottest months, but all have hatched normal. I could not get food for the larvæ there, or would have tried with them.

Localities: Haputale, Ohiya, Pattipola, Nuwara Eliya, &c.

58. VANESSA HARONICA, M. & De N.; *Vanessa canace haronica*, B.; *Kaniska canace haronica*, E.—Peculiar to Ceylon.

It differs from *canace* as follows: "The broad blue band is discal, not post-discal, and anteriorly is continuous with the broad short oblique bar beyond the cell, not commencing, as in *canace*, below the pre-apical white spot. On the hind wing the band is without the series of black spots, but beyond it there is a transverse post-discal row of small blue spots" (Bingham).

Specimens showing any signs of grading into *canace* are very rare. There is one specimen in the Museum collection in which the blue band on the upper wing is distinctly forked, the outer branch continuing to the pre-apical white spot. In a few cases, where the blue band is especially wide, there are distinct signs of the post-discal black spots on the lower wing. In general appearance, however, the two butterflies are very distinct.

Moreover, according to authorities quoted by Bingham, their larvæ are most distinct, as follows:—

Canace.—"Segments alternately orange and white, with numerous black spots on the orange segments, and black streaks on the white. Seven white branching black-tipped spines on each orange segment."

Haronica.—"Light red, spotted with black, the segments divided by blackish and purplish lines, anal segment slightly humped, segments armed with eight longitudinal rows of yellow branched spines."

Very common at Haldummulla and fairly easy to catch. It comes readily to sugar, but is very shy. Very common at Haputale and Ohiya, but seems scarcer at lower elevations, though a few have been taken at Galle.

"Very plentiful in the highest mountain passes, Matale to Rangalla" (F. M. Mackwood).

59. KALLIMA PHILARCHUS, M.; *Kallima horsfieldi*, B.; *Kallima horsfieldi philarchus*, E.—Peculiar to Ceylon, but is very near *K. horsfieldi* of Southern India. It differs in being rather larger and of a more brilliant blue, but is subject to considerable seasonal variation.

Rare at Haldummulla, except occasionally in December. The flight nearly always starts in Christmas week, and usually only lasts a few days. In December, 1914, they arrived early in December, and were plentiful for the whole of that month, but at Haputale, Ohiya, &c., viz., at a higher elevation, they remained in fair numbers till April. During these flights they are common on the Horton Plains (7,000 feet), but seldom seem to reach Nuwara Eliya. In parts of the low-country of Uva they are usually very abundant in July, but very few of this brood migrate up-country. They are extremely easy to catch, as they cannot refuse toddy, treacle, &c., especially mixed with rum.

They are pursued by Drongoes (*Dicrurus leucopygialis*), but I have never seen one eaten, the bird almost invariably taking a triangular piece out of one of the lower wings. Whether he finds this distasteful or not I cannot say, but he never seems to continue the pursuit of that individual, though the next one to pass is probably treated in the same manner. At least 50 per cent. of those taken at sugar in open country will be found to have been damaged. The birds seem quite unable to see them when settled, though they do not make the most of their resemblance to a dead leaf. If settled on a twig with the tail towards the base and the fore wing well drawn out, the resemblance is perfect; but they usually settle with their heads towards the base, and the fore wing more than half covered by the lower, when the resemblance is far inferior.

"Of late fairly plentiful at Kandy and Ratnapura" (F. M. Mackwood).

60. DOLESCHALLIA BISALTIDE, M.; *Doleschallia polibete*, De N.; *Doleschallia bisaltide malabarica*, B.; *Doleschallia bisaltide ceylonica*, E.—Evans writes in his list: "There is not sufficient material in the British Museum to judge whether these races are worth retaining."

It varies a little on the upper side, but very greatly on the under side in Ceylon specimens.

Usually very rare at Haldummulla, but sometimes appears in fair numbers in the tea in November and December. It settles, usually low down, on the side of a tea bush, so only gives room for a very awkward stroke with the net between the bushes ; it also requires very careful stalking, so is not easy to catch. I have never succeeded in attracting it with sugar or other baits.

Localities: Kandy, Badulla, &c. "Ratnapura" (F. M. Mackwood).

61. ARGYNNIS HYPERBIUS, B. ; *Acidalia niphe*, M. ; *Argynnis hyperbius taprobana*, E.—*A. hyperbius* is found in India, Burma, Abyssinia, China, Japan, &c., but it is possible that our Ceylon specimens form a local race, though they only differ in the slightly darker ground colour. They vary extremely little.

It is common at high elevations nearly all the year round, and is usually found on the patanas near jungle. It settles on the ground, or low down, and is very easy to catch, as it only flies a short distance if disturbed.

I have seen one straggler (♀) as low as Haldummulla (3,000 feet), but it is very rare below 4,500 feet.

Localities : Nuwara Eliya, Horton Plains, Haputale, Maskeliya ; in fact, wherever the wild violet grows.

62. ATELLA PHALANTA, M. & E. ; *Atella phalantha*, De N. & B.—Found in Africa, India, Burma, Malaya, China, &c.

Common at Haldummulla nearly all the year round, except in September and October, viz., the end of the dry season. Sometimes it flights in very great numbers. When flighting, it goes fairly fast and straight, but at other times it settles on flowers, &c., and is very easy to catch. In the dry low-country it swarms on wet patches on the roads.

Common from Galle to Jaffna and at all elevations up to 6,000 feet at least.

63. ATELLA CEYLONICA ; *Atella alcippe ceylonica*, B. & E.—Peculiar to Ceylon. Differs from *alcippe* " in the broad immaculate black apex of the fore wing in both sexes and on the greater breadth of the terminal band on both fore and hind wings " (Bingham).

I know nothing of this, so asked Mr. Mackwood for particulars. He writes: "*Atella ceylonica* is a distinct species or sub-species. Major Manders described it. So far it has only appeared in one valley in the Nitre Cave, surrounded by 6,000 feet hills, except towards the north-west and east, where it faces the Bintenna country. The butterflies are found from 2,000 to 4,000 feet. Principal appearance, May–June. A few at end of the year."

I possess a pair given to me by Mr. Mackwood.

64. Ergolis taprobana, M. & De N.; *Ergolis merione taprobana*, B. & E.—Also found in Southern India. A well-defined race, which, in Ceylon at any rate, shows very little variation.

Common all over the Island up to 6,000 feet at least. The wings, especially of the females, seem to split extremely easily, and perfect specimens are not easy to procure.

Found at Haldummulla all the year round, but is only numerous in the flights. I have seen it at Galle, Jaffna, Mannar, &c., and up to 6,000 feet at Ohiya.

65. Ergolis ariadne, De N., B., & E.; *Ergolis minorata*, M.—Also in India, Burma, Malaya, Formosa, &c.

Flights with the last at Haldummulla, but is rather more numerous. It is far easier to catch perfect.

It is found in the same localities as the last, viz., all over the Island.

66. Byblia ilithyia, M., De N., & B.; *Byblia ilithia*, E.—Central and Southern India, Africa, Arabia, &c.

An extremely local fly, and is apparently gregarious. In March, 1909, I found numbers settled on a small bush at Palatupane, in the Hambantota District, but in all my subsequent visits there I have never seen another specimen.

I have specimens from Anuradhapura and Giant's tank, and caught one very battered female at Kankesanturai, probably the sole survivor of a brood.

It is apparently confined to the driest districts of the Island.

If disturbed, it flies off fast and low, but is almost certain to return in a few minutes, and can be found in the same place day after day.

Acræinæ.

67. TELCHINIA VIOLÆ.—Also found in India.

Very common everywhere, from sea level to 6,000 feet at least. I have seen it in every month at Haldummulla. Prefers open country to jungle, and is very easy to catch. It can be found in the same place day after day, and if disturbed seldom goes more than a few yards.

LEMONIIDÆ.

Libythæinæ.

68. LIBYTHEA MYRRHA.

69. LIBYTHEA RAMA.—*L. myrrha* is found in India, Burma, Malaya, and China. *L. rama* is a race or variety from Southern India and Ceylon.

Bingham says : " Var. *rama*, Moore, is the smaller southern and Ceylon form, with the orange markings much narrower and restricted, and the pre-apical double spots entirely white, or white slightly suffused with yellow."

My specimens of *rama* also differ from *myrrha* in the shape and colour of the lower wings, which are more scalloped along the termen, and on the under side variegated with light and dark gray ; while in *myrrha* they are uniformly coloured, without conspicuous markings.

Both forms fly together at Haldummulla and show very slight signs of grading, but in a large number of specimens which I have examined *the " rama " are always males and the " myrrha " always females.* This seems to point to the conclusion that they are the same insect, and that *rama* is a race in which the male has varied from the original stock far more than the female. This point can, of course, be settled at once by breeding. The sexes can be easily distinguished by the fact that the fore-legs of the ♂ are short hairy brushes, while those of the ♀ are functionally perfect.

They are almost always found settled on wet roads. If disturbed, they usually only fly a few yards, but if frequently put up, they may fly a little way off the road and settle on the bushes or grass ; but in fine weather they are certain to return to the road in a few minutes.

Both forms are plentiful at Haldummulla, but probably ten *rama* will be seen for one *myrrha*.

They are found from 500 to 5,000 feet in Uva, but so far I have not taken them out of the Province.

70. LIBYTHEA LEPITOIDES ; *Libythea celtis lepitoides*, B. & E.—*Libythea celtis* is found in Europe, Asia Minor, and Chitral. *Lepitoides* is peculiar to Southern India and Ceylon. It differs from *celtis* in the different shape of the hind wing, different shape of the orange band on the fore wing, and absence of an orange spot in interspace 1.

It differs from *lepita* in having the orange band divided, and all the sub-apical spots white.

It is very rare. I have only caught a single specimen at Haldummulla, and have seen others caught at Badulla and Wellawaya.

The Colombo Museum has a good series, mainly from the Kandy District.

"Found also at Dambool" (F. M. Mackwood).

Nemeobiinæ.

71. ABISARA PRUNOSA, M. ; *Abisara echerius*, De N. & B. ; *Abisara echerius prunosa*, E.—The race is confined to Southern India and Ceylon. De Niceville thinks it identical with *echerius*. Bingham does not mention *prunosa*. Evans says *prunosa* is larger and brighter.

I have a ♀ caught at Haputale in March (cold, dry season, elevation 5,000 feet). It is much darker than usual, and the post-discal fascia is almost obsolete. The black spots on the lower wing are very minute. The under side is very like Bingham's illustration of the dry season form of *echerius*. It is very unlike any specimen of *prunosa* I have seen.

It is almost always found in jungle. During the day time it usually settles on a leaf five or six feet from the ground. If disturbed it flies a yard or two and settles again. In the evenings, however, its flight completely changes, and it darts up and down a jungle path with a quick jerky flight, so that I have more than once mistaken it for one of the *Hesperiidæ*.

It is commonest at Haldummulla during the dry weather in the south-west monsoon.

I have taken it at Jaffna, Kandy, Galle, Trincomalee, Ratnapura, and up to 5,000 feet at Haputale.

" Caught at Colombo " (F. M. Mackwood).

LYCÆNIDÆ.

Lycæninæ.

72. NEOPITHECOPS ZALMORA, B. & E.; *Pithecopos dharma*, M.—Found in Southern Asia.

One of the most variable insects in Ceylon. The amount of white on the upper side varies as much in location as in amount. The principal varieties in my series are :—

(1) Upper side: both wings black, minute white speck or pale patch on disc of fore wing.

(2) Discal white spot on fore wing much larger. Lower wing with a large white patch from the cell to the margin, between veins 4 and 7.

(3) Fore wing about half white. Lower wing with five very minute sub-marginal white spots. The markings on the under side almost obsolete, except the black sub-costal spot on hind wing. (Only taken at over 5,000 feet elevation.)

Very common at times at Haldummulla, and apparently flights. A great number appeared in August, 1915, all flying west. They settle frequently, and usually close to the ground, and are easy to catch. Their wings, however, are very frequently rubbed in the net.

I have taken it from 500 to over 5,000 feet elevation in Uva. Also at Galle, Ratnapura, Trincomalee, Vavuniya, &c.

73. SPALGIS EPIUS.—Also found in India, Burma, Java, Borneo, &c.

The male can be distinguished by its very sharp-pointed wings.

The larva feeds on coccidæ (scale insects), especially " mealy bug," and is never known to eat vegetable food.

May be taken at Haldummulla all the year round, but is never numerous. I have also taken it at Galle, Kegalla, and Kandy.

" Found in the North-Central Province " (F. M. Mackwood).

73 A. SPALGIS EPIUS NUBILUS, B. & E.—Bingham gives this race also from Ceylon, and says two typical specimens in

the British Museum are labelled "Trincomalee, Ceylon." Evans restricts it to the Andamans and Northern India.

It differs from *epius* as follows: Much darker ground colour, no white spot on fore wing of ♂, and only a slight pale patch on ♀.

S. epius varies considerably in the size of the white patch, especially the female, but I have not yet come across a specimen answering the description of *nubilus*. I have, however, no specimens from the dry zone, and this form may occur there.

74. MEGISBA MALAYA, B. & E.; *Megisba thwaitesi*, M.—Found in Southern Asia.

In India two forms exist: tailed and tailless. In Ceylon none have tails.

The upper side does not vary much, though the white patch is occasionally rather indistinct. The under side is variable, and the spot in the cell of the fore wing is often wanting in the female.

The male is very abundant at times in the low-country of Uva, and may be found in dozens settled on wet sand in river beds or on wet roads.

The female, which has more rounded wings, is much scarcer.

Single specimens may be taken at Haldummulla all the year round, but I have no notes of its capture above 4,000 feet.

Other localities: Galle, Kegalla, Jaffna, Trincomalee, &c. "Colombo to Kandy, Ratnapura" (F. M. Mackwood).

75. CHILADES LAIUS, B. & E.; *Chilades varunana*, M.—Also in India, China, Formosa, &c.

Varunana is the wet season form. Both dry and wet season forms are very common almost everywhere in Ceylon. The dry season forms (with clouded brown patch on under side of lower wing) are rather scarcer than the others, but both fly together.

The ♀ varies very much in the amount of blue.

Can be taken all the year round at Haldummulla, but is only abundant here during the north-east monsoon flights, when it is occasionally the commonest blue for a week or two.

I have taken it everywhere up to 6,000 feet. It is plentiful at Nuwara Eliya at times.

76. CHILADES PUTLI, M.; *Chilades trochilus*, B.; *Chilades trochilus putli*, E.—Also found in Europe, Asia, Africa, and Australia.

Bingham says var. *putli* is only the small Indian form, which is identical with *trochilus* in ground colour and markings. It is very variable in these respects and in size, and in the number of the metallic green spots on the under side of the lower wing.

It is so small that it may be easily overlooked, though it is generally found fluttering over the shortest grass, or nearly bare ground.

Essentially a low-country insect, but I took one specimen in January and another in May, 1916, on this estate (3,000 feet). These are both above the average in size.

Localities: the lawn in front of the Colombo Museum, Jaffna (very abundant), Mannar, Hambantota, Wellawaya, &c.

77. CYANIRIS AKASA.—Also in Southern India, Java, Sumatra, &c.

A very local insect, but plentiful where it occurs. It is usually found near streams in the hills, the male settling on wet patches on the roads, the female hovering among the bushes, and settling frequently on flowers.

It varies very little in Ceylon. The figure in Bingham is not at all like our specimens. In neither male nor female is the black border of the upper wing extended to the tornus.

Common at Haldummulla and Haputale, especially during the north-east monsoon, March and April being the best months. Also taken at Nuwara Eliya.

" Pundalu-oya and Pattipola " (F. M. Mackwood).

Note.—The genus Cyaniris is now named Lycænopsis by many writers.

78. CYANIRIS PUSPA, B. & E.; *Cyaniris lavendularis*, M.—Found also in India and Malaya.

" Var. *lavendularis*, Moore, has the costal and terminal margins of both fore and hind wings more narrowly bordered with black than in typical *puspa*, but seems otherwise indistinguishable " (Bingham).

This seems a very constant feature of the males in Ceylon, and it is questionable if Moore's name should not stand for the race.

The males vary a great deal in the shade of blue, the amount of white, especially on the lower wing, and the clearness of the black marginal spots on the lower wing. Bingham says of these spots in *puspa* that "these are formed, not by actual scaling, but by the dark markings of the under side, which show through more or less clearly." This is not the case with Ceylon specimens, as the spots on the upper side are frequently far larger than those on the under side, and are occasionally very large and distinct above, when almost obsolete below. The female varies chiefly in the markings on the under side; in some specimens these are comparatively small and indistinct, especially on the hind wing.

The male is often very plentiful in the low-country of Uva, settled in river beds and on wet roads. It occasionally can be taken at Haldummulla. The female is very common at Haldummulla at times, and is apparently given to flighting. I have taken it here in every month but February and March.

The female bears no resemblance at all to the figure given in Moore.

79. CYANARIS SINGALENSIS, M. & E.; *Cyaniris huegeli singalensis*, B.—Found in Ceylon, Java, and Sumatra.

Originally described from specimens taken at "Kalupahana, about 3,000 feet." I have no doubt this estate is referred to.

The male is very plentiful at high elevations. It is chiefly found settling in stream beds or on wet roads. Occasionally I have taken specimens at Haldummulla, but they do not seem to descend below 3,000 feet. The female I have found extremely rare, and I know nothing of its habits.

"♂ numerous at Maskeliya and the Horton Plains; ♀ scarce" (F. M. Mackwood).

80. CYANIRIS LANKA.—Peculiar to Ceylon.

The male is extremely plentiful at high elevations. At Ohiya, Pattipola, &c., it is usually the commonest blue. It sometimes descends as low as 3,000 feet. It is nearly always found settled on damp spots on the roads. The female flies low over the bushes, settling occasionally on flowers. I have never taken one lower than 5,500 feet.

"The larva feeds on *Smithia blanda*, which grows in damper portions of patanas. The egg is deposited on the stem at

the foot of the flower bud" (F. M. Mackwood in "Spolia Zeylanica," Vol. X., Part XXXVI.).

"Taken also in Kandy District" (F. M. Mackwood).

81. CYANIRIS LIMBATA, B. & E.; *Cyaniris limbatus*, De N.—Also in India and Sumatra. Not mentioned by Moore.

Not common at Haldummulla. The male settles on wet roads in April, May, September, and October. The female is a great rarity. I have never taken the males anywhere else than at Haldummulla, but I have taken the females at Haputale and Ohiya as well.

The male is intermediate between *lanka* and *singalensis*. The upper side is much darker than *singalensis*, but not so dark as *lanka*. The marginal spots on the under side in both sexes on both wings are enclosed in a lunular gray line in *limbata* and *singalensis*; this is absent in *lanka*. The upper side of the female is very distinct from either ♀ *lanka* or *singalensis*.

"♂ taken at Kandy, Pundalu-oya, and Maskeliya" (F. M. Mackwood).

82. ZIZERA LYSIMON, B. & E.; *Zizera karsandra*, M.—Also in Europe, Africa, Southern Asia, and Australia.

"Var. *karsandra*, Moore, is a pale form of *lysimon*" (Bingham).

It very closely resembles *Z. indica*, but can be distinguished by the presence of a black spot in the cell on under side of fore wing.

I have a curious variety, of which I took four specimens on a small patch of grass on one day, in which there is a quite irregular dusting of small black spots, ringed with white, between the discocellular streak and the line of discal spots. One specimen has four of these spots on one wing and three on the other. In April, 1916, I took a ♂ *Z. gaika* showing the same aberration.

Specimens from Jaffna have the marginal bands and spots very clearly defined, and one specimen taken there, a female, measures 26 mm. in expanse.

Common everywhere in short grass from sea level to 5,000 feet at least. It occurs all the year round here, but is commonest in August and September.

83. Zizera gaika, B. & E.; *Zizera pygmæa*, M.—Found also in Africa, Arabia, India, and Malaya.

Very common at low elevations, but gets scarcer above 3,000 feet. It may be found all the year round at Haldummulla, but is commonest in August. Usually found flying over short grass.

Localities: the low-country from Galle to Jaffna, but commonest in the drier districts.

84. Zizera indica, M.; *Zizera otis*, B.; *Zizera otis indica*, E.—Found also in India, Burma, Malaya, Hong Kong, and Philippines.

Bingham says *indica* differs from *otis* in the great size of the discal black spots on the under side of the fore wing.

These spots vary very much in size, shape, and position, and the two posterior ones are often obsolete.

Very common everywhere from Galle to Jaffna, and from sea level to the Horton Plains. I have taken it in every month at Haldummulla.

85. Azanus ubaldus.—Found in India and Arabia. Not mentioned by Moore.

The only place where I have caught this insect is at Elephant Pass, in the Jaffna Peninsula. It is fairly common there in December, but is very likely to escape notice. It is very small, and settles usually at a fair height from the ground, at the end of a twig or thorn. If disturbed, it flies round quickly, but soon settles in a similar place, and is not hard to catch. When settled, it is very like a small specimen of the next species, *A. jesous*, but that seldom settles so high up.

Since writing the above I have found it common near Giant's tank in July.

86. Azanus jesous, B.; *Azanus crameri*, M.; *Azanus jesous gamra*, E.—Found in Africa, Arabia, and India.

Very common in the dry low-country, and is an occasional visitor to Haldummulla, all caught here being males. It flies low, and is fond of settling at the end of a twig or large thorn, whence it apparently can get a clear view round. It is seldom seen more than two or three feet from the ground. It is usually found along road sides in open country or scrub, very seldom in jungle.

Localities: Jaffna, Mannar, Anuradhapura, Wellawaya, Hambantota, &c.

" Abundant at Trincomalee " (F. M. Mackwood).

87. LYCÆNESTHES LYCÆNINA.—Also in India, Malaya, and Dutch Indies.

The male is very common at Haldummulla, and is always found settled on wet roads or in the beds of streams, especially from March to May. If disturbed, it flies round very rapidly, but settles again quickly, and will allow one to miss it several times with the net before clearing off. The female is rarer here, and may be found settled on the tea or on flowers. I found it very plentiful on the tea at Kegalla, but I never saw a male settled on the wet roads there.

Other localities: Galle, Hambantota, Wellawaya, &c.

" Colombo, Kandy, and Pussellawa " (F. M. Mackwood).

88. TALICADA NYSEUS.—Also in India and Burma.

Exceedingly common wherever its food plant (*Bryophyllum*) grows. It flies slowly, and settles frequently. In the evenings it generally roosts on flower heads, and generally in groups of four or five. It is very conspicuous, and can be easily caught then in a killing bottle, and the finest specimens and unusual varieties of under sides can be selected. It does not retire till rather late, so there is not much time to take them before dark.

The upper side varies little, but specimens with the red patch replaced by buff may be taken. The under side is variable, especially in the number of black spots on the lower wing.

I have now taken four specimens of a peculiar aberration, with a conspicuous irregular white patch between the black and red on the upper side of the lower wing. One was taken in 1902, two in 1912, and one in 1915. All four were taken at the same spot, within a few yards of the 106½ milepost on the Haldummulla road. This rather points to its being hereditary.

One is figured in " Spolia Zeylanica," Vol. IX., Part XXXIII.

Plentiful all the year round at Haldummulla, and I have taken it at Galle, Hambantota, Wellawaya, Kandy, &c.

89. EVERES PARRHASIUS, M.; *Everes argiades*, B. & De N.; *Everes argiades parrhasius*, E.—*Argiades* is found in Europe, Asia, Australia, &c., and is said to have been taken near Dover. The limits of *parrhasius* do not seem to be defined yet.

Microscopical examination of the scales of the male has proved *parrhasius* to be distinct from *argiades*.

Exceedingly plentiful all the year round at Haldummulla. Common at Galle and all over the southern half of the Island up to 6,000 feet at least. I have no records of its capture in the North.

The male varies little, except in size; the female varies greatly, the ground colour being sometimes brown without a sign of blue, and at others pale grayish-blue with brown border at the apex and termen of the fore wing, and along the costa of the hind wing.

Nacaduba.—This is one of the most difficult families to name, and apparently the more specimens one examines, the greater the difficulty becomes. During the last five or six years I have caught and examined many hundreds of specimens, and I now feel less competent to name them than ever.

As a guide of sorts, I annex a table, mainly taken from Bingham :—

Key to Forms of Ceylon Nacaduba.

A.—Under side fore wing: basal area unmarked by white strigæ :

*a*1.—White strigæ very broad and diffuse = *macropthalma*.

*b*1.—White strigæ narrow, never diffuse = *pavana*.

B.—White strigæ on basal area :

*a*2.—Fore wing : apex very acute = *viola*.

*b*2.—Fore wing : apex not very acute :

*a*3.—Basal strigæ not extended to vein 1 :

*a*4.—Under side hind wing: small black spot in tornal angle, and larger one in interspace 2 = *noreia*.

*b*4.—Under side hind wing: small black spot in tornal angle, and equally small one in interspace 2 = *dana*.

*b*3.—Basal strigæ extended to vein 1 :

*a*5.—Expanse under 25 mm. = *ardates*, tailed and tailless.

*b*5.—Expanse over 25 mm. :

*a*6.—♂ upper side : brownish-purple = *atrata*.

*b*6.—♂ upper side : darker brownish-purple suffused with plumbeous = *plumbeomicans*.

The great objection to this table is that it largely depends on the old fallacy, that "the exception proves the rule."

For instance, the *atrata* group are separated from *ardates* by the question of size, all under 25 mm. being classed as the latter. My smallest specimens are the white variety of female *atrata*, and a variety which was flighting in great numbers in September, 1915, which is certainly not *ardates*, but probably a dwarf form of *plumbeomicans*.

Again, an important division depends on whether the basal pair of strigæ are continued to vein 1. I have a series of tailed *ardates*, otherwise quite normal, showing every graduation, from the strigæ stopping at the median vein till they reach vein 1.

As our knowledge now stands, it is nearly impossible to say how many species we have in Ceylon.

90. NACADUBA MACROPTHALMA.—Found in India, Malaya, and Australia.

91. NACADUBA PAVANA.—Found in India, Burma, Java, &c.

The latter is not mentioned in Moore. This group is unfortunately rare at Haldummulla, so I have a comparatively poor series. My specimens are easily divided into two groups :—

(1) Male very large, my largest being 39 mm. in expanse ; white strigæ on under side rather broad and diffuse. Female : blue area very large, extending to at least four-fifths of the posterior portion of fore wing ; veins across the blue area very clearly marked in dark brown ; under side, white markings more diffuse. This, I take it, is a form of *macropthalma*.

(2) Male smaller, average about 30 mm., darker in colour on upper side, white strigæ on under side narrower and more clearly defined. Female : blue area darker, and much reduced in size ; the veins very indistinctly marked ; under side white strigæ clearly defined, but broader than in the male, a complete series of dark oval spots along margin of fore wing and along hind wing down to interspace 2.

The female is usually much smaller than the male, one of mine measuring only 22 mm.

This I believe to be *pavana*, though it is considerably larger than the specimens of *pavana* I have seen from the Andamans.

N. macropthalma is not rare in parts of the low-country of Uva and at Ratnapura, but I have taken very few specimens as high as 3,000 feet.

N. pavana is not rare at Galle and elsewhere in the wet zone, and I have a few specimens from Haldummulla.

Both forms vary enormously in almost every particular, but I have insufficient material to hazard any opinion as to how the group may be subdivided in Ceylon.

92. NACADUBA VIOLA, M. & E.; *Nacaduba hermus*, B. & De N.—Also found in India, Burma, Malaya, and Australia.

Very rare. I have taken about half a dozen males settled on wet roads in Haldummulla, but I have never seen a female. I have seen a male caught at Hirumbara, near Galle, and another from Deniyaya.

It can be distinguished at once from any other Ceylon *nacaduba* by its very pointed wings. It varies very much in size.

93. NACADUBA DANA.—Also in India, Burma, &c. Not mentioned by Moore.

This can be at once recognized by the fact that it is the only Ceylon *nacaduba* which does not possess the conspicuous large black spot in interspace 2 of the under side of the hind wing. There is only a minute spot, nearly equal in size to the one in the tornal angle.

It is not given in any of the Ceylon lists, but I have taken more than a dozen males settled on wet roads, or in beds of streams, at Haldummulla, and in May, 1916, I found it very abundant at Wellawaya, and also took one at Tanamalwila, on the borders of the Southern and Uva Provinces. I have also got it from Ratnapura.

It is tailless, and may easily be mistaken for a tailless *ardates* when settled, but is of a distinctly lighter blue when flying.

The female is very rare, and I have only taken two specimens.

One of my specimens (a ♂) is in the British Museum. It is labelled Wellumwittia, but there is nothing else to show that it is a Ceylon specimen. It was sent there by the late Mr. John Pole.

In May, 1916, I took a butterfly at Wellawaya in company with a lot of *N. dana*, which is entirely unlike any other Lycænid I have ever seen. The upper side matched *dana*, except for a regular, rather broad, black border to both wings. The under side is dark gray. Unmarked, except for a short pair of strigæ above the end of the cell on the upper wing. It may be an aberration of *dana*.

94. NACADUBA ATRATA.—Also found in India, Malaya, and Java.

95. NACADUBA PLUMBEOMICANS.—Also found in India.

Moore does not give *plumbeomicans*, but divides our Ceylon specimens into *prominens* and *atrata*.

I have caught many hundreds of these in the last few years for examination, and have over a hundred selected specimens now in my collection.

Both sexes vary very much in the colour of the upper side, the markings of the under side, and in size (18–36 mm. expanse). The extreme specimens are very distinct, and correspond almost exactly in colour, &c., to the two divisions of the *macropthalma* group, but all are so variable, and there are so many intermediate forms, that it is almost impossible to decide if they belong to one species or to several. Personally I have roughly divided the males into four groups, and the females into three, but it is not easy to draw the lines between them.

Moore divided them by the markings on the under sides, but these grade perfectly in both sexes.

De Niceville says *plumbeomicans* differs from *prominens* "in its *slightly paler* colouration on the upper side in the male." Bingham says it differs in being "*darker* brownish-purple suffused with *plumbeous*."

My specimens were almost all taken on one mile of cart road through this estate. Possibly a quantity from other districts might help in separating the forms, or in grading them even more perfectly.

Weather seems to have little to do with the variations, as the most extreme forms fly together. They can be taken all the year round at Haldummulla, but are easiest to capture in the wet months. The males settle on wet roads in abundance in April, May, October, and November. The females visit flowers, or settle on low bushes, showing a preference for bare projecting twigs. They flight in large numbers many times in the year.

A curious flight appeared for a day or two in September, 1915, viz., at the end of the dry season. The insects only measured 18–22 mm. in expanse, but in colour and markings were what I understand to be *plumbeomicans*. A dwarf variety of the white female (*prominens*) is not rare here, and I have received it from Ratnapura.

I have taken single specimens at Galle and Dambulla, but the group seems to be mainly confined to the hills, from 500 to 5,000 feet.

" Taken at Colombo " (F. M. Mackwood).

96. NACADUBA ARDATES, tailed form ; *Nacaduba nora*, E.—Found in India, Malaya, and Australia.

97. NACADUBA ARDATES, tailless form ; *Nacaduba noreia*, E.—Evans writes : " I believe with various other writers that *nora* and *noreia* are separate species ; *nora*, the tailed form, is also yellow below."

Personally I am of opinion that the two forms are at least as fully entitled to rank as distinct as, say, *atrata* and *plumbeomicans*, but I agree with Bingham and De Niceville in thinking that the tailless form does not answer at all to Felder's description of *noreia*, which I consider quite a distinct species. Apparently *nora* should stand for the tailed form and *ardates* for the tailless.

It is hard to define any difference between them, but the post discal pair of strigæ usually appear to be nearer the terminal margin in the tailless form, and sometimes even touch the sub-terminal markings. The bands enclosed by the strigæ also seem comparatively broader. I have never yet seen the variety of the female with the yellow under side without tails, and in both sexes the tailed form is the most variable in the ground colour of the under side.

They both fly together all the year round, but the males are most often seen when the roads are wet. In habits they resemble *atrata*, but both sexes seem particularly fond of the blossom of *acacia cæsia*, which is, I believe, also the food plant of the larvæ. The tailed form is far the commonest, though both are very abundant.

They both vary much in the markings on the under side, and specimens can be taken of both in which the basal strigæ fail to reach vein 1.

I have seen a few specimens in Galle, Colombo, Jaffna, Trincomalee, Anuradhapura, &c., but they seem commonest in the hills. Common at Ratnapura.

98. NACADUBA NOREIA.—This name is usually given to the tailless form of *ardates*, but both De Niceville and Bingham point out that this does not at all agree with Felder's description. The two main distinctions are :—

(1) The external margin is less convex.
(2) The basal strigæ on the under side of the fore wing do not extend below the median vein.

I have four males and two females which seem to answer this description. The males are a much brighter purple than *ardates*, and have a fairly broad purple-brown border. The females have a very bright blue patch on both wings, as bright on the lower wings as the upper ; this I have never seen in *ardates*. In both sexes the fore wings are distinctly pointed, though not so much as in *viola*. The marginal spots on the lower wing of the female are obsolete, except in interspace 2, as Felder says ; and the under side agrees with his description in every particular.

It is so rare that I do not care to express a decided opinion as to whether it is a distinct species, or merely a variety of *ardates*, but the few specimens I have seem to be quite as worthy of specific rank as *dana*, and I have seen no signs of gradation.

All my specimens are from the Haldummulla district. Felder described it from a specimen taken at Nuwara Eliya.

Since writing the above I have received 2 ♂♂ from Wellawaya and 2 ♀♀ from Kandy.

99. JAMIDES BOCHUS, M. & De N.; *Lampides bochus*, B. & E.—Also found in India, Burma, Malaya, &c.

Varies a good deal in the width of the black border.

Bingham says that, measured on the dorsum of the male, this takes up one-fourth of the wing. In my specimens one-sixth is nearer the average. The female varies far more than the male in this respect.

It is exceedingly plentiful all over the southern half of the Island, and flies at Haldummulla all the year round. It occasionally flights in great numbers, and these flights are usually composed of dwarf specimens 22–25 mm. in expanse.

I have taken it from sea level to over 6,000 feet, and it seems to be equally plentiful in Galle and Nuwara Eliya. I have no notes of its occurrence in the north of the Island.

The male sometimes settles on wet roads, but prefers flowers.

" Caught in North-Central Province " (F. M. Mackwood).

100. LAMPIDES ELPIS.—Also in India and Malaya.

Common at Haldummulla, especially in March, April, and May. At times it becomes a pest in cardamom clearings.

The male varies little, and the female only in the width of the black border to the fore wing.

It is not given to settling on wet roads, but is usually found on bushes at the edge of jungle.

I found it very common near Galle in February and March, but have never seen it in the north of the Island.

101. LAMPIDES CORUSCANS.—Peculiar to Ceylon and very local.

The male varies little, but the female a great deal in the amount of blue on the upper side.

I used formerly to get this plentifully near Haldummulla, in a jungle which is now part of Mentenne rubber estate. Since this was cleared it has apparently disappeared from the district.

The specimens from there were rather smaller than those from wetter districts.

I have found it in fair numbers at Watering Point, Galle, in April, and it is common sometimes at Kottawa, and at Deniyaya. I have also specimens from Ratnapura.

"Found also in Kelani Valley and Dolosbage" (F. M. Mackwood).

102. LAMPIDES LACTEATA, B. & E.; *Lampides pseudelpis*, M.—Peculiar to Ceylon.

Bingham thought it might be "an occasional variation" of *L. elpis*.

The differences from *elpis* are very marked, and it shows no tendency to grade.

In the ♂ it is best distinguished by the absence of the subterminal row of black spots on the hind wing, and the much narrower terminal black border of the upper wing. In the ♀ the ground colour is much paler, and the basal half of the costa is blue, not black as in *elpis*; it is much more like the female *celeno* than *elpis*.

In both sexes the large spot in interspace 2 of the under side of the hind wing is very different, being larger and roughly pentagonal, instead of round, as in *elpis*.

It is not given to settling on wet roads.

Not common at Haldummulla, but may be taken in May, June, November, and December.

I have also taken it at Wellawaya and Monaragala, and have received specimens from Ratnapura and Deniyaya.

"Abundant at times in Lady Horton's Walk, Kandy, near the Pavilion" (F. M. Mackwood).

103. LAMPIDES CELENO, B. & E.; *Lampides ælianus*, M.—Also found in India, Malaya, China, &c.

The upper side varies very little. The under side varies in the ground colour and markings, but I cannot see that the variations depend on climate.

The male is often seen settled on wet roads, but both sexes are more frequently found on the bushes and grass by the road side.

The male has the same habit as *H. bolina* of taking up a position for days, and attacking every butterfly of about its own size that passes.

Exceedingly plentiful all the year round at Haldummulla, and I have taken it from Galle to Mannar, but it is commonest in the south. It is common in Nuwara Eliya.

104. Catachrysops strabo.—Also found in India, Malaya, Australia, &c.

Very common in Ceylon, everywhere at low elevations, but becomes rare above 3,000 feet.

In his key to the genus Catachrysops (Bombay Nat. Hist. Journal, Vol. XXIII., p. 491), Bell gives, as the distinction between the species, the fact that *strabo* has "a dot on costa between discocellulars and post-discal band of spots." This dot is sometimes absent in Ceylon specimens of *strabo*, and I have a specimen of *cnejus* which shows it. In *strabo* and *lithargyria* the eyes are hairy, in *pandava* and *cnejus* they are smooth.

Not given to settling on wet roads, but both sexes fly low in open ground and settle on flowers, &c. It is especially plentiful in abandoned low-country paddy fields and chenas.

I have specimens from all over the low-country, from Galle to Jaffna, and the males show no marked variation dependent on climate, &c.; the females, however, vary in the amount of blue on the upper surface.

105. Catachrysops lithargyria.—This is said to be found wherever *strabo* exists, but I believe that the only females known were caught in Ceylon. Bingham thinks it is only a variety of *strabo*, and says: "Nor has any corresponding difference been found among the females, while in the blue males the markings are precisely the same as those of typical males."

These remarks cannot possibly refer to Ceylon specimens. The ♂ differs not only in colour, but in the shape of the wings, and on the under side the markings are far broader, better defined, and an entirely different colour, the general appearance being very dissimilar. The female is much larger than any specimens of ♀ *strabo* I have seen, and the blue on the upper side is paler; the markings on the under side agree with those of the male, though lighter in colour, but are even broader. Moreover, it is apparently constant, and I have seen no signs of its grading into *strabo*.

The male may easily be mistaken for *L. celeno* on the wing, as the colour is the same, though paler.

It is very rare. I have taken one ♂ and three ♀ on this estate in the tea, and one ♂ settled on leopard's dung at Wellawaya.

" Captured at Puttalam, Lunugala, and Haragam, near Kandy " (F. M. Mackwood).

106. CATACHRYSOPS CNEJUS.—Also in India, China, Malaya, and Australia.

Rather a local fly. Very rare at Haldummulla, but is common in a few places in the low-country of Uva. Very plentiful in the Northern Province.

The males can be readily distinguished from the males of other species of Catachrysops in Ceylon by having on the upper side of the hind wing *two* nearly equal-sized black spots, one each in interspaces 1 and 2. The females have *both* these spots crowned with orange.

It is very variable in size, in the ground colour of the under side, and in the amount of blue on the upper side of the female. Var. *contracta* is apparently only a dwarf form and grades into *cnejus*.

In Southern India it is frequently a serious pest to the gram crops.

Localities : Hambantota, Wellawaya, Galgamuwa (North-Western Province), Anuradhapura, Jaffna, &c.

" Kandy and Colombo " (F. M. Mackwood).

107. *Catachrysops pandava*.—Also found in India, Malaya, &c. There are two very distinct forms of this in Ceylon, which apparently do not fly together, and might be separated as different races, if not species :—

(1) The large form, or true *pandava*. Average about 30 mm.

The male is a bright lavender-blue, with the veins very clearly marked. The fore wing with a brown terminal border over 1 mm. wide. Hind wing with a sub-terminal series of black spots, edged outwardly by a white line, the one in interspace 2 being sometimes inwardly bordered by red. Under side hind wing : sub-basal row of *four* black spots edged with white.

(2) The small form. Average about 20 mm.

The male is a rather dull violet-blue (almost matching *E. parrhasius* ♂), the markings of the veins very indistinct. The brown marginal border on the fore wing is extremely narrow, and the sub-terminal spots and white line on the hind wing are wanting, except in interspaces 1 and 2. Under side hind wing: sub-basal row of *three* black spots, of which the lower is often very indistinct.

The two females are very similar, but the smaller race have the blue on the upper side much darker, and on the under side show only *three* sub-basal spots instead of *four*. The eyes are smooth.

The large race is very common in the low-country of Uva, and is a very rare visitor to Haldummulla. I have not taken it above 3,000 feet.

The males settle in numbers on wet patches on the roads or on the sand in river beds, and have rather a quick flight if disturbed. They usually, however, settle again quickly. The females are much scarcer, and are most likely to be found on weeds in abandoned paddy fields or chenas.

The small form is apparently confined to the dry zone, and is extremely common in the Northern Province. Its habits are those of a Zizera, both sexes fluttering about together over short grass, and frequently settling on flowers. I have never seen the male on wet patches on the roads. It is especially plentiful at Elephant Pass (Jaffna) in December and January.

I have never yet found both forms in the same district. The small form occurs sparingly at Hambantota, so one might expect to find both near Tanamalwila, on the boundary of the Uva and Southern Provinces. So far I have failed to take either there. I have taken the large form at Trincomalee.

108. Tarucus theophrastus.—Also in North Africa, Socotra, Arabia, India, &c.

There are two varieties of the under side. In the first, all the black markings are very slender, and the post-discal band on both wings is a practically continuous slender line. In the second the markings are much broader, and sometimes rusty brown in colour. The post-discal band on the fore wing consists of six well-separated oblong spots; on the hind wing

of eight spots, of which the middle three or four are crescent-shaped. I have taken both forms together, and think they are only seasonal. They apparently grade into one another.

A very local fly, and apparently found only in the driest districts.

It is very abundant on the bund of Tissamaharama tank, and the sand dunes at Kirinda in the Hambantota District, in February and March. Also on the bund of Murunkan tank, near Mannar, in November. Fairly common at Kankesanturai on the north coast, and at Fort Frederick, Trincomalee.

It flies slowly near the ground and frequently settles on flowers, so is very easy to capture.

109. Tarucus plinius, M., B., & E.; *Tarucus telicanus*, De N.—Also in Africa, India, Burma, Malaya, and Australia.

Very plentiful at Haldummulla, and I have taken it in every month but December. Its range extends from sea level to over 6,000 feet.

I have taken it at Jaffna, Mannar, Vavuniya, and Hambantota, but not in the wet zone.

The male frequently settles on wet roads, and when disturbed has a rather quick flight, and does not usually return. They are easiest to catch when flying round *Indigofera anil*, which is, I fancy, the food plant.

" Also on the seed pods of the white- and blue-flowered plumbago plant " (F. M. Mackwood).

110. Castalius rosimon.—Also in India, Burma, Malaya, &c.

Very plentiful all over the low-country of Ceylon, but becomes rarer above 3,000 feet. It is commonest at Haldummulla in the dry season, June-August.

I have noticed it all over the low-country, from Galle to Jaffna. It prefers open country, and especially road sides; flies slowly, and is very easy to catch. It settles in numbers on wet patches on the roads.

It varies a great deal in the amount of black on the upper surface, but the variation does not seem to depend much on climate. Several of my lightest-marked specimens are from Galle (wet zone), and my two darkest are from Haldummulla (medium) and Jaffna (dry zone).

111. Castalius ethion.—Also in India, Burma, Malaya, &c.

Much more a jungle fly than the last, and is fond of settling on a twig or leaf projecting over a jungle path.

Is found nearly all the year round at Haldummulla, but is usually commonest in April and May.

It is common in the south of the Island, especially in the wetter districts, and I have taken it up to 5,000 feet elevation at Haputale. I have so far not taken it north of Dambulla.

112. Castalius decidea.—Also in India and Burma.

Moore also gives *C. hamatus*, but Bingham says this is only the wet season form. They certainly grade into one another.

In Ceylon the variation seems to depend very little on rainfall. Some of mine with an exceptionally narrow band (viz., *hamatus*) were taken here in the dry season, and some with the broadest band were taken from March to May, when there is a fair rainfall. Others are from Galle, which is in the wet zone.

It is a jungle fly, with habits like the last, except that it apparently flights at times.

It seldom settles on wet patches on the roads, like *rosimon*.

I have only taken it in the southern half of the Island, and never at any great elevation. It is very plentiful at times at Galle, and I have also taken it at Kegalla and Peradeniya.

113. Polyommatus bœticus.—Europe, Asia, Africa, and Australia. It is said to have been taken in England, and is included in English lists as "the long-tailed blue."

One of the commonest butterflies. Is found everywhere, and is equally common in Galle, Jaffna, and Nuwara Eliya.

It varies very greatly in size, dwarf forms being very common. The female varies in the amount and shade of blue on the upper side.

114. Amblypodia anita, De N. & E.; *Amblypodia darana* and *naradoides*, M.—Also found in India, Burma, Siam, and Borneo.

Moore says *darana* is larger than *naradoides*, the male being a darker blue and the marginal band narrower; the anal lobe is red only in the middle, its margin and the tail being black. The ♀ is uniformly brown above. I have not yet acquired

any specimens of males answering to this description. Moore says it is found at Kottawa. I have one ♂ from there, but it exactly matches all my other specimens, and I fancy *darana* is only a seasonal form. I have a specimen of the brown ♀ from Tangalla, and another with only a trace of blue from Haldummulla. By far the largest ♀ I have has a large blue patch.

Anita is very abundant in parts of the low-country of Uva. The best place I know for it is Wellawaya, where the males can often be seen in hundreds, settled on wet roads or any filth. If disturbed they only fly a short distance, and return very quickly. I have frequently covered half a dozen with one stroke of my net.

The female is exceedingly rare. I have taken two (on this estate) in twenty-seven years, and have seen one taken at Wellawaya. I have specimens from Tangalla and Kandy.

" Males abundant in the neighbourhood of Kandy ; females very scarce " (F. M. Mackwood).

115. Iraota timoleon, De N. ; *Iraota mæcenas*, M. ; *Iraota timoleon nicevillei*, E.—Evans thinks the Ceylon specimens are a distinct race. *Timoleon* is found in India, China, and Malaya.

Very rare. I have taken a single specimen at Haldummulla in June, which appeared to be freshly hatched. I have three from Colombo.

I know nothing of its habits from actual observation.

" Feeds on the Banyan tree ; emergence about March. Has been taken in the Knuckles district, and around Kandy " (F. M. Mackwood).

116. Surendra discalis, M. ; *Surendra quercetorum*, De N. ; *Surendra quercetorum discalis*, E.—*Discalis* is smaller than *quercetorum*, which is found in India, Burma, and the Dutch Indies.

Formerly common at Haldummulla, but *Acacia cæsia*, its food plant, is apparently being killed out by *Lantana* here. I have also taken it at Wellawaya, Matara, Kegalla, Madampe, Dambulla, &c.

None of my specimens show any sign of variation, except in size. It generally settles on a bush at no great height, and if disturbed flies a short distance only, so is easy to catch.

Usually there are several specimens together, so if one is caught, an examination of the bushes near will probably lead to the capture of others.

117. Arhopala pirama, De N.; *Nilasera pirama*, M.; *Arhopala centaurus pirama*, E.—Also found in Southern India.

Rare in Uva. I found it once in abundance at Obergoda, on the Muppane-Pottuvil road, in June, in the dry bed of a river. It only flew a short distance and settled on the bushes, so was easy to catch.

I have specimens caught at Kandy and Trincomalee in April.

" Taken at Colombo and Galle " (F. M. Mackwood).

118. Arhopala amantes, De N. & E.; *Nilasera amantes*, M.—Also found in India, Burma, the Andamans, &c.

It can at once be distinguished from the last by having a distinct lobe in the anal angle of the hind wing.

I have not yet taken it in Uva, but found it common near Galle, on nutmeg trees. If disturbed it almost always returns to the same tree at once, so is very easy to catch.

I have specimens from Colombo and Ratnapura.

" Plentiful around Kandy " (F. M. Mackwood).

118 a. Arhopala, nov. sp.—Last April I procured seven males and one female of an entirely new Arhopala in the forest between Kottawa and Udagama. I sent a specimen to the Indian Museum, Calcutta, for identification, and received the reply that " the species does not appear to be represented either in our general collection of butterflies, or in the De Niceville collection." It is therefore apparently new to the Indian region. When it is again safe to send parcels to England I hope to send one to the British Museum to be named.

119. Arhopala abseus.—Also found in India, Burma, Malaya, &c. Not mentioned in Moore.

I have never taken this, but have specimens from Ratnapura given to me by Mr. Mackwood.

While fishing at Ambawela (6,000 feet) I saw a very small Arhopala. It settled close to me, and I think it must have been this species. Unfortunately I could not get my net in time.

" Has been taken in Colombo " (F. M. Mackwood).

119 A. There are two specimens in the Colombo Museum labelled *abseus* (Nos. 829 and 3,484), from Mr. Pole's collection. No localities are given. They are much larger than, and very distinct from, all the specimens of *abseus* from Ratnapura, and should be re-named.

120. CURETIS THETIS, B. & E.; *Curetis thetys*, M.—Also found in India, Indo-China, and Malaya.

Very common in the drier parts of the low-country. The male is very plentiful at Wellawaya, and is almost always found settled on wet roads and river beds. The female is scarce there. At Anuradhapura I have found the male scarce, but the female common. I have specimens from Elephant Pass (Jaffna), Mannar, Dambulla, &c., and have taken one on this estate (3,000 feet).

It is a most variable insect. I have two males, which correspond exactly to Bingham's description of var. *arcuata*, and there is a similar one in the Colombo Museum. My other males vary much in the shape of the wings and in the width of the black border on the fore wing; this border is almost always produced a short way up each vein of both wings.

The female usually has far less white than in Bingham's description and plate. In only one of my specimens does it reach to vein 1.

Bingham says, writing of the under side of the female: "In no specimen that I have seen is there any trace of the outer sub-terminal line of dark dots."

In three of my specimens these are far more distinct than in the males, and in all some of the spots are visible.

121. ZESIUS CHRYSOMALLUS.—Also in India.

A common low-country fly, but the male is not rare at Haldummulla, April to August.

I found it extremely abundant at Kegalla, both sexes being equally plentiful on the tea, October to February. It is not rare at Watering Point, Galle, Jaffna, and Mannar.

The male varies very little, but the female is most variable in the quantity and colour of the blue on the upper side. In some of my specimens it is reduced to a few blue scales at the base of the fore wing, while in others the wings are pale or dark blue, with a brown border.

I have found the pupa on the stem of an *Albizzia moluccana*. The larvæ are always attended by the large red ant, and the perfect insect may be looked for wherever these ants' nests abound.

122. Camena deva, De N. & E.; *Pratapa deva*, M.—Found in India, Java, Philippines, &c.

A quite local insect. For very many years past I have always been able to find the males basking on one tree (*Ficus arnothiana*) on this estate, from April to November. The strong north-east wind entirely defoliates this tree in December, and the new leaves do not appear till the end of March, and the butterfly appears with the leaves.

The tree grows out of the side of a precipice, and requires a long-handled net to reach it. If disturbed, the males fly round and settle again, and never seem to go a dozen yards from the tree.

I have never seen a male anywhere except within twenty yards of this tree, and have never seen a female there. The ♂ *Z. chrysomallus* is fond of the same tree, but flies away very soon if disturbed. I have taken four females on the tea on this estate, and regard them as great rarieties. The female can be at once distinguished from ♀ *T. longinus* by the absence of the post-discal band on the upper side of the hind wing.

I know of no other locality.

" Taken in Balangoda, Dolosbage, and Pundalu-oya " (F. M. Mackwood).

Aphnæus.—This is quite the most difficult genus to name, and I confess that I am quite unable to hazard a decision as to how many species should appear in a Ceylon list.

The literature is unfortunately very limited. Moore's " Lepidoptera of Ceylon " only gives four species, viz., *schistacea*, *fusca*, *lazularia* (= *lohita*), and *ictis*. De Niceville mentions a great number of species, but says that material is too limited to decide which should stand. Evans gives, from Ceylon, *shistacea*, *fusca*, *lohita*, *ictis*, and *lilacinus abnormis*. Species given by other writers are *greeni*, *minimus*, *nubilus*, and *zebrinus*.

Every species is variable, some very greatly so, and freaks seem to be common. There is also evidently a tendency, in

the *ictis* group, to form small local races, so it is most important that all specimens be carefully labelled.

Something might be done by breeding, but the larvæ unfortunately require the attention of certain species of ants, so it is by no means a simple matter to breed them.

There are a very fine series in the Colombo Museum, but they require a lot of sorting.

123. APHNÆUS LOHITA, De N. & E.; *Aphnæus lazularia*, M.—Also found in India, Malaya, China, &c.

The largest Ceylon Aphnæus and the easiest to distinguish. It varies comparatively little on the upper side, but the colour of the under side varies greatly.

It is usually gregarious, and if one is found, a search near will probably put up others. It is very fond of the blossom of *Microglossa zeylanica*, in common with most other species of Aphnæus.

It used to be common at Haldummulla, but I have seen only one specimen there for many years. In February, 1916, it was very plentiful at Watering Point, Galle, and I have taken it at Hambantota, and have specimens from Ratnapura.

Its flight is very rapid, but it usually only goes a short distance and is easy to catch.

" Has been captured at Diyatalawa. Plentiful in southern parts of the Central Province up to 3,000 feet" (F. M. Mackwood).

124. APHNÆUS FUSCA, M. & De N.; *Aphnæus vulcanus fusca*, E.—Peculiar to Ceylon.

De Niceville gave *vulcanus* as well, but Evans writes of Ceylon specimens: " The orange anal patch on hind wing below is not extended upwards along dorsal margin as in continental specimens," *i.e.*, *vulcanus*.

The commonest *Aphnæus* in Ceylon. It varies greatly in the amount of orange on the fore wing, and in size. On the upper side of the hind wing the orange anal patch is sometimes continued nearly the entire length of the termen.

I have found it in the greatest abundance at Kankesanturai, on the north coast, in December and January. Very common at Elephant Pass and Giant's tank in the Northern Province, on the hill behind Haldummulla post office, at Hambantota,

and Tangalla. I have also taken it at Haputale, Kandy, &c., but not, so far, at Galle.

Its habits are the same as the last, and it is even easier to catch. At Kankesanturai I used the killing bottle instead of the net, as they were so difficult to disturb when feeding at flowers.

" Found generally north of Kandy, up to 1,500 feet elevation " (F. M. Mackwood).

125. Aphnæus minimus.—Given in Moore's " Lepidoptera Indica " as peculiar to Ceylon. Evans thinks it is a casual aberration of *A. fusca*. I do not think it can stand as distinct. I have found it with *fusca*, and it seems to grade. I think it is only a starved variety.

I have specimens from Haldummulla and Anuradhapura.

126. Aphnæus greeni.—Described from a single male captured at Pundalu-oya. Evans thinks it a casual aberration of *A. fusca*.

Considering how common freaks are in this genus, I do not see how a species can be established on a single specimen.

127. Aphnæus schistacea.—Also found in India and Burma.

It is usually larger than *fusca*, and the males can be distinguished by the light blue irridescence on the lower wing. The females are usually still larger, but they seem to grade with *fusca*, and I am not always certain that I can separate them. It is extremely variable, as is usual with the genus.

It is common on a patana ridge near Haldummulla resthouse and at Haputale, and I have taken a few specimens at Kankesanturai, Elephant Pass, Trincomalee, Hambantota, and near Kurunegala.

128. Aphnæus ictis.—Also found in India.

This is the most difficult species, or group of species, to name, and I can at present only treat it as a number of local races.

Bell, in " The Common Butterflies of the Plains of India," defines it as follows : " Fore wing upper side : brown, with a large triangular orange patch before apex, reaching the costa, markings of under side showing through as black spots and bands."

I know of no Aphnæus *in Ceylon* that has an orange patch *reaching to the costa*. In most Ceylon races of the *ictis* group the orange patch, *if present*, is very small and diffuse, the only one with a large clearly-defined patch being—

No. 1.—Very plentiful in the Northern Province.

♂.—Upper surface dark brown, with a variable, but usually well-defined, orange patch on fore wing; a patch of light blue scales along the dorsum: lower wing brilliant irridescent blue; anal patch usually pale red, with rather large diffuse black spots.

♀.—Ground colour slightly paler, orange patch much larger, occasionally occupying one-third of fore wing; dorsal portion of fore wing, and the whole of the hind wing, except anal patch, covered with pale gray-blue scales. In both sexes the marking of the under side appears on the orange patch with exceptional clearness.

Under side, both sexes: very pale gamboge-yellow with darker markings, occasionally varying into khaki or even, very rarely, pale reddish-brown.

The markings are always very clearly defined.

I have caught and examined some hundreds of these at Jaffna and Mannar, and, except for three abnormal specimens, they seem a fairly constant race or species. One freak is a ♂, upper side both wings pale reddish-brown, with slight blue irridescence on lower wing. No sign of an orange patch on fore wing.

Under side pale khaki-brown, the markings very indistinct, and broken up into more or less round spots with dark borders and silver centres. The other two are ♂ and ♀, only varying in entirely wanting the orange patch.

No. 2.—Somewhat resembles the last, but is darker; the orange patch is very small and very indistinct; the under side is reddish-brown *with well-defined markings*. I have a single specimen of No. 1 that nearly matches it on the under side, though very distinct above. This was very plentiful in the Hambantota district in July, but I did not succeed in catching a ♀. I have taken one ♂ at Haldummulla.

No. 3.—Very near No. 2 on the upper side, except that it is larger and the blue irridescence is carried well up into the upper wing, and the orange spot is sometimes absent.

The under side is reddish-brown. The markings are *very indistinct*, consisting of slender silver lines and a few black scales. Even the anal patch is merged into the rest of the ground colour, and the usual black spots are absent.

This is found on the Uva patanas at high elevations, but I have seen specimens from Badulla.

These are the only three races in my collection, but I think others could be picked out of the specimens in the Colombo Museum. Possibly No. 1 may prove to be an extreme dry season form of Nos. 2 and 3, but in general appearance it is very distinct.

129. APHNÆUS NUBILUS.—Is said to be distinguished from *A. ictis* by the absence of an orange spot on the fore wing of the male. If this were so, the majority of my specimens of what I have described as *A. ictis*—No. 3 race—are *nubilus*.

At Elephant Pass, in the Jaffna Peninsula, there is a common Aphnæus which is, I believe, true *nubilus*. It flies there with *A. ictis*, race No. 1, but I have, so far, found it nowhere else.

It is as widely distinct from *ictis*—No. 1—in appearance as any other Aphnæus in Ceylon, and I have so far seen no signs of grading.

♂.—Upper side : ground colour intense black, a dark blue iridescence covering the lower half of the fore wing and all the hind wing, except the anal patch, which is dark red. It strongly resembles *lohita* ♂, but the shape of the wings is different. Under side dark brick-red, with *clearly defined* markings ; anal lobe with two large black spots with a border above varying from yellowish to deep red.

♀.—Upper side : ground colour lighter than in the ♂ ; a small very diffuse orange spot on fore wing, the blue irridescence of the male being replaced by a slight dusting of pale blue scales. Under side as in ♂.

The very deep red of the under side is in striking contrast to the gamboge-yellow of *A. ictis*, No. 1, and they can be at once distinguished from one another, when settled, as far as they are visible.

130. APHNÆUS LILACINUS ABNORMIS.—Given by Evans as occurring in Southern India and Ceylon.

I do not know it at all, unless two specimens in the Colombo Museum should prove to be it. These specimens are ♂ and ♀, and were taken by the Museum collector at Illipakadavai, about twenty miles north-east of Mannar.

131. TAJURIA LONGINUS, M. & E.; *Tajuria cippus*, De N.—Also found in India, Burma, and Malaya.

It is often very common at Haldummulla, and I have taken it in every month but February. The larva feeds on *Loranthus*. Neglected orange and lime trees are always infested with this parasite, and a stone thrown into the top of the tree will often put up a number of the butterflies. They fly round rapidly, but soon settle again.

It evidently hatches out in the early morning, and requires a few hours before it is able to fly fast. If put up then, it will fly a few yards slowly and settle, and is very easy to capture in perfect condition.

It is equally plentiful in the Northern Province, and may either be beaten out of *Loranthus*-infested trees, or taken at flowers.

It varies little, except in size.

" All over the Island up to 1,500 feet " (F. M. Mackwood).

132. TAJURIA JEHANA.—Also found in India. Not mentioned by Moore.

It is apparently confined to the Northern Province, and the only place that I have seen it is between Kankesanturai and Kirimalei on the north coast in July, August, December, and January.

I found it plentiful on a hedge of *Todalia aculeata*, which was in blossom in December and January. I only captured a few, intending to take more later, but for the rest of my stay in the district the weather was so bad that I got no more.

It was in company with *T. longinus*, but was easily distinguished by the different gray of the under side.

In July, 1916, it was very plentiful in the same place, at tamarind blossom. The wind was, as usual at that time of year, very strong, and the butterflies kept to the sheltered side of the trees, and were easy to catch with a long-handled net.

133. HYPOLYCÆNA NILGIRICA, M. & De N.; *Chliaria nilgirica*, E.—Also found in Southern India.

An exceedingly rare fly. I have taken males at Wellawaya, settled on wet roads, in March, April, and November, and one female on this estate in February.

" A scarce fly, with extensive range. Has been caught at Matale (2,000 feet), Kandy, Puttalam, Jaffna, West Dolosbage, and Henaratgoda " (F. M. Mackwood).

134. CHERITRA JAFFRA, De N.; *Cheritra pseudojaffra*, M.; *Cheritra freja jaffra*, E.—Also found in Southern India. Evans says the Ceylon race only differs from *jaffra* in size.

Not rare in the low-country of Uva, but has a habit of settling too high for an ordinary net to reach. Generally several will be found together.

I have taken it at Wellawaya, Telulla, Tanamalwila, Kumbukkan, and Hambegama, in the low-country of Uva, and have specimens from Ratnapura.

It seems to vary very little, except in size.

" Found in heavy chenas around Kandy, Kurunegala, and in the Kelani Valley " (F. M. Mackwood).

135. RATHINDA AMOR.—Also found in India.

Found all over the Island, from sea level to 3,000 feet at least. Fairly common at Haldummulla. Plentiful at Galle and Jaffna.

Settles on bushes, and flies a very short distance if disturbed. Varies very little.

136. HORAGA CINGALENSIS, De N.; *Horaga ciniata*, M.; *Horaga onyx cingalensis*, E.—Peculiar to Ceylon.

Exceedingly rare. I have never seen a living specimen. I have one, given to me by Mr. Mackwood, caught at Kandy in September.

" Found at Kandy several months of the year. Very local and scarce. Latterly a few specimens taken near Ratnapura " (F. M. Mackwood).

137. CATAPÆCILMA ELEGANS.—Found in India, Burma, and Malaya.

When I first came to this estate in 1889, this butterfly was plentiful on one field of tea. An adjoining chena was then cleared, and it entirely disappeared, and I never saw another specimen till August, 1915, when I took a male near Haldummulla kaddies.

I have never come across it in my travels, so it must either be very rare or very local.

" Found around Kandy resting on stems of sunflower plants during the heat of the day. Has been taken in Maskeliya, Ratnapura, &c." (F. M. Mackwood).

138. Loxura arcuata, M. & De N.; *Loxura atymnus arcuata*, E.—Peculiar to Ceylon.

Common at Haldummulla, and I have taken it in every month but February. Common at Galle, and I have specimens from Ratnapura and Madampe.

It varies very greatly in the shade of the ground colour, the amount of black on the lower wing, and the markings on the under side.

I have noticed that the colour fades a great deal if it is left too long in the killing bottle (cyanide).

Generally found fluttering along the edges of jungle or chenas, and is very easy to catch.

" Common in Central and North-Western Provinces to about 2,000 feet " (F. M. Mackwood).

139. Deudorix epijarbas, M. & De N.; *Deudoryx epijarbas*, E.—Also found in India, Malaya, China, &c.

Common at Haldummulla, especially when flighting. There was a very large flight in August, 1915, travelling west, and small ones often arrive about December.

I noticed an exceptionally large flight at Pattipola in November, 1917.

I have also taken it at Galle, Hambantota, Jaffna, Mannar, Anuradhapura, and Ratnapura.

The male varies in the amount of red, especially on the lower wing. The female seems very constant.

Is fond of settling on the tea and on low bushes, but flies off very strongly if disturbed, and cannot be relied on to settle again quickly.

" Fond of the cultivated *Lantana* in gardens. Has been taken at Nuwara Eliya " (F. M. Mackwood).

140. Rapala schistacea.—Found in India and Malaya. Not mentioned by Moore.

Usually very common at Haldummulla all the year round. I believe the larva feeds on tea blossom *inter alia*.

It is always to be found on tea which has run some time from pruning; if disturbed it flies very rapidly round and settles quickly, generally on the same bush, so is easy to catch. It visits flowers freely, and seems especially fond of *Pointsettia*.

I have taken it at Anuradhapura, at the blossom of *Micasea scandens*, and also at Jaffna and Trincomalee.

"Found in Central Province generally, up to 2,500 feet" (F. M. Mackwood).

141. Rapala lazulina, M. & De N.; *Rapala varuna*, E.—Also in India.

Can be distinguished at once from the last, *R. schistacea*, by the much broader bands on the under side. The male has none of the brilliant blue irridescence on the upper side that *schistacea* has.

Very rare at Haldummulla, and it is many years since I caught one. Commoner at lower elevations in Uva. I have taken it in company with *R. schistacea*, at Anuradhapura, at the blossom of *Micasea scandens*. I have also specimens from Galle and Ratnapura.

"Found from Galle to Anuradhapura, up to 3,000 feet" (F. M. Mackwood).

142. Rapala lankana, De N. & E.; *Deudorix lankana*, M.—Also found in Southern India.

I have never taken this, and my only specimen was caught by a native dealer—he said "at Colombo."

It is found in the wettest district, viz., from Ratnapura to the Kottawa forest.

"Caught near Ratnapura, March, May, October, and December" (F. M. Mackwood).

143. Rapala melampus.—Also in India, Burma, Dutch Indies, &c. Not mentioned by Moore.

I took one male at the blossom of *Todalia aculeata*, near Kankesanturai (Jaffna), in December. It is apparently confined to the Northern Province.

The upper side of the male is bright red, and the female dull brick-red, and they may easily be mistaken for *D. epijarbas*. In fact, I believed my only specimen was *epijarbas* when I first saw it in the net.

Mr. Fairlie took it at the blossom of tamarind trees in July, at Manipai, Jaffna.

144. BINDAHARA SUGRIVA, De N.; *Bindahara phocides*, M.; *Bindahara sugriva moorei*, E.—*B. sugriva* is found in Southern India, Java, Sumatra, &c. Sometimes common at Haldummulla.

The larva feeds inside the fruit of a creeper, called by the Sinhalese *Himbatu* (*Salacea reticulata*). An examination of these fruits will often show the eggs, usually near the stalk, and a hole by which the larva has entered. Curiously enough there are almost invariably two or more eggs, but I have never found more than one larva in the fruit.

When fully fed it leaves the fruit, and evidently burrows into the bark of some tree. I had great difficulty in rearing them at first, as, if they could not burrow to pupate, they died. I then gave them a sheet of cabinet cork, and it seemed to be just what they wanted; the burrows were usually about one inch long.

Note.—Do not cut open the fruit to get the larvæ, or they will probably die.

My specimens show very little variation.

I have also taken it at Galle, Kegalla, and Kandy, and found it plentiful at the hot springs near Trincomalee in October.

" Very plentiful in the Matale district. Taken also around Ratnapura " (F. M. Mackwood).

145. VIRACHOLA ISOCRATES.—Also in India.

I have found this at Kirinda, in the Hambantota district, in February, at Elephant Pass (Jaffna) in December and January. And at Murunkan, near Mannar, in July, on the blossom of *Derris scandens*. The males are much less rare than the females.

" Low-country, generally where the pomegranate grows, as the larva feeds on its fruit " (F. M. Mackwood).

146. VIRACHOLA PERSE.—Also in India.

I took this, with the last, at Kirinda (near Hambantota), in February, and one female at Hambegama tank, in the low-country of Uva, in July, and have seen it caught at Wellawaya.

I have found it so rare that I know nothing of its habits.

" Similar range to the preceding, food plant being the same " (F. M. Mackwood).

(*To be continued.*)

APHIDIDÆ OF CEYLON.

By P. VAN DER GOOT. (Salatiga, Java.)

(*With two Illustrations.*)

UP to the present time but little has been recorded about the *Aphididæ* which occur in Ceylon. The most important Ceylon publication on this interesting group of insects is a paper by Mr. H. Schouteden, of Brussels, entitled "Notes on Ceylonese Aphides" ("Spolia Zeylanica," Vol. II., Part VIII., 1905, pages 181–189). This paper gives us a fairly good description of four Ceylonese plant lice, namely, *Greenidea artocarpi*, Westw., *Lachnus greeni*, Schout., *Oregma bambusæ*, Buckt., and *Ceratopemphigus zehntneri*, Schout.

Since then little or no further systematic work has been done on this group of insects in Ceylon. In the course of 1913 and 1914 a number of *Aphididæ*, collected by the late Mr. A. Rutherford, the Government Entomologist of Ceylon, were submitted to me for determination. Most of them were either well-known species, or had already been previously collected by me in Java; two of them appeared to be new to science. A list of the plant lice in this collection may, perhaps, be of some value in increasing our knowledge of Ceylonese insects; with the kind permission of Mr. Rutherford I therefore give a list of the plant lice observed, together with a description of the two new species.

List of Ceylon Aphididæ, collected by Mr. Rutherford.

Macrosiphum, minutum, nov. sp.
Macrosiphum rosæ, L.
Micromyzus nigrum, v.d.G.
Toxoptera aurantii, Boyer.
Toxoptera minuta, v.d.G.
Aphis gossypii, Glov.
Aphis tavaresi, Del Guercio.
Aphis medicaginis, Koch.
Longiunguis spathodeæ, v.d.G.
Brachycaudus helichrysi, Kalt.
Greenidea artocarpi, Westw.
Greenideoida ceyloniæ, nov. sp.
Shivaphis celti, Das.
Oregma insularis, v.d.G.
Oregma minuta, v.d.G.
Cerataphis lataneæ, Boisd.

Notes on the above-mentioned Aphididæ.

Macrosiphum minutum, nov. sp.—

Apterous viviparous female.—Examples of some measurements :—

Length of body	2·34 mm.	Length of siphunculi	0·63 mm.
Breadth of body	1·17 mm.	Length of cauda	0·45 mm.
Length of antennæ	—		

Colour.—Body brownish. Eyes black. Antennæ yellowish-brown, darker towards the tip. Legs yellowish-white; the tarsi, the tip of the tibiæ, and the greater part of the femora blackish. Cornicles and cauda black. (Notes from specimen preserved in alcohol.)

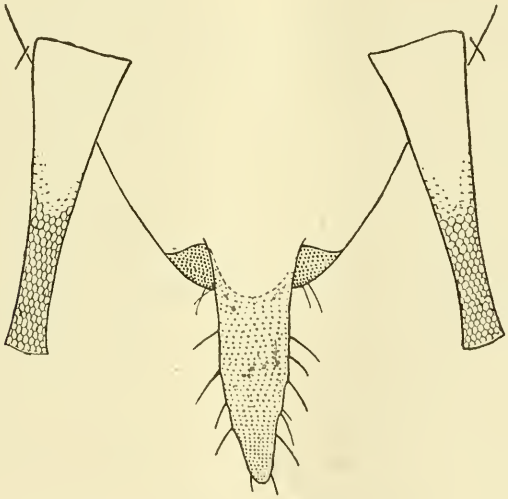


FIG. 1.—*Macrosiphum minutum,* n. sp.

HINDER PART OF ABDOMEN OF WINGLESS FEMALE (UPPER SIDE).

Morphological Characters.—Body ovate, the dorsum with transverse rows of spiny hairs, which do not arise from tubercles; the hairs are mostly slightly knobbed at the apex.

Antennæ partially broken off in all specimens examined, with a few stout spines. The third antennal joint bears only a single sensorium near its base. Frontal tubercles strongly developed.

Rostrum reaching to the third coxæ.

Siphunculi fairly long and thin, their basal half distinctly enlarged; the top part of the cornicles is finely reticulate. Cauda ensiform, about quarter shorter than the cornicles.

Legs long and slender, with scattered short spines.

Life History.—This small *Macrosiphum* was captured by Mr. Rutherford in May, 1914, living on *Vernonia cinerea*. Only a few wingless specimens could be discovered at that time.

Locality.—Peradeniya.

Macrosiphum rosæ, L.—Collected on roses, only wingless specimens present.

Locality.—Peradeniya.

Mycromyzus nigrum, v.d.G.*—A few winged and wingless individuals of this small species were collected by Mr. Rutherford on ferns (17–11–13); some months later (11–7–14) a single-winged female was observed on cinnamon (*Cinnamomum*, sp.). In Java only ferns have been observed as host plants.

Locality.—Peradeniya.

Toxoptera aurantii, Boyer.—The author's recent observations on this species have proved that *Toxoptera aurantii* has a very wide range of food plants. In Ceylon it has been collected by Mr. Rutherford on the following host plants: *Celtis cinnamomea* (on flowers), *Cynometra cauliflora* (on inflorescences), *Eugenia mooniana* (on apex of twigs), *Flacourtia ramontchi* (on young shoots), *Mesuaferrea* (on young twigs), and on *Plumbago capensis*. On *Mesua* the colonies were attended by the well-known ant *Œcophylla smaragdina*.

Locality.—Peradeniya.

Toxoptera minuta, v.d.G.—A single specimen was captured on the wing. In Java the author has observed a *Cyperacæ* (*Fimbrystilis diphylla*) as a food-plant of this species.

Locality.—Peradeniya.

Aphis gossypii, Glov.—This widely spread and polyphagous species has been collected by Mr. Rutherford on *Aristolochia indica*, on an Euphorbiaceous weed, and on *Solanum torvum*. On the latter food-plant the colonies were attended by the red

* This and following species, bearing the author's name, are described in full in his recent publication on Javanese plant lice (Zur Kenntnis der Blattlause Java's. Contributions à la faune des Indes neerlandaises. Vol. I., fasc. iii., 1915).

ant *Œcophylla smaragdina ;* though the infestation was heavy, only a single *Syrphid* larva was observed.

Locality.—Peradeniya.

Aphis tavaresi, Del Guercio.—Observed on *Citrus*, sp. only wingless specimens collected.

Locality.—Peradeniya.

Aphis medicaginis, Koch.—Collected on *Crotalaria striata ;* the colonies consisted chiefly of wingless individuals.

Locality.—Peradeniya.

Longiunguis spathodeæ, v.d.G.—A number of wingless and winged females of this species were collected by Mr. Rutherford on the shoots of *Panax*, sp. The colonies were exterminated by *Syrphid* larvæ and by an *Aphidius*, sp. This same species has been collected by the author in Java on *Gardenia florida*, *Senecio tenuifolia*, and *Spathodea diepenhorsti*.

Locality.—Peradeniya.

Brachycaudus helichrysi, Kalt.—A few wingless specimens were collected by Mr. Rutherford on Memer glover [*? Memecylon.*—Ed.].

Locality.—Peradeniya.

Greenidea artocarpi, Westw.—A number of apterous and alate females belonging to this species have been collected on the young shoots of the jak tree (*Artocarpus integrifolia*).

Locality.—Peradeniya.

Greenideoida ceyloniæ, nov. sp.—

Apterous viviparous female.—Examples of some measurements of the body :—

Length of body	2·50 mm.	Length of siphunculi	2·16mm.
Breadth of body	0·72 mm.	Length of cauda	—
Length of antennæ	2·70 mm.		

Colour.—Body pinkish-white (from notes by Mr. Rutherford on the living insect).

Morphological Characters.—Body elongate, slightly arched, nearly naked, except the margins of the body, which bear a few very short, slightly capitate hairs.

Antennæ about as long as the body, seven-jointed (the processus terminalis considered as a true joint) ; relative lengths of the last five joints about as 60, 23, 25, 18, 32. Primary sensoriæ apparently without hair fringe.

Rostrum slender, reaching to the third coxæ.

Siphunculi very long, not much shorter than the body, nearly cylindrical, with rather short hairs. Cauda nearly obsolete, obtuse. Rudimentary gonapophysæ 3, often indistinct.

Legs normally built, with a few short hairs.

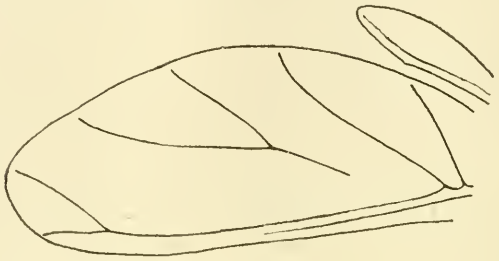


Fig. 2.—*Greenideoida ceyloneæ*, n. sp.

FORE AND HIND WINGS OF ALATE FEMALE.

Alate viviparous female.—Examples of some measurements :

Length of body	2·35 mm.	Length of siphunculi	2·70 mm.
Breadth of body	0·72 mm.	Expanse of wings	7·90 mm.
Length of antennæ	—	Length of cauda	—

Colour.—Body brownish-black ; the sides of meso and metathorax, the base and the apex of the abdomen yellowish-brown. Venter yellowish-brown. Eyes crimson. Antennæ black. Legs dusky white. Cornicles black. Pterostigma of fore wings black.

(Notes on living insects by Mr. Rutherford.)

Morphological Characters.—Body elongate, nearly naked. Antennæ broken off in the specimens examined ; the third joint bears about 23 fairly large sensoriæ. The antennæ are placed on very small frontal tubercles.

Rostrum, siphunculi, and cauda as in the wingless form.

Wings hyaline, the fore wings with the pterostigma very long, extending to near the tip of the wing ; *sector radii* short and nearly straight, the *media I.* only once forked, the *media II.* somewhat curved. Hind wings very small, with only a single longitudinal vein. Hooking hairs 2 in number.

(Description from two specimens.)

Life History.—This interesting species was discovered by Mr. Rutherford on May 11, 1914, feeding on the young foliage of *Mesua ferrea*. Only a few winged individuals could be collected at that time.

The species is preyed on by *Syrphid* larvæ and parasitized by an *Aphidius*, spec.; the parasitized insects are black in colour and somewhat circular.

Locality.—Peradeniya.

Shivaphis celti, Das.—A number of winged females and a few wingless ones were observed by Mr. Rutherford on the under surface of leaves of *Celtis cinnamomea*. The insects are very conspicuous owing to their white waxy coating and the large amount of a yellowish liquid (honey-dew) which they secrete. The same species has been found by Mr. B. Das in the neighbourhood of Lahore (British India).

Locality.—Peradeniya.

Oregma insularis, v.d.G.—Of this species a number of wingless individuals were collected on the under surface of leaves of bamboo (*Dendrocalamus strictus*). The colonies were attended by *Œcophylla smaragdina*, the red ant. The same species is fairly common on bamboos in Java.

Locality.—Peradeniya.

Oregma minuta, v.d.G.—Some alate and apterous females of this species were observed on the under surface of leaves of *Dendrocalamus strictus*, where they were attended by small blackish ants (*Cremastogaster*, sp.).

Locality.—Peradeniya.

Cerataphis lataneæ, Boisd.—A large number of apterous females were found on the inflorescences of an *Areca* palm.

Locality.—Peradeniya.

A NOTE ON LYMANTRIA AMPLA (Walker).

By R. Senior-White, F.E.S.

(*With a coloured Plate.**)

Position.—Order Lepidoptera, Heterocera. Family Lymantriidæ.

Distribution.—Throughout India, Burma, and Ceylon (Hampson).

Food Plants.—*Terminalia catappa* (De Niceville); *Ficus religiosa* (Lefroy); while in Ceylon I have found it on cacao, *Carissa carandas*, geranium, begonia, and rose. It appears to be extremely polyphagous, not one of the plants mentioned being even of the same natural order. The normal food plant in this district is probably cacao.

Occurrence.—There appear to be four broods a year, in January, April, June, and October.

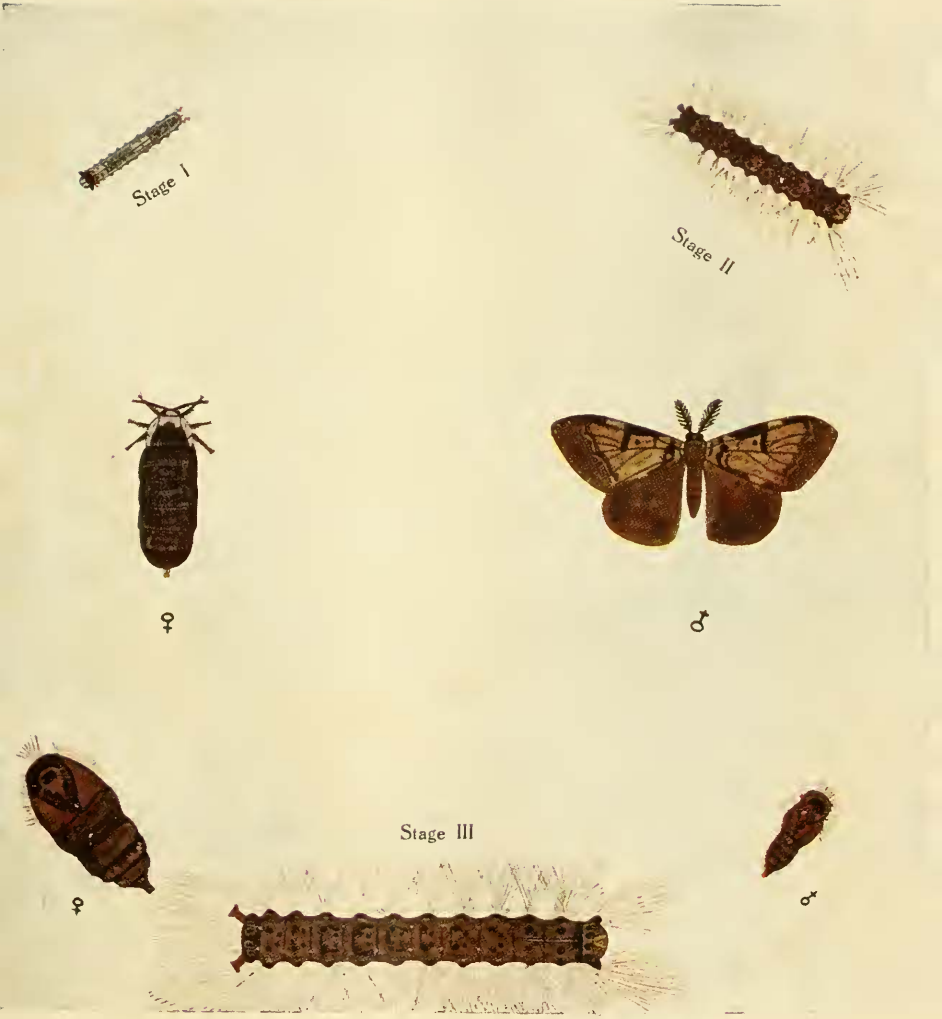
Egg.—Eggs are laid on the food plant in masses, which may measure as much as 25 mm. by 15 mm. by 12 mm., and which contain hundreds of eggs. The individual eggs are pinkish, over 1 mm. in diameter. The egg mass is covered with buff down from the body of the female moth.

Larva.—The hatching of an egg mass commences in about 11–12 days after laying, and continues irregularly for two or three days. The young larvæ make their first meal off the egg shell, and are at first 3 mm. long, buff in colour; but within twenty-four hours they darken to light brown, with a darker bar dorsally on abdominal segments 1–4 and 6–9, the ends of the bars being rounded off. As is usual with all Lymantriid larvæ, there are rings of small hair-bearing papules on each segment, and on either side of the head is an anteriorly directed hair pencil, but the large dorsal hair cushions on the leading abdominal segments so noticeable in other genera of the family are wanting.

The appearance of the larva remains thus until a length of 15–20 mm. is attained. During this time there are probably two instars.

* This will appear in the next Part of *Spolia Zeylanica*.

LYMANTRIA AMPLA



R. S-W. del.

This plate to face page 76 in Vol. XI., Part 40, of "Spolia Zeylanica."

In the second stage the colour is brown, darker dorsally throughout, with a bluish spot, faintly ringed with yellow, on each segment each side of the median line, while, in addition, on the sixth abdominal segment there is a median red spot ringed with black, and on the seventh abdominal segment a median black spot. The hairs are as in the first stage. This second stage lasts through only one instar. The maximum length attained is 30 mm.

Third Stage.—Colour coffee-brown. There is an inverted Y-mark on the clypeus. The junction of the pro- and meso-thorax bears dorsally a broad transverse dark velvety band, only visible when the segments are extended. There is a light median line on the three thoracic segments. On each segment is a dark brown hair-bearing papule each side of the median line, and on the meta-thorax and abdominal segments a similar but smaller pair of papules interior to and anterior of the larger pair. The larger outer papules are connected transversally across the segment by a dark line, which is complete on abdominal segments 4, 5, 6, and interrupted medianly on abdominal segments 2, 3, 7. On the three first-mentioned segments an inwardly directed dark line leads from in front of the larger hair papule to the anterior edge of the segment, but the lines from each side do not meet at the segmental edge. These lines are prominent only on segment 5 of the abdomen. On the sixth and seventh abdominal segments is a small dark reddish horn-like process on the median line. On the anal segment are three additional hair papules. The anteriorly directed hair pencils from the pro-thorax are prominent. There are the usual lower rows of hair papules, those at the lateral position being larger than the others. This is the last larval stage, and is of one instar duration only. The length full grown varies with the sex, the male larvæ attaining a length of 20–30 mm. only (this last being exceptional, and found only in the case of one larva, to be referred to later, which pupated in stage 2), while the female larvæ attain a length of 50 mm. with a corresponding increase in girth.

Varieties in Larvæ.—In one case I have found a larva, of normal appearance in stage 1, to appear in stage 2 with a

white subdorsal band, extending from the lower edge of the dark dorsal bar to the upper side of the sub-dorsal hair papules, which were thus strongly accentuated in appearance. The white bar was most marked on abdominal segments 1–4 and 7–8. In this larva the median spot on abdominal segment 7 was red. This larva pupated in stage 2, never assuming the appearance of the third stage, but the second stage was, as usual, confined to one instar. It gave rise to a normal male imago.

In another case I found a larva in stage 3 which possessed a broad white lateral suffusion from the meta-thorax to the anal segment. This larva gave rise to a normal female. It is thus apparent that the white bar is not indicative either of sex or of larvæ which pupate without assuming the appearance of the third stage.

Pupa.—In no case have I found a cocoon formed. The male pupa is 15 mm. long, chocolate-brown, slender. The wing cases are fully formed. The female pupa is 25 mm. long, ovate, with noticeably small wing cases. It is free, or attached to a twig by a few silk threads. The colour is similar to the male pupa. Pupæ of both sexes have tufts of short lighter hairs in rings on the abdominal segments, a few scattered tufts on the thoracic portion, and a collection of closely set small tufts around the head end. Both sexes have an obtuse anal spike.

Imago: Male.—Expanse 30 mm. Fore wings brown, lighter basally, across which portion are three ill-defined crenulated dark lines from costa to dorsum. The inner half of the costal margin is dark, but exterior to cell there is a whitish patch on costa, which may be very noticeable, or nearly uniform with the brown of the wing. The outer portion of the wing is dark, with a post-medial lunular line of darker brown, divided from the outer dark area by a lighter brown line of lunules. There is a dark spot in cell, and a dark lunule at the end of it. The median nervure is dark and prominent, especially from the sub-basal line to end of cell. The terminal cilia are yellowish at the extremity of each vein. The hind wings are a uniform somewhat lighter brown, but in one specimen (which originated from the above described larva

which pupated in stage 2) there were traces of post-medial and marginal dark lines. The body is small, slender, of a uniform brown. Antennæ plumose.

Imago : Female.—The female imago possesses only rudimentary white scale-like wings, which are functionless. The body is dark gray-black, pubescent. On emergence from the pupa the body length is 30 mm., being enormously distended with eggs, but as these are laid the length shrinks to only 10 mm. The legs are somewhat long, and enable the female to crawl a few inches from the pupa. Antennæ serrate.

Life Cycle.—Egg 11–12 days. Male : larva 27–32 days. Pupa 10–12 days. Total 48–56 days. Female : larva more than 55 days. Pupa 6–9 days. The total female life cycle thus occupies probably quite a month longer than that of the male. As the moths have no means of feeding, it is difficult to understand how the male moth exists until the female has emerged.

Oviposition.—On emergence from the pupa the female imago usually crawls a few inches and awaits the advent of the male. The female apparently produces a scent (though this is not noticeable to man), which reaches its strongest on the fourth day of imaginal life, when males are attracted in considerable numbers from some distance. In one case a female confined under a glass bowl from the time of emergence attracted five males into the laboratory from cacao quite 75 yards distant. The windows were shut at the time, but the males at length managed to gain entrance through a fanlight only some two feet square. The male is apparently dependent entirely on his scent organs to find the female, as on another occasion, when a male had entered the room and was fluttering round the table on which the female was confined in a glass, the latter was removed from the glass, the disturbance of the air in which apparently sent a wave of scent upwards, to which the male immediately flew, settling at the bottom of the glass, now empty, and ignoring the female herself, placed on the table within a few inches of him. He even had to pass her to enter the glass. The visits of the males to females in confinement always appear to take place about noon, and the males fly in the

brightest sunlight. At no other time have I seen the male flying by day.

An unvisited female appears to eagerly await the male, seeming uneasy, and continually raising the end of the abdomen and extruding the ovipositor. Copulation continues for about five hours, and fertilized egg laying commences about two hours later. If the male is not allowed access to the female, unfertilized egg laying may commence within a few hours of emergence, or be postponed for as much as two days. If the female has commenced to lay unfertilized eggs prior to copulation, eggs laid subsequently to this are still infertile. An unfertilized female can live ten days, but no eggs are laid after the sixth day until within a few hours of death, when a few separate white eggs, not covered with down, and removed from the main egg mass, are laid. Fertilized females do not lay such last few eggs, and die when oviposition is completed. The death of the male has not been observed.

Control.—The larvæ are parasitized by a hymenopterous fly, probably a chalcid, the grubs of which kill the larvæ at any stage, emerging from the dead body, pupating close by and emerging as imagines 9–10 days later. In common with other Lymantriid larvæ, the larvæ sometimes die of a kind of dysentery, very dark brown in colour, which appears to be caused by a diplococcus, which can be found freely in the discharge. Light has apparently no attraction for the males.

Status.—At present the insect can hardly be described as a pest, save of pot plants, geranium, and begonia, to which it is very partial. Its attacks on cacao are very slight, though I have no doubt that this is its main food plant in the Matale district, and much searching is necessary if larvæ are to be found. It is probably kept in check by the hymenopterous parasite. As, however, owing to obscure causes, the control over it of the latter may suddenly prove ineffectual, and a serious attack occur, the above notes are offered in the hope that they may prove of service in the event of such happening.

In conclusion, I have to thank Mr. G. M. Henry, Assistant Entomologist at Peradeniya, for confirming my identification of the insect.

NOTES.

Further Notes on the Wellawatta Horse.—In a recent publication of the Colombo Museum (" Spolia Zeylanica," Vol. X., Part 38) the writer (Mr. Wayland) attempted to establish a case in favour of the antiquity and specific distinctness of a couple of equine teeth discovered at Wellawatta. In the absence of type specimens and palæontological literature, it was not possible to compare the remains with any fossil species already described, excepting *Equus leptostylus*, Matsumoto (Science Reports, Tôhoku Imperial University, Japan, Second Series (Geology), Vol. III., No. I., pp. 29–30), but certain structural differences between the Wellawatta teeth and those of the modern domesticated horse (*Equus caballus*) were noted and described in detail. Moreover, it was shown that while the remains are younger than the oldest stone implements of Ceylon, they almost certainly antedate the historic period. Hikoshichiro Matsumoto, the Japanese Palæontologist, in a letter to the writer goes into the question of the possible affinities of the Wellawatta horse in some detail. After pointing out the more important features of the grinder (*i.e.*, very simple plication of the enamel ; the great width of the bay between the anterior and posterior inner pillars, and the concave inner side of the sub-triangular inner pillar), he shows that the Wellawatta horse exhibits likenesses to certain members of the Ass group (sub-genus *Asinus*). Next he gives some account of the following species : *E. sivalensis* and *E. namadicus* (upper Pliocene, India), *E.* (*Asinus*) *asinus* (upper Pleistocene, Europe and India), *E. hemionus* (upper Pleistocene, Europe and India), *E. hemionus* (upper Pleistocene, Europe and China, still living in Central Asia, Mongolia, and Siberia), *E. onager* (still existing in India), and an unnamed species described by Lydekker from the Karnul cave near Madras.

Matsumoto points out the resemblance between the Wellawatta molar and the corresponding teeth of *E. onager* and *E. hemionus*. He maintains it is not impossible that *E. hemionus* and the Wellawatta horse are co-specific, but does not, for zoographical reasons, regard this as a probability. He says in his covering letter : " I have observed the Wellawatta

horse* from the Palæontological side. I can safely regard that the Wellawatta horse [? molar] belongs to a certain horse not yet palæontologically named, though there is a possibility that it belongs to *Equus onager*."

In his summing up Matsumoto favours a correlation with Lydekker's unnamed species from the Karnul cave—a species which may, or may not, be closely allied to *E. onager*. He calls attention to the strong resemblance of a grinding tooth of the Karnul horse to the Wellawatta molar, and adds : " On the other hand, it may easily be expected that some members of the Karnul fauna haunted also in Ceylon. Thus, it is highly probable from the morphological and zoogeographical points of view that the Wellawatta and Karnul horses are co-specific. Thus, the specific name *E. zeylanicus*, Wayland, may be applicable to both horses, at least for the present, and until the supposed alliance of them with *E. onager* be actually proved. The following is a statement by Lydekker with regard to the antiquity of the Karnul remains :—

" The comparatively large number of species either totally extinct, or which are not now found living in India, renders it probable that the age of a considerable part of the Karnul cave deposits is not newer than the Pleistocene ; and the fauna, as being almost certainly more recent than the Narbada beds, may be provisionally assigned to the latter part of that period."

Such an age corresponds well enough with the geological position of the Wellawatta teeth.

The following bibliography of the fossil horses of India is supplied by Matsumoto :—

(1) *Equus sivalensis*, Falconer and Cantley.

Falconer and Cantley : Fauna Antiqua Sivalensis, Pt. IX., 1849, Pls. LXXXI.–LXXXV. ; Falconer : Palæontological Memoirs (edited by Charles Murchison), Pt. I., 1868, pp. 186 and 524 ; Lydekker : Palæontologia Indica, Ser. 10, Vol. II., Pt. 3, 1882, p. 87 (21) ; Lydekker : Brit. Mus., cat. Foss. Mam., Pt. III., 1886, p. 66 ; Lydekker : Rec. Geol. Surv. India, Vol. XXIV., 1891,p. 211 ; Schlosser : Abhandl. k. bayer. Akad. Wiss., II. Class, Bd. XXII., Abth. I., 1903, p. 86.

* From my drawings of the teeth ; that is, Mr. Matsumoto has not had the advantage of handling the actual specimens.

(2) *Equus*, sp., aff. *namadicus*, Falconer and Cantley.

Lydekker: Palæontologia Indica, Ser. 10, Vol. II., Pt. 3, 1882, p. 88 (22), Pl. XIV., fig. I. (as *E. sivalensis*).

(3) *Equus namadicus*, Falconer and Cantley.

Falconer and Cantley: Fauna Antiqua Sivalensis, Pt. IX., 1849, Pls. LXXXI.–LXXXII.; Falconer: Palæonotological Memoirs (edited by Charles Murchison), Pt. I., 1868, pp. 186 and 525; Lydekker: Palæontologia Indica, Ser. 10, Vol. II., Pt. 3, 1882, p. 92 (26); Lydekker: Brit. Mus., cat. Foss. Mam., Pt. III., 1886, p. 71.

(4) *Equus* (*Asinus*) *zeylanicus*, Wayland. ? *Cf. onager* Brisson.

Leydekker: Palæontologia Indica, Ser. 10, Vol. IV., Pt. II., 1886, p. 39 (without specific determination); Wayland: Spolia Zeylanica, Vol. X., Pt. 38, 1916, p. 261.

(5) *Equus* (*Asinus*) *asinus*, Linne.

Lydekker, Palæontologia Indica, Ser. 10, Vol. IV., Pt. 2, 1886, p. 39.

E. J. WAYLAND.

On Colour Shades and Wing Markings of Euproctis semisignata (Wlk.).—An egg mass of this moth bred out yielded thirty-nine imagines, in which the fore-wings were coloured and marked as follows :—

	Male.		Female.	
	White.	Yellow.	White.	Yellow.
Four spots on band cell to dorsum ..	—	3	—	—
Faint traces of such throughout ..	—	1	1	1
One spot below cell	—	1	—	1
One spot above vein 1 ..	1	2	—	—
Immaculate	4	5*	19†	—
	5	12	20	2

* 53 per cent. † 86 per cent.

The " smoky black spot at end of cell " described by Hampson was only slightly developed on the left fore wing of one of the strongly marked males.

Five of the males had a dark brown patch on the posterior abdominal segments, absent from the rest of the series.

R. SENIOR-WHITE.

PROCEEDINGS OF THE CEYLON NATURAL HISTORY SOCIETY.

Twenty-first General Meeting.

The Twenty-first General Meeting of the Society was held in the Colombo Museum Library on November 16, 1917, at 5.15 P.M., the Rev. Father M. J. Le Goc in the Chair.

A paper entitled "Notes on Colombo Water Plants" was given by the Rev. P. T. Cash, and illustrated by many specimens.

In the absence of the contributors, Mr. W. A. Cave read the following papers :—

(i.) Further notes on the Wellawatta Horse, by Mr. E. J. Wayland.

By Mr. G. M. Henry :—

(ii.) Note on an albino Barbet (*Cyanops flavifrons*).

(iii.) Tameness of nesting Fantail Flycatcher (*Rhipidura albifrontata*).

(iv.) Land Leeches (*Hæmadipsa zeylanica*) attacking Snails (*Achatina fulica*).

(v.) Food of the Water Tortoise (*Nicoria trijuga*).

New Members :—G. H. Elliott ; R. A. Senior-White ; Dr. Gerald H. de Saram ; C. Ismail.

OUTLINES OF THE STONE AGES OF CEYLON.

By E. J. Wayland,
Late Assistant Mineral Surveyor to the Government of Ceylon.

(*With nine Plates.*)

I.—Introduction.

DURING the last five years much of my spare time has been spent in the investigation of the Stone Age remains of this country, and more particularly of those which occur in the lowland and coastal regions. I hoped to publish a detailed account of such discoveries as it was my lot to make when I had earned the right to do so; and the end of this year would probably have seen the result had it not been for a more urgent call upon my time. The present outlines are sketchy and somewhat disconnected, but they must serve in the circumstances, as best they may, to indicate present results and possible lines of future investigation. My entire collection, with the exception of a few duplicates and hill specimens which have been given to other collectors, has been passed over to the Principal of the Royal College, who will select a representative series for the Colombo Museum. Unfortunately the most prolific sites for the older tools, of which my collection chiefly consists, are hidden away in far jungles, in places which are both costly and difficult to get at, and where too, the explorer must risk sickness and discomfort. It is unlikely, therefore, that the work which I drop so unwillingly will be at once taken up by others. There are few in this country so fortunately placed that they can in the course of their

official travels get well away from the beaten track; but to those who travel at all opportunities to add something to our knowledge of early man must now and then occur. It is to such among you that these outlines are more particularly addressed. They will serve a useful purpose if they keep to stimulate an interest in the prehistoric antiquities of the Island, and thereby tend to foster future research. If they are no more than outlines, it is for reasons already told.

II.—Veddas and the Stone Age.

The researches of Messrs. J. Pole, E. E. Green, Drs. F. and P. Sarasin, Dr. C. G. and B. Z. Seligmann, and Mr. C. Hartley have shown that in bygone days Ceylon was inhabited by a primitive people, whose weapons and tools were of stone, bone, and wood.

The want of representative types of artefacts has, till quite lately, rendered the culture stage (or stages) attained by these early folk a matter of some speculation;* while, in the absence of definite geological evidence, nothing certain could be said of the age of such tools as were discovered. The vast majority of implements recorded by the above-mentioned authorities were found in the hill country, often on the surface, and seldom more than a foot below it. Their association with charcoal and presumably modern refuse and their occurrence in Vedda caves have led to the belief that the Veddas themselves or their immediate ancestors were the stone-age people of Ceylon.

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* Drs. F. and P. Sarasin ("Spolia Zeylanica," Vol. IV., Part XVI., 1907, p. 189) say: "These stone chips are of a very rough kind, belonging to the older or Paleolithic Stone Age." And on p. 190: "We, furthermore, may venture to say that the second main period of the Stone Age, the Neolithic one, ... is entirely wanting in the Island of Ceylon." Dr. C. G. and B. Z. Seligmann say ("Spolia Zeylanica," Vol. V., Part XX., 1908, pp. 162 and 163): "As regards the type of these quartz implements, there seems no good reason to consider them other than neolithic; . . . . many of the specimens differ in no respect from implements of the neolithic age found in Europe." James Parsons (*loc. cit.*, p. 190) remarks of one tool which was submitted to him that it closely resembles an eolith.

Misconceptions with regard to Vedda anthropology have fostered this view,* and the occasional discovery of bits of worked bottle-glass would appear corroborative.†

To the best of my belief, however, there is no evidence at all to show that people of Vedda blood passed through a stone-age phase in this country. Moreover, if, as seems highly probable, the wild forest people, so recently extinct in this Island, were the last survivals of the *Yakkas* of antiquity, one can hardly doubt that they (the Veddas) were a degenerate and not a primitive race.‡ The *Mahawansa* makes it plain that more than twenty centuries ago the *Yakkas* were highly civilized.

The fact that beneath the floors of Vedda caves stone tools are sometimes to be found throws little light upon their authorship; nor is the apparent newness of the tools themselves a telling argument in favour of modernity, since the crystal quartz, from which the vast majority were struck, is among the most imperishable of substances. Mr. Charles Hartley has shown that charcoal not uncommonly occurs in the "chip-layer" of the Bandarawela hills, and he takes this

* The late Professor Virchow, although a believer in the probable autochthony of the Veddas, shows in his monograph upon them (first published by the Royal Academy of Sciences of Berlin and afterwards translated—Jour. C. B., R. A. S., Vol. IX., No. 33, 1886) that anthropologically they are related to certain tribes of Southern India, and not to the Andamanese or to the aborigines of Australia, as some have thought. Churchward ("The Signs and Symbols of Primordial Man," London, 1913, p. 133) speaks unblushingly of "The Viddas of Ceylon—The race that the Ainu drove out and destroyed in Japan . . . ." Parker, writing with some authority on the Veddas, says ("Ancient Ceylon," London, 1909, p. 20): "Perhaps the strongest evidence of the country of their origin is their own tradition that this deity (a Hill God) came to Ceylon from Malawara-desa, 'the Country of the hill-region,' that is the Malayalam hills." If I remember rightly, even Huxley went amiss about the Veddas; to the best of my recollection he says in effect that the internal evidence of their language shows them to be related to the aborigines of Australia. (I cannot verify this statement, as the Colombo Museum Library has no copy of that remarkable work "Man's Place in Nature," and my own copy is in England.) The Vedda language, of course, is little known.

† I was much puzzled when, in August, 1912, I found at Haputale a fragment of a bottle which had obviously been worked to an edge. The explanation of this interesting specimen is probably to be found in a statement made by Mr. John Pole (Ceylon "Stone Implements," Calcutta, 1913, p. 3) to the effect that Tamil coolies working on estates in Ceylon, some thirty years ago, fashioned "rude glass razors" from the bases of beer bottles.

‡ See Chapter II. of Parker's "Ancient Ceylon," and in particular the last section of it "Evidence of Former Civilization" (pp. 103–112).

to indicate that the artefacts with which it is associated "are not of a very remote date, or otherwise the charcoal would have been absorbed and have left no trace behind." Again, I do not think this argument is valid, firstly, because charcoal is durable enough, and has been found on Roman and on stone-age sites of proved antiquity before; and secondly, because not everything in the "chip-layer" is of prehistoric date, as a recent find of brass cartridge sheets (by Mr. Hartley) conclusively proves.

If the Veddas made the stone tools of Ceylon, how is it that these people who lived, as we know they did, under conditions of extreme want and savagery, made no use of their art in the quest after a livelihood? Why should a people skilled in the manufacture of tools and weapons sufficient for their needs depend on barter with an alien race for precisely these implements?*

A wild hunting race, so long as it remains such, is not likely to forget the very rudiments of a craft upon which its life depends; but the weaker members of a civilized community, forced by the growing strength of class antipathy back into the wilderness, and divorced from the common arts of primitive folk by a thousand generations of specialized endeavour, may well be at a loss to cope with the conditions of a nomad's life. Such in effect, I believe, is the story of the Veddas. Like the Ascidians, who have forgotton how to swim, they have turned aside from the paths of progress and belied their heritage.

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* The use of stone implements persists among a people long after their first acquaintance with metals. For example, flint implements, probably used for dressing monoliths, have been found at Stonehenge, and this structure is generally supposed to be a temple of the Bronze Age. In Egypt flint blades were used for eviscerating a body before embalmment long after the discovery of metals. Obsidian knives were used by the priests of mediæval Mexico to hack out the vitals of their victims; and sharpened flint was used at Jewish circumcisions. The custom of placing flint blades in graves persisted as an ancient rite among the Frankish people of Gaul (whose sway over what is now north-west France came to an end in 752 A.D.); but the habit survived in Celtic folklore to a much later period. It is significant that Shakespeare makes the priest say at the burial of the unfortunate sister of Laertes—

> . . . "Her death was doubtful;
> And, but that the great command o'ersways the order,
> She should in ground unsanctified have lodg'd
> Till the last trumpet; for charitable prayers,
> Shards, flints, and pebbles should be thrown on her."

Out of tune with their environment, out of time with their era, they were doomed to extinction. The Veddas, we are told by those who knew them, did not laugh or sing, "but for amusement they would toss leaves in the air, in order to watch how these would flutter to the ground."* This is, indeed, a sad picture.

Man's innermost being is mirrored in nature, and so perhaps the Vedda saw (albeit subconsciously) little but his own sorry heart expressed in forest and dell, in the running waters, and the pleasant glades of Uva. And he must have known, if indeed he cared to know, that the days of his pilgrimage were few; that ere long he and his kind must pass away for ever. Perhaps he was glad of it, for to those who fall short in compliance with the demands of life there is a welcome in oblivion.

The brothers Sarasin say (*loc. cit.*) that the Veddas must represent the few remnants of the aborigines of the Island, who were met with by the Sinhalese on their first arrival, and were called by them *Yakkas*, according to the old tradition preserved in the *Mahawansa*. If this were true, *it is necessary to presume that these aborigines were living in the Stone Age at the time* . . . . (the italics are mine). Why should it be necessary to presume any such thing? That the Veddas and *Yakkas* were one is probable enough; but the authoritative statements of anthropology and history in so far as they prove anything at all go to show that the Veddas, as a race, have known better and kindlier days. Moreover, we are told by the same authorities that the Veddas were an older stone-age people, and, as I hope to show, the Paleolithic period in Ceylon takes us back many thousands of centuries, to a time when the geography of the land was different, and to days before the modern races of mankind had yet emerged. Twice on one page the brothers Sarasin find it expedient to insist that the autochthony of the Vedda "is a proved fact," and their evidence for this statement is the occurrence of stone tools under the floors of Vedda caves and in the soil of the patanas. I submit that the autochthony of the Veddas is not a proved fact, and further, that it is not even probable.

* Lewis, F.: "Notes on an Exploration in eastern Uva and southern Panama Pattu." (Jour. C. B., R. A. S., Vol. XIII., No. 67, 1914, p. 285.)

III.—The Stone Tools of the Hills.

Stone tools are now known to exist in enormous numbers in Ceylon. I divide them into two series: The Hill series and the Lowland series. This division is not a strictly natural one, but it is convenient. Previous authors have dealt chiefly with the Hill series. The artefacts found upon the highlands of the Kandyan Provinces are generally supposed to be of Neolithic date. They comprise scrapers (round, hollow, irregular, and straight), small blades, chisels, planes, arrow-heads, points and borers, flakes, cores and hammer-stones, &c. Large tools are conspicuous by their absence.

Nearly all of them are made from crystalline quartz, but occasionally one comes across a chert implement.* It is a curious fact that while chert tools are remarkably rare in the hills, flakes and broken fragments of this material occur in great abundance on certain sites. No doubt this fact is not without significance, but no one has yet ascertained its meaning.

Over and above these ordinary tools, Mr. C. Hartley has of late years discovered large numbers of highly specialized implements, which, on account of their small size and the fineness of their workmanship, are generally known as Pigmies. The term refers, of course, to the tools alone, and not to the people who made them.

This discovery is one of extreme interest and importance, for Pigmies are known to represent a particular culture-stage in the history of man, obtaining either at the close of the older (Palæolithic) or at the beginning of the newer (Neolithic) Stone Age. Authorities are inclined to differ on this point.

I need not detail to you the features of these implements, as they have already been figured and described in the pages of "Spolia Zeylanica."† Their uses are not certainly known,

* Mr. James Parsons, the late Principal Mineral Surveyor, in his paper on "The modes of occurrence of Quartz in Ceylon" ("Spolia Zeylanica," Vol. V., Part XX., 1908, pp. 171–177), gives an interesting account of the materials used by stone-age peoples of this country in the manufacture of their tools. Collectors should consult this.

† Hartley, C.: "On the occurrence of Pigmy Implements in Ceylon ("Spolia Zeylanica," Vol. X., Part XXXVI., 1914, pp. 54–67).

but the fact that their distribution is practically world-wide* shows that they were designed to meet a very general demand; and, if I might throw out a suggestion in passing, it is that the pigmy tools were used chiefly in the manufacture of bone needles, and that the so-called "back" was really the business edge. Mr. Hartley has called attention to the curiously limited number of types of artefacts in the Hill series; he says: "Nothing resembling an axe has ever been found in Ceylon. There was, besides, no chopper or heavy blade, no spearhead, saw, punch, or fabricator . . . . there were no sling stones or throwing discs, nor any sign of pot-boilers."† It should be remarked that this statement applies to the implements of the hill group only; no information with regard to the tools of the lowlands was available at the time when Mr. Hartley's paper was written. These omissions cannot be without their meaning, but I for one am disinclined to throw in my lot with those who believe that the makers of the pigmies "maintained an inglorious existence by preying on the lesser creatures and trusting to flight from the more formidable."

It should be remembered that the tools of the Hill series have been collected almost exclusively from the tops of grass-covered knolls and ridges which protrude from the upland forests. There is no reason to believe that the natural conditions of this part of the country were essentially different in pigmy times; indeed, the large accumulations of flakes and cores, indicative of "factory sites," show beyond reasonable doubt, that patanas existed in those far off days much as now.

There can be no question that the differentiation of crafts proceeds *pari passu* with the growth of civilization; and, for my part, I believe this tendency to specialize expressed itself in very early times. One has only to see some of those excellent productions of the Solutrean period‡ to realize that the individuals who could express designs in flint with such extraordinary skill had advanced beyond the ordinary run of men. I believe that since the earliest times men have made

* England, France, Belgium, Spain, North Africa, Egypt, Palestine, East Africa, South Africa, India, Ceylon, and Australia are the countries from which pigmies have been recorded up to date. Doubtless they will be found in many more places yet.

† *Loc. cit.*, p. 64.

‡ See Appendix A.

two sets of implements: a common set to meet demands of immediate necessity, and another for more permanent use. The tools of the first were crude and made by any man, while those of the second were the work of few, who constructed them, no doubt, with not a little pride. They are the index of the culture-stage of the folk who made them, and, in some measure, a criterion of the mental status of the race.

The rise of industrial arts would naturally lead to the centralization of industries, with results akin to those which still obtain in some parts of Africa, where an entire village is devoted to the manufacture of spears and knives, another to wood-carving, &c. Nor is it perhaps too much to suppose that among a savage people skilled workers would be looked upon as a class apart at first escaping, and later on despising, common labour; living by means of their craft alone and bartering their artefacts for the products of the chase.

If these, then, were the conditions of pigmy times, the larger implements adapted to the ordinary needs of life might well be missing from the patana sites. There on the open ground a colony of pigmy-makers, protected from intrusion, no doubt, by a palisade of stakes, could live at ease, quite unmolested by the big carnivores and other dangerous inhabitants of the wild. The meaner people would construct the palisade and build the huts with timbers hewn in the neighbouring forest. They would supply the pigmy-makers with meat and fruit and honey collected in the woods. All materials for the manufacture of the pigmy tools were brought up from the valleys, and as the industry was presumably special and more or less exclusive, the common tools were made, no doubt, in the valleys below, where the streams supplied large quantities of quartz.

I suggest this explanation of pigmy-factories merely as a working hypothesis. Further research will show whether it is acceptable or not, for the proof of its validity (or otherwise) lies in the jungles, the rice fields, and the wooded dells, which separate the patanas; and these have never yet been searched.

There is one fact which, taken together with the general absence of common tools and weapons of offence, seems at first to militate against the hypothesis I offer. Mr. Hartley

states it thus : "In all cases where identical types of implements from above and below the surface can be compared, there is no question that the former is on the average considerably larger than the latter. The only marked exception is the large round scraper from the pigmy-layer alluded to. I have also picked up on the surface of Bungalow Hill a single arrowhead ; it is significant that this differs, not only in size, but in type from any recovered from below ground. I do not attempt at present to draw any hard and fast conclusion ; but the evidence before me inclines me now to believe that the two types are separated in time."* This may be so, of course, but it is well to remember that in soils subject to conditions such as those which affect the patanas, the larger pebbles and rock-fragments are situated at the tops, when they themselves are both chemically and physically stable, and are not derived from the strata underneath.

Microscopic examination shows that the soil-cap on the hill referred to is due to the weathering of the rocks below. The chip-layer is situated at a depth seldom less than two inches or more than six beneath the surface ; since, as can be shown, the soil-cap was not deposited over the chip-layer from an extraneous source, it follows that the chips must have sunk, as there can be no doubt that they were originally on the surface.

Worms, as far as my observations go, are decidedly rare on the patanas, so their participation as burying agents may be safely ignored; burrowing insects, however, are more common. The latter carry out most of their work during the dry season, when a large percentage of the soil which they bring to the surface must be blown down the hill slopes. Consequently the chips descend chiefly by a process of undermining, and since small chips are more easily undermined than large ones, the tendency is for the larger fragments to lag behind in the downward movement. Moreover, large stones protruding from the soil are more easily dislodged from their positions by accidental circumstances, and are also less liable to be pressed into the soil by the feet of animals and men who may by chance trample on them.

* *Loc. cit.*, p. 66.

A difference in size of "identical types" from above and below the surface is not enough to establish an essential difference in age when the specimens are separated by only a few inches of soil; a consistent difference of type is what is wanted. I will not here enlarge on the question of surface and buried implements, though it is one of considerable interest. Nor will I deal further with the stone tools of the hills, for all else I can say under this head has been said by others before me, so I will pass on to speak of the prehistoric antiquities of the lowlands.

IV.—The Stone Tools of the Lowlands.

The stone tools of the lowlands occur in detrital deposits or on the surface of such deposits, from which some of them are derived. These accumulations take the form of gravels terracing the river valleys and capping low hills composed of red earth which commonly overlies the gravels, of sand dunes, of the clays and loams of the rice flats, and the beds of modern streams. The features of these deposits will be described later.

The tools discovered include the forms described as belonging to the Hill series, together with another, and, I venture to think, older, assemblage, in which the types missing from the upland series are present.

Noticeable features of the lowland group, as a whole, are the prevalence therein of steep-sided scrapers or planes, the number of split and worked pebbles, the presence of domed, tortoise-like pieces, the size of the tools, and their composition.

On the average the lowland artefacts are very much larger than those of the Hill series. Small types occur, and these are generally composed of quartz either of the milky or crystal variety, while the bigger forms, more characteristic of the group to which they belong, were commonly struck from chert.

The chert varies in quality from an opaque splintery substance, little used by stone-age peoples, to a stone with a fine conchoidal fracture, closely resembling European flint, and often translucent in thin flakes.

In colour the newly cleft surfaces vary from almost black (rare) to white (also rare). The commonest colours are brown, greenish-brown (rarely distinctly green), various shades of buff, and an occasional gray. Brown chert, which is the commonest of all, is known to the Sinhalese as *ginigala* (fire-stone), and was in former days used by them, and also probably by the Portuguese, Dutch, and British, for gunflints. Dark red and pink shades are also to be found.

Comparatively pure chalcedony also occurs, while in the North-Central Province (basin of the Kal-aru) common opal, due to the replacement of limestone by silica, has been occasionally made use of by early man; but the material is too soft to have been much sought after.

The cherts are seldom homogeneous. The buff and brown varieties often contain strings and rosettes of a fibrous lighter-coloured silicious substance, in which the fibres are arranged at right angles to the length of the strings. Sometimes, too, the chert is brecciated or conglomeratic in structure, very rarely the latter.

Under the microscope many specimens show a marked development of spheroidal structures, due to the segregation of the purer silica around numerous centres. The more ferruginous material lies between the centric structures. Some cherts, more particulary those of Uva, exhibit a finely mottled appearance; and in these the microscope reveals a system of branching, butt-ended rods or tubes. These strongly recall organic structures. I believe, however, that they are nothing of the sort.

The origin of chert in Ceylon does not appear to be always the same. The mottled variety and that which contains the fibrous structures are formed, as far as my observations go, by the metasomatic replacement of gneissose and granulitic rocks by silica, a very curious and interesting phenomenon. Some grayish and brown cherts of the Northern Province appear to have been formed by a similar replacement of limestone. I say "appear" advisedly, for though I have never seen direct evidence of this replacement, I find it extremely difficult to account for the presence of the mineral otherwise. Some specimens from the extreme north of the Island bear

so astonishing a resemblance to European flint, that I was led at first to suppose that they had been imported (in the form of ballast) in the days of our forefathers for the purpose of making strike-a-lights or gunflints.

The occasional occurrence of a precisely similar material in the jungles of the Puttalam District, showing prehistoric workmanship proves this supposition unnecessary.

An extremely remarkable white laminated chert occurs interbedded with the metamorphic rocks of the lower part of the basin of the Moderagam river in the Northern and North-Western Provinces; while red and yellow jaspers of inferior quality are to be found near Pomparippu and in a few other districts. All these materials have been worked by prehistoric man.

Tools of milky and crystal quartz occur as they do, in the hills, while certain large implements were made from granular quartz rock (sometimes wrongly called quartzite). Tools of quartzite and volcanic glass resembling obsidian, like the materials themselves, are exceedingly rare, as are those of sandstone. Some bits of hæmatite appear to have been "nibbled" at and cast aside as useless. Once I came upon a pebble of white topaz which a stone-age man had attempted to flake under the impression that the material was quartz; his blows soon developed the perfect natural cleavage of the mineral and he cast the stone away. But that was in the hills.

Mr. Hartley records rounded pebbles of gneiss from hill sites. Personally I have never come across any tools composed of this material whether in the hills or lowlands.

How important a thing is silica in the history of man!* With no other substance could he have developed his skill so well, given a latent intelligence, two hands, and a chunk of flint, the rise of civilization is assured. Without the flint (or a closely allied substance) and the hands to work it, the most potent intelligence on earth would not have enabled man to rise above the status of a cunning beast.

* I suppose that 99 per cent. of the older stone tools of the world are composed of silica in one form or another. Quartz, jasper, chalcedony, opal, flint, and quartzite are chemically identical.

In order to indicate the several culture-stages represented by the lowland artefacts, it would be necessary to describe the various forms in detail and to draw comparisons between them and what may be called the standard types of Europe. This would be a lengthy procedure, and one which, to my great regret, I have not the time to carry out. It will have to be done one day, and when it is accomplished, I believe we shall see some striking parallels. Most interesting work it will prove, and it is not without considerable reluctance, and perhaps just a *soupçon* of jealousy, that I leave it to another. It is my hope that some future explorer will sooner or later be able to spare time to investigate the collection which I have made, and to publish his conclusions with regard to it. Here I will confine myself to general remarks. I may say at once that from all the best lowland stone-age sites artefacts of very different types may be recovered from the surface ; the crudest tools may be seen rubbing shoulders, as it were, with Pigmies of the finest workmanship ; and much-abraded artefacts with implements as sharp almost as in the days when they were made. Not only so, but flakes of new appearance may be gathered with others showing evidence of advanced decay. From these facts there is but one conclusion to be drawn, namely, the very obvious one, that manufactories have always been established near the source of raw material. In many parts of the Island gravels have afforded the one and only source.

Some day it will be shown, I think, that all of the several stone-age cultures of Ceylon were practised on the gravel sites. Meanwhile I will deal with a few outstanding features. One characteristic set of tools was made from pebbles (very generally quartz) of various sizes ; these comprise scrapers, blades, axes, &c., so closely resembling some pre-paleolithic tools of England,* that a similarity of culture of their respective makers can hardly be denied. These I call *chipped pebbles*. Another series, possibly representing an advance, comprises flakes, trimmed and otherwise, which were detached from

* Reid Moir : " A Series of Pre-Paleolithic Implements from Darmsden, Suffolk " (Proc. Prehist. Soc. E. Anglica, Vol. II., Part II., 1916, pp. 210–213). The tools figured on Plates XLI. and XLIV. can be matched exactly from the Ceylon gravel sites.

pebbles by a smart blow delivered with a hammer-stone. The result of such a blow, of course, was to cleave from the pebble a segment having an oval outline, one flat, and one domed face. Such segments were, no doubt, used as knives, while trimming of the edge produced a scraper; these I call *split pebbles*, and since all these tools, whether of the chipped or split variety, are restricted in form by the stones from which they were made, I class them all together as the "Pebble group." There is another class of pebble tools which I regard as probably of later date.

These are widely distributed, but few and far between. They are small oval pebbles of crystal quartz, seldom more than an inch in length, which have been worked in such a manner that they resemble very tiny hand-axes of the Chellean period of Europe. They are delightful little tools, but I cannot tell what they were used for; and, as far as I know, they do not occur outside Ceylon.

The remaining artefacts are mostly unconditioned by the pebble outline. In passing we may note that pebbles of chert are by no means common, although this substance was extensively used by prehistoric man. Of angular fragments there is any number.

The Chellean phase seems to be represented by the usual hand-axe; but I have found few of these. The best example that I have came from the elevated ground to the east of Pomparippu; and one I found *in situ* at the base of the red earth near Marichchukkaddi. Scrapers of all sorts (hollow, round, straight, and irregular) are common. Side scrapers, the *râcloir* and "pointe," of Mousterian type occur, as do tea-cosy and prismatic tools. Pointed instruments with edge trimming, resembling that of the Aurignacian culture, and "hoof-shaped" pieces recalling those of Egypt* and North-fleet in England, are characteristic. Steep-faced scrapers or planes are very common, and Dolphin planes are to be found, columnar cores, conical cores, and throwing discs are fairly abundant. "Dosquabattu" knives and forms that I class as "peelers" are common. Beaked instruments are to be found.

* See "The Stone Age in Egypt," by W. M. Flinders Petrie ("Ancient Egypt," Part II., 1915, p. 68).

Picks (or perhaps I should call them gravers) made from large thick flakes and large rude digging tools are characteristic. Chopping instruments occur, of course, arrowheads (rare), (?) spearheads, points of various kinds, borers, and discarded bulb-ends are not uncommon. Flakes are to be found in enormous numbers accompanied by hammer-stones. Besides these, the ordinary Neoliths and Pigmies of the hills are not wanting.

A word about the peelers. These are worked on one face, and generally on one edge ; the chipping is on a large scale, so that the worked edge appears more or less engrailed or coarsely toothed. I suppose that these were used in preparing spear- and arrow-shafts, or sticks for fish kraals and traps. Nor must I forget to mention bits of hæmatite ground flat on one or more faces. The flat faces are covered with scratches, which I take as evidence that these curious relics were used for the production of pigment.

Lastly, I may add that among the tools that I have mentioned, one occasionally comes across well-worn stones apparently chipped by man which recall the eoliths of Europe.*

There are other forms besides these, but for the present we must pass them by. I have merely mentioned the more important types as they presented themselves to my memory ; but enough has been said to support my main contention, which is, that among the lowland implements we have an assemblage of distinctly paleolithic forms, and also a cruder and possibly older set. Added to these we have others resembling the neoliths of the hills. Circumstances have not permitted me to do much digging on the plateau sites, but I have several times recovered flakes *in situ* in the gravels, once a broken boring tool (?) (at Wellipatanwila), some crude pebble and eolithic forms (at Minihagalkanda and Kosgala), and a net-like tool, already mentioned, from the base of the red earth near Marichchukkaddi. The examination of steep and crumbling talus-heaps, particularly those of Minihagalkanda in the Southern Province, leaves little room for doubt that the Paleolithic forms gathered therefrom were once *in situ* in the gravel.

* Besides these, there are some quite unworn tools of eolithic type certainly, in my opinion, chipped by man.

Before passing on to speak of the geology of the plateau deposits and their derivatives, I must say a word upon the much-discussed subject of patination. By patination is meant the surface changes affecting the colour and other physical characters of flint or chert. Crystal quartz is not liable to these, but may become frosted either by constant collision with other stones and particles of sand in motion, as in a river bed, or by long-continued exposure to the influence of the weather. In the former case the surface of the stone is generally covered with a meshwork of microscopic cracks; in the latter, the surface resembles that of ground glass, but is infinitely finer.

Patination is a big subject, but I shall dismiss it briefly. Some chert tools acquire during the course of ages a deep almost black hue, others affect ochreous shades, and a good many of them turn white · of these only I shall speak. Ceylon chert is an intermediate mixture of crystalline and colloid silica. The first is hardly soluble at all, the latter is more easily dissolved in alkaline solutions. Consequently the colloid particles are leached out during the course of centuries, and what remains is nothing but a spongy mass of tiny crystals which reflect the light, much as powdered chert would do, and make the stone look white.

The degree of rigidity of the spongy matter depends, of course, upon the ratio of the colloid to the crystalline material in the original chert and the proportion of the former removed. It would appear that the cherts of this country contain a high percentage of uncrystalline material, with the result that they are far less stable than European flint, which contains less. Indeed, not a few tools and flakes which I have collected are so "rotten" that one can scrape their surfaces with as much ease as one could a piece of chalk.

In certain circumstances fresh silica, drawn up probably from the as yet undecomposed chert below the surface of a tool by a process akin to inflorescence, is apparently deposited in crystalline continuity with the surface grains; and, as a consequence of this, the tool presents a glazed exterior. The thin crust thus formed is tolerably resistant, and protects the "rotten" layer below, which is generally so porous, that it

will cling to the tip of the tongue more readily than will the broken stem of a new clay pipe.

The mottled cherts often display differential weathering, the mottling, by reason of its more resistant nature, standing out in bold relief from the remainder of the stone.

I am strongly disposed to believe that exposure to the weather is an essential factor in patination. I do not wish to be dogmatic on a subject which we have no time to pursue; but I may add that I am inclined to think that patination never comes about without exposure. At any rate, I am convinced that no one who studies Ceylon stone artefacts impartially will place much reliance on degrees of similar patination as indices of age. That an artefact must be old to be patinated I have no doubt, but I do not think it follows that an old artefact must of necessity be patinated.

V.—The Geology of the Plateau Deposits and their Derivatives.

In order to understand the history of early man in this country, it is necessary to pay some attention to the deposits in which such relics as he has left may yet be found. I have already briefly outlined these beds, and would not dwell further upon them were it not that the story they tell is one full of interest and significance.

The oldest accumulations with which we shall deal in this connection are what I have called the plateau deposits for reasons which will be presently apparent.

They are very widely distributed, and were, no doubt, at one time developed along the entire seaboard of the Island and covered much of the lowland regions. Since then, however, they have suffered denudation, and are now represented by detached and often widely separated outcrops.

The plateau deposits are generally venetian or brick-red in colour. They are liable, however, to be bleached from various causes, the growth of vegetation being one, when they present various shades of buff; while some detrital beds derived directly from them are snow-white.

They consist typically of two strata; the lower of these, though varying a good deal in composition in different areas,

belongs to that series of rubbly débris which the Public Works Department describes under the sometimes misleading name of gravel ; while the upper stratum consists of a red earth free of stony content. The whole series varies in thickness up to 50 feet or more.

The larger of the "gravel" fragments may consist of quartz in various stages of angularity and roundness, or of irregular concretionary bodies consisting chiefly of ferric oxide and angular sand. Every gradation exists between a good, well-rounded gravel, and a deposit in which the concretionary bodies are paramount.*

The quartz pebbles are seldom more than a few inches in length, while the longest axes of the concretionary bodies hardly ever exceed an inch. The matrix of the beds is a finely divided red material, which varies considerably in proportion to the mass, even within very limited areas. Pebbles of crystal quartz, when present, are generally corroded over their entire surfaces ; with milky quartz it is otherwise.

Boulders, sometimes weighing over a ton, occur locally.

All the pebbles are remarkably free from iron staining or any colouring matter, which cannot be removed with a scrubbing brush and a little water.

The gravel bed, as for the purposes of this paper I will call the lower of the plateau deposits, overlaps all the older rocks. It is to be seen sometimes resting on the archæan, sometimes on the older sedimentaries of the North-Western Province,† and sometimes on the various members of the Kudremalai (Kuthiraimalai) series.‡ It fills up the irregularities of the ancient surface below it. Nowhere does it overlie the alluvials of the rice fields, the coastal (or "reef") sandstone,§ or any

* Similar concretionary bodies are to be found in the beds of practically all streams which run dry in the rainless seasons.

† The Tabbowa beds. These have never been described, except in an official (unpublished) report on the district by the present writer.

‡ Though it has been necessary to make several references to these rocks in my official reports, no detailed description of them has yet been produced. It will suffice for the present to say that they are younger than the Tabbowa beds (older sedimentaries of the North-Western Province), and older than the high gravels which terrace the main river valleys.

§ For some account of this, see "Equus zeylanicus" ("Spolia Zeylanica," Vol. X., Part 38, 1916, p. 267).

deposit belonging to the modern era. The gravel bed is not always present, but whether this or the other member of the series, the red earth, directly overlies more ancient beds, the contrast in colour between the older rocks and the plateau deposits is striking, except when the former have suffered laterization. (See Appendix B.)

A typical plateau gravel in this country consists of a powdery deposit stuffed with stones, of which well-rounded pebbles are in the minority. It contains stone-age tools and flakes of both chert and quartz. The former, to judge by their surface appearances alone, are of every age from the newest to the oldest; the quartz flakes, too, give one a similar impression. It is evident that in this jumble of things, apparently ancient and apparently new, with a mixture of perfectly rounded and perfectly angular detritus in an earthy matrix, we have a deposit of no ordinary kind. These things are certain: it is not marine; it is not a common soil; it is not any ordinary accumulation at all. More than anything else it suggests a glacial till; but I may say at once that no theory of its origin founded on the presence of ice in this country can be entertained, for there is not the slightest evidence of past glaciation in Ceylon.

The apparent diversity in age of the contained artefacts is almost certainly deceptive, although it is probable that in the plateau gravels we have tools of more than one period. Among the specimens which I have obtained *in situ*, some highly frosted forms, recalling eoliths, and the occasional inclusion in plateau beds of masses of conglomerate, suggest an older deposit, from which the gravels have been in part derived.

The red earth which overlies the gravel is of simpler composition and justifies its name, in that it is best described as an earthy material of a brick (or venetian) red colour. It is remarkably free from stones or other foreign material, except very occasional flakes and artefacts.

I have examined a number of samples from various parts of the country, and I find that the following general description applies to all of them. They consist essentially of sand grains and very finely divided material, which is probably a mixture

of kaolin or china clay (with, perhaps, some aluminium hydrates) and iron oxides. The sand grains themselves are thickly coated with iron oxide, which often requires acid to remove it. The surface of the grains beneath this red coating are peculiar. Under the high power of the microscope, and by reflected light, they are seen to be polished and covered with the tiniest little pits imaginable. Moreover, sharp angles are generally wanting. The grains are all small, and seldom exceed one-sixteenth of an inch in diameter, while the majority are smaller. Most of the grains are quartz, but other minerals, such as spinel, zircon, ilmenite, &c., occur sparingly.

Rounded grains of quartz, like these, do not exist in the rocks from which they were certainly derived ; so that, like pebbles, they must have acquired their roundness by a process of attrition.

If you examine the sand of rivers or of the sea, you will find that it is sharp. The reason for this is that the grains have been protected from excessive abrasion by the water, which acts as a cushion or fender between the solid particles.

In wind-blown sand, however, the grains are typically rounded, while the sand of most deserts includes a varying proportion of *millet seed*, or practically spherical particles. The reasons for these differences are given by Hatch thus :—

" Under wind action the rolling motion is predominant, while sliding is subordinate ; secondly, when a sand grain moves in air, the whole weight is effective in producing friction, while in water only part comes into play."*

So that while sand deposited by water is sharp, that blown by the wind is rounded. Another distinctive feature of sands is the presence or absence of mica. This mineral is nearly always present in aqueous sands, but practically never in wind-blown sands, though exceptional cases, of course, occur.

A certain proportion of millet seed grains is to be found in the red earth, while all the quartz particles are characteristically rounded. These facts taken together with the absence of mica point very decidedly to an æolian origin of the red earth ; but there are difficulties. The wind in transporting material

* Hatch and Rastell : " The Petrology of the Sedimentary Rocks," London, 1913, p. 54.

acts as a sorting agent, and separates lighter from heavier particles, so that in a wind-blown deposit we should expect to find an evenness of grain and an absence of pebbles. These two features are those of the red earth, but let us examine the matter more closely.

I find that the vast majority of particles in the red earth are less than one-sixteenth and more than one-sixtieth of an inch in longest diameter. A similar statement can be made with regard to recent blown sands in the north of the Island. These figures are by no means bound to hold good for all blown sands for obvious reasons; but I have selected this example from the north for comparative purposes. Now, since the wind is selective, we may well expect to find some sort of rule with regard to the proportion of the different sized particles which it will shift, or has shifted. There will always be a certain amount of very fine material present in a blown sand; let us examine that. The average of eighteen specimens (all of which conform in the general size of their constituent particles with those of the red earth) collected over a seaboard of some 30 miles in length shows that 1·114 per cent. of the material is less than one-ninetieth of an inch in diameter, while an average of sixteen samples of red earth from different districts shows that 4·52 per cent. of its bulk is equally small. This is a very big difference, and this last figure is too low, for it only expresses the proportion of fine material (less than one-ninetieth of an inch in diameter), which is easily separated by means of a sieve. It says nothing of the quantity of snuff-like dust which clings to the larger particles.

If the first figure then is of any use for comparative purposes, the red earth is either not a wind-blown deposit, or it is a very abnormal one.

If you take a handful of dry red earth and sprinkle it in fair quantities before the breeze, you will find that the wind separates, more or less, the fine material from the coarse as it falls; this argues badly for the æolian origin of the red earth.

But in this connection there is one significant point to be noticed.

All the larger grains are composed of chemically stable materials, the vast majority being quartz. Now the ordinary

river or sea sand is differently constituted, for, in addition to quartz, a large number of other minerals are present. Among these felspar is conspicuous.

Felspar gradually decomposes under the influence of meteoric waters; and one of the chief products of this breakdown is kaolin (china clay), which takes the form of exceedingly minute flakes. But felspar is not by any means the only other mineral besides quartz, which is to be found in sands derived, as those of Ceylon are, from igneous and metamorphic rocks. There are, besides, ferromagnesian silicates and iron ores, all of which are unstable. These decompose in time under the influence of rain water just as felspar does.

In the light of these facts, therefore, we may interpret the red earth. In my opinion the red earth is a wind-borne deposit, of which the constituent grains were those of the crystalline rocks from which the particles were derived. In the course of time the unstable minerals have decomposed, thereby giving rise to the usual decomposition products, of which finely divided kaolin and hydrated iron oxide are the two most prominent. Thus can we account for the peculiar features of the red earth.

I may say that certain deposits of white sand in the Western Province can be shown to be derived directly from the red earth. All the fine earthy material has been removed from it by natural causes, so that now it consists of over 99 per cent. of quartz sand. I find on estimation of sixteen samples that on the average 1·225 per cent. of the material is below one-ninetieth of an inch in diameter, a figure sufficiently close to that obtained from modern dunes to corroborate our conclusion drawn from other facts. The wide occurrence of red earth points to the past existence of enormous stretches of blown sand, in fact to desert-like conditions over much of the low-country.

Such, then, are the plateau deposits; now for their distribution.

In the course of coast surveys I have traversed on foot the entire coast between Kumane in the south-east and Point Pedro in the north *viâ* Galle, Colombo, and Mannar; and from Point Pedro to the mouth of lagoon immediately above

Mullaittivu, a total distance of over 850 miles, most of which I have covered more than once. Besides this, I have travelled and made observations in all the Provinces of Ceylon, except the Eastern. From what I have learnt from those who know the Eastern Province, I gather that plateau deposits are represented there; certainly they occur in all the others, and everywhere their features are much the same.

A complete list of all the places in which I have found these remarkable beds would not only be tiresome, but also out of place in a general paper such as this.

The following is an account of the more interesting localities in which plateau deposits occur.

Starting from the Kumbukkan river and working eastwards to Hambantota one comes upon a number of plateau outcrops, and a still greater number of plateau deposits which have been reconstructed at lower levels. The best exposures are to be seen between Uda Potana and Yala, where there are several outcrops of exceptional interest. The best, perhaps, is at Minihagalkanda.

Here an ancient plane of marine denudation, once of crystalline rock, but now highly kaolinized, supports sedimentary strata, which in their turn are covered by plateau beds. The site is highly implementiferous, and is, perhaps, the most geologically interesting of all plateau sites that I have seen. Between Minihagalkanda and the lowland hills, situated several miles inland, are reconstructed plateau gravels and other deposits of newer formation than the red earth, while here and there one can trace the remains of gravels still *in situ* around the hills.

Travelling towards Hambantota one sees occasional plateau outcrops, and quite a number of implementiferous deposits of younger date. I am inclined to think, though I have not sufficient evidence to prove the supposition, that the reconstructed gravels and other beds formed after the denudation of the red earth are more or less contemporaneous with the Pigmies and (?) Neolithic tools with which they are associated, and younger than the larger types which are found in the same beds, which artefacts, I suppose, were derived from the older gravels.

Beyond Hambantota gravels occur. These yield a certain number of implements. Exposures are best seen between Ranna and the coast.

Wellipatanwila affords some interesting sections ; and there implements are fairly plentiful. Several gravels capping low hills between Hambantota and Tangalla are exposed in road cuttings.

Outcrops between Tangalla and Colombo are, as far as my knowledge of the country goes, not particularly good. They are to be seen, however, between Matara and Galle—the Kamburupitiya resthouse is built on them—and in patches between Galle and the Capital.

North of Colombo outcrops are more plentiful. Numerous between Negombo and Chilaw. They are, however, small, and seldom afford anything but the crudest artefacts.

Between Chilaw and Puttalam plateau gravels are fairly common, and artefacts rather more plentiful.

In the Puttalam District many may be gathered. Outcrops along the main roads to Anuradhapura and Kurunegala are not without interest ; but the best occurrences are to be found to the north of Puttalam. A fairly good section is to be seen to the south of Karativu, but the implements are poor.

The coast road from Puttalam to Mannar is easily followed to Vannathivillu, a distance of 12 miles ; beyond that it is nothing but a jungle track to beyond Arippu ; but implement-bearing gravels along it are worth investigating. The best sites along the track are (1) 4 miles beyond Vannathivillu, and (2) a mile south of Marichchukkaddi.

If one turns aside from the tract, however, and goes into the Puttalam Game Sanctuary, more interesting discoveries may be made. In order to do this, one must be prepared to " rough it."

Nothing but a bullock cart can be taken beyond Vannathivillu, and that only with difficulty. The collector must make his way to Pomparippu, and thence into the sanctuary,* as far as Kokkarevillu. Beyond this his only means of transport is a gang of coolies. In the sanctuary, of course, nothing can

* Permission must first be obtained to enter the sanctuary.

be shot, and all supplies both for the collector and his men must be carried, as well as a tent, that is if he wants a tent; personally I have managed without, but I cannot recommend this mode of travelling to anybody who cares for comfort. From Kokkarevillu he must travel northwards and eastwards to a point some 12 miles from the mouth of the Moderagam river (marked on the map with a cross) and establish his camp. Once across the river one is beyond the limits of the sanctuary, and may shoot for the pot, but there are no villages here, so nothing can be bought.*

This spot is a perfect paradise for the Prehistoric-archæologist, and is the most productive that I know. Here the plateau beds are dissected by a number of streams and exposed over a wide area. Stone tools of all descriptions, from the earliest to the latest, may be gathered here; and to anybody who will spend a week or so collecting interesting discoveries are assured. There are, too, several relics of ancient Sinhalese civilization in the vicinity.

Another good site for the collector lies near Pomparippu.

Looking eastwards from the village one sees two ridge-like elevations (really turtle backs).

The further of these, some 3 miles away, is well worthy of investigation. It was from there that I obtained my first Ceylon example of an early stone-age hand-axe.

Several sites in the North-Central Province are worthy of a visit. One of the best is Kumpudumalai; another prolific locality is the source of the Kunji-aru; but these again are difficult of access.

Though a number of sites from the Moderagam river to Mannar and northwards might be mentioned, none to my knowledge yield many relics. The same remark applies to the Jaffna peninsula and to the country between Point Pedro and Mullaittivu.

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* A word of notice to the intending traveller. Do not pay too much attention to the maps of the jungle parts of the Puttalam District. They are often inaccurate and liable to lead one astray. The best plan is to take a native who knows the country, if one can be found, and let him act as guide. There are several men in Puttalam at the present time who were members of my caravan.

The two best sites that I am aware of are (1) Minihagalkanda in the Yala Game Sanctuary, and (2) the point marked with a cross on the map in the Puttalam Game Sanctuary. These, like all the best plateau sites, are situated in unopened country; and in order to work them, the collector must exchange the artificial comforts of the town for the rough and ready ways of the wild.

The red earth country has a geography of its own. It is essentially low-lying, with large low domes generally less than 100 feet in altitude above sea level and 2 or 3 miles in length by, perhaps, $1\frac{1}{2}$ in width. From the plain they resemble low ridges, but are best described as "turtle backs." They are covered with red earth, but the flats between them are of varying composition, and, are younger than the red earth. The whole supports dense jungle or cultivation. This curious undulating country is at first extremely difficult to account for, since the red earth is a soft deposit, and not likely to offer much resistance to denudation. Nor are matters simplified by the occurrence of pools which have no outlet or streams to feed them,* and the fact that all the turtle backs appear to have a core of older rocks. At first sight it looks almost like a case of folding. The older rocks of Ceylon have been bent and folded to a remarkable degree by secular movements. That these are exceedingly old there can be no doubt, inasmuch as all the bold features of our mountain scenery have all been produced by denudation since the ancient crystalline rocks were twisted and crumpled. The movements were due to certain tangential stresses set up in the earth's crust, and acting for the most part in approximately east and west directions, so that the major folds run across the country more or less at right angle to them. Now the long axes of the red earth domes also follow this direction, but evidence of folding in the plateau beds is generally wanting. It would not be surprising to find that beds newer than the ancient crystalline rocks, and separated from them by a tremendous lapse of time, had been folded too, for the axis of a fold is a line of weakness, and earth movements often re-assert

* Most of these *villus*, as they are called, dry up in the rainless season.

themselves after a considerable interval. Now at Kudremalai the red earth is bent over an anticline of sedimentary rocks, while plateau beds at Minihagalkanda have suffered in a somewhat similar way; but evidence, so far as I have been able to gather it, does not allow one to apply these facts to the explanation of the earth domes in general. Indeed, folded plateau beds seems to be the exception, not the rule. Owing to the density of the vegetation and the thick mantle of red earth, and also to the accumulations of detrital matter derived from the red earth which flank the domes, the internal structure of these features is generally difficult to observe. Small streams, however, sometimes afford interesting sections; and from them one gathers that the structure of what I shall call the typical red earth dome is as follows.

The central core is a mass of ancient rock; over and around this is a layer of sedimentary material. Above the whole are the plateau deposits.

There can be no doubt whatever that the cores are the remains of ancient turtle backs which once ran in lines across the country. They are not in themselves folds, but a product of past differential weathering. What is the probable history of these remarkable elevations? I think it is this. We start from the fact that gravel is deposited in water, and water shows a preference for valleys, not for hills. Now the plateau beds can be traced from one elevation to another, but they are missing in the valleys between; and so we must infer that the valleys have been produced since the plateau beds were deposited. All this is plain sailing, but we have to account for the curious persistence of the hills. When the plateau gravels were left dry, they must have formed a vast plain, and in places, such as the north of the Island, where there are no permanent rivers (and where, by the way, the domes are best developed), there was no *a priori* reason why valleys should have been produced on particular sites; and apparently none whatever why denudations should choose to carve out hills exactly where it had done so before. Manifestly then the cause must be, so to speak, an internal one; and since secular movement cannot be invoked, the cause must somehow lie in the buried hills themselves. Now the

plateau beds are extremely pervious to water. The sedimentary beds, though less so,* are infinitely more pervious than the crystalline rocks. Consequently rain water which passes freely downwards through the plateau deposits soaks through the sedimentary beds and tends to collect upon the rocks below, making its way down the slopes of the ancient turtle backs to the bottom of the buried valleys. Somewhere along the main line of flow the surface of the country is bound to cut the water table, for meanwhile subaerial denudation will have been at work ploughing runnels and small streams in the plains, or, failing that, the water table, kept up by the beds below, will be cut at the coasts if the country has been elevated at all. And so a spring starts. The gradual crumbling in the beds above the source of the spring opens the way for a surface water-course, and thereby to external drainage on ancient lines. Thus the general features of the buried landscape are reproduced.

But superimposed upon this persistent geography are the remains of that of red earth days; that is to say, of a desert geography; and just as water tends to accumulate between the hollows of the sand hills of the Jaffna peninsula, so, no doubt, it did among the dunes of red earth times. Thus, I think, are the *villus*, those curious ponds unfed by streams and provided with no outlets, of which I have spoken before, to be explained. Nearly two years ago Mr. H.F. Tomalin, the present Conservator of Forests, suggested to me that *villus* owe their origin to the action of the wind. I now see that his suggestion was probably much nearer the truth than I was at that time disposed to think. The fact that *villus* really are ancient features is rendered probable by the occurrence of stone tools on more recent sand dunes, which sometimes flank them on the north-east sides. The sand of these dunes is white; it was derived from the red earth and bleached by the hygrophytic vegetation on the edges of the water before it was blown into its present position. The stone tools cannot have been blown up as well; and, as we have seen, they are probably

* See my remarks on this subject in "Spolia Zeylanica," Vol. X., Part 37, pp. 166–174.

of ancient manufacture. Presumably these white sand heaps belong to Neolithic days. They do not seem to be encroaching much upon the jungle now.

Ancient red earth dunes are to be found buried beneath those of more modern dates and lighter colour in the Jaffna peninsula. From some of the former, at Kalmunai, I have gathered quartz flakes.

Denudation has accomplished so much since the red earth was laid down that the present outcrops are mere scattered remnants. One traces them over the lowlands and up the valleys of the permanent rivers.* And here I would call attention to the difference between permanent rivers, such as the Kelani and the Kalu-ganga, for example, with their buried bottoms and ancient history, and the modern streams which have no such buried bottoms. The latter have all been formed since red earth times, and the great majority (though not all, I should suppose) rise in the low-country, and run dry in the rainless seasons ; whereas all the permanent rivers rise in the mountain zone.

I have already made reference to the occurrence of red earth dunes below more modern ones at Kalmunai and elsewhere. The former have been preserved of course by the latter, which protect them from denudation. Blown sand is a fine protection, for as fast as it is removed, either by the wind or rain, it is replaced with fresh material ; but its action is often limited to a zone a few hundred yards in width around the coast. So one finds high rims of sedimentary rocks and plateau beds along the coast which separate flat country, standing but a very few feet above sea-level, from the ocean. An excellent example of this is seen at Minihagalkanda in the Southern Province. In this instance elevation has gradually raised the plateau beds above the influence of the blown sand, and now denudation is playing its usual part. From the present distribution then of plateau deposits and their typical occurrence on the summits of low hills, it follows that the geography of the low-country is distinctly different to-day

* In the case of the Maha-oya this can be traced with comparative ease, and I have no doubt whatever that some of the higher gravels of the Kelani river are part of the flaked series.

from what it was when these beds were laid down. It is quite certain that the valleys and flats separating these elevations have been carved out since plateau days. One can hardly escape from the conclusion that the present isolated outcrops once formed part of a huge plain surrounding the hill country of Ceylon. Since these outcrops are now well above the sea, though bordering upon it, it must follow that in plateau times the coast line cannot have been situated where it now is.

We may suppose, if we like, that the country as a whole stood at much the same elevation as it does to-day, but that the coast line was situated further out in what is now the Indian ocean ; or we may suppose that the country as a whole has risen in relation to the sea. From general considerations, which I will not go into now, the latter supposition is preferable. But I can produce something more than supposition. Near Ranna, in the Southern Province, some of the plateau representatives contain the shells of marine mollusca, similar to those which now inhabit the very shallow inlets of the sea that run into the coast, like salt pans.

The beds which hold these fossils are now some 50 feet above the ocean, while the breakers themselves are within shouting distance. We must believe then that the relative altitudes of sea and land have changed. Whether the ocean has subsided or the land has risen, or whether both have moved, I will not discuss in detail ; but since the plateau beds have undergone a small amount of folding, we know that the land is at least in part responsible.

What were the conditions under which early man lived in Ceylon ? When did he arrive ? Was he or was he not succeeded by another people before the Veddas came ?

Let us go back to the days before the plateau beds were deposited and discover, if we can, what in general were the then conditions of the country.

Ceylon is an ancient land. The great majority of its rocks are among the oldest known. They belong to what is called the Archæan epoch ; and some of them, according to the last pronouncement of my friend Mr. Arthur Holmes, who

determines the periods of geology by means of radio-activity,* were formed some fifteen hundred million years ago. The sedimentary beds, practically unknown in this country till recently, are on this basis comparatively modern.

How long the country of Ceylon has been above the ocean nobody can say ; but the extremely advanced stage of denudation of the mountains shows that many eons have passed since the rain first beat and the sun first shone upon this land.

Doubtless all have seen that wonderful view from the Haputale Gap, where one looks down upon the jungle across the tank of Hambagamuwa, and on to the sea 5,000 feet below and 40 miles away. And beneath the general level of the range you must have noticed the remnants of a vast plateau, which now, battered and dissected by the ravages of time, stands out as hills and pinnacles from the forest-covered plains. From Haputale this plateau, or periplane, is best observed ; but it can be traced with more or less distinctness all round the mountain zone. It is a wonderful relic of a time long past when the blue ocean lapped the highlands of Ceylon. Below the level of the periplane, which I call the mountain plateau, is the remnant of another, infinitely younger, yet almost as old may be as the human race itself. Over this vast plain roamed savage man; perhaps a thousand centuries ago. The rivers began to carve their courses in the mountains before the periplane emerged ; probably they were hoary with age ere this event took place. That they had run for countless ages before the second periplane was formed is certain, for it can be shown that the former was dissected much as now when the plateau gravels were deposited. The rivers had taken their courses before denudation had carved away the less resistant portions of the mountain plateau, so that now we have the quaint anomaly of rivers cutting through hills instead of adopting easy routes around them.†

* Radio-activity and the Earth's Thermal History, Part II. (Geol. Mag. N. S., Decade VI., March, 1915, Vol. II., pp. 102–112).

† For example, the Kelani-ganga above Hadduwa cuts through a high rocky ridge, thus detaching the end of it from the main mass. The Kalu-ganga flows through the range between Nambapana and Dumbara.

The low degree of culture evidenced by the early plateau tools suggests that man first came to Ceylon on foot and not in ships. Moreover, the large mammalia must have come hither thus, so that we may infer a land connection between Ceylon and some other country, most probably India, in the past. It is reasonable to assume that our land stood higher then than now, since by a small elevation a connection with the continent would be established. Have we any evidence, then, that Ceylon was ever higher? Indeed, we have. Besides the buried plateau of the Pearl Banks, which seems to point to such conditions, we have the fact, which I was incidentally able to establish when boring in the Western Province and Sabaragamawa, that the ancient bottoms of modern rivers, vertically beneath their present beds, are now below sea-level. I will not elaborate this point, though its side issues are important; it is sufficient for our purpose now to realize that when man first came the land was higher.

Now we come back to the plateau gravels, which were deposited after man arrived; and when, as we have seen, the land was lower, at a time, too, when the connection with India had doubtless broken down. Who were these people? Did they make the frosted "Eoliths" which one finds associated with a better type of tool in the plateau beds? Are these, indeed, derived from older sites? For my part I answer *probably*. And the plateau gravel, how came it to be strewn about the ancient plain? How comes the plain at all? The surface of the beds below the gravel is likely enough an old sea bed converted into land by elevation; but the gravels are not sea gravels; of that I am persuaded.

They have none of the characters of a marine deposit. But that they were low-lying and liable in places to inundation by the sides we have already seen.

What cause can we ascribe to the midden-like accumulations and wide occurrence of these beds? Glaciers will not do; yet no other ordinary agency is half as capable. The cause seems catastrophic. An alternative suggests itself, and that is Noah's flood!

The legend of the deluge is so universal and so ancient that one can hardly escape from the conclusion that it originated

in some real occurrence. It may be, as Suess maintains, nothing more than a traditional account of a flood in the lower Euphrates valley ;* but the wide diffusion of the story is more easily understood, if it can be shown that the catastrophe which it chronicles was one affecting many countries of the world.

And can it be shown that any such event was probable ? I think it can. My friend Mr. Charles E. P. Brooks, in a masterly paper read before the Royal Meteorological Society three years ago,† showed how the influence of low temperature on the density of the air causes a permanent anticyclone to occupy the Arctic regions, and that within such regions precipitation must be very slight.‡ These conditions must have been very marked during the glacial period.

Now, although the precipitation for the world at large was probably below normal by reason of decreased evaporation caused by a general lowering of temperature, the outward blowing winds from the anticyclone deflected by the earth's rotation into a south-easterly and easterly direction allowed so little moisture to fall over the ice sheets that in unglaciated and tropical areas the annual precipitations must have been considerably above the normal. Evidence of a heavier rainfall in the past is widespread enough, for not only are most modern rivers too small for the valleys they occupy, but the great lakes, like those of Central Africa, Australia, Chad in the Sahara, lakes Bonneville, Lah Outan, Titicaca, and the lakes of Mexico in America, to mention a few, were very much larger in bygone days than now.

We in Ceylon who know what a monsoon shower can do, and have seen hundreds of square miles inundated in a day, may well shudder at the thought of what the rivers really could accomplish if they tried.

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* "Das Antlitz der Erde." See English translation by Sollas, London, 1904, Vol. I., Chapter I.

† "The Meteorological Conditions of an Ice Sheet, and their bearing on the Desiccation of the Globe" (Q. J. R. Met. Soc., Vol. XL., No. 169, 1914, pp. 53–70).

‡ Investigations show that nearly all the moisture in the Arctic regions falls as snow, which measured in terms of rainfall seldom exceeds 10 inches a year.

And Ceylon is not a land of exceptional precipitation. Look at Cherra Punji in Assam, with its yearly average of 458 inches, "and a maximum record of 905 inches said to have fallen during the year 1861, of which 503 inches came down in June and July."* We who saw how choked the rivers were with sand after the rapid and disastrous floods of 1913 may well be glad that the rain stopped when it did, for otherwise the entire rice crop of the low-country would have been buried in a bed of mud and silt.

If the average yearly rainfall for Ceylon were as great as that of Cherra Punji, the low-country would be flooded out at least once a year.

Let us see how Mr. Brooks's contentions help us to interpret the plateau beds.

Across the plain formed by the emergence of the ocean floor rivers would flow, probably much as they did in previous days when the land was more elevated, and when man first came to the Island. For these upheavals are generally very slow affairs, and the rivers would have time enough to cut anew their courses as the country rose again. But these, we will assume, were the days of the Great Ice Age, when prehistoric man was living in Europe under conditions of intense cold. Precipitation, as we have seen (by the thesis noticed above), was greater then than now, and so we see the rivers filling their valleys in the hills and pouring forth in great volume over the plains below. The renewed energy of the running water engendered by the heavy rains, and the rising country, would enable it to carry enormous loads as long as the gradient was steep enough to permit of a high velocity. But once the streams poured forth upon the flats, much of their power would be lost, their channels choked, and their detritus spread abroad.† Large boulders would be dropped first, later the gravel, while some of the fine sediment would be carried out to sea or spread on distant portions of the plain.

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* Pascoe, E. H. : The Petroleum Occurrences of Assam and Bengal (Mem. Geol. Survey, India, Vol. XL., Part 2, Calcutta, 1914, p. 274).

† The transporting power of a current varies as the sixth power of its velocity ; so that if the velocity be doubled, the transporting power is multiplied sixty-four times (see I. C. Russel's "River Development," London, 1909).

Seasonal variations probably existed then as now, and during the dry months the streams would dwindle, and seeds of grass and other plants brought down by the floods would germinate and grow, thereby giving rise to a patchy grass land vegetation and a splendid hunting ground.

In the quieter days that follow floods, a stream starts to scour its bed; but at the beginning of the rains, before the load is heavy, this work is mostly finished. Thus, the rivers would tend to keep an outlet.

As time went on, the load would diminish, for the débris spread about the hills would have been disposed of. Moreover, the velocity of the rivers would diminish with their gradients. As the glaciers dwindled, too, in other lands, the rainfall would become more evenly distributed, and in the course of time normal conditions would supervene.

Such a state of things may well explain the plateau deposits. That the rivers played no small part in the deposition of these beds is manifest, for the poorest gravels are furthest from the permanent water-courses.

We have seen that elevation followed the formation of plateau beds, but, in spite of the energy thereby gained, the phenomena of the preceding period were not repeated. The rivers wanted volume; the flood had passed, and with it the conditions of plateau days.

I will not insist that this was, indeed, the flood recorded in the Hebrew scriptures, but I suggest the possibility as a point of interest. Even could it be proved that the deluge and the abnormal rains of the Pleistocene were indeed one, it would not follow that early man had handed the story on to succeeding generations.

In fact, this would be most unlikely, since the conditions of the Ice Age were not cataclysmic, but of gradual increase and decline. It is quite possible that the story of the flood is the result of one of the earliest geological deductions man ever made. For consider this. At Minihagalkanda denudation in producing a cliff of a hundred feet in height has laid bare an outcrop of chert, from which comparatively modern stone-age man has shaped his implements. Now, he must have been able to recognize a chipped stone at least as well

as we, and in searching for materials with which to make certain of his tools, he was bound to come upon artefacts of a pre-existing time in the gravels near the cliff top. Savage man is an excellent observer ; doubtless he knew well enough that gravels are not in general deposited upon an elevation. Movements of the land were presumably unknown to him, and the rise and fall of tides was an everyday affair. A heavy flood, such as might occur at almost any time, would provide an explanation of the gravels. The extinction of a race of men, save a favoured few who carried on the race, might be read by Neolithic man by the light of the buried artefacts.

We have yet to show it probable that the plateau beds of this country are as old as the Pleistocene Ice Age of Europe, for without this probability our theory of the origin of the gravels is of little weight.

The only criteria which we have in this connection are the comparative results of denudation. But it may be argued that denudation is more rapid in the Tropics. I hardly think this is so, at any rate as far as Ceylon is concerned. Have we not in this Island inscriptions which have felt the sun and rains for a couple of millennia and yet are readable ? Would they have lasted better in Europe ? I doubt it. There is no evidence to show that denudation in Ceylon is more rapid than in Europe. Since the earliest Paleolithic days the Thames Valley has been carved, and many of the features of European geography produced. Here, in Ceylon, results comparable to these have been achieved since the red earth was laid down. Great areas of land miles in length and breadth and a hundred feet in depth have been gradually eaten away without the assistance of a great river. Witness, for example, the stupendous effects of subaerial erosion which have slowly accrued in the Southern Province since red earth times alone.

Secular movements of a widespread nature have impressed their influence on the country ; stone-age cultures have succeeded each other and passed away ; civilizations have risen and declined ; great cities have been built, and the trackless wilderness converted to a fertile plain. All this has passed ; the grasping jungle has regained its own, and European men have come, the Portuguese, the Dutch, and latterly

the British, with their goods, their gods, and their women to settle in the land.

History, as we know it, affords but a poor picture of man's activity. Aggressively foreshortened at best, it is all consequence and no foundation. Like the Struldbrugs of Swift's incomparable satire, the races of man have outlived the reach of memory.

Judged by the span of mortal generations humanity is old, ridiculously old, yet, we suppose, it has all before it. But the story of man is the last paragraph, as it were, in a whole library of chronicles: and well may we believe with the more moderate savants of the Western School that a hundred thousand years have gone since the Paleolithic savage first shaped his implements in Britain.

And if it were true of Britain, why not of Ceylon? The evidence of both is comparable in kind and in degree. The cradle of humanity is still unknown, in spite of many bold and ingenious contentions; but as facts accumulate, it becomes increasingly apparent that in those dim and far-off days stone-age people had multiplied and spread to many corners of the earth.

I submit then that we have reason to suppose that the plateau beds of Ceylon are comparable in age with the Paleolithic deposits of Europe, and that their formation may in part be explained by the meteorological conditions which accompanied the Ice Age.

As to the red earth which overlies the gravels, it is largely sand blown over the low-country from the seaboard, when the wet phase of the Pleistocene was passing or had passed. In red earth days much of the low-country no doubt resembled that sandy waste which borders the eastern coast of the Jaffna peninsula at the present time; dry and arid conditions must have supervened. From Cape Comorin in the Native State of Travancore one sees the fag-end of the Western Ghauts protruding from a sand plain. Not far otherwise, if one allows for modern cultivation, must Ceylon have appeared to red earth man.

The period of denudation which followed the upheaval of the plateau beds gave rise to fresh deposits derived in no

small measure from those we have been studying. We may not consider these in detail now, but I cannot dismiss them without a few remarks.

One striking feature of the post-plateau deposits is their contrast in colour with their parent beds. They are never deep red, while some of them are dazzlingly white. These are the sands derived from the red earth and bleached by vegetation. While geologically younger, they are geographically lower than the red earth, but above the general level of the rice fields which were formed after them. They indicate swamp conditions in the past. Mineralogically they are of interest, in that they are practically pure silica, and historically they are of interest as the ground on which the Dutch chose to plant their cinnamon.

The beds of the paddy flats (rice grounds) which were formed after them have a history of their own, and they, the cinnamon grounds, and certain interesting shell deposits of local occurrence, may be correlated with the more recent sediments of the coast. Here, too, belong the white dunes of the *villus*.

I have on a previous occasion ("Spolia Zeylanica," Vol. X., Part 38, pp. 273 and 274) given a short account of the movements which these deposits indicate. I will say nothing further of them now beyond that I am strongly inclined to think that some of them at least belong to Neolithic days.

VI.—Summary and Conclusion.

To recapitulate. According to the evidence the following seems probable. Early man came to Ceylon from India by means of a then existing land bridge. He had not in those days reached the Paleolithic stage of culture; but he attained this later in the Island.

The downward movement of the land, which took place after man's arrival, was followed by an uplift; and on the coastal plains, thus widened by the exposure of the ocean bed, the now Paleolithic man hunted in the drier seasons.*

* Uplifts seem to have been as characteristic of the Pleistocene, as depressions were during the later carboniferous.

The climatic conditions of the Pleistocene period caused the rivers to fill their valleys and discharge their loads during one or both of the monsoons over the coastal flats. In these deposits were buried the implements of early stone-age man.

As the ice sheets of other lands retreated towards the poles, the rainy phase of the Tropics passed away ; and the drier monsoon winds, laden with the fine detritus of the coast, spread a mantle of sand over the low-lying regions. In those days the low-country probably resembled the arid waste which now exists on the eastern coast of the Jaffna peninsula. Later elevation re-asserted its sway, and the denuding agencies of rain and sun and wind began to develop the features of modern lowland geography.

With the new condition of things came Neolithic man, but whether of a race apart from the people of the Pleistocene nobody can say. Later still came the Veddas and the Naga people from Southern India,* and finally, the Sinhalese, whose advent brought the prehistoric epochs to a close.

The above, I submit, are outlines of the Stone Ages of Ceylon—sketchy outlines, nothing more.

A great deal of work must be accomplished and much detail added before these outlines can assume the aspect of a tolerable picture. Nor do I blind myself to the fact that some alteration of the outlines may be necessary. In the main, however, I fancy they will stand. For what they are worth I give them here now ; and it is for others to investigate and criticise.

If any one will take the subject up and work upon it systematically, he cannot fail to achieve valuable results. Moreover, if he is unable to carry on research in the wilder districts of the Island, where, in addition to the human interest of the work, he will experience all the romance of a jungle life, there is yet open to him a wealth of possibilities in more convenient spots.

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* The Nagas were a Dravidian people who found their way to Ceylon before the Aryans arrived. Their chief stronghold appears to have been in the north of the Island.

For along the river valleys, in the gemming fields, in the beds of streams, and in a hundred other places relics of a long-forgotten past lie buried to him who will investigate is the joy of fresh discovery assured.

Much may be done if only people will keep their eyes open and record simple facts. Every fact, however isolated, is of value, though its true significance may not be gauged at once.

There are men among us who have done splendid service and will yet do more in the cause of science ; but the humblest may add his quota to the store of knowledge by the simple means of observation.

If there is any one in need of a hobby, but who feels himself unqualified to tackle the more intricate problems of biology, let him take up the work where I have dropped it ; for there he will find himself on the edge of a vast and unexplored territory, wherein he may accomplish far more than it has been my humble lot to do for the Natural History of the Island.

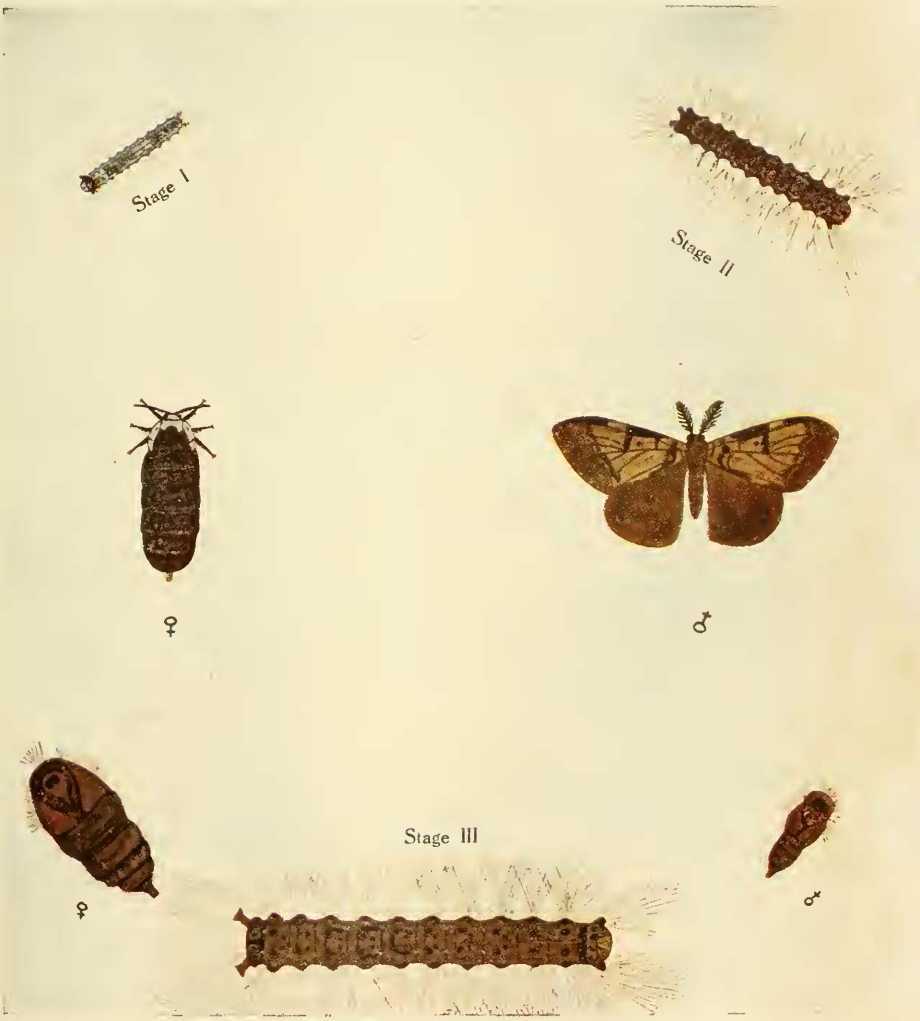
I have to express my indebtedness to Mr. G. M. Henry for kindly undertaking to draw the figures, and to Mr. C. Hartley, not only for the helpful criticism and advice, from which the author has on many occasions profited, but also, and chiefly perhaps, for performing the onerous task of seeing this paper through the press.

Appendix A.

The Human Period is subdivided as follows :—

Holocene	Historic Age, Early Iron Age, Bronze Age, Neolithic Age	Modern races of man	Modern species of man
Pleistocene	Paleolithic	Magdalenian, Solutrean, Aurignacian, Mousterian, Acheulean, Chellean	Extinct species of man
	Pre-Paleolithic		
Pliocene	Eolithic, Sub-Crag		

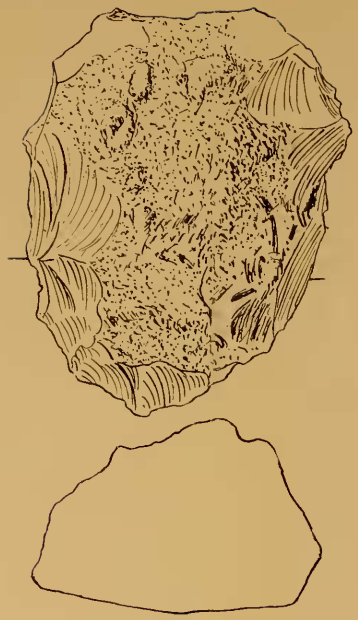
LYMANTRIA AMPLA



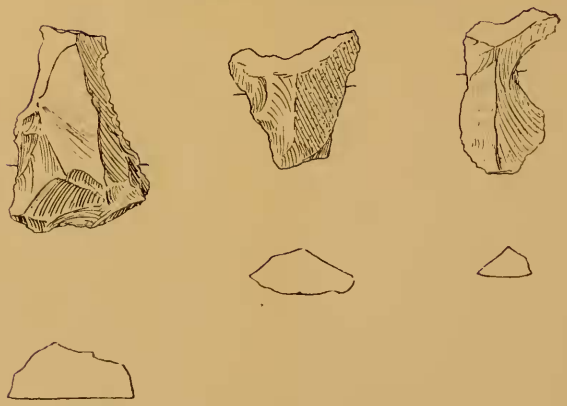
R. S-W. del.

This plate to face page 76 in Vol. XI., Part 40, of "Spolia Zeylanica."

CONES



HOLLOW SCRAPERS



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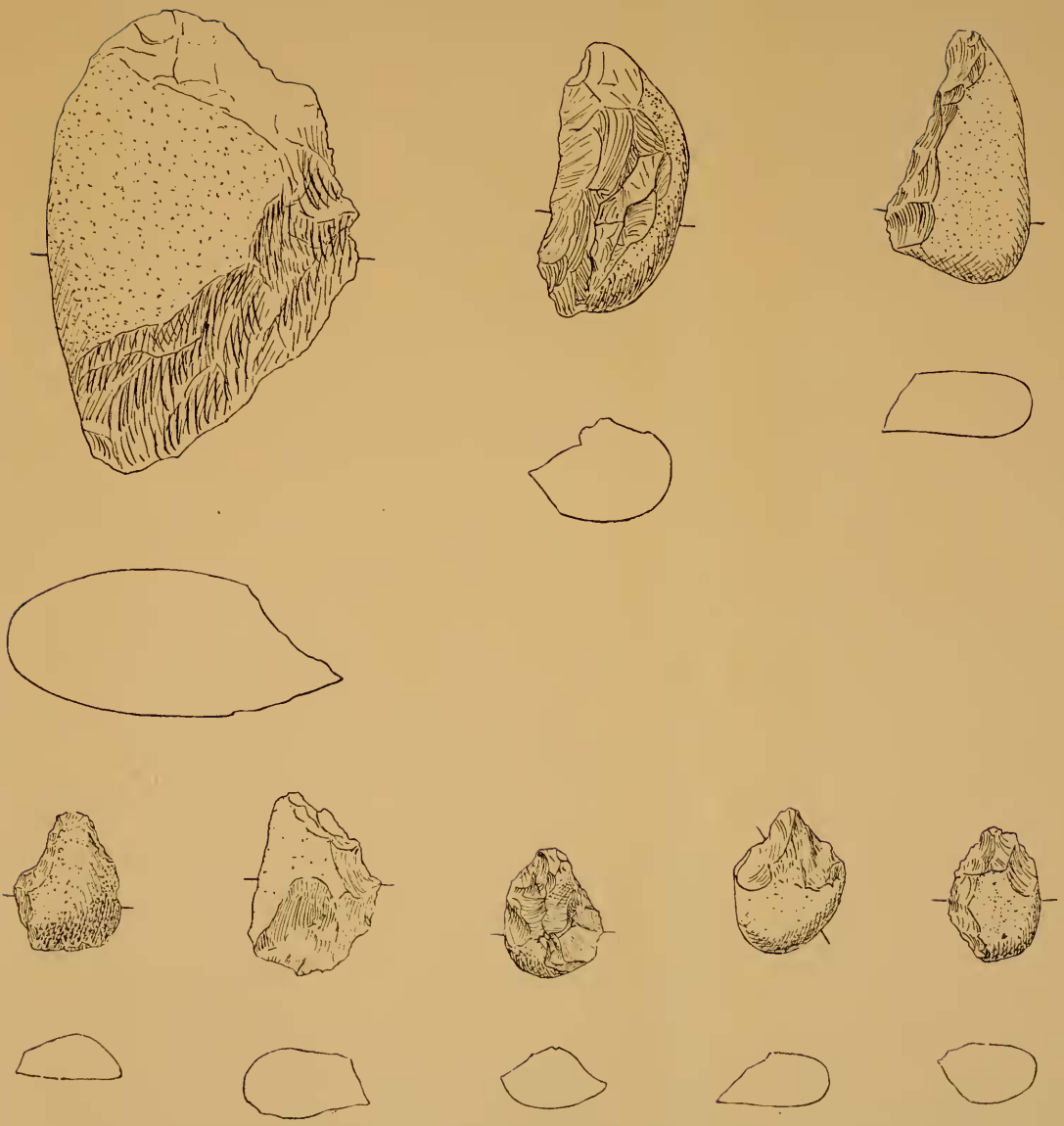

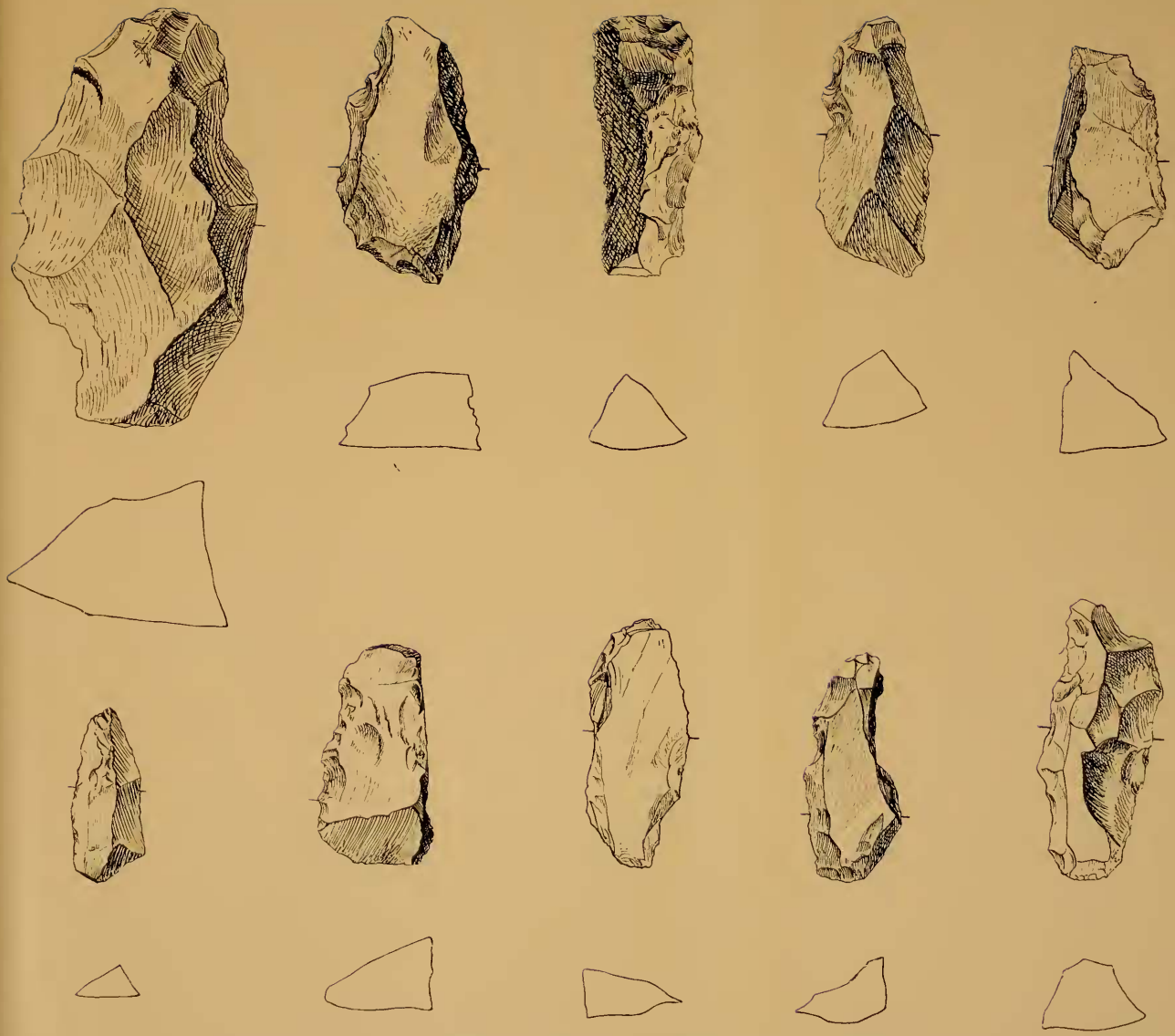

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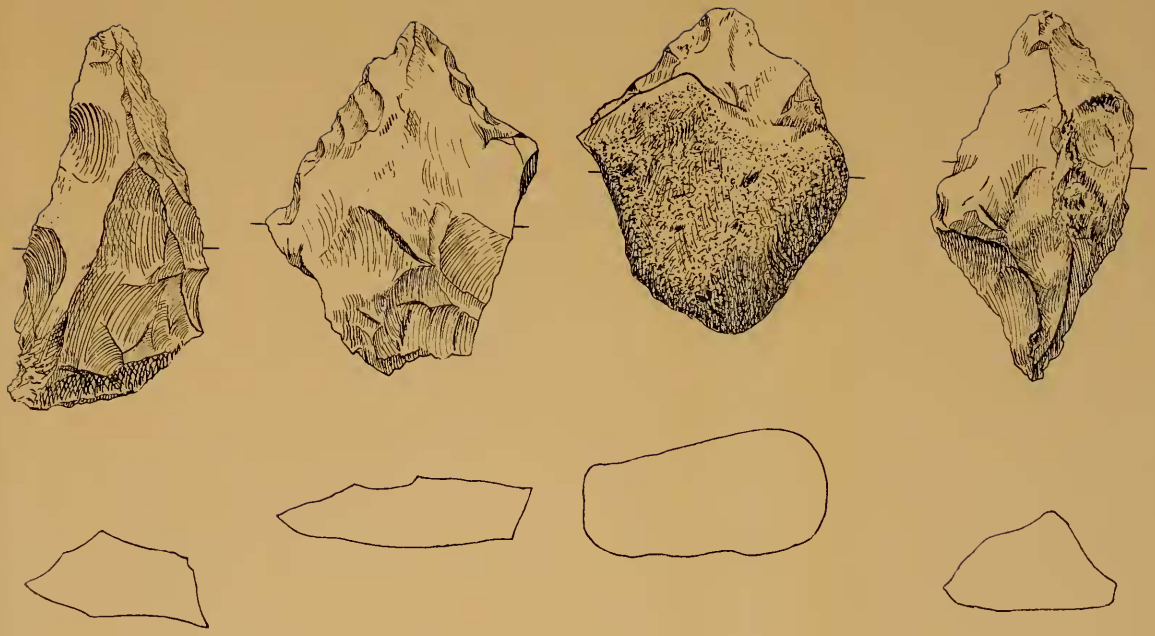

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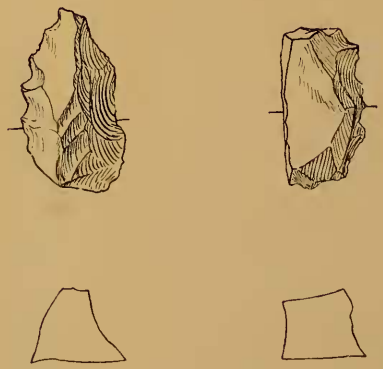
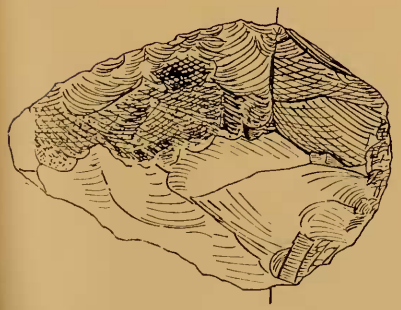
SLUG PLANE



HAND AXES



DISCS

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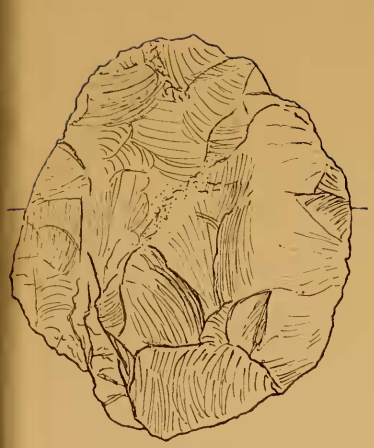

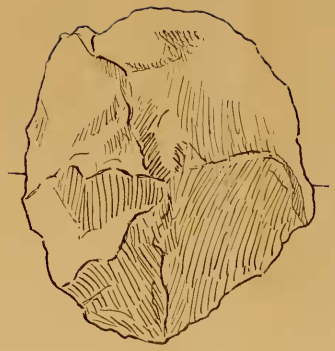

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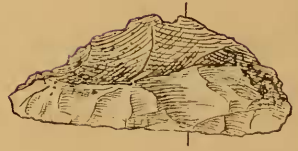

OVATE SCRAPERS

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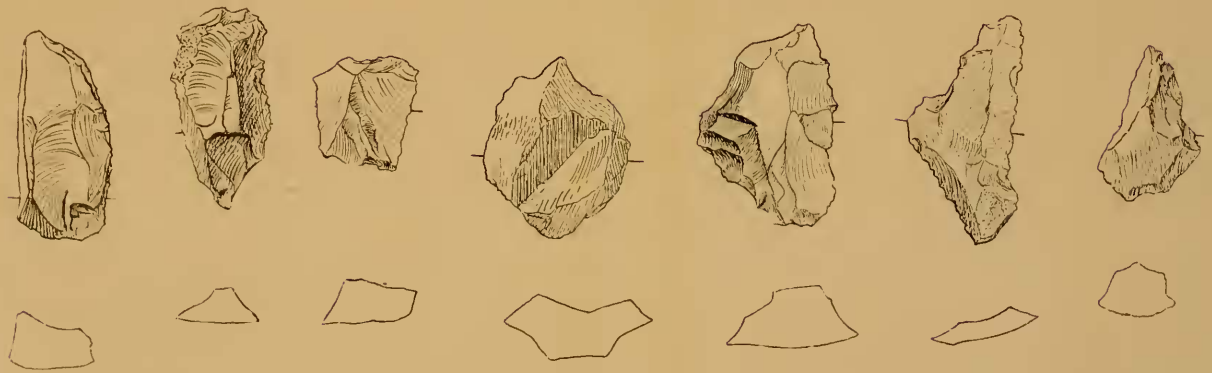


The exact range in time of the extinct and modern species of man is at present a little uncertain. Homo sapiens certainly existed in the Magdalenian Period, while some now extinct species were probably still living. No human remains indisputably older than the Chellean Period have yet been discovered. Those which have come to light from the older Paleolithic deposits, however, all belong to extinct species. The subdivisions of the Paleolithic Period are based on discoveries in Europe, and have not yet been proved to have a world-wide application. The question of Eolithic and Sub-Crag "implements" is still being debated. There are high authorities on both sides.

Appendix B.

Laterite is a product of decomposition of igneous, metamorphic, and sometimes sedimentary rocks. It is the substance well known in Ceylon as "*Kabook*."

The origin of laterite has given rise to considerable discussion; and the term itself has had more than one definition. Geikie (Text Book of Geology, London, 1903, Vol. I., p. 169) defines it thus:—

"A cellular, reddish, ferruginous clay, found in some tropical countries as the result of the subaerial decomposition of certain kinds of rock, as granites, gneiss, diorite, and basalt; it acquires great hardness after being quarried out and dried. The peculiar kind of alteration exemplified by this rock and by Bauxite (hydrated aluminium oxide) has been termed 'laterization.'"

A good description of laterite will be found in "A Manual of the Geology of India" (Medlicott and Blanford), Calcutta, MDCCCLXXIX., pp. 348–370.

NOTES ON CEYLON BUTTERFLIES.

Part II.

By W. Ormiston, F.E.S.

(*With seven Plates.*)

Abbreviations after Names.

M. = Moore : Lepidoptera of Ceylon.
B. = Bingham : Fauna of India : Butterflies.
De N. = De Niceville : The Butterflies of India, Burma, and Ceylon.
E. = Evans : A List of Indian Butterflies.

Papilionidæ.

Pierinæ.

147. Leptosia xiphia, B. & E. ; *Nychitona xiphia*, M.—Also found in India and Malaya.

Very common in jungles all over the low-country. It becomes much scarcer above 2,500 feet elevation, and is rather a rarity at Haldummulla. A native collector once brought me a specimen said to have been caught at Ohiya (6,000 feet). Though mainly a jungle fly, it sometimes appears in open country, and I have noticed it in the Fort at Galle, and it is common in the town of Jaffna.

I have two specimens from Mannar (January—wet season). They are very small, but have an exceptional amount of black, the post-discal spot being joined by a black line to the black on the terminal margin ; one of these specimens also shows a very fine black marginal line on the lower wing. With these exceptions, I have noticed very little variation.

It is the slowest flying butterfly I know, and is nearly always found fluttering low on the edge of the jungle, so is very easy to catch. It flies all the year round.

148. Delias eucharis.—Found also in India and Burma.

It is abundant everywhere, at all elevations, and flies all the year round.

The larva feeds on *Loranthus*, but wanders some distance to pupate, as the pupa, which is very conspicuous, may be found anywhere : on bungalow walls, rocks, &c.

It usually flies rather high, but comes readily to flowers, especially *Duranta*. It is not given to settling on wet roads, like the next species (*P. sita*).

The female varies greatly in the width of the black markings, and I have also taken two or three specimens of a variety in which the white of the upper surface is replaced by yellow. I have found this form rare, but a native collector assures me that he has frequently seen it in the Ratnapura District, so it is apparently a wet season form.

149. Prioneris sita.—Also found in Southern India.

A well-known mimic of the last (*D. eucharis*). The males can be distinguished by their stronger flight, their much more pointed fore wings, and the absence of the post-discal band on the upper side of the fore wing. The real mimicry is, as I believe is always the case among Ceylon butterflies, shown by the female. She has a much slower flight than the male, the fore wing is not so pointed, and the post-discal band is almost as well marked as in *eucharis*, the resemblance being even greater on the wing than in the cabinet. On the under side the mimicry is not quite so perfect; the marginal spots on the hind wing being vermillion instead of carmine, and they are broadest at the margin, whereas in *eucharis* they come to a point there. Seitz, in his work on Butterflies, states that *eucharis* is white at the apex of the fore wing below and *sita* is yellow. In all my specimens both are yellow.

The male is common all the year round at Haldummulla, especially during the south-west monsoon, and may be seen day after day in the same place. It flies fast and high, going round the same trees for hours, often in company with *eucharis*, but it comes to flowers, especially *Lantana*, early in the morning, and often settles on wet patches on the roads in the heat of the day, so it is not difficult to procure. The female is very seldom seen, or, if seen, is mistaken for ♀ *eucharis*.

I once came on females in numbers settled on an evil-smelling blossom in the Amherst gap, Uda Pussellawa, in company with *H. remba*, but not a specimen was perfect.

I have taken it from 500 to 6,000 feet elevation in Uva, and have specimens from Uda Pussellawa, Balangoda, and the hills above Ratnapura.

150. Catopsilia crocale, B. & E.; *Catopsilia catilla*, M.
151. Catopsilia pomona, E.; *Catopsilia crocale*, M., B., & De N.—Also found in India, Malaya, and Australia.

De Niceville and Bingham treated these as one species, but Bell has found that their larvæ are distinct. They can be distinguished as follows :—

Crocale.—A conspicuous reddish pearl-centred spot at the end of the cell on the under side of both wings. Antennæ plum coloured.

Pomona.—The spots at the end of the cell usually absent in the ♂, and absent or inconspicuous in the ♀. Antennæ blackish-brown.

C. crocale ♂ varies very little. The ♀ has two forms: one sulphur-yellow, and the other cream colour. The first is by far the most common. *Var. catilla* is the variety of ♀ *crocale*, with large reddish blotches in the centre of the under side of both wings.

C. pomona ♂ varies in the amount of yellow on the upper side. The ♀ is very variable in ground colour and the amount of the black markings. I have no specimens of as bright a sulphur-yellow as normal ♀ *crocale*.

Both species appear in enormous numbers in the flights, but are not usually at their maximum at the same time. These flights of *crocale* will be found almost always to consist of well-grown specimens of 2 inches to 2½ inches in expanse. In *pomona*, on the contrary, dwarfs of under 2 inches form the great majority.

152. Catopsilia pyranthe.—Moore divided this into *pyranthe*, *ilea*, and *chryseis*. Found also in India and Malaya.

It is very plentiful at times everywhere, but chiefly so at a low elevation. It seldom appears at Haldummulla, except during the north-east monsoon flights, but I have often seen it laying its eggs then. This district is exceptionally well stocked with small insectivorous birds, and I fancy the great majority of the larvæ fall a prey to them. To observe this

better I have grown the food plant in a flower pot in my garden, and, though I have seen a large number of eggs being laid, I have so far failed to find a single half-grown larva on the plant.

It is very variable, but all the varieties grade. The one named *chryseis* by Moore is by far the rarest.

153. Catopsilia florella, B. & E.; *Catopsilia gnoma*, M.—Found in Africa, Persia, Afghanistan, Siam, China, &c.

C. florella differs mainly from *pyranthe* in the terminal border of the fore wing; *pyranthe* has a *continuous* band, broad at the apex and narrowed posteriorly; *florella* has a narrow *macular* band, as broad in interspace 2 as at the apex. The difference is only clearly shown in the females.

The female is occasionally very plentiful in Ceylon, and is found in company with *pyranthe* from Galle to Jaffna. I am uncertain if I can distinguish the male from *pyranthe*, as it seems to grade perfectly. The female is certainly very distinct on the upper side, but typical specimens of ♀ *pyranthe* may be found with the under side coloured almost as in *florella*. The antennæ of *florella* are said to be plum coloured, and those of *pyranthe* dark brown, but I have not found this test reliable. Personally I suspect it to be only a seasonal variety of *pyranthe*, but I hope to induce a ♀ to lay her eggs in captivity and so settle the point. Breeding experiments by Mr. O. S. Wickwar and the late Colonel Manders seem to prove that *gnoma* is a wet season form of *pyranthe*, but I am not sure that *gnoma* = *florella* in this case.

It is commonest at Haldummulla in November and December, viz., during the north-east monsoon flights.

"Found in the Minneriya–Polonnaruwa country" (F. M. Mackwood).

154. Terias libythea, B.; *Terias drona*, M.; *Kibrecta libythea*, E.—Found also in India and Burma.

This is a most variable insect in size, shape of the wings, and markings, and I consider that the variation is seasonal, the extremes being the cold and warm season forms respectively. They grade perfectly into one another. See Pl. 2, figs. 1 and 2.

In the cold season form the apex of the fore wing is acuminate, the black marginal band on the fore wing is interrupted by a narrow yellow patch in interspace 1. The band

on the lower wing is broken up into a broad apical patch reaching to interspace 5, followed by triangular spots at the ends of veins 2 to 5, continued a little way up each vein. There is usually a pink border to the under side of the costa of the fore wing, and the cilia are sometimes salmon-pink, as given by Bingham. In the warm season form the apex of the fore wing is more rounded, and the black marginal band on both wings is unbroken, being continuous from the apex of the fore wing to the tornus of the hind wing. The pink border to the under side of the costa is never present, and the cilia are pale yellow mixed with black. On the under side of the fore wing there is occasionally a distinct narrow pre-apical black streak running from the costa to vein 4. All the other markings are more obscure.

The cold season form is rare, and is most likely to be taken at Haldummulla from January to March, a cold, dry season following the rains. The warm season form is very plentiful here all the year round, and is found everywhere on the patanas of Uva from 500 to over 6,000 feet elevation. It is common at Galaha, near Kandy.

The size of my specimens varies from 26 to 45 mm. in expanse, dwarfs being by far the commonest.

155. Terias venata, B. & De N.; *Nirmula venata*, E.; *Terias cingala* and *rama*, M.—Found in India, China, the Philippines, &c.

Moore separated this into *cingala* and *rama*, and, taking extreme examples, the difference is considerable, especially in the females. *Cingala* has the apex of the fore wings rounded, *rama* has it acuminate. Other differences are:—

In *cingala* ♂.—Upper side: The black border of the fore wing is but slightly, if at all, narrowed below vein 1, and it is continued as a fine black line the whole length of the dorsum to the base; its inner edge is very slightly produced inward along veins 2 and 3; there is a distinct black streak on the disco-cellulars, and the veins of the upper half of the wing are marked out in black; the sex mark is large.

Under side: All markings are very indistinct; on the fore wing there is usually a minute black spot at the upper apex

of the cell, and others at the end of each vein, but all these are sometimes absent. The discal bands on the hind wing, though faint, can always be distinguished.

In *rama* ♂.—Upper side: The black border of the fore wing is abruptly narrowed below vein 1, and is not continued along the dorsum; its inner edge is strongly produced inwards along veins 2 and 3; there is no disco-cellular streak, and the veins are not marked out in black; the sex mark is smaller.

Under side: There is a distinct black linear spot at the upper apex of the cell. On the lower wing there is a black spot in the basal half of 7, and a series of three dusky spots across the wing near the middle of the cell. The discal bands are very clearly marked.

In *cingala* ♀.—Upper side: The black border of the fore wing is of nearly even width from vein 4 to the tornus, and it is usually produced a short distance along the dorsal margin; on the hind wing it is broad at the apex, but narrows *gradually* to the tornus; there is a fine black line on the disco-cellulars of the fore wing.

In *rama* ♀.—Upper side: The ground colour is much brighter; the black border of the fore wing is broken below vein 2, and continued to the tornus as a fine line; on the lower wing there is a broad apical black patch, but it narrows *abruptly* in interspace 5, and is continued thence to the tornus as a narrow black line; there is no mark on the disco-cellulars of the fore wing.

Under side: In *cingala* it resembles the ♂. In *rama* it answers nearly in ground colour and markings to Bingham's description of *T. læta*, wet season form.

The males are fairly constant, but it is possible to grade them. The females are very variable, and grading is easy. I believe that *rama* is the cold and *cingala* the warm weather form of our Ceylon race. The differences between them coincide very nearly to the seasonal variations of *T. libythea*. See Pl. 2, figs. 1 to 6.

Cingala is very plentiful on the Uva patanas, from 500 to 3,000 feet elevation. *Rama* is not so common, and is chiefly

found from 3,000 feet upwards, at Haputale, Ohiya, &c. I found *cingala* very plentiful at Galaha, near Kandy. Although I have always regarded *cingala* as by far the commonest form, it is curious that the Colombo Museum did not possess a specimen till I sent them some a few years ago. They had, however, a very fine series of *rama*.

I have an exceptionally large specimen of *cingala* ♀, in which the ground colour is nearly white.

The next group of *Terias* have always given a lot of trouble, as the species have a wide range, and are very variable. Moore split it into seven species in Ceylon, viz., *hecabe*, *hecabeoides*, *simulata*, *citrina*, *uniformis*, *rotundalis*, and *templetonii*. Manders and De Niceville (A List of the Butterflies of Ceylon) reduced the number to three : *hecabe*, *silhetana*, and *sari*. Bingham and Evans do not give *silhetana* from Ceylon ; the former allows us *hecabe* and *sari*, and the latter *hecabe* and *andersoni*.

Mr. E. E. Green, writing in "Spolia Zeylanica," Vol. VIII., Part XXX., gives *silhetana* and *hecabe*, and distinguishes them as follows :—

"*hecabe*.—Outer margin of fore wing entire ; marginal area of costa distinctly black ; lower extremity of black border not subtended by yellow.

"*silhetana*.—Outer margin of fore wing distinctly crenulate ; marginal area of costa yellow ; lower extremity of black border partially subtended by yellow."

My objection to this is that I have several *hecabe* in which the basal half of the costal border is yellow, and *silhetana* in which it is black. In a variety of *silhetana* mentioned later it is almost always black.

Bingham separates the Indian species as follows :—

Three spots in base of cell = *silhetana* or *moorei*.
Two spots in base of cell = *hecabe*.
One spot in base of cell = *andersoni* or *sari*.

My objection to this is that one or both of the spots in *hecabe* are frequently obsolete in Ceylon specimens.

My own opinion is that we have three species in Ceylon, which, making use of both Green's and Bingham's tables, I would define as follows :—

Three spots in basal half of cell ; terminal margin of fore wing distinctly crenulate ; lower extremity of black border of fore wing usually subtended by yellow = *silhetana*.

Not more than two spots in cell ; if only one, it is usually rather indistinct ; terminal margin of fore wing entire ; lower extremity of black border of fore wing never subtended by yellow = *hecabe*.

One very distinct black streak in cell ; terminal margin of wing entire, or very slightly crenulate ; lower extremity of black border of fore wing distinctly subtended by yellow = *rotundalis*.

156. Terias hecabe.—Found in India, Malaya, China, &c. Moore also gives *hecabeoides* and *simulata*, but these are now regarded as varieties only. It is very variable in markings and in size, and a dwarf form from 25 to 30 mm. in expanse is very common at Haldummulla.

While in the Northern Province in November, 1915, and January, 1916 (wet season), I noticed that a large number of specimens showed exceptionally few markings on the under side. I caught many with both spots in the cell wanting, others with only one spot, and even a specimen with two spots on one wing and none on the other. More than half of those I caught were abnormal. I have subsequently found similar varieties plentiful at Haldummulla, Kottawa, &c. On the upper side the markings are normal, but the colour of the females is rather paler than usual, the under side of the hind wing being, as a rule, very pale. There are two specimens in the Colombo Museum labelled *T. sari*, which are, I believe, only this variety of *hecabe*. They are very unlike Indian specimens of *sari*.

It is one of the commonest butterflies everywhere in the Island, and both wet and dry season forms fly together all the year round.

157. Terias silhetana.—Moore gives *citrina*, *uniformis*, and *templetonii*. From the illustrations the two former are

clearly only varieties of *silhetana*, and the latter is described as having three spots in the cell. Also found in India, Burma, and Malaya.

It is as common as the last in the hills, but less plentiful in the low-country. I have taken it all over the southern half of the Island, but not so far in the north. When *Albizzia moluccana* was first planted through the tea it became a pest, but latterly its natural enemies have kept it fairly well in check. The best way to get fine specimens and varieties is to find an *Albizzia* leaf of which all the soft part has been eaten, and the pupæ are hanging about an inch apart along the ribs. Thirty to forty pupæ may be found on one leaf, and a fine series of varieties will probably hatch out, as the wet and dry season forms fly together. These pupæ on *Albizzia* leaves are always black, but a few larvæ sometimes descend and pupate on the under side of tea leaves; these pupæ are usually green.

It is extremely variable, and cream-coloured specimens are not at all rare. With one possible exception mentioned below, every specimen I have seen had three spots in the basal half of the cell, but Manders mentioned one in his notes in which the basal spot was "almost obsolete." There is a variety found in the wettest forests, the male of which was described by Moore as *rotundalis* ♂, probably because it is usually found in company with that species. It differs from normal *silhetana* in the narrower and more intense black borders to both wings, that on the fore wing being usually continued to the base of the costa, and that on the hind wing being clearly defined, never diffuse, as usual, in *silhetana*. The reddish-brown apical patch, when present, is a narrow streak from the costa to vein 4, as in *hecabe*. There are three basal spots in the cell. On the lower wing below there is a black streak across the angle at the base of vein 8, which I find in all my *silhetana*, but never in *hecabe* or *rotundalis*.

Mr. A. C. Hayley has given me a specimen, which I believe to be an aberration of *silhetana*. The spots in the basal half of the cell have coalesced into one large irregular figure, and the black streak across the angle of vein 8 on the hind wing is wanting.

158. TERIAS ROTUNDALIS, M.—Occasionally plentiful in forests in the wettest zone, but rare elsewhere. Mr. Mackwood, who is by far the greatest authority on our butterflies, has always insisted on its claim to specific rank. See Pl. 2, figs. 7 and 8.

At the first glance the upper side of the ♂ is very like a variety of *silhetana*, but its rounded wings distinguish it. On the under side of the fore wing there is only one very dark streak in the basal half of the cell. It answers nearly to Bingham's description of *andersoni*, but in the specimens I have examined the inner margin of the black border of the fore wing is very rarely angulated on vein 7, and the ground colour of the under side is not noticeably paler than that of the upper. Moore's figures of the under side, and of what he calls the female, are fair. That of the male is, I believe, that of a variety of *silhetana*. The female resembles the male in the shape and markings of the fore wing, but is paler in colour. The border of the hind wing is a very fine black line, widening out into slightly diffuse triangular spots at the end of each vein. This border is sufficient to distinguish the female from any other Ceylon *Terias*.

The reddish apical patch below is wanting, its place being sometimes taken by an indistinct patch of black scales. Judging from my specimens, this species varies less than any *Terias* in Ceylon.

Evans writes: "*sari* is recorded from Southern India and Ceylon; the only specimens in the British Museum marked as such are two from Ceylon, which may be *andersoni*, but are certainly not *sari*." It would be interesting to see if these are *rotundalis*.

Pending a decision as to whether this is *andersoni*, or a race thereof, I retain Moore's name.

I have taken it at Wellawaya and Buttala in the low-country of Uva, and have specimens from Kandy, but it is apparently only plentiful at Ratnapura and in other very wet forests.

159. IXIAS CINGALENSIS, M.; *Ixias pyrene cingalensis*, E.; *Ixias pyrene var. cingalensis*, B.—Moore also gives *pirenassa*, under which name he describes the dry season form.

It is peculiar to Ceylon, but is very near *pyrene*, from which it differs in having the ground colour of the fore wing extended into the base of interspace 3. This seems to be constant, though very variable in amount.

The males vary chiefly in the width of the black border of the hind wing and the amount of markings on the under side. The females vary in the same way, but the band on the fore wing also varies much in width and colour. In specimens from the north this band is usually yellow or pale orange, in those from the south it is almost always deep orange. In Ceylon the ground colour of the female is, I believe, always yellow, slightly paler than that of the male.

It is an insect of the dry low-country, but in some years it joins in the flights in November–December, and may then be found anywhere. I have known it then common at Haldummulla, Peradeniya, and Galle, none of which places are its usual haunts. It is very plentiful in the low-country of Uva and at Anuradhapura, but becomes rarer in the Northern Province. It is not easy to catch, as it is usually found among thorny bushes, and dives into them to escape. The female is especially hard to procure in good condition. The males sometimes settle on wet patches on the roads or in river beds.

"From North Matale to Anuradhapura and Puttalam" (F. M. Mackwood).

160. Ixias marianne.—Also found in India.

Its habitat is much the same as that of the last, but it prefers more open country, and is commoner in the Northern Province. It is very plentiful in the Jaffna and Mannar Districts. It flies more away from the thorny bushes, and is therefore much easier to catch. I have never seen it settling on wet patches on the roads. I have once only seen a specimen at Haldummulla during the flights, and, in my opinion, it does not "flight."

The male varies very little, but in the female the black inner border to the orange band is sometimes missing between veins 2 and 4, and the ground colour of the under side varies greatly.

A melanism of the ♂ of this species, captured by myself in the Hambantota District, is described and figured in "Spolia Zeylanica," Vol. IX., Part XXXIII.

161. Colotis amata, B.; *Idmais modesta*, M.; *Colotis amatus*, E.; *Teracolus amata*, De N.—Also found in Africa, Persia, Arabia, and India.

It is not common in the Province of Uva, except near the boundaries of the Southern and Eastern Provinces. I have taken a single specimen at Wellawaya. It is very plentiful in the drier districts, especially in the Southern Province, from Tangalla to Hambantota, Anuradhapura, Jaffna, Mannar, &c.

The males vary little, but the females grade perfectly from salmon colour to almost pure white, specimens as dark as the males being by far the rarest; they also vary considerably in the ground colour of the under side.

They fly slowly near the ground, and settle frequently, so are very easy to catch.

162. Idmais tripuncta, M.; *Teracolus tripuncta*, De N.; *Colotis fausta tripuncta*, B.; *Madais fausta fulvia*, E.—Also found in India.

Moore figures the female the same colour as the male, but all the specimens I have seen have been white. The markings are the same in both sexes, so, if a salmon-coloured female exists, she could only be distinguished by the different shape of the dorsal margin of the fore wing and the absence of the sex mark, which is a small oval patch of specialized scales on the under side of the fore wing above the basal half of vein 1.

It is found only in the north of the Island, and is never plentiful. It has a very strong flight in the middle of the day in bright sunshine, but is easier to catch in the early morning. I have taken a few males at the blossom of *Cadaba indica*. It seems to frequent forest country more than any other member of the group, with the exception of *amata*.

There is a fair amount of seasonal variation, but the dry season forms, especially of the female, seem to be very rare.

I have specimens from Puttalam (October), Murunkan (July and November), and Elephant Pass (November to January), and I saw a fair number from the train near Madhu Road, on the Mannar line, in November.

163. Callosune limbata, M.; *Teracolus limbatus*, De N.; *Colotis etrida limbata*, B.; *Callosune etrida limbata*, E.—Peculiar to Ceylon, but is an insular race of the Indian *C. etrida*.

It varies considerably, but the race seems to be well established everywhere, except in the Mannar District, where specimens that are very close to typical *etrida* may be taken in company with typical *limbata*. Their flight is so weak that it is difficult to imagine specimens of *etrida* crossing by Adam's Bridge, so they may only be extreme dry season forms of *limbata ;* they are almost invariably very dwarfed. (My specimens vary from 21 to 32 mm. in expanse.) In this connection I may mention that I have taken a specimen of *limbata* on the cart road at Haldummulla, at least 50 miles from its usual haunts. I believe in this case that the insect had pupated on a Hambantota salt cart, and hatched out on the road to Haputale. Specimens might, therefore, be easily brought over from India in a similar manner on the native boats, and thus interfere with the complete establishment of the race in the Mannar District.

It is found all round the north and east coasts from Chilaw to Tangalla, but its range does not, as a rule, extend for as much as 10 miles inland. The largest and darkest specimens are found in the Hambantota–Tangalla District. It flies close to the ground, and is very easy to capture.

" Particularly abundant in Fort Frederick, Trincomalee " (F. M. Mackwood).

164. Callosune eucharis, M. & E. ; *Colotis eucharis*, B. ; *Teracolus eucharis*, De N.—Also found in India.

Confined to the north of the Island and never found very far from the sea. It is very abundant in places in the Mannar and Jaffna Districts, especially near Giant's tank.

Both sexes are very variable, and the variation seems to be largely dependent on season. In the dry season form of the male the black is confined to an external border to the orange patch on the fore wing, and very minute spots at the end of the veins on the hind wing. In the wet season form there is a large black patch on the fore wing below the orange, extending to the tornus, another small one on the costa at the commencement of the orange, and traces of an inner border connecting the two. The black spots on the hind wing are much larger, and sometimes coalesce to form a black border. In the females the orange spots at the apex vary in number from 3

to 5, 4 being the usual number; the orange often extends into the wing within the inner border of the black area. In some specimens the apical spots are nearly white. This may be the result of fading, as the majority of those I have caught were worn specimens. I have, however, failed to produce the effect by exposing dead specimens to sunlight for some weeks. The under side of both sexes varies greatly in ground colour and markings.

In bright sunshine its flight is rather fast, though low, and owing to the thorns it is not easy to catch. In cloudy weather it flies little, and, if beaten up, is easily taken.

165. CALLOSUNE DANÆ, M. & E.; *Colotis danæ*, B.; *Teracolus danæ*, De N.—Moore also gives *sanguinalis*, which is only the small dry season form. Also found in India and Persia.

I have never seen it out of the Northern Province, though I believe it has been taken at Puttalam. It is extremely plentiful in the Mannar District, and is not rare at Kankesanturai on the Jaffna coast. The females are usually much scarcer than the males, but I found them in profusion at Murunkan in July.

It flies with *C. eucharis*, and has the same habits, its flight in bright sunshine being rather fast, but it is easy to catch in the early morning or in cloudy weather. Both species congregate round bushes of *Cadaba indica*, which is apparently the chief food plant of their larvæ in Ceylon, and they may be found roosting at the foot of these bushes in the evening, and the finest specimens can be easily selected.

It seems to vary much less than either *eucharis* or *limbata*, the chief variation being in the ground colour of the under side. Dry season specimens are very often dwarfed.

166. BELENOIS TAPROBANA, M.; *Anaphæis mesentina taprobana*, B. & E.—Peculiar to Ceylon, but is an insular race of *B. mesentina*, which is found from Africa to India.

It is very variable, but seems to be well established as a race, except in the north of the Island. I have single specimens from Jaffna and Mannar, and have seen one from Anuradhapura, which are very near typical *mesentina*, though the under side of the hind wing is chrome-yellow in all. It is much given

to "flighting," especially during the north-east monsoon. During these flights it is common at Haldummulla, Kandy, and Galle, which are much further from its normal haunts than the distance across Adam's Bridge, so it is easy to understand the introduction of fresh blood, from the parent species, in the north.

It is very plentiful in the drier parts of the Island, especially in the Hambantota and Mannar Districts. The cream-coloured variety of the female is commonest in the wet season.

167. Hiposcritia narendra, M. ; *Appias indra narendra*, B. ; *Hyposcritia indra narendra*, E.—Also found in Southern India.

I have never come across this butterfly, my only specimen being a male from Ratnapura given to me by Mr. Mackwood.

"Found also at 3,000 feet elevation in the country north of Matale and the Knuckles Mountains" (F. M. Mackwood).

168. Catophaga venusta, M. ; *Appias albina*, B. ; *Catophaga albina venusta*, E.—Also found in India, Burma, Malaya, &c.

Moore divides it into *venusta* and *neombo*. I have never seen anything at all resembling his figure of *neombo* ♂, but those of the female and under side are clearly lightly marked varieties of *venusta*. It is, however, curious that he describes *neombo* as extremely plentiful, and *venusta* as having been taken only at Vavuniya. In both the white and yellow varieties of the female specimens may be captured in which the pre-apical black band on the under side of the fore wing is obsolete, except for a round spot in interspace 3. This variety, however, grades perfectly into the normal.

The male can be distinguished from the next (*C. paulina*) by its more pointed wings. The female can be distinguished by having the outer margin of the black band on the under side of the fore wing, irregularly zig-zag, never regularly curved as in *paulina* ♀. It has in addition, as a rule, four or five white spots at the apex of the fore wing above while *paulina* has almost invariably only 3 ; but I have specimens of *venusta* in which these spots are reduced to two, those in interspaces 3 and 4 being obsolete.

It is very plentiful everywhere during the flights, but is not often found at high elevations, except when these are on.

169. Catophaga paulina ; *Appias paulina*, B. ; *Catophaga melania paulina*, E.—Also found in Malaya, Siam, and Java.

Moore divides it into *galene* and *lankapura*. In *galene* ♀ the under side of the hind wing is pearly white, while in *lankapura* ♀ it is yellow. They are now regarded as varieties only.

It is very variable. In heavily marked specimens of the male the costa and apex of the fore wing are heavily irrorated with black scales. This dark area is widened on the termen in interspace 3, and then narrowed abruptly, stopping before vein 1. On the hind wing there are black spots on the termen at the end of each vein, and the tornus is irrorated with black scales. In the lighter marked specimens the black scaling is restricted to the costa, and a small patch at the apex of the fore wing. The female varies much in the width of the apical black area, and in the colour and markings of the under side. The variations may be seasonal, but all varieties fly together at all times.

It is extremely plentiful all over the Island during the flights, and single specimens may be found everywhere all the year round.

" Up as high as Pattipola, 6,000 feet " (F. M. Mackwood).

170. Appias libythea.—Also found in India.

This is another most variable species, especially in the case of the females. In the males the variation seems to be largely dependent on locality, the darkest specimens being most often found in the south-east of the Island, in the Hambantota–Tangalla country. This does not, however, apply to the females, as the most extreme forms always fly together, and my lightest and darkest specimens were taken on the same day at Murunkan (Mannar District) in July—dry season.

The male is very similar to *C. venusta* ♂, but can be distinguished by the absence of the yellow tint on the under side of the hind wing. This is usually pure white and unmarked, but there is sometimes a small yellow patch at the humeral angle. I have two specimens which have black spots at the ends of the veins of the hind wing above ; on the under side there are diffuse black spots at the ends of veins 2 and 3 of

the fore wing, the terminal halves of the veins on the hind wing are very lightly marked with grayish-black, and there is a narrow gray marginal line at the tornus.

It is normally an insect of the dry low-country, but it often joins in the November–December flights, and may then be found at any elevation. I received a very dark variety of the female from Ohiya (6,000 feet) in October, 1917, before the flights had started. It was in perfect condition, not like those that have "flighted" far; it may, therefore, occasionally breed in the hills.

I have found it especially abundant in the Hambantota District in March and May, and in the Mannar country in July, November, and January.

"Also Anuradhapura in December" (F. M. Mackwood).

171. Appias taprobana, M.; *Appias hippo taprobana*, B.; *Appias lyncida taprobana*, E.—Moore also gives *A. vacans*, which is only a lightly marked variety.

Bingham separates the race *taprobana*, from Southern India and Ceylon, from *hippo*, by the fact that, on the under side of the hind wing, the sub-costal vein and veins 6, 7, and 8 are conspicuously edged with black in *taprobana*, whereas they are yellow in *hippo*. This does not apply to Ceylon specimens, as, in my experience, almost 25 per cent. show no signs of this black edging. The width of the black border to the hind wing below is extremely variable, and specimens in which this border is narrow (viz., *A. vacans*) seldom show any black edging to the veins. All varieties fly together.

I had been collecting in Ceylon for twenty-seven years before I caught a specimen of this butterfly. In May, 1916, I saw a fair lot of males while travelling from Galle to Tangalla. After entering the dry zone east of Tangalla I saw no more, although species of *Capparis*, which is said to be its food plant, are plentiful between Tangalla and Hambantota, and much scarcer further west. It continued to be plentiful at Tangalla till, at any rate, the end of October, and I also received specimens from Kandy in September and October. It was fairly common round Galle in July, 1918, especially at Gintota, where I saw numbers flying round a tree of *Cratæva roxburghi*.

" Thirty years ago plentiful in and round Colombo " (F. M. Mackwood).

172. HEBOMOIA AUSTRALIS, De N.; *Hebomoia glaucippe*, M.; *Hebomoia glaucippe australis*, B. & E.—Also found in Southern India, but is only a race of *H. glaucippe*, from which it differs in having no inner black border to the orange patch on the fore wing. Females in the wet season sometimes show this black border fairly well, and the ground colour of the upper side is then pale greenish-yellow instead of white.

It is very common in the low-country, especially in the drier regions. Single specimens apparently " flight " all the year round, and may be seen at the highest elevations. These fly very fast and seldom settle, so are almost impossible to catch. The largest flight I ever saw was in November, 1912. From south of Maho to Ambanpola, on the Northern line, the train passed for nearly half an hour through a swarm of many thousands.

In the dry low-country the males settle in numbers on wet patches on the roads, in river beds, &c., and are easy to catch. The females may be taken at flowers. When settled the resemblance to a dead leaf is very striking.

173. HUPHINA PHRYNE, M.; *Huphina nerissa evagete*, E.; *Huphina nerissa var. phryne*, B.; *Huphina nerissa*, De N.—Moore also gives *H. zeuxippe* from Ceylon, but this is only a pale variety, which I have taken at Haldummulla and in the north of the Island. It is probably a dry season form.

Evans does not give *nerissa* as found in India. He gives the race *phryne* from Nepaul and Assam, and *evagete* for the rest of India and Ceylon. Bingham gives *nerissa* for Nepaul, Assam, and Bengal, and var. *phryne* from Nepaul, Bengal, Southern India, and Ceylon.

It is very plentiful in the low-country, especially in the drier parts, and may be seen settled in hundreds on mud or wet sand. It flights at least twice a year, and is then common everywhere in the hills. I have seen it in swarms at Nuwara Eliya. I have not yet, however, observed it in the Galle District.

174. Huphina remba, M.; *Huphina nadina remba*, B.; *Huphina nadina cingala*, E.—Evans gives our Ceylon race as distinct from *remba* of Southern India. Bingham says: "Ceylon specimens differ in the relative width of the black markings, and in the general paleness and dull tint of the greenish-yellow on the under side." Among the few specimens that I possess there is great variation in both respects, those from Ratnapura being much larger and far brighter in colour on the under side than those from the hills of Uva. I have, however, not yet seen a female from Ratnapura. In some of my specimens of both sexes from above 4,000 feet elevation the greenish tint is entirely absent, all markings on the under side being in dull shades of brown. This is a dry season form. A specimen in Colombo Museum has the under side bright brownish-red. It is not labelled with the locality, but from its size and brightness of colouring is evidently from the wet zone.

It is usually a great rarity. In February and March, 1902, it appeared in fair numbers on the bridle road from Haldummulla to the Horton Plains and at Ohiya (6,000 feet). In March, 1906, I found it plentiful at the Amherst gap, Uda Pussellawa, but every specimen was worn. On these two occasions the females seemed almost as common as the males. They flew slowly and settled frequently, so were easy to catch. The low-country form, on the other hand, is said to be very hard to catch, and females are extremely rare.

"Found in Upper Pundaluoya and the higher parts of East Matale. A rarity, especially the female" (F. M. Mackwood).

175. Nepheronia ceylonica, M.; *Pareronia ceylonica*, B. & E.—Also found in Southern India.

Moore divides it into *ceylonica*, *fraterna*, and *spiculifera*. Bingham says it differs from *pingasa* in having the black border of the hind wing of even width throughout, not narrowed towards the tornus.

Both sexes are very variable, and extreme forms of the male are very distinct. These are named by Moore—

1st, ceylonica.—The terminal margin of the fore wing is very slightly concave, if at all. It has a very broad black border, with only a few minute, or no, blue spots on it.

2nd, *spiculifera*.—Smaller and of a paler blue. The termen of the fore wing more falcate, and the hind wing proportionately smaller. The black border of the fore wing is much narrower, especially near the tornus, and there is a series of small elongated blue spots on this border that in interspace 3 being shifted inward, and the two in interspace 1 almost or quite joined to the ground colour. As Moore points out, *ceylonica* appears to be nearest to *pingasa* and *spiculifera* to *hippia*. His variety *fraterna* appears to be an intermediate form.

Ceylonica is common in the drier low-country, but is found at all elevations during the flights, but I have only taken *spiculifera* in the hills. Both are variable, and it is easy to grade them.

Personally I believe *spiculifera* to be the cold season (or high elevation) form, while *fraterna* and *ceylonica* are the dry and wet season forms respectively of those bred in the low-country. Indian writers all agree in regarding *pingasa* and *hippia* as distinct species, and it is curious that varieties of our Ceylon race should almost grade into each of them. An analogous case is that of *Terias læta* and *venata*, the former of which is allied to the Ceylon *T. rama* and the latter to *T. cingala*, and yet there can be little doubt that *rama* and *cingala* are only varieties of our Ceylon race.

The females vary greatly in the width of the blue markings on the upper side and the amount of black shading below. In June, 1916 and 1917, I got specimens at Wellawaya, which were very exceptionally dark both above and below; in fact, all flying there then were of this unusual colour. The males with them seemed to be normal specimens of *ceylonica* above, but had more black shading below. I have received a similar pair from Kandy. These dark varieties of the female are good mimics of *D. septentrionis*. Normal varieties mimic *D. limniace* and *aglea*, but especially resemble *R. exprompta*, which, however, is not found in the usual haunts of *Nepheronia*.

They usually fly among thorny bushes in the low-country, and are not easy to catch. They are often seen at Haldummulla when "flighting," but are seldom caught, as they go fast and straight and seldom settle. The mimicry of the females also prevents recognition until too late.

Var. ceylonica is very common in the low-country of Uva and at Anuradhapura, but becomes scarcer further north. I have seen single specimens at Galle and Nuwara Eliya. It is not rare at Ohiya during the flights. *Var. spiculifera* is much rarer, and I have only seen it above 4,000 feet.

Papilioninæ.

176. Ornithoptera darsius, M. & E.; *Papilio darsius*, B.; *Troides darsius*, De N.—Peculiar to Ceylon.

It differs from Indian species in having the yellow area on the lower wing more restricted. It varies to a certain extent in this respect, but all my specimens of both sexes have the apex of the cell yellow. One male in the Colombo Museum collection has the whole cell black, but I believe this variety is very rare. In a few cases the male has black spots in the yellow interspaces. One of mine has four of these spots, one each in interspaces 2, 3, 5, and 6, and the yellow in 7 is exceptionally small, the reduction being apparently caused by a spot coalescing with the basal black area. I have two others with a spot in interspace 2, and the Colombo Museum has one with spots in 2 and 3. This variety has been named *cambyses*; it is far from common.

It flies all the year round at Haldummulla, and is apparently common everywhere up to 6,000 feet elevation at least, except in the Northern Province, the furthest north that I have taken it being at Puliyankulam resthouse. It usually flies very high, but frequently visits flowers, and it is then easy to catch.

177. Menelaides hector, M. & E.; *Papilio hector*, B. & De N.—Also found in India.

It is very plentiful all over the low-country, but especially so in the drier districts. Single specimens visit the hills all the year round, but their flight is usually fast and straight, and they seldom settle. In the low-country they fly, as a rule, close to the ground, visiting flowers, and are very easy to catch. In November, 1914, I saw a fair number far out to sea, off the Indian and Ceylon coasts, several of which came on board the ship. At Kankesanturai, on the north coast, I have often noticed its gregarious habits when roosting for the night, a dozen or more settling on a single palmyra leaf.

The female is much more difficult to procure in good condition than the male. It can be distinguished by the much duller colour of the crimson spots and the greater amount of black on the upper surface of the abdomen.

"Female difficult to get in perfect condition on account of being incessantly harassed and damaged by the males" (F. M. Mackwood).

178. MENELAIDES JOPHON, M. & E.; *Papilio jophon*, De N. & B.—Peculiar to Ceylon, and confined to the wet zone.

I have taken it at Elpitiya and Kottawa in the Galle District, and single very battered specimens at Kegalla and Rambukkana. The latter place is, I imagine, quite its most northern limit. I am told that it is quite common at times at Ratnapura and at Udagama and Deniyaya in the Southern Province. I have noticed very little variation, except in size.

It is very easy to catch in the early morning or late evening, but it flies very high in the middle of the day in fine weather.

"Has been captured at Pussellawa and Galboda in Ambegamuwa" (F. M. Mackwood).

179. MENELAIDES CEYLONICA, M.; *Papilio aristolochiæ*, B. & De N.; *Menelaides aristolochiæ ceylonicus*, E.—Peculiar to Ceylon, but is at the most only a race of the Indian *aristolochiæ*.

Bingham says: "Var. *ceylonica* has a white spot at the apex of the cell of the hind wing." The great majority of Ceylon specimens show this spot, but others without it are not very rare, and are widely scattered in different localities in both the wet and dry seasons. I have one specimen, a female, from Giant's tank, Mannar, which not only has no white in the cell, but the white spots do not commence till at least 4 mm. below it. These spots are much reduced in size, the one in interspace 5 being almost obsolete. The black on the upper surface of the abdomen is much reduced. It answers to Bingham's description of the dry season form of *aristolochiæ*. It was caught in July (dry season). It seems to me, therefore, that the race *ceylonica* is hardly well established yet.

It is very common at Haldummulla all the year round, and is well distributed all over the Island from Galle to Jaffna, though it is less common in the north than in the south. Its

flight is slow, and it settles frequently at flowers, so it is easy to catch. I have never noticed it "flighting."

I have seen a full-sized specimen killed and carried off for a short distance by an Asilid fly.

180. Papilio demoleus, De N., B., & E.; *Orpheides erithonius*, M.—Found also in Arabia, Persia, India, Burma, China, &c.

It is common all over the low-country, from Galle to Jaffna, and occasionally joins the flights in great numbers, and may then be taken at the highest elevations.

The colour seems to be much affected by the sun or age, as specimens of a rusty orange are very plentiful all over the low-country, though I have never seen one over 3,000 feet elevation. These specimens will almost invariably be found to be much worn. An extraordinary aberration captured by myself on the Wellawaya–Hambantota road is figured and described in "Spolia Zeylanica," Vol. IX., Part XXXIII.

The larvæ may be found on orange and lime trees, and are very like those of *romulus*, *parinda*, and *mooreanus*, which are found on the same trees. According to Fryer ("Spolia Zeylanica," Vol. VII., Part XXVIII.), they may be distinguished as follows:—

A.—Fourth and fifth segments markedly swollen:

*a*1.—Diagonal bands on segments 8 and 10 mainly brown, and meeting in the dorsal middle line = *mooreanus*.

*b*1.—Diagonal bands mainly white, not meeting in middle line = *parinda*.

B.—Fourth and fifth segments not markedly swollen:

*a*2.—Candal tubercles white, much reduced = *romulus*.

*b*2.—Candal tubercles brown, size moderate = *demoleus*.

181. Charus mooreanus; *Charus helenus*, M.; *Charus helenus mooreanus*, B. & E.; *Papilio mooreanus*, De N.—Peculiar to Ceylon.

It differs from the Indian *C. helenus* in having a complete series of seven sub-discal blue lunules on the under side of the hind wing, but the two in interspaces 3 and 4 are sometimes nearly obsolete. The number of red lunules visible on the upper surface of the hind wing varies from 1 to 5 in my specimens.

It is only found where there is a fairly heavy rainfall. It is very plentiful in the jungles between Haputale and Ohiya (4,000 to 6,000 feet), and occasionally descends as low as Haldummulla, but it is very rarely seen below 3,000 feet in Uva. In wetter districts it is found at very low elevations, and it has been taken at Kottawa, near Galle. It is common at Ratnapura, Madampe, and Deniyaya.

The female seems to be very rarely captured. I have only one specimen, which I bred. It differs from the male in having the inter-nervular yellow streaks on the fore wing much more clearly marked, as they are formed by scales in the ♀, and by hairs in the ♂. It also differs in having the white patch on the lower wing the same size both above and below, in the ♂ this patch is much smaller on the under surface than on the upper. The males are fond of settling on wet patches on the roads or in the beds of streams.

" Generally plentiful in heavy jungle land, especially in the Matale hills " (F. M. Mackwood).

182. Iliades parinda, M.; *Papilio parinda*, De N.; *Iliades polymnestor parinda*, E.; *Papilio polymnestor parinda*, B.—Peculiar to Ceylon, but is a race of the Indian *I. polymnestor*. The male differs from *polymnestor* in the greater area of the blue on the upper side. The female differs in having the blue area tinged in spots, or sometimes even entirely replaced by pale buff. The last form is by far the rarest.

It is a most variable insect. In the male the width of the blue band on the fore wing varies greatly, and the post-discal spots on the hind wing may be large and conical, as in *polymnestor*, or small and round. In the female these spots are sometimes very much reduced, and the two upper ones may be entirely obsolete.

It is very common at Haldummulla, especially during the south-west monsoon (viz., the dry season). I have seen it all over the low-country as far north as Mankulam, and I found it once in extraordinary abundance at Anuradhapura in December. The male is very fond of settling on the sand in river beds and on wet roads in the hot weather. The female is easiest to catch when laying her eggs.

183. Lærtias romulus, M.; *Papilio polytes*, B. & De N.: *Lærtias polytes romulus*, E.—Evans says: "Jordan confines *polytes* to China, giving the Indian race as *romulus*."

As is well known, there are three varieties of the female: 1st, like the ♂; 2nd, mimics *M. aristolochiæ* ♀; and 3rd, mimics *M. hector* ♀. The first has been named *cyrus*, the second *polytes* or *stychius*, and the third *romulus*. The one which mimics *aristolochiæ* has usually in Ceylon a white spot in the cell (like the race *ceylonica*), but sometimes the white patch does not commence till well below it. The one which mimics *hector* is, as might be expected, a far better mimic of the female *hector* than of the male, though it is sometimes compared with the latter in articles on mimicry. It has been suggested that the crimson bodies of *aristolochiæ* and *hector* would spoil the mimicry, but in the females of both almost the whole of the upper surface of the body is black, and the abdomen is so carried in flight that the crimson would be quite invisible when viewed by a bird from above.

It joins the flights in great numbers, especially in November and December, and I have noticed that in these flights the variety which mimics *hector* is the commonest. At Haldummulla *hector* is far less common than *aristolochiæ*, but these flights were coming from the dry low-country, where the opposite is the case. When the flights are not on, the variety, like *hector*, is by far the rarest at Haldummulla, and the one like the male is the commonest.

The males may often be found settled on mud or wet sand. The females visit flowers, but are best caught when laying their eggs. They are very easy to breed, but occasionally remain for a long time in the pupal stage. Last year I had six larvæ which pupated in May. Three hatched out early in June, one at the end of July, one in the middle of August, and the last in September. The larvæ are usually to be found on orange and lime trees, but I have often seen the females laying their eggs on *Todalia aculeata*. I have bred a fair number, but have not yet lost a single larva through parasites, and I imagine their numbers must be mainly kept in check by birds.

184. Chilasa lankeswara, M.; *Papilio lankeswara*, De N.; *Papilio clytia lankeswara*, B.; *Chilasa clytia*, with var. *lankeswara* and dimorph *dissimilis*, E.—Moore gives *dissimilis* and *clytioides* as separate species.

I think it is certain that there is only one species in Ceylon, but I do not feel competent to express an opinion as to whether it is a variety of clytia, as given by Evans; a race, as given by Bingham; or a sub-species, as given by De Niceville. All the later writers agree that *dissimilis* is only a dimorph.

Rothschild says that *lankeswara* "differs from *P. clytia* in the umber brown colour of the wings, and in the small sub-marginal spots of the fore wings . . . . This sub-species has been described from slightly aberrant specimens, in which the sub-marginal spots of the fore wings are partly obliterated; in most individuals the series of these spots is complete, and on such specimens Moore's *clytioides* is based."

I have only a rather poor series, but they vary much in the number and size of these spots and of the discal sagittate spots on the hind wing. The umber brown colour seems constant.

C. lankeswara is a mimic of the *Euplœas*, and it is curious that these, in Ceylon, differ from their corresponding Indian species in the same way that *lankeswara* differs from *clytia*. The form *dissimilis* mimics *D. limniace* and *aglea*, and is said to agree with Indian specimens. It varies greatly in size and the amount of the white markings. In both forms the females can be distinguished by their broader and more rounded fore wings.

It has as rapid a flight as any *Papilio* in Ceylon, but does not always make use of its powers. When visiting flowers, or hovering over wet patches on the roads, its flight is slow, and so like that of a *Danais* or *Euplœa*, that after thirty years' experience I am still sometimes deceived by it. I imagine that protection is most needed by the female when laying her eggs; she would then probably be hovering slowly over the cinnamon, &c., and her mimicry would be most advantageously displayed. The pupa is a most wonderful example of camouflage. It is fixed to a branch so as to exactly resemble the end of a broken twig, and I have found it difficult to distinguish even in a breeding cage.

I have found *dissimilis* rather more plentiful than *lankeswara*, but neither form is common. The best localities I have noticed are the road from Wellawaya to Muppane and Dambulla. I have also taken it at Haputale (5,000 feet), Haldummulla, and Galle, but have not yet seen it in the Northern Province.

185. Papilio crino, B. & De N. ; *Harimala montanus*, M. ; *Achillides crino fruhstorferi*, E.—*P. crino* is found in India. Evans gives *fruhstorferi* as the Ceylon race. Bingham says : "*var. montanus*, Felder, was founded on specimens devoid of the cottony scent streaks on the upper side of the fore wing." These streaks are present in the male in a fair proportion of Ceylon specimens, but those without them are usually the commoner.

It is especially abundant in the low-country of Uva and the North-Central Province, but is common everywhere in the low-country, except in the extreme north. I have seen it once in the Mannar District. Individuals which are apparently "flighting" appear all the year round in the hills. I once saw a very big flight at Galle in March, the direction was south-west, viz., straight out to sea. It continued for three or four days, and enormous numbers must have perished in the sea.

The male is often to be found settled in numbers in the sandy river beds, and is very easy to catch. The females are not easy to procure in good condition. They can be distinguished by the narrower green band on the fore wing, and there is also usually a diffuse orange spot near the apex of the hind wing above.

"Abundant in Kandy and Kurunegala jungles" (F. M. Mackwood).

186. Pathysa antiphates, M. ; *Papilio alcibiades*, De N. ; *Papilio antiphates alcibiades var. ceylonicus*, B. ; *Pathysa antiphates ceylonicus*, E.—*P. antiphates* is found in India, Burma, Siam, Malaya, China, &c. The range of the various races is still unsettled.

Rothschild describes *ceylonicus* as having "Two basal black bands on the upper side of the fore wing extending beyond the median nervure ; the fourth band broad and reaching to the median nervure (not triangular)." This I consider merely

a seasonal variety. In two of my specimens from the dry zone this fourth band does not reach the median nervure, and is triangular; those from the wet zone agree with Rothschild's description. The specimens in the Colombo Museum vary much in this respect, and in one the band is very acutely triangular; unfortunately it has no label of locality. It is so rare and so variable in every respect that it is difficult to say whether it is a local race or not, but dry zone specimens seem to agree approximately with Bingham's description of *alcibiades*.

The only place where I have personally taken it is at Sirigalla, near Muppane, in the low-country of Uva. I found it settled on wet sand in the bed of a stream. A native catcher has brought me specimens from Ratnapura, Kottawa, and Deniyaya. All my specimens are males.

"Found in the Ratnapura District February to June and October to December" (F. M. Mackwood).

187. Pathysa nomius, M. & E.; *Papilio nomius*, De N. & B.—Also found in India.

This is usually rare in Uva, but it occasionally appears in great numbers at the commencement of the north-east monsoon. In October, 1893, I found it in hundreds settled on the wet roads near Wellawaya, and I have heard of two similar swarms in the same district since. It joins in the flights, and I have notes of its occurrence above Haldummulla at an elevation of 5,000 feet. I have also seen it in great numbers on the road from Trincomalee to Dambulla, and have received specimens from Kandy.

It varies a great deal in the width of the black markings, dry season forms being much lighter than those taken during the rains. I have not yet obtained specimens from the wet zone, though it is found there.

"Numerous on roads to Trincomalee. Caught at Kottawa" (F. M. Mackwood).

188. Zetides doson, M. & E.; *Papilio jason*, De N.; *Papilio eurypylus jason*, B.—Evans gives *doson* as peculiar to Ceylon, and *eleius* as the Southern Indian race; Bingham and De Niceville give *jason* from both Ceylon and Southern India. Moore divides our Ceylon race into *doson* and *telephus*. He

says that *doson* "differs from *Z. telephus* in being larger, the transverse medial macular band much narrower in both wings. On the under side the medial band is also narrower, especially across the hind wing . . . ., the outer black spots to the discal band are larger, and less bordered with carmine." Extreme specimens are fairly distinct, but they vary, and it is easy to grade them. I consider the difference is seasonal. In March, 1917, I took *telephus* at Wellawaya after two months' drought, and *doson* in May after heavy rains.

It is extremely plentiful at times all over the low-country, except in the extreme north, and I have taken it from Kottawa to Vavuniya. It sometimes "flights" in great numbers, and on rare occasions these flights visit the hills, and specimens may then be taken at any elevation. The males settle in crowds on wet patches on the roads and in river beds, and a dozen or two may be covered at one stroke of the net. The females seem to be very difficult to obtain, and I have not yet succeeded in capturing a single specimen.

189. Dalchina teredon, M.; *Papilio sarpedon teredon*, B.; *Zetides sarpedon teredon*, E.—Also found in Southern India.

It differs from *sarpedon* in the narrower medial band across both wings, and in the upper portion of this band, on the fore wing, being of a more distinct greenish shade. The width of the band varies in Ceylon specimens, but the greenish tint is usually very pronounced; in one of my specimens, however, it is almost indistinguishable.

They may be seen day after day in the same place flying very fast round the tree tops, generally in pairs, but are then extremely hard to catch. The females occasionally visit flowers, but I have found it very difficult to get specimens in good condition. The males are much addicted to settling on wet roads, but are not gregarious like *doson;* usually there is only one on the wet patch, and to find more than two is extremely rare.

They are very plentiful at Haldummulla all the year round, and I have found them common at Kottawa, near Galle, and at Ohiya (6,000 feet). They become much rarer in the drier districts, and I have not yet seen a specimen in the northern half of the Island. They do not join in the flights.

" I have seen six or more together on wet patches on several occasions. Fairly plentiful in the Central Province hills " (F. M. Mackwood).

190. ZETIDES AGAMEMNON, M. ; *Papilio agamemnon*, De N. & B. ; *Zetides agamemnon menides*, E.—*Z. agamemnon* is found in India, Malaya, China, &c., The race *menides*, which only differs in the greater length of the tails, is restricted to Southern India and Ceylon.

It is common all over the low-country, but especially so in the south. Not rare in the hills at times, and, as a rule, does not appear to be " flighting," as the direction of flight is seldom constant. In November, 1917, however, I saw it at Pattipola in great numbers, and on this occasion it was certainly "flighting," as all were flying due south.

It is most frequently caught when visiting flowers. It only stops a very short time at each blossom, so is not easy to capture. Occasionally the males may be taken settled on the mud near cattle sheds or lines.

" Fairly plentiful everywhere. Larva feeds on the soursop leaves " (F. M. Mackwood).

HESPERIIDÆ.

This group of butterflies are not, as a rule, showy, and therefore they have been less studied than the others. From an economic point of view, however, they are the most important group in Ceylon, as at least four species feed on paddy, two on coconut palms, two on ginger, one on sugar cane, &c. The literature is rather meagre, as they were not dealt with in De Niceville's work, and have not been reached in the Fauna of India series. The leading work is still " A Revision of the Oriental Hesperiidæ," by Messrs. Elwes and Edwards (Transactions of the Zoological Society of London, Vol. XIV., Part 4). Unfortunately the authors had apparently few Ceylon specimens to examine, and I fear, therefore, that several of our species will require re-naming.

This work mainly decides questions of specific identity by an examination of the prehensores of the males, and the authors point out " that a very considerable practice in

making this examination, and great experience in estimating the value of the characters observed, are necessary to form an opinion on the subject." I confess that I have had no previous experience, but the sketches in the plates herewith are in nearly every case the result of the examination of a large number of specimens. In no case was the sketch made from a single specimen. I am sending a set of my slides to the Colombo Museum, where any one interested can examine them. They include all the Ceylon Hesperiidæ, with the exception of *C. spilothyrus* and *G. albofasciata*. When removed from the body and allowed to dry, the clasps almost invariably shrivel and curl up, thus entirely altering their outlines as seen under a microscope. I have, therefore, whenever possible, used perfectly fresh, undried specimens for my sketches.

In cases where there are only slight differences between the prehensores of two forms, it is necessary to examine a large number of each, to ascertain if these differences are permanent, or only casual variations. For instance, with regard to *Padraona dara*, Messrs. Elwes and Edwards write that "Mr. Edwards dissected fifteen specimens from different localities, and found considerable variation in degree, but no differences which can be regarded as specific." Lieutenant-Colonel Evans, in his Notes on Indian Butterflies (Journal of the Bombay Nat. Hist. Society, Vol. XXIII., p. 808), says that he examined twenty-three males in his collection, and found that he had five species. I have dissected well over a hundred Ceylon specimens, and find two very distinct forms, which show no signs of grading, and *extremely slight internal variation*. (See Pl. 5, figs. 3, 4, 5, and 6). I believe there is also a third form, but I have been unable, so far, to obtain sufficient specimens to prove that it is not merely a variety or seasonal form. (See Pl. 5, figs. 7 and 8). By the courtesy of Mr. F. Hannyngton, I.C.S., I have been able to dissect a few specimens from Coorg, and found two forms among them, which are quite distinct from anything I have seen in Ceylon. Apparently this group is split up into numerous local races, and, so far as my experience goes, the prehensores will be found a more constant and reliable means of separating them than the colouration of the wings. Similar

local races apparently also occur in the *phillippina* and *kumara* groups of the genus *Parnara* and others.

A question which arises is whether differences in colour caused by climatic influences are accompanied by changes in the prehensores. This, of course, can only be settled by breeding experiments. For instance, Indian writers treat *Caprona saraya* as a seasonal form of *C. ransonnettii*, though Elwes and Edwards point out that their clasps differ considerably. In Ceylon *C. siamica* shows an almost similar divergence from *C. ransonnettii*, and would therefore, I presume, be regarded as a seasonal form. I have examined over a dozen specimens of *C. siamica*, and have, so far, found no signs of grading in the clasps, and am therefore inclined to regard it as distinct. (See Pl. 3, figs. 9, 10, 11, and 12.)

To satisfactorily settle the status of our Ceylon species and races, it will be necessary to examine a large number of allied Indian forms, especially from Southern India, and I shall be very grateful to any Indian collectors who may send me specimens for dissection.

In describing external markings, Elwes and Edwards use a different nomenclature for the parts of the wing from that given in Plate 1. For instance, they call the vein next below vein 2 vein 1*a*, and the interspace between this vein and vein 2 cell 1*a*. To avoid confusion I have continued to use Bingham's terms, and call the former vein 1, and the latter interspace 1.

My attention has been called to the fact that Moore's Lepidoptera Indica is now the leading work on this group. The price (£80), however, places it beyond the reach of most collectors.

191. HANTANA INFERNUS.—Peculiar to Ceylon.

This is a very variable species. In my lightest marked specimen the markings on the upper side of the fore wing consist of two minute pre-apical yellow spots. In the most heavily marked there are three pre-apical spots, one spot in the cell touching the pre-costal vein, and a smaller one below it, and a small one in the centre of interspace 2. Some specimens have a minute spot on the costa, above the spot in the cell; Moore says these are females; all I have seen were

males. The upper side of the hind wing is usually uniformly black, but sometimes the terminal half is irrorated with golden yellow scales shaped like a sword blade; these are grouped between the veins, forming a row of post-discal diffuse spots. On the under side of the fore wing, in addition to the pre-apical spots, there is sometimes a straight row of five spots, viz., three from the costa to the middle of the cell, a round spot in interspace 2, and a smaller one below in interspace 1. There is also occasionally a large very diffuse spot at the apex of interspace 1. On the hind wing some specimens have complete discal and post-discal rows of very diffuse orange spots; in others all these spots are absent. When present they are formed by sword-shaped scales as above.

It is usually found in jungle from 2,000 to 6,000 feet elevation, and settles with its wings spread out flat on the under side of a leaf; if disturbed it seldom flies far. It is very active in the net, and the wings rub easily, so perfect specimens are not easy to procure. I have not yet seen a female.

It is plentiful at Haputale, and not rare at Haldummulla, and occurs at all times of the year. I have also specimens from Kandy and the hills above Ratnapura. For prehensores, see Pl. 3, figs. 1 and 2.

"Kandy District, Matale hills at 5,000 feet, parts of Kotmale, and in the Ratnapura hills" (F. M. Mackwood).

192. Celænorrhinus spilothyrus, E.; *Plesioneura spilothyrus*, M.—Also found in Southern India.

Evans says: "*C. fusca* can easily be separated from *spilothyrus* by the chequered cilia." In several of my specimens the cilia of the hind wing are distinctly chequered. Elwes and Edwards point out that in *C. fusca* the costal spot "is usually, but not always, white," whereas in Ceylon specimens "it seems to be always yellow." Moore says this spot is white in the male, and yellow in the female. He may be right. In every specimen I have seen it was yellow, though varying in depth of colour, but I have never seen a male from Ceylon.

It varies greatly in the size and shape of the spots on the fore wing, and one or both of those in interspace 1 are often missing. The definition of the golden-yellow spots on the hind wing is very variable, and they may be entirely obsolete

below. They are formed by sword-shaped scales identical with those of *H. infernus*, but, when especially well marked, there is also a mixture of broader scales.

It is found in the same localities, and has the same habits as *H. infernus*, but, whereas the female of *infernus* seems unprocurable, in *spilothyrus* the opposite is the case, and I have not yet seen a male. This, coupled with the resemblance in habits, venation, and scaling, gives rise to a suspicion that *infernus* is the male, and *spilothyrus* the female, of our Ceylon form. Of course, this can only be proved by breeding.

My specimens are from Haldummulla, Haputale, Kandy, and the hills above Ratnapura.

"Occurs in jungles about 3,000 feet elevation, mostly July to September" (F. M. Mackwood).

193. Sarangesa albicilia.—Peculiar to Ceylon, but probably a race of *S. dasahara* of India. It only differs in having the under side of the hind wing white. The prehensores seem to be identical. (See Pl. 4, figs. 1 and 2.)

It varies little. On the fore wing the discal spot in interspace 2 is sometimes obsolete. On the under side of the hind wing there is sometimes a complete series of diffuse black marginal spots in interspaces 1 to 5, in other specimens there is no trace of these.

In May, 1917, it was apparently "flighting" at Haldummulla, and I caught a fair number of specimens. The direction of flight was west. It is usually a rarity here, but is very common in the low-country of Uva. I have taken it at Trincomalee in November, and have received specimens from Kandy taken in August.

"Numerous in the Kandy–Matale heavy chenas" (F. M. Mackwood).

194. Coladenia tissa, M.; *Coladenia indrani*, De N.; *Cnaiolade indrani tissa*, E.—Probably a race of *C. indrani*, which is found in India and Burma. Elwes and Edwards distinguish *tissa* from *indrani* by the "distinct displacement inwards of the middle one of the three pale spots which form the sub-apical series." In my specimens these spots vary in number from 2 to 5, though 3 is most usual. The spot in 7 is usually displaced inwards, but the displacement is sometimes

very slight. All other markings and the ground colour are also extremely variable. I have only been able to examine a single specimen of *indrani* from Coorg. In it the three pre-apical spots are equal in size, and are far larger than in any specimen of *tissa* that I possess. They are arranged in a straight line. The clasp differs slightly from that of *tissa*, but this cannot be relied on with the examination of only a single specimen. For the prehensores of *tissa*, see Pl. 3, figs. 5 and 6.

It is very widely distributed in Ceylon, but I have never found it common. I have taken it at Haldummulla, Wellawaya, Hambantota, Galle, Kegalla, and Vavuniya, and have specimens from Kandy. It settles with its wings spread out flat on the under side of a leaf, and, as a rule, does not fly far if disturbed; but its flight is so rapid that it is not always easy to see where it settles.

" Captured at Jaffna in August ; found at Badulla " (F. M. Mackwood).

195. Tagiades distans, M. & E.—Also found in India, but is probably a race of *obscurus* from Java. Moore says: " *Obscurus* differs in the absence of the discal semi-transparent spots on the fore wing." Elwes and Edwards say they have not been able to compare Malayan with Ceylon specimens, but regard the distinction as of no value, as these spots are often missing in Ceylon specimens. Males without them are not at all rare, but all the females in my collection show them. I have received three specimens of an allied race from Mr. F. Hannyngton, I.C.S., Coorg. I am uncertain whether they are *obscurus* or *alica*. They differ in many ways from Ceylon specimens, but especially in the markings on the under side of the hind wing. The clasp is distinct, though clearly allied. The clasp of *distans* is figured on Pl. 3, fig. 7.

It is common from sea level up to 5,000 feet at least, wherever there is a fair rainfall. It flies all the year round, but is most abundant at Haldummulla, near the changes of the monsoons.

On the roads at Haldummulla large skippers are often met " flighting " west. When approaching they are inconspicuous, but when going away they show a lot of white. These flights

are, I believe, almost entirely composed of *T. distans* and *atticus*, but one specimen I succeeded in catching proved to be *U. folus*. In May, 1917, they were exceptionally numerous, and all I caught, or saw settled, were *T. distans*. When not flighting, it only flies a short distance, and settles with its wings expanded, usually on the under side of a leaf, but often in the most conspicuous positions.

"Has a wide range, from Colombo to Nuwara Eliya" (F. M. Mackwood).

196. Tagiades atticus.—Also found in India, Burma, Malaya, Dutch Indies, &c.

This is a very variable species; as a rule, specimens from Kandy, Ratnapura, and other places in the wet zone are much smaller, and have less white, than those from the highest elevations. The marginal spots on the hind wing vary greatly in size, but the one at the end of vein 1 is usually the largest. The black spot in the cell on the under side of the hind wing is frequently missing. In my series the number of hyaline spots on the fore wing varies from 5 to 10, the lowest one in the cell, and those in interspaces 2 to 5 being sometimes obsolete. The clasp is figured on Pl. 3, fig. 8. I have noticed no variation in it so far, but have only been able to spare specimens for dissection from Kandy and Ratnapura (wet zone).

It is much rarer at Haldummulla than *distans*, and far harder to catch, as it seldom seems to settle here. It is commoner at Haputale (5,000 feet), and I am told that it is abundant in Nuwara Eliya at times. I can get plenty from Kandy.

"An up-country species, from Kandy upwards" (F. M. Mackwood).

197. Tapena thwaitesi.—Also found in India, Burma, Malaya, &c.

Elwes and Edwards divide this genus as follows:—

"1. Upper lobe of clasp bifid at the apex = *thwaitesi*.

"2. Upper lobe of clasp not bifid at the apex.

"3. Upper lobe of clasp with three limbs, all of which are serrate. Similar to *thwaitesi*, but smaller and paler above = *minuscula*.

" 4. Upper lobe of clasp with two limbs, of which the lower is serrate and the upper simple. Size of *thwaitesi*, but upper side in the male nearly uniformly umber brown = *hampsoni*."

Swinhoe groups them all as one species, as the only differences are, he considers, in the genitalia, and it seems probable that they will eventually be only classed as local races of *thwaitesi*.

As might be expected, the clasp of the Ceylon form is nearest to that of the Southern Indian one, viz., *hampsoni*. See Pl. 3, figs. 3 and 4. The sole difference appears to be the slight serration of the upper limb of the clasp. This is present in the four specimens that I have dissected, but almost disappears when the clasp dries up. The name *thwaitesi* was originally given to a specimen from Ceylon, so that name would, I presume, stand for our form in any case. Externally my specimens of both sexes closely agree with the description of *hampsoni*. The clearness of the dark markings in the male is very variable.

A great rarity, and I have never personally caught a specimen. A native collector has sent me specimens from Kandy, Deniyaya, and Kottawa, and I saw Mr. Mackwood catch one at the latter place in February.

" Found at Kandy February to August, and Ratnapura January to April and October " (F. M. Mackwood).

198. Caprona ransonnettii, E.; *Abaratha ransonnettii*, M.—Also found in India.

This is a variable insect. The hyaline spots on the fore wing vary much in size and shape, the two in interspace 1, and the one at the upper margin of the cell being often nearly obsolete. In all my males there are three pre-apical spots, but the females sometimes have four or five. Some specimens have a faint marginal row of pale spots, with a sub-marginal row of more conspicuous ones in interspaces 4, 5, 6, and 7, thus disagreeing with Elwes and Edwards' classification of the species. The markings on the under side are very variable.

It is fairly common at Haldummulla during the south-west monsoon (dry season), but becomes much more abundant at a lower elevation, and I have taken it all over the low-country

of Uva and at Trincomalee and Vavuniya. The males are most frequently found settled on the wet sand in river beds or on wet roads ; the females visit flowers, and seldom fly far if disturbed.

The clasps are figured on Pl. 3, figs. 9 and 10.

" Common in the low-country up to Jaffna " (F. M. Mackwood).

199. Caprona siamica.—Not mentioned in any list that I know of Ceylon Butterflies.

Elwes and Edwards, in their analytical table of the genus *Caprona*, divide the species by two important characters : 1st, the possession of " a terminal row of pale spots on the fore wing above " ; and 2nd, the presence of " a hyaline spot in the cell of the fore wing above, near the middle." Neither of these help to place this species. The row of pale spots is sometimes very prominent, but in other specimens it is equally obscure. The spot in the middle of the cell is usually present, but I have specimens without it. The other hyaline spots seem fairly constant, but the large one at the end of the cell is sometimes divided into two very small ones. The pre-apical spots usually number 5, but they are sometimes reduced to 3. As a rule, the under side of the hind wing is pure white, but it is occasionally tinged with ochreous. The ring of small black spots round the disc number 10 in all my specimens. In general appearance it somewhat resembles Elwes and Edwards' figure of *saraya*. Evans thinks *saraya* is a dry season form of *ransonnettii*. If he is right, it seems probable that *siamica* bears the same relationship, as the clasps differ from those of *ransonnettii* in almost exactly the same way as those of *saraya*. See Pl. 3, figs. 11 and 12.

I found it fairly common many years ago in chenas at 1,000 to 2,500 feet elevation below Haldummulla, but I have not been able to work this country lately. It is not rare at Wellawaya, and a native collector caught fourteen specimens there at the beginning of November, 1917 (commencement of rainy season). It does not seem to settle on wet sand, like *C. ransonnettii*. I have not yet caught a female.

" A scarce fly. Caught in Kandy and Haragam January, July, August, October, and November " (F. M. Mackwood).

200. Gomalia albofasciata.—Also found in India.

A very scarce and local insect in Ceylon. It is said to be found in the jungle between Weerawella and Kirinde, in the Hambantota District. I have frequently searched for it there without success, but only in February, March, and April.

My only specimen was given to me by the late Mr. John Pole. It has no label of locality or date.

"Hambantota District in July. Found also near Batticaloa" (F. M. Mackwood).

201. Hesperia galba.—Also found in India, Burma, &c.

This is one of the commonest skippers in Ceylon. I have taken it all over the low-country, from Galle to Jaffna, but have no records of its capture above 4,500 feet elevation. It is especially common at Haldummulla, and can be taken all the year round. Specimens from Jaffna and Mannar are usually very small.

It varies little, except in the size of the white discal band on the upper side of the hind wing. It flies low and settles on the ground or short grass, and never goes far if disturbed, so is very easy to capture.

"I have caught it at Haputale and Pattipola" (F. M. Mackwood).

202. Baracus vittatus.—Peculiar to Ceylon.

The male varies in the size of the white patch on the fore wing, and the spots in interspaces 6 and 7 may be absent. In the female these spots are also sometimes absent, and those in interspaces 2 and 3 may be very small; the amount of white scaling on the lower wing also varies considerably.

It is exceedingly plentiful on patanas at high elevations, especially on the Horton Plains. It may occasionally be taken on grass by the roadsides as low as 3,000 feet at Haldummulla, and I found it common at Galaha, near Kandy. Those taken below 4,500 feet are usually smaller than those from the highest elevations.

For prehensores see Pl. 4, figs. 3 and 4. They bear a very close resemblance to those of *B. subditus* from Coorg.

"On the Ambegamuwa patanas" (F. M. Mackwood).

203. Suastus gremius.—Found also in India, Burma, China, &c

Moore also gives *subgrisea*, and says it differs in having the three discal spots smaller, the sub-apical spots very indistinct, and the under side less gray. It is a most variable insect, but all my varieties grade perfectly with one exception. This specimen was taken on this estate. It is smaller than usual, and the ground colour above and below is much darker. The only markings above are two minute spots, one each in interspaces 2 and 3 of the fore wing. Below, in addition to these spots, there are very minute black dots in interspaces 6, 7, and 8 of the fore wing, and a small black spot in the cell of the hind wing ; the discal series of black spots is wanting. This may be the insect named *subgrisea* by Moore, though he describes it as having the black discal spots below. I have only seen the one specimen. The ground colour of the under side of *gremius* seems to vary climatically, those from the hills being usually much darker than those from the low-country.

The larva feeds on palms, and the butterfly is found wherever coconuts are grown, and in some places where they are not. It is very abundant at Galle and Kurunegala, common at Pallai, near Jaffna, and not rare at Haputale and Haldummulla. I have no records of its capture above 5,000 feet.

204. Suastus minuta, E. ; *Tagiades minuta*, M.—Peculiar to Ceylon.

The prehensores are somewhat like those of *S. gremius*, the tegumen being almost identical. See Pl. 4, figs. 5, 6, and 7. They are very distinct from those of any *Tagiades* that I have examined.

It is very rare in Uva, and I have never found it common anywhere ; the native collectors, however, seem to be able to get any quantity at Kandy, and they have also sent me specimens from Ratnapura and Kottawa. The few living specimens I have seen only flew a short distance, and were very easy to catch.

"Not uncommon in the Kandy District in February and in August, September" (F. M. Mackwood).

205. Iambrix salsala, E. ; *Astictopterus stellifer*, M.—Found also in India, Burma, Malaya, Hong Kong, &c.

The male is fairly constant, but the female varies very much in the number and size of the translucent discal spots on the

fore wing. These vary in number in my specimens from 4 to 8.

It is very common in jungles or on grass by the roadsides at Haldummulla, especially during the dry season. It is plentiful in jungles near Galle, and I have also taken it at Hambantota, Anuradhapura, Trincomalee, Kandy, &c., but have no notes of its capture above 3,000 feet, or north of Vavuniya.

"Numerous in guinea grass fields, Colombo, and similar localities in July and August" (F. M. Mackwood).

206. Taractrocera mævius. — Found also in India, Burma, Borneo, &c.

Evans says: "The Ceylon form of *mævius* has not the veins on the hind wing below conspicuously pale as in continental specimens." I have not been able to compare them with Indian specimens, but my series vary considerably in this respect, and also in the size of the spots on the upper side, which are sometimes white and sometimes yellow in both sexes.

It is very abundant at Haldummulla all the year round, and I have found it plentiful on the ramparts at Galle in May. It is so small, and looks so like a fly, that it can be easily overlooked, but I fancy it is common on short grass in most districts. I have not, however, noted it yet north of Vavuniya.

207. Ampittia maro. — Also found in India, Burma, Malaya, China, Dutch Indies, &c.

The amount of the yellow markings is variable in both sexes, but specially so in the male.

It may be seen in plenty at times in growing paddy, but I have also taken a few on the grass by the roadsides at Haldummulla during the south-west monsoon (dry season), when the paddy fields are not being cultivated. Other localities I have noted are Kandy, Galle, and Anuradhapura, and a single specimen from Giant's tank, near Mannar. It flies low and settles often, so is very easy to catch.

208. Hyarotis adrastus.—Also found in India, Burma, Dutch Indies, Hong Kong, &c.

The spots on the fore wing vary much in size, and those in interspaces 1 and 3 are sometimes absent. The clasp is figured on Pl. 3, fig. 8.

It is usually very rare at Haldummulla, but in July, 1900, it appeared in fair numbers in the jungle bordering this estate. They flew fast, settled rather high, and were very difficult to catch. They could, however, be found day after day in the same spot, so gave me plenty of chances. Except for a single specimen at Kottawa, I have never come across it anywhere else, so imagine it must be very local. I get plenty of specimens from the native collectors at Kandy.

" Numerous in Lady Horton's jungle at Kandy from June to December " (F. M. Mackwood).

209. Matapa aria.— Found also in India, Burma, Dutch Indies, Hong Kong, &c.

This can be at once distinguished, when settled, from any other Ceylon skipper of the same size, by its bright red eyes, which, however, fade soon after death.

The only place I have taken it is at Hirimbura, 3 miles from Galle, in February, March, April, July, and October. As a rule, it only flies a short distance if disturbed, and is very easy to catch.

The prehensores are figured on Pl. 4, figs. 9 and 10.

" Found at Colombo and Kandy. Comes freely to flowers of white *Lantana* " (F. M. Mackwood).

210. Gangara thyrsis.—Also found in India, Burma, Dutch Indies, Philippines, &c.

Judging from my personal experience, I should consider this a great rarity in Ceylon. I have only once seen it on the wing, viz., at Kegalla. It was settled on a path in jungle with its wings closed over its back; on being approached it flew away very fast, and I did not see it again. For some years past I have asked the native collectors in Kandy to get me specimens, but without result till August, 1918, when they brought me half a dozen males. I have not yet succeeded in getting a female. Bainbrigge-Fletcher describes it as a minor pest of palms in India (" Some South Indian Insects "). The clasp is figured on Pl. 4, fig. 12.

" Found in damp jungles in several low-country districts. Females in condition quite scarce " (F. M. Mackwood).

211. Paduka lebadea, E.; *Matapa subfasciata*, M.— Found also in India, Malaya, Dutch Indies, &c.

The figure in Moore's "Lepidoptera of Ceylon" is evidently drawn from a very dwarfed specimen, as, with the exception of *G. thyrsis*, it is the largest Hesperid in the Island. I have never seen a specimen alive, and the Kandy collectors were for many years quite unable to supply me with one. In August, 1918, however, it was common near Kandy, and a collector brought me a fair number, of which six were females.

The clasp is figured on Pl. 4, fig. 11.

"Found also in Colombo, Ratnapura, and Pattipola" (F. M. Mackwood).

212. NOTOCRYPTA ALYSOS ; *Plesioneura alysos*, M.
212*a*. NOTOCRYPTA RESTRICTA ; *Plesioneura restricta*, M.

Grouped as *Notocrypta feisthamelii* by Elwes and Edwards, but Swinhoe ("Lepidoptera Indica") gives *feisthamelii* and *restricta* from Ceylon.

N. feisthamelii, or races thereof, is found in India, Malaya, China, Japan, Philippines, &c.

I agree with Moore that there are two distinct forms in Ceylon, but they may prove to be merely seasonal varieties of our local race : *1st, alysos*.—Upper side fore wing : The white band is of nearly even width throughout, and its outer edge has a fairly regular curve. Beyond this band there is, as a rule, one spot in interspace 4, but this is sometimes absent. I have seen a few specimens in which there was also a very minute spot in interspace 5. Under side : The white band is *always* continued to the costa by an opaque whitish patch. *2nd, restricta*.—Upper side fore wing : The white band broad in interspace 2, and narrower in the cell and interspace 1. White spots outside the band in 3, 4, 6, 7, and 8, and occasionally in 5. The spot in 6 is sometimes absent. *That in interspace 3 is always the largest ; this spot is never present in alysos*. The white band is *never* continued to the costa below.

I have examined a great number of specimens, but so far I have seen only one exception to the rule in Ceylon, that, if the band below is continued to the costa, there are never more than two spots beyond the band, and very rarely more than one ; whereas, if it is not so continued, there are always 4 to 6. The sole exception is in the Colombo Museum collection. In addition to the small spots in 4 and 5, it has two very minute

pre-apical dots in 7 and 8. I have only noticed small differences in the prehensores, the most marked being the size of the clasps. I have selected males of both for dissection approximately equal in size, and the clasp of *restricta* has invariably proved to be larger, and comparatively broader, than that of *alysos*. Elwes and Edwards describe *feisthamelii* as having a " broad white band on the fore wing, and five white spots besides," and quote Leech as saying that the band is continued to the costa below by a pale patch. If *both* these points are essential, typical *feisthamelii* does not, I believe, exist in Ceylon.

Both are plentiful at times at Haldummulla, though *alysos* is by far the commoner form. I have specimens of *alysos* from Kandy, Ratnapura, and Galle, and of *restricta* from Haputale and Kandy. I have bred *restricta* on *Kæmpferia rotunda*.

They are usually found in jungle, and fly rather fast up and down the paths, settling frequently. They are not at all shy, and, if frightened away, will nearly always return in a few minutes.

" Taken at Lindula, and common at Kandy and Ratnapura " (F. M. Mackwood).

213. Udaspes folus.—Found in India, Burma, Dutch Indies, &c.

A rarity in Ceylon, though Bainbrigge-Fletcher says it is " occasionally a serious pest of ginger and turmeric " in India (" Some South Indian Insects ").

I have seen it three times in my garden, and believe it had bred on *Kæmpferia rotunda*, as I caught a freshly hatched one close to the plant, and found a fresh empty pupa case on a leaf. I have also taken it at Kirinde, in the Hambantota District, and have seen specimens from Badulla, Madulsima, and Wellawaya.

" Caught at Batticaloa " (F. M. Mackwood).

214. Telicota bambusæ.—Found also in India, Malaya, Australia, China, &c.

It is very common at Haldummulla, and I have taken it in every month, but January. It is not rare at Haputale (5,000 feet), and I have specimens from Colombo, Kandy, Galle, &c.

Usually seen settled on grass by the roadside, but it visits flowers, especially *Duranta*, and is very easy to catch.

" Common at Colombo " (F. M. Mackwood).

215. Telicota augias.—Also found in India, Burma, Malaya, Hong Kong, &c.

This has not been previously recorded from Ceylon, having been mistaken for *T. bambusæ*.

Elwes and Edwards say that it differs from *bambusæ* in having the " lower outer angle of the yellow spots in cells 2 to 4 narrowly produced along the contiguous vein nearly or quite to the termen ; terminal dark band brown." Whereas in *bambusæ* the " lower angle of the yellow spots in cells 2 to 4 is not, or but little, produced ; terminal margin black-brown."

The male can also be at once distinguished from male *bambusæ* by having narrow yellow streaks along all the veins at the apex of the fore wing. As pointed out by Elwes and Edwards, there is a marked difference in their clasps. See Pl. 5, figs. 1 and 2.

The female is a much duller insect than female *bambusæ*, the ground colour being dark brown, not black-brown, and the orange markings being narrower. The spots in interspaces 1 to 3 have their lower edges produced along the contiguous veins, but to a much less extent than in the males. The veins at the apex of the fore wing are not edged with yellow. The under side of the hind wing has a marked greenish tinge.

There seems to be a tendency to grade.

It is very common at times at Haldummulla. The larva is said to feed on sugar cane, which is extensively cultivated in native gardens here. I have specimens from Wellawaya and Galle.

216. Padraona gola, E. ; *Padraona goloides*, M.—Found also in India, Malaya, China, Dutch Indies, &c.

Moore says *goloides* is " nearest allied to *P. gola*. Differs from it on both sides in the narrower discal band of the fore wing, the band being also disconnected from the costal spots. The band of the hind wing is also narrower." My series show considerable variation in the width of the band in both sexes, and it is connected to the pre-apical spots in a few of my

males. The prehensores are similar to those of *P. gola*, as figured by Elwes and Edwards.

It is almost always found settled on grass by the roadsides, or at flowers, and is especially attracted by *Duranta*. If disturbed, it darts off very rapidly, but usually settles again near, and is easy to catch. It is very common at Haldummulla all the year round, except in August and September. I have also taken it at Haputale, Galle, Kandy, and Vavuniya.

" A common insect up to 5,000 feet " (F. M. Mackwood).

217. PADRAONA PSEUDOMÆSA, M.; *Padraona mæsioides*, E.

218. PADRAONA MÆSIOIDES, M.; *Padraona tropica satra*, E.

218*a*. PADRAONA DARA ?

Elwes and Edwards group these as one species, *Telicota dara*. In my preliminary remarks on the *Hesperiidæ* I have already given my reasons for disagreeing with their opinion. I am convinced that there are two very distinct forms in Ceylon, and suspect that there is a third. I do not care to express an opinion as to which of the local forms, here or in India, are entitled to specific rank, and which are merely races, or even varieties. A great deal of investigation is still required before this can be settled. In the meantime I use Moore's names for the two common Ceylon forms.

1st, Pseudomæsa.—This is a large form. The yellow band on the fore wing is broken, the spots in 4 and 5 being never joined to the apical group, but usually to the discal in the male. On the lower wing the band is divided along the veins by brown lines. There is, as a rule, a small well-defined spot in 6, and sometimes a larger faint and diffuse one in 7. It varies much in size. In the female the yellow markings are much reduced, and the band on the fore wing is more broken, the spots in 4 and 5 being almost invariably well separated from both the apical and discal series. On the lower wing there is usually a very minute spot in 6. For prehensores see Pl. 5, figs. 3 and 4. The clasp is very like Elwes and Edwards' figure of that of *dara*, but the tegumen is quite distinct.

This is extremely plentiful at Haldummulla, but I have no specimens from any other locality. My notes give many

localities for *dara*, but I cannot say for certain to which one of the group they refer. It usually settles on grass by the roadsides, but visits flowers in bright sunshine.

2nd, Mæsioides.—This is a small form. I think it is either the one described by Evans as *Tropica satra*, or a closely allied race. He describes the clasp as ending in a bluntly triangular point, but all I have examined show a distinct spine at the apex of the triangle. See Pl. 5, figs. 5 and 6.

The yellow band is almost always continuous, the spots in 4 and 5 being joined to both the discal and apical series; it, however, varies greatly in width. The band on the hind wing is not divided by brown lines along the veins. There is almost invariably a large spot in 7, but very rarely one in 6. In the female the yellow markings are much reduced, and the spots in 4 and 5 are not always joined to the apical series. I have one aberration of the female, in which the spots in 4 and 5 are quite obsolete, and the discal band almost so. I took it at Anuradhapura in company with normal specimens.

It is not so plentiful as *pseudomæsa* at Haldummulla, but is very abundant in the Galle District. I have also taken it at Vavuniya and Mannar.

3rd, Dara ?—This is intermediate in size between the two last. The male closely resembles *pseudomæsa* female; in fact, I had placed it as such in my collection till I noticed the sex mark. This, in all Ceylon forms, is a deep black streak of specialized scales above the middle of vein 1 of the fore wing. Elwes and Edwards have overlooked this. The yellow band is very narrow, and the spots in 4 and 5 are well separated from both the discal and apical series. There is a spot in 7, but none in 6. The band on the hind wing is not divided by brown lines. The female has the yellow markings greatly reduced, and the band on the hind wing is broken up by brown lines along the veins. The under side of the hind wing in both sexes has a very distinctive greenish tinge, which is, I believe, typical of *dara*. The prehensores differ slightly from those of *pseudomæsa*, but the differences appear to be constant; however, I have so far only been able to dissect four males. See Pl. 5, figs. 7 and 8. It may prove to be only a seasonal form of *pseudomæsa*.

The only place I have seen it is on the cart road near Haldummulla in March and May.

In working out this group, I am greatly indebted to some notes on Indian Butterflies published by Colonel Evans in the Journal of the Bombay Natural History Society (Vol. XXIII., p. 307). I am also indebted to Mr. F. Hannyngton, I.C.S., for some specimens of two forms from Coorg. One of these is very like *pseudomæsa* externally, but the prehensores are quite distinct; the other is very unlike any Ceylon form both externally and internally.

219. HALPE CEYLONICA.
220. HALPE EGENA, E.; *Halpe brunnea*, M.

Halpe egena is restricted to Ceylon. *H. ceylonica* is also found in Southern India.

According to Moore, who described *brunnea* (= *egena*) from a single female specimen, the chief distinction between it and *ceylonica* lies in the ground colour, which is "dark vinous brown" in *brunnea*, and "dark brown, base of wings and body olive-brown," in *ceylonica*.

Elwes and Edwards distinguish them by the discal band on the under side of the hind wing, which is brownish-yellow, and very indistinct, in *egena*, and yellowish-white, and clearly defined, in *ceylonica*. The colour of the discal band is usually as they state, but it varies greatly in definition, and I have specimens of *ceylonica* in which it is so diffuse as to be almost indistinguishable. My experience is that the ground colour is the only reliable test. In the specimen of *egena* described by Moore the discal band was evidently exceptionally indistinct. As a rule, the spots on the fore wing are larger in *ceylonica*, but they vary much in size in both. In *ceylonica* ♂ the pre-apical spots vary from 1 to 3 in number, but the discal spots vary only in size. I have a specimen of *egena* ♂ with the wing entirely unspotted. The spot in the cell is rarely present in *egena* ♂, and rarely absent in *ceylonica* ♂. I can perceive no difference whatever in the prehensores. See Pl. 5, figs. 9 and 10. The females are much rarer than the males, and the material at my disposal is rather limited. Apart from the ground colour, the chief difference between them seems to be the spots in interspace 1 of the fore wing. I have

so far examined 15 *ceylonica* ♀ and 6 *egena* ♀. The usual marking in *ceylonica* is apparently one spot visible above and 2 below, but one or more of these are sometimes absent, and I have two specimens in which this interspace is quite unspotted. In 5 *egena* ♀♀ the interspace is unmarked, but in one specimen there is a white spot visible above and below. Personally I can find no reliable tests for separating the two forms, except by the ground colour when freshly caught, and I strongly suspect them to be only seasonal varieties of the same insect.

H. ceylonica.—I have never taken this myself, but the native collectors seem to be able to get the males in any quantity at Kandy; females are apparently scarce. It is also common at Ratnapura, and Mr. Hannyngton has sent me a specimen from Coorg, which seems to be identical. It is very distinct, both externally and internally, from *H. moorei*.

"Numerous at Kandy in the latter part of the year, and found at Pundaluoya" (F. M. Mackwood).

H. egena.—This was originally described by Felder from "Kalupahana, Ceylon," and I think there can be little doubt that this estate was meant. The gentleman who was Superintendent then (Mr. R. E. Pineo) told me that naturalists used frequently to stop with him on their way to collect in the Bintenna country. I have taken it on the estate.

It is a very local fly, and was formerly always plentiful on a *Duranta* hedge at the bungalow on Blackwood estate, 2 miles from here. This hedge has now been cut out, but a few specimens may still be taken in the garden there, in July–August and November–December. I have also taken it on the Haldummulla-Horton Plains bridle road, and received specimens from Ratnapura.

221. Halpe Decorata.—Peculiar to Ceylon, and confined to the wettest zone.

I have never caught this myself, but have received a lot of males from Ratnapura. The female was discovered by the

late Mr. C. C. Gilbert. It is extremely rare. Messrs. F. M. Mackwood and T. G. Elliott have given me specimens, and my collector caught one at Deniyaya. On the upper side the fore wing differs from that of the male in having an orange spot above vein 1, and the orange patch in the cell is much reduced in size. On the lower wing the large median yellow patch is much reduced, or even sometimes entirely obsolete. All markings are much darker in colour. The ground colour of the under side is entirely different, being brownish-red instead of gamboge yellow ; the spots on the fore wing agree with those on the upper side, except that that on vein 1 is more diffuse. On the lower wing the small black spots are usually very indistinct or absent, but when present they correspond in position with those of the male. I figure the prehensores on Pl. 5, figs. 11 and 12.

" Very abundant in Ratnapura, and parts of Ambegamuwa. Caught also at Labugama and Kottawa. Females very scarce " (F. M. Mackwood).

222. Baoris pencillata, M. ; *Baoris oceia*, E.—Evans says (Bombay Natural History Society Journal, Vol. XXIII., p. 309) : " Dr. Chapman has dissected fourteen specimens, and finds that there are four species under the name *oceia*, viz., *oceia*, confined to the Philippines ; *leechii*, El., confined to China ; *farri*, M., the common Indian species ; *unicolor*, M., from Sikkim and Assam, a species with no markings on the fore wing."

Elwes and Edwards figure the prehensores of *oceia*, *leechii*, and *simillima*, but none of them resemble those of our Ceylon race. See Pl. 6, figs. 1 to 4. Till the question is settled as to whether this is *pencillata* or *farri*, I think Moore's name may stand.

The few males in my collection vary in the number of spots on the fore wing ; in one there are spots in 2, 3, 4, 6, 7, and 8, the latter being very minute ; in another there are spots in 2 and 3 only. The cell of the fore wing and the whole hind wing are unspotted in all.

I do not know the female, though possibly I have a specimen, and have described it further on as an unknown form of *Parnara* (see No. 225c later). Mr. Mackwood has given me one

from the Andamans ; it differs from all large Ceylon *Parnaras* (except *conjuncta*), in having two large spots in the cell. I have seen nothing like it in Ceylon.

I consider *pencillata* a great rarity. Till last year my only specimen was one given to me by the late Mr. Butt, of Avissawella, in 1889. I have now received one each from Galle and Deniyaya, and Mr. Mackwood has given me two from Ratnapura.

It is apparently confined to the wettest zone.

"Found at Avissawella, Pundaluoya, and Lindula" (F. M. Mackwood).

223. CHAPRA MATHIAS ; *Chapra agna*, M.

223*a*. CHAPRA SUBOCHRACEA ; *Chapra mathias*, M.

C. mathias, or races thereof, is found from Turkey to Japan, and in Australia.

Moore gives *mathias* and *agna* from Ceylon, and says *agna* is larger than *mathias*, and has smaller spots. Personally I find that the form with the small spots is usually the smaller insect. Elwes and Edwards agree with Moore in dividing it into two species, naming the one with the small spots *mathias*, and the one with the large *subochracea*. There are certainly two distinct forms in Ceylon which are extremely common ; they fly together, and the males, at any rate, do not seem to grade.

The male of the large form, with large spots, is much lighter in colour both above and below ; the fore wings are broader in proportion to their length, and the hind wings more rounded. The females show this difference in the shape of the wings to a greater degree than the males. There is little variation in either form in the number of spots on the fore wing ; the males of *subochracea* usually have a spot in interspace 8, which is seldom present in *mathias ;* all the females of both forms in my collection show this spot. A spot in 5 is present, more often than not, in both females, but it is only traceable in two of my specimens of male *subochracea*.

The differences in the prehensores are exceedingly minute and hard to see, though they are apparently constant ; the chief one lies, as pointed out by Elwes and Edwards, in the apex of the tegumen. Personally I attach much more

importance to external differences, and the fact that I have seen no signs of grading in the males. They may be only seasonal varieties, as the dry and wet season forms of most species fly together in Ceylon. Both fly all the year round at Haldummulla. A small form of *subochracea* is found in the Northern Province (and very rarely, during the drought, at Haldummulla). In this the under side of the hind wing is suffused with pale gray.

Both are potential pests of paddy.

PARNARA.—The true *Parnaras*, or those without a sex mark, are only represented by a few species in Ceylon, but they seem to have been little studied, and I find some difficulty in naming them. Moore gives five species: *kumara*, *seriata*, *narooa*, *cingala*, and *bada*. Evans gives *phillippina*, *kumara*, *austeni*, *conjuncta*, *colaca*, and *bada*. These separate easily into two groups, the large and the small, the latter consisting of *cingala* and *bada*. The large can be again subdivided by the colour of the under side of the hind wing, viz., reddish-brown or greenish-brown.

There is no Indian collection in the Colombo Museum, and little literature on the subject, so the most I can do is to roughly describe our forms, leaving it to Indian collectors to compare the descriptions and figures of the prehensores with Indian specimens and settle their true status.

I hope to send slides of the prehensores to the Entomological Section of the Agricultural Research Institute at Pusa for their assistance.

Group A.—Under Side of Hind Wing Reddish-Brown.

224. PARNARA KUMARA ♂, M.—Expanse 40–45 mm. No spot in cell of fore wing; hind wing unmarked. Spots on the fore wing in 2, 3, 4, 6, and 7, some or all of the three latter being sometimes obsolete. Under side: Costa and apex of fore wing and the whole hind wing dark orange-brown, deepening in worn specimens into vinous brown. As a rule,

there are no spots in interspace 1 of the fore wing below, but very rarely a small very diffuse one is present. I have three specimens in which there is a minute spot showing above on vein 1, but in colour, shape of the wings, and prehensores they are identical with this species.

I have dissected many specimens with both bright and dull coloured under sides and find the prehensores to be identical. See Pl. 6, figs. 5 to 8. The clasp answers exactly to Elwes and Edwards' illustration of that of *austeni*, the tegumen, however, is quite distinct from that of either *austeni* or *kumara*, though nearer to that of the former.

It occasionally appears in great numbers on the Haldummulla-Horton Plains bridle road, and a few can be taken as low as 3,000 feet here. It is abundant on the hills above Ratnapura. It usually settles low along the roadsides, and does not fly far if disturbed.

224*a*. PARNARA KUMARA ♀, M.; *Parnara phillippina*.—Differs from No. 224 as follows :—Expanse 42–48 mm. Spots on fore wing in 1, 2, 3, 4, 6, 7, and 8. The spot in 8 is sometimes missing, and there is occasionally a second minute spot in 1 just below vein 2. The wings are broader in proportion to their length, the termen and dorsum of the fore wing being almost equal. The colour of the under side and cilia are identical with No. 224. There is always a diffuse spot in interspace 1 below, and often a second very minute one touching vein 2.

Elwes and Edwards' table of the species of *Parnara* gives the presence of a spot in 1 as the difference between *phillippina* and *kumara*. This form differs from the preceding mainly in that respect, and therefore it is usually labelled *phillippina* in Ceylon collections.

Moore believed it to be the female of No. 224, and I am very strongly of opinion that he was right. Both forms are very plentiful at times, and invariably appear together. I have never seen any specimens of No. 224 which were not males, nor of No. 224*a* which were not females. The sole objection, I understand, to Moore's opinion is that the female of *kumara* has no spot in interspace 1. I do not, however, believe that No. 224 is rightly named *kumara*.

224*b*. Parnara austeni.—This is given by Elwes and Edwards from Ceylon on the authority of Mr. E. E. Green. I have never seen a specimen.

As far as I can follow Elwes and Edwards' work, the description is as follows.—Expanse 37–41 mm. *One* or *two* spots in the cell of the fore wing in the male, none in that of the female. Hind wing unmarked. No white spot in interspace 1 of the fore wing of the male; a white point near vein 2 of the female. Under side: apex of fore wing and whole of hind wing reddish-yellow-brown.

224*c*. Parnara kumara ♀.—A single battered female specimen. Very similar to No. 224, but the spots in 2 and 3 are larger, and there is a spot in 8. On the under side of the fore wing there is a small spot on vein 1 so diffuse as to be almost obsolete. Under side dark vinous brown.

To sum up Group A. I believe Nos. 224, 224*a*, and 224*b* only represent one species, and that that will prove to be a local race of *austeni*. The males differ from that species in being larger, and in having no spots in the cell of the fore wing. The females apparently differ only in size. No. 224*c* may be a variety of No. 224*a*. I have only seen the one poor specimen. The markings of the fore wing answers to the description of *kumara* ♀, in having no spot below vein 2 above; true *kumara* may, therefore, exist in Ceylon, though I have not yet identified the male.

Mr. Hannyngton has sent me two pairs of a very closely allied race from Coorg. They differ from Nos. 224 and 224*a* in being smaller, and the female has a white spot in interspace 2 of the hind wing only visible on the under side. The clasp is identical with that of our Ceylon race, but the tegumen differs slightly.

Group B.—Under Side of Hind Wing Greenish-Brown.

225. Parnara seriata, M.; *Parnara phillippina*.—Moore describes it well, as "smaller than *kumara*, the spots smaller and less angular. Under side greenish-brown, not deep ochreous brown."

Expanse 36–42 mm. Spots on fore wing above in 1, 2, 3, 4, 6, and 7. In two of my specimens there is also a minute dot in 1, just below vein 2. In a few others the spot on vein 1 is almost obsolete. No spot in cell. Under side: Spots on fore wing as above, except that there are always *two* diffuse spots in 1. I have seen two specimens which showed a rudimentary spot in the cell which did not show above. Costa, apex of fore wing, and whole of hind wing brown, irrorated with yellow scales, giving a marked greenish tinge. The fore wing is much narrower than that of No. 224.

This is also classed as *phillippina*, though very unlike No. 224*a* in colour and shape of the wings. Elwes and Edwards say: "We think the identification must remain somewhat uncertain." The clasp bears a resemblance to that of *phillippina*, but the tegumen is very different. See Pl. 6, figs. 9 to 12. In the very large number of specimens that I have examined I have found no variations in these. I have no specimens of *phillippina* with which to compare it, but it does not resemble the figures of that species in Elwes and Edwards' work. It varies little, except in the size of the spots.

It is found from sea level to 3,000 feet elevation. I have taken it at Haldummulla and Galle, and received specimens from Kottawa and Ratnapura. The native collectors can get abundance of males in the Kandy District, but seem quite unable to catch the females there.

225*a*. Parnara seriata ♀, M.—Expanse 42–45 mm. Spots on fore wing in 1, 2, 3, 4, 6, 7, and 8. There is also a second very small spot in 1, just below vein 2. The spot in 8 is sometimes missing. No spots in cell visible above. Under side: Two large diffuse spots in 1. Many specimens also show rudimentary spots in the cell, of which the lower is the larger. In ground colour and shape and colour of the spots it is identical with No. 225, and I am quite confident that it is the female *seriata*.

I have taken it at Galle in the same localities and at the same seasons as *seriata* ♂, and I have specimens from Ratnapura and Balangoda. It is far rarer than the male, and I have only a poor series.

225*b*. Parnara seriata ♀ var. ?—This differs from all others in Ceylon, in having a single white spot on the under side of the hind wing, in the basal half of interspace 2, clearly defined below, and sometimes visible above. The only *Parnara* mentioned by Elwes and Edwards with this spot is *P. bromus*, of which they say: "I have great doubt as to whether *P. bromus* can be separated from *P. phillippina* . . . . The fact remains that in *phillippina* the cell spots of the fore wing are wanting, or at most feebly developed, and the hind wing below is unspotted, and in *bromus* there are two well-developed cell spots visible on the upper side of the fore wing, and the hind wing below bears a small pale spot near the middle of cell 2. We have not seen any intermediate specimens."

This also differs from No. 225*a*, in having the spot below vein 2 on the fore wing sometimes enlarged into a streak, almost joining the spots in 1 and 2. All my specimens show two rudimentary spots in the cell below, and in most cases the upper one is visible above as a minute white dot.

All the specimens I have seen were females. I have five from Galle and one from below Haldummulla. Mr. T. G. Elliott has shown me three from Ratnapura. In April, 1918, I took one specimen at Galle intermediate between Nos. 225*a* and 225*b*. It has a white spot in interspace 2 of the hind wing on one wing only.

225*c*. Baoris pencillata ♀ ?—Expanse 43 mm. Spots on fore wing in 1, 2, 3, 4, 6, 7, and 8. No spot in cell. Hind wing unmarked. It differs from Nos. 225*a* and 225*b* as follows:—The yellow hairs above and scales below are darker. The fore wing is broader in proportion to its length, and is more evenly convex on the termen. The spot on vein 1 is much smaller, and those in 2 and 3 are distinctly excavated on the outer margin, which I have never seen in any specimen of *seriata*. On the under side of the fore wing there is only *one* small diffuse spot in interspace 1. It is almost identical with No. 224*a* in markings and shape of the wings, but differs in the ground colour, especially of the under side of the hind wing.

I have only a single specimen, and Mr. Elliott has shown me another, both females from Ratnapura.

To sum up Group B. I believe Nos. 225, 225*a*, and 225*b* represent one species, viz., Moore's. *P. seriata*. As to whether this is a good sub-species, a local race, or merely a variety of *phillippina*, I can express no opinion, as I have no specimens of typical *phillippina* with which to compare it. I rather expect further investigation will prove it to be a local race of that species. Till this is settled I think Moore's name may stand.

No. 225*c* is, I think, quite distinct. The material available at present is too limited to decide anything, but I expect it will prove to be the unknown female of *B. pencillata*.

226. Parnara narooa, M.; *Parnara conjuncta*, E.—*P. conjuncta* is also found in India, Burma, Malaya, Hong Kong, &c.

Elwes and Edwards say: "Though we have no specimens from India or Ceylon, yet we think the plate in 'Lep. Ceylon' sufficiently identifies the species, which has been hitherto known as *narooa*, Moore." Personally I regard such an identification as eminently unsatisfactory, as the plate is a very poor representation of the insect.

It is by far the largest of the genus in Ceylon, the females attaining up to 55 mm. in expanse, and it can be at once distinguished from all our other large *Parnaras* by the two large spots in the cell and the row of spots on the under side of the hind wing. From *subochracea* ♀ it can only be distinguished by its greater size and darker ground colour. The tegumen seems to be very near that of *conjuncta*, but the clasp differs. It may possibly prove to be a local race of *conjuncta*.

The spots vary much in size. In some specimens there is a minute spot below vein 2 and another in interspace 5; in one of my specimens this latter spot is crescent-shaped. Either two or three spots are visible on the hind wing above; below there are usually four discal and one in the cell. In fresh specimens the spots on the fore wing have a pronounced yellow tinge, but this soon fades.

It is not rare at Haldummulla, but is difficult to catch in first class condition. I have also taken it at Haputale, Madampe, and Galle, and have specimens from Ratnapura.

"Taken at Kandy and Ratnapura in July" (F. M. Mackwood).

227. PARNARA BADA.—Found also in India, Malaya, Burma, China, and Japan. Evans gives *guttatus* as a distinct species from Chitral and Assam.

This is the smallest *Parnara* in Ceylon. It can be distinguished from *cingala*, which is only slightly larger, by the absence of the spot in interspace 1. The spots vary greatly in size, shape, and number. On the fore wing there are normally spots in 2, 3, 4, 6, 7, and 8, but those in 4 and 8 are often absent. I have one specimen with a spot in 5, and two with a linear spot on the lower edge of the cell, near the base of vein 3. On the hind wing there is normally a row of four spots in interspaces 2 to 5, visible both above and below. I have two specimens in which the hind wing is quite unspotted above or below, and several with only one to three spots below. I have also two or three with five discal spots in interspaces 2 to 6, and one in the cell. The spot in 6 is never in line with the others.

For comparison with Indian specimens, I give a figure of the prehensores. Pl. 7, figs. 5 to 7.

It is not very common at Haldummulla, but becomes much more abundant at lower elevations, being widely distributed through the low-country. I have taken it at Wellawaya, Hambantota, Galle, Vavuniya, Jaffna, Mannar, &c., and have specimens from Kandy.

228. PARNARA CINGALA, M.; *Parnara colaca*, E.—*P. colaca* is also found in India.

Moore thought it distinct from *colaca*, but did not state in the "Lepidoptera of Ceylon" how it differed. I give a sketch of the prehensores for comparison with Indian specimens. Pl. 7, figs. 8 to 10.

It varies much less than the last species (*bada*), the main variation being in the number of spots in the cell; these may be two, one, or none; all varieties seem to be equally common in both sexes. The number of the spots on the fore wing outside the cell never seems to vary, being always one each in 1, 2, 3, 4, 6, 7, and 8. On the hind wing below there are always three large spots in 2, 3, and 5, and usually a smaller

one in 4; of these, one or two are, as a rule, visible above. Some varieties are very like *mathias* ♀, but can be distinguished by the absence of the small spots just below vein 2 and in 5 of the fore wing above, and of that in the cell of the hind wing below.

It is the commonest skipper at Haldummulla, and flies all the year round. I have also taken it at Ohiya (6,000 feet), Jaffna, Mannar, Galle, &c. It is chiefly found in the grass by the roadsides, and visits flowers when the sun is shining.

229. Ismene ataphus, E.; *Ismene œdipodea*, M.—Also found in India and Burma.

I. œdipodea differs in having the "costa of the hind wing folded over on to the upper surface of the apex" (Elwes and Edwards). It is found in Java and Sumatra.

Very rare in Uva, but well distributed. I have taken it at Ohiya (6,000 feet), Haldummulla (3,500 feet), and Hambegama tank (400 feet). It is fond of settling in the beds of streams, on wet rocks, or sand.

For prehensores see Pl. 7, figs. 11 and 12.

"Not uncommon round Kandy. Taken at Trincomalee" (F. M. Mackwood.)

230. Hasora badra. — Found also in India, Burma, Malaya, Dutch Indies, China, &c.

I have taken a pair in my garden, but have seen no others in the Province of Uva. I have specimens from Ratnapura, Kottawa, Deniyaya, and Kandy. I understand it is not rare at Balangoda, and has been taken in Nuwara Eliya.

The prehensores are figured on Pl. 8, figs. 5 and 6.

"Not uncommon around Kandy. Caught at Kottawa" (F. M. Mackwood).

231. Hasora alexis; *Hasora chromus*, E.; *Parata chromus*, M.

232. Hasora butleri, E.; *Parata alexis*, M.

P. butleri is found also in Southern India. Races of *chromus* are found in India, Burma, Dutch Indies, &c.

Elwes and Edwards treat these as varieties of *H. chromus*. The external differences are very marked, they fly together and do not grade, and their prehensores are widely different. To judge from the latter, *H. chromus* is not found in Ceylon.

The clasp of *alexis* agrees with that of *inermis*, to which it is apparently closely allied, but the tegumen is entirely distinct. The clasp of *butleri* is the same as that of *chromus*, but, again, the tegumen is very different. See Pl. 8, figs. 1 to 4.

The upper sides of the males are similar, but the under sides are very distinct, the most prominent difference being that *butleri* has a broad, sharply defined, white band on the lower wing, and *alexis* has a narrow diffuse one. The female of *butleri* has, as a rule, two small white spots on the upper side of the fore wing in 2 and 3, of which the lower is much the smaller, but both these spots are often absent. In this case the ♀ can only be distinguished from the ♂ by the absence of the sex mark. The female of *alexis* has two spots in all my specimens, of which the lower is the larger. It has also occasionally a minute dot in 6.

Mr. Hannyngton sent me a *chromus* ♀ from Coorg. It is larger than our Ceylon forms, the spots in 2 and 3 are much larger, and there is a spot in 6 and a small dot in 7. The band on the hind wing is broader than that of *alexis*, but is not sharply defined like that of *butleri*.

They suddenly appear in great numbers, generally during the north-east monsoon, and I am of opinion that they "flight." In October, 1916, I noticed great flights of large Hesperiidæ on several evenings just before dark, all going south. I put on two native collectors and tried myself to catch specimens, but owing to the bad light and the speed of the flight I secured none. They can be walked up in the daytime in the tea or jungle, but then only fly a short distance, and settle on the under side of a leaf with their wings closed over their backs. They visit flowers in the early morning or evening or on a dull day, and I have known them come to my moth lamp at night.

Both are extremely plentiful all over Uva up to the highest elevations, and I have specimens of *butleri* from Kandy and Deniyaya, and of *alexis* from Kandy, Jaffna, and Mannar.

Alexis: "Numerous in low jungles of North Matale."

Butleri: "Colombo, East Matale" (F. M. Mackwood).

233. Bibasis sena.—Also found in India and Siam.

The colour of the cilia on the hind wing and the patch of long hairs on the dorsum, above the tornus, varies from rather pale orange to orange-vermillion in freshly caught specimens. The fore wing of the female is broader than that of the male, and the hind wing is more rounded.

I consider it a rarity. I have taken one or two specimens on this estate, and in December, 1904, I found several inside Wellawaya resthouse settled on the walls. They were very wary and difficult to catch, so I only got three or four; the others did not return to the resthouse that day. With these exceptions, I have never come across it.

The prehensores are figured on Pl. 8, figs. 9 and 10.

"Found at Kandy and Pundaluoya" (F. M. Mackwood).

234. Badamia exclamationis.—Also found in India, Burma, Malaya, China, and Australia.

It appears in great numbers at times, usually in company with *H. alexis* and *butleri*. It has the same habits as these, but seems to be less afraid of the sun, and to visit flowers more on a bright day.

I have notes of its occurrence at Haldummulla, Haputale, Kandy, Galle, Vavuniya, and Mannar, and believe it to be common everywhere at times.

The prehensores are figured on Pl. 8, figs. 11 and 12. That of the clasp is poor, as it does not show the formidable armament of spines on the inner face.

"All over the low-country, and up to 5,000 feet or over" (F. M. Mackwood).

235. Rhopolacampta benjaminii, E.; *Choaspes benjaminii*. M.—Found also in India, Burma, China, Japan, Borneo, &c.

There seems to be a doubt as to whether two species are not included under this name, I therefore figure the prehensores of our Ceylon form. Pl. 8, figs. 7 and 8.

It is fairly common in the hills, and was formerly very plentiful on the cart road below the Haputale jungle, but since the Forest Department has cleaned out the original vegetation and planted Eucalyptus in its place, this and other hill insects have, of course, disappeared. It is still common between

Haputale and Ohiya, and I have specimens from Maskeliya, the hills above Ratnapura, and Kandy. I have taken it as low as 3,500 feet at Haldummulla.

When walking in the jungle near the Mocha Patanas, Maskeliya, with the late Mr. John Pole, he pointed out the larvæ to me feeding on a shrub, called by the Sinhalese there *hik*. I have been unable to identify this. The name *hik* is usually given to *Odina wodier*, a low-country tree.

The males are nearly always found settled on wet roads or in the beds of streams. They are strongly attracted by birds' droppings. The females are difficult to procure.

"Found at Kandy, Ramboda, Dolosbage, and Dikoya" (F. M. Mackwood).

ADDENDA.

27*a*. Elymnias merula.—Colonel Swinhoe gives this as a new species from Ceylon (Ann. Mag. Nat. Hist., No. 93., September, 1915, Vol. XVI., page 171). His description is: "♂ upper side deep black, as dark as *E. hecate*, Butler, from North Borneo; fore wing with the costa spotted with blue, three blue streaks near the apex, and three sub-marginal blue spots in interspaces 2, 3, and 4; hind wing with a slight shade of fulvous on the outer margin; outer margins of both wings as in *hecate*. Under side dark chestnut-brown, densely striated with pale blue, fore wing with white costal points, which become thickly clustered together at the apex; hind wing with a small bluish-white spot below the middle of the costa.

"Expanse of wing, 2 8/10 inches.

"Habitat: Kandy, Ceylon.

"Except for the white spot on the hind wings beneath, it much resembles *hecate*."

I know nothing of the history of this insect. It is difficult to imagine a new species of a large butterfly being discovered at Kandy, which is the headquarters of the native collectors, and the best worked district in Ceylon. From the description it seems possible that it may be a melanism of *E. fraterna*. It is

larger than normal in that species, but the description of the under side tallies very closely.

98. Nacaduba noreia.—Since Part I. was published I have received sixteen ♂♂ of this from Wellawaya, and have now no doubt as to its being quite distinct from *N. ardates*. It seems to vary very little.

In addition to the distinctions previously mentioned, I notice that the cilia at the apex of the fore wing are pure white, and those of the hind wing are lighter than those of *ardates*.

128, 129. Aphnæus ictis and nubilus.—Mr. F. A. Fairlie, who made collecting trips to the Northern Province some years before the railway to the North was built, writes as follows in reference to my remarks in Part I. :—

"Under *A. nubilus* you describe a butterfly I have taken many specimens of at Iranaimadu resthouse, about 50 miles from Jaffna on the North road, which I think has not yet been named. I took it with an equal number of *A. ictis*, race 1, and it is certainly quite distinct.

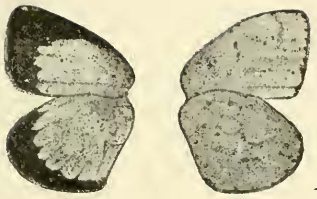
"At Manipai, Jaffna, I took races 2 and 3 of *A. ictis*, also with race 1, and I consider these also quite distinct from *A. ictis* No. 1, and have always considered them to be *A. nubilus*. This was in July and August, 1890.

"I sent several specimens of them to De Niceville at that time, and he named those without the discal spot *A. nubilus*, race 3 of your notes. Race 2 appears to me to be only a variety, and cannot be separated from race 3, but both distinct from race 1, which I call typical *A. ictis*.

"The blue irridescence on both wings of the male of Nos. 2 and 3 is more violet than in the *Aphnæus* you describe under *A. nubilus*, and spreads over a larger area of the fore wing in my specimens, and the under sides are paler red."

132. Tajuria jehana.—In September, 1918, I took two pairs of this at Pointsettia blossom in my garden (3,000 feet).

These specimens are larger, much darker in colour, and have far broader wings than those from Jaffna, but agree in markings. They were taken at the end of a severe drought in company with *T. longinus*. They may prove to be a new species.



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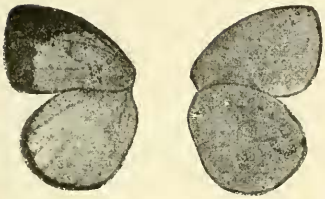

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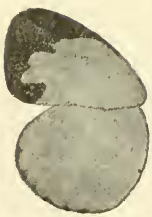

8

1. Terias libythea : normal form
2. Do. cold season form
3. Terias venata var. cingala ♂
4. Do. ♀
5. Terias venata var. rama ♂
6. Do. ♀
7. Terias rotundalis ♂
8. Do. ♀


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1. Hantana infernus: inner face of clasp
2. Do. dorsal aspect of tegumen
3. Tapena thwaitesi: inner face of clasp
4. Do. dorsal aspect of tegumen
5. Coladenia tissa: inner face of clasp
6. Do. dorsal aspect of tegumen
7. Tagiades distans: inner face of clasp
8. Tagiades atticus: inner face of clasp
9 and 10. Caprona ransonnettii: inner face of clasps
11 and 12. Caprona siamica: inner face of clasps


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1. Sarangesa albicilia : inner face of clasp
2. Do. dorsal aspect of tegumen
3. Baracus vittatus : inner face of clasp
4. Do. dorsal aspect of tegumen
5. Suastus gremius : inner face of clasp
6. Suastus minuta : inner face of clasp
7. Suastus minuta : dorsal aspect of tegumen
8. Hyarotis adrastus : inner face of clasp
9. Matapa aria : inner face of clasp
10. Do. dorsal aspect of tegumen
11. Paduka lebadea : inner face of clasp
12. Gangara thyrsis : inner face of clasp


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1. Telicota bambusæ : inner face of clasp
2. Telicota augias : inner face of clasp
3. Padraona pseudomæsa : inner face of clasp
4. Do. dorsal aspect of tegumen
5. Padraona mæsioides : inner face of clasp
6. Do. dorsal aspect of tegumen
7. Padraona dara ? : inner face of clasp
8. Do. dorsal aspect of tegumen
9. Halpe ceylonica (or egena) : lateral aspect of clasp
10. Do. dorsal aspect of tegumen
11. Halpe decorata : inner face of clasp
12. Do. dorsal aspect of tegumen

1. Baoris pencillata : inner face of clasp
2. Do. lateral aspect of tegumen
3. Do. dorsal aspect of tegumen
4. Do. ventral aspect of tegumen
5. Parnara kumara ? : inner face of clasp
6. Do. lateral aspect of tegumen
7. Parnara kumara ?: dorsal aspect of tegumen
8. Do. ventral aspect of tegumen
9. Parnara seriata : inner face of clasp
10. Do. lateral aspect of tegumen
11. Do. dorsal aspect of tegumen
12. Do. ventral aspect of tegumen

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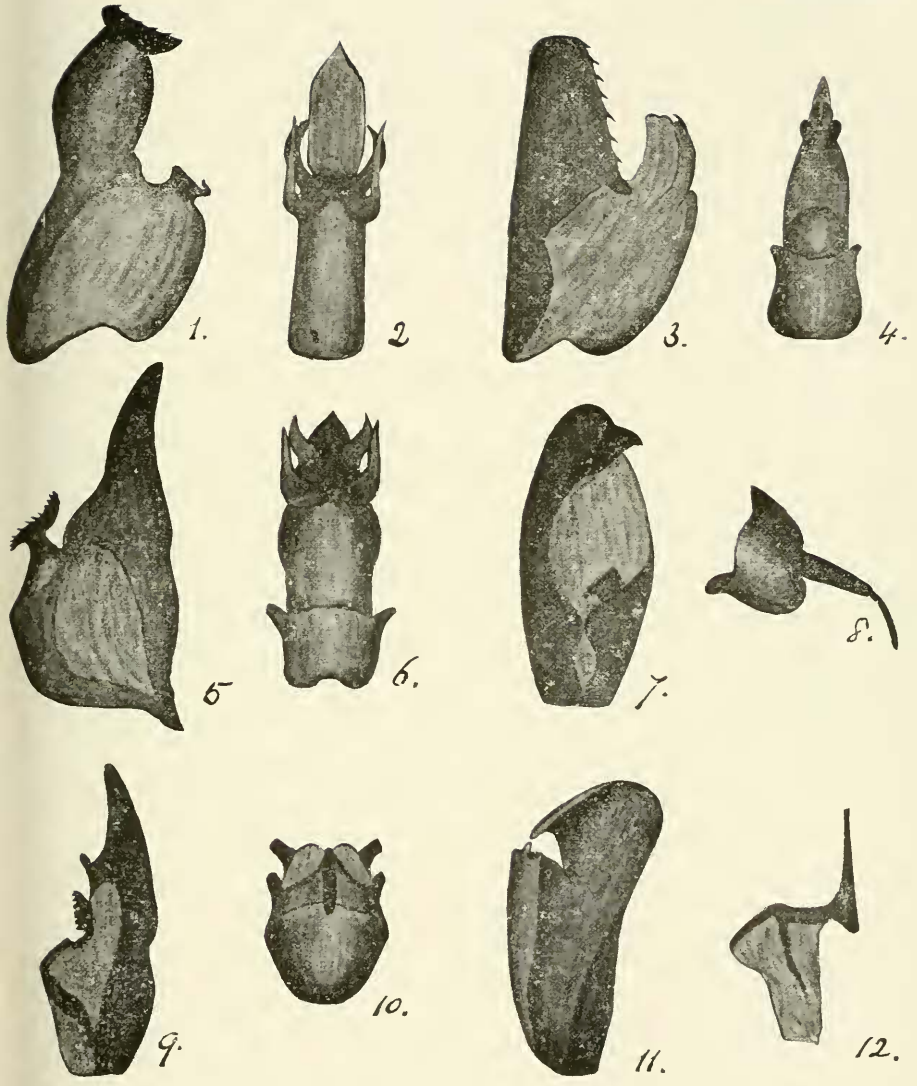
1. Parnara narooa : inner face of clasp
2. Do. lateral aspect of tegumen
3. Do. dorsal aspect of tegumen
4. Do. ventral aspect of tegumen
5. Parnara bada : inner face of clasp
6. Do. lateral aspect of tegumen
7. Do. dorsal aspect of tegumen
8. Parnara cingala : inner face of clasp
9. Do. lateral aspect of tegumen
10. Do. dorsal aspect of tegumen
11. Ismene ataphus : inner face of clasp
12. Do. dorsal aspect of tegumen



1. Parata butleri : inner face of clasp
2. Do. dorsal aspect of tegumen
3. Parata alexis : inner face of clasp
4. Do. dorsal aspect of tegumen
5. Hasora badra : inner face of clasp
6. Do. dorsal aspect of tegumen
7. Rhopolacampta benjaminii : inner face of clasp
8. Rhopolacampta benjaminii : lateral aspect of tegumen
9. Bibasis sena : inner face of clasp
10. Do. dorsal aspect of tegumen
11. Badamia exclamationis : inner face of clasp
12. Do. lateral aspect of tegumen

NOTES.

Toxorhynchites minimus (*Theob.*).—References:—Theobald: Jl. Bom. N. H. S., Vol. XVI., p. 237; Monog. Culic., Vol. IV., p. 138. Brunetti: Rec. Ind. Mus., Vol. I., p. 324; Vol. IV., p. 437.

Since the unique male, which is the type, was captured at Yatiyantota in 1902, no further specimens of this species seem to have been taken, and though it has been moved from the genus *Megarhinus*, in which it was originally placed, to *Toxorhynchites*, the proof of its belonging to the latter genus is wanting in the absence of a female specimen.

It has recently been my lot to obtain two such, and from them it is at once obvious that the species belongs to *Toxorhynchites*.

Before describing the female, I would like to note that Brunetti's remark in his paper "Critical Review of Genera in *Culicidæ*" (Rec. Ind. Mus., Vol. X., p. 34) that the section *Megarhini* of the sub-family *Culicinæ* is characterized by possessing the posterior cross-vein beyond the anterior does not seem to constantly apply, as this is not the case in the type specimen here described; whilst I also possess a female *T. immisericors*, in which the posterior cross-vein, though approximate, is distinctly before the anterior.

Female.—Head: nape black with apple-green and blue flat scales behind occiput and over most of the surface, the posterior orbits fringed above with a single line of white scales, broadening on genæ. Two pairs of black vertical bristles, the median pair porrect, the outer more upward-directed. Basal joint of antennæ globular, black with whitish sheen at sides, the flagellum 14-jointed, brown, the first joint very small, clothed throughout with microscopic white hairs, in addition to the long dark verticils at the joints. Clypeus black, shining whitish viewed from before and above. Proboscis black, with metallic violet reflections. Palpi only as long as head, apparently 3-jointed, black with metallic blue reflections, purple at apex of first and second joints, the colouration extending over the second joint on to basal third

of apical segment, which has the tip yellowish, leaving only the middle third black. First and second segments approximately equal in length, apical short, slightly incurved, so that its tip touches the proboscis.

Thorax: shining black, clothed with flat metallic brassy scales, with a patch of brilliant scales at base of wings, blue before and green behind. There are some short black bristles over base of wings also. Behind the root of the wing is a præscutellar tuft of bright metallic yellow hairs, arising from the patch of coloured scales. Prothoracic lobes clothed with purple and greenish scales, bearing on anterior margin some long golden brown hairs. Scutellum very dark brown, with one or two flat brassy green scales on mid-lobe, and at tip of each side lobe. Border bristles brown; pleuræ black with dense flat snowy white scales.

Abdomen: apically somewhat truncate, but not expanding. Dark brown mottled with paler yellow-brown scales, which form a broad dorsal band at junction of first and second segments. With the exception of this yellow band, the whole dorsal surface has metallic blue and purple reflections. Laterally the apical margin of the first with a large, and basal margin of the fourth, fifth, and sixth segments with a small, patch of creamy-white scales. Venter creamy-yellow, apex black.

Legs: coxa, trochanter, and most of femur creamy-yellow with purple scales exteriorly on apical two-thirds of fore femur, a line of such throughout extoriorly on mid-femur, and on apical one-third of hind femur; tibiæ and tarsi black with a mottling of yellowish scales. Tibiæ with purple reflections.

Wings: small with dark brown scales, with a little purple reflection showing at the base of the first longitudinal vein. First, sub-marginal cell minute; second, posterior cell barely one-third as long as its stem. A line of scales appears to carry the third longitudinal vein inward to a point well interior of the fork of the fifth vein. The basal erect portion of the third vein about three times its own length nearer the apex of the wing than the anterior cross-vein, which is small, in the type about its own length beyond the posterior cross-vein, in another specimen the posterior cross-vein is just beyond the

anterior. Posterior cross-vein inwardly sloped in both specimens. Halteres creamy-yellow. Length of type 6 mm.; of second specimen nearly 8 mm.

Described from a female in perfect condition taken at Suduganga, Matale District, Ceylon, flying in bungalow garden at 10 A.M., April 20, 1919. Another female taken on same estate, around *Lantana* scrub on boundaries, at dusk on March 30, 1919. Type and additional specimen in my own collection.

April 20, 1919. R. SENIOR-WHITE, F.E.S.

The Tea Tortrix (*Homona coffearia*, Neitner).—Synonyms: *Tortrix coffearia*, Feld. in lit. Neitner. *Capua coffearia*, Neitner, Enem. Coff. Ceyl. 1861. *Pandemis* (*? Capua*) *menciana*, Walker, E. C. Cotes, Ind. Mus. Notes, Vol. III., No. 4, 1896. *Homona fasciculana*, Walker, List Lep. Het. Brit. Mus., Vol. 28, p. 424, 1863.

Male.—Gray. Head and thorax gray, densely scaled; eyes rufous; antennæ ciliated filiform, reaching to medial portion of wing; palpi short, curled, ascending, with appressed scales, terminal joint short; thorax with crest of scales on dorsal surface. Fore wing gray, narrow, with an oblique slightly sinuous medial band of light brown from costal margin to centre of dorsum; a dark gray punctum bordered with black at centre of costa; a sinuous brown band crossing apex from costa to termen; termen arcuate, fringed with gray scales; costal fold, curled towards the upper surface, densely scaled; 3 from angle, 7 and 8 stalked, 7 to termen. Hind wing unicolourous, dark gray, fringed, without basal pecten, 3 and 4 connate, 5 approximate to 4 at base, 6 and 7 stalked. Posterior tibia with a pair of medial spurs as well as an apical pair. 15 to 17 mm. expanded.

Female.—Ochraceous. Head and thorax ochraceous, eyes black, sometimes rufous; antennæ simple, filiform, as long as head and thorax, palpi as in male; thorax without crest. Fore wing ochraceous with a darker ochraneous patch on the shoulder, and oblique slightly sinuous medial band of the

same shade from costal margin to dorsum, a similar band across apex, borders of the atomi rufous; apex pointed, termen arcuate and fringed; no costal fold; venation as in male. Hind wing unicolourous, cupreus, fringed, venation as in male. The wings when at rest lie over the body. Their outline being of the same shape as the section of a bell. Posterior tibia with a medial as well as an apical pair of spurs. 25 to 28 mm. expanded.

Pupa: Naked. Thorax fulvous, darker on the dorsum; wing cases well defined and dark fulvous; ventral median area bronzus in male; eyes rufescent; abdomen tawny, dorsum adminiculate, adminiculæ transversely placed, rescuspate, two rows to each segment, with the exception of the penultimate and ultimate segments, anterior rows more developed than posterior; two dorso-lateral rows of cilia extending to the penultimate segment, each segment bearing four cilia; penultimate segment thinly cirrose, rescuspate; creamaster stout, flattened dorsally, eight-spined, four apically bifarious, a pair dorso-laterally, a pair ventro-laterally placed.

Male 7 mm. Female 11 mm.

N. K. JARDINE.

Report of the Proceedings of the Second Entomological Meeting, held at Pusa, February 5 to 12, 1917, edited by T. Bainbrigge-Fletcher, R.N., F.L.S., F.E.S., F.Z.S.—This publication justifies the claim made in the preface that it is "practically an abstract of our current knowledge of Indian crop pests." In addition to this, it gives some idea how meagre our knowledge is, and how many are the gaps yet to be filled before it will be reasonably complete, even in the case of the commoner pests. To quote again from the preface, the report is "based partly on the notes prepared before the meeting was held, and partly on a running abstract made during the meeting."

The book commences with a list of members and visitors who attended the meeting—twenty-six in all. A list of the coloured plates follows. There are no less than thirty-four of these depicting the life-histories of various major and minor pests. These plates are one of the most useful features

of the book, as they are well drawn and accurate, and should enable any one, whether with Entomological knowledge or not, to recognize their subjects, without difficulty, in the field.

An account is given of the combined Entomological and Mycological conference, at which were discussed various questions relating to the Madras Agricultural Pests and Diseases Act and the Rome Phytopathological Conference. Then follows the Chairman's opening address, in which the present state of Entomological knowledge in India is commented on, and many practical hints regarding the labelling of specimens and keeping of exact records are given. Various questions that need solving are briefly mentioned by way of stimulating research.

The various insects are treated of under the following headings :—(1) Pests of Hill Crops ; (2) Miscellaneous ; (3) Leguminous Field Crops ; (4) Oil Seeds ; (5) Malvaceæ ; (6) Non-Malvaceous Fibre Plants ; (7) Sugar Cane, Paddy, and other Cereals, Grasses, and Fodder Crops ; (8) Fruit Trees ; (9) Palms ; (10) Garden Plants ; (11) Drugs and Dyes ; (12) Cruciferous Crops ; (13) Other Vegetables and Condiments ; (14) Insect Pests of Stored Products.

Under these headings all the principal crops of India are gone over in detail, with a list of recorded pests divided into such sections as leaf-eaters, stem-borers, sucking-insects, &c., for each plant. The discussion on each pest is given. With so large an amount of work to get through in so limited a time, it is obvious that these discussions could not be very full, and there is inevitably a good deal of matter which contains very little information, but, nevertheless, the main facts concerning each insect seem to have been brought to light with great success. As many of the insects treated of are pests of several distinct crops, there is a considerable degree of repetition, but this is reduced to a minimum.

The name of each speaker is given in the margin opposite to his remarks. A very full index is given.

The notes on control methods are often meagre, except in the case of insects, which have received a good deal of attention from Entomologists. This is unfortunate, but it is probably

unavoidable, owing to the small amount of work that has been done in India on the testing of suitable insecticides and insecticidal methods. The main reason for this deficiency of knowledge is, of course, the difficulty of devising methods suited to the uneducated native cultivator, who cannot be induced to try anything in the way of a "new departure" in his cultural operations, unless its simplicity and efficiency are demonstrated to him in the clearest possible way.

The book forms an excellent companion and extension of the Editor's former volume, entitled "Some South Indian Insects and other Animals," and will prove a most useful addition to the library of any Economic Entomologist, whether professional or amateur, who works in India or the countries adjacent to it. It gives a very complete summary of the known pests of practically all the crops which are grown in India, and this information is given in a readily accessible form. Finally, the price is only Rs. 3, which, as in the case of "Some South Indian Insects," is astonishingly cheap, especially considering the number of coloured plates.

The Editor and his staff are greatly to be congratulated on the excellent work they have turned out.

G. M. HENRY.

Crocodiles' nesting Habits.—My personal experience of the nests of crocodiles is, I am sorry to say, limited to one, which was found near the resthouse at Horowapotana. It was situated on a small backwater of the tank, not far from the bund, in a position only slightly above the water level at the time, but apparently flooded at high-water level. The species must thus have been the Marsh Crocodile (*Crocodilus palustris*). In this case the parent certainly remained near the nest. We cautiously approached from behind the bund, and saw that the animal was actually over or very near the site of the nest. While we were watching another adult crocodile approached, for what purpose is unknown, but possibly for the purpose of robbing the nest. At any rate the parent at once attacked the intruder, and they had a tussle. As some of our party wanted to get a crocodile, they then fired, and both beasts

escaped into the water. We went up to the nest and had it dug up. The tracker who did it was very careful when he came to the eggs, as he said that he was afraid that some of the young crocs might have hatched out and would then bite him. The eggs, which numbered over thirty, were about six inches below the surface, and were not all heaped together. Possibly the arrangement was such as is described elsewhere, namely, laid around a central small mound, which causes the eggs to scatter in a circular layer as they are laid. They had a thick hard shell, and were about the size of a goose egg. Those we opened were all quite fresh, but our efforts to hatch them out after our return to Colombo failed, possibly owing to the vibration on the motor journey. I have spoken to another keen and reliable observer with regard to the nesting of the crocodiles on the south coast rivers and lagoons. His observations would refer to the Estuarine Crocodile (*Crocodilus porosus*). He states that the parent does not remain near the nest, but leaves the sun to do its work alone. Also the nests appear to be placed in very much drier ground, considerably above high-water level. Speaking of nests that he has observed when the young were on the point of hatching out, he states that it is quite easy to tell when the youngster is ready to come out, as it makes a cheeping noise, rather like that of a young chicken. It then breaks the shell by means of a temporary tooth developed at the end of the snout. When it emerges, the youngster does not at once make for the water, but stays near the nest for several minutes with its mouth wide open. If during this period it is put into the water, it at once comes out again and stays with its mouth open. After a certain time it goes down to the water and swims away, as an adult would. I presume that this action of the young crocodile in avoiding the water at first is due to the fact that in the egg its lungs are not expanded, and the interval with gaping mouth on dry ground is to give the lungs and the air tube, which runs up to the back of the nostrils, time to open and expand properly without any chance of their being choked with water.

October 8, 1918. C. T. SYMONS.

PROCEEDINGS OF THE CEYLON NATURAL HISTORY SOCIETY.

Twenty-second General Meeting.

THE Twenty-second General Meeting of the Society was held in the Colombo Museum Library on May 22, 1918, at 5.15 P.M., Dr. A. Nell in the Chair.

A paper on the Mendelian theory was given by the Rev. Father M. J. Le Goc, O.M.I.

New Members:—Mrs. Sri Pathmanathan; Leigh Smith, Esq., and A. C. Hayley, Esq.

Twenty-third General Meeting.

The Twenty-third General Meeting of the Society was held in the Colombo Museum on October 10, 1918, at 5.15 P.M.. Dr. A. Nell in the Chair.

Dr. R. L. Spittel gave a paper entitled "Nuwaragala, and the Veddas of Henebeda," illustrated by lantern slides.

New Members:—A. M. Hurst, Esq., and H. Wicebloom, Esq.

THE PICARIAN BIRDS AND PARROTS OF CEYLON.

By W. E. Wait, M.A., F.Z.S.

(*With two Plates.*)

"Notes on Ceylon Butterflies."

With reference to the "Notes on Ceylon Butterflies," published in Vol. XI., Parts 40 and 41, of this Journal, Mr. Ormiston will be glad to receive any criticisms, corrections, or notes from any one interested in the subject, as it is proposed to publish these notes in an enlarged and revised form at some future date.

The Editor,
Spolia Zeylanica.

Australasia, and Polynesia, and are readily distinguishable by their outward form and habits, which do not vary greatly among the different species. The bill, which is generally strong and chisel-shaped, is used for cutting away the bark of trees in search of insects, and for excavating nest holes in tree trunks or branches. The tongue is peculiar, being of enormous length, and provided with glands secreting a sticky fluid, to which insects adhere. The foot is usually four-toed, and adapted for climbing. The arrangement of the toes is zygodactylic, *i.e.*, the hallux or true hind toe and the fourth toe are directed backwards, the second and third toes

PROCEEDINGS OF THE CEYLON NATURAL HISTORY SOCIETY.

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THE PICARIAN BIRDS AND PARROTS OF CEYLON.

By W. E. Wait, M.A., F.Z.S.

(*With two Plates.*)

THE present paper comprises the Picarian Birds and Parrots found in Ceylon. It includes all the Ceylonese species described in the third volume of birds in the Fauna of British India, with the exception of the Owls and Hawks. I have again to acknowledge my thanks to Mr. Stuart Baker for advice and for information on the nesting of many of the rarer species.

Order **PICI.**

Family Picidæ.

Sub-family *Picinæ.*

Woodpeckers.

The true Woodpeckers, together with two allied sub-families unknown in Ceylon—the Piculets and Wrynecks—form a well-marked family, which, by Blanford, has been placed in a separate order. They are found in the temperate and tropical regions all over the world, except in Madagascar, Australasia, and Polynesia, and are readily distinguishable by their outward form and habits, which do not vary greatly among the different species. The bill, which is generally strong and chisel-shaped, is used for cutting away the bark of trees in search of insects, and for excavating nest holes in tree trunks or branches. The tongue is peculiar, being of enormous length, and provided with glands secreting a sticky fluid, to which insects adhere. The foot is usually four-toed, and adapted for climbing. The arrangement of the toes is zygodactylic, *i.e.*, the hallux or true hind toe and the fourth toe are directed backwards, the second and third toes

forwards. In one Ceylon genus, *Micropternus*, the hallux is rudimentary. The wings are short and pointed, and the flight undulatory. The tail feathers are twelve in number (the outermost pair being frequently concealed by the tail coverts), and are provided with stiff shafts. Woodpeckers seldom perch, but cling to trees in an upright position with the tail pressed as a support against the stem ; hence the tail feathers are often much worn. The birds generally alight at the foot of a tree and work their way up the trunk in a spiral, moving rapidly for a short distance, and then stopping to tap on the bark for insects. Their cry is generally a harsh scream, or in the smaller species a shrill trill. Their food consists wholly or mainly of ants and other similar insects. All Woodpeckers lay white eggs in a nest hole, which in nearly all cases is hollowed in the stem or branch of a tree. One genus, however, *Micropternus*, makes the nest hole in the interior of the hanging nest of a certain species of ant.

Nine species, divided among six genera, occur in Ceylon, two species being peculiar to the Island.

Rough Key to Ceylon Picinæ.

A.—Mantle green. Genus *Gecinus*.

(1) Length 11. Rump tinged with bright yellow.
Male : Crown and crest crimson.
Female : Crown and crest black.

Gecinus striolatus (The Little Scaly-bellied Green Woodpecker).

(2) Length 9·5. Rump green.

Male : Crown and crest crimson.
Female : Crown dark olive, crest crimson.

G. chlorogaster (The South Indian Yellow-naped Woodpecker).

B.—Mantle black and white.

(1) Length 7. A small crest, pale crimson in males, yellow in females.

Liopicus mahrattensis (The Yellow-fronted Pied Woodpecker).

(2) Length 4·8. No crest. Males with a vermilion streak on side of occiput.

Iyngipicus gymnophthalmus (The Ceylon Pigmy Woodpecker).

C.—Mantle dull rufous-brown barred with black. Feathers below the eye in males tipped with crimson.

Micropternus gularis (The Malabar Rufous Woodpecker).

D.—Mantle wholly or in part either crimson or yellow.

(*a*) Bill about 1·5; jaws, throat, and fore-neck black speckled with white. Genus *Brachypternus*.

(1) Mantle yellow or orange, crest crimson. Forehead and crown in males black tipped with crimson, in females black with white spots.

B. aurantius (Golden-backed Woodpecker).

(2) Mantle and crest crimson, bill blackish. Forehead and crown in males black tipped with crimson, in females black with white spots.

B. erythronotus (Red-backed Woodpecker).

(*b*) Bill about 2; jaws, throat, and fore-neck white with five longitudinal black stripes. Genus *Chrysocolaptes*.

(1) Wing coverts golden, a white triangular patch on hind-neck and upper back. Crest crimson in males, yellow in females.

C. festivus (The Black-backed Woodpecker).

(2) Mantle crimson, bill greenish-white. Crown and crest crimson in males, black with white spots in females.

C. stricklandi (Layard's Woodpecker).

GECINUS STRIOLATUS (Blanford, Vol. III., p. 20; Legge, p. 194).

The Little Scaly-bellied Green Woodpecker.

Description.—Male: Crown and crest crimson; general colour of upper parts olive tinged with green; rump and upper tail coverts bright yellow, sometimes tinged with orange. Wing quills dusky brown with white bars on the inner webs; the primaries have white spots on the outer webs, and the outer webs of the secondaries are washed with green. Tail blackish-brown with indistinct lighter bars towards the base. On the eyebrow a white stripe runs back to the nape, it is bordered above by a black stripe extending forward to the nostrils; lores and cheeks dirty white, the cheeks with darker streaks; ear coverts streaky gray. Chin and throat yellowish-white with darker centres to the feathers and black streaks along the jaw. Under parts greenish-white, each feather with a dark V-shaped band near the margin, and some feathers with dark shaft stripes.

Female: Differs only in the crown and nape, which are black streaked with ashy-brown.

Bill dusky horn colour, the greater part of the lower mandible yellow; iris red with an outer ring of white; legs and feet dusky green.

Length 11; wing 5·2; tail 3·75; tarsus 1·00; bill from gape 1·5.

Distribution.—Rare in Ceylon, and apparently found only on the higher patanas of the Central Province and Uva. In India it occurs in forest country on the Malabar Coast and on the eastern side of the peninsula north of the Godaveri. It is also met with in the Eastern Himalayas, North Burma, and Siam.

Habits, &c.—This species may be looked for on patanas which are thinly dotted with trees and in the intersecting ravines where wooded. The eggs do not appear to have been found in Ceylon as yet. In India the birds breed from March to May, making the usual nest hole in trees, and laying four to five glossy white eggs, averaging 1·05 by ·8.

GECINUS CHLOROGASTER (Blanford, Vol. III., p. 25).

CHRYSOPHLEGMA XANTHODERUS (Legge, p. 197).

The South Indian Yellow-naped Woodpecker.

Description.—Male: The feathers of the forehead, crown, crest, and a stripe down the jaw crimson with greenish-black bases; nape yellow. Upper plumage and wing coverts olive-green, the greater coverts golden-olive. Wing quills dark brown with some white spots; the outer webs of the inner primaries and secondaries orange-red bordered with bronze-green; tail black. Lores dusky; face, throat, and under parts dull green; the throat, abdomen, and flanks more or less barred with white; the breast generally unspotted.

Female: Forehead and crown dark olive, the crimson cheek stripe is wanting, otherwise it resembles the male.

Bill blackish, the sides of the lower mandible and the edge of the upper mandible near the gape yellowish; iris brownish-red; legs greenish-olive.

Length 9·5; wing 4·65; tail about 3·50; tarsus ·80; bill from gape 1·0; females are a little smaller.

Distribution.—Apparently confined to the southern half of the Island. It is found in the Western Province and Galle District. I have occasionally seen it north of Tangalla, and it occurs in the Eastern Province. It is also met with in the hills, mainly in Sabaragamuwa and Uva. In India it occurs on the Malabar Coast and the Western Ghauts up to 5,000 feet.

Habits, &c.—Rather a shy bird, found in forest country, especially near streams, and in decayed gardens where there is plenty of undergrowth. It may sometimes be seen on the ground breaking open dried cowdung in search of beetles. It feeds also on ants.

In India this species breeds about March and April, making the usual nest hole in a tree in the jungle. One to three, but generally two, white eggs are laid. The texture is hard and glossy, the shape a long oval. Average measurement about 1 by ·74.

LIOPICUS MAHRATTENSIS (Blanford, Vol. III., p. 43; Legge, p. 184).

The Yellow-fronted Pied Woodpecker.

Description.—Male : Forehead and front of crown shining straw colour, remainder of crown with the crest pale crimson ; nape and hind-neck smoky brown ; back and scapulars white, much mixed with black ; wing coverts, wing quills, and tail black, largely spotted or barred with white ; rump and upper tail coverts white, the latter with broad arrow-shaped black markings. Sides of face, chin, throat, and fore-neck white ; a broad brown stripe runs from below the ear coverts down the sides of the breast ; remainder of lower parts white streaked with brown, the centre of the abdomen being stained with crimson.

Female : The whole of the top of the head, including the crest, straw yellow.

Bill dusky bluish, darker on the ridge and at the tip ; iris deep red ; legs and feet lead colour.

Length 7 ; wing 3·80 ; tail 2·5 ; tarsus ·7 ; bill from gape 1·05.

Distribution.—This little Woodpecker is nowhere very common. Its chief haunts are in the Mannar and Jaffna Districts. Thence it appears to have worked its way east and south, as it occurs in the Eastern Province and parts of the Hambantota District, and on the patanas in the drier parts of Uva and the Central Province. It is found in India in suitable places here and there throughout the peninsula, in the valleys at the base of the Western Himalayas, and the drier parts of Upper Burma.

Habits, &c.—This species haunts low jungle and scrub, being especially fond of Euphorbia trees. The note is a weak trill. I have known it to breed in the Mannar District in May, and near Hambantota in July. The nest is a small hole in the stem or branch of a decaying tree.

The three white eggs average about ·87 by ·68.

Note.—Dendrocopus macii (The Fulvous-breasted Pied Woodpecker) is said by Kelaart to have occurred in Ceylon,

but his identification was probably incorrect, as the species is restricted to the base of the Himalayas, Lower Bengal, and parts of Assam.

It is slightly larger than *L. mahrattensis*, which it somewhat resembles in build, but has no crest. It may be distinguished by the uniform black of the hind-neck, upper back, and upper tail coverts, and by the bright crimson of the vent and lower tail coverts. The top of the head is crimson in males and black in females.

Length 7·5 ; wing 4·3.

IYNGIPICUS GYMNOPHTHALMUS (Blanford, Vol. III., p. 48 ; Legge, p. 186).

The Ceylon Pigmy Woodpecker.

Description.—Male : The top of the head, the centre of the nape, and the hind-neck very dark brown ; a broad white stripe runs from behind the eye to the nape, and is bordered above by a streak of vermilion. Remainder of upper plumage dark brownish-black ; the back is barred, and the wing quills, wing coverts, and tail are spotted with white. The cheeks, ear coverts, and sides of the neck are brown. Under plumage dirty white, faintly streaked with brown in young birds ; under tail coverts streaked with brown.

Females lack the vermilion stripe over the eyebrow.

Bill olive-brown, paler underneath ; iris white, at times tinged with gray, yellow, or red ; legs and feet greenish.

Length 4·8 ; wing 3 ; tail 1·25 ; tarsus ·58 ; bill from gape ·62.

Distribution.—Found nearly all over the low-country, except in the extreme north, and in the hills up to about 3,000 feet, occasionally higher. In India it occurs on the Malabar Coast.

Habits, &c.—This, the smallest of our Woodpeckers, frequents the top branches of trees. Its presence is generally betrayed by its note, a shrill long trill. It makes its nest hole in small dead branches, laying probably three white eggs, which measure about ·62 by ·53.

MICROPTERNUS GULARIS (Blanford, Vol. III., p. 57 ; Legge, p. 200).

The Malabar Rufous Woodpecker.

Description.—Male : General colour dull rufous ; head and cheeks dark brown, the feathers from the gape beneath the eye to the ear coverts tipped with crimson. The upper plumage from the hind-neck to the tail is barred with black.

The chin and throat feathers have broad darker borders and faint whitish edges. The remainder of the lower plumage is almost uniform rufous-brown with indistinct black bars on the flanks and thighs.

Females have no crimson tips to the cheek feathers.

Bill dull black, paler beneath ; iris deep brown : legs and feet slaty-black.

Length 9·5 ; wing 4·75 ; tail 2·75 ; tarsus ·75 ; bill from gape 1·2.

Distribution.—Fairly well distributed throughout the low-country, and on the lower hills up to about 2,000 feet. In India its range is restricted to the forest tracts of the Malabar Coast.

Habits, &c.—This species is found in forests or well-wooded gardens. It feeds mainly on ants, and occasionally may be seen on the ground in search of its food.

The nest has not yet been recorded from Ceylon, but in India the breeding season is during April and May. The nest hole is excavated in the interior of large hanging ants' nests. Three fragile, glossless, white eggs are laid, measuring about 1·12 by ·68.

BRACHYPTERNUS AURANTIUS (Blanford, Vol. III., p. 58).
BRACHYPTERNUS PUNCTICOLLIS (Legge, p. 205).

The Golden-backed Woodpecker.

Description.—Male : Pale form. Feathers of forehead and crown black with crimson tips ; crest crimson ; a fairly broad stripe runs from over the eye to the nape, another broad white stripe extends from the nostrils across the cheek and broadens down the side of the neck. The sides of the head between these two stripes are streaky black and white. The hind-neck,

upper back and primary coverts, rump, tail coverts, and tail are black; scapulars and middle of the back golden-yellow; a portion of the wing coverts and the outer webs of the secondaries golden-olive; primary quills and inner webs of secondaries black with white spots; the wing coverts are also more or less spotted with yellowish-white. The jaws, chin, throat, and fore-neck are black, speckled with white; the lower neck and upper breast mainly black. The rest of the lower surface, with the upper flanks whitish, more or less tinged with tawny buff, each feather margined with black, most heavily on the breast; the lower flanks and under tail coverts barred with black.

Forest Race: The yellow of the back and wings is tinged more or less with orange, or even red; some specimens are so red that they are probably hybrids between this and the next species.

Female: The feathers of the forehead and crown are black with terminal white spots, the crest is crimson as in the male.

Bill slaty-black; iris reddish-brown; legs and feet dark green.

Length about 10·5; wing 5·25; tail 3·5; tarsus ·8; bill from gape 1·5.

Distribution.—Occurs only in the northern half of the Island. The palest specimens come from the Jaffna peninsula and the scrub country adjoining the coast of the Northern Province. In the jungles of the North-Central Province the specimens are much darker, and appear to interbreed with the red-backed species *B. erythronotus*.

In India the present species is found over the greater part of the continent westward of Assam.

Habits, &c.—A common bird in the north of the Island, occurring in coconut and palmyra groves, village gardens, scrub jungle, and forest.

It is usually seen in pairs. The nest is the usual hole in the stem of a tree. The breeding season is about April. Three rather glossy white eggs are laid, measuring about 1·10 by ·8.

BRACHYPTERNUS ERYTHRONOTUS (Blanford, Vol. III., p. 60).

BRACHYPTERNUS CEYLONUS (Legge, p. 202).

The Red-backed Woodpecker.

Description.—In the typical form from the south of the Island, where *B. aurantius* is not found, the present species differs from the last named as follows :—The middle of the back and the scapulars are bright crimson, the wing coverts and outer webs of the secondaries are duller crimson, while the black of the lower back and rump is faintly tinged with the same colour ; the spots on the wing coverts are, as a rule, fewer and tinged with the colour of the mantle, they may be almost absent ; the white stripes above and below the eye are considerably reduced in breadth. In the north of the Island, where both species are found together, the Red-backed Woodpecker approaches the Golden-backed form more nearly. The crimson of the mantle is tinged with orange, and the white stripes down the head and neck are more conspicuous. Some specimens seem to be undoubted crosses.

The sexual differences in plumage are as in *B. aurantius*.

Bill blackish ; iris red ; legs and feet dusky green.

Length about 11·5 ; wing 5·5 ; tail 4 ; tarsus ·7 ; bill from gape 1·5.

Distribution.—Peculiar to Ceylon. Found all over the low-country, except in the extremely dry maritime coast tracts of the north-west and south-east. It ascends the hills to about 4,000 feet.

Habits, &c.—This is the most abundant of our Woodpeckers, being equally common in plantations and forest. It always alights near the bottom of a tree and works its way spirally to the top, tapping the trunk for insects. It feeds largely on red ants. The flight is undulatory and jerky ; the cry a loud harsh scream. The breeding season is from about March to June, and again in September. The nest is the usual hole in the stem of a decaying coconut or other tree. The three eggs in appearance closely resemble those of the last species, and have approximately the same measurements.

CHRYSOCOLAPTES FESTIVUS (Blanford, Vol. III., p. 64 ; Legge, p. 191).

The Black-backed Woodpecker.

Description.—Male : Forehead brownish with large white spots ; crown and crest crimson bordered by a black stripe ; a broad white stripe runs from behind the eye to the nape, and expands into a triangle of white on the hind-neck and upper back. The rest of the back, the scapulars, rump, upper tail coverts, and tail are black, as are the smaller wing coverts on the forearm. The remainder of the wing coverts are black at the base, the exposed portions being golden-olive with bright golden-yellow fringes. The outer webs of the secondary quills are golden-olive ; remainder of wing quills brownish-black, the outer webs with light brown or greenish, and the inner webs with large white spots. A broad black stripe runs from the eye down the side of the neck. The jaws, chin, throat, and fore-neck are white with five longitudinal black stripes. The under parts are white streaked with black, most heavily on the breast.

Female : The fore part of the crown, as well as the forehead, is speckled black and white, the rest of the crown and crest are light golden-yellow.

Bill blackish ; iris crimson ; legs slaty-greenish.

Length about 12 ; wing 5·8 ; tail 3·5 ; tarsus 1·1 ; bill from gape 2.

Distribution.—A rare bird, found in a few forest localities in the northern half of the Island. Legge met with it also near Tissa in the Hambantota District. In India it is locally distributed throughout part of the peninsula, but is everywhere rare.

Habits, &c.—I have come across several small colonies of this species in the North-Central Province and Puttalam District always in large trees, and generally in the "tisbamba," or clearing, round isolated villages in the jungle. They nest high up in large trees, and, to judge from the number of holes, make a fresh nest every year. Apparently they roost in these nest holes. The breeding season is in March, and again in August. I once obtained an addled egg on April 1 from a

nest in which there were two young ones, and again found a single young bird in September.

The birds thus seem to have two broods and to lay from one to three eggs.

The single egg in my collection is rather elongated, measuring 1·25 by ·88. The texture almost exactly resembles that of celluloid.

CHRYSOCOLAPTES STRICKLANDI (Blanford, Vol. III., p. 67; Legge, p. 188).

Layard's Woodpecker.

Description.—Male: Forehead dark brown; crown and crest crimson; hind-neck blackish with large white spots; back, rump, wing coverts, and outer webs of secondaries crimson, the colour being brightest on the rump; primaries and inner webs of secondaries blackish-brown with white spots; tail coverts and tail black. A row of white spots passes from behind the eye above the ear coverts to the hind-neck; cheeks and sides of head and neck blackish-brown. The jaws, chin, throat, and upper fore-neck are white, at times tinged with buff, with five black longitudinal stripes. The feathers of the breast and lower fore-neck are white with broad black borders, giving a scaly appearance; remainder of lower parts more streaky black and white; under tail coverts barred black and white.

Female: The whole of the top of the head above the eyes, together with the nape and hind-neck, are black with white spots; the hindmost under tail coverts are dark brown.

Bill mainly greenish-white, darker at the base; iris yellowish-white; legs and feet greenish-slate colour.

Length about 11·5; wing 5·15; tail 3·5; tarsus 1·05; bill from gape 2.

Distribution.—Peculiar to Ceylon; found practically all over the Island in suitable forest country, but never so abundant as the two species of *Brachypternus*.

Habits, &c.—A bird usually found in tall forest; in wilder districts it occasionally visits large trees in gardens. The flight is more rapid than that of the common Red-backed Woodpecker, and the note is a thin shrill trill.

It would appear to have much the same nesting habits as *C. festivus*. The first brood is hatched early in the year, and I once found an addled egg with two young ones in September. Oftener only one egg is laid.

The eggs measure about 1·16 by ·86.

Order **ZYGODACTYLI.**

Family Capitonidæ.

Barbets.

The Barbets are found in the tropical regions of Africa, Asia, and America. Four species occur in Ceylon; two of them are peculiar to the Island. In general structure and nesting habits they are akin to Woodpeckers, but they feed almost entirely on fruit, and perch on branches, instead of clinging to the stem in a vertical position. The bill is generally stout, slightly curved, and fairly powerful. Prominent bristles overhang the nostrils and spring from the chin. The wings are short and rounded; the tail is short and soft and composed of ten feathers.

As in the Woodpeckers, the feet are zygodactylic, the first and fourth toes being directed backwards. The cry is a peculiarly monotonous call of from one to three syllables repeated at intervals. The nest hole is like that of a Woodpecker, the entrance being generally neatly bevelled and rounded.

The eggs are of a dull glossless white.

In all Ceylon species the plumage is mainly green. The short wing quills and soft but rather scanty plumage give the birds the appearance of not being quite fledged.

Rough Key to the Ceylon Capitonidæ.

A.—Larger forms; length over 8 inches; no crimson on head and neck.

(1) Length 9·75; whole head and neck brown with pale streaks.

Thereiceryx zeylonicus (Common Indian Green Barbet).

(2) Length 8·5; cheeks, chin, and throat blue.

Cyanops flavifrons (Yellow-fronted Barbet).

B.—Smaller forms under 7 inches; patches of crimson on head and neck.

(1) Throat yellow; cheeks black.

Xantholæma hæmatocephala (Crimson-breasted Barbet).

(2) Throat orange; cheeks blue.

X. rubricapilla (Small Ceylon Barbet).

THEREICERYX ZEYLONICUS (Blanford, Vol. III., p. 86).

MEGALÆMA ZEYLONICA (Legge, p. 208).

The Common Indian Green Barbet.

Description.—Head, neck, breast, and sometimes the upper abdomen umber-brown, each feather with pale shaft-stripes, on the head these stripes are not very distinct. Back, wing coverts, and tail grass green, the mantle with a few pale streaks and the wing coverts tipped with small white spots. Wing quills brown with pale inner margins, the outer webs green, except on the first few primaries.

On the abdomen the brown of the chest gradually merges into the pale grass green of the flanks and lower tail coverts; under surface of tail bluish.

Bill orange-brown; iris red-brown; a circle of naked yellow skin round the eye; legs and feet light brownish-yellow.

Length about 9·75; wing 4·37; tail 3; tarsus 1·2; bill 1·60.

Distribution.—Common over nearly all the low-country, except in the arid maritime districts and the dense forest tracts of the wet zone. It ascends the hills to three or four thousand feet. Blanford unites in one species the northern form, *T. caniceps*, which ranges over the greater part of India proper, and the southern race, *T. zeylonicus*, a smaller and darker form, which is confined to Travancore and Ceylon.

Habits, &c.—This species is very common in village gardens and thin jungle, chiefly near cultivation. It feeds largely on various species of wild fig. The nest hole is hollowed out of a rotten tree, or even a fence post. The three dull white eggs

are usually laid on a few stalks of dried grass which line the bottom of the cavity. Their average size is about 1·23 by ·87.

There appear to be several broods, as I have taken eggs as early as March and as late as August.

Cyanops flavifrons (Blanford, Vol. III., p. 94).

Megalæma flavifrons (Legge, p. 212).

The Yellow-fronted Barbet.

Description.—The forehead, front of crown, and a spot below the gape golden-yellow; top of the head brownish-green, passing into the grass-green of the remainder of the upper plumage; the feathers of the nape and of the back and sides of the neck have pale shaft-stripes. Wing quills brown with pale yellow inner margins, the outer webs of all but the first few primaries green. Eyebrows, lores, cheeks, ear coverts, chin, and throat verditer-blue; rest of lower plumage pale green, the breast feathers bordered, and the flanks and abdomen washed with emerald green; under surface of tail shot with blue.

Bill greenish horn colour, darker by the nostrils; iris light red; legs and feet greenish, sometimes bluish.

Length 8·5; wing 3·5; tail 2·30; tarsus ·9; bill from gape 1·1.

Distribution.—Peculiar to Ceylon. Found chiefly in the hill zone, except at the highest altitudes. From the bases of the hills it spreads into the damp low-country zone, being found in most parts of the Western Province, Sabaragamuwa, and the Galle and Kurunegala Districts. In the drier forest region it is more restricted, but is found locally in parts of the Eastern Province and the district north of the Matale hills.

Habits, &c.—Chiefly a forest bird, keeping to the tops of trees and feeding on fruit. It is very noisy in the mornings and evenings. The call is something like that of the preceding species, but more shrill. The birds breed in almost every month of the year. The nest hole is usually excavated in a soft-wooded tree. Two or three eggs are laid on the bare wood. They are white and smooth in texture, and generally slightly pointed at each end. Average size 1·10 by ·80.

XANTHOLÆMA HÆMATOCEPHALA (Blanford, Vol. III., p. 98).
XANTHOLÆMA HÆMOCEPHALA (Legge, p. 218).
The Crimson-breasted Barbet; Coppersmith.

Description.—Lores black; forehead and crown crimson; top and sides of head, hind cheeks, and a stripe forward along the jaw to the lower mandible black; a patch above and below the eye, the chin, and throat yellow; nape and sides of neck grayish-green; remainder of upper plumage dull olive-green; tail and outer web of most wing quills bluish-green, the outer primaries and the inner webs of the remaining wing quills blackish with pale yellow edges. On the lower throat is a crimson patch, bordered behind by a wash of yellow; rest of lower plumage and the flanks whitish streaked with dull green.

Bill black; iris reddish; legs and feet coral red.

Length about 6; wing 3; tail 1·5; tarsus ·8; bill from gape ·9.

Distribution.—Found all over the drier parts of the low-country, and in the adjoining hills up to about 2,000 feet. It occurs practically all over the Indian Empire, except on the hills, and ranges east and south-east to the Malay Peninsula, Sumatra, and the Philippines.

Habits, &c.—Common in almost every village garden in the localities in which it is found, also in thin jungle, especially near cultivation. It is a great fruit eater. It gets the name of Coppersmith from its cry (wonk-wonk-wonk slowly repeated), which resembles the tapping of a hammer on copper.

The breeding season lasts from January to June. The nest is a small hole in a decaying branch or rotten fence post. Three dull, white, glossless eggs are laid on the bare wood at the bottom of the cavity. Like nearly all white eggs, they have a pinkish tinge when fresh and unblown. They are large for the size of the bird, measuring about ·99 by ·69.

XANTHOLÆMA RUBRICAPILLA (Blanford, Vol. III., p. 100; Legge, p. 215).
The Small Ceylon Barbet.

Description.—A narrow black line across the base of the forehead; remainder of forehead and the front of the crown crimson bordered behind by a black band which passes behind

the eye to the cheeks; a stripe above and a patch below the eye, together with the chin and throat, bright orange. Remainder of upper plumage dark green, tinged on the top of the head with blue; the outer web of most wing quills bluish-green, the outer primaries and the inner webs of the remaining quills black with white inner margins. Hind cheeks, ear coverts, and sides of neck bluish; a small crimson patch on the lower throat fringed behind with orange. The bases of the throat feathers are black. Lower parts from breast pale green, often with a bluish tinge.

Bill black; iris red-brown; legs and feet coral-red.

Length 6; wing 3·1; tail 1·4; tarsus ·75; bill from gape ·85.

Distribution.—Peculiar to Ceylon. It replaces the last species in the damp parts of the low-country, where it is commonest, and is found in the hills up to about 4,000 feet. It also extends locally into the dry zone, except in the arid maritime districts. It is, however, occasionally found in the Jaffna peninsula.

Habits, &c.—Like the last species, this bird is common in gardens and compounds, but in the north and east it is rather more partial to wild fruit trees in the forest. The call is quicker and sharper than that of the Coppersmith. The breeding season is from about March to June. The nest is the usual small round hole in the dead branch of a living tree. The eggs resemble those of the last species, but are slightly smaller, averaging ·9 by ·65.

Order **ANISODACTYLI.**

In the classification adopted by Blanford, who in this respect follows Gadow, the above order comprises five sub-orders: *Coraciæ*—Rollers; *Meropes*—Bee-eaters; *Halcyones*—Kingfishers; *Bucerotes*—Hornbills; and *Upupæ*—Hoopoes. This order thus comprises birds which in outward appearance seem to have little in common, but all have the same structure of palate, that known as desmognathous, a hallux or hind toe is always present, while the three front toes are more or less joined at the base.

All members of the order lay white eggs in a nest hole, which may be hollowed out either in a tree or in the ground, and in all cases the young when hatched are naked.

Sub-order CORACIÆ.

Family Coraciadæ.

The Rollers.

The Rollers are birds mainly of brilliant plumage found throughout most parts of the Old World. In build and in the shape of the bill they resemble crows. The soles of the feet, however, are flat, and the three front toes more or less united at the base. The flight is buoyant, with vigorous flaps of the wings, and at intervals curious turnings and tumblings, which have given the birds their English name. The nest is placed in the hole of a decaying tree, and the eggs are white and glossy. Two genera are found in India: *Coracias*—the true Rollers, and *Eurystomus*—the Broad-billed Rollers. One species of each genus occurs in Ceylon.

Rough Key to Ceylon Coraciadæ.

A.—Plumage gay; bill twice as long as broad. Throat and fore-neck lilac with buff shaft-stripes.

Coracias indica (The Indian Roller).

B.—Plumage more sober; bill as broad as long. Throat and fore-neck washed with royal blue in adults.

Eurystomus orientalis (The Broad-billed Roller).

Coracias Indica (Blanford, Vol. III., p. 103; Legge, p. 281).

The Indian Roller.

Description.—A small patch above the nostrils sandy buff, at times tinged with violet; crown and nape bluish-green, tinged above the eyes with turquoise-blue; hind-neck and sides of neck brownish-lilac; back, scapulars, and innermost wing quills dull greenish-brown; lower back and tail coverts deep purple-blue, the former tinged with greenish-blue. Middle tail feathers dark dull green washed with purple-blue at the base; rest of tail deep purple-blue with a broad band of turquoise-blue on the outer half. Innermost wing coverts deep purplish-blue, most of the remainder greenish-blue, the primary coverts, the tips of the secondary coverts, and the

edge of the wing being turquoise ; wing quills deep purplish-blue tipped with dusky brown and with a broad band of turquoise across the six outer primaries. Chin sandy buff ; throat and sides of the head purplish-lilac with broad pale shaft-stripes ; breast lilac-brown ; abdomen, wing lining, thighs, and lower tail coverts pale greenish-blue.

Bill blackish-brown ; iris grayish-brown ; eyelids and naked skin round eye pale orange-yellow ; legs and feet brownish-yellow.

Length 13 ; wing 7 ; tail 4·75 ; tarsus ·9 ; bill from gape 1·70.

Distribution.—Found chiefly in the drier northern half of the Island ; during the north-east monsoon it wanders south to the Western Province and Ratnapura District, where it also occasionally breeds. Occurs in suitable localities over most of India, but avoids the hills, thick forests, and deserts. It straggles westwards to Asia Minor.

Habits, &c.—Generally seen in open compounds, round paddy fields, or near the borders of tanks. It is extremely fond of perching on dead trees or telegraph wires. The cry is a harsh grating call. The bird feeds largely on insects. The breeding season extends from January to June. The nest is a hole generally in a rotten tree, sometimes in an old wall. It is lined with a modicum of grass or vegetable fibre. The eggs generally number four, sometimes five. They are almost round and of a glossy china white. Average size of a small Ceylon series 1·38 by 1·10.

Eurystomus orientalis (Blanford, Vol. III., p. 107 ; Legge, p. 285).

The Broad-billed Roller.

Description.—Head, face, and chin rusty black, slightly tinged on the nape with green. Rest of upper plumage dark dull green, with a tinge of dark blue on the rump, tail coverts, and wing coverts. Primary coverts deep blue ; quills black, washed with deep blue on the outer webs ; outer primaries crossed with a broad band of turquoise-blue ; tail black, washed on the outer half with deep blue, the basal portion of the central feathers shading into the dark blue-green of the

tail coverts. Throat and fore-neck rusty greenish-black, a patch of varying size on the centre of the throat and neck washed with royal blue, which is brightest on the shafts of the feathers. Remainder of lower parts greenish-blue, darker on the breast.

Bill deep orange-red, the extreme tip blackish-red, in young birds wholly black; iris dark brown; legs and feet orange-red.

Length 11·5; wing 7·25; tail 4; tarsus ·75; bill from gape 1·5.

Distribution.—One of our rarest residents; has been found in thick forest in various scattered localities in the Island.

The southern form of this species—*E. lætior* of the British Museum Catalogue—occurs in Ceylon and Travancore. It is darker than the northern forms, which range along the base of the Eastern Himalayas through Burma to China and Malaya. Blanford unites all these forms into one species.

Habits, &c.—Essentially a forest bird, frequenting tall dead trees in deep jungle. The food appears to consist mainly of wood-boring beetles. In Travancore this species has been found breeding from September to April in a hole in a large tree at a great height from the ground. The three white eggs measure about 1·38 by 1·15, but vary considerably in shape and size.

Sub-order MEROPES.

Family Meropidæ.

Bee-eaters.

The Bee-eaters are a single family found throughout the greater part of the Old World. They are slim-built smallish birds, the plumage—with certain African exceptions—being mainly or largely of some shade of green. The bill is long, slender, pointed, and gently curved; the wings are long and pointed; the legs and feet are weak. The three front toes are syndactylic, *i.e.*, united at their bases between the inner and middle toes along the basal joint, between the middle and outer toes up to the last joint. In all Ceylon species the nostrils are partially covered with plumes, and there are a few small rictal bristles at the base of the bill.

All species feed on insects, chiefly bees and wasps, which they capture on the wing with an audible snap of the beak. They generally keep a lookout for their prey from a perch on a telegraph wire, railing, or twig, and after making a short swoop return to their starting point. The nest is a small unlined chamber at the end of a long burrow excavated in the bank of a river or roadside ditch. At times the little tunnel is driven at a gentle slope into almost level ground. The eggs are white, glossy, and nearly globular. Three species are found in Ceylon; one is migratory, two belong to the genus *Merops*, one is a *Melittophagus*.

Rough Key to Ceylon Meropidæ.

A.—Middle pair of tail feathers in adults much longer than the others. Genus *Merops*.

(*a*) Wing 3·65; chin and throat bluish-green.

Merops viridis (Common Indian Bee-eater).

(*b*) Wing 5·25; chin yellow, throat chestnut.

M. philippinus (Blue-tailed Bee-eater).

B.—Middle pair of tail feathers not elongated. Genus *Melittophagus*.

Wing 4·2; chin and throat saffron-yellow, fore-neck chestnut.

M. swinhoii (Chestnut-headed Bee-eater).

MEROPS VIRIDIS (Blanford, Vol. III., p. 110; Legge, p. 309).

The Common Indian Bee-eater.

Description.—Upper plumage green with a bronze tinge, most pronounced on the crown and nape, which at times are almost golden-brown; tertiaries, rump, and tail coverts often washed with greenish-blue. Wing quills pale rufous on the inner, and greenish-bronze on the outer webs, the tips and shafts black; tail bronze-green, the outer half of the long central feathers and the tips of the remainder black. There is a black band from the nostrils through the eye to the ear

coverts. Chin, cheeks, and throat greenish-blue; a black band across the fore-neck; lower parts green, the lower tail coverts and vent much paler.

Bill black; iris red; legs and feet brown.

Length 9·5 to 10·5; wing 3·65; tail, outer feathers 2·85, central feathers up to 5·25; tarsus ·4; bill from gape 1·4.

Distribution.—Common throughout the drier parts of the low-country, especially in the sandy tracts round the coast in the north-west and south-east. It avoids the damp low-country, and seldom ascends higher than 1,000 feet. It occurs almost throughout India and Burma, and extends through Southern Persia to North-East Africa.

Habits, &c.—Those of the family. May commonly be seen perching on a rail or low branch, from which it makes frequent short flights. The cry is a not unpleasant chirrup. I have often seen it hawking for insects over small sheets of water. The breeding season is from April to August. The nest hole is run almost horizontally into any little hummock of sandy soil, frequently along the side of a road or path.

Three to five eggs are laid in a small circular chamber at the end of a passage 2 to 4 feet in length. They are glossy white, almost spherical, and average ·79 by ·70.

Merops philippinus (Blanford, Vol. III., p. 3: Legge, p. 306).

The Blue-tailed Bee-eater.

Description.—Upper plumage, together with the wing coverts, brownish-green, darkest on the crown and nape, and shading on the lower back and tertiaries into the bright blue-green of the rump and tail; the elongated central pair of tail feathers tipped with black. Primary and secondary quills pale cinnamon on the inner margin, the remaining portion bronze-green, brightest on the outer web, tips blackish. From the nostrils through the eye to the ear coverts runs a black streak, bordered above by a narrow pale blue line, and below by a broader line of the same colour; chin pale yellow, throat chestnut, shading on the breast into green, which again passes into pale blue on the vent and lower tail coverts; wing lining light rufous-brown.

Bill black : iris crimson : legs and feet blackish.

Length about 12 ; wing 5·25 ; tail, outer feathers 3·5, central pair 5 to 6 ; tarsus ·5 ; bill from gape 2.

Distribution.—A migrant species, arriving about the end of August and leaving in April. It spreads fairly well all over the low-country, and is found in the patanas up-country to about 5,000 feet. It occurs over a great part of the Indian Empire, being partially migratory in many districts, and extends almost throughout the Oriental region.

Habits, &c.—In Ceylon it is found chiefly in open country, or about paddy fields, swamps, and hill patanas. Its habits are much the same as those of the last species. Its note is rather fuller and louder. Just before leaving the Island it collects in large flocks. It has not been known to breed in Ceylon.

MELITTOPHAGUS SWINHOII (Blanford, Vol. III., p. 114).

MEROPS SWINHOEI (Legge, p. 313).

The Chestnut-headed Bee-eater.

Description.—Forehead, head above the eyes, hind-neck, and upper back chestnut ; a black streak runs from the gape of the bill under the eye to the ear coverts. Wing, wing coverts, and scapulars green, the primary and secondary quills with black tips and rufous inner margins ; rump and upper tail coverts pale blue ; tail green, the margins and tips of all but the central pair of feathers blackish ; chin and throat saffron-yellow ; fore-neck chestnut, bordered below by a black gorget band ; breast greenish, the tips of the feathers across which the black gorget runs are washed with pale yellow ; abdomen and lower tail coverts bluish-green.

Bill black ; iris crimson ; legs and feet dark brown.

Length 8·5 : wing 4·2 ; tail 3·25 ; tarsus ·43 ; bill from gape 1·7.

Distribution.—Rather locally distributed ; it is common on the banks of the Gin-ganga in the Galle District and on some rivers in the Western Province. Scattered colonies are also found in the North-Western Province, Sabaragamuwa,

and Hambantota District, while a few birds may be seen here and there in the northern forest tract. It is more common in the central hill zone up to a moderate height.

It occurs on the Malabar coast and the Nilgiris, and also ranges from the Lower Himalayas through Assam and Burma to Malaya and Cochin-China.

Habits, &c.—This species is generally to be found on the banks of rivers, round tanks, or in forest country. It generally perches on the upper branches of trees. The birds occasionally fish for insects and small fry on the surface of water. They breed about April, excavating a long tunnel in the sandy bank of a river or tank bund. The eggs are laid in a circular chamber at the end of the passage. They are glossy white and spherical, averaging ·87 by ·76.

Sub-order HALCYONES.

Family Alcedinidæ.

Kingfishers.

The habits and outward appearance of the Kingfishers are too well known to require much description. The sub-order consists of a single family, which ranges over the whole world, though only one genus—*Ceryle*—is found in America. The bill is long, stout, and pointed, the wings are moderate, the tail is short and consists of twelve feathers, the legs and feet are weak, the formation of the toes is the same as in the Rollers. Most of the species are fish feeders, but some members, including one Ceylon species, *Halcyon smyrnensis*, may be seen away from water feeding largely on land insects, small lizards, &c. The nest, like that of the Bee-eater, is a small round chamber at the end of a tunnel excavated in a bank, generally near water. As a rule, the round, white, glossy eggs are laid on the bare floor, but in some cases on a lining of fish bones. Seven species, belonging to five genera, are found in the Island, but only four are common, two being excessively rare, while a third is by no means abundant.

Rough Key to Ceylon Halcyones.

A.—Plumage black and white; length 11·7.

Ceryle varia (Indian Pied Kingfisher).

B.—Cap transversely barred black and blue. Genus *Alcedo*.

(*a*) Cap light blue and black; a rufous patch from eye to ear coverts; length 6·5.

Alcedo ispida (The Common Kingfisher).

(*b*) Cap deep blue and black; no rufous patch from eye to ear coverts; length 6·5.

Alcedo beavani (Beavan's Kingfisher).

C.—Cap orange-red, washed with violet; only three toes; length 5·35.

Ceyx tridactyla (Indian Three-toed Kingfisher).

D.—Cap and face dingy brown; length 15.

Pelargopsis gurial (Stork-billed Kingfisher).

E.—Head and face chocolate-brown; no white collar; length 11.

Halcyon smyrnensis (White-breasted Kingfisher).

F.—Crown and cheeks black; a white collar; length 12.

H. pileata (Black-capped Kingfisher).

CERYLE VARIA (Blanford, Vol. III., p. 119).

CERYLE RUDIS (Legge, p. 288).

The Indian Pied Kingfisher.

Description.—Male: Crown and nape black, streaked with white; rest of upper plumage, including wing coverts and wings, black, mottled or barred with white; tail feathers white on the base and tip, remaining portion black; cheeks, wing lining, and most of lower plumage white. The fore-neck is often spotted with black, and there are two black bands across the breast, the upper being the broader, while the flanks are more or less spotted with black.

Females lack the lower black gorget, while the upper broad band is imperfect, leaving the centre of the breast white.

Bill black; iris brown; legs and feet blackish.

Length 11·7: wing 5·4; tail 3; tarsus ·4; bill from gape 2·75.

Distribution.—Fairly common on lagoons, tanks, near the sea coast, and the lower reaches of our rivers. It is found on some of the larger inland tanks, but its occurrence elsewhere in the Island is rare. It is common throughout the plains of India and Burma, and ranges eastward to China.

Habits, &c.—This species avoids forest streams, and is most plentiful on brackish lagoons and large sheets of fresh water. Unlike many other Kingfishers, it hovers over the water and plunges perpendicularly on its prey, instead of darting at an angle from a fixed perch. The breeding season is about May. The nest hole is driven for some distance into the bank of a river, tank bund, or water channel. The eggs, generally four in number, are of the usual spherical form and glossy white colour. Average size 1·15 by ·92.

ALCEDO ISPIDA (Blanford, Vol. III., p. 122).

ALCEDO BENGALENSIS (Legge, p. 292).

The Common Kingfisher.

Description.—General colour above greenish-blue ; crown and nape with fine transverse bands of dusky black ; a rust-coloured stripe runs from the base of the upper mandible to the ear coverts, terminating in a whitish patch on the side of the neck ; a broad blue stripe runs from the lower mandible down each cheek ; centre of back, rump, and upper tail coverts bright cobalt blue ; wing coverts greenish-blue, each of the feathers of the lesser and median coverts with a brighter blue spot. Wing quills brown, with greenish-blue outer edges ; tail blue above, dusky brown beneath. Chin and throat whitish ; rest of lower surface rusty orange-brown.

Bill, upper mandible black, lower mandible generally reddish-yellow ; iris deep brown ; legs and feet coral red.

Length 6·5 ; wing 2·75 ; tail 1·3 ; tarsus ·35 ; bill from gape 1·8.

Distribution.—Common all over the Island wherever there is water, stagnant or running. The range of the species extends throughout Europe and Asia. In India it is found everywhere, except in the Himalayas.

Habits, &c.—This little Kingfisher lives mainly, if not entirely, on small fish, and is seldom seen away from water. It generally darts on its prey from a fixed perch, but occasionally hovers. The flight is swift and low; the cry is a shrill whistling note. The birds are usually met with in pairs. The breeding season lasts from February till about June, and occasionally birds breed as late as November.

The nest hole is usually in a bank close to the water's edge. The passage is about 2 to 4 feet in length, and the nest chamber 6 inches in diameter. The eggs are of the usual type, and measure about ·8 by ·68.

Alcedo beavani (Blanford, Vol. III., p. 124; not in Legge).

Beavan's Kingfisher.

Description.—The colouring is deeper and richer than in the preceding species. Crown, nape, and hind-neck black with narrow cross bands of royal blue; lores rufous, the lower border black; sides of head and cheeks royal blue; a whitish patch on the side of the neck behind the ear coverts; middle of back and rump deep cobalt blue; upper tail coverts deeper, almost royal blue; scapulars, wing coverts, and wings blackish-brown, the inner quills washed with royal blue, and most of the wing coverts tipped with a spot of deep cobalt blue; tail feathers dusky brown at the base, deep purplish-blue at the tip. Chin and throat buffy white; remainder of lower plumage deep chestnut.

Ceylon specimens appear to be darker than typical *A. beavani*.

Bill dusky brown; lower mandible paler; iris dark brown; legs and feet red.

Length 6·5; wing 2·75 tail 1·35; tarsus ·35; bill from gape 1·8.

Distribution.—A fairly recent addition, first discovered by A. P. Greene, I believe near Dambulla, in 1893. A. L. Butler found it several times near Medagama, in Uva. It should be looked for on forest streams among the lower hills. It is occasionally seen in Travancore and a few other localities in

South and Central India: commoner, but locally distributed, at the foot of the Eastern Himalayas, and through parts of Burma to the Andamans, Cochin-China, and Celebes.

Habits, &c.—A shy bird, keeping to lonely streams and tanks in the heart of the jungle. It probably breeds in the Island. The nesting habits are similar to those of the last species. The eggs, four to six in number, average about ·78 by ·69.

CEYX TRIDACTYLA (Blanford, Vol. III., p. 127; Legge, p. 303).

Indian Three-toed Kingfisher.

Description.—A V-shaped mark of black washed with purple on the forehead at the base of the upper mandible; crown, nape, hind-neck, lower back, rump, and upper tail coverts orange-red with a metallic lilac gloss, which is strongest behind the eye and on the rump and tail coverts; upper back black washed with brilliant cobalt blue; wings dark brown, the coverts tinged with blue; the edge of the wing, the wing lining, and the inner margin of wing quills rufous; tail orange-red. There is a black spot in front of the eye and a deep blue spot behind the ear coverts; lores, cheeks, ear coverts, and ower parts from the fore-neck orange-yellow; chin and throat white tinged with yellow.

Bill, legs, and feet coral red; iris brown.

Length 5·35; wing 2·2; tail ·9; tarsus ·35; bill from gape 1·5.

Distribution.—Occurs sparingly in the dry and medium zones up to about 2,000 feet. It is found rarely in scattered localities in the Indian Peninsula, also in Lower Bengal and through Burma to Malaya and the Andamans.

Habits, &c.—This beautiful little species is occasionally met with on lonely streams. It is generally seen singly or in pairs, and at times wanders away from water. It has been found breeding in the Mannar District. The nest hole was excavated in the side of a small water-course. The eggs, three in number, were more oval than is the case with most Kingfishers, measuring ·77 by ·66.

PELARGOPSIS GURIAL (Blanford, Vol. III., p. 129 ; Legge, p. 295).

The Brown-headed Stork-billed Kingfisher.

Description.—Head, face, hind-neck, and ear coverts dull brown ; a collar round the back of the neck, together with the whole of the lower plumage, orange-buff, deepest on the flanks and abdomen, and palest on the chin and throat ; upper back and scapulars with the lesser wing coverts dull bluish-green ; the greater wing coverts, the tertiaries, the outer webs and tips of the secondaries, the larger tail coverts, and tail slightly bluer ; the primary quills, the inner webs of the secondaries, and the under surface of the tail dull brown ; the lower back, rump, and lesser tail coverts bright turquoise blue.

In the young birds the buff feathers on the collar and breast have darker edges.

Bill dark blood red ; iris brown ; legs and feet coral red.

Length about 15 ; wing 5·75–6·25 ; tail about 4 ; tarsus ·75 ; bill from gape 3·75.

Distribution.—Occurs more or less all over Ceylon on rivers, streams, brackish lagoons, and tanks. Commonest in the northern half of the Island. It is found throughout the Indian Empire, and extends southward and eastward to Malaya and Cochin-China. Some authorities differentiate the Burmese race as a sub-species, *P. burmanicus*.

Habits, &c.—Our largest Kingfisher. It is always found near water, generally in the neighbourhood of large trees, or, on lagoons, among the mangrove swamps. The cry is a loud, harsh laugh. It feeds on frogs, fish, and crabs. The flight is straight and powerful. The usual nest hole is made in the sandy banks of rivers and streams, generally in dense jungle, or in the bund of a lonely tank. It appears to be always made in a bank well covered with bushes, at least in the immediate vicinity of the nest. The eggs are typical Kingfisher's eggs in shape and texture, and measure about 1·50 by 1·18.

HALCYON SMYRNENSIS (Blanford, Vol. III., p. 13 Legge, p. 298).

The White-breasted Kingfisher.

Description.—The head, cheeks, hind-neck, sides of neck, flanks, and lower parts from the breast downwards chocolate-brown ; the chin and throat to the centre of the breast white ; back, scapulars, tertiaries, outer portion of secondaries, greater wing coverts, rump, and tail blue, brightest on the rump and tail coverts ; medium wing coverts black, lesser wing coverts chestnut ; inner margin of secondaries and the end half of primaries black ; basal portion of primaries white on the inner and blue on the outer web.

Bill dark blood red ; iris brown ; legs coral red.

Length 11 ; wing 4·5 ; tail 3·3 ; tarsus ·5 ; bill from gape 2·6.

Distribution.—Common all over the Island, and found throughout India and Burma, except on the Himalayas. The range extends from Cyprus to Southern China.

Habits, &c.—May be seen on rivers, swamps, and paddy fields. It is by no means confined to the neighbourhood of water, and is not uncommon in Colombo gardens. It occasionally fishes, but feeds chiefly on insects, small lizards, and crabs. The call is a harsh scream, generally uttered while flying. As the breeding season extends from January to August, there are probably several broods during the year. The nest is the usual hole in the bank of a stream, pond, or ditch. The eggs are of the usual type, and average 1·14 by 1·04.

HALCYON PILEATA (Blanford, Vol. III., p. 133 ; Legge, p. 301).

The Black-capped Kingfisher.

Description.—Crown, nape, and cheeks black ; a white collar round the neck ; the feathers of the upper back adjoining the collar and the wing coverts are black ; the general hue of the rest of the upper plumage, including the tail, tertiaries, and the outer webs of the secondaries, is purplish-blue, brightest on the lower back and rump. The inner webs and the tips of

the secondaries are black; the primaries are black on the terminal half, the basal portion being white on the inner and bluish-white on the outer web. Chin, throat, and middle of breast white, shading into rusty buff on the remainder of the lower parts; under surface of tail black.

In young birds the breast feathers have dusky black fringes.

Bill deep coral red; iris dark brown; legs and feet dull red.

Length 12; wing 5·1; tail 3·25; tarsus ·6; bill from gape 3·0.

Distribution.—Solitary specimens have been obtained in the Northern, Eastern, and Western Provinces. This species has been found in various localities throughout the Indian Peninsula, the Ganges delta, Assam, and Burma, and ranges eastwards through Malaya to China and Corea. It is extremely rare over most of its habitat, but turns up unexpectedly all over India, generally near the coast, but at times far inland. It is common during the breeding season in Hong Kong.

Habits, &c.—Occasionally seen by fresh water, but generally found on brackish lagoons and among mangrove swamps, where it feeds upon the crabs, which swarm in the mud. It may possibly be found breeding in Ceylon, as the nest has been taken in Travancore in February and March. The nest is the usual hole, generally in the sandy banks of streams near the seashore, but occasionally on the banks of forest streams.

The eggs are of the usual round shape and glossy texture, four to six in number, and measure about 1·15 by 1.

Sub-order BUCEROTES.

Family Bucerotidæ.

Hornbills.

The Hornbills are a family of large, ungainly, forest birds, which are found in Africa, Tropical Asia, and New Guinea. They derive their English name from the enormous bill, which, as a rule, is surmounted by a hollow or cellular horny casque. In some cases, however, including that of the smaller of the two species found in Ceylon, the casque is wanting. Other peculiar features are that the eyelids are furnished with strong lashes, while the wing lining—*i.e.*, the coverts on the

underside of the wing—does not cover the bases of the quills. The feet are fairly large and stout, and formed like those of the Rollers. The nidification is extraordinary, and the accounts of it were long regarded as travellers' fairy tales. At the breeding season, before the eggs are laid, the female is walled up in the hollow of a tree by means of a plaster formed of earth mixed with the bird's droppings, or of the droppings alone. An opening is left, through which the male feeds her, and there she remains imprisoned, apparently until the young are fledged. The eggs when new laid are white, but, as may be imagined, they soon get discoloured as incubation proceeds. The young are naked when hatched. Hornbills feed largely on fruit, but also to some extent on small lizards, scorpions, insects, &c. They are frequently, but erroneously, called "Toucans," a name which applies to a family of large-billed birds of brilliant plumage, akin to the Barbets, and found only in South America.

Rough Key to Ceylon Bucerotidæ.

A.—Size large; length about 36; a compressed casque pointed in front.

Anthracoceros coronatus (Malabar Pied Hornbill).

B.—Size smaller; length about 23; no casque.

Lophoceros gingalensis (Ceylon Hornbill).

ANTHRACOCEROS CORONATUS (Blanford, Vol. III., p. 144; Legge, p. 272).

The Malabar Pied Hornbill.

Description.—The head, neck, and upper parts with the wing and the middle pair of tail feathers are glossy greenish-black; the remainder of the tail and the under parts from the breast downwards white. The primaries—with the exception of the first two quills, which are small—and the secondaries have broad white tips, and the primaries have whitish bases.

The bill is large and curved, with serrated edges; in adults it is surmounted by a large horny casque, which slopes backward over the crown, and in front runs into a pointed projection overhanging its line of junction with the bill. The

casque and bill are pale yellow, with a black patch at the base of the mandible and a large black patch covering most of the upper portion of the casque. In males the back of the casque is also black. Iris in males orange-red, in females brown; naked skin round eye, blackish in males, whitish in females; bare skin of throat flesh coloured; legs and feet grayish.

In young birds the contour of the casque is not developed, but grades into the upper mandible, giving the beak a distinctly Roman-nosed appearance, and there are patches of bare skin on the thighs and hind-neck, which remain unfledged until after the wing and tail quills are fully formed.

Length about 36; wing 13; tail 13; tarsus 2·5; bill from gape 7. Females are slightly smaller.

Distribution.—Found in the drier forest zone of the low-country, ascending the foothills to about 2,500 feet; commonest in the northern half of the Island. In India it occurs at the foot of the Western Ghauts and the forests of South-west Bengal, Orissa, and the Eastern-Central Provinces.

Habits, &c.—Generally found in small troops in heavy forest. It has a laboured, ungainly, dipping flight, alternately flapping its wings and sailing. The note is loud and harsh. The curious nesting habits are described in the remarks on the family. The breeding season appears to be from March to June. The eggs are two to four in number, white at first, but much discoloured as incubation proceeds. They measure about 2 by 1·5.

LOPHOCEROS GINGALENSIS (Blanford, Vol. III., p. 157).
TOCKUS GINGALENSIS (Legge, p. 275).

The Ceylon Hornbill.

Description.—Crown and nape ashy-brown with pale shaft-stripes; ear coverts slightly darker; rest of upper plumage ashy-gray, the wing coverts with darker edges; wing quills black, the middle primaries with white tips and the secondaries with gray outer margins; tail feathers dusky with a greenish tinge, all but the central pair with broad white ends; in old birds the three outer pairs become entirely white. Lower parts grayish-white, becoming lighter with age; vent and lower tail coverts dingy rufous.

Bill curved, and not surmounted with a casque; in adult males it is yellowish-white, with a black patch at the base of the upper mandible from the gape to the nostril, and another indistinct patch beneath the lower mandible. Females have the bill grayish-black, with a long white patch on the lower portion of the upper mandible. Iris red; orbital skin and eyelashes black; legs and feet greenish lead colour.

Length 23; wing 8; tail 9; tarsus 1·7; bill from gape 4·25. Females slightly smaller, and with shorter bills.

Distribution.—Peculiar to Ceylon; fairly common all over the low-country wherever there is forest. It ascends the hills to about 4,000 feet.

Habits.—A rather shy forest bird, keeping to the tops of trees. The flight is slow and dipping. The cry is rather a harsh laugh, starting with the syllable "kaa," which is often repeated, at first slowly, then quicker and quicker. It breeds from April to August in the fashion peculiar to the family. The two or three dingy white eggs measure about 1·62 by 1·25.

Sub-order UPUPÆ.

Family UPUPIDÆ.

Genus **Upupa.**

Hoopoes.

The Hoopoes are confined to a single family and genus, which ranges through the temperate and tropical parts of the Old World. In structure and nesting habits, though not in appearance, they are closely related to the Hornbills. They are all birds of moderate size, about one foot in length. The bill is long and slender, and curves from the base. There is a large conspicuous crest on the crown, folded or erected at will. The wings are rounded, the tail moderate in length, and the legs short. Hoopoes feed on the ground, scratching and probing for grubs and insects. The females, though not walled into nest holes like the Hornbills, sit very close, and are fed entirely by the males during the breeding period. Only one species occurs in Ceylon.

UPUPA INDICA (Blanford, Vol. III., p. 161).
UPUPA NIGRIPENNIS (Legge, p. 278).

The Indian Hoopoe.

Description.—Head, crest, hind-neck, throat, upper back, and breast cinnamon brown. The crest feathers are broadly tipped with black, and the breast has a vinaceous tinge. The lower back, wings, and tail are black barred with white, the tertiaries are tinged with brown and barred and tipped with buff. The abdomen is whitish, more or less streaked with brown, the vents and under tail coverts are white, the thighs have often a rufous tinge.

Bill brown-black, pinkish at the base; iris brown; legs and feet lead colour.

Length 11·5; wing 5·25; tail 3·75; tarsus ·85; bill from gape 2·3.

Distribution.—Fairly common in the Northern Province, occasionally wandering as far south as Anuradhapura and Chilaw; occurs in portions of the park country in the Eastern Province and on the Uva patanas, while it is by no means rare in the Hambantota District eastwards of Ranna. It is found all over India, except in Sind and the Western Punjab, and ranges through Burma to Siam, Indo-China, and Southern China.

Habits, &c.—This species is found chiefly in open country, grazing grounds, and patanas, and is generally seen on the ground searching for insects. The breeding season appears to last from November to April. The birds nest in holes in trees, banks, or walls. The nest chamber is usually very insanitary. The eggs, four to seven in number, are of a pale bluish- or greenish-white, and measure about ·97 by ·66.

Order **MACROCHIRES.**

Swifts, Nightjars, and Frogmouths.

By Blanford the Swifts, Nightjars, and Frogmouths are grouped together in the above order, which also includes the Humming Birds, *Trochilidæ*, and the Oil Birds, *Steatornithidæ*, two families, which are confined to the New World. All the members of the order have short bills with broad gapes, and live on insects captured while on the wing.

There are three Indian sub-orders: *Cypseli*, Swifts; *Caprimulgi*, Nightjars; and *Podargi*, Frogmouths. Each sub-order consists of a single family.

Sub-order CYPSELI.

Family Cypselidæ.

Swifts.

Outwardly Swifts resemble Swallows, in each case the form having been specialized for the purpose of a swift and enduring flight. Anatomically there are considerable differences. In the structure of the sternum, feet, and wings, the Swifts are Picarian, while the Swallows are typically Passerine. All Swifts have ten tail feathers, Swallows have twelve. The primary wing quills are very long and curved, the secondaries extremely short. The bill is small and hooked at the tip, while the gape is broad. The hind toe is either directed forwards or is more or less reversible. Swifts are aerial in their habits, and feed entirely upon insects captured on the wing. They are found all over the world, except in Arctic or Antarctic regions. Their powers of flight are enormous, and they often cover immense distances in the course of a day's wanderings. All our species are resident or mainly so. The nidification varies, but all species lay white eggs, and in almost all cases the materials of the nest are cemented together with hardened saliva, which is also used to glue the nest itself to the surface from which it depends.

The family is divided into three sub-families :—

(1) *Cypselinæ*.—The true Swifts, in which the tarsus is feathered, and all the front toes have but three phalanges or joints.

(2) *Chæturinæ*.—Spinetails, &c., have the normal number of phalanges in the three front toes, *i.e.*, three in the second toe, four in the third, and five in the fourth. In most forms, including both our Ceylon species, the tarsus is naked.

(3) *Macropteryginæ*.—Crested Swifts differ from the two preceding sub-families, in that the closed wings only just reach the end of the tail instead of extending far beyond it, while the head is crested.

Sub-family *Cypselinæ*.

True Swifts.

The typical Swifts are represented in Ceylon by three species belonging to two genera.

Rough Key to Species.

A.—All four toes directed forwards. Genus *Cypselus*.

(1) Size large ; wing 8·25 ; tail deeply forked.

C. melba (Alpine Swift).

(2) Size smaller ; wing 5·20 ; a white band across rump ; tail almost square.

C. affinis (Common Indian Swift).

B.—Toes arranged in pairs ; first and second toe pointing inwards, third and fourth outwards ; size small ; wing 4·4 ; tail deeply forked ; no white on rump.

Tachornis batassiensis (Palm Swift).

CYPSELUS MELBA (Blanford, Vol. III., p. 164 ; Legge, p. 317).

The Alpine Swift.

Description.—Upper parts with the sides of the head and neck mouse-brown ; darker on the wings and tail ; chin, throat, breast, and abdomen white ; a broad, dark brown band across the upper breast ; wing lining and lower tail coverts deep brown with whitish edges. In young birds all the dark feathers have whitish edges.

Bill black ; iris brown ; legs and feet livid brown.

Length 8·5 ; wing 8·25 ; tail about 3 ; tarsus ·55 ; bill from gape ·85.

Distribution.—Resident in the higher hills, and being a bird of great powers of flight, it visits all parts of the Island. The species ranges from the Alps, Southern Europe, and Northern Africa, eastwards to India.

Habits, &c.—The birds roost and breed in colonies on high rocky cliffs, and cover enormous distances during the day while hawking for insects. The cry is shrill and tremulous.

They probably breed during April and May on some of the great precipices of the higher ranges in the Central Province and Uva. The nests are of the usual Swift type, and are composed of feathers, grass, &c., cemented with hardened saliva and glued to the surface of a rock. The eggs, three or four in number, are pure white, smooth, and slightly glossy. In shape they are elongated ovals, and average about 1·2 by ·75.

Cypselus affinis (Blanford, Vol. III., p. 168; Legge, p. 319).

The Common Indian Swift.

Description.—Head, wings, and tail dark brown with a slight gloss, the crown and nape slightly paler; back black with a greenish gloss; a broad whitish band across the rump and sides, chin and throat whitish with faint black shaft-stripes; remainder of under surface blackish-brown, paler on the wing lining and lower tail coverts.

Bill black; iris deep brown; legs and feet vinous-brown.

Length about 5·3; wing about 5·20; tail 1·75; tarsus ·4; bill from gape ·75.

Distribution.—Occurs over the greater part of the Island; found throughout India, and ranges westward to Palestine and the greater part of Africa.

Habits, &c.—While there are regular breeding colonies in many parts of the low-country, as at Trincomalee, Anuradhapura, Dambulla, and Kirinde, in other parts this species appears to be a mere wanderer. It is, however, resident almost throughout the hills. It generally occurs in fairly large flocks, which may be seen high in the air hawking for insects. The cry is a shrill, weak scream. The breeding season is between March and July. The birds nest in colonies in rock caves, verandahs of buildings, &c. The nests are made of grass, straw, or feathers, cemented together with saliva, and glued to the roof or walls of the nesting haunt. The eggs, generally two in number, are long, pure white ovals, measuring about ·92 by ·59.

TACHORNIS BATASSIENSIS (Blanford, Vol. III., p. 170).

CYPSELUS BATASSIENSIS (Legge, p. 322).

The Palm Swift.

Description.—Upper parts ashy-brown, the head slightly darker, the wings and tail dark brown with a slight gloss; under parts mouse-gray, paler on the throat and chin.

Bill black; iris reddish-brown; legs and feet vinous-brown.

Length 5·20; wing 4·4; tail 2·6; tarsus ·4; bill from gape ·5.

Distribution.—Common all over the low-country and in the lower hills: most abundant in districts where the palmyra palm grows. Found in suitable localities throughout the Indian Peninsula.

Habits, &c.—This little Swift prefers fields and open spaces round palmyra and coconut plantations, or, in the south of the Island, near areca palms. It never wanders far from the palms in which it roosts and nests. The breeding season appears to extend from October to April. The nest is placed on the under surface of a downward hanging palm leaf, and is a little open pocket made of wild cotton and feathers glued together with saliva. Two or three eggs are usually laid. They are pure white long ovals, measuring about ·71 by ·46.

Sub-family *Chæturinæ*.

Spinetails, &c.

This sub-family contains two Indian genera, each of which is represented in Ceylon by a single species. The Spinetails—genus *Chætura*—are the fastest birds in existence. They take their name from the tail feathers, in which the shafts project beyond the webs and end in a spiny point. The genus *Collocalia* comprises the Swiftlets, whose nests, almost wholly composed of hardened saliva resembling isinglass, are much prized by the Chinese as an article of food.

Rough Key to Species of Chæturinæ.

A.—Size large ; wing 8 ; tail nearly square ; shafts of tail feathers ending in spines.

Chætura indica (Brown-necked Spinetail).

B.—Size small ; wing 4·6 ; tarsi naked ; tail slightly forked ; tail feathers normal ; hind toe directed backwards, and only partially reversible.

Collocalia unicolor (Indian Edible-nest Swiftlet).

CHÆTURA INDICA (Blanford, Vol. III., p. 173).

CHÆTURA GIGANTEA (Legge, p. 314).

The Brown-necked Spinetail.

Description.—The crown, the sides of the head, the nape, wings, the sides of the rump, upper tail coverts, and tail black, with a metallic gloss of green and steel blue ; the back, scapulars, and rump pale brown, palest on the centre of the back. A deep velvet black spot in front of each eye, and a white spot on each side of the forehead bordering the upper mandible ; chin and centre of throat whitish ; lower parts umber-brown with a faint gloss ; under tail coverts and a streak along the flank white.

Bill black ; iris dark brown ; legs and feet fleshy purple.

Length 9 ; wing 8 ; tail 2·7 ; tarsus ·65 ; bill from gape 1.

Distribution.—Resident in the hills, occasionally wandering over the whole Island. It occurs in Southern India, and also ranges from Assam eastwards throughout Burma.

Habits, &c.—This species may be seen wheeling at enormous speed round hillsides. Often after rain it wanders far over the low-country in the course of a day's flight. The nesting habits are peculiar. It has been found breeding in March and April on the Travancore hills inside green trees, of which the core is hollow down to the ground. The nest is a mere depression in the earth at the foot of the hollow core, and is lined with dry leaves and straw. The eggs, three to five in number, are pure white, and measure about 1·28 by 1. The shell is hard, and like porcelain in texture.

COLLOCALIA UNICOLOR (Blanford, Vol. IV., p. 485).

COLLOCALIA FUCIPHAGA (Blanford, Vol. III., p. 176).

COLLOCALIA FRANCICA (Legge, p. 324).

The Indian Edible-nest Swiftlet.

Description.—Upper parts blackish-brown, with a greenish gloss on back, wings, and tail; under parts mouse-gray, the feathers of the lower breast and abdomen with darker shaft-stripes; tarsi quite naked.

Bill black; iris brown; legs and feet fleshy brown.

Length 4·65; wing 4·6; tail 2·1; tarsus ·4; bill from gape ·4.

Distribution.—Roosts and breeds in rock caves in the hill ranges, and also in the isolated hills of the low-country, as at Hiniduma and Ritigala. As it wanders a good deal in the course of a day's flight, it may be seen almost anywhere in the Island. It also occurs in the South Indian hills and the Western Himalayas.

Habits, &c.—This species is often seen in company with the Palm Swift hawking for insects over open ground, round tanks, &c. The breeding season varies in different localities between Christmas and April. The birds nest in large colonies. Of late years they have taken very kindly to the railway tunnels between Ohiya and Bandarawela. The nest is a half saucer formed of clear hardened saliva mixed with a little moss and glued to the wall of the cave. Two white eggs of the usual type are laid, measuring about ·84 by ·53.

Sub-family *Macropteryginæ*.

Crested Swifts.

This sub-family consists of a single genus confined to India, Malaya, and the New Guinea region. Only one species occurs in Ceylon.

The Crested Swifts differ considerably from the other sub-families. The tarsus is short and naked, and the closed wings do not extend beyond the tail, which is long and forked.

The plumage is more silky than in other Swifts, and differs slightly in the two sexes. The feathers of the crown are elongated into a crest, which is raised or depressed at will.

MACROPTERYX CORONATA (Blanford, Vol. III., p. 180).

DENDRO CHELIDON CORONATA (Legge, p. 328).

The Indian Crested Swift.

Description.—Male : Upper plumage with the sides of the neck bluish-gray ; the crest and upper wing coverts darker with a bluish-green gloss ; wing and tail quills dark brown glossed with green ; lores velvet black, bordered above with a thin whitish stripe ; upper chin, moustache stripe, and ear coverts chestnut ; throat, breast, and sides of body light bluish-gray, passing gradually into the white of the abdomen and lower tail coverts.

Females lack the chestnut patch on the face and throat ; the ear coverts are almost black, and are bordered below by a white stripe from the gape.

Young birds have broad brownish-gray borders, edged with white, on the feathers of the upper parts, and dark brown bars near the tips of the feathers on the lower plumage.

Bill black ; iris dark brown ; legs pinkish-brown.

Length 9·5 ; wing 6·1 ; tail, outer feathers about 5, central about 1·75 ; tarsus ·4 ; bill from gape ·75.

Distribution.—Fairly common all over the Island. Like most Swifts, the birds wander a good deal ; in the northern half of the Island it is found chiefly round the large tanks. It occurs in the better wooded parts of India, and extends eastwards throughout Burma and Siam.

Habits, &c.—Found generally in small parties round forest clearings or jungle tanks. It is extremely fond of perching on dead trees. When flying over water, it often dips to the surface and rises again. The breeding season is about May. The nest is a tiny, fragile, half saucer composed of flakes of bark cemented with saliva, and glued to the side of a bare horizontal branch generally at some height from the ground. A solitary grayish-white egg is laid, measuring about ·85 by ·55.

Sub-order CAPRIMULGI.

Family Caprimulgidæ.

Genus **Caprimulgus.**

Nightjars.

The Nightjars or Goatsuckers are a family with crepuscular and nocturnal habits, found almost all round the world, except in the Frigid Zones. The plumage is soft and mottled, and the flight noiseless. Their food consists wholly of insects, which are generally caught on the wing. The gape of the mouth is very wide, but the bill itself is short, weak, and flexible. The only genus found in Ceylon is furnished with strong rictal bristles, *i.e.*, bristles bordering the upper mandible of the bill. The wings are long and pointed. The legs are rather weak ; the middle toe is long, and furnished on the inside of the claw with a comb-like appendage. There is no nest, the two protectively coloured eggs being laid on the bare ground. The young when hatched are covered with down, and are helpless. In one Ceylon species—*C. asiaticus*—the sexes are alike, but generally males are distinguished by white spots on the wings and tail. In the females these spots are either buff coloured or rufous, or are altogether wanting. Three species are found in the Island.

Rough Key to Ceylon Caprimulgi.

A.—Tarsus almost entirely naked ; sexes alike ; length 9.

C. asiaticus (Common Indian Nightjar).

B.—Tarsus feathered ; sexes not quite alike ; length 10 or over.

(1) Rictal bristles white at the base, a continuous white patch across the throat.

C. macrurus (Horsfield's Nightjar).

(2) Rictal bristles dark throughout ; centre line of throat dark, dividing the white throat patch into two.

C. indicus (Jungle Nightjar).

CAPRIMULGUS ASIATICUS (Blanford, Vol. III., p. 186; Legge, p. 343).

The Common Indian Nightjar.

Description.—General colour of upper plumage sandy gray finely pencilled with brown; forehead and centre of crown striped with black; the feathers of the back with dark shaft-stripes; round the neck a broad collar of buff speckled with black; scapulars velvety black with broad margins of rich buff; paler buff patches on the wing coverts. Wing quills dark brown, the first four primaries each with a large white spot in the middle, the secondaries barred with rufous-buff; middle tail feathers coloured like the back, but with indistinct narrow cross bars, the two outer pairs with large white tips, and the outermost pair with buff margins to the outer web. Moustache stripe whitish-buff; on each side of the throat a patch of white feathers tipped with buff and black; rest of lower parts buff barred indistinctly with brown; lower tail coverts buff without any bars. Sexes alike.

Bill reddish, the tip black; iris deep brown; legs and feet fleshy brown.

Length 9; wing 5·75; tail 4; tarsus ·8; bill from gape 1·2. Females rather smaller.

Distribution.—Common all over the low-country, except in the wet forest zone, and ascends to about 4,000 feet in the drier parts of the hills. It occurs throughout the greater part of India and Burma, except on the higher hills and in the large forests.

Habits, &c.—This species haunts scrub jungle, especially low sandy scrub near the sea; it is also fond of open tracts near woods and chenas. Any one motoring after dark in the wilder parts of the Island will probably flush dozens of them off the road. During the day they roost on the bare ground, between bushes, and can almost be trodden on before they get up. The cry starts off with a slow *chuk*, which is repeated at quickening intervals, and exactly resemble the sound of a stone skimming across a stretch of ice. The breeding season is about April, and again in August. The two eggs are laid on the bare ground, generally in the shelter of a bush

They are fairly regular ovals, with a smooth texture, and a ground colour of salmon pink, or some approximate shade, marbled and mottled with brownish-red and faint purplish-gray. Average size 1·05 by ·78.

CAPRIMULGUS MACRURUS (Blanford, Vol. III., p. 188).

CAPRIMULGUS ATRIPENNIS (Legge, p. 340).

Horsfield's Nightjar.

Description.—Male : General colour above a minutely mottled brownish-buff ; crown and hind-neck paler, with long black spots on the middle feathers ; lower hind-neck slightly tinged with rufous ; scapulars with large velvety black patches, some feathers with buff bars and margins ; wing coverts mottled and stippled with black and buff ; a white spot on the inner web of the first primary and on each web of second primary, a white bar across the third and fourth.

Tail feathers blackish-brown with lighter mottlings, the two outermost pairs with broad white tips. Moustache stripe whitish ; chin, throat, and breast a finely mottled brown ; across the centre of the throat a patch of white feathers tipped with buff and black ; abdomen and lower tail coverts fulvous, narrowly barred with dark brown.

In females the spots on the primaries and tail feathers are smaller and buff coloured instead of white.

Bill reddish-brown, tip black ; iris deep brown ; legs brown.

Length 10·5–11 ; wing 7 ; tail 5 ; tarsus ·7 ; bill from gape 1·35. Females are smaller. Wing about 6·5.

Distribution.—More local than the preceding species, but fairly well distributed over the low-country and up to about 3,500 feet. Blanford has united in one species three races : *C. atripennis*, a small form from Southern India and Ceylon : *C. macrurus*, which ranges through the Malay Peninsula to Australia ; and *C. albonotatus*, which occurs in Northern India and Burma.

Habits, &c.—More of a forest bird than *C. asiaticus*, but equally fond of squatting on paths after dark. It also frequently perches on dead branches of trees. It is found mainly in dry forest or chena, avoiding localities in which there

are no large trees. The note is a fairly loud "churr," preceded by a low "grog-grog-grog" heard only when one is close to the bird. The breeding season is from March to about May. Two eggs, as usual, are laid on the bare ground, but Ceylon eggs are not of the normal marbled type. Eight eggs in my collection taken from five nests are pale buff sparingly spotted with dark brown. Legge and A. L. Butler both give the same description. Northern Indian birds appear to lay eggs of the usual marbled type, so probably the southern race is a good sub-species or even species. Average size of Ceylon eggs 1·14 by ·88.

Caprimulgus indicus (Blanford, Vol. III., p. 190).

Caprimulgus kelaarti (Legge, p. 337).

The Jungle Nightjar.

Description.—Male: General colour above ash-gray mottled with white, and finely pencilled with dark brown; the centre of the crown and nape, the back, scapulars, rump, and upper tail coverts are heavily marked with black; the scapulars have pale buff margins; wing coverts dusky brown with ocellate whitish spots, which are faintly mottled with brown. Wing quills dusky brown; first primary notched on the outer web with buff and with a white spot on the inner web; the next three primaries have a white bar right across the quill. The tail is much mottled, and is irregularly barred with black. All feathers, except the central pair, have large white spots towards the end, the extreme tips being mottled brown. There is an imperfect white moustache stripe; centre of the throat chestnut buff with black cross markings, on each side of the throat the feathers have white bases, which form a white patch; the buff markings are continued round the sides of the neck forming an imperfect collar; fore-neck and breast dusky brown mottled with ash colour; abdomen and lower tail coverts whitish-buff with brown bars.

Females are darker; the spots on the wing quills are smaller, and buff instead of white; the tail feathers have no white tips, and the throat patches are buff.

Bill vinous-brown, paler at the gape and black at the tip: iris deep brown; legs and feet vinous-brown.

Length 10·5; wing 7·25; tail 5; tarsus ·6; bill from gape 1·25. Females slightly smaller.

Distribution.—Occurs mainly on the hills of the central ranges down to about 3,000 feet, but Legge also found it in the forests at the foot of Friar's Hood in the Eastern Province.

Blanford again unites in one species three forms: *C. kelaarti*, from Ceylon and South India; *C. indicus*, which occurs over the greater part of India and Burma; and *C. jotaka*, a larger bird which ranges from the Amur and Japan through South-eastern Asia to New Guinea.

Habits, &c.—Occurs chiefly on the patanas, open forest glades, and "eliyas" of the higher hills. During the day it lies up among the rocks at the edge of the jungle, coming out in the evening.

The cry is described by Legge as "chump-pud" repeated at intervals. It is noisiest in the breeding season, which occurs about April.

The usual two eggs are laid on the ground under a bush. The ground colour is salmon-pink, with brown and purplish-gray markings. Average size (in the small South Indian race) 1·15 by ·86.

Sub-order PODARGI.

Family PODARGIDÆ.

Genus **Batrachostomus.**

Frogmouths.

The Frogmouths closely resemble the Nightjars in their general appearance and habits, but are readily distinguished by the bill, which is extremely broad, and flat, rigid, and horny, while the tip is hooked. There are no true rictal bristles, but at the base of the bill on each side is a tuft of bristly feathers. There are similar tufts in front of the eyes, while the feathers of the ear tufts also end in bristles. The wings are rounded and short. The nest is either a structure of twigs, or a pad of moss, &c., placed on a branch. The eggs, one or two in number, are white and glossless. Frogmouths are found in South India, the Eastern Himalayas, South-eastern Asia, and Australasia. One species occurs in Ceylon.

BATRACHOSTOMUS MONILIGER (Blanford, Vol. III., p. 196; Legge, p. 331).

The Ceylonese Frogmouth.

Description.—Male: In a beautiful gray bird from the North-Central Province the general colour of the upper plumage is lichen-gray, mottled with soft black. The feathers of the crown and back end in black spots with a minute tip of white or buff; an indistinct white collar on the hind-neck; the outer feathers of the scapulars almost entirely mottled white, with the same terminal black spots and white specks as on the crown feathers, the inner scapulars are pale only on the outer web. Some of the wing coverts have conspicuous white spots. Primary and outer secondary quills dull blackish-brown, notched with black or rufous on the outer web; tail mottled gray with narrow wavy dark cross bars. Under surface the same mottled gray as the back, with an imperfect white gorget; the abdomen much paler. Some birds, probably older, are less mottled and much more rufous.

Females are reddish-brown with faint blackish mottlings, and have an indistinct white collar, sometimes wanting, on the hind-neck; there are minute black tips to a few of the scapulars, and white spots on a few of the longer wing coverts; the tail feathers bear traces of narrow dark bars.

The feathers of the throat have sub-terminal black bars and white fringes; a few similar feathers are scattered over the abdomen.

Bill olive-brown, paler on the lower mandible; iris dull yellow; legs yellow or fleshy brown.

Dimensions vary considerably; length 7·75–9; wing 4·3–5; tail 4–4·75; tarsus about 5; bill from gape about 1·4.

Distribution.—Occurs in the heart of the jungle probably all over the Island, but very seldom seen. Specimens have been obtained from sea level to nearly 6,000 feet up. It is also found in the Wynaad and Travancore.

Habits, &c.—A sluggish nocturnal bird frequenting thick bamboo jungle or dense forest growths. During the day it lies fast asleep perched across a branch with its bill turned

upwards. A. L. Butler reported it as common round Medagama in Uva, and describes the cry as a rapid "coorroo, coorroo, coorroo." Legge also noticed a chuckling cry as fairly common in the northern forest tract and in Ratnapura, and attributed it to this species, which is more abundant than generally supposed. The nest is a small pad of dead leaves, lichen, &c., woven in with vegetable down, and placed in the fork of a sapling at some height from the ground. The breeding season is probably from Christmas to April. The single egg is pure white and glossless; the texture is fine, but the shell is rather fragile and porous; the shape is long and cylindrical, with little difference between the two ends. Average measurement about 1·19 by ·80.

Order **TROGONES.**

Family Trogonidæ.

Genus **Harpactes.**

Trogons.

The Trogons form a well-marked group of forest birds found in the tropical regions of Asia and America, and in Africa south of the Sahara. They are noted for their brilliant colours, soft plumage, and tender skin, and may be told apart from all other birds by the structure of their feet. The first and second toes are turned backwards, the third and fourth forwards. Herein they differ from the zygodactylic orders, in which the first and fourth toes are turned backwards. The bill is short, strong, and wide; the tip of the upper mandible is hooked and notched; the nostrils and chin are covered with bristles. In the only Indian genus the wing is short and rounded; the tail is long, with broad feathers, which are square-tipped in adults and pointed in young birds; the tarsi are short and half feathered; the feet are small.

All Indian species feed on insects, captured mainly while flying, but sometimes picked up from the ground. They breed in the hollows of rotten stumps or branches, laying three creamy white eggs on the bare wood. Only one species is found in Ceylon.

HARPACTES FASCIATUS (Blanford, Vol. III., p. 199; Legge, p. 269).

The Malabar Trogon.

Description.—Male: Head, neck, and upper breast dull black, the breast slightly tinged with slate gray; back, scapulars, and the short wing coverts along the forearm yellowish-brown; rump and upper tail coverts slightly paler. Wings mainly black; the unexposed bases of the primary quills are white, and all primaries, except the first, have a well-defined white outer edge; outer webs of secondary quills, the whole of the tertiaries, and the wing coverts, except those on the forearm, black, daintily barred with fine, close set, wavy white lines. The middle tail feathers are chestnut, tipped with black, in the next two pairs the black increases on the inner web, while the three outer pairs have black bases and long white tips. A white band across the chest divides the dark upper breast from the pale crimson of the rest of the lower plumage.

Females: Head and neck olive-brown; upper breast lighter brown; chin blackish; the bars on the wing coverts and inner wing are light brown instead of white, while the second and third pair of tail feathers have more chestnut. There is no white chest band, and the under parts from the lower chest to the vent are brownish-buff.

Immature males have a brownish head and neck, the bars on the wings are fulvous, the chest feathers are mixed with gray, and the breast and abdomen with rusty buff.

Bill deep blue; iris dark brown; legs grayish-blue.

Length 11; wing 4·7; tail 5·7; tarsus ·6; bill from gape 1. Females slightly smaller. Indian birds are larger.

Distribution.—Occurs in high forest all over the Island. It is also found on the Malabar Coast and in parts of Central India.

Habits, &c.—May be found in thick forest. The birds generally go about in pairs and spend most of their time perched bolt upright on a large branch, flying out now and again to catch insects. The breeding season is about May. Three very glossy pale buff eggs are laid in a hollow in a rotten stump 6 to 12 feet off the ground. Average size about ·94 by ·82.

Order **COCCYGES.**

Family Cuculidæ.

The Cuckoos, Koels, Malkohas, and Coucals are comprised in one family—*Cuculidæ*—which is united with an African group, the Plantain-eaters—*Musophagidæ*, to form the Order *Coccyges*.

The birds of this order show some affinities in their anatomy with the Parrots and also with the Game birds. The *Cuculidæ* are found almost all over the world, but are most numerous in the tropics. The feet are zygodactylic, the first and fourth toes being directed backwards. The young are hatched naked, and acquire their feathers without passing through a downy stage. The family is divided by Blanford into two sub-families : the *Cuculinæ*, or true Cuckoos, which have the tarsus feathered in front, and the *Phœnicophainæ*, in which the tarsus is naked.

Sub-family *Cuculinæ*.

Cuckoos.

The true Cuckoos are a curious group of birds with parasitic breeding habits. Nearly all the species, instead of pairing, indulge in promiscuous intercourse, while the eggs are placed in the nests of other birds. In most cases the females appear to lay their eggs on the ground, and convey them in their bills to the chosen nest. As soon as the young cuckoos grow large enough, they eject the young of their foster parents from the nest.

Cuckoos are found nearly all over the world ; most species are migratory, or partially so. They are wholly or mainly insectivorous. The bill is of moderate size, slightly curved towards the tip, and pointed ; the wing is more or less pointed, and the tarsus more or less feathered in front. In most genera the measurement of the tail is equal, or nearly equal to that of the closed wing. In one genus, *Coccystes*, it is much longer. The last-named genus is also differentiated by a pointed crest and rather rounded wings, and forms a connecting link between the typical forms of the present sub-family

and the *Phœnicophainæ*. The various species of the genera *Cuculus* and *Hierococcyx* are very hawk-like in their flight and outward appearance, but may be recognized by their head and bill, which are much longer in profile than those of a bird of prey, and by their zygodactylic feet. The genus *Surniculus* closely mimics the Black Drongo.

Those who care to know more about the breeding habits and eggs of this group will find an interesting series of articles with coloured plates in Volume XVII. of the Journal of the Bombay Natural History Society.*

Ten species, which include representatives of all the seven Indian genera, are found in Ceylon, but several of them are rare migrants, and one is rather a doubtful inclusion in our list.

Rough Key to Ceylon Cuculinæ.

A.—No crest ; tarsus feathered.

I.—Wing over 5·6 ; appearance hawk-like.

(*a*) Tail not regularly cross-barred ; primary quills twice the length of secondaries. Genus *Cuculus*.

(1) Wing 8 or over ; tail same shade of brown throughout.

C. canorus (The Cuckoo).

(2) Wing about 6.

C. poliocephalus (The Small Cuckoo).

(3) Wing about 7·5 ; a broad black band at end of tail.

C. micropterus (The Indian Cuckoo).

(*b*) Tail regularly cross-barred ; primary quills half as long again as secondaries.

Hierococcyx varius (The Common Hawk Cuckoo).

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* "The Oology of Indian Parasitic Cuckoos" (J. B. N. H. S., Vol. XVII., pp. 72, 351, 678), by E. C. Stuart Baker.

II.—Wing 5 inches or under and comparatively shorter, primaries only one-third longer than secondaries.

(*a*) Bill fairly slender, not compressed ; wing about 4·5; adult plumage unbarred ashy-gray; immature birds suffused with rufous on throat and chest, and with barred upper plumage.

Cacomantis passerinus (Indian Plaintive Cuckoo).

(*b*) Bill stouter and compressed ; wing about 5 ; no distinct immature dress ; plumage always barred ; no rufous on throat and chest.

Penthoceryx Sonnerati (Banded Bay Cuckoo).

III.—Sexes dissimilar ; upper plumage metallic green or bronze ; wing about 4·4.

Chrysococcyx maculatus (Emerald Cuckoo).

IV.—Plumage black; appearance mimics that of the Drongo ; wing about 5.

Surniculus lugubris (The Drongo Cuckoo).

B.—A distinct crest ; tarsus feathered only at the base. Genus *Coccystes*.

(*a*) Wing under 6 ; upper parts black.

C. jacobinus (Pied Crested Cuckoo).

(*b*) Wing over 6, and mainly chestnut coloured ; a white collar.

C. coromandus (Red-winged Crested Cuckoo).

CUCULUS CANORUS (Blanford. Vol. III., p. 205 ; Legge, p. 221).

The Cuckoo.

Description.—Adult : Upper plumage ashy-gray, paler, and tinged with bluish on the rump and upper tail coverts ; wing quills brown, the inner webs with deep notches of white ; tail feathers blackish-brown with white tips, the margin of the inner webs spotted with white, and a few white markings along the shafts. Throat and fore-neck pale ashy-gray, blending on the sides of the neck into the darker hue of the upper

plumage ; rest of lower parts and wing lining white with narrow wavy bars of brownish-black.

Young, First Stage: Feathers of upper parts dark brown, barred with rufous and edged with white. A white spot on the nape. Lower plumage broadly barred with brownish-black and white ; tail browner than in adults and more boldly spotted ; as the birds grow up the rufous bars on the upper plumage are lost, except on the wings.

Second Stage : The black bars on the under parts become narrower ; the upper plumage, wings, and tail are barred with pale rufous. As the birds reach maturity the white nape spot disappears, while ashy patches appear on the upper parts and spread until they wholly replace the rufous bars.

Bill dark horn colour, orange-yellow at the gape, and yellowish on the edges and at the base ; iris yellow ; legs yellow. In young birds the lower mandible is pale green and the iris brown.

Length about 13 ; wing 8–9 ; tail about 7 ; tarsus ·8 ; bill from gape 1·2. The dimensions are variable.

Distribution.—The Common English Cuckoo is one of our rarest hill migrants. Two or three specimens have been obtained during the north-east monsoon in Dikoya and Kotmale and Layard once shot a specimen in Colombo while migrating. It is found practically over the whole of the Old World, breeding in the north and centre of its range, and wintering in the tropics, occasionally going as far south as Australia.

Habits, &c.—Should be looked for on the borders of woods. The well-known call is uttered only by the male in the breeding season, so is not likely to be heard in Ceylon. In flight and appearance it is singularly like a hawk. It feeds on caterpillars, grubs, and insects.

Cuculus poliocephalus (Blanford, Vol. III., p. 208; Legge, p. 231).

The Small Cuckoo.

Description.—Adult : Very similar to the last species, but considerably smaller ; the black bars on the breast are broader.

Young birds pass through three stages. In the nestling plumage the feathers of the upper parts are blackish-brown with white margins; chin and throat almost wholly black; rest of lower parts white broadly barred with black.

Second Stage: Chin and throat imperfectly barred with white and tinged with rufous; the white margins on the upper plumage become smaller, while a white spot, sometimes extending to a half collar, appears on the nape.

Third Stage: The white disappears from the nape; the upper parts become bright chestnut with black bars, as the birds approach maturity the black bars disappear from the neck, rump, and tail coverts, while the throat and breast are tinged with rufous.

Lastly, the ashy adult plumage appears in patches which spread. All the changes from one phase to another are gradual.

Bill blackish, the gape and the base of the lower mandible yellow; iris brown; legs and feet yellow.

Length about 10; wing about 6; tail 5–6; tarsus ·75; bill from gape 1.

Distribution.—Breeds in the Himalayan countries, China, and Japan. In winter it migrates southwards, and has occasionally been recorded from Ceylon. It also occurs in Madagascar and Africa south of the Equator.

Habits, &c.—Appears to be a very tame bird, "frequenting low trees and stunted jungle near open places" (*Legge*). The cry appears to be uttered only in the breeding season, and is a loud, harsh call of several syllables.

Cuculus micropterus (Blanford, Vol. III., p. 210; Legge, p. 228).

The Indian Cuckoo.

Description.—Adult: Upper plumage ashy-brown, grayer on the back of the neck and head; the wing quills have deep notches of white on the inner webs. Tail light smoky brown, with a broad dark sub-terminal bar and a white tip. The tail feathers also have white or buff marks on the edges, and on the shafts white spots, which on the outer feathers form irregular bars. Throat and neck pale gray, sides of the face

darker ; rest of lower parts creamy white with broad black bars. The bars are narrower and more distant on the under tail coverts and wing lining.

Females are browner on the throat and neck.

Immature birds are brown above ; the head and neck mottled with white and rufous ; the feathers of the back and wings tipped with rufous ; lower parts buff, barred with dark brown ; the markings on the tail are more rufous and banded. The change to adult plumage is gradual.

Bill horny black, the lower mandible fleshy ; iris brown ; legs yellow.

Length about 12·25 ; wing about 7·5 ; tail 6·25 ; tarsus ·8 ; bill from gape 1·25.

Distribution.—Said to be rare in Ceylon, and apparently a migrant. Specimens have been recorded from various localities both in the low-country and in the hills. In the breeding season it is found in the Himalayas and Assam hills, and ranges north to Eastern Siberia, China, and Japan. In winter it is found over most of India, though rarer in the south, and extends south-eastwards through Burma, &c., to the Malay Archipelago.

Habits, &c.—This species has a very hawk-like appearance. It keeps to the tops of trees in tall forest, especially on hill slopes, and is a very shy bird. The call is described as a melodious double note of two syllables in each part, represented by its Bengali name of "Boukotako." It may be the bird whose call is not uncommonly heard in the Eastern Province, where it is known as "Captain Philpots." I have also heard this call in the Medagama hills and near Polonnaruwa, but have never seen the bird or met any one who has done so.

Hierococcyx varius (Blanford, Vol. III., p. 213 ; Legge, p. 240).

The Common Hawk Cuckoo.

Description.—Adult : Upper plumage dark ash-gray, darkest on the back and palest on the rump and upper tail coverts. Wing quills browner, with broad white bars on the inner webs ; tail ash-brown crossed with four or five bars of blackish-brown, each of which is bordered behind with a pale rufous

band. Lores, cheeks, and ear coverts bluish ash colour ; chin and throat whitish ; fore-neck and breast rufous mixed with pale ash colour ; the rest of the lower parts shade from rufous on the breast to white on the lower tail coverts, and are barred with ashy-gray.

Young birds are dark brown above with rufous crossbars ; the lower parts are tinged with rufous and marked from the throat to the abdomen with rufous-brown drop-shaped markings ; tail as in adults, but more rufous. The adult plumage is gradually assumed.

Bill horny black on the upper mandible, lower mandible and gape yellowish ; iris in adults yellow or orange, in young brown ; legs and feet yellow.

Length about 13·5 ; wing 7·5 ; tail 6·75 ; tarsus ·95 ; bill from gape 1·25. Dimensions are rather variable, and females are smaller than males.

Distribution.—A migrant to Ceylon, arriving early in November, and making at once for the hills. It is found as a resident over all India westward of the Bay of Bengal, except in the Punjab, Sind, and Assam.

Habits, &c.—This is the true "Brain-fever Bird." Its cry is a piercing "pïpceha," repeated several times in an ascending scale. In Ceylon it is found in big jungle, especially on the borders of the grassy "eliyas" in the higher ranges. It does not appear to be very abundant.

Cacomantis passerinus (Blanford, Vol. III., p. 216). Cuculus passerinus (Legge, p. 235).

The Indian Plaintive Cuckoo.

Description.—Adult : Upper plumage dark ash colour with a greenish gloss on the mantle. Wing quills brown, with a white patch near the base of the inner webs. Tail feathers nearly black, with white tips and oblique bands of white on the inner webs, most noticeable on the outer feathers. Lower plumage ashy, paler on the abdomen ; the edge of the wing, the vent, and lower tail coverts are white.

Young birds are largely rufous, and pass through three stages. At first the upper plumage is dark glossy brown, with rufous edges to the feathers ; tail black, with broad white and

rufous bars and marks; lower parts white, with dull brown bars; throat and breast tinged with rufous.

Second Stage: Upper parts and sides of head and neck bright chestnut, with broad black bars on the back and wings, and a few black spots on the head, hind-neck, rump, and tail coverts; tail feathers chestnut, with irregular black markings on the shaft and a large black patch near the tip, which is usually white.

Third Stage: The head, hind-neck, back, rump, and tail coverts lose their spots, the dark bars on the wings change to spots; the tail feathers lose all black marks, save the patch near the end, and many of the bars on the throat and breast disappear, leaving these parts bright chestnut. Young birds can always be distinguished from the next species by their slightly smaller size, more slender bill, and by the rufous tint of the throat and breast. The change from one stage to another is gradual.

Bill dark brown; iris reddish- or grayish-brown; legs and feet dingy yellow or grayish.

Length about 9; wing 4·5; tail 4·5; tarsus ·65; bill from gape 1.

Distribution.—Apparently a migrant, appearing during the north-east monsoon, and wandering all over the Island. It is commonest in the drier parts of the low-country, and does not ascend to any great height. It occurs over the greater part of India.

Habits, &c.—This species frequents low and scrubby jungle, the edges of open spaces round tanks, &c. It is a restless and rather wary bird. In India during the breeding season it has a plaintive, ventriloquistic note, described by Jerdon as "ka-veer, ka-vee-eer." During its stay in Ceylon it appears to be silent. A few birds may possibly remain and breed in Ceylon, as the species is resident over the greater part of its range in India. The eggs have been found in the nest of the Tailor Bird—*O. sutorius*. These are of a white type, rather larger than the eggs of its host, with a few reddish spots. Another type of egg is blue, with even more scanty spots. In India it also lays in the nests of the Common Wren Warbler (*P. inornata*) and the Yellow-eyed Babbler (*P. sinensis*).

PENTHOCERYX SONNERATI (Blanford, Vol. III., p. 219).

CUCULUS SONNERATI (Legge, p. 233).

The Banded Bay Cuckoo.

Description.—In this species the adult plumage remains barred, and resembles that of the immature bird. Upper plumage dark brown, lustred with green and barred with rufous; forehead more or less mottled with white; wing quills dark brown, the outer webs with a narrow rufous margin, and the inner with a broad rufous white border; middle tail feathers brown with indented rufous edges; the other feathers have white tips, and the rufous borders increase, the outermost feathers being mainly rufous with irregular brown bars. The lower parts from chin to tail coverts, together with the sides of the head and neck, are buffy-white with many narrow, wavy crossbars of dark brown; the ear coverts are darker.

Bill black above and at the tip, greenish-yellow underneath; iris brownish or yellowish-red; legs and feet brownish-slaty, or bluish-lead colour.

Length about 10; wing 5; tail 4·85; tarsus ·7; bill from gape 1·1. Females rather smaller: wing 4·75.

Distribution.—Resident in Ceylon; found almost all over the Island; commonest in the Eastern Province, but nowhere numerous. Mr. Stuart Baker informs me that the Ceylonese form is a good sub-species, recognizable at a glance from typical *P. sonnerati*, a reddish form, which occurs in India and Burma, by its almost blackish colouration. He has done me the honour of naming the Ceylon sub-species *P. sonnerati waiti*. Allied sub-species occur in Java and Malaya.

Habits, &c.—Frequents the edges of tanks where there are dead trees, also chenas and the park country. It is a shy bird, keeping to the tops of trees. It is noisy in the mornings and evenings, giving out a curious whistle, which Legge represents by "whi-whip, whi-whip—whi-whip, whi-whip." It has also a call note, beginning in a low key, changing to a higher, and then dying away.

In India this Cuckoo is reported as laying its eggs in the nests of the Southern Red-whiskered Bulbul (*O. fuscicaudata*), a species not found in Ceylon; also in the nests of the Small

White-throated Babbler (*D. albogularis*) and the Common Bush Bulbul (*Æ. tiphia*). An egg taken from the oviduct is described as brownish-pink, speckled and freckled with reddish-brown. The size is about ·76 by ·63; the shape a broad blunt oval, slightly pointed at one end. The texture is smooth and fine and somewhat glossy.

Chrysococcyx maculatus (Blanford, Vol. III., p. 222).

Cuculus maculatus (Legge, p. 238).

The Emerald Cuckoo.

Description.—Adult Male: Head, neck, upper breast, and upper parts glossy green tinged with bronze; wing quills brown; a white patch on the basal portion of the inner webs of most of the primaries; outer tail feathers tipped with white, the outermost pair with three white bars; lower breast, wing lining, and abdomen banded with white and metallic green or bronze; under tail coverts green with narrow white bars.

Females and Immature Males: Crown and back of neck pale rufous, generally barred with white and dark brown; back, wings, and tail metallic green tinged with yellow or coppery bronze; wing quills brown with rufous patches on the inner webs; central tail feathers tipped with coppery bronze; outer feathers barred with chestnut and black and tipped with white; under surface barred white and copper.

Bill orange-yellow, black at the tip; iris red-brown; legs and feet reddish-brown.

Length 7; wing 4·4; tail 2·9; tarsus ·6; bill from gape ·85.

Distribution.—The specimen figured in Brown's "Illustration of Indian Zoology, 1776," is said to have been obtained in Ceylon by the Dutch Governor Loten. As the bird has never been seen in the Island since, its place in the Ceylon list is a little doubtful. It occurs in the Lower Himalayas and the Assamese hills, and ranges eastward through Burma and Malaya to Sumatra. It is nowhere common.

Habits, &c.—This species keeps to the tops of trees in forest. It feeds entirely on insects.

SURNICULUS LUGUBRIS (Blanford, Vol. III., p. 223 ; Legge, p. 243).

The Drongo Cuckoo.

Description.—Adult : Black all over, with a green and purple gloss, which is brightest on the upper plumage ; there are white patches on the inner webs of the primary quills ; the outermost tail feathers are crossed with slanting bars of white, and there are a few white spots on the next pair ; there is also a little white on the thighs and lower tail coverts.

Fledglings are speckled all over with white, each feather, except the wing quills, being marked with a clear white spot on the centre near the tip ; these white spots gradually disappear, but often a few spots remain after maturity on the nape and upper tail coverts.

Bill black ; iris brown ; legs blackish. Length about 10 ; wing 5·1 ; tail 5·5 to end of longest quill ; tarsus ·60 ; bill from gape 1·0.

Distribution.—Locally distributed throughout the low-country and up to about 4,000 feet ; in some districts it is possibly a partial migrant. In the peninsula of India it is very rare, but it is commoner on the Himalayas west of Nepaul, and ranges through Burma to Borneo and Java.

Habits, &c.—This species frequents the undergrowth and low branches of trees throughout the northern forest tract ; it is also found in scrub jungle, chena clearings, and on patanas dotted with trees. It is by no means shy. The call, heard chiefly during the north-east monsoon, is a clear whistle of six ascending notes. The food consists of seeds, as well as of caterpillars and beetles. As the adults in their appearance closely mimic Drongos, it was for long supposed that this species deposited its eggs in the nest of the Drongo. It will be seen, however, that the fledgling is most unlike that of the Drongo, and I have lately obtained clear evidence that in Ceylon this Cuckoo lays in the nest of the Black-fronted Babbler (*R. nigrifrons*), as in May, 1917, in the Puttalam District, a nest of this species was brought to me tenanted by a young Drongo Cuckoo. Previously to this, Mr. E. C. Stuart Baker had seen a strange egg taken by me from a Black-fronted Babbler's nest and had assigned it tentatively to this

Cuckoo. This egg was taken in the Southern Province also in May. In shape it is an elliptical oval, measuring ·83 by ·61. The ground colour is white, with a very faint pink tinge, fairly profusely spotted with reddish-brown and dull inky purple. This Cuckoo may also possibly lay in the nests of the Bush Bulbul (*Æ. tiphia*).

Coccystes jacobinus (Blanford, Vol. III., p. 225; Legge, p. 246).

The Pied Crested Cuckoo.

Description.—Adult: Upper plumage and sides of the head black, glossed with green and purple. Wing quills brown with a broad white band across them; the tail feathers have white tips, which on the central feathers are narrow and tend to be abraded; under parts and wing lining dirty yellowish-white.

Immature birds are brown above; the markings on the wings and tail are buff; the chin and throat are gray; remainder of lower parts buff.

Bill black; iris reddish-brown; legs leaden blue.

Length 12 to 13; wing 5·5 to 6; tail about 6·5; tarsus 1·0; bill 1·1.

Distribution.—Found fairly widely over the low-country, commonest near the sea. It is resident in the drier zone, but in the wet districts it is apparently a migrant during the north-east monsoon. It may be found up to about 3,000 feet. It occurs throughout India and Upper Burma, and ranges through South-west Asia to the whole of South Africa south of the Sahara.

Habits, &c.—Usually found in scrub jungle, the fringes of open spaces in the forest zone, and in open plains. It is generally met with singly or in pairs, but in the Hambantota District I have seen flocks of as many as twelve perched on low rushes in swampy ground and hunting for flies. The note is a distinctive high metallic whistle. The eggs are laid in the nests of the Southern Indian Babbler, *Crateropus striatus*, and the breeding season appears to be as extended as that of their host, for I have taken eggs from November to June, and again in August. I have several times found two of these eggs

in one nest, but never more. They closely resemble the Babbler's eggs in size and colour, but are generally of a slightly different shade. They are broadly elliptical in shape, sometimes with rather square ends, the shell is hard, the surface smooth, satiny, and slightly pitted, while the "white" is greenish instead of being colourless as in Babbler's eggs. The average of a dozen Ceylon eggs is ·94 by ·76.

Coccystes coromandus (Blanford, Vol. III., p. 226; Legge, p. 249).

The Red-winged Crested Cuckoo.

Description.—Crown, nape, and sides of head black; a blue-green gloss on the longish crest; a clearly marked half collar of white on the hind-neck. The back, scapulars, inner wing coverts, and tertiaries are black glossed with green; the remaining coverts and the wing quills chestnut; rump, upper tail coverts, and tail black, the two former glossed with green, the last with purple; outer tail feathers narrowly tipped with white. The throat and fore-neck are chestnut-buff; breast and upper abdomen white; lower abdomen, vent, and thighs dusky gray; under tail coverts black glossed with violet.

In young birds the feathers of the upper parts are tipped with rufous; chin and throat whitish; under tail coverts and edges of the tail feathers buff.

Bill black; iris hazel brown; legs and feet lead colour.

Length 15 to 16; wing about 6·4; tail 9·5; tarsus 1; bill from gape 1·4

Distribution.—A rare bird, found here and there throughout the Island up to about 4,000 feet. The majority of the specimens appear to be migrants, arriving in October and leaving about Easter, but it is possible that in the northern forest tract some birds stay all the year round, and I have an egg found in the Puttalam District, which probably belongs to this species. This Cuckoo is very rare in the Indian Peninsula, but ranges from Nepaul, through Assam and Burma, to China and the Malay Archipelago.

Habits, &c.—Found singly or in pairs in thick scrub and thorny jungle. It feeds on caterpillars, beetles, &c. In the north of the Island the eggs may be looked for in the nests of

the Southern Indian Babbler, *C. striatus*, or possibly in those of the Magpie Robin, *Copsychus saularis*. They resemble those of the last species, but are larger and of a slightly paler blue. An egg from near Puttalam, which probably belongs to this species, measures 1·04 by ·83. The average size of Indian eggs is about 1·06 by ·90.

Sub-family *Phœnicophainæ*.

Koels and Coucals.

The Koels, Malkohas, and Coucals are a cuculine group, typically represented in Ceylon by the familiar Crow Pheasant, frequently but erroneously termed the "Jungle Crow" and the Koel. They are all birds of moderate size, with short, rounded wings and long, broad tails; the bill is generally stout, and the upper mandible much curved; the tarsus is always naked. Most of them are ground feeders, and are found in thorny scrub, thick jungle, or long grass. Their powers of flight are poor, but they slip through tangled thorn bushes and undergrowth with surprising ease. The Koel, *Eudynamis honorata*, like the true Cuckoos, is parasitic in its nesting habits, and its eggs approach in colour and markings those of the crows, in whose nests it lays. The other members of the sub-family build their own nests and lay chalky-white eggs. Seven species representing five genera are found in Ceylon. Several of them are rare or local, while one—*Phœnicophæs pyrrhocephalus*—placed in a genus by itself, is peculiar to the Island.

Rough Key to Ceylon Phœnicophainæ.

A.—Tail and wing measurements equal; male glossy black; female glossy brown speckled with white.

Eudynamis honorata (Koel).

B.—Tail measurement longer than that of wing.

I.—Tail tipped with white.

(1) Upper plumage gray, glossed with green; naked skin of face bluish.

Rhopodytes viridirostris (Small Green-billed Malkoha).

(2) Upper plumage glossy green ; naked skin of face red.

Phœnicophæs pyrrhocephalus(Red-faced Malkoha).

(3) Plumage sandy brown ; back and breast feathers spiny.

Taccocua leschenaulti (The Sirkeer Cuckoo).

II.—Plumage black ; wings chestnut. Genus *Centropus*.

(*a*) Wing lining black.

(1) Bill black.

C. sinensis (Common Coucal).

(2) Bill green.

C. chlororhynchus (Ceylonese Coucal).

(*b*) Wing lining chestnut.

C. bengalensis (Lesser Coucal).

EUDYNAMIS HONORATA (Blanford, Vol. III., p. 228 ; Legge, p. 251).

The Indian Koel.

Description.—Male : Black all over with a bluish-green gloss.

Female : Upper plumage brown with an olive gloss ; the head, black, and wing coverts speckled, and the wing and tail quills barred with white ; throat and fore-neck brown with white streaks, which change to wavy crossbars on the rest of the lower parts.

Young birds at first are black like the males, then become barred and spotted like the females, only the spots and bars on the upper plumage are rufous. Males then gradually assume their adult plumage, and females their adult markings.

Bill dull green ; iris crimson ; legs plumbeous.

Length about 16 ; wing 7·5 ; tail about 7·5 ; tarsus 1·2 ; bill from gape 1·5.

Distribution.—Common all over the low-country, but rather more local in the north than in the south. It appears to wander about to some extent, but does not ascend the hills to any great height. It occurs practically all over India, except on the higher slopes of the Himalayas, and ranges through Burma to China and the Malay Archipelago.

Habits, &c.—A noisy bird, familiar to most people in Ceylon. Its cry of "kuil, kuil" is uttered most persistently during the breeding season; the male has another call "ho-iy-o." The birds skulk from tree to tree, and seldom remain long in the open. They feed on fruit for the most part. The breeding season is in June and July. Near the coast, where the Gray Crow is found, the eggs are laid in the nests of that species, elsewhere in the nests of the Black Crow. As many as five Koel's eggs have been found in one Crow's nest, and I have several clutches of four. They are noticeably smaller than Crow's eggs, and, as a rule, more dumpy. The ground colour is a grayish- or brownish-green, blotched and spotted with reddish-brown. The average size of a fair Ceylon series is 1·23 by ·94.

Rhopodytes viridirostris (Blanford, Vol. III., p. 231).

Zanclostomus viridirostris (Legge, p. 258).

The Small Green-billed Malkoha.

Description.—Upper parts gray with a greenish gloss, most noticeable on the wings and tail; tail broadly tipped with white; under parts ashy; the feathers of the throat and fore-neck are forked, which gives these parts a streaky appearance; the breast and abdomen are more or less tinged with rufous.

Bill pale leaf-green; iris blood-red; a small naked patch of bluish skin round the eye: legs dusky greenish or bluish.

Length about 15·5; wing 5·25; tail 8·5 to 9·5; tarsus 1·35; bill from gape 1·35.

Distribution.—Found all over the low-country, but most numerous in the drier parts of the Island. It does not appear to ascend the hills to any great height. It also occurs in the southern half of the Indian Peninsula.

Habits, &c.—Found in thickets and thorny scrub, flitting through the bushes, but seldom coming out into the open. It feeds on both fruit and insects. The breeding season appears to extend throughout the year, as I have taken eggs from January to November. The nest is rather a flimsy structure of twigs placed at no great height from the ground in a thorny bush. It often contains a sprig of green leaves, on which two

or sometimes three eggs are laid. The bird sit fairly close. The eggs are blunt ovals with little difference between the two ends. They are dull white, and chalky in texture. Average size 1·21 by ·96.

PHŒNICOPHAËS PYRRHOCEPHALUS (Blanford, Vol. III., p. 234; Legge, p. 255).

The Red-faced Malkoha.

Description.—Crown, sides, and back of neck black, glossed with green and streaked with white; remainder of upper plumage deep glossy green, the wing quills and tail with a bluish lustre; tail feathers with long white tips, longest on the outer feathers; chin and feathered portion of cheeks white with black shaft streaks; throat and fore-neck glossy black; remainder of lower parts white.

The feathers of the head and neck are forked; the whole side of the face from the bill to the ears is covered with a short stiff crimson growth resembling rudimentary feathers.

Young birds have only a bare brick-red naked patch round the eye; the streaks on the crown are dull gray; the black feathers on chin and throat are streaked with white; the tail feathers are shorter and less broadly tipped with white than in adults.

Bill apple-green, paler below; iris in males brown, in females white; legs and feet bluish.

Length about 18; wing 6·25; tail 11; tarsus 1·4; bill from gape 1·55.

Distribution.—Peculiar to Ceylon; found in thick forest and heavy jungle over most of the medium and wet zones. It ascends the southern hill ranges as high as Haputale.

Habits, &c.—A very shy bird, not uncommon in the wilder stretches of forest, but seldom seen near cultivation. It feeds mainly on fruit, and travels about in small parties. The breeding season appears to be about May. The nest probably resembles that of the preceding species. The eggs, two or three in number, are also similar, but slightly less chalky on the surface. They are short broad ellipses, practically the same at both ends. Average measurement about 1·40 by 1·04.

Taccocua leschenaulti (Blanford, Vol. III., p. 237 Legge, p. 266).

The Sirkeer Cuckoo.

Description.—Upper plumage olive or sandy brown, with a gray-green gloss on the back and wings; the shafts of the feathers on the head, neck, mantle, and chest are glossy black and spiny. The middle tail feathers are of the same colour as the back, the others blackish with broad white tips. The chin and throat are pale buff or whitish; fore-neck and upper breast darker and grayish or brownish; remainder of lower plumage rufous, and much darker in some birds than in others.

Bill cherry-red with a yellowish tip; iris reddish-brown; feet lead colour.

Length about 16; wing 6·1; tail 8·60; tarsus 1·6; bill from gape 1·4.

Distribution.—Found mainly in the tract between the Haputale hills and Hambantota, also on the eastern slopes of the Uva and Central Province ranges and the park country at their foot. Fairly widely distributed in the Indian Peninsula, but nowhere common.

Habits, &c.—A shy bird, found chiefly in the long grass of the patanas and park country. It feeds almost entirely on the ground. In South India the birds breed in March and April. The nest is a loose cup of twigs lined with green leaves.

The three chalky-white eggs measure about 1·39 by 1·07.

Centropus sinensis (Blanford, Vol. III., p. 239).

Centropus rufipennis (Legge, p. 260).

The Coucal, Crow Pheasant, or Jungle Crow.

Description.—The entire plumage, except the wings, wing coverts, and scapulars, black with a metallic gloss, which is mainly purple on the hind-neck, back, and breast, and bluish-green on the tail. The wing coverts, scapulars, and, in some specimens, the inter-scapulars are chestnut. The tips of the quills are dusky, the wing lining black.

Young birds are duller; the upper parts are marked with bars and spots of rufous or white; the wings and coverts are barred with black, the tail is dark brown with narrow whitish bars; the lower parts dull black with grayish-white bars.

Albino specimens sometimes occur. Legge notices one in which the body was white and the wings light brown, and there is a pure white chick in the Colombo Museum collection.

Bill black; iris crimson; legs black.

Length 18; wing about 7·7; tail 9·75; tarsus 1·9; bill from gape 1·75.

Distribution.—Found all over the Island, Blanford unites in one species three fairly well-marked races which occur respectively in Peninsular India, Northern India, and the country from Assam to Burma; the last race is identical with typical *Centropus sinensis* from China.

Habits, &c.—Found everywhere, except in the heart of heavy forests. It feeds on the ground on insects, small reptiles, &c., and is not averse to the eggs and young of smaller birds. It can run with considerable speed. The flight is slow and heavy. The cry is a resounding "kook-kook-kook." The breeding season continues from March till about September. The nest is a large globular affair of sticks, dry leaves, and grass, placed in a thick bush or thorny tree. The three chalky-white eggs are broad, oval in shape, and measure about 1·34 by 1·14.

CENTROPUS CHLORORHYNCUS (Blanford, Vol. III., p. 242; Legge, p. 263).

The Ceylonese Coucal.

Description.—Similar to the last species, only rather smaller and slighter; the gloss on the breast, hind-neck, and upper back is purple and bronze; the wing coverts and wings are darker chestnut, and the quill tips more dusky; the feathers of the crown and nape are longer and looser, and the bill pale instead of black. The young have no distinct plumage.

Bill pale apple-green; iris deep red or dull crimson; legs and feet black.

Length about 17; wing 6·4; tail 9·25; tarsus 1·75; bill 1·7.

Distribution.—Peculiar to Ceylon, and practically confined to the tract between the Deduru-oya and the Nilveli-ganga. It ascends the western slopes of the hills to about 2,500 feet. It is commonest in the dense forests of the Western Province and Ratnapura District, where the rainfall is heavy.

Habits, &c.—An inhabitant of the deep jungle, where the undergrowth is thick and tangled. It very seldom emerges into the open. The cry is a sonorous "hoo-whoop-whoop," given out in the morning and evening, or after rain.

The breeding season appears to last from April to July. The nest and eggs are similar to those of the last species, only a little smaller.

Centropus bengalensis (not in Legge ; Blanford. Vol. III., p. 243, and Vol. IV., p. 485).

The Lesser Coucal.

Description.—Considerably smaller than either of the last two species, but the adult is similarly coloured ; the gloss on the body plumage is purplish, and on the tail green ; the wings are deep chestnut ; the wing lining, however, is chestnut, and not black.

Young birds at first are dark brown, spotted with rufous on the head and neck, and barred with rufous on the back, wings and tail ; under parts rufous-white, with dark spots on the throat and dark bars on the abdomen.

Second Stage : Sides and top of head and neck, the back, scapulars, and wing coverts brown with white on the shafts ; the upper tail coverts are lengthened, and they and the rump are narrowly barred with black ; wings and tail as in adults, save that the tail feathers are tipped with rufous and the wings are more dusky ; lower parts are rufous-white speckled with dark brown on the throat, and with narrow dark bars on the lower abdomen, flanks, and tail coverts. The changes from one phase to another are gradual.

Adults : Bill and legs black ; iris crimson. In the young the bill and iris are yellowish, legs lead colour.

Length about 13 ; wing 5·4 ; tail 7 ; tarsus 1·6 ; bill from gape 1·1. Females are larger : length 14·5 ; wing 6·7.

Distribution.—Mr. A. L. Butler found in the collection of a native dealer a single skin procured in the North-Western Province in April, 1896. It is possibly a rare resident. The species is found in a few localities in Peninsular India. It is commoner in Bengal, and ranges through Burma to Southern China and Malaya.

Habits, &c.—Somewhat similar to those of the common Crow Pheasant, but this species is found mainly in high grass. It feeds largely on grasshoppers. In India the breeding season lasts from May to August. The nest is a domed structure of long grass woven in among growing grass stems. Two or three chalky-white eggs are laid, measuring about 1·17 by 1·01.

Order **PSITTACI.**

Family Psittacidæ.

Parrots.

The Parrots form a distinct order, whose nearest affinities are with the Owls and Hawks. The feet are zygodactylic; the bill is short, stout, and boldly hooked, the upper mandible is loosely articulated to the skull and is movable; the base of the bill is covered by a cere of fleshy skin; the tongue is thick and fleshy. All species lay white eggs in a hollow excavated in the stem or branch of a tree. The young are naked when hatched. Parrots are found all round the world, mainly in the tropics, but one species occurs as far north as Carolina, United States of America, others as far south as New Zealand and Patagonia. They all have more or less the same habits, feeding on fruits and seeds and going about in flocks. The flight is swift and straight, and the cry a harsh scream. They are not well represented in India, as only three genera belonging to one family are found within Indian limits. In Ceylon we have four species of the genus *Palæornis* and one species of *Loriculus*. Out of these five species three are peculiar to the Island.

Rough Key to Ceylon Parrots.

A.—Tail long; the middle feathers much longer than the rest. Genus *Palæornis*.

(*a*) Head and body green; males with, females without, a rose collar on hind-neck.

(1) A large red patch on wing coverts; wing about 8.

P. eupatria (Large Ceylonese Paroquet).

(2) No red patch on wing coverts; wing about 6·3.

P. torquatus (Rose-ringed Paroquet).

(*b*) Head and neck not green, or not wholly green.

(1) Head, in males red with a purple bloom, in females bluish-gray ; upper back green.

P. cyanocephalus (Blossom-headed Paroquet).

(2) Crown and upper back gray ; a bright green collar on neck.

P. calthropæ (Layard's Paroquet).

B.—Tail short ; size small ; length about 5·5.

Loriculus indicus (Ceylonese Loriquet).

PALÆORNIS EUPATRIA (Blanford, Vol. III., p. 247 ; Legge, p. 168).

The Large Ceylonese Paroquet.

Description.—Male : Upper plumage grass-green, most vivid on the forehead, lores, and rump, and darker on the wings ; a faint dark stripe from the nostril to the eye ; a rose-pink collar round back and sides of neck, met by a broad black stripe, which runs from the side of the neck to the lower mandible. The nape just in front of the collar has a grayish-blue bloom. A large dark-red patch on the secondary wing coverts ; the first primary and the inner webs of the remaining quills are dark brown. The central tail feathers pass from green at the base into verditer blue, the tips being yellow. Lower plumage dull pale-green, brightening a little on the flanks and abdomen ; wing lining and lower tail coverts pale green ; lower surface of tail dull yellow.

Females and young lack the rose collar and black mandibular stripe.

Bill deep red, paler at the tip ; iris pale yellow with a bluish-gray inner circle ; legs and feet greenish or grayish lead colour.

Length about 19 ; wing about 8 ; tail up to 11·5 ; tarsus ·75 ; bill from cere 1. Females rather smaller.

Distribution.—Peculiar to Ceylon, but closely allied forms with probably only sub-specific differences occur throughout the greater part of India and Burma. It is widely, but rather locally, distributed throughout the low-country, and is most numerous in the maritime districts of the northern half of the Island ; rare above 1,000 feet, but occasionally found at higher elevations.

Habits, &c.—Found in flocks, generally round villages where coconut plantations border on forest and jungle. The birds usually roost in colonies in coconut groves, flocking with loud screams towards their roosting ground just before sunset. They feed on fruit, berries, and seeds.

The breeding season is from November to about March. The birds usually select natural holes in trees on the outskirts rather than in the interior of forests, increasing these holes to a suitable depth and size. Two to four white glossless eggs are laid. Average size about 1·2 by ·95.

PALÆORNIS TORQUATUS (Blanford, Vol., III., p. 250; Legge, p. 171).

The Rose-ringed Paroquet.

Description.—Smaller, but very similar to the last species, and with the same sexual differences in the plumage. The present species, however, lacks the red patch on the wing coverts, and there is little or no yellow on the tips of the central tail feathers. In the males the rose collar is generally paler and narrower, and the bluish-gray bloom on the neck in front of it is more pronounced. In some birds the green plumage is tinged in places with yellow.

Bill, upper mandible red, lower mandible blackish; iris pale yellow; legs and feet dusky slate colour or greenish.

Dimensions are very variable: length about 15; wing 6·3; tail 9; tarsus ·6; bill from cere ·85.

Distribution.—The most abundant species over the greater part of the low-country, except in the wet zone; it is not found at any great elevation. It occurs throughout India; and ranges through Pegu to Cochin-China.

Habits, &c.—Found in flocks about villages and in open lands or scrub jungle near coconuts. Like the last species, it roosts in dense flocks in coconut groves, and is very noisy when flying home in the evening.

The breeding season is from Christmas time to about April. Four or five white eggs are laid in a hole in a tree. Ceylon eggs appear to be smaller than Indian, two in my collection measure 1·15 by ·85.

PALÆORNIS CYANOCEPHALUS (Blanford, Vol. III., p. 251; Legge, p. 174).

The Western Blossom-headed Paroquet.

Description.—Male: Head red, tinged with a purple bloom on the nape and lower cheeks; chin, throat, and a narrow collar round the neck black; adjoining this collar the sides of the neck and the hind-neck are verdigris green; back and scapulars olive-green; wing coverts green with a wash of verdigris; a red patch on the middle coverts; inner wing quills green with pale edges and dusky black shafts and inner margins; the black increases on the outer quills, the first primary being almost wholly black; rump verdigris green. The central tail feathers are blue with greenish bases and broad white tips; in the next pair only the outer web is blue, the inner web being yellowish-green and the tip yellow; in the remaining feathers the outer web is green, the inner web and tip yellow. Lower plumage yellowish-green.

Females: Head slaty with a blue bloom on the crown and nape; the black collar and throat patch are lacking, being replaced by a yellowish-green ring round the neck; no red patch on the wing coverts.

Young birds are green all over, and gradually assume the coloured hood.

Bill, upper mandible orange-yellow, lower blackish-white or yellowish; iris white or yellowish-white; legs and feet dusky green.

Length about 13·5; wing 5·20; tail about 7·5; tarsus ·5; bill from cere ·6. Females a little smaller.

Distribution.—Common in many parts of the low-country, but avoids the coast, and is distinctly scarce and local in the northern forest tract. In the hills it is fairly common up to 4,000 or 5,000 feet. It is found in suitable districts throughout the greater part of India westwards of the Bay of Bengal.

Habits, &c.—This species feeds largely on grain and native vegetables, and is found mainly round paddy fields and in jungle chenas. Up-country it is partial to hillside patanas.

The breeding season is from February to May; the nest hole is excavated generally in the smaller limbs of dead trees. The eggs are white and glossless. They are usually four in number, and average 1·0 by ·81.

PALÆORNIS CALTHROPÆ (Blanford, Vol. III., p. 256; Legge, p. 177).

Layard's Paroquet.

Description.—Male: Forehead, lores, and a patch round the eye green; rest of head, nape, and upper back bluish-gray; lower back and upper tail coverts bluer; a broad emerald collar on the neck; chin and a broad stripe on the side of the neck dusky black; lower parts bright green; under tail coverts yellowish; wing coverts green, the smaller secondary coverts rather yellower; wing quills as in the preceding species, only the pale edges are not so noticeable; tail feathers a beautiful deep blue with yellow tips, the outer feathers washed and edged with green.

Bill, upper mandible coral-red with a yellowish tip, lower dusky red; iris greenish or yellowish-white; legs and feet greenish or lead-coloured.

Females are of a duller green on the face, and the upper mandible is black. Young birds are green throughout, except the tail, which is blue.

Length about 12; wing 5·5; tail 6; tarsus ·6; bill from cere ·7. Females a little smaller.

Distribution.—Peculiar to Ceylon. The common Paroquet of the hill-country, but rather local, and in some localities replaced by the Blossom-headed Paroquet. It also extends into the forests at the foot of the hills.

Habits, &c.—A forest bird feeding on jungle fruits, such as wild figs and wild cinnamon, also on flower buds. It is found in fair-sized flocks on the outskirts of woods, in open spaces in the jungle, and in the wooded gorges of patanas. The cry is harsher than that of the last species. The breeding season lasts from January to May; the nest and eggs are of the usual type.

The nest hole is often in dead coconut trees, sometimes high up in big forest trees. The eggs are from one to three in number, the texture is dull and rather soft and porous. Average size about ·97 by ·78.

Note.—Palæornis columboides (The Blue-winged Paroquet) is said to have been recorded from Ceylon, but probably in error. It is a hill species, more or less of the same type as *P. calthropæ*,

and occurs in the hill forests of the Malabar Coast. It may be recognized by the blue wing quills, and by the fact that the breast as well as the crown and upper back are dove-gray in males and greenish-gray in females. Length about 15 ; wing 6·5 ; tail 8·5.

Loriculus indicus (Blanford, Vol. III., p. 262 : Legge, p. 180).

The Ceylonese Loriquet.

Description.—General colour of upper parts green ; crown deep red passing into orange on the nape ; back and scapulars faintly washed with orange ; rump and upper tail coverts deep red ; wings and tail rather deeper green ; inner webs of wing quills dusky black, the outer primary almost wholly black ; cheeks and lower plumage paler green, the throat faintly washed with blue ; under surface of wing and tail quills verditer blue.

In young birds the crown is green, the crimson tint being assumed gradually.

Bill orange-red, paler at the tip ; cere yellow ; iris white ; legs and feet dusky yellow.

Length 5·5 ; wing 3·7 ; tail 1·75 ; tarsus ·45 ; bill from cere ·5.

Distribution.—Peculiar to Ceylon ; widely distributed in many parts of the low-country, commonest in the south-west of the Island, almost wholly absent from the arid maritime region, and local in the northern forest tract. It is common in the hills up to about 4,000 feet, and during the north-east monsoon is found at even higher elevations.

Habits, &c.—Found in native gardens or in any jungle which contains the fruit and flowers on which it feeds. It is a ravenous eater, and is especially fond of kitul toddy, on which it will gorge until stupefied. The flight is swift ; the cry is a shrill little scream. The breeding season lasts from March till June. For its nest it chooses a small natural cavity in a tree, excavating the interior to a depth of 2 to 4 feet. The clutch consists of two or three eggs laid on a pad of green leaves spread about an inch thick at the bottom of the hole. They are white and glossless, and measure about ·75 by ·62.

FIG. 1.

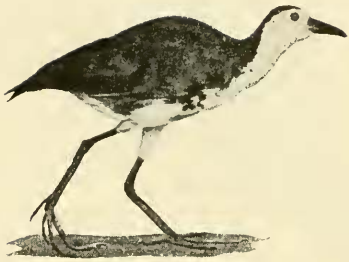

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 1.—XANTHOLÆMA HÆMATOCEPHALA.

FIG. 2.—CORACIAS INDICA.

FIG. 3.—MEROPS VIRIDIS.

FIG 4.—HALCYON SMYRNENSIS.

FIG. 5.—UPUPA INDICA.

FIG. 1.

FIG. 2.

FIG. 3.

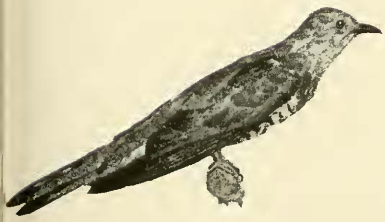

FIG. 4.

FIG. 5.

FIG. 1.—MACROPTERYX CORONATUS.

FIG. 2.—CAPRIMULGUS INDICUS.

FIG. 3.—HARPACTES FASCIATUS.

FIG. 4.—CUCULUS MICROPTERUS.

FIG. 5.—PHŒNICOPHAËS PYRRHOCEPHALUS.

THE MIGRATION OF BIRDS AND CEYLON MIGRANTS.

By W. E. Wait, M.A., F.Z.S.

THE migration of birds may roughly be defined for general purposes as the seasonal movements of those birds which spend the winter and the breeding season in different regions. These seasonal movements are well known in all countries, and references to them may be found in the literature of all ages. There is an allusion in Job to the migrant Hawk; the Greek poets Anacreon and Homer speak of the migration of the Crane and the Swallow; the arrival of the Cuckoo and the Swallow with the returning spring in England, and of the Stork in Continental Europe, are constant themes in folklore and proverb. In Ceylon the advent of the Snipe and other birds in autumn and their departure from the Island at Easter are well known to all of us.

Many people, however, are unaware of the enormous number of birds which migrate, or of the scope and complexity of their migrations. Within the last hundred years the subject has received increasing attention, and especially within the last quarter of a century a mass of observations has been patiently recorded, chiefly in temperate climates. From these records have been deduced many clearly-ascertained facts, which have thrown much light on the question, and beyond these facts a number of theories and surmises have been propounded to account for many problems which still remain a mystery.

In temperate regions the number of species which migrate is relatively far higher than in the tropics. In England, for instance, nearly every species is migratory to a greater or less extent; the migrants are by no means confined to those species which, like the Swallow and the Cuckoo, are purely summer residents, or, like the Fieldfare and Wild Swan, purely winter visitors.

As regards migration, the birds of a temperate climate, such as the British Islands, may be divided into five main classes :—

(1) Permanent residents, for instance, the Grouse, though even the Grouse has a short local migration from the moors, where it breeds, to the valleys, where it spends the winter.

(2) Summer residents, such as the Cuckoo, which spend the winter in warmer countries.

(3) Winter residents, such as the Fieldfare and Swan noted above. These birds breed in the far north and come in winter to the British Isles as a haven of comparative warmth.

(4) Birds of passage. In the spring hosts of birds which neither breed nor winter in the British Isles halt there for short intervals *en route* from their winter quarters in the south to their breeding stations in Scandinavia, Iceland, and Greenland. In the autumn the process is reversed.

(5) Irregular migrants and stragglers. These are birds which occur only at irregular intervals. Some species turn up fairly often in more or less regular cycles ; others, again, are vagrant oceanic rovers, such as some of the rarer Petrels, while yet others are storm-driven wanderers.

It must not be imagined that each species has a hard and fast place in only one of the above classes. Numbers of the commonest English species, such as the Song Thrush and Skylark, which many people look upon as permanent fixtures in the English landscape, have the most complex movements. Some Song Thrushes are perennial residents in the British Isles, though even among these there is a vast amount of local movement from the more exposed localities, where they breed, to more sheltered valleys, where they retreat in cold weather. Many of the Thrushes, however, are only summer residents, and winter in countries south of the Channel. Their place in winter is taken by individuals which have bred in Scandinavia and Central Europe. Other Thrushes, again, winter in France and Southern Europe, breed in Scandinavia, and occur on English shores as birds of passage. Lastly, birds which usually winter in Central Europe may occasionally be driven out of their accustomed winter haunts by unusually severe weather, and may seek temporary refuge from the cold snap in the milder English climate. Indeed, as Mr. Eagle Clarke

remarks :* "The Song Thrush furnishes us with a most excellent example of the complex nature of the phenomena of bird migration as observed in Great Britain and Ireland, and its various movements cover nearly the whole year."

What is the cause of this widespread migration, and how did the habit originate? To quote Professor Newton :† "Here . . . we are brought face to face with perhaps the greatest mystery which the whole animal kingdom presents—a mystery which attracted the attention of the earliest writers and can in its chief points be no more explained by the modern man of science than by the simple-minded savage or the poet or prophet of antiquity."

The theories are many; some more or less far fetched, but, as Mr. Eagle Clarke‡ points out, the question may best be answered by asking yet another, namely: "What would become of those myriads of birds, which in the summer delight in and breed amidst the solitude of the Arctic countries, when those vast wastes which form their feeding grounds lie under a pall of snow or are transformed into solid ice? What, too, would become of certain birds which, similarly, make our islands their summer home if they attempted to remain the winter with us?" He goes on to point out that insect feeders, such as the Swallow and Cuckoo, would perish during the English winter for want of food. Bears or various other animals solve the problem by hibernating during the winter months, and writers from Aristotle down to savants at the beginning of last century have held the theory that certain birds also hibernated, while the superstition that Swallows spent the winter in holes or even under the ice in ponds and streams was widely believed in mediæval times.

Modern observation has entirely disposed of the theory of hibernation among birds. Their power of flight enables them to escape starvation by moving to warmer climates in search of food. The reason for the autumn migration is thus then comparatively easy of explanation, but once the birds have reached their winter quarters, what is the impulse which calls them back in spring? In some cases the food problem again

* "Studies in Bird Migration," Vol. I., p. 212.
† "Dictionary of Birds," p. 549.
‡ "Studies in Bird Migration," Vol. I., p. 15.

may have something to do with it. The torrid and often parching tropical summer in many localities may lower the food supply to some extent. Again, it must be borne in mind that some northern migrants winter far to the south of the Equator, and may be warned to turn north by the approach of the southern winter. In many cases, however, these factors do not come into force, and it is probable that the breeding instinct is the main impulse which calls birds back to their summer haunts. Most birds seem greatly attached to particular nesting sites which they occupy year after year. Professor Newton records* a remarkable instance of such a persistent habit : " A pair of Stone Curlew—a very migratory species, affecting almost exclusively the most open country—were in the habit of breeding for many years on the same spot, though its character had undergone a complete change. It had been part of an extensive and barren rabbit warren, and was become the centre of a large and flourishing plantation."

It is undoubtedly the fact that many birds which have a comparatively restricted breeding area scatter widely during the winter. For instance, the Curlew Stint, *Tringa subarquata*, breeds only within the Arctic Circle on the Siberian Tundras, while in winter it is found all over the tropics, and occurs as far afield as Patagonia, Tasmania, and Cape Colony. Probably it is this attachment to accustomed breeding grounds that prevents northern migrants which visit the Southern Hemisphere from breeding a second time in their winter quarters.

A not inconsiderable number of such species " winter " in South Africa—which, of course, is then enjoying summer—at a time when the local residents are breeding. In spite of such favourable conditions, there is as yet no positive evidence that these northern migrants turn their " winter " into a second breeding season. The breeding impulse does not seem to be awakened until the season for their migration northwards sets in, by which time conditions in the South Temperate Zone are unfavourable.

As regards the origin of the migratory habit, however instinctive it may now be, it must have originated in an intelligent movement intended to escape some danger or secure

* " Dictionary of Birds," p. 553.

some advantage.* Dr. A. R. Wallace offers a probable explanation of the manner in which the habit had its origin as follows : † " It appears to me probable that here as in many other cases ' survival of the fittest ' will be found to have had a powerful influence. Let us suppose that in any species of migratory bird breeding can, as a rule, be only safely accomplished in a given area ; and further, that during a greater part of the rest of the year sufficient food cannot be obtained in that area. It will follow that those birds which do not leave the breeding area at the proper season will suffer and ultimately become extinct, which will also be the fate of those which do not leave the feeding area at the proper time. Now, if we suppose that the two areas were (for some remote ancestor of the existing species) coincident, but by geological and climatic changes gradually diverged from each other, we can easily understand how the habit of incipient and partial migration at the proper seasons would at last become hereditary, and so fixed as to be what we term an instinct. It will probably be found that every gradation still exists in various parts of the world, from a complete coincidence to a complete separation of the breeding and subsistence areas ; and when the natural history of a sufficient number of species in all parts of the world is thoroughly worked out, we may find every link between species which never leave a restricted area in which they breed and live the whole year round to those other cases in which the two areas are absolutely separated. The actual causes that determine the exact time, year by year, at which certain species migrate will, of course, be difficult to determine."

The next problem to consider is the route by which migrants find their way between their summer and winter quarters. It must not be supposed that each bird moves indiscriminately southwards in autumn and northwards in spring. Indeed, it is by no means the case that the winter quarters are always southwards of the summer breeding grounds. For instance, owing to the gulf stream, the British Isles in winter have a milder climate than parts of Central Europe which lie

* A. P. Taverner. " Auk," Vol. XXI., 1904, p. 322.
† " Nature," Vol. X., p. 459.

further to the east, and a proportion of the Central European migrants turn their course in autumn, not south, but west, to find winter quarters in South England and Ireland. Mr. Eagle Clarke, when spending a month in autumn at the Kentish Knock lightship off the mouth of the Thames, found on the same day and hour streams of the same species, such as the Skylark, crossing the North Sea in contrary directions. Birds from the north which had followed the east coast line southward to the Thames were flitting across to the Continent from north-west to south-east *en route* for Southern Europe, while at the same time there was a steady stream of birds which had come down the Rhine delta from Central Europe and were migrating to England from east to west.*

Many observations have shown that migratory birds do not perform their journey "as the crow flies," but follow certain accustomed routes. For many species these routes coalesce, for longer or shorter distances, and form favourite fly lines. Most birds follow coast lines as far as possible.

The main fly lines used by migrants to and across the British Isles have been worked out, from a multitude of records, by Mr. Eagle Clarke, the great British authority on the subject. If you look at the map you will see that these Islands form as it were a great junction for migratory birds. It lies on the migration route of many species which breed in Greenland and Iceland on the north-west and in Scandinavia on the north-east. Let us examine some of the main routes as used in spring.

The English Channel is crossed at various points. Immigrants to Ireland and many birds on passage to Iceland and beyond take the route from Ushant to the Scillies, and from thence round the west coast of Ireland. Others, again, make their way up the coast of the Irish Sea and on through the Hebrides. Birds breeding in England and many Scandinavian birds use various crossings between the Ushant-Eddystone route on the west and the Straits of Dover on the east. The English birds on their arrival slip inland to their breeding grounds; the northerners mainly follow the coast round as

* "Studies in Bird Migration," Vol. II., Chap. I.

far as the Humber, where they begin to cross the North Sea. Few leave our shores before they reach this point in their northward journey. Many hold right on till they come to the Orkneys and Shetlands. Others, again, such as the Swallows, cross the North Sea at various points between the Humber and the north coast of Scotland.

From the Shetlands there are two main streams: one north-west to Iceland, meeting the Irish and Hebridean routes at the Faroes; and one north-east to the mainland of Norway. In autumn the process is reversed.

From observations on the Continent and in America we find that there also there are favourite fly lines; river valleys and coast lines are greatly followed. For instance, from South-west Europe there is a main route up the Rhone Valley and down the Rhine, while in the United States the Mississippi Valley is a much-used route.

It is interesting to note that for some species the spring route is not the same as that taken in autumn. This is especially well shown in the case of the American Golden Plover, *Charadrius dominicus*, whose routes have been carefully worked out by an American ornithologist.* This bird breeds in Arctic North America, from Alaska to Hudson's Bay. In autumn the flocks move south-east to Labrador, where the autumn berries give them abundant food. After a short stay there, they move on to Nova Scotia, and then cross the sea by a long journey southwards to the north-east coast of South America. It is probable that this direct sea route is the evolution of a longer coastal journey down the eastern shores of the States and round the Caribbean. On arrival on the Guiana coast the birds rest for a short time, then cross Brazil to winter quarters, mainly in the Argentine. The return journey in spring is more directly northwards, probably because the spring moves northwards earlier on the western side of the States than on the bleaker Atlantic coast. The route lies across Bolivia, through Central America, to Texas, thence up the great fly line of the Mississippi and over Western Canada.

* *Vide* Coward, "Migrations of Birds," p. 77, &c.

It will be noticed from the foregoing pages that many birds traverse enormous distances in their annual migrations. The American Golden Plover and the Curlew Stint travel between the Arctic Circle and the South Temperate Zone. Other species perform journeys not so extended, but still very wonderful when one considers how fragile and apparently weak-winged many of them are. The Himalayas and the desolate high-lying plateaux north of them are crossed by numbers of Shrikes, Pipits, and the most diminutive little Warblers. A small Australasian species of Cuckoo winters in Eastern Australia, and summers 1,200 miles across the open ocean in New Zealand ; the tiny Gold-crested Wren regularly braves the crossing of the North Sea.

A rather curious fact is brought to light when examining the distances travelled by various species, and even by different birds of the same species. Birds which breed the furthest north often winter the furthest south. I have already exemplified this in the case of the Curlew Stint and Golden Plover. Here the species as a whole performs a long journey. But take the case of the European race of the common Swallow, *Hirundo rustica*. In the summer it is found breeding throughout Europe, from the Mediterranean to Scandinavia. Some specimens also breed in North Africa. The winter quarters lie in Africa, south of the Sahara right down to Cape Town but a few birds winter in the North African oases. The Swallow happens to be a day migrant, which performs its journey leisurely, and its movements northwards can, therefore, be timed accurately. Birds which breed in England begin to appear there as early as the end of March, and most of them have come by the end of April. These birds appear on the North African coast at the end of February, and through March and early April they are crossing Spain and France. Now most of the birds which winter in Cape Colony do not leave that part of the world until March, so they cannot possibly be the birds which are then crossing South-western Europe. During May, for some time after our English birds have settled down to breed, Swallows on passage are met with along the English east coast migration routes. They reach Shetland about the end of May and early June. Some breed

there, others proceed to Scandinavia. The inference is fairly obvious that our English Swallows come from the northernmost winter quarters, and that the South African birds breed in Scandinavia. In the far north nesting conditions are not favourable till June, so South African birds have no need to migrate as early as those which nest in Central Europe and England.

I have just mentioned that the Swallow is a day migrant, but this is not the case with many birds. A vast amount of the migration which takes place is unseen by us, as it is performed at night, and at altitudes and speeds which are still to a certain extent open to conjecture. The reason why birds chose night time for a long flight, especially across the sea, admits of a very probable explanation. Most birds spend a great part of the day hunting for food, so that if a bird takes an all-day flight, it must start on an empty stomach, spend an exhausting day without food, and on arrival pass another night of fasting before it can satisfy its hunger. A night flight can be taken without interfering with the feeding hours.

Various and often accidental observations by astronomers have given interesting data of the height and speed of some migrations. An observer was measuring the height and velocity of clouds when some ducks came under his notice. He calculated that they were 958 feet up, and flying at a rate of 48 miles an hour. Other records based on somewhat similar observations give heights varying from 1,400 to 5,400 feet. Mr. Eagle Clarke observed during his stay at the Kentish Knock lightship that many birds performing this North Sea journey of about 120 miles by day flew close above the waves, whatever the weather, and at no extraordinary speed. He says: "Speaking generally, the migrants pursued their way at the steady rate characteristic of their respective species. There was no hurry, but at the same time there was a business-like manner about them in keeping with the important work on hand. Certain species habitually fly faster than others. He roughly gauged the speed of the Larks at 25 miles per hour, and of the Starlings at 35 to 40.

Lastly, there remains a problem as difficult to answer as any. By what faculty do migrants find their way from point to

point and from start to finish of their journey ? The great majority cannot possibly be guided by unaided sight or memory, as most of the migration takes place at night, and often over hundreds of miles of trackless ocean. Again, in many species, the young birds migrate apart from their parents, and so have no bird with actual experience of the route to guide them. The older Cuckoos leave England some weeks before the yearling birds, which have been brought up mainly in the nests of English residents and have never seen their parents. Yet the young Cuckoos hatched in England manage the long autumn trip over strange ground to their winter home which lies in Africa, south of the Sahara. There is no doubt that birds possess a special and mysterious sense of direction, known technically as " orientation," or, as Professor Newton phrases it, " inherited but unconscious experience." Explorers in Antarctic seas have come across flocks of flightless Penguins trudging along over the open ocean to breeding grounds hundreds of miles away. Practical experiments with other birds have also proved their possession of this mysterious power of direction. The Florida Keys are the most northerly breeding grounds of the Noddy and Sooty Tern. Fifteen marked birds of these two migrant species were taken from their nesting haunts on one of these Keys and placed on board a steamer. They were then released at distances varying from 20 to 850 miles away. Some of them were set free off Cape Hatteras, many degrees northward of their usual range. Thirteen out of fifteen found their way home.

It is also fairly obvious that in the course of long flights, which may extend to over a thousand miles, many birds must frequently be blown by contrary winds far out of their direct route, so that, if they had not this sense of direction, few would ever reach their destination.

But this sense, as might be expected, is by no means infallible, and birds often stray. No doubt the majority of these strays come to a tragic end, but some find unaccustomed havens, and account for the irregular appearance of many species far away from their usual haunts. Some of these waifs may owe their salvation to falling in with a train of another species using a different route. This explanation has been

ingeniously used to account for the fairly constant appearance of odd specimens of North American species in Great Britain. It is pointed out that a certain number of these species breed in Greenland, not far away from species which migrate south-east to Europe, instead of south-west to America. An American bird straying slightly might fall in with voyagers taking the European route and follow in their wake to Great Britain instead of taking its proper course.

There is no doubt that the perils of the journey are many, and take a heavy toll of the migrating hosts. A bird may start from Ushant with a fair wind and encounter a gale before Scilly or the Eddystone is reached. Fog is another source of danger, especially when there are lighthouses near. When the nights are clear, the light does not exercise so great an attraction, but in haze, drizzle, or fog it seems to act in a mesmeric manner and lures thousands of birds to death. They dash at the lantern, strike the glass, fall stunned or with broken wings, and so perish.

Weather, in fact, has a most important bearing on migration. Migrants have in the main a fairly regular time table. Most of the English summer visitors, for instance, start south before the necessities of inclement weather and a failing food supply drive them away, but an unusual warm spell in autumn may make birds put off their departure or linger *en route*, while a sudden cold snap will hasten their going. The great thing to remember is that it is the weather at the point of departure which influences them, especially at the start of a long overseas journey. The *direction* of the wind does not seem to have a great influence, provided it is not too strong, but boisterous weather holds migrants up. Most of the wholesale destruction which at times overtakes migrating flocks is due to their suddenly meeting with unfavourable weather after they have once committed themselves to an extended flight.

In the light of these main facts concerning migration in general, we may now consider the special conditions applying to migration in Ceylon. I am afraid that in this part of my paper many of my remarks have to rest on inference and analogy. Little detailed observation on the subject has been done in the Island, nor can I find much on record regarding the

neighbouring continent of India. We know pretty accurately what species are migrant, together with their summer and winter quarters, but details of the routes and times have not been thoroughly worked out. As a matter of fact, Ceylon lacks many of the advantages possessed by the British Isles as a centre for the study of the subject.

It does not lie athwart the main thoroughfares of migration, while in the tropics the proportion of migrant birds is fewer. Above all, we lack the incomparable observation stations which surround the British Isles in abundance. To quote Mr. Eagle Clarke once more :* "In connection with the geographical aspect of migration, it is impossible to over-estimate the value of observations made at islands, *i.e.*, small islands, and rock stations, and other places removed from the usual haunts resorted to by the various species. At such stations to see certain birds is to know at once that they are migrating, for under no other conditions would these particular species be found there. The most unsatisfactory of all observations are those made inland. Here individuals of many species moving to other quarters are most difficult, if not impossible, to distinguish from the native representatives of the same species. In addition, the area, and in many cases the cover, is so extensive that few, very few, of the birds passing through any district come under notice. One never knows what is in the next field or the next bit of cover, while woods are hopeless, it being impossible to ascertain the smaller migrants which are nesting in them."

The few lighthouses in Ceylon, with the exception of Colombo, lie away from the main routes of migration; Colombo lighthouse is in the middle of the town, and does not seem to attract any remarkable number of birds. The open grassy extents on the Galle Face, the racecourse, and the golf links are among the best stations obtainable. Probably a good deal might be done on some of the islands between Mannar and Point Pedro, but Ceylon will never be a paradise for the recorder of general migratory movements, though, as I shall show later, in one or two respects our opportunities are unique.

* "Studies in Bird Migration," Vol. I., Chap IV.

To realize the position occupied by Ceylon in the general flow of migration, one should glance at the map of Asia. The bulk of the migrant species which are summer residents in Northern and Central Europe winter in Africa. The desert of the Sahara is the "No man's land," which lies between the summer and winter quarters of many a species. In Asia a more or less corresponding position is occupied by the Himalayas and the great elevated plateaux of Central Asia. Countless hosts which breed on the Siberian Tundras winter in Tropical Asia. There can be no doubt that many Siberian birds move south-eastwards down through the Malay Archipelago to Australasia, or south-westwards down the Arabian Coast to East Africa; but for those that cross the Himalayas and strike southwards through India, Ceylon lies at the end of the route.

Accordingly, instead of being a busy junction like the British Isles, Ceylon is a terminus reached by comparatively few. It is possible, but unlikely, that a certain number of migrants may strike off from our shores south-west to Mauritius and Madagascar or south-east to the Malay Archipelago; but in each case the sea voyage is so long, and these countries may be reached by so much easier routes, that in all probability we may say we have practically no birds of passage. Again, as we are almost on the Equator, we have no summer residents, that is, as far as I know, we have no migrants which come to us for their breeding season. Our Island is wholly a winter resort. Our stragglers, too, are comparatively few in number, and are composed, not so much of birds which have wandered off their true line of migration, as of stray specimens of species which usually winter a little to the north of us, but which have pushed on beyond their accustomed range. We must also remember that being in the tropics the proportion of resident species is larger than it would be in a temperate climate. The migratory movements, therefore, in Ceylon are not nearly so complex as in England.

The total number of species at present recorded from Ceylon is roughly 375; of these, about 15 are very doubtful inclusions, leaving about 360 genuine species on the list. Of these 360 species, two-thirds are known, or are reasonably believed, to

breed with us, leaving about 120 species to be accounted for between the regular migrants and the stragglers. The above figures are rough calculations based on our present knowledge, which is in many cases by no means perfect. So much work remains to be done with regard to the oology and distribution of our birds that the figures may need some revision when our information is more complete.

Now these 240 species which breed in Ceylon may be either wholly "permanent residents" or "partial migrants." "Partial migrants" are those species in which some individuals reside with us all the year round, while others migrate usually to regions not very far away. Our knowledge of local seasonal movements is so incomplete that in many cases it is extremely hard to say with any certainty whether a species is wholly resident or only partly so.

On the one hand, we know that in the tropics birds are much less given to wander than in temperate climates. This is forcibly illustrated by the much greater part borne by geographical isolation in the evolution of peculiar species in Ceylon as compared with the British Isles. In Britain there is only one well-defined species peculiar to the country—the Red Grouse, *Lagopus scoticus*—though it has been ascertained, largely as the result of studies in migration, that there are various insular races, or resident sub-species, even among the partial migrants. In Ceylon, which lies about as near to India as England lies to the Continent of Europe, we have over 40 peculiar species. Legge mentions 47 such, but one or two of these—*e.g.*, Legge's Hawk Eagle, *Spizætus kelaarti*—have since been discovered in South India, and several others might now be classed as only sub-species. The number of insular races or sub-species is probably very high. Mr. Stuart Baker, who has been working out the races and sub-species of a good many Indian birds, tells me that, in his opinion, two out of every three of our residents will turn out to be more or less sub-specifically distinct.

On the other hand, we know that, as a rule, in the case of partial migrants, the migrant individuals do not make a very extended journey, and India does not lie far away. It is very obvious to any one who is acquainted with the birds of

any locality in Ceylon that there is a good deal of seasonal movement, especially among such birds as the smaller species of Heron, the Lark family, the Rails, and some of our Hawks. We have still to ascertain whether numbers of these birds move merely to other parts of the Island during the breeding season, or leave our shores for South India.

It is definitely known that some species—for example, the Ashy Finch Lark, *Pyrrhulauda grisea*, and the Pariah Kite, *Milvus govinda*—which have only a local distribution in Ceylon, are largely reinforced during the north-east monsoon by migrants from India. I have heard Whistling Teal passing over Colombo at night and coming probably from South India.

We have also a small, but very interesting, group of partial migrants, which includes the Kentish Plover (*Ægialitis alexandrina*), several other species of Waders, and one or two of our Terns. The birds of these species which breed with us are really resident races of northern migrants, and their permanent abode in our Island is probably due to the gradual breaking down of the migratory habit. I shall revert to this group later on.

To sum up. Our knowledge of the partial migrants is very imperfect, and while in Ceylon this group undoubtedly includes a far smaller proportion of the bird population than in temperate climates, probably a good deal of partial migration passes unsuspected.

We now turn to a group of non-resident species: the stragglers and casual visitors. It is very difficult to draw at any one point a hard and fast line of demarcation for these two classes. There are about 60 species on the Ceylon list which visit us at very infrequent intervals, or which have been recorded less than half a dozen times. Some of these are genuine waifs, such as the Lesser Scavenger Vulture, *Neophron ginginianus*, of which a stray specimen, probably storm-driven from South India, was once obtained at Nuwara Eliya. Then there are the ocean wanderers, such as the Frigate Birds, Tropic Birds, Boobies, several species of Tern, and so on. These turn up at odd intervals, generally after stormy weather, and can hardly be classed as seasonal migrants.

Again, how are we to class Jerdon's Imperial Pigeon, *Ducula insignis cuprea*, which occurs all over South India ? It has only once been recorded from Ceylon, but was on that one occasion found breeding.

However, at least half of our casual visitors are species which perform regular migrations, but whose usual winter quarters do not extend so far south as our Island. Nearly all the members of this class belong to families which include our common winter visitors. If we look at the 12 species of duck which occur in Ceylon, the gradation is well seen. The Smaller Whistling Teal, the Quacky Duck or Goose Teal, and the Comb Duck are resident, but also in all probability partial migrants ; the remainder are all migrants, which visit us in varying numbers. The Common Teal and Garganey are fairly abundant in some years, but scarce in others. The Brahminy Duck and the Shoveller visit the lagoons in the north of the Island in small numbers, which vary from year to year. The same may be said of the Spotted-billed Duck and the Pintail. Two more species, the Larger Whistling Teal and the Gadwall, have only been recorded once or twice, and should, therefore, be put down as casual visitors, while the Red-crested Pochard is on the doubtful list ; it is said to have been seen near Jaffna by Layard.

We have now arrived by the process of elimination at our regular migrants. These vary from birds which visit us every year in enormous quantities, such as the Pintail Snipe, to species which are extremely scarce, but fairly regular in their visits, such as the Woodcock. At the lower end of the scale, as I have said, it is difficult to draw the line between them and the casual visitors. We may, however, say roughly that the regular migrants number between 60 and 70 species, all of which visit us during the north-east monsoon.

The number of species is thus only just over one-sixth of those on the Ceylon list, but the number of individuals is so large that the bird population is swelled enormously by their arrival. This is especially the case on our lagoons, paddy fields, and tanks, which teem with bird life during the north-east monsoon, and present a comparatively deserted appearance during the south-west. In fact, in Ceylon we have the

converse of the conditions obtaining in the far north of Asia. From about October to April, at a time when Siberia is frozen out, there are vast areas all over the " dry zone " of the Island which are swamped by the heavy monsoon rains, and afford abundant sustenance for the hordes of Waders and aquatic birds which visit us. From April to October these mud flats and paddy fields are parched and dry, and many of the tanks have shrunk to mere puddles. The aquatic and semi-aquatic migrants would have a meagre time if they all stayed on.

From what regions do our migrants arrive ? The Passerine migrants, which are most strongly represented by the Warblers, Shrikes, Flycatchers, Thrushes, and Wagtails, mostly come from North India. The same may be said of the Cuckoos. Most of the migrant Hawks and Waders come from further afield, from temperate or Northern Asia.

I have noted earlier that the Himalayas in a great measure form the dividing line between the winter and summer quarters of the Asiatic migrants, just as the Sahara does for those of Europe and Africa. There is this difference though : on the southern slopes of the Himalayas we have an extensive regional belt of elevated land with temperate conditions of climate, and many birds find a congenial breeding ground there without continuing their course further north. It is no wonder, therefore, that many of the more delicately formed Passerine migrants settle down to breed in large numbers in Cashmere and other Himalayan districts, which are well suited for them, while the stronger-winged Harriers, Falcons, and Waders carry on to the enormous breeding grounds in the marshes of Siberia. This distinction, however, is by no means universal. Some Swallows and other Passerine species breed on the north as well as on the south side of the great ranges. The Forest Wagtail—*Limonidromus indicus*—retreats to Northern China and Eastern Siberia, and so on, while some of the Kestrels and Woodcocks breed on the Himalayas.

It is quite possible, though in the present state of our knowledge it would be unwise to be dogmatic, that the axiom that those birds which breed furthest north winter furthest south holds good to a certain extent, in which case our Ceylon

birds would seek the northernmost confines of their breeding area. The same axiom may hold good when we come to examine the range of several species, which, though wholly migratory as far as Ceylon is concerned, are only partial migrants in India, for example, the Indian Pitta—*Pitta brachyura*. This species ranges practically all over India. In summer it is found in Northern India ; in winter in Southern India and Ceylon ; in a good many parts of Central India it is a permanent resident. Very possibly it is the South Indian and Ceylon birds which migrate to Northern India. It is equally possible that in Central India the seasonal movements of this species may be as complex as those of the Thrush in England.

Another general axiom that migrants wander a good deal more in winter than at the breeding season has considerable bearing on the ebb and flow of our migrant population, and accounts for many of our irregular migrants. There is no doubt that the Snipe, Golden Plover, and many more of the Waders which visit us in such hosts are more abundant in some years than in others. The difference may to some extent be accounted for by favourable or unfavourable conditions on the breeding grounds, resulting in a stronger or weaker tide of migration from the far north. On the other hand, the difference in number seems to be affected rather by a favour able or unfavourable season in Ceylon. Our winter visitors do not arrive from Siberia in one long flight. Once they have crossed the Himalayas, they probably filter gradually down through India, and if they do not find conditions suitable as they proceed south, they do not penetrate in their usual numbers as far as Ceylon.

There is no doubt that many birds linger some time on the way. Let us take a typical Wader. The Pintailed Snipe breeds in Northern Siberia, from the Yenesei to the Pacific, and the birds must leave such a cold region fairly early. The van-guard arrives in Ceylon on the south-west coast of the Island about the beginning of September. In the north and east of the Island, where the rains do not render the country suitable for them until far later, the birds do not appear in great numbers until well on towards Christmas. These later arrivals

must have journeyed down gradually and lingered on the way, knowing that it was useless for them to arrive here before the conditions were favourable.

This leads us on to a discussion of the routes by which our migrants in general arrive and spread over the Island, and also of the times of their arrival and departure.

Our knowledge of the particular routes used by the various species leaves much to be desired, but there are fair general indications. We have seen that coast lines and large river valleys are favourite fly lines, so it is probable that most of our migrants come to us down the Indian Peninsula either by the east coast or west coast routes. Birds from Eastern Siberia, Mongolia, and the Chinese Empire would come chiefly by the former fly line; birds from Turkestan and Western Siberia by the latter.

We have a very good example of a species which uses the east coast routes in the Pintailed Snipe, which, as I have mentioned, breeds in Siberia from the Yenesei eastwards to the Pacific. During the winter it is very rare in the Punjab and North-west Provinces, commoner as one passes east to the Ganges delta, while it is *the* Snipe of Southern India, Ceylon, Assam, and further India. It is fairly obvious, then, that this species finds its way into India mainly from the north-east. Probably its main line of migration lies down the valley of the Brahmaputra, and divides when the delta is reached, one branch going south-east to Burma, the other south-west down the western sides of the Bay of Bengal. There may be other crossings over the Eastern Himalayas, in which case the birds would make their way to the coast down the Ganges valley. Migrant species in general coming from Nepaul and the Eastern Himalayas would follow this latter fly line.

There can be little doubt that species, such as the Little Stint (*Tringa minuta*) come to us mainly by the west coast. This Stint breeds in Northern Europe and Siberia, and in winter is not found east of the Bay of Bengal. Individuals from the neighbourhood of the Urals may possibly come southwards to the Caspian, then across country to the Persian Gulf, and right along the coast line of India to Cape Comorin.

Others, again, from further east may cross the Western Himalayas and come down the Indus. The Indus valley and west coast fly line would also serve many of our visitors from the Western Himalayas as far east as Cashmere.

Some species may come to us by both routes. The Large Sand Plover (*Ægialitis geoffroyi*) breeds in Japan and Eastern China. In winter it is a shore bird, found all along the coasts of the Indian Ocean, from Australia to Africa. Birds proceeding to western winter quarters probably cross over the mountain ranges from Thibet and so down the Indus valley. On arrival at the mouth of the Indus birds going to Africa would cross to the Arabian coast, others would turn south-east down the west coast of India. More easterly migrants would come down the Brahmaputra and the east coast of India. These two routes would meet in Southern India, so that Ceylon birds may arrive from either direction.

Again, some migrants, especially hill species, may come overland most of the way south, keeping down the line of the Ghauts.

As regards the actual crossing from India to Ceylon and *vice versâ*, we have a good many indications to show that there are two main routes: one which strikes the shore at or near Colombo, and the other into the north of the Island along the belt of shallows from Point Pedro to Mannar. There is no doubt that a good many of our migrants use the Colombo route. Exhausted specimens of such species as the Indian Pitta (*Pitta brachyura*) and the Banded Crake (*Rallina euryzonoides*) are found from time to time at the beginning of the north-east monsoon in Colombo gardens. They are generally in a very exhausted state, and have evidently just landed. Again, the earliest Snipe of the season are usually obtained in the Western Province, while the Blue-tailed Bee-eater (*Merops philippinus*) appears in the south-west as soon as in other parts of the Island. As a matter of fact, Colombo is just the place where one might expect the arrival of the Indian west coast route migrants, which would take off at Cape Comorin; but the early presence of the Pintailed Snipe would seem to show that it is not confined to such birds, unless it be that the early Snipe cross over to

the western side of the peninsula before Cape Comorin is reached. Probably, too, many of our hill migrants arrive by this route, as it affords them a more direct journey, and avoids the long stretch of unsuitable country in South-eastern India and North Ceylon.

The evidence that a large number of birds reach us *viâ* the north of the Island is equally satisfactory. This route would appear to feed especially the north-west, north, and east of the Island. Many of our lagoon-haunting species are found on the north-west coast as far south as Chilaw, and all down the east coast as far round as the Tangalla district, while between Chilaw and Tangalla they are rarer or absent. There are a good many such species, *e.g.*, the Little Green Shank (*Tobanus stagnatilis*), the Whimbrel (*Numenius phæopus*), the Red Shank (*Totanus calidris*), and the Green Shank (*T. glottis*).

Again, the Wood Wagtail (*Limonidromus indicus*) is extremely common round Puttalam during the north-east monsoon, and spreads across through the forests in the north of the Island. It is very rare further south.

To this evidence we must add that some common species, such as the Swallow and the Eastern Golden Plover, appear in the north of the Island just as soon as in Colombo. Mr. Hartley tells me that the Golden Plover is generally seen by him on the Royal College grounds very early in September. This year they appeared on the 2nd. I once saw a flock at Mannar on August 30.

There is one species which seems to give a very striking proof that these two routes are the main fly lines. The Indian Ashy Drongo (*Dicrurus longicaudatus*) is with us a migrant found chiefly in the forests of the north and east of the Island. It has been seen at the beginning of the north-east monsoon at Jaffna and Trincomalee, and also at Colombo, but apparently at no other points on the coast.

There are also traces of cross-country migration between the south-east or east and the west or north-west. On April 22 of this year, for instance, Mr. Roberts of Kotiyagalla, Bogawantalawa, shot a Black Bittern (*Dupetor flavicollis*) in

that district. It must have been migrating from somewhere in the low-country of the south or south-east to Colombo or the north-west.

The times of arrival and departure of our migrants varies to a certain extent, some species putting in their appearance earlier than others; many species begin to arrive in September, and the tide of migration has set in strongly by the end of that month; but, as we have seen, many birds, especially the Fresh-water Waders, do not arrive in the north of the Island until later. April appears to be the month in which most depart, and by May 1 the bulk of them have gone. Some species, probably those which migrate slowly and linger on the way, seem to arrive later and leave earlier. This is the case with such hill birds as *Hierococcyx varius*—the Common Hawk Cuckoo—and the Woodcock, which do not come in much before November and depart about February.

Other species, such as the two small Sandpipers—*Totanus glareola* and *T. hypoleucus*—usually known as Snippets, often come in considerable quantities quite early in August. Now these particular species do not generally leave us till April, and they breed north of the Himalayas, where the country cannot be ready for them until well on in May; so that birds which arrive early in August can scarcely have had time to get to the breeding grounds and stay there long enough to bring up a family before their return. We know, however, that many individual Waders do not breed at the end of their first year. Some of these on arrival in their summer quarters play about for a few weeks and then turn south earlier than the nesting birds. Some, again, only perform part of the journey; for instance, in England numbers of Turnstones and other species, which are solely "birds of passage" breeding further north and wintering further south, spend the summer as non-nesting birds. So birds which arrive in Ceylon from the far north early in August are most certainly those which have not been breeding.

This habit of loitering is carried even further. In some species a certain number of birds never start on their northward journey, but remain in their winter quarters throughout the breeding season.

You may find little groups of such birds in suitable places on the Ceylon lagoons during the south-west monsoon, and it is important to note that the great majority of such birds have not changed into breeding plumage. This fact strengthens the evidence for the theory that it is the breeding impulse which calls migrants north in the spring. Birds which for some reason or other have not developed full maturity do not feel the impulse to such a degree, and so some of them remain with us.

This habit of loitering has been known for some time, but no one seems to have studied it with great thoroughness, probably because most of the work on migration has been carried out in temperate climates, where loiterers do not attract so much attention. I think it is a subject which will well repay investigation, and here in Ceylon we have an ideal opportunity for its study.

It is at the southern limits of the migration routes that the question of actual loitering of migrants in their winter quarters can best be investigated. Then there is no disturbing factor introduced by birds of passage. Where such a southern limit lies far south of the Equator, as in South Africa, much loitering is not likely to take place. The approach of the southern winter would drive north those birds which might otherwise be inclined to stay. In our case we are at the very end of a migration route, and in the tropics, with an equable climate, a combination of conditions which affords the fullest temptation for birds to linger.

It appears to me that in loitering we may see the intermediate steps by which all along the tropics new resident species are being evolved from northern forms by the gradual breaking down of the migratory habit among a proportion of the birds of any species. When birds once take to loitering, they find that life in the tropics is possible all the year round, and so in process of time may slowly be induced to overcome the deeply ingrained instinct which impels them to migrate northward for the purpose of breeding. In some cases, from whatever reason, this evolution has already taken place, and accounts for the interesting group of our "partial migrants," to which I have already alluded.

The most noticeable instances are among the Hawks and Plovers. The Shaheen Falcon, resident in India and Ceylon, and, similarly, the Indian Hobby, differ almost solely by their smaller size and darker colouring from closely allied migrant species, which breed in the north and visit the tropics in winter. Herein they follow the general rule, exemplified again and again in Indian Ornithology, that where species are found over a wide range of latitude, birds bred in the south of that range are smaller and darker than those from the north.

Two migratory species of the genus *Ægialitis*—*Æ. alexandrina* (the Eastern Kentish Plover), and *Æ. dubia* (the Little Ringed Plover) have also produced resident tropical races, which breed in Ceylon. Each of these resident Plovers is a little smaller and darker than the allied migrant form from further north, which visits us during the winter in considerable numbers. Again, *Himantopus candidus* (the Black-winged Stilt) is a Ploverine species, in which a very large proportion of our Ceylon birds are resident ; whereas over the greater part of India the species is migrant, and appears to visit breeding grounds in Central Asia. There are, however, well-known nesting localities in several parts of India.

Now, if there is any truth in my theory, we should find every gradation between species with resident tropical forms and those in which there is little or no loitering. If we take a census of Ceylon loiterers, this does seem to be more or less the case ; and further, loitering seems to be commonest among those species for which our Island affords the most suitable summer conditions, and consequently the greatest temptation to loiter.

The "Fresh-water Waders," of which the commonest are the Pintailed Snipe and the Snippet (*Totanus glareola*), do not appear to linger much in the Island. By Easter the paddy fields, which are their main haunts, have been reaped, and in the dry districts are parching up, so there is no great inducement for them to stay. There is no doubt that loitering Snipe are occasionally seen, and in one or two instances have nested in Ceylon. Very probably these are birds which have received some slight injury from a stray pellet during the shooting season, and so have been incapacitated from making

the long journey north. Also in some cases confusion has arisen from inexperienced persons failing to distinguish between the Painted Snipe, which is a resident species, and the migrant Pintail Snipe. The loitering records for this species are thus not very trustworthy.

Loiterers are more common among the "Salt-mud Waders." In the mangrove swamps and on the adjoining shores of the lagoons in the Puttalam District I have seen from May to July quite a number of Whimbrel and Curlew Stints and a few Redshanks and Little Stints. Most of these birds are not in breeding plumage, but some bear traces of their summer dress. On the big brackish lagoon at Hatagala, in the Tangalla district, I have at the same time of year come across the Greenshank and the Little Greenshank. I have never yet, however, discovered any traces of breeding among birds of these species.

The loiterers are most numerous among our Sand Plovers, and it is in this sub-family that we get the most distinct signs of the evolution of resident forms. As we have seen, the Eastern Kentish Plover and the Little Ringed Plover have already reached the resident stage. The Lesser Sand Plover (*Æ. mongolica*) is found in comparative abundance during the south-west monsoon, and an equal proportion of the relatively scarcer Large Sand Plover (*Æ. geoffroyi*) remain. Most of these, again, are in winter plumage, but a few are in full summer dress, and some are halfway towards it.

I have once or twice seen the Lesser Sand Plover in pairs late in May, though I have never found the eggs. The Eastern Golden Plover (*Charadrius fulvus*) for some reason does not appear to loiter much, though Mr. Parker seems to have discovered traces of birds laying eggs in Ceylon.*

It is also interesting to note that there have been sporadic instances where migrants which do not usually loiter have nested in the Island. There seem to be fairly authentic records of such nesting on the part of the White Stork† and the Shoveller Duck.‡

* Legge: "Birds of Ceylon," p. 1222; and "Stray Feathers," Vol. IX., p. 482.

† "Stray Feathers," Vol. IX., p. 485.

‡ Legge: "Birds of Ceylon," p. 1088.

I do not by any means pretend that I have proved my theory conclusively, but the facts I have stated seem to indicate its possibility. Our knowledge of the subject is as yet very imperfect. In other problems of migration we have for guidance a great mass of carefully sifted evidence based on work in other parts of the world; but here is a point which seems to have been comparatively unnoticed, and in which reliable evidence would be of great value. Such reliable evidence requires a large series of accurate observations and a patient examination of the records obtained. It is one more instance of the vast field of work in our Ornithology which still awaits investigation.

A NOTE ON SUANA CONCOLOR (WALKER).

By Ronald Senior-White. F.E.S.

(*With one Plate.*)

Position.—Lepidoptera, Heterocera. Family Lasiocampidæ.

Distribution.—Throughout India and Ceylon; Philippines; Java (Hampson).

Food Plants.—*Psidium guyava; Cajanus indicus; Hibiscus rosa-sinensis;* "Daminiya" (Sin.) = ? *Grewia tiliæfolia.* Lefroy gives *Shorea robusta* as the food plant, whilst Beeson (Ag. Jo. Ind. 1918) mentions it as a definite pest of this tree. It probably occurs locally on other plants, but such have not come under my notice. It is said to occasionally attack tea in Ceylon.

Occurrence.—There are in this district two broods per annum, maturing in February-March and September, respectively.

Egg.—Barrel-shaped, height 2 mm., diameter $1\frac{1}{2}$ mm. Upper end brown, micropyle black, lower end all white. There is a brown patch on each side apparently at point of contact with adjacent two eggs. A few eggs are pale green, and not white. Eggs laid in plates around a branch strongly cemented together. A few eggs are found on the ground beneath, mixed with male anal hairs, being apparently those first laid. A female I had under observation laid 611 eggs in one night, and contained on dissection 50 more developed eggs.

Larva.—The young larvæ on hatching make their first meal off the shell, and take no other food for two days. Length when hatched 7 mm. Head black, body ringed black and white, with a yellow patch on the black meta-thoracic band. There are long soft hairs, those from the thorax directed

upwards and outwards. There are no urticating hairs at this stage. The length increases to 13 mm. before changing. The cast skin is not eaten. When very young the larvæ web the food plant, but only for the first few days of larval life. After the first skin change, the appearance of the larvæ is unchanged as regards the thorax, save that the yellow patch is not so broad, but abdominally dorsally there is a broad bluish band with darker striæ. Dorsally on the eighth abdominal segment a black cushion with white tips to hairs. The black and white bands remain laterally. Thoracic lateral hairs white and thick, abdomen up to eighth segment almost naked. The meso- and meta-thoracic bands of black urticating hairs develop in this instar. These are situated in folds on the upper surface of these segments, and are erectile when disturbed. Towards the end of the instar the white abdominal bands turn yellowish, and are indistinguishable. Head blue-gray, with longitudinal black striæ. The length before the next change is 30 mm. After this change the abdomen becomes entirely bluish, irrorated with yellow. As the instar progresses, the yellow predominates over the blue, till laterally the abdomen is all yellow with darker striations. There is an oblique white bar on the meta-thorax—first abdominal segments. Length before next change 50 mm. The next is normally the last larval instar. Colour uniformly pale gray-brown with darker striæ all over. On meso- and meta-thorax are fan-shaped tufts of black erectile very urticating hairs, barbed, which, if they enter the skin, set up severe irritation, which persists for 48 hours or more. On the eighth abdominal segment dorsally is a dark hair cushion. On each segment sub-infra-spiracularly are downly-directed gray hairs, with some, shorter, whitely spatulate. The hairs at the extremities are anteriorly and posteriorly directed, those on the thorax make tufts, not pencils. There are five pairs of prolegs, the anal pair spread sideways and nearly hidden in hair. Head brownish, with four vertical lines on the occiput, the two central ones shorter, basal joint of antennæ and clypeus white. All legs brown. The ventral colour is pink with median orange bar, and black bands to segments. Length, full grown: male 75 mm., female 140 mm., though bred

larvæ of this sex do not exceed 120 mm. The larval sex is indistinguishable by size until the last instar is approaching completion.

Pupa.—After 7 days as a pre-pupa this is formed within a very tough cocoon of grayish silk interwoven at each end with the urticating thoracic hairs. The pupa itself is dark brown with three yellow rings abdominally. Length, male 26–30 mm., female 50 mm. The cocoon is softened by a fluid prior to the emergence of the imago.

Imago.—Male: Fore-wings dark red-brown, some pale yellowish suffusion along costal margin, and some lighter scales along the course of the veins. The hind-wings are dark brown. Thorax red-brown, abdomen dark brown, with long anal tuft of very dark brown hairs. Antennæ bipectinate, very broadly on the basal half. Expanse 48–60 mm.

Imago.—Female: Fore-wings a paler red-brown, the basal area slightly darker, and a slightly darker indefinite broad band across the middle of the wing, with some darker colouration from outside this bar below costa to apex broadly. Near outer edge of sub-basal dark area is a prominent white lunule. The hind-wings are pale brown. The thorax and abdomen coloured as fore- and hind-wings respectively. Antennæ minutely pectinate. Expanse 106 mm.

Life Cycle.—Egg 14 days. Larva 12–16 + 21–24 + 25 + 58–78. In all 119–140 days. Pupa: (male) 29–33 days; (female) 24 days. Total 162–178 days. These figures apply to the brood maturing in February, but the September brood probably is of very similar duration.

Hampson describes a variety or "? younger stage" of the larva with small white-haired dorsal papillæ on segments 4 to 10, each with a pair of red-brown papillæ in front and a pair of crimson papillæ on each side. In all the larvæ that I have bred I have never seen this form occur.

The female has a very strong attraction for the male. If a female be placed out at dusk, I have never failed to attract a male within a few minutes between the hours of 6.30 and 6.45 P.M., though the insect is by no means abundant here. Copulation commences at once, and egg laying is completed by morning.

If both sexes emerge on the same evening in the breeding cage, they couple as soon as the wings harden, though in the one case on which this occurred with me the pair were still in copulation at 7 A.M. next morning. In copulation the male alights on the back of the female, after flying round her for from only a few seconds to 5 minutes, and then, conjoining the abdominal apices, the male hangs below the female, which supports the weight of both, in the usual Lasiocampid attitude of a fallen leaf, the stalk of which is made by the palpi.

With one brood which I carried through from the egg there were two larvæ, which did a fourth change (5 larval instars), and lived for 47 days after the last change, then dying without any visible cause or attempt to pupate.

Control.—The larvæ are attacked at all stages by a fungus, which has been identified by the Government Mycologist as *Verticillium sp.*, a *Penicillium* being also found on a dead larva kept for some time, which Mr. Petch considers as being probably secondary. The attack of the *Verticillium* is rapid, larvæ being suddenly found covered with the matted white hyphæ of the fungus. A Phorid with a pupal period of about 16 days was also found in suspicious circumstances emerging from dead larvæ which had turned a dark brown prior to death, though there was no visible fungus attack. These had been placed in test tubes closed with a cotton wool plug when almost dead, and though it is not proved that the Phorid will parasitize healthy larvæ, I think I am correct in stating that it will certainly oviposit in larvæ before death from some other cause. Specimens of this fly have been sent out for identification, but this has not yet been done.

Explanation of Plate.

Suana concolor.

Fig. 1.—Larva, first instar. × $\frac{3}{2}$.
Fig. 2.—Larva, second instar. × $\frac{3}{2}$.
Fig. 3.—Larva, third instar. × $\frac{3}{2}$
Fig. 4.—Imago ♂. × 1.
Fig. 5.—Pupa ♂. × $\frac{3}{2}$.
Fig. 6.—Larva, fourth instar. × 1.

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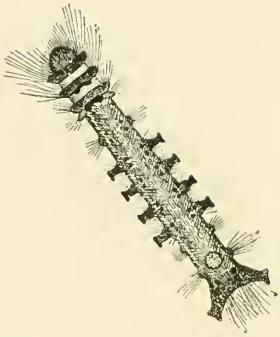

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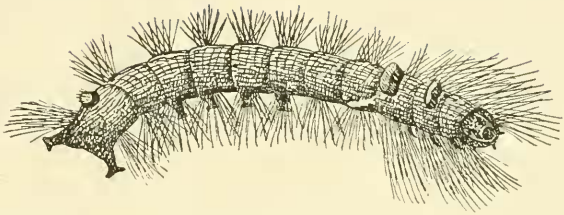

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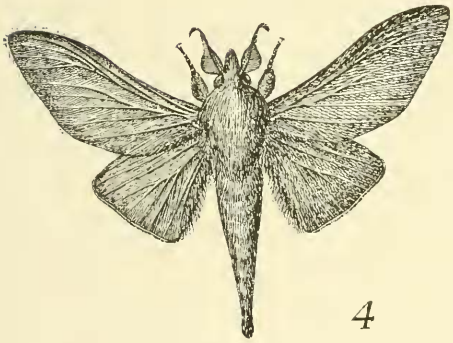

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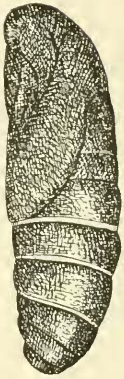

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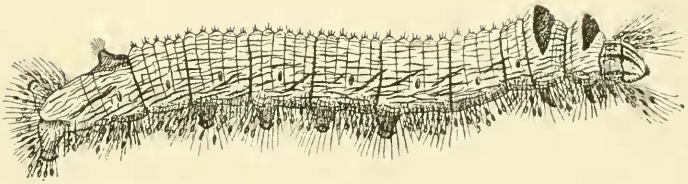


6

SUANA CONCOLOR.

A NOTE ON KOGIA BREVICEPS.

By Joseph Pearson.

(*With four Plates.*)

A SPECIMEN of *Kogia breviceps* (de Blainville), the Pygmy Sperm Whale, was washed ashore at Moratuwa on the western coast of Ceylon on November 30, 1915, and the carcase was presented to the Colombo Museum by Mr. J. B. N. Jayasinhe. The specimen was stuffed, but the skin deteriorated very rapidly owing to the difficulty of removing the fat and oil. Finally, it was decided to make a papier-maché cast, and this has proved a complete success, and is now exhibited in the Mammalian Gallery of the Colombo Museum, together with a complete skeleton. Although the skull and other parts of the skeleton are fairly well known, I do not know of any other Museum in which there is a cast of the soft parts.

The synonymy of *Kogia breviceps* is somewhat complicated, and it has been described under the following names :— *Physeter breviceps* de Blainville, 1838; *Euphysetes grayii* Wall, 1851; *Euphysetes simus* Owen, 1869; *Euphysetes macleayii* Krefft, 1865; *Kogia floweri* Gill, 1871; *Euphysetes pottsii* Haast, 1874; *Cogia breviceps* Benham, 1901. Also *Kogia breviceps, K. grayii, K. simus, K. macleayii,* and *K. pottsii* by various authors.

It is now generally agreed that there is only one species, though there appears to be a good deal of variation within the species regarding the proportions of the cranial bones, the absence or presence of teeth on the upper jaw, the number of ribs, the vertebral formula, and the phalangeal formula.

The following notes refer to the Ceylon specimen :—

Colour.

Jet black above and at the sides, the belly being pinkish in colour. The two colours do not merge into one another at the sides, but are clearly separated.

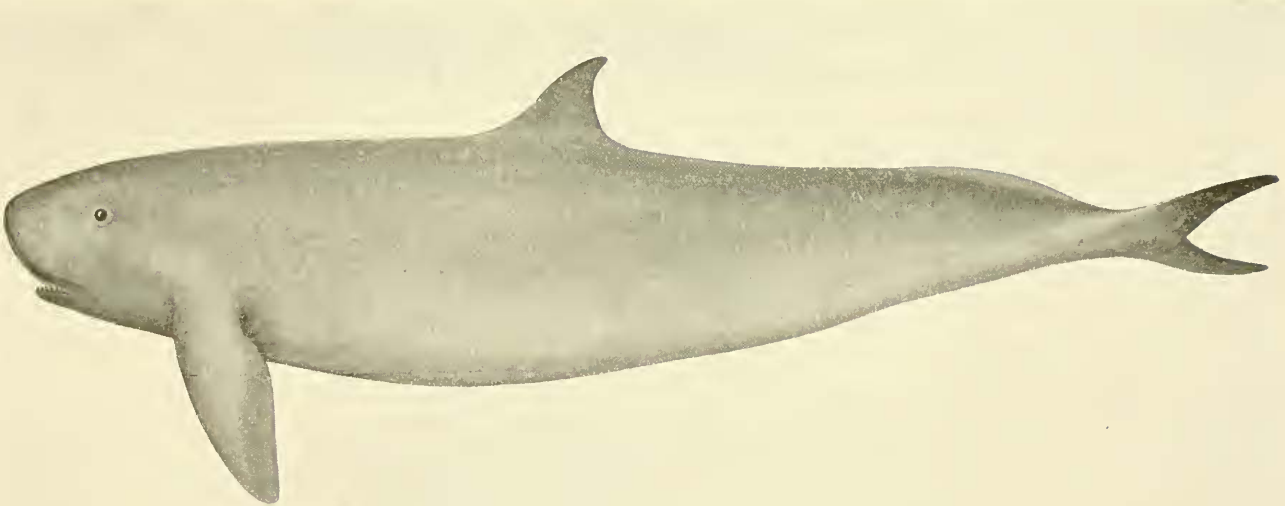
Measurements.

Total length from tip of snout to tip of tail ..	255 cm.
From tip of snout to tip of dorsal fin ..	129 cm.
Height of dorsal fin	19 cm.
Length of flapper	33 cm.
Distance from front of eye to tip of snout ..	23 cm.
Depth of body just in front of dorsal fin ..	53 cm.
Girth of the same place	145 cm.
Girth halfway between dorsal fin and base of tail	72 cm.
Extreme horizontal distance between the two flukes of the tail	56 cm.

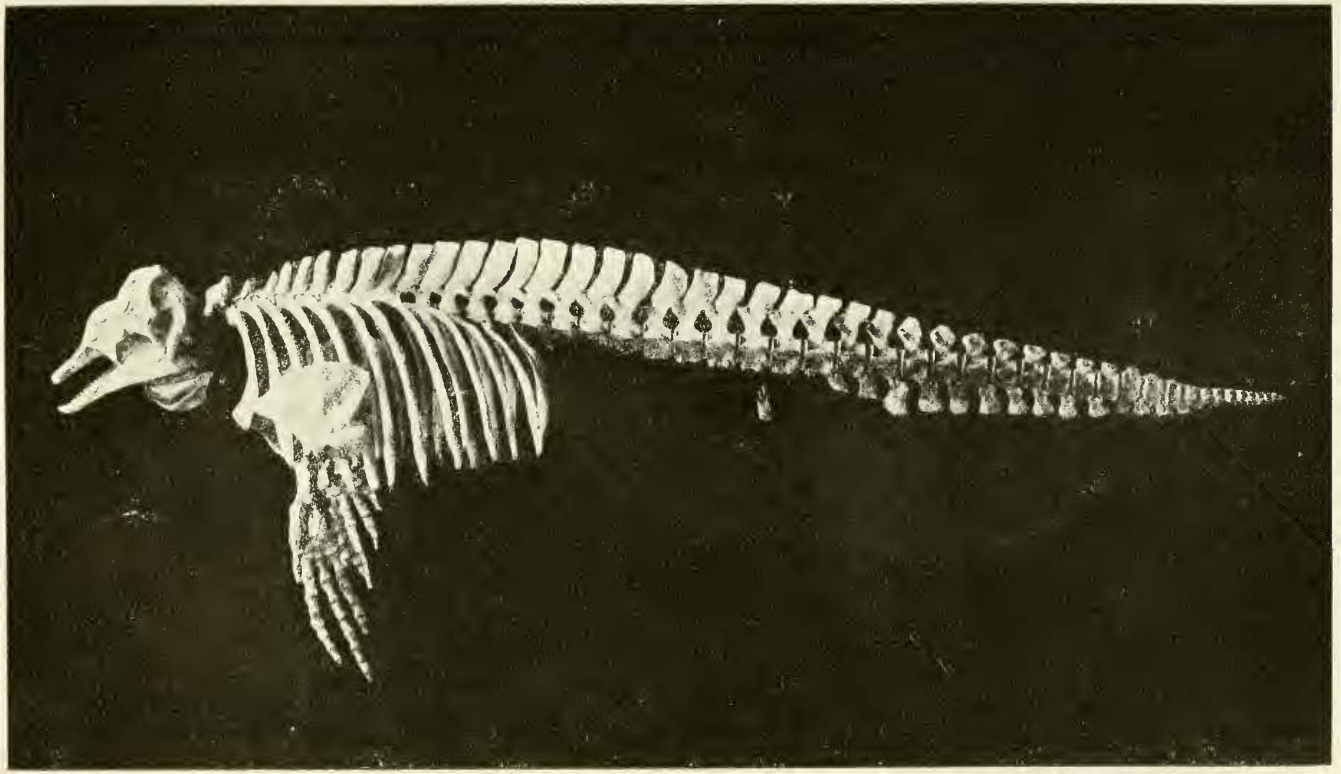
The vertebral formula of the specimen under examination is C7, D13, L9, Ca24. The 25th caudal vertebra is absent, but I am satisfied that it has been lost in the preparing of the skeleton. There are only fifteen hæmal arches, the small posterior vertebræ apparently not having any, though it is possible that some of these may have been lost in preparing the skeleton owing to their small size.

There are thirteen ribs, the anterior eight alone having both capitulum and tuberculum. Each rib consists of a single bone, from the ventral end of which is a cartilaginous extension, with the possible exception of the last pair, which are exceedingly short.

The sternum consists of three parts, the presternum being the largest, and having a deep cleft in its anterior border. The first pair of ribs articulate with lateral expansions of the presternum. The second pair of ribs joins the sternum between the presternum and mesosternum, and the third pair between the mesosternum and xiphisternum. The cartilaginous extensions of the fourth and fifth ribs unite and join the posterior part of the xiphisternum. The last eight ribs are not joined to the sternum.



KOGIA BREVICEPS.



KOGIA BREVICEPS.

KOGIA BREVICEPS.

KOGIA BREVICEPS

The phalangeal formula differs from the general arrangement usual in the species, but this may be due to small bones having been lost in mounting. The formula of the Ceylon specimen is I2, II8, III8, IV6. V4.

In the skull there are thirteen sharp slightly curved teeth at each side of the lower jaw.

Distribution.

Cape of Good Hope (type locality), Indo-Pacific, Australasia, Atlantic and Pacific coasts of North America, and the coast of France. Records of the species are rare. At least one specimen has been recorded from Ceylon previously, as the specimen on view in the British Museum was presented by Mr. Hugh Neville in 1891 from Trincomalee.

EXPLANATION OF PLATES.

Plate I.—Lateral view of *Kogia breviceps*. × $\frac{1}{13}$.
Plate II.—Lateral view of the complete skeleton. × $\frac{1}{13}$.
Plate III.—Lateral view of skull. × $\frac{2}{5}$.
Plate IV.—Dorsal view of the skull (× $\frac{1}{5}$) and lateral view of pectoral girdle and skeleton of paddle (× $\frac{1}{5}$).

[*Note*.—While this paper was in the press, the writer received Schulte's paper on the Skull of *K. breviceps* (Bull. Amer. Mus. Nat. Hist., Vol. XXXVII., 1917, p. 361). He gives a list of twenty-one specimens of the species that have been described up to the present. At least two other specimens are known, both from Ceylon, viz., the Trincomalee specimen presented to the British Museum by Mr. Hugh Neville in 1891, and the Moratuwa specimen, which forms the subject of the present note.—J. P.]

NOTES ON CERTAIN SHORE CRABS.

By C. T. Symons, B.A. (Oxon.), F.R.G.S.

THE observations here recorded were made at Neerodumunai, which is a few miles south of Trincomalee, at the outlet of Lake Tamblegam. It appeared advisable to put them on record, firstly, because there do not appear to be many records of the habits of crabs; and, secondly, because there is some discrepancy in the records of the habits of one of the crabs mentioned.

The shore crabs which were watched belonged to three distinct genera, namely, a Gelasimus, a Dotilla, and a Scopimera, the first and third of which have not yet been absolutely identified.

Gelasimus.—The Fiddler or Caller crabs are well known as possessing one cheliped enormously exaggerated in size, and usually of a very distinct pink colour. This enlarged claw may occur on either side of the body, the numbers, so far as I could ascertain, being about equal for each.

Near Neerodumunai there are three colonies of these crabs, and it is very noticeable that they are all situated in positions where the sand is comparatively muddy, only just covered at high tide, and not on the fine soft sand which is so abundant there. In one case the colony is amongst rocks, under some shrubs. Here the crabs are much tamer than in the more open colonies, presumably because a person watching them is mistaken for the overhanging branches. In watching these crabs it is very noticeable that though their sight is very acute, their sense of hearing appears to be very deficient. They remain quite undisturbed while an ordinary conversation is carried on, and I understand that even a gun-shot produces little effect on the colony. The situation of their eyes on long eyestalks renders them very efficient for keeping a good lookout in all directions.

The male members of the colony do not appear to wander far from the entrances to their burrows. All seem to spend most of their time in feeding, and it was their method of doing this which first attracted me to this series of crabs.

As soon as the crabs emerge from their burrows, if not alarmed, they commence to feed, a process which is carried out by means of the chelipeds, the male using only the smaller one. Small particles of sand are passed up to the mouth, being seized by the upper end of the maxillæ. These small particles are then passed downwards, presumably in the process being scraped by the mandibles to remove minute traces of food. The sand thus accumulates at the lower end of the mouth, and when sufficient has accumulated still adhering to the jaws, the ball of sand is carried downwards and backwards by the walking legs and deposited behind the crab. I have not seen these crabs eating anything else, even when such a thing as a small dead fish or crab was available, although other observers report the use of such food. In the colonies of Fiddler crabs, which I watched, the females were certainly in the minority, and usually, so far as I was able to see, lived in small colonies amongst the males, though some appeared to be paired. The females certainly wandered further from their burrows. On one occasion I was watching the colony, and noticed a female wandering about. There were eight males grouped around her in a circle about 2 feet in diameter. These males were in a most excited state, and showed the one most obvious use to which the large pink cheliped is put. They were standing near the entrances to their burrows on tip-toe, *i.e.*, raised on the points of their walking legs and waving their conspicuous chelipeds in the air, all around the female, evidently determined to do their best to arrest her attention. She seemed to be rather frightened or annoyed. When she approached the edge of the circle, a male would attempt to head her off, but they made no attempt to seize her, nor would they venture far from their burrows. Eventually the female wandered away. At times the whole colony of males may be seen in the same excited state, waving their pink "arms" in the air, and hence earning the name of "Caller" crabs. The burrows inhabited by these crabs appear to descend nearly vertically to below sea level, for the crabs when they emerge are quite wet. As the entrances are comparatively small, the large cheliped has to be carried closely folded to the body on

entering, but there appears to be no general rule as to whether the larger arm shall be moved into the entrance first or after the other arm. In the colonies these crabs do not appear to be very pugnacious, and I have never seen the large cheliped used as a weapon of offence. In fact, the animals appear to find it somewhat unwieldy, and do not move it rapidly. Occasionally I saw one crab trespass on the feeding ground of his neighbour, but I never saw a fight. I have seen one male take hold of the cheliped of another, but nothing more happened, so far as I could see.

Alcock,* who gives a description of these crabs, states that "the dismembered chelipeds of the vanquished males could often be seen lying on the battlefield." I have noticed

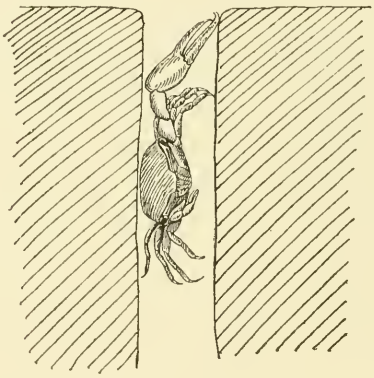


Fig. 1.—Gelasimus protecting its burrow.

two uses for the large cheliped, in each of which it was used as a kind of shield. In one case a male when approached by another one, presumably for the purpose of attack, crouched down in a small cavity in the ground and covered himself with his large arm. In the second case the method was similar, except that the crab escaped into his burrow, leaving the cheliped to block up the entrance (Fig. 1). This was evidently quite intentional, because the animal, instead

* A. Alcock: A Naturalist in Indian Seas, p. 219.

of carrying the arm folded closely to the body, as is usual on entering the burrow, in this case carried it trailing behind. Tennent, in his "Natural History of Ceylon," says that these crabs, presumably *Gelasimus annulipes*, are common on the sandy shores north and south of Colombo. I have not found any in the immediate neighbourhood of Colombo, but there is a colony to be seen on the island opposite the resthouse at Negombo.

Dotilla.—This species, which I have identified as *Dotilla mycteroides*, is not so striking in appearance as the last one, but in its habits it is more interesting. It is of a dull brown colour, rather globular in form, and is provided rather long arms of equal size with long pointed fingers. It inhabits the fine, rather dry sand nearer the sea than the Gelasimus. Its burrows are of much the same form, though smaller, are usually covered at high tide, and thus have to be partly re-made after each tide, as in the case of the others. The diagram (Fig. 2) shows the surroundings of one of the burrows of a Scopimera crab, which closely resemble the runways of the Dotilla. These crabs are comparatively tame, and as they are small, the best way to watch them is to sit or lie down in the middle of a colony. They will soon emerge, and may be watched at a distance of a few inches if the watcher remains absolutely still. The most noticeable feature of the colony is a series of "pathways" leading to little holes, with heaps of countless little round pellets of sand at one side (occasionally both sides). When the tide has gone down leaving the sand quite smooth, the crab, from inside, breaks open the entrance to the burrow and emerges, at once starting to feed; at first there is no sign of a pathway, and no sign of balls of sand, the feeding crab making both as it feeds. As in the case of the Gelasimus, this crab appears to live entirely upon fine particles of food which adhere to the sand. Thus, in order to feed, the crab squats down and starts shovelling sand up to its mouth with the two long "hands" alternately. In this case, as opposed to the habit of the Gelasimus, the sand passes into the mouth from below and emerges above to form a sort of ball or pellet, which is held in position by the maxillary palps which extend

outwards from the mouth. When a considerable pellet has accumulated, one of the arms is used to carry the pellet downwards; it is then passed backwards by the legs and deposited on one side. The first part of this latter movement is very rapid, and looks as if the crab was wiping his moustache, so to speak, with his hand. This feeding goes on

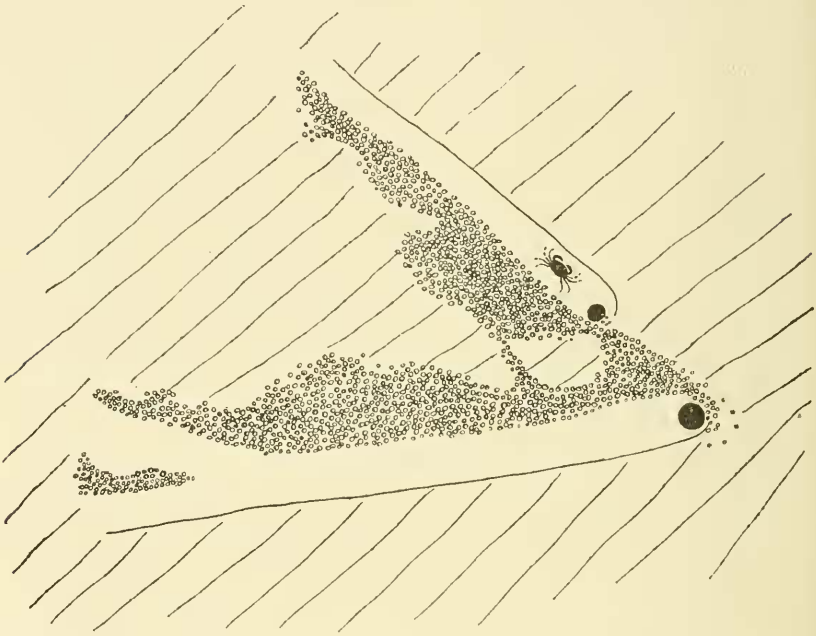


Fig. 2.—Runways of Scopimera.

continuously, and the crab works usually in a direct line from his burrow, thus cutting a kind of hollowed-out pathway about half an inch wide, which has the balls of "eaten" sand on one side. Whenever the crab emerges, it appears to go down the pathway and commence feeding. Thus, the smooth sand left by the receding tide is soon covered with lines and piles of pellets of sand, separated seemingly by pathways leading to the burrows of the crabs. The burrows are close together, so that the pellets may be heaped

somewhat haphazard, and though there is in every case a clearly defined pathway, it is not so well defined as with the Scopimera crabs.

There is another phenomenon amongst these Dotilla crabs which is worthy of mention. As is usual, on the stretches of shore which are exposed at low tide some parts are quite dry, whereas others are comparatively wet during the whole period of low tide. These animals appear to have adapted themselves to both these conditions. Some live, as above described, in burrows in dry sand, while others of the same species live on the wet patches. If such a wet-sand colony be cautiously approached, troops of these crabs may be seen moving about and feeding. When disturbed, they do not scurry away, as Ocypodes do, and having no ready-made burrows, they cannot escape as their dry-sand brethren do. Their method is to move to a soft wet patch of sand, if not already there, and then to vanish. This disappearance is is at first sight very astounding, as it only takes a few seconds for a whole colony of them to pass out of sight and leave the sand looking almost undisturbed. On closer examination the mystery is explained, when one of them is seen disappearing down into the sand by a kind of corkscrew movement. The animal accomplishes this by digging itself sideways and downwards into the sand. This method of taking cover is only used for temporary escape; for the crabs may be unearthed by disturbing the surface of the sand. I never found one which had penetrated more than an inch under the sand in this way. This habit provides the easiest method of procuring specimens.

When these wet-sand crabs have finished feeding, *i.e.*, when the tide is rising, they have a most ingenious way of providing themselves with a retreat full of air while the tide covers their feeding ground. In the wet sand a small cavity about three-quarters of an inch in diameter is excavated in the shape of a cup (Fig. 3). Then the crab, standing in the middle, starts to carry wet lumps of sand from the bottom and piles them on to the sides. Working very rapidly, he soon (that is, in 2 or 3 minutes) has a complete wet-sand chamber enclosed and roofed in, the air inside being retained by the

wet sand. I watched one do this, waited for a few minutes, and then dug down at the spot and found that the crab and the air chamber had disappeared quite deep into the sand. Presumably, although it is impossible to see this part of the process when the chamber is completely roofed in, the crab goes on working in the same way until the air bubble or chamber is carried down to the requisite depth, so that the tide overhead will not disturb it. In this air chamber the crab remains until the tide has gone down and he can come up again to feed.

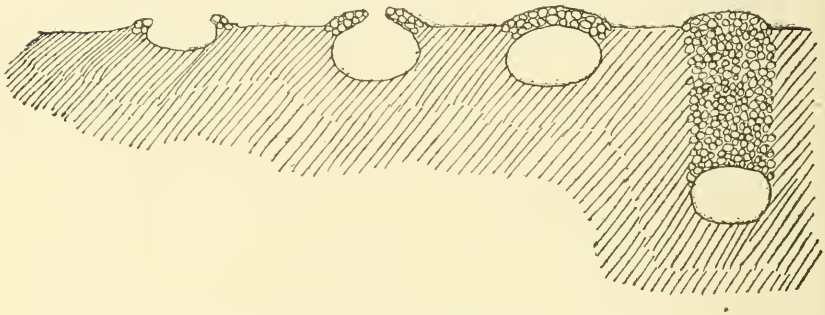


FIG. 3.—Section showing stages in the formation of an air chamber by Dotilla.

The habits of a nearly-allied species of crab is described by R. P. Cowles,* who has observed the habits of *Mycteris longicarpus*, Latreille, in the Philippine Islands. But though he gives photographs of the sand pellets and describes the corkscrew descent of the hiding crab, with a plate illustrating the crab in the air chamber, he appears to think that the pellets are thrown up and the air chamber is made by the rapidly-descending crab. As I have recorded above, these two habits are quite distinct. The air-chamber method is used by those which live on the wet sand and have no permanent burrows. In one case I noticed that one of the crabs living on the dry sand most carefully closed up the entrance to his burrow with several lumps of sand, presumably to retain the air inside when the tide came up.

* R. P. Cowles: "Habits of some Tropical Crustacea," II. Philippine Journal of Science, Vol. X., Sec. D, No. 1, p. 11.

Scopimera.—I have not been able to identify the species to which these crabs belong. Their habits closely resemble those of the Dotilla just described. They are always to be found on the dry, fine sand just below high-water mark. They are smaller and flatter than the Dotillas, and their chelipeds are much more spade-like. Their method of feeding is exactly the same as that of the Dotilla species, but the pellets of sand are often as large as the body of the crab before they are removed from the mouth and placed on the heap. Their burrow "paths" and piles of "eaten" sand are much more orderly than those of the Dotilla. Just after the tide has fallen and the sand become fairly dry, this neatness is most marked. They work a path, which is about three-quarters of an inch wide, and only scrape it on the surface to form a shallow groove, all the pellets being placed on one side of the path, that is, in eating they always appear to face in one direction. Occasionally an aberrant one is seen, feeding in an irregular manner so far as the pathways are concerned, but the actual method of handling the sand is always the same, and there is no possibility of mistaking the work of one of these crabs for the work of an Ocypode in clearing out its burrow.

NOTES.

Viviparous Habit of the Snake Cylindrophis maculatus (*Linne*).—Among half a dozen Ceylon snakes sent to me recently through the kindness of Mr. Gerard A. Joseph, I found a specimen of *Cylindrophis maculatus*, which proved to be gravid. As far as I am aware, the viviparous nature of this species has not been previously noted; in fact, judging from Boulenger's Catalogue (1893, Vol. I., p. 131 *et seq.*), nothing is known of the breeding habits of any of the species of the family Ilysiidæ. This being so, the specimen referred to by me is of very special interest.

When cut open two fœtuses (1 ♂, 1 ♀) were brought to light, each folded twice into three about equal parts, and marked and coloured just like the dam. The ♂, known from its extruded claspers, measured $5\frac{3}{8}$ inches, and the ♀ 5 inches in length, the parent taping just $10\frac{3}{4}$ inches. Now I find that in most viviparous snakes the young measure at birth about one-quarter the length of the dam, so that the embryos now referred to are relatively very large, being almost half the length of the parent. Such unusual development probably influences the numbers in the brood, which in this case is considerably less than in any other land snake that I am acquainted with. In a paper of mine published in the Bombay Natural History Journal (Vol. XXV., p. 607), I drew attention to the very small broods that two sea snakes (*Enhydris curtus* and *Hydrophis gracilis*) produce. Both usually discharge one or two at a birth, and in the case of the former, the embryos measure at least two-fifths of the dam before birth.

Unfortunately there is no record of the date of capture of this interesting *C. maculatus*.

October 12, 1918. F. WALL.

Occurrence of Motacilla alba (the White Wagtail) in Ceylon.—On Saturday, November 23, 1918, when walking from the Residency to the Kachcheri at Puttalam I saw a strange Wagtail on the maidan. I went out to look for a specimen in the evening and shot a young male, which turned out to be *M. alba*—the White Wagtail—in its first autumn plumage. There were several other specimens. One I used to see almost daily either in the resthouse compound, or on the maidan between the Residency and the Kachcheri. They stayed until early February. I left Puttalam for a week's circuit in the first week of February, and when I came back they had gone. The specimen I obtained is now in the Colombo Museum.

The species is common in summer throughout Northern Europe and Western Siberia. It winters in North Africa and India, but seldom visits the extreme south of the peninsula, and it has never before been recorded from Ceylon.

December, 1919. W. E. WAIT.

PROCEEDINGS OF THE CEYLON NATURAL HISTORY SOCIETY.

The Seventh Anniversary Meeting of the Society was held in the Colombo Museum Library on March 14, 1919, at 5.15 P.M., the Hon. Mr. R. E. Stubbs, C.M.G., President, in the Chair.

The accounts and reports of the Honorary Secretaries and Treasurers for 1918 were read and confirmed.

A vote of thanks was proposed to Mr. W. H. Young for auditing the accounts.

The following office-bearers were elected for the ensuing year:—

Patron.

His Excellency the Governor.

President.

The Hon. Mr. R. E. Stubbs, C.M.G.

Vice-Presidents.

F. M. Mackwood, Esq.
Sir S. D. Bandaranayake, C.M.G.
Dr. A. Nell.
Dr. J. Pearson.

Council.

T. Petch, Esq.
The Ven. the Archdeacon of Colombo
Harry Creasy, Esq.
The Rev. Father M. J. Le Goc.
E. Evans, Esq.
G. A. Joseph, Esq.

Joint Honorary Secretaries and Treasurers.

Messrs. C. T. Symons and W. A. Cave.

New Member :—T. R. Mitchell, Esq.

Further exhibits of photographic animal studies from the Game Sanctuary taken by F. E. Mackwood, Esq., were shown. Some interesting notes on these exhibits were given by Mr. C. T. Symons, who accompanied Mr. Mackwood on the trip.

Twenty-sixth General Meeting.

The Twenty-sixth General Meeting of the Society was held in the Colombo Museum Library on April 24, 1919, at 5.30 P.M., Dr. A Nell in the Chair.

A paper on " Sex Statistics of the Mullaittivu District, Northern Province," was given by Frederick Lewis, Esq.

Mr. C. T. Symons gave a few short notes on squirrels eating butterflies, white ants working in the open, and some crossed varieties of *Mirabilis jalappa* (Marvel of Peru).

Twenty-seventh General Meeting.

The Twenty-seventh General Meeting of the Society was held in the Colombo Museum Library on May 20, 1919, at 6 P.M., Dr. A Nell in the Chair.

A paper on " Wild Life at the Water-hole " was given by Dr. R. L. Spittel.

Mr. David Scott gave a short note on the depredations of white ants in the top floor storey of a building in the Fort reinforced with concrete.

Twenty-eighth General Meeting.

The Twenty-eighth General Meeting of the Society was held in the Colombo Museum Library on June 26, 1919, at 6 P.M., Dr. A. Nell in the Chair.

A paper on " Notes on Ceylon Cuckoos and their Eggs " was given by W. E. Wait, Esq., M.A., M.B.O.U.

Twenty-ninth General Meeting.

The Twenty-ninth General Meeting of the Society was held in the Colombo Museum Library on July 17, 1919, at 6 P.M., Dr. A. Nell in the Chair.

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New Member :—L. M. Maartensz, Esq.

THE OWLS AND DIURNAL BIRDS OF PREY FOUND IN CEYLON.

By W. E. Wait, M.A., F.Z.S.

ERRATUM.

It is regretted that by an oversight, in the second figure of the first plate accompanying Mr. W. E. Wait's article on the "Picarian Birds and Parrots of Ceylon" in Part 42 of this Magazine, facing page 272, an illustration of *Amaurornis phœnicurus*, The White-breasted Water-hen, has been inserted instead of a presentment of *Coracias indica*, The Indian Roller.

I hope, however, when the Handbook is published in volume form, to follow the new trinomial classification of Indian birds, which Mr. E. C. Stuart Baker is bringing out in the Journal of the Bombay Natural History Society.

Order **STRIGES.**

Owls.

The Owls form a naturally marked order, lying between the Parrots and the Birds of Prey. They are birds, mainly nocturnal, of very distinctive appearance. The whole plumage is soft and fluffy. In most genera the head is large and densely feathered; the big round eyes are directed

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Twenty-eighth General Meeting.

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THE OWLS AND DIURNAL BIRDS OF PREY FOUND IN CEYLON.

By W. E. Wait, M.A., F.Z.S.

(*With one Plate.*)

THE present instalment of the rough draft for the Handbook on the Birds of Ceylon includes the members of the Orders *Striges* and *Accipitres*. As in the earlier portions, I have followed the classification given by Oates and Blanford in the volumes on Birds in the "Fauna of British India." After this paper had been completed, I had the advantage of meeting with Mr. W. L. Sclater, and of reading the manuscript of his forthcoming rescension of the *Accipitres*. There is no doubt that since Blanford wrote much greater accuracy of classification has been attained, largely by the use of the trinomial system in differentiating sub-species, or geographical races. As, however, Mr. Sclater's work was not complete, and as the adoption of his classification would have entailed the recasting of a considerable portion of my paper, I am publishing it as it stood, in order not to delay its appearance. I hope, however, when the Handbook is published in volume form, to follow the new trinomial classification of Indian birds, which Mr. E. C. Stuart Baker is bringing out in the Journal of the Bombay Natural History Society.

Order **STRIGES.**

Owls.

The Owls form a naturally marked order, lying between the Parrots and the Birds of Prey. They are birds, mainly nocturnal, of very distinctive appearance. The whole plumage is soft and fluffy. In most genera the head is large and densely feathered; the big round eyes are directed

forwards, and are circled with disks of radiating feathers, which may be bordered by a close-set ruff. Many species bear, above the eyes, upstanding tufts of feathers known as aigrettes, horns, or ear tufts. The bill is short, curved, and hooked; its base is furnished with a cere, which is usually covered by stiff bristles concealing the nostrils. The ear openings are generally of large size, and are often protected by a lid or "operculum." The legs are usually, but not always, completely feathered down to the toes. The feet are strong, the toes have sharp, curved claws of moderate length; the hallux or hind toe is always present, the outer toe is reversible.

The coloration, as might be expected in nocturnal birds, is mainly some combination of brown or rufous. Most species breed in hollow trees and lay white eggs, which are almost spherical. The young when born are helpless and covered with down. Owls are carnivorous, the larger species preying chiefly on small mammals and birds, while the smaller forms feed mainly on beetles and various other insects.

Members of the order are found all over the world, and from their silent ghost-like flight, their large eyes, nocturnal habits, and weird cries have always been looked upon in all countries as birds of ill-omen. The usual call is either a hoot or a shriek, but in the forests of India and Ceylon eerie, strangulated sounds are heard at night, and are usually supposed to be the alarm calls or mating cries of one or other of the Owls. In Ceylon the identity of this "Devil Bird" is still a subject of much discussion and conjecture. From personal experience, inquiries, and the evidence recorded, I am convinced that the cries vary considerably, and probably are not all made by the same species. In the northern forest tract the cry usually heard is a loud, piercing, single scream, which is audible at a great distance. The villagers in the interior of the Puttalam District ascribe this call, not to an Owl, but to the Crested Hawk-Eagle—*S. cirrhatus*—and I believe that in some cases they are right. I have heard this cry at night in the North-Central Province, and although the effect was blood-curdling, there was a ring in it not altogether unlike the ordinary note of an eagle. The calls described by

other observers in the central and southern parts of the Island differ so from this cry that they seem fairly obviously to be uttered by some other bird, and it is not improbable that more than one species is responsible. Four Owls are held in suspicion. Native legends and belief point to the Brown Wood-Owl—*S. indrani*—a fairly common, large species. Its ordinary note is a resounding "too-whoo," but tame birds have been known to utter dismal wailing sounds (*vide* Legge, p. 158) where the question is discussed at some length.*

Another bird with equal claims is the Forest Eagle-Owl—*H. nepalensis*. There is in the Colombo Museum a skeleton of this Owl, presented by J. H. Stephens, who stated that he shot it while uttering the cries of the Devil Bird. It is, however, a rare species in Ceylon, though the few specimens recorded come from widely distributed localities, both in the hills and in the low-country. Others, again, state that the Devil Bird is a "small whitish bird," which would point to the Ceylon Bay-Owl—*P. assimilis*. This is also a rare bird peculiar to Ceylon, and as yet recorded only from the hills and from the forest at their bases. An allied species from northern India—*P. badius*—is said to make an appalling noise. The latter two species are probably genuine "Devil Birds," but as they are either rare or restricted in range, and as the Devil Bird's cries are reported from all over the Island, I cannot imagine that they are the sole authors of the ill-omened sounds.

Lastly, the Brown Hawk-Owl—*N. scutulata*—a small species found all over the Island, is mentioned by several Indian observers as making noises like a strangled cat, or a hare caught by hounds. It has not, however, been regarded with suspicion in Ceylon.

The order is divided into two families, the distinction being founded solely on osteological characters, there being no external differences of any importance. In the family *Strigidæ*, which includes only one of the eleven species found

* The cries described in the letter from Mr. Mitford, quoted in the passage here alluded to, as having been "heard on the rock at the back of the Residency at Kurunegala," are probably those made by the Flying Squirrels, which still haunt the same locality and utter wailing calls at night-time.

in Ceylon, the skull is long and narrow, and the "furcula," or merrythought is united to the keel of the breastbone. In the *Asionidæ* the skull is broader, and the furcula is not in contact with the keel of the breastbone.

Family Strigidæ.

Genus **Strix.**

Screech Owls.

This is a small family, containing only two genera, one of which—*Strix*—is world-wide, the other confined to Madagascar. In the genus *Strix* there are no ear tufts, the facial disk is large and full, and completely surrounded by a ruff of stiff feathers. The bill is weak and compressed, the nostrils are oval; the wings are long and pointed, and when closed reach beyond the tail. The legs are long, the upper part of the tarsus is feathered; on the lower tarsus and toes the feathers become bristles. The middle toe is of about the same length as the inner; the middle claw is serrated on the inner margin. Only one species, the familiar English Barn Owl, is found in the Island. It may be distinguished from all other Ceylon Owls by its pale plumage, and by the combination of the long pointed wings with the slightly serrated comb on the middle claw. The Bay Owl has a serrated middle claw, but the wings are comparatively short and rounded.

Strix flammea (Blanford, Vol. III., p. 264; Legge, p. 164).

The Barn Owl; Screech Owl.

Description.—Facial disk white, a rufous patch in front of the eye; ruff feathers white, the outer feathers rufous towards the end and with dark brown tips; back and upper parts tawny-buff and stippled-gray, with a small eye-shaped spot of black and white at the end of each feather; wing quills tawny-brown with mottlings and irregular cross bands of dark grayish-brown and a large amount of white on the inner webs; tail tawny brown with four wavy, slightly mottled bars of dark brown, the tip mottled-white and dark brown, with some traces of eye spots as on the back; the underside of the tail feathers white. Lower parts white, more or less tinged on

the flanks and thighs with very pale buff, and with scattered small triangular dark spots, mainly on the sides of the breast, the flanks, and wing lining.

Bill fleshy-white; cere flesh colour; iris black; bare portion of legs and feet fleshy-brown.

Length about 14; wing 11·25; tail 4·75; tarsus 2·5; bill from gape 1·5.

Distribution.—In Ceylon practically limited to the Jaffna peninsula; a few specimens have been recorded from the north-west coast as far south as Puttalam. It occurs all over the world in tropical and temperate regions, with minor racial distinctions in the various continents.

Habits, &c.—A thoroughly nocturnal bird, frequenting house roofs, outhouses, old buildings, ruins, or occasionally old hollow trees. In Jaffna it haunts the old drainage outlets from the bastions of the fort into the moat. It feeds almost entirely on rats and mice. The cry is a loud and rather weird screech. The birds are noisiest in the breeding season, which at Jaffna is in June and July. The eggs are laid in some hole in a building or tree; generally there is no nest lining, in some cases a few sticks are placed on the floor of the hole. The eggs vary in number from 3 to 6; the shape is roundish oval, the colour white with a creamy tinge, the measurement about 1·69 by 1·28.

Family Asionidæ.

This family comprises ten out of our eleven species. It is again sub-divided into three sub-families as follows:—

Photodilinæ.—Facial disk and ruff well marked; ear orifice smaller than the eye, and not furnished with an operculum inner margin of the middle claw with a small serrated comb.

Asioninæ.—Facial disk and ruff well marked; ear orifice larger than the eye, an operculum present; middle claw not serrated.

Buboninæ.—Facial disk and ruff not well marked; ear orifice smaller than the eye; middle claw not serrated.

Sub-family *Photodilinæ*.

Genus **Photodilus.**

Bay Owls.

This sub-family is limited to a single genus of two species, one of which is peculiar to Ceylon. Both are of medium dimensions, being slightly under a foot in length. As in the genus *Strix*, the inner margin of the middle claw is furnished with a slightly serrated file-like process or comb. The wings, however, are much shorter and rounded. The tarsus is feathered throughout, the inner toe is longer than the middle. The facial disk is very distinct, but the ruff is not quite complete above the eyes. The Ceylon species can be told apart from all our other Owls by the pinkish tinge of the face and lower parts.

Photodilus assimilis (Blanford, Vol. III., p. 269).
Phodilus assimilis (Legge, p. 161).

The Ceylon Bay Owl.

(See Fig. 1.)

Description.—Forehead and facial disk vinous-pink; feathers round the eye chocolate; ruff white tipped with chestnut and black; feathers of the crown and nape dark chestnut, flecked in the centre with black and paler chestnut, a few feathers sometimes whitish; remainder of upper parts a mixture of chestnut and rich tawny-buff, marked with smallish triangular spots of black, which on the scapulars and wing coverts are flecked with white; wing quills chestnut on the outer, dark grayish-brown on the inner webs, both webs being barred with black; on the long winglet feathers, on the outer web of the first primary, and on the ends of the outer webs of the next two or three primaries the spaces between the black bars are white; tail rufous chestnut with narrow black bars.

Throat and chest buff, shading into pale vinous-pink on the remainder of the under parts; most of the feathers with two dark brown spots on the centre; the thigh plumes sometimes silky-white; wing lining buff with a patch of deep chocolate brown at the base of the primaries.

Bill greenish-white; iris dark brown; feet pale whitish-green.

Length about 11; wing 7·75; tail 3·5; tarsus 1·65; bill from gape 1·25.

Distribution.—A rare bird peculiar to Ceylon. A few specimens have been obtained in the hills under 3,000 feet, and in the forest country at the foot of the ranges.

Habits, &c.—There is little on record regarding these. The species is nocturnal and lives in the forest. The nest has been found on Martin's town estate, near Rakwana. It was made in the hole of a tree, and was composed of dry twigs, moss, and feathers. The parent bird and three young were taken from the nest in November, so it would appear to breed towards the end of the year and to lay three eggs. As stated in the remarks on the order, this Owl is probably the author of some of the eerie cries of the Devil Bird. Mr. E. C. Stuart Baker informs me that the North Indian species—*P. badius*—makes a noise "like half a dozen mad cats."

Sub-family *Asioninæ*.

Eared Owls and Wood Owls.

The two Ceylon members of this sub-family are of fairly large size. The ear orifice is larger than the eye, and is furnished with an opereulum. The facial disk is well marked and the ruff distinct. The tarsus and upper surface of the toes are fully feathered. The legs and feet are fairly strong, but not so stout and formidable as in the Fish and Eagle Owls.

Rough Key to Ceylon Species.

A.—Length about 15; wings long and pointed; ear tufts well marked.

Asio accipitrinus (The Short-eared Owl).

B.—Length about 18; wings rounded; no ear tufts.

Syrnium indrani (The Brown Wood Owl).

Asio accipitrinus (Blanford, Vol. III., p. 271 ; not in Legge).

The Short-eared Owl.

Description.—Facial disk pale tawny-buff, the feathers round the eye black ; the ruff rich buff, streaked and speckled with dark brown ; upper plumage buff, broadly streaked and mottled with dusky-brown ; on the scapulars and longer wing coverts the buff colour is paler ; primary quills chestnut-buff with broad tips and irregular bands of dark brown ; secondaries buff, banded with brown ; tail tawny-buff with irregular brown bars. Lower parts buff with longitudinal streaks of brown, broad on the breast and narrow on the abdomen ; the lower abdomen, legs, and under tail coverts are unmarked.

Bill black ; iris deep yellow ; claws black.

Length about 15 ; wing 12·25 ; tail 6 ; tarsus 1·6 ; bill from gape 1·2.

Distribution.—On several occasions in recent years this Owl has visited Ceylon in some numbers. In November, 1896, seven specimens were recorded from Jaffna, and next February two from the Horton Plains. There was another strong invasion about Christmas, 1904, when ten specimens were obtained in Colombo alone. The species is a migrant found almost all over the world, breeding in temperate climates, and visiting warmer regions in winter.

Habits, &c.—In Ceylon most of the specimens have been secured immediately on their arrival. In India this Owl is met with chiefly in grass plains, but sometimes in low bush or cultivated lands. It is largely nocturnal, and feeds principally on small mammals.

Syrnium indrani (Blanford, Vol. III., p. 275 ; Legge, p. 155).

The Brown Wood Owl.

Description.—Loral plumes black, fringed with dirty-white ; facial disk rufous-tawny, whitish above the eyes, the feathers round the eye black ; ruff and chin dark chocolate-brown ; Crown and upper plumage dark sepia-brown ; scapulars, wing

coverts, rump, and upper tail coverts paler, and with narrow whitish bars; wing quills deep brown with paler brown crossbars; tail feathers brown with narrow white tips and crossbars. Under parts and legs whitish or yellowish, closely barred with dark brown.

In young birds the feathers have broad whitish edges, the whole of the upper plumage is barred, but the under parts are white, and only gradually assume the barring of the adult phase.

Bill bluish near the cere, whitish-horny near the tip; cere dusky-bluish · iris deep brown; claws bluish.

Length about 18; wing 12·25; tail 7; tarsus 2·15; bill from gape 1·5. Males slightly smaller than females.

Distribution.—May be met with in forest over the whole of Ceylon from sea level to Nuwara Eliya. In India the species is rarely found on the plains, but occurs in the Himalayas and on the hills of the Malabar Coast. It has been recorded from a few other localities in India proper, Burma, and Formosa. The Himalayan form is probably a good sub-species, much larger than our Ceylon bird.

Habits, &c.—A fairly common species, found mainly in heavy jungle. At times it may be seen during the day being mobbed by drongos and other small birds. It feeds on small birds, lizards, and, at any rate in captivity, on small fish. The note is of four syllables "oot-oot-tu-whoo," but the first two syllables can only be heard when close at hand. As noted in my remarks on the order, this is the species commonly credited with the cries of the Devil Bird. The breeding season is during the early part of the year; two eggs are laid in a hole in a large tree, but in India stick nests have been found, placed on a rocky shelf, or in the fork of a tree. The eggs are of the usual owl type. North Indian eggs measure about 2·25 by 1·81.

Sub-family *Buboninæ*.

Fish Owls, Eagle Owls, and Owlets.

This sub-family comprises a much larger variety of forms than the other two, and includes seven Ceylon species: our two largest Owls and five owlets.

The Fish and Eagle Owls are large birds with well-marked ear tufts, powerful beaks, stout legs and feet, the latter armed with powerful talons, and rounded wings. The Fish Owl, as suits its mode of life, has a naked tarsus ; the Eagle Owl has its legs feathered to the toes, and differs from most Owls in possessing a completely distinct immature plumage.

The Owlets fall into three genera : *Scops*, with ear tufts and a streaky upper plumage ; *Glaucidium*, with no ear tufts and a barred upper plumage ; and *Ninox*, which is very hawk-like in appearance, as it possesses no ear tufts, and the ruff and facial disk are not developed.

Rough Key to Ceylon Buboninæ.

I.—Size large ; length 20 or over ; ear tufts present.

(1) Tarsus naked.
Ketupa zeylonensis (The Brown Fish Owl).

(2) Tarsus feathered.
Huhua nepalensis (The Forest Eagle Owl).

II.—Size small ; length under 12.

A.—Ear tufts well developed (genus *Scops*).

(1) Wing about 5·25 ; third primary longest, first longer than eighth.
S. giu (Scops Owl).

(2) Wing about 5·85 ; fourth or fifth primary longest, first much shorter than eighth.
S. bakkamœna (Collared Scops Owl).

B.—Ear tufts absent.

(*a*) Upper plumage barred (genus *Glaucidium*).

(1) Abdomen transversely barred.
G. radiatum (Jungle Owlet).

(2) Abdomen longitudinally streaked.
G. castanonotum (Chestnut-backed Owlet).

(*b*) Upper plumage not barred.
Ninox scutulata (Brown Hawk Owl)

KETUPA ZEYLONENSIS (Blanford, Vol. III., p. 281 ; Legge, p. 127).

The Brown Fish Owl.

Description.—Bristly loral plumes white at the base, black towards the tips ; cheeks tawny with black shaft-stripes ; upper parts light chestnut-brown with broad black shaft-stripes ; lower back, rump, and upper tail coverts a little paler and with narrow shaft-stripes ; scapulars, tertiaries, and wing coverts considerably mottled with whitish, the outer webs of the outer scapulars white ; wing quills and tail feathers dark brown, barred and tipped with dusky buff, which becomes almost white on the outer webs of the larger primaries. Throat white with dark shaft-stripes, in some birds the white throat patch is almost absent ; feathers of remaining lower parts with fine wavy pale brown crossbars and bold black shaft-streaks. Bill yellowish-green ; cere pale dusky-green ; iris golden-yellow ; legs greenish or yellowish.

Length about 21 ; wing 15 ; tail 7·5 ; tarsus 2·75 ; bill from gape 2.

Distribution.—Fairly common and well distributed over the whole of the low-country, ascending the larger river valleys up to about 3,000 feet. It occurs in suitable localities throughout the Indian Empire, extending eastwards to China, while westwards it re-appears in Palestine.

Habits, &c.—This species is generally found in fairly thick jungle near water. During the daytime it roosts in large trees. Its cry is a deep triple note "tu-whoo-hu." Its food is composed mainly of fish, but it will also eat small animals, snakes, large beetles, &c. It breeds about April, making a scanty stick nest on the ledge of a rock near water. At times it will lay in the hollow of a tree or even appropriate the deserted nest of a Fish Eagle. The two white, broad, oval eggs are fairly glossy, and measure about 2·30 by 1·75.

HUHUA NEPALENSIS (Blanford, Vol. III., p. 287).
BUBO NIPALENSIS (Legge, p. 131).

The Forest Eagle Owl.

Description.—Bristly loral feathers, cheeks and ear coverts grayish-buff with rather darker shafts ; ear tufts blackish-brown, sometimes barred on the inner webs with whitish-buff ;

upper plumage glossy sepia-brown with narrow cross bands and edges of tawny-buff; on the scapulars and wing coverts these pale cross bands become broader and are mottled with brown; wing quills dark brown with bands of smoky gray; tail with mottled bands and tips of buff. Lower parts white, at times tinged with buff, with broad brown crescent-shaped bars.

Young birds are white or buff, with crescent-shaped dark brown bars on both upper and lower plumage; quills and tail feathers as in adults.

Bill yellow; iris brown; toes yellow.

Dimensions variable; females, as a rule, are larger than males. Length about 23; wing 15·3–18; tail 7·5–9·5; tarsus 2·60; bill from gape 2.

Distribution.—Not very common, but found apparently as much in the low-country forests as on the hills. Specimens in the Colombo Museum come from Kurunegala; Giriulla, North-Western Province; and Batticaloa. If this species is the only Devil Bird, it is found fairly generally throughout the Island. In India, like *Syrnium indrani*, this is a hill species, occurring in the lower Himalayas and the hill ranges of Assam and Southern India. It is also recorded from one or two localities in Burma.

Habits, &c.—A forest bird, but found more in scattered clumps of large timber, such as the wooded gorges of the patanas, and on the edges of thick forest than in the heart of the jungle. Not much is known of its mode of life, as it is a nocturnal bird seldom seen. To judge from its size and powerful talons, it probably hunts fairly large game, and appears to live mainly on birds. In India it is credited with killing pheasants, hares, and even young deer. The cry is described by Jerdon as a low, deep, and far-sounding moaning hoot. I have discussed in my remarks on the order the claims of this species to be the Devil Bird. Nothing appears to be known of its breeding habits in Ceylon. In India the nest has been found in Northern Cachar. It consisted of a broad platform of sticks and grass, placed about 6 feet from the ground in a large fig tree. One white egg of the usual type measured about 2·21 by 1·87.

Scops giu (Blanford, Vol. III., p. 291).

Scops sunia (Legge, p. 139); S. minutus (Legge, p. 143).

The Scops Owl.

Description.—General colour above grayish-brown, more or less tinged with rufous, finely stippled with black and white, and with dark shaft-stripes and some lighter patches. The lores are whitish, some of the bristles with black tips; remainder of facial disk light grayish-brown with slightly darker markings; ruff feathers narrowly tipped with black; the outer scapulars have the outer webs whitish tipped with black; wing coverts with pale spots which are sometimes indistinct: wing quills rufous-brown with irregular dark barrings and pale patches, most distinct on the outer webs of some of the primaries; tail pale sandy-brown, mottled and irregularly barred with darker-brown. Lower parts grayish-buff, vermiculated with sandy brown, and with irregular but fairly conspicuous shaft-stripes of black-brown.

Rufous Phase.—The ground colour of the upper plumage, including wings and tail, almost uniform pale rufous chestnut with black shaft-stripes, most conspicuous on the head; the white outer webs of the scapulars stand out most distinctly, and are bordered behind with black. Lower parts much the same as in the gray phase, but tinged with rufous.

Bill olive-brown; cere greenish; iris yellow; feet fleshy-brown.

Length about 6·5; wing 5·25; tail 2·2; tarsus ·75; bill from gape ·75.

Distribution.—Blanford regards a variety of gray Indian forms, which others divide into several species, as merely local races of *Scops giu*, which ranges over central and southern Europe and Asia and the greater part of Africa. Of these local races, our Ceylon bird—Legge's *S. minutus*—is the smallest and darkest. *S. sunia* of some authors is held by Blanford to be merely a rufous phase, which may occur in any of the Indian forms. Both the rufous and gray birds are extremely rare in Ceylon, but have been recorded from a few widely scattered localities both in the hills and the low-country.

Habits, &c.—Found in the outskirts of jungle, or in isolated thickets and round lonely bungalows. A nocturnal species, feeding on insects and at times small birds and mammals. The cry according to Legge is a feeble "woot-woot." This agrees with the note recorded for the Indian species. A. L. Butler,* however, says the note of the Ceylon bird is "hoot-coorroo." Legge noticed a similar call, but thought it was possibly the cry of *Ninox scutulata*. This cry may be heard at night at several of the wilder circuit bungalows and rest-houses in the northern forest tract. It is really a four-syllabled cry, "*wook took-toorroo*," the first note not carrying so far as the others. I am inclined to put it down as the call of *Batrachostomus moniliger*, as the cadence seems more like the note of a Nightjar than of an Owl. If, however, Butler is correct, our Ceylon bird having a cry so different from the Indian form must surely be a distinct species. The point requires further elucidation. Little is known of the nidification in Ceylon, but such a well-marked local race must breed in the Island. Indian forms are largely migratory, but breed in certain hill localities, laying three or four white eggs in holes of trees.

Scops bakkamœna (Blanford, Vol. III., p. 297).

Scops bakkamuna (Legge, p. 135).

The Collared Scops Owl.

Description.—Bristly loral feathers grayish or buffy-white tipped with black; facial disk grayish, or at times rufescent, with darker pencillings; ruff feathers buff, boldly tipped with blackish-brown; the forehead, a broad eyebrow, and the inner webs of the ear tufts grayish or buffy-white pencilled with black; upper plumage buff or grayish finely vermiculated with blackish-brown, and with broad black shaft-stripes on some of the feathers: crown and nape almost black, more or less mottled with buff; a more or less distinct collar on the hind-neck, formed by buff feathers with dark edges;

* Journal Bombay Nat. Hist. Society, Vol. XII., p. 570.

the outer webs of the outer scapulars are buff bordered with black; wing quills brown with paler mottled bands and tips, the pale bands becoming white patches on the outer webs of the primaries; tail brown mottled and banded with smoke gray or tawny; chin buff or whitish; throat, breast, and remainder of lower parts grayish or tawny-buff, more or less marked with fine wavy crossbars of brown and with occasional bold black-brown shaft-stripes; legs, vent, and under tail coverts generally unmarked. Some birds are grayer, others more rufous.

Bill greenish-horny, darker above; iris chestnut or reddish yellow; feet brownish-olive or greenish.

Length 8; wing 5·85; tail 2·6; tarsus 1·25; bill from gape ·85.

Distribution.—The commonest small Owl in the Island, most abundant in the west and south, especially near the sea, rarer in the north and east. In the lower hills it is found up to about 3,000 feet. It occurs all over the Indian Empire and Malaya, including the Archipelago. As in the last species, there are several distinct local races, raised by some to the rank of species. As usual, Ceylon and Southern Indian forms are the smallest and darkest.

Habits, &c.—A nocturnal species, occurring largely in cultivated country, and even in town gardens. Its monotonous little "wok, wok" is frequently heard after dark in Colombo. The birds go about in pairs. For months a couple slept every day side by side in a tall shady thorn bush in my compound at Puttalam. It feeds mainly on insects and other small fry. The breeding season appears to be about February, March, and April. It nests in hollow trees, or in the angle between the frond and stem of a palm. A few leaves or blades of grass are sometimes placed as a lining, but in the only two nests I have found the eggs were laid on the chips of rotten wood at the bottom of the hole. In Ceylon two eggs appear to be the usual number, occasionally three. They are of the usual shape, almost spherical, and not very glossy. They soon become stained with yellow. The average of four Ceylon eggs is 1·24 by 1·09.

GLAUCIDIUM RADIATUM (Blanford. Vol. III., p. 306; Legge, p. 152).

The Jungle Owlet.

Description.—Lores whitish with dark tips; the sides of the head and neck, the crown and the upper plumage, the wing coverts, tertiaries, and upper tail coverts dark brown with narrow bars of pale rufous or white; some white spots on the scapulars and wing coverts; wing quills barred with rich dark brown and rufous, the latter colour paling into whitish at the edge of the larger primaries and near the tips of the secondaries; tail feathers black-brown with narrow white tips and crossbars. The chin and a band on each side of the throat whitish; remainder of lower parts whitish-buff with numerous bars of olive-brown which become rather arrow-shaped on the abdomen and fade away on the legs and lower tail coverts.

Bill greenish-horny; cere greenish: iris yellow; feet greenish-yellow.

Length 8; wing 5·1; tail 2·6; tarsus ·9; bill from gape ·75.

Distribution.—Fairly widely distributed over the southern half of the Island, being commonest in the Eastern Province. It is found also in the Uva hills. It occurs in well-wooded country over the greater part of India.

Habits, &c.—Found in tall forest and dense jungle, or occasionally in scrub jungle near the sea. It is very seldom seen, but its presence may be detected by its peculiar call, which is uttered during the daytime when the weather is dull or cloudy. This call is described by Legge as starting "with the syllable kāow, slowly repeated, and gradually accelerated until changed to kāow whap, kāow whap, which increases in loudness till suddenly stopped." Its flight is straight and strong. It feeds on beetles and other insects, and also on small birds, even attacking young chickens. In India it breeds during April and May in holes of trees, laying two or three smooth white glossless eggs averaging 1·25 by 1·06.

GLAUCIDIUM CASTANONOTUM (Blanford, Vol. III., p. 307; Legge, p. 149).

The Chestnut-backed Owlet.

Description.—Lores whitish with dark tips; whole head, sides and back of neck, throat, chest, and sides of breast dark brown with narrow transverse bars of whitish-buff; on the back and sides of the lower neck the bars are broader and pure white, forming a broken white collar; the back, scapulars, wing coverts, and tertiaries reddish-chestnut with faint dark bars; at times there are some pale spots on the scapulars and wing coverts; wing quills brown with rufous bars, which become almost white on the inner webs of the secondaries; upper tail coverts and tail brownish-black with narrow white crossbars. Chin and a band on each side of throat white; a white patch in the centre of the fore-neck; centre of breast and remainder of lower parts white, with broad longitudinal streaks of dark brown on the abdomen and thigh plumes.

Bill greenish-horny; cere dusky-greenish; iris yellow; feet olivaceous.

Length 7·5; wing 5·15; tail 2·5; tarsus ·85; bill from gape ·75.

Distribution.—Peculiar to Ceylon; found in the hills, the forest tracts at their base, and the wet zone of the low-country, being not uncommon round Colombo.

Habits, &c.—Occurs in forest or jungle, also in thickly planted native gardens. A shy bird, keeping to the top branches of tall trees. It is fairly diurnal in its habits. The note is a curious little "craw." Like other small Owls, it feeds on insects, lizards, small birds, mice, &c. It breeds from March to May in holes in trees, laying two white oval eggs on the bare wood. Average size about 1·37 by 1·11.

NINOX SCUTULATA (Blanford, Vol. III., p. 309; Legge, p. 145).

The Brown Hawk Owl.

Description.—Feathers of the lores and edge of the forehead white at the base and black at the tip; the sides of the head and neck, the crown, and upper plumage chocolate-brown.

often grayer on the head and neck; some concealed white patches on the outer scapulars; edge of wing white; wing quills brown, crossed by narrow bars, which at the ends of the primaries are only slightly paler than the ground colour, but become white on the inner webs of the secondaries and across the tertiaries. Tail feathers equally barred with black and smoky-brown, and tipped with whitish. Chin and upper throat dirty-white with black shaft-stripes; fore-neck, breast, and flanks rich chocolate-brown with paler lateral margins; lower down these lateral margins increase and become white, while the brown centres of the feathers dwindle into heart-shaped spots on the abdomen, and into bars on the thighs; lower tail coverts almost entirely white.

Bill bluish-black; cere dull-greenish; iris golden-yellow; feet dusky-yellow.

Length about 11·5: wing 7·65; tail 4·5; tarsus 1; bill from gape ·85.

Distribution.—Fairly widely distributed throughout the low-country, and in the hills up to about 4,000 feet. It occurs in the well-wooded parts of the Indian Empire, and ranges throughout the Oriental region.

Habits, &c.—Found mainly in thick jungle, preferably on the borders of tanks or on river banks. The cry, much more musical than that of other owls, is a clear low "coo-ook," which may be heard, especially on moonlight nights, soon after sunset and again towards midnight. It also continues to call in the morning till some time after sunrise. This species feeds almost entirely on insects. It breeds from about Christmas to April, laying two or three almost spherical white eggs in holes of trees. A Ceylon egg measured 1·45 by 1·27.

Order **ACCIPITRES.**

Birds of Prey.

The diurnal Birds of Prey found in the Indian region fall into a very natural group, with the Osprey forming a probable connecting link between the rest of the order and the Owls. By some authors, indeed, the Osprey is placed in an

intermediate order, but Blanford includes it in the *Accipitres*, giving it rank only as a separate family.

The *Accipitres*, which are found all over the world, agree with the Owls in the structure of the palate, in the strong, much-hooked beak, furnished with a cere, and in their curved claws. They differ in the position of their eyes, which are directed laterally and not forwards, while the plumage is firmer and not so fluffy. The females in most species are larger than the males. The young when hatched are helpless and covered with down. The nest is usually a large structure of twigs placed in a tree, or on a rocky ledge. The eggs are often white, but generally more or less blotched with red or brown.

Indian members of the order are divided into three families :—

(1) *Pandionidæ*—The Osprey, in which the outer toe is reversible, *i.e.*, provided with more or less the same power of movement as the human thumb, and capable of being directed backwards or forwards. The contour feathers are not provided with an after-shaft.*

(2) *Vulturidæ*—Vultures. In this family the contour feathers are provided with an after-shaft, while the outer toe is not reversible. The crown of the head is either wholly naked, or covered only with down.

(3) *Falconidæ*.—Eagles, Hawks, and Falcons. These agree with the Vultures in the non-reversible outer toe and the presence of an after-shaft, but have the crown of the head fully feathered.

Family Pandionidæ.

Genus **Pandion.**

The Osprey.

The Osprey or Fishing Hawk, as stated before, differs from all the other members of the order in having no after-shaft to the feathers, and in possessing a reversible outer toe.

* The after-shaft is a miniature feather springing from the inner surface of the shaft of the main feather at its base. It can generally be well seen on the breast feathers of an Eagle or Hawk.

The family is confined to a single genus and species, which, however, is found nearly all over the world. The bill is of moderate size and much hooked; the nostrils are small, narrow, and oblique; the long and pointed wings, when closed, extend beyond the tip of the tail. The tarsus is short, naked, and reticulated; the under surface of the toes is provided with prickly scales; the claws are much curved and slightly rounded beneath.

Pandion haliætus (Blanford, Vol. III., p. 314; Legge, p. 122).

The Osprey.

Description.—Head and neck white, the middle and sometimes the sides of the crown and nape with broad brown shaft-stripes and tips; a broad brown band runs from each eye down the sides of the neck; upper parts pale glossy brown; wing quills blackish-brown; tail feathers brown, tipped with whitish and barred with paler brown, the bars becoming fainter in old birds. Lower parts white, the feathers of the upper breast with dark shafts and brownish centres of varying width; the flanks also partially streaked with brown.

In young birds the brown feathers of the upper parts are edged with whitish, the tail is more distinctly barred, and the breast is quite white, or only faintly spotted with brown.

Bill black; cere dull greenish-blue; iris yellow; legs and feet greenish or yellowish.

Females: Length 22; wing 20; tail 8·5; tarsus 2·25; bill from gape 1·6. Males are rather smaller; wing about 18·5.

Distribution.—A winter visitor, mainly to the north of the Island, where it is said to be fairly common on the lagoons. It has been recorded from Galle, Moratuwa, and the Ratnapura District. It is a world-wide species, occurring over the whole Indian Empire in winter, though probably few birds remain south of the Himalayas in the breeding season.

Habits, &c.—This species in Ceylon seldom goes inland, but haunts brackish lagoons, estuaries, or sometimes the open coast. When at rest it may be seen perched on dead trees.

guide posts in channels, &c. It often soars at a considerable height, and may then be recognized by its long-pointed wings and quick circling movements. It feeds wholly on fish, which it catches in its talons, dropping on its quarry often from a considerable height.

Family Vulturidæ.

Vultures.

The true Vultures are confined to the warmer regions of the old world, but are unknown in the Malay Archipelago, Madagascar, and Australia. They are practically unrepresented in Ceylon, as only a chance straggler of a single species of Scavenger Vulture has been recorded. This gap in our Avifauna is curious, as one would have imagined that there was abundant opportunity for such birds—which are common in the Indian peninsula—to find a living in the Island. They feed on dead animals, or even excrement, and the absence of feathers from the head and neck, which is the distinguishing feature of the family, is a modification highly necessary for birds of such unclean habits. In other respects they closely resemble Eagles and Hawks.

The only species recorded from Ceylon is the smallest of the family and belongs to the genus *Neophron*. The bill is long and slender, straight at the base, with a sharply-hooked tip; the cere is very long. The head and upper fore-neck are naked, and below the naked portion is a ruff of hackles. The crop also is naked. The wings are long and pointed; the tail wedge-shaped; the tarsus is fairly long and partly feathered.

Neophron ginginianus (Blanford. Vol. III., p. 326; Legge, p. 2).

The Smaller White Scavenger Vulture.

Description.—Plumage in general whitish; the neck hackles often with a rusty stain; primaries mainly black, ashy-white on the outer web near the base; secondaries dark brown with some ashy-white on the outer web; tertiaries pale brown.

Young birds are blackish-brown, with fulvous tips to the feathers, and gradually change to the adult plumage.

In adults the bill is horny-yellow ; cere and naked skin of head and neck yellow ; iris dark brown ; legs dirty-yellow. In young birds the bill is dark, and the naked skin of the head and neck gray.

Length 24 ; wing 18·25 ; tail 9·5 ; tarsus 3 ; bill from gape 2·4.

Distribution.—A solitary specimen, probably a storm-driven straggler, was shot at Nuwara Eliya in March, 1874. The species is found over the greater part of India, south of the Himalayas, and westwards of lower Bengal.

Habits, &c.—In India this bird is a regular town scavenger, living largely on human excrement and other filth. It is, however, also found in open country, away from human habitations.

Family Falconidæ.

Sub-family **Falconinæ.**

Eagles, Hawks, Falcons, &c.

In Blanford's classification the whole of the Eagles, Hawks, and Falcons found in Ceylon—some twenty-nine species—fall within the single sub-family *Falconinæ*, which includes birds ranging in size from the Eagles to the Sparrow-Hawks and Falconets. They are practically all carnivorous, and the greater number of them feed on living prey. Some of our smaller species are partly or wholly insectivorous, while others, especially the Kites, feed on carrion.

Most of the sub-family undergo considerable changes of plumage between their immature and fully adult phases ; in consequence coloration is often a very unsafe guide for the differentiation of the various species. There are, however, noteworthy characteristics of the bill, lores, wings, and tarsi, which serve to divide our twenty-nine forms into small, fairly well-marked groups, without altering the sequence adopted by Blanford, or greatly disturbing the natural affinities of the various species. I propose, therefore, for the sake of simplicity, in the first place to split the sub-family into nine small groups, and to treat each group separately.

In most groups the tarsus is naked behind, and only partially feathered in front ; the upper mandible of the bill is sharply

hooked, and its cutting edge between the hook and the cere has a wavy outline or "festoon"; the feathers of the lores—*i.e.*, the space in front of the eye—are mere bristles or end in bristles. Exceptions to these general characteristics serve to mark out several of the groups, as will be noted below :—

Group I.: Hawk Eagles.—Legs feathered all round down to the toes. Six large or fairly large species.

Group II.: Serpent and Fish Eagles.—Three large, stoutly-built species, well over 20 inches in length. Tarsus over 3 inches in length, and only partially feathered. Wings broad and rounded, long in the Fish Eagles, and short in the Serpent Eagle.

Group III.: Kites and allied Species.—Two fairly large and one small species. Tarsus short, only about half as long again as the measurement in a straight line from the gape to the tip of the bill. Toes short.

Group IV.: Harriers.—Four species: one fairly large, three of medium size. Form slender; wings long and pointed; tarsus long and slender, feathered in front only at the base, the naked portion covered in front with transverse shields and behind with polygonal scales.

Group V.: Buzzards.—One rare species of medium size. Wings long; tarsus long and fairly stout, feathered in front to halfway down or more, the naked portion covered both in front and behind with transverse shields.

Group VI.: Hawks.—Three small species. Wings short and rounded; tarsus long.

Group VII.: Honey Buzzards.—One rarish species of fairly large size. Face, lores, and eyelids covered with small overlapping scale-like feathers. Wings long, tarsus short, toes very long and scaly.

Group VIII.: Bazas.—Two rare, smallish species. Bill with two "teeth" or notches on the upper mandible opposite the end of the lower mandible. Head crested; wings moderate; first quill much shorter than fourth.* Nostrils linear.

* In young birds there is at times only one notch, but such birds may be distinguished from Falcons by the shortness of the first quill.

Group IX. : Falcons.—Six medium or small species. Bill with one notch on the upper mandible. No crest; wings long, first quill not shorter than fourth. Nostrils round.

Group I.—Hawk Eagles.

The Hawk Eagles differ from the true Eagles, which do not occur in the Island, by their slimmer build, longer tails, and more slender tarsi. They resemble them, however, and differ from all the remaining groups in having the tarsus clothed all round down to the toes with fine close-set feathers. They are all birds of large or fairly large size, armed with powerful bills and talons, and flying with a fine bold sweep. The note is generally a loud, clear call. Among the villagers of the Puttalam District the Crested Eagle—*S. cirrhatus*—is put down as the author of the Devil Bird's cry, and a loud, resounding, eerie scream, which I have heard at night in the northern forest tract, seemed certainly more like the cry of an Eagle than of an Owl. The six species found in Ceylon are mostly rare. They are divided among four genera. The main generic and specific differences are shown in the following key :—

Key to Ceylon Species.

1.—Wings long; when folded the tip of the longest primary exceeds the tip of the longest secondary by more than the length of the tarsus.

A.—Claws much curved ; hind claw longest.

(*a*) No crest ; mid-toe without claw not much longer than bill.* Genus *Hieraetus.*

(1) Larger : wing well over 18.
H. fasciatus (Bonelli's Eagle).

(2) Smaller : wing under 17.
H. pennatus (Booted Eagle).

(*b*) A wedge-shaped crest on the nape ; mid-toe without claw more than half an inch longer than the bill.
Lophotriorchis kieneri (Rufous-bellied Hawk Eagle).

* *I.e.*, the distance from the gape to the tip of the upper mandible, measured in a straight line, *not* round the curve.

B.—Claws not much curved ; inner claw longer than hind claw.

Ictinaetus malayensis (Black Eagle).

II.—Wing short ; primaries exceed secondaries by less than the length of the tarsus ; a long thin crest on the crown. Genus *Spizaetus*.

1) Smaller ; wing up to 15 ; lower parts plain or streaked but not crossbarred.

S. cirrhatus (Crested Hawk Eagle).

(2) Larger ; wing over 16 ; lower parts crossbarred.

S. kelaarti (Legge's Hawk Eagle).

HIERAETUS FASCIATUS (Blanford, Vol. III., p. 343).
NISAETUS FASCIATUS (Legge, p. 36).

Bonelli's Eagle.

Description.—Adult : Upper plumage deep brown, the feathers with white bases ; eyebrows and sides of neck streaked with white ; cheeks and ear coverts streaked with brown ; sides of face white ; upper tail coverts with pale margins ; wing quills black, the bases of the inner webs mottled with white ; tail feathers brownish-gray above, almost white underneath, with a broad band of dark brown at the tip, and irregular wavy bars of the same colour near the base. Lower parts white with black-brown shaft-stripes of varying width ; thigh plumes and lower abdomen more or less pale brown with the same dark streaks ; under tail coverts with light brown crossbars ; wing lining black-brown marked along the edge with white.

In some old birds the ground colour of the lower parts is buff, and the thighs and abdomen are darker.

Young birds are lighter above, with pale edges to the feathers of the crown and nape ; lower parts brownish-rufous with narrow dark stripes ; the wing quills are more banded ; the tail is smoky-brown without the dark broad terminal band but with numerous, narrow, wavy, dark bars.

Bill bluish-gray, darkening to black at the tip ; cere and gape yellowish ; iris bright yellow or brownish-yellow ; feet yellowish or whitish-brown.

Male : length 27 : wing 19 ; tail 11 ; tarsus 3·6 ; middle toe 2·4 : bill from gape 2·15. Females are larger ; length 29 ; wing 20.

Distribution.—Only once recorded from Ceylon.* It occurs throughout India, west of the Bay of Bengal, and ranges westward through South-western Asia to Northern Africa and Southern Europe.

Habits, &c.—A powerful species, which kills its own prey, and never touches carrion. It feeds largely on mammals and small birds, especially pigeons. It is a fine bird on the wing, and generally soars at some height. As it is resident throughout its range, it may possibly be found nesting in Ceylon. In the plains of India it breeds about Christmas time, making a large stick nest, lined with green leaves and placed on a rocky ledge or in a high tree. Two eggs are laid. The ground colour is dirty white faintly blotched at the large end with brown. Measurement about 2·75 by 2·2.

Hieraetus pennatus (Blanford, Vol. III., p. 344). Nisaetus pennatus (Legge, p. 36).

The Booted Eagle.

Description.—Adult : Forehead and lores whitish ; a narrow black streak above the eye : feathers of sides of head, crown, and hind-neck fawn colour with black shaft-streaks, which are broadest on the crown ; cheeks and ear coverts richer brown ; upper plumage brown, darkest on the upper back, rump, and large scapulars ; smaller scapulars, tertiaries, and wing coverts paler with dark shaft-stripes and broad whitish-brown edges ; wing quills almost black, the secondaries with pale ends ; upper tail coverts fawn colour ; tail feathers dark grayish-brown above, grayish-white underneath, with paler tips and traces of darker bars. The lower parts, including the wing lining, are buff-white with blackish shaft-stripes, which are most numerous on the chin, less so on the breast, and fade away on the abdomen ; a few large black spots on the wing lining.

* *Vide* Legge's Birds of Ceylon, p. 37 The locality and date are not known.

Some specimens are dark brown all over. In old birds there are faint rusty barrings on the thigh coverts and vent.

In young birds the head and neck are rufous-brown or dark brown; the upper plumage much as in adults, but with dark shaft-stripes; tail coverts paler; lower parts dark brown, or pale rufous, with dark shaft-stripes, except on the abdomen; upper surface of tail as in adults, but under surface pale brown instead of whitish-gray.

Bill pale blue at the base, blackish at the tip; iris pale brown; cere yellow; legs and feet yellow.

Male: length 20; wing 15; tail 8·5; tarsus 2·4; mid-toe without claw 1·60; bill from gape 1·4.

Females larger: length 22; wing 15·75.

Distribution.—An occasional visitor to the Island; specimens have been recorded from Colombo and Kandy. It is found, mainly as a winter visitor, throughout India, and occasionally in Burma. It also occurs in Southern Europe, South-western and Central Asia, and the greater part of Africa.

Habits, &c.—A bold and active little Eagle, which preys on squirrels, birds, &c., being very fond of poultry and pigeons. It may be found both in wooded country and about inhabited places. It generally breeds north of the Himalayas, but a nest has been found in Southern India. It is of the same description as the nest of the last species, and is placed in a tree. The two eggs are greenish-white, and measure about 2·13 by 1·78.

Lophotriorchis kieneri (Blanford, Vol. III., p. 345; Legge, p. 42).

The Rufous-bellied Hawk Eagle.

Description.—Adult: Whole upper plumage and sides of head and neck glossy-black; wing quills black, tinged with brown; tail feathers dark brown with indistinct black bars; the underside of the wing and tail is gray with dark ends and bars. Chin, throat, and breast white; remainder of lower parts, including the wing lining, chestnut-red, streaked with bold black shaft-stripes.

Young birds are dark brown above, some of the feathers with paler edges; tail barred; lower parts pure white; ear coverts rufous-brown streaked with black.

Bill black; cere yellowish-white; iris dark brown; feet pale yellow.

Male: length 21; wing 15; tail 8·25; tarsus 2·8; middle toe without claw 2·15; bill from gape 1·5.

Females larger: length about 24; wing 16. Both male and female appear to vary in size.

Distribution.—A rare bird, but apparently resident in the hills, and occasionally seen in the low-country, as I recently obtained a specimen in forest 16 miles south-east of Puttalam. It is found in the Eastern Himalayas and the hill ranges of Eastern Bengal and Southern India. It also occurs in Malaya, but is nowhere common.

Habits, &c.—A fine bold bird with a graceful buoyant flight. It may be met with perched on tall trees in the forest, or seen sailing over wooded hillsides, patana gorges, &c. It feeds on small mammals and birds. It breeds regularly on the hills of Travancore in Southern India. The nest, which is used year after year, is a huge structure of sticks. The work of repairing it is begun in October or November. As early as December or as late as March a single egg is laid on a lining of green leaves. The colour is white, roughly speckled and dotted with pale reddish or yellowish-brown, sometimes with some deeper markings of blood red, and faint underlying blotches of gray. The texture is fairly smooth, but coarse-grained, and the inner lining of the shell is a fairly bright green. Average size about 2·29 by 1·83.

Ictinaetus malayensis (Blanford, Vol. III., p. 347).
Neopus malayensis (Legge, p. 47).
The Black Eagle.

Description.—Adult: Brown-black almost all over; lores whitish; lower parts with a browner tinge; the tail feathers and the inner webs of the wing quills near the base are barred with mottled-gray, which on the underside of the feathers appears whitish.

Young birds are browner, the head is almost tawny, especially on the sides. Some specimens have tawny spots

on the tips of the feathers of the crown, hind-neck, and sides of neck; also similar pale drops or broad shaft-stripes on the lower plumage. The change to the adult plumage is gradual.

Bill greenish-horny, the tip black; cere and gape citron-yellow; iris dark brown; legs gamboge-yellow.

Males: length 27; wing 21·5; tail 13; mid-toe without claw 1·60; bill from gape 2.

Females: length 31; wing 24; tail 14.

Distribution.—Found on the hills and in low-country forest tracts. It occurs in the Malay Peninsula and Archipelago, on the Western Himalayas and Western Ghauts, on the hills south of Assam, and more rarely in Burma.

Habits, &c.—A graceful long-winged bird, usually seen sailing over forests with a flight rather like that of a Harrier. It is known to kill such large game as jungle fowl, but also feeds on lizards, grasshoppers, &c. Unlike most birds of prey, it does not require an open space in which to swoop on its quarry, but will seize it even in forest. It is, as a rule, a silent bird, but occasionally utters a shrill cry when soaring. The nest may be used for many years in succession, and is the usual large structure of sticks lined with green leaves and placed in a large tree.* Repairs start in October or November, and about Christmas time one or occasionally two eggs are laid. They vary a good deal in size, shape, and the character of their markings, but most specimens are extremely handsome. The ground colour is white or creamy, with large irregular blotches and specks of rich brown. In some specimens these markings are not so distinct, and the egg is more or less clouded with secondary markings of neutral tint or grayish-purple. Average size 2·45 by 1·95.

Spizaetus cirrhatus (Blanford, Vol. III., p. 349). Spizaetus ceylonensis (Legge, p. 55).

The Crested Hawk Eagle.

Description.—Adult: The whole head except the chin and throat, the sides of the neck, and the hind-neck tawny-brown,

* The statement in Blanford and in Humes' "Nests and Eggs" that this species builds in the ledges of cliffs appears to be erroneous (*vide* "Ibis," January, 1918, p. 51).

with dark centres to the feathers; a long dark crest with conspicuous white tips; back, scapulars, and wing coverts dark brown with pale edges; rump and tail coverts smoky-brown with darker shafts; wing quills smoky-brown above and whitish underneath, barred and tipped with black, the inner webs white towards the base; the tail feathers are of the same smoky brown above and white beneath, with broad black crossbars and narrow white tips. The chin, throat, and under surface are white; there is a narrow black streak down the centre of the throat; the feathers of the breast and abdomen are splashed with bold brownish-black drop-shaped marks, which increase in size downwards, the flanks, vent, and under tail coverts being almost wholly brown; the thighs and upper tarsus are rather more rufous, the lower tarsus is white. The edge of the wing and the wing lining are white with long drop-shaped marks of dark-brown.

Some mature birds appear to be much lighter and have no dark chin stripe. There are fewer dark drops on the breast, while the abdomen, thighs, and under tail coverts are white with patches of pale rufous-brown.

In young birds of the darker race the head and neck are lightish brown; the feathers of the upper plumage have white edges, most conspicuous on the wing coverts; the dark bars on the wings and tail are more numerous than in adults; the lower parts are white or pale buff, with fewer dark drops; the abdomen and thighs are lighter.

Young birds of the pale race have the upper plumage much mixed with white; the head and neck are inconspicuously streaked with tawny buff, against which the dark crest shows boldly. The lower parts are of unspotted white shading into rufous on the abdomen; the thighs and under tail coverts are barred with pale rufous.

Bill dark leaden, black at the tip; cere yellow in young birds, leaden in adults; iris pale straw to golden-yellow; feet yellow.

Dimensions are rather variable; males, as a rule, are smaller than females, and dark birds than light forms.

Length about 23·5; wing 14·5; tail 9·75; tarsus 3·6; mid-toe without claw 2; bill from gape 1·65.

Distribution.—Fairly common nearly all over the low-country, and in the hills up to about 4,000 feet. It is replaced in the higher ranges by the next species. In India it is practically confined to the peninsula south of the plain of the Ganges.

It is possible that the smaller darker birds are a local resident race, and the larger paler birds migrants from India.

Habits, &c.—A woodland species, usually met with on the edge of heavy jungle, in park country, or in chenas and scrub jungle through which larger trees are scattered. It rarely soars for any prolonged period, but is usually seen perched on the top of a high tree. It feeds mainly on lizards, but also kills small mammals and birds, and on occasions is very destructive to poultry. It breeds early in the year on tall trees, constructing a large nest of twigs lined with green leaves. The single egg is of dull greenish-white, either unspotted or faintly streaked at the larger end with reddish-brown. Measurement about 2·67 by 2·03.

Spizaetus kelaarti (Blanford, Vol. III., p. 354; Legge, p. 51).

Legge's Hawk Eagle.

Description.—Adult: Feathers of the head and hind-neck black with pale edges, which are broadest on the hind-neck; the long crest black, tipped with white; upper parts blackish-brown; the scapular and upper tail coverts tipped with white; wing coverts pale brown, darker at the ends; wing quills brown above, pale gray below, with dark crossbars; tail feathers smoky-brown above and gray below with dark crossbars and narrow white tips. Chin, throat, and fore-neck creamy-white, with a broad dark stripe down the centre and a less clearly-defined stripe down each side; rest of lower parts, including the legs and tail coverts, pale brown with broad white crossbars; the bars on the thighs are narrower; tarsus pale brown with white tips to the feathers.

Young birds are paler. The head and neck feathers are tawny white with drop-shaped marks of rufous-brown; there is a good deal of white on the wing coverts; the sides of the

head and neck, the throat, and fore-neck are almost unmarked creamy-white ; the breast and abdomen are very pale brown with white crossbars.

Bill black, paler at the base ; cere blackish ; iris yellow ; feet lemon-yellow.

Females : length about 31 ; wing 18 ; tail 12·5 ; tarsus 4·5 ; mid-toe without claw 2·8 ; bill from gape 2.

Males are rather smaller.

Distribution.—Confined to the higher ranges of Ceylon and Southern India. In Ceylon it appears to reside at elevations of over 4,000 feet, though it may be met with at lower altitudes in search of food.

Habits, &c.—Rather a shy bird. It may be seen soaring slowly in wide circles above the higher ranges. It remains on the wing longer than the preceding species. It is fond of poultry, and most of the specimens obtained have been shot while raiding hen runs. The nest has frequently been found in the hills of Travancore. It is a huge structure of twigs lined with green leaves and placed in a tall tree. Unless the birds are driven away, it is used year after year. A single egg is laid generally in December. If the first egg is taken, a second may be laid later on. The shape is a broad oval, the small end well defined, but not pointed. The colour is white, at times with a few scattered markings of faint yellow or red. The texture is coarse, rough, and glossless. Average size 2·75 by 2·14.

Group II.—Serpent and Fish Eagles.

For the sake of convenience I have included the Serpent and Fish Eagles in one group, though they are not very closely akin, the main points of resemblance being their large size, powerful build, and longish tarsi. The Serpent Eagle—genus *Spilornis*—has a very distinctive plumage ; adults being brown above and below, with white rounded spots on the lower parts. The wing is short, but broad and rounded ; the bill is fairly long and stout, with only a trace of a festoon ; the lores are nearly naked ; the nape is covered with a thick bushy crest ; the tarsus is only moderately stout, is naked, except for a short distance in front, and is covered with small

polygonal scales ; the toes and claws are short, the latter are not very much curved. The two Fishing Eagles rival in size the largest of our Hawk Eagles. The plumage is a combination of white and gray or brown. The wing is long, broad, and rounded ; the bill is stout with a well-marked festoon ; the tarsi and feet are very stout and powerful, the former are feathered in front for about one-third of the length. In the genus *Haliaetus* the outer toe is not reversible, but it is partially reversible in the genus *Polioaetus*.

Rough Key to Group.

A.—A thick bushy crest ; tarsus almost naked, and only moderately stout ; plumage brown, the lower parts with white rounded spots.

Spilornis cheela (Crested Serpent Eagle).

B.—No crest : tarsus very stout and powerful, feathered in front for about one-third length.

(1) Claws grooved beneath.
Haliaetus leucogaster (White-bellied Sea Eagle).

(2) Claws rounded beneath.
Polioaetus ichthyaetus (Large Gray-headed Fishing Eagle).

SPILORNIS CHEELA (Blanford, Vol. III., p. 35).
SPILORNIS SPILOGASTER (Legge, p. 61).

The Crested Serpent Eagle.

Description.—Adult : The feathers of the forehead, crown, crest, and hind-neck jet black with a very narrow tip of brown and a white base ; the lores naked, except for a few black bristles ; the cheeks and ear coverts grayish-black ; upper parts dark brown with a purplish gloss ; smaller wing coverts blackish with a few small white spots at the tip ; wing quills blackish with some white patches at the base of the inner webs and with three broad bars, which are smoky-brown above and whitish below ; basal half of tail smoky-brown, outer half blackish with a broad band of whitish brown and a pale tip. Lower parts earthy-brown, lighter in some birds

than in others; chin and throat rather grayer; the whole under surface from the breast down marked with roundish white spots, which are edged with darker brown; on the vent, thighs, and lower tail coverts these spots change to bars.

In young birds the crown and nape are white with black-brown ends and pale edges; the feathers of the upper parts are lighter at the base and have pale tips; the wing coverts are a good deal mixed with white; the pale bands on the wing quills and tail are more numerous; the breast bears traces of fulvous crossbars; the edge of the wing lining is white.

Bill lead colour, darker at the tip; cere and naked skin of face lemon-yellow; iris yellow; legs and feet dingy-yellow.

Males: length about 23; wing 15; tail 9·5: tarsus 3·25; mid-toe without claw 1·8; bill from gape 1·7

Females are a little larger: length 24; wing 15·5.

Distribution.—Fairly common all over the Island, but most abundant in the drier low-country forest tracts. Blanford unites in one species several races which range all over the Indian Empire, also south-east to Malaya, including the Archipelago, and eastwards to Japan.

Habits, &c.—A forest species, generally found on large trees by the banks of rivers and streams, and round village tanks. From such trees the birds watch for their prey, which consists mainly of snakes, lizards, and frogs. They may also be seen soaring, often at a considerable height, and may then be recognized by their loud whistling cry and by the numerous light bars on the wings and tail. The birds appear to breed from about March to May. The nest is a loose structure of twigs, scantily lined with green leaves, and placed in a tall tree. The eggs number one or two, and are dirty-white with rusty-red stains and blotches. They measure about 2·50 by 1·95.

Haliaetus leucogaster (Blanford, Vol. III., p. 368; Legge, p. 67).

The White-bellied Sea Eagle.

Description.—Adult: The whole head, neck, and lower parts are white, the neck and breast generally marked with

narrow dark shaft-lines; the back and wings are dark ash colour tinged with brown; wing quills and base of tail blackish; outer third of tail white.

In young birds the head, neck, and lower parts are pale tawny or rufous; the breast is darker; the upper plumage is brown, many of the feathers with pale edges; the tail feathers are whitish with brown ends, which are narrowly tipped with white.

Bill dark leaden; cere paler; iris hazel-brown; legs and feet whitish.

Male: length 27·50; wing 22; tail 10; tarsus 3·6; mid-toe without claw 2·3; bill from gape 2·25. Females are slightly larger.

Distribution.—Not uncommon round the coast, except from Chilaw to Galle, where it is local. It is also found on the large inland tanks. It occurs on the shores of the Indian Ocean, from Bombay to the Malay Archipelago, and ranges into Australasia.

Habits, &c.—The birds live in pairs and reside year after year in the same place, hunting along the coast, lagoons, or tanks in the vicinity of their eyrie. Their food consists mainly of fish, sea-snakes, crabs, &c., but they will also on occasion seize wounded wild birds or young chickens.

The nest is a huge structure of sticks in a large tree, and is used year after year. The breeding season is early in the year. Two eggs are generally laid on a lining of green leaves. They are dull white with a green inner texture, and measure about 2·85 by 2·10.

Polioaetus ichthyaetus (Blanford, Vol. III., p. 370; Legge, p. 72).

The Large Gray-headed Fishing Eagle.

Description.—Forehead whitish; the head, upper part of hind-neck, and throat ashy-gray; crown and nape brownish; back, wings, rump, upper tail coverts, and a broad band at the end of the tail dark brown; breast and flanks rather lighter brown than the back; abdomen and basal two-thirds of the tail pure white.

Young birds are lighter brown, the feathers with pale edges ; head light brown with pale shaft-lines ; fore-neck and breast with broad white shaft-stripes ; wing quills barred with smoky-brown above and whitish underneath ; the white upper surface of the tail much mottled.

Bill dark horny, bluish at the base ; cere lead colour ; iris clear yellow, at times mottled with brown, or tinged with red ; legs and feet whitish.

Males : length 24·5 ; wing 17·25 ; tail 9·75 ; tarsus 3·5 ; mid-toe without claw 2·3 ; bill from gape 1·85.

Females rather larger : length 27 ; wing 18.

Distribution.—Found mainly in the northern half of the Island on coastal lagoons and estuaries, or inland on rivers and village tanks. It occurs in India eastwards of Delhi and throughout Burma to Malaya and the Archipelago.

Habits, &c.—A pair of these birds may usually be seen on jungle-girt village tanks of any size in the northern and eastern forest tracts. It is also fairly common round well-wooded shores of lagoons and estuaries. It feeds largely on fish, for which it watches from a perch on a tall tree near the water, swooping out now and then for short flights, but seldom soaring or staying on the wing for any very long period. The cry is a deep resonant "kyaw" repeated several times. The birds are frequently noisy early in the morning long before it is light. The breeding season is about Christmas time. The nest is a huge platform of sticks in a large tree. Two eggs are laid, grayish-white in colour, and measuring about 2·68 by 2·09.

Group III.—Kites.

The Kites and their allies form a group distinguished by their long, pointed wings and distinctly short tarsi, which are feathered for about halfway down or a little more. The bill is moderate with a distinct festoon, less prominent in the true Kites—*Milvus*—than in the other genera. The toes and claws are shortish.

There are three Ceylon species, two of medium and one of small size. Each is placed in a separate genus. *Haliastur*—the Brahminy Kite—forms a connecting link between the Sea Eagles and the true Kites.

Rough Key to Group.

A.—Size medium ; length 19 or over.

(1) Adult plumage maroon and white ; tail slightly rounded at the end.
Haliastur indus (Brahminy Kite).

(2) Plumage streaky brown ; tail forked.
Milvus govinda (Pariah Kite).

B.—Size small ; length about 12·50.

Adult plumage black, white, and gray.
Elanus cæruleus (Black-winged Kite).

HALIASTUR INDUS (Blanford, Vol. III., p. 372 ; Legge, p. 76).

The Brahminy Kite.

Description.—Adult : Head, neck, flanks, and lower parts to the centre of abdomen white with dark brown shaft-lines ; rest of plumage chestnut-maroon with the same dark shaft-lines, except on the tail ; primaries black, except on the basal portion of the inner webs ; the tip and the under surface of the tail whitish.

Young birds are very different ; the upper plumage is earthy-brown ; the feathers of the head and hind-neck with pale tawny tips ; the back feathers and wing coverts with pale margins ; primaries black ; secondaries and tail dark brown. Throat and breast brown with tawny shaft-stripes ; abdomen and lower tail coverts with dark shaft-lines.

In the next stage the head, neck, and breast feathers are pale brown with a rufous tinge, and have dark shaft-lines ; wing coverts mixed with white ; lower abdomen dull-rufous. From this the birds moult into the adult plumage.

Bill bluish-horn colour ; cere yellowish ; iris brown ; legs and feet greenish-yellow.

Male : length about 19 ; wing 14·75 ; tail 8·5 ; tarsus 2 ; middle-toe without claw 1·25 ; bill from gape 1·4.

Females are a trifle larger.

Distribution.—Found all round the coast, and abundant on the tanks in the northern and eastern forest tracts ; much

more local in the south of the Island and the Western Province, and only a straggler in the hills.

It occurs throughout the Indian Empire, except in the dry districts and hill forests. It ranges eastwards to China and south-east to the Malay Peninsula. Closely allied forms are met with in the Malay Archipelago and Australia.

Habits, &c.—This, with us, is the commonest species of the group, and takes the place of the true Kites in acting as a general scavenger of garbage. It is, however, seldom met with far from water, and its food consists largely of fish, frogs, and crabs. On the coast it is generally seen near towns, large villages, and fishing stations. Inland it is a familiar sight round tanks and over paddy fields. It is continually on the wing, soaring and wheeling at a considerable height. The cry is a peculiar, rather dreary squeal. The breeding season begins about Christmas, with apparently a second brood about June. The nest is a structure of twigs, somewhat larger than a crow's nest, and placed in much the same positions. The two or three eggs are grayish-white, generally scantily speckled or dotted with faded reddish-brown. They measure about 1·95 by 1·62.

Milvus govinda (Blanford, Vol. III., p. 374; Legge, p. 80).

The Pariah Kite.

Description.—Adult: Head and neck slightly tawny-brown with dark shaft-stripes; a patch of unstreaked brown on the ear coverts; back a more uniform, deeper, and slightly glossy-brown; the medium wing coverts lighter, with dark shaft-stripes; wing quills the same colour as the back, except the longer primaries, which with their coverts are blackish; the inner secondaries are paler, and bear traces of dark brown crossbars; all the quills are mottled with whitish on the concealed parts of the inner webs; tail brown above, whitish-brown below, with faint dark bars. The lower parts are paler brown than the back; the chin whitish; abdomen and lower tail coverts generally tinged with rufous; the whole marked with dark shaft-stripes.

Young birds are much streaked with pale buff on the head and lower parts, while the feathers of the back, secondaries, and tail are tipped with whitish.

Bill black; cere pale greenish; iris brown; legs and feet yellow or greenish.

Males: length about 22·5; wing 17; tail 10·5; tarsus 2·1; middle toe without claw 1·5; bill from gape 1·6.

Females larger: length 23·5; wing 18.

Distribution.—Confined to the sea coast in the north, from near Mannar to Trincomalee. It is apparently a partial migrant, especially on the north-east coast. It abounds all over the Indian Empire. A closely allied species inhabits Malaya and Australia.

Habits, &c.—It is strange that a bird so common all over India has such a restricted range in Ceylon. With us it feeds on garbage and the leavings of the nets when the fishermen haul in their catch. It breeds in the north of Ceylon in the early part of the year. The nest is a loose mass of twigs mixed with old rags and grass and placed in a tree. Two eggs, occasionally three or four, are laid. The colour is pale greenish-white generally spotted and blotched with brown or reddish, but occasionally unmarked. Average size of eight Ceylon eggs 2·08 by 1·55.

Elanus cæruleus (Blanford, Vol. III., p. 379; Legge, p. 85).

The Black-winged Kite.

Description.—Adult: Upper plumage ashy-gray, paler on the head; fore-neck, a streak above the eye, the sides of the head, and all the lower parts white; at times the fore-neck and flanks are tinged with pearl-gray; lores, eyebrow, median, and smaller wing coverts black; primary quills dark ash-gray above and blackish below; the central pair of tail feathers ash-gray, the rest white, tinged with gray on the outer webs.

In young birds the feathers of the upper parts are brownish-ashy with pale edges; the quills and tail feathers are tipped with white; the throat, chest, and breast are tinged with buff.

Bill black; cere pale yellow; iris in adults deep ruby-red, in young birds yellow; legs and feet rich yellow.

Length about 12·50; wing 10·5; tail 5·25; tarsus 1·3; mid-toe without claw 1; bill from gape 1·1.

Distribution.—Fairly widely distributed over the Island, probably a partial migrant, as in some districts it is commoner during the north-east monsoon. It is found throughout the greater part of India and Burma, ranges over the whole of Africa, and occurs locally in Southern Europe and South-western Asia.

Habits, &c.—This handsome little species avoids heavy forest, and is partial to grassy lands, patanas, young plantations, and low chenas, provided they are thinly dotted over with large trees. It is a solitary bird, and nowhere abundant. It is most noticeable during the north-east monsoon, but undoubtedly breeds in the Island. On the wing it rather resembles a gull in appearance. It seldom soars or takes long flights, but frequently hovers like a kestrel. Its food consists of insects, mice, small lizards, &c. In the hills the breeding season appears to be from December to March. In the low-country I once saw a bird in the Tangalla district beginning to build in July. The nest is like that of a crow, and is placed generally high up in a solitary tree. The eggs number two or three, and are almost perfect ovals. The ground colour is dull white, more or less densely blotched with brownish-red. Average size 1·55 by 1·20.

Group IV.—Harriers.

The Harriers belong to a single large genus, various members of which are found in most tropical and temperate climates. Four species, all of which are migratory, occur in Ceylon. They are easily recognized by their appearance and flight. The form is slender; the beak is small, curves regularly from the base, and has a very slight festoon. There is a ruff of small soft feathers across the throat and up the sides of the neck to behind the ear coverts. The tail is long and even at the tip, or slightly rounded. The wings are long and pointed. The tarsus is long and slender, and is feathered in front only

at the base. The naked portion is covered in front with transverse plates, and behind with smaller polygonal scales. The toes are moderate, the claws slim, curved, and sharp.

In their habits all the species are very similar. They are generally seen flying over marshes or open grassy lands with heavy flaps of the wings, beating up and down for their prey, which consists largely of frogs, reptiles, insects, and small mammals. They are somewhat crepuscular, and generally perch and roost on or near the ground. In many species the male and female have a very different plumage, and the best way to identify the various forms is by the "notch" or indentation in the outer web of the larger primaries. This "notching" is characteristic of the larger wing quills in most birds of prey. From the base to this wavy indentation the barbs of the quill are set at an angle of about 45° to the shaft. From the "notch" to the tip the barbs, though no shorter in length, are set at a much more acute angle, thus considerably reducing the width of the web.

Rough Key to Species.

A.—Outer web of second, third, and fourth quills notched; fifth quill not notched.

(1) Tarsus over 2·5 in length; notch on second quill close to tip of greater coverts.

Circus macrurus (Pale Harrier).

(2) Tarsus under 2·5; notch on second quill about an inch beyond tip of greater coverts.

C. cineraceus (Montagu's Harrier).

B.—Outer web of second to fifth quills notched.

(1) Wing under 15 in length.

C. melanoleucus (Pied Harrier).

(2) Wing 16 or over.

C. æruginosus (Marsh Harrier).

Circus macrurus (Blanford, Vol. III., p. 381 ; Legge, p. 17).

The Pale Harrier.

Description.—Male : Upper surface pale bluish-gray ; except in very old birds, the nape and mantle are tinged with brown ; lores and all round the eye white ; ear coverts pale gray, streaked with white ; primaries ash-gray, second to sixth quills blackish-brown towards the ends, the bases of all the quills white ; upper tail coverts darker gray barred with white ; central tail feathers gray, outer feathers white with irregular gray bars. Lower parts white, with a gray tinge on throat, neck, and breast.

Female : Upper surface brown ; feathers of head and hind-neck with pale rufous margins ; forehead, eyebrow, and a patch below the eye buffy-white ; ear coverts and a broad moustache-stripe brown ; a well-marked ruff of white, or buff, with brown shaft-stripes runs right round the neck ; smaller wing coverts with tawny edges ; wing quills smoke-brown above, whitish underneath, with ends and broad bars of black-brown ; upper tail coverts white, with brown shaft-stripes ; central tail feathers smoke-brown, outer feathers tawny, all with dark brown bands. Lower parts white with rufous shaft-stripes which are broadest on the breast. In old birds these stripes become very narrow.

Young birds resemble females in their upper plumage, but the feathers have tawny margins, the ruff is pale tawny all round the neck and stands out very conspicuously. The upper tail coverts are white and the lower parts buff with faint shaft-stripes. The adult plumage is assumed gradually.

Bill blue-black ; cere greenish-yellow ; iris yellow in adults, brown in young ; legs yellow.

Males : length 18 ; wing 13·5 ; tail 9·25 ; tarsus 2·7 ; mid-toe without claw 1·25 ; bill from gape 1·10.

Females rather larger : length 19·5 ; wing 14·5.

Distribution.—Fairly common throughout the Island during the north-east monsoon. A few stray and probably immature specimens remain with us all the year round, chiefly

up-country. The species ranges over Eastern Europe, and practically the whole of Asia and Africa, breeding in the north and wintering in the south.

Habits, &c.—All our Harriers have much the same habits, which are described in my remarks on the group. The present species frequents swamps, paddy fields, and stretches of grass land near water. At times large numbers of these birds and the next species congregate and roost in some favourite spot in a swamp. It does not appear to breed in the Island.

Circus cineraceus (Blanford, Vol. III., p. 383; Legge, p. 12).

Montagu's Harrier.

Description.—Male: Head, neck, breast, and upper plumage dark ash-gray, with a bluish tinge; back, scapulars, and tertiaries, except in old birds, tinged with brown; upper tail coverts white at the base, ashy-gray at the ends, and sometimes with bands of the same colour; first six primaries almost black with slight gray tips, which increase in size on the inner primaries; secondaries gray with two black cross bands; middle tail feathers unbarred frosted gray, remainder whitish with bars of dusky gray, which become rufous brown on the outermost feathers. Abdomen, under tail coverts, and thighs whitish with rufous shaft-stripes; wing lining white with a few chestnut patches.

Females resemble those of the preceding species, only the ruff is not so distinct, the upper parts are darker, and the lower parts are dull rufous, or buff, with rufous brown shaft-stripes.

In young birds the ruff is streaked, and is less distinct than the conspicuous, clear-coloured ruff of the young Pale Harrier. At all stages the present species may be distinguished by the characters noted in the key.

Bill black; cere greenish-yellow; iris yellow in the male, brownish-yellow in the female; legs and feet yellow.

Male: length 17; wing 14·75; tail 9; tarsus 2·25; mid-toe without claw 1·1; bill from gape 1·05.

Females larger: length 19; wing 15·25

Distribution.—Appears in considerable numbers in the north of the Island during the north-east monsoon and spreads down the coast on both sides. It is not so common in the interior as the last species. In winter it is met with locally throughout India, but is very rare in Burma. It occurs over the greater part of Europe, Asia, and Africa.

Habits, &c.—Much the same as those of other Harriers. It is largely crepuscular, and appears to be rather dazzled in broad daylight. It haunts swamps, marshes, and open country, and feeds mainly on frogs and lizards. It does not appear to breed south of the Himalayas.

Circus melanoleucus (Blanford, Vol. III., p. 385; Legge, p. 9).

The Pied Harrier.

Description.—Male: Head, neck, breast, back, and median wing coverts black, glossy above, but duller on the breast; smaller wing coverts almost white: the first six primaries and the tertiaries black, remainder of wing quills silver-gray, the secondaries with tips and inside borders of white; rump white; upper tail coverts white shaded with gray towards the ends; tail feathers gray, the outer feathers paler, and with a considerable amount of white on the inner web; lower parts from breast downwards clear white.

Female: Upper plumage dark brown; the feathers of the crown and neck edged with rufous; nape feathers with broad white borders and bases; a distinct ruff of small whitish feathers with dark brown shaft-stripes; cheeks and ear coverts dirty-white, streaked with brown; the smaller wing coverts along the bend of the wing white with brown streaks; greater wing coverts and secondaries with broad brown bands; primaries blackish-brown; upper tail coverts white with some rufous markings; tail smoky-gray with brown bands. The lower parts from the ruff downwards white with brown stripes, which are very broad on the neck and breast, but narrower and tending to disappear on the abdomen.

Young birds are like females, but are more uniformly brown above and have no gray on the wings and tail, which are

brown with darker bands, while the lower parts are rufous brown with slightly darker streaks.

Bill black, bluish at the gape; core greenish-yellow; iris bright yellow; legs yellow.

Male: length 17·5; wing 14; tail 8·5; tarsus 3·1; mid-toe without claw 1·3; bill from gape 1·10.

Females are larger: length 18·5; wing 14·5.

Distribution.—A rare migrant during the north-east monsoon, recorded from a few localities on the coast, also from Ratnapura and the North-Western Province. It occurs in Burma and the eastern half of India during the winter, and ranges throughout Eastern Asia, breeding mainly in the north.

Habits, &c.—Found quartering over grassy jungles as well as over paddy fields and swamps. It has been found breeding in Northern India, but is not likely to nest in Ceylon.

Circus æruginosus (Blanford, Vol. III., p. 387; Legge, p. 5).

The Marsh Harrier.

Description.—Adult: Head and neck buff, or rufous, with dark brown shaft-stripes; the back, with the smaller and median wing coverts, and at times the tertiaries, dark brown, some of the feathers tipped with rufous; the lesser coverts along the bend of the wing are buff with dark shaft-stripes; the first six primaries blackish, the remaining wing quills and the greater wing coverts silver-gray; the concealed basal portion of all wing quills white; upper tail coverts white, mixed with gray and rufous-brown; tail pale gray. The breast is buff with broad brown shaft-stripes; abdomen and lower tail coverts rather streaky rufous-brown.

In immature birds the plumage is mainly dark brown; the crown, nape, and chin buff with narrow brown stripes; the tail coverts, wing coverts, back, and lower parts may have rufous tips to the feathers. In some cases the bird is dark brown all over. The adult plumage is gradually assumed.

Bill black; cere greenish-yellow; iris yellow, brownish in young birds; legs and feet yellow.

Length 21; wing 16; tail 9·5; tarsus about 3·4; mid-toe without claw 1·75; bill from gape 1·35. Females are generally slightly larger.

Distribution.—A migrant visiting the Island in fair numbers during the north-east monsoon; more plentiful in some years than in others, and always rather locally distributed, mainly round the coastal swamps and lagoons. It occurs in winter in suitable localities throughout India and Burma, and its range extends over most of the Old World.

Habits, &c.—It frequents marshes, paddy fields, and sometimes dry grass lands. It lives on frogs, fish, and insects, but, being a far more powerful species than our other Harriers, it can also tackle birds, and will occasionally carry off a wounded snipe or teal. A few birds breed in India, so a stray nest may, perhaps, be found in Ceylon. The nest is made of straw or grass placed among reeds or on the ground. The four or five eggs are white, at times slightly spotted with bright reddish-brown. Size about 2 by 1·50.

Group V.—Buzzards.

The Buzzards, structurally, are closely allied to the Eagles, differing from them mainly in their less powerful beaks and claws, and in their partially naked tarsi. Another distinctive characteristic is that, though the colouration varies enormously in different specimens, there is no distinct immature plumage.

Only one species occurs in Ceylon, and that species as an exceedingly rare straggler. It is of about the same size and general colour as an immature Brahminy Kite, but may be distinguished by the tarsus, which is about twice as long as the measurement in a straight line from the gape to the tip of the bill, and is feathered in front to halfway down or more; the naked portion both in front and behind is covered mainly by transverse plates. The bill is moderate, and curves from the cere, the festoon is but slight. The wings are ample, long, and pointed; the tail is moderately long and rounded at the end; the toes are short.

BUTEO DESERTORUM (Blanford, Vol. III., p. 393).
BUTEO PLUMIPES (Legge, p. 31).

The Common Buzzard.

Description.—Colour variable, either dark or pale brown, with more or less noticeable shaft-streaks ; the feathers of the crown, nape, and hind-neck with white bases ; sides of the neck whitish with dark brown streaks, including a dark moustache-stripe and a band running backwards from the eye ; the primaries have black-brown ends, a large portion of the inner web is white, the under surface of the quills is also white, except at the tip ; secondaries brown above, with the inner webs partly white or rufous, underneath whitish with dark gray ends and cross bands ; tail brown or rufous above, whitish below, with more or less distinct bars. Lower parts white or buff, the throat streaked with brown, the breast and abdomen also broadly streaked, or at times almost covered with brown.

Some birds are brown almost throughout.

Bill black, bluish-gray at the base ; cere yellow ; iris brown ; legs and feet yellow.

Females : length about 20 ; wing 15 ; tail 8–9 ; tarsus about 2·8, but rather variable ; mid-toe without claw 1·5 ; bill from gape 1·40. Males smaller ; wing about 14.

Distribution.—An extremely rare straggler to the Island, only recorded twice or thrice. It occurs throughout the greater part of Europe, Asia, and Africa, and is resident in the Himalayas, visiting the peninsula of India in the winter.

Habits, &c.—Rather like those of a Harrier. It quarters over marshes and bare lands hunting for mice, frogs, lizards, and insects. It is rather sluggish and solitary, and during the heat of the day generally perches on a low tree or bush, or on the ground.

Group VI.—Hawks.

The three typical Hawks found in Ceylon are all of small size. They are to be met with mainly in forest or in well-wooded localities. As a group they are distinguished by their short, rounded wings and long tarsi. The bill is short and

stout, and curves sharply from the cere ; the festoon is well marked. The tarsus is feathered in front only at the base ; the naked portion is covered in front and behind with transverse shields, and on the sides with reticulated scales. The tail is fairly long and square at the ends. The lower plumage is transversely barred in adults and spotted in the young. The females in all three species are much larger than the males.

Rough Key to Group.

A.—Tarsus fairly stout ; toes moderate ; bill from gape about three-fifths of mid-toe without claw.

(1) No crest ; wing up to 7·5 ; central tail feathers in adults not completely barred.
Astur badius (The Shikra).

(2) A small crest ; wing 7·5 or over ; central tail feathers in adults fully barred.
Lophospizias trivirgatus (Crested Goshawk).

B.—Tarsus slender ; toes long ; bill from gape half mid-toe without claw.
Accipiter virgatus (Besra Sparrow Hawk).

ASTUR BADIUS (Blanford, Vol. III., p. 398 ; Legge, p 23).

The Shikra.

Description.—Adult male : Upper plumage bluish-ashy ; the hind-neck generally tinged with rufous ; wing quills blackish towards the ends, the inner webs below the notch white, or buff, with blackish bars ; in the tail the middle and outermost feathers are not barred, or have only traces of bars, the remainder have four or five broad dark bars. The sides of the head and neck and a narrow streak down the chin are ashy-gray ; chin and throat otherwise whitish ; breast some shade of rufous with narrow white bars, which vary considerably in regularity and distinctness ; on the abdomen the colour gradually fades into the buff or white of the vent, thighs, and tail coverts.

Females are darker and browner above, and more boldly barred on the under surface.

Young birds are brown above, with rufous edges to the feathers; all the tail feathers are barred, the bars on the outer feathers being narrower and more numerous; lower parts white with large brown drop-shaped markings, which are largest on the breast; there is generally a brown stripe down the centre of the throat.

Bill bluish, darker at the tip; cere greenish-yellow; iris yellow or orange, darkening to red in old birds; legs and feet yellow.

Females: length 13·50; wing 7·5; tail 6·5; tarsus 2; mid-toe without claw 1·25; bill from gape ·75.

Males are smaller: length about 12; wing 6·75.

Distribution.—Found all over the Island in considerable numbers. It occurs throughout India and Burma, extending westwards into Southern Persia and eastwards as far as China.

Habits, &c.—May be seen almost anywhere, except in thick forest. According to Legge, it is a partial migrant, the majority of the birds seen near the sea during the north-east monsoon retiring inland to breed during the south-west. It feeds largely on lizards, but will also take small birds, rats, mice, grasshoppers, &c. The call is a two-syllabled whistle. The breeding season appears to last from April till about August. The nest is rather a loose structure of twigs, about a foot across, and lined with grass. It is generally placed near the top of a tree. The three eggs are plain bluish-white; the texture is smooth, but glossless. Average size 1·55 by 1·22.

LOPHOSPIZIAS TRIVIRGATUS (Blanford, Vol. III., p. 401).
ASTUR TRIVIRGATUS (Legge, p. 20).

The Crested Goshawk.

Description.—Adult: Forehead, crown, and short crest blackish, shading into ashy on the sides of the head and neck, the shafts of the feathers darker; upper parts from nape to tail coverts dark glossy-brown; upper tail coverts tipped with white; wing quills with blackish bars, much more distinct on the underside of the feathers than above; tail smoky-brown with four broad blackish bands. Chin and throat white with

a long black stripe down the centre and one on each side on the border of the gray cheek; breast rufous brown with white margins, which vary in width; abdomen and thighs barred chocolate-brown and white, the bars becoming narrower on the thighs; under tail coverts white; wing lining whitish with brown patches.

Young birds are brown above with pale edges to the feathers and buff bases which show on the nape and hind-neck; under parts whitish-buff with traces of black stripes on the throat, some deep rusty spots on the flanks and abdomen and some brown bars on the thighs.

Bill bluish-brown at the base, black at the tip; cere, eyelids, and gape of bill greenish-yellow; iris golden-yellow; legs and feet pale yellow.

Females: length about 15·5; wing 8; tail 7; tarsus 2·25; mid-toe without claw 1·25; bill from gape 1·1.

Males are smaller: length about 14; wing 7·5.

Distribution.—Not very common, but fairly widely distributed in the forests of the low-country and up to about 3,500 feet in the hills. It is found in similar country throughout India, Burma, and South-eastern Asia, including the islands from the Malay Archipelago to the Philippines. Himalayan birds are much larger than our Ceylon form.

Habits, &c.—Entirely a forest bird, generally seen in tall trees. The cry is a shrill note of one syllable. It feeds chiefly on lizards, but also on small birds.

The breeding season in Ceylon is probably during the south-west monsoon. The nest is rather like that of the preceding species, and is placed in a high tree. The two eggs are pale greenish-white, and measure about 2 by 1·4.

Accipiter virgatus (Blanford, Vol. III., p. 404; Legge, p. 26).

The Besra Sparrow Hawk.

Description.—Adult male: Head, hind-neck, back, and wings very dark ash colour, deepest on the head; the back often tinged with brown; the feathers on the nape and the scapulars white at the base; wing quills brownish-gray above,

whitish below, with broad dark crossbars (the fourth quill has seven or eight such bars, including the tip); secondaries and tertiaries barred on the inner web with white; tail dark ash-gray above, whitish below, with four dark bands on the inner feathers and five or six on the outermost; the latter disappear in old birds. Throat white, generally with a dark stripe down the middle; upper breast rufous, the central feathers with white edges and dark shafts; lower breast, abdomen, and thighs barred white and rufous brown, but the breast and flanks are so tinged with rufous as to conceal the bars; vent and lower tail coverts white.

Females are dark brown above; the crown and nape blackish; wings and tail browner than in males; throat and fore-neck white with a broad dark central stripe; the centre of the chest boldly striped with dark brown; sides of chest, breast, abdomen, and thigh coverts banded rufous brown and white, the white bands growing narrower in old birds.

Young birds are brown above with rufous margins to the feathers; the under parts are buff or brownish-white, with a broad dark band down the centre of the throat, and large brown spots on the breast, abdomen, and thigh coverts. The spots turn to bars as the birds grow older.

Bill lead-gray, blackish at the tip; cere pale lemon-yellow; iris bright yellow, orange in old birds; legs and feet yellow.

Males: length about 10·5; wing 6·25; tail 5; tarsus 2; mid-toe without claw 1·25; bill from gape ·62.

Females considerably larger: length about 13·5; wing 7·5; mid-toe 1·4; bill from gape ·7.

Distribution.—Blanford unites under one head (1) *A. affinis*, a large form resident from the Himalayas to the Shan States, Siam, and possibly Malaya; and (2) *A. virgatus*, of which the typical sub-species *A. virgatus virgatus* occurs as a resident in Southern India and Ceylon. It is fairly widely distributed over the Island wherever there is jungle.

Habits, &c.—Like the Crested Goshawk, this is a jungle bird and rather shy. The cry is a loud shrill squeal. It feeds on small birds, lizards, &c.

The breeding season appears to be about May; the nest is a rough structure of twigs placed in a tree. The clutch varies

from two to four, three being the usual number of eggs. The eggs are white, tinged with a faint bluish tinge when fresh, and more or less brightly marked with blotches of reddish-brown. Average size 1·46 by 1·18.

Note.—*Accipiter nisus*—The Sparrow Hawk—may possibly occur in the Island. Kelaart in his *Prodromus* (*p. 96*) states that he saw a single live specimen. *Legge* (*p. 29, footnote*) shows that the authenticity of this record is doubtful. The species, however, is a winter migrant as far south as the Nilgiris, and may possibly turn up one day in the Ceylon hills.

It is a larger bird than the Besra Sparrow Hawk; males measuring about 8 and females 9·5 in the wing. It may be recognized by the fourth primary quill, which in adults has only five or six dark bars, and by the lack of the dark throat-stripe, which is generally present in *Accipiter virgatus*.

Group VII.—Honey Buzzards.

The Honey Buzzards differ from all other Birds of Prey by having the sides of the head, the lores, and even the eyelids covered with close overlapping scale-like feathers. As the birds feed largely on the combs and larvæ of bees and wasps, the close feathering of the head is doubtless a protection against the stings of these insects. The bill is weak, rather long, not very hooked, and has little or no festoon. The wings are long and rather rounded. The tail is moderate in length. The tarsus is short and feathered halfway down in front. The toes are long, the middle toe being as long as the tarsus, and are covered with conspicuous bony scales. Honey Buzzards are found throughout most parts of the Old World. One species occurs throughout the Indian Empire.

PERNIS CRISTATUS (Blanford, Vol. III., p. 406).
PERNIS PTILONORHYNCHUS (Legge, p. 89).

The Crested Honey Buzzard.

Description.—Plumage extremely variable. A fairly typical specimen is coloured as follows:—Forehead and crown iron-gray, deepening on the back of the head to light brown, with dark shaft-stripes; the small crest is black; nape and sides

of neck light brown with dark shaft-stripes ; back and rump sepia-brown ; upper tail coverts lighter brown with some white bars ; wing coverts brown, lighter at the tip ; primaries gray-brown with black tips and two black bars ; secondaries grayer with light tips ; innermost quills almost tawny-brown ; tail brownish-black with a broad band of gray-brown on the outer half and a similar narrower band towards the base. Lores, sides of head, ear coverts, eyelids, and chin gray ; throat tawny-brown with darker shaft-stripes ; a faint black streak down the centre of the throat and on each side ; rest of lower parts, with the wing lining, brown, more or less mottled with white ; under surface of wing and tail grayish-white with black bars.

Some, probably quite old birds, are darker, and have the throat and whole under surface chocolate-brown.

Young birds are much lighter. The feathers of the crown and nape and sometimes of the whole head and neck are pale tawny with dark shaft-stripes and white bases ; the rest of the upper parts are brown with pale edges to the feathers ; the wing coverts and upper tail coverts are a good deal mixed with white ; wing quills and tail brown, narrowly tipped with white and irregularly barred and mottled with lighter grayish-brown. The lower parts are white, or buff, more or less marked with long dark shaft-stripes, which are sometimes drop-shaped.

Mature birds may be told by the tail. In the adult stage the broad pale cross band, though it may be mottled, is never barred as in younger birds.

Bill black, whitish-blue at the gape ; cere hard and horny, and of a deep lead colour ; iris golden or brownish-yellow ; legs and feet yellow.

Females : length about 26 ; wing 16·5 ; tail 10·5 ; tarsus 2 ; mid-toe without claw 2 ; bill from gape 1·65.

Males : length about 25 ; wing 16.

Distribution.—Found during the north-east monsoon, mainly in the northern half of the Island. Some birds appear to be resident. It occurs throughout the Indian Empire and South-eastern Asia.

Habits, &c.—Generally seen near water and in well-wooded country, but on its first arrival it may be met with near the coast. The flight is straight and rather hurried, but seldom long-sustained. It feeds largely on the combs of bees, eating both honey and brood-comb. It will also eat white ants, various insects, and small reptiles. Some birds may breed in the northern forest tract, probably during the south-west monsoon. Indian nests are the usual structure of twigs placed in a tree. One or two eggs are laid. They are white or buff mottled and blotched with blood red or reddish, and measure about 2·03 by 1·72.

Group VIII.—Bazas.

The Bazas form a genus which differs from all the preceding groups, in having the upper mandible of the bill furnished with two saw-like teeth on each side, just opposite the end of the lower mandible. In young birds there is often but one tooth, as in the Falcons, but whereas in the present genus the nostril is an oblique slit, in the Falcons it is a circular opening. There is a long crest on the crown. The wings are only moderate in length, and the first primary is much shorter than the fourth. The tail is fairly long and square at the ends. The tarsus is short and feathered halfway down in front; the toes are fairly long.

Bazas are forest birds, of smallish or medium size, found in Africa, Madagascar, the Oriental region, and part of Australia. Two rare species occur in Ceylon.

Rough Key to Species.

A.—Plumage mainly black; length about 13.
Baza lophotes (Black-crested Baza).

B.—Plumage mainly brown; length about 17.
Baza ceylonensis (Legge's Baza).

BAZA LOPHOTES (Blanford, Vol. III., p. 409; Legge, p. 98).

The Black-crested Baza.

Description.—Adult: General colour of upper plumage, wings, and tail black with a slight grayish bloom; the bases of all body feathers white; the longer scapulars white with broad margins of black washed with ferruginous red; the

exposed portions of the longer wing coverts and the last few wing quills largely white, irregularly pied with black and ferruginous red; the outer webs of the inner primaries and some secondaries washed with reddish-chestnut; wing lining black, the greater under coverts and the under surface of wing quills and tail ashy-white, darkening to blackish towards the tips of the wing quills, and with blackish patches towards the end of the tail feathers.

Chin and throat black; a broad white gorget on the lower fore-neck; below this is an indefinite black band tinged with chestnut; breast and long flank plumes whitish-buff, banded with chestnut; abdomen, thighs, and lower tail coverts grayish-black, the abdomen fringed with pale reddish-white, and the tail coverts with whitish.

Young birds have the ferruginous and white markings on the scapulars and quills more developed, the black of the plumage is duller, and the red banding on the flank is fainter or wanting.

Bill, in a fresh specimen, pale grayish-blue, black at the tip; cere, legs, and feet pale grayish-blue; iris purple-brown.

Males: length 13; wing 9·25; tail 5·25; tarsus 1·1; mid-toe without claw 1·1; bill from gape 1.

Females slightly larger; wing 9·9.

Distribution.—A rare bird, which appears to have its head-quarters at the base of the Himalayas, from Nepal eastwards. It also ranges through Burma to Cochin-China and the Malay Peninsula. In Ceylon it is a rare migrant during the north-east monsoon. Specimens have been recorded from various widely-scattered localities in the low-country.

Habits, &c.—This species may be found in fairly wild jungle or forest, generally at no great elevation. It occasionally goes about in little troops, and is said to feed mainly on insects. The cry is sharp and Kite-like.

Baza ceylonensis (Blanford, Vol. III., p. 409; Legge, p. 94).

Legge's Baza.

Description.—Adult: Feathers of crown and nape dark brown, deepening to black on the shafts and towards the end,

and with pale margins; the long crest blackish with white tips; the feathers from the hind-neck to the rump earthy brown with narrow pale tips; greater secondary coverts and tertiaries rather paler and with more white; primaries, secondaries, and tail smoky-brown above, grayish-white below, with darker brown bars; the inner primaries, the secondaries, and outer tail feathers with narrow white tips. The lores and a stripe behind the eye blackish-brown; cheeks and ear coverts gray with dark shaft-stripes; chin and throat buff, also with dark shafts; the sides of the neck and of the breast more tawny; rest of lower surface white with broad crossbars of pale rust colour, which are less conspicuous on the under tail coverts.

Young birds are paler; the dark bars on the tail are five in number, as against four in adults; the lower surface is whiter, and the rusty cross bands are paler and less perfect.

Bill blackish lead colour; cere brownish-black; iris orange-yellow; legs and feet yellowish.

Length about 17; wing 12; tail 8; tarsus 1·5; mid-toe without claw 1·5; bill from gape 1·25.

Distribution.—An extremely rare resident in the hills. It has also been obtained in India in the Wynaad. It is, perhaps, only a sub-species of *B. jerdoni*, which occurs in Sikkhim, Tenasserim, the Malay Peninsula, and Sumatra.

Habits, &c.—Little is known of its habits. It occurs on wooded hill slopes and in the jungles scattered over the patanas. The nidification is as yet unknown, but probably its nesting habits resemble those of *B. lophotes*, which makes a nest like that of a small Kite in a high tree and lays three chalky white eggs.

Group IX.—Falcons.

The Falcons and their allies are a world-wide group noted for their speed and courage. Many of the species have long been trained by Falconers.

The typical Falcons prey on birds, swooping down on their quarry while in flight, and killing it with a powerful ripping stroke of the hind claw. Kestrels, however, hover over the ground hunting for small mammals, upon which they drop

quietly from above. The members of the group vary from medium to small size. They are all neatly built with long pointed wings. The second quill-may be the longest, as in the genera *Falco* and *Erythropus*, or the second and third quills may be almost equal, thus giving the wing a slightly more rounded appearance, as in *Æsalon* and *Tinnunculus*. The bill is stout, shortish, and well hooked, with one conspicuous tooth on each side of the upper mandible, and with more or less of a festoon further back. The nostril is circular with a central tubercle. The tarsus is fairly short, with the upper half plumed in front; the toes are long; the claws curved and sharp. The tail is of moderate length, and is slightly rounded in all our genera, except the Kestrel, in which it is more fan-shaped, the outer tail feathers being markedly shorter than the central pair.

Rough Key to Group.

A.—Second primary longest; first primary much longer than fourth.

(*a*) Sexes similar; legs yellow. Genus *Falco*.

(1) Length 16–19; crown dark gray; breast only slightly rufous.

F. peregrinus (Peregrine Falcon).

(2) Length 15–18; crown blackish; breast generally dark rufous.

F. peregrinator (Shahin Falcon).

(3) Length 10·5–11·5.

F. severus (Indian Hobby).

(*b*) Sexes dissimilar; legs deep orange-red; length about 12.

Erythropus amurensis (Eastern Red-legged Falcon).

B.—Second and third primaries longest; first primary about equal to fourth.

(1) Tail only slightly rounded.

Æsalon chicquera (Red-headed Merlin).

(2) Tail graduated, outer feathers distinctly shorter than inner pair.

Tinnunculus alaudarius (Kestrel).

FALCO PEREGRINUS (Blanford Vol. III., p. 413 ; Legge, p. 101).

The Peregrine Falcon.

Description.—Adult : Above blue-gray with dark shaft-stripes and bars, the rump and upper tail coverts paler ; hind-neck, upper part of mantle, and wing coverts largely dusky ; forehead whitish ; there is a black moustache band, which expands into a patch on the cheeks and ear coverts ; primary quills brown-black, the inner webs barred with white or pale rufous, except near the tip ; secondaries ash-gray with indistinct darker crossbars ; tail dusky gray, with many ash-gray crossbars and a whitish tip. Lower parts white tinged with rufous ; lower breast and centre of abdomen with a few brown or black spots and bars ; flanks, wing lining, thigh coverts, and under tail coverts with more regular narrow black bars.

Young : Above dark brown with rufous edges to the feathers ; the white bases of the feathers are exposed on the nape ; the tail feathers have pale rufous oval spots ; the black cheek-stripe is narrower than in adults ; lower parts white tinged with buff or rufous and with long fairly wide dark brown shaft-stripes ; wings as in adults. The slaty-gray back of the adult is gradually attained, while the dark markings on the breast slowly become smaller, and in old birds practically disappear, save for a few specks on the abdomen and three-cornered marks on the thighs.

Bill bluish, black at the tip ; cere and orbital skin yellow ; iris brown ; legs and feet yellow.

Females : length about 19 ; wing 14·5 ; tail 7·5 ; tarsus 2·2 ; mid-toe without claw 2·25 ; bill from gape 1·35.

Males are smaller : length about 16 ; wing 12·5.

Distribution.—A very rare migrant during the north-east monsoon, keeping mainly to the coast, but specimens have been met with inland as far as the bases of the main central hill ranges. It is found all over the world, breeding in the north and visiting the tropics in winter.

Habits, &c.—This species in Ceylon generally frequents cliffs and marshes near the sea, preying largely on Wild-fowl and

aders. From its bold nature, its swift flight, and powerful stroke it has long been a favourite with Falconers, who train it to fly at Herons, Storks, Cranes, &c. Though usually breeding in the far north, there seems no doubt (*vide Legge, p. 104*) that Layard shot a pair breeding in the Jaffna peninsula. The nest was a rough structure of twigs in the top of a palmyra. In temperate regions the nest is usually placed on a cliff ledge. The three or four eggs are reddish-white, freckled with brick-red or reddish-brown, and measure about 2·2 by 1·65.

Falco peregrinator (Blanford, Vol. III., p. 415; Legge, p. 106).

The Shahin Falcon.

Description.—Darker than the last species; at all ages the head, nape, and hind-neck are almost charcoal-black, and the lower surface from the chest to the tail coverts is a deep ferruginous brown.

In young birds almost the whole upper plumage is black with rufous edges which soon wear off; the nape is tinged with rufous and the tail marked with oval spots, as in the young of the last species. The chin and throat are pale and unspotted; the breast and abdomen marked with long dark drops. In old birds these markings on the breast and abdomen almost entirely disappear.

Bill slate-blue, dark at the tip; cere and orbital skin yellow; iris deep brown; legs yellow.

Females: length about 17·5; wing 12·75; tail 6·25; tarsus 2; mid-toe without claw 2; bill from gape 1·25.

Males: length about 15; wing 11·5. Ceylon birds are smaller than those from Northern India.

Distribution.—A resident species closely allied to the true Peregrine, which is migrant. Exceedingly rare in Ceylon, where it is found occasionally in the mountain zone, and round isolated hills or sea cliffs in the low-country. It occurs in rocky hills in or near forest throughout India and Burma, and perhaps in Afghanistan, but it is nowhere common.

Habits, &c.—A shy bird, which frequents inaccessible ledges of rocky cliffs. It hunts chiefly in the early morning and evening, and feeds exclusively on birds, chiefly pigeons, parroquets, swallows, and swifts. In its swoop it is as swift and bold as the larger Peregrine, and for this reason is a great favourite with Indian Falconers. It has been found breeding at Sigiriya in June. The nest is a mass of sticks placed on the ledge of a cliff. The three eggs are brownish-yellow, pinkish, or brick-red, speckled and blotched with reddish-brown. The ground colour may vary greatly in a single clutch. They are broad oval in shape, and measure about 2·05 by 1·65.

Falco severus (Blanford Vol. III., p. 423; Legge, p. 110).

The Indian Hobby.

Description.—Adult: Cheeks, sides of head, crown, and hind-neck black, shading into dark slate-gray with black shafts on the remainder of the upper parts; wing quills and larger coverts black, the inner webs of the quills deep brown with some rufous bars or spots; tail slate-gray with a darker bar near the tip. Chin, throat, and sides of neck white, washed with rufous; rest of lower parts deep rusty red.

Young birds: Upper plumage brownish-black with light rufous edges to the feathers; the inner webs of the tail feathers, except the central pair, banded with rufous; breast, abdomen, wing lining, and tail coverts with long drop-shaped black markings.

Bill lead colour; cere and orbital skin pale lemon-yellow; iris deep brown: legs yellow.

Females: length 11·5; wing 9·75; tail 4·5; tarsus 1·35; mid-toe without claw 1·35; bill from gape ·9.

Males: length 10·5; wing 8·5.

Distribution.—A very rare straggler, recorded from two or three up-country localities during the north-east monsoon. It occurs on the lower Himalayas eastwards of Kulu, in Assam, and Manipur, and occasionally during winter in the Indian Peninsula. It is also met with in the Malay Archipelago and New Guinea.

Habits, &c.—A mountain species frequenting wooded hills. It is crepuscular in its habits, and appears to feed on dragon flies, small birds, and lizards.

ERYTHROPUS AMURENSIS (Blanford, Vol. III., p. 424).
CERCHNEIS AMURENSIS (Legge, p. 119).

The Eastern Red-legged Falcon.

Description.—Adult male: Upper parts and tail dark slaty-gray; head, nape, back, and scapulars blackish; quills washed externally with silvery-gray; cheeks sooty-black; ear coverts paler. Lower surface ashy-gray; lower abdomen and under tail coverts deep ferruginous red; wing lining white.

Adult female: Upper parts slate-gray; head, neck, and upper back brownish; rump and tail paler; feathers of head and neck with dark shafts; rest of upper surface barred with black; the cheek-stripe, the feathers below the eye, and a band running back from the eye black; primaries blackish, the inner webs with many large oval white patches, except near the tips. Lower parts creamy-white or pale rufous, the breast with long black spots passing into arrowhead marks on the flanks and upper abdomen; lower abdomen and lower tail coverts unspotted; wing lining white with brown spots.

Young: Brownish, the feathers with indistinct pale tips; lower scapulars, inner secondaries, rump, and upper tail coverts grayish with pale tips and bars of dull black; tail gray with black bars; sides of face and throat white; nape mixed with white; lores and an indistinct moustache-stripe brown; under parts white; the breast with blackish central streaks to the feathers; thighs and under tail coverts buffy-white, the former tinged with rufous.

Bill fleshy red with a dusky tip; cere deep orange; iris hazel; legs orange-red.

Length 11·5; wing 9; tail 5; tarsus 1·1; mid-toe without claw 1; bill from gape ·75. Females a little larger.

Distribution.—Immature stragglers have once or twice been procured in Ceylon. It is a migrant breeding in Northern China, and wintering chiefly in East Africa, but occasionally in India and Burma.

Habits, &c.—An insectivorous species, which hawks over grass lands mainly at dusk. A specimen shot by Legge at Trincomalee was busy feeding on grasshoppers. In its usual haunts it is rather gregarious.

AESALON CHICQUERA (Blanford, Vol. III., p. 427).
FALCO CHICQUERA (Legge, p. 110).
The Red-headed Merlin.

Description.—Crown, nape, sides of neck, ear coverts, and a narrow cheek-stripe chestnut; lores and a narrow forehead whitish; a few bristly feathers round the eye black; upper parts from the neck ash-gray; scapulars, secondaries, and wing coverts more or less barred with brown; primaries blackish-brown closely barred on the inner webs, except at the tip, with white; tail gray, with narrow black bars, a broad black band near the end, and a narrow white tip, lower parts white, with a few short blackish streaks on the breast, and black bars on the flanks and abdomen.

In old birds the dark bars on both the upper and lower plumage become narrow and tend to disappear. In young birds the gray feathers of the upper parts are barred with black, the crown and nape are dusky rufous with dark shaft-stripes, and the lower parts have a rusty tinge.

Bill bluish-black, greenish-yellow at the base; cere, eyelids, and legs yellow; iris lightish-brown.

Male: length 11·25; wing 8·25; tail 6; tarsus 1·5; mid-toe without claw 1·3; bill from gape ·80.

Females are rather larger: length 14; wing 9.

Distribution.—The inclusion of this bird in the Ceylon list rests on the authority of Layard, who watched a specimen at Point Pedro, but failed to secure it. It is found throughout India, being common in many parts.

Habits, &c.—Found chiefly in gardens, groves of trees in cultivated districts, or on the edges of isolated woods. It feeds mainly on small birds. A good lookout should be kept for it in the north of the Island, as it is quite possible that stray specimens occasionally wander across from India. It breeds in trees, making a neat nest of twigs lined with fibres. Four eggs are laid. They are brownish-red, mottled and blotched with darker red, and measure about 1·66 by 1·27.

TINNUNCULUS ALAUDARIUS (Blanford, Vol. III., p. 428).
CERCHNEIS TINNUNCULUS (Legge, p. 114).

The Kestrel.

Description.—Adult male : The head, the back and sides of the neck and a moustache-stripe bluish-ashy with dark shafts ; back, scapulars, and wing coverts brick-red, tinged with vinous, and scattered over with triangular black spots ; rump and upper tail coverts ashy-gray ; tail ashy-gray above, whitish beneath, with a broad black band near the end and a narrow white tip ; wing quills dark brown barred with whitish on the inner webs ; checks and ear coverts whitish with darker streaks ; lower parts pale or buff with brown streaks on the breast, which pass into spots on the lower breast and flanks ; lower abdomen and tail coverts unspotted ; wing lining white with some large black spots.

Female : Ground colour of upper plumage more brownish-rufous, with black streaks on the head and hind-neck, and with conspicuous black bands on the remainder of the upper parts and tail. The black band at the end of the tail is narrower than in the male. Wings and lower parts as in the male, but the latter are more heavily streaked and spotted. In old females the rump, upper tail coverts, and tail are more or less tinged with blue-gray.

Young males resemble females ; the tail turns blue-gray earlier than the head.

Bill bluish-black ; cere and eyelids yellow ; iris brown ; legs orange-yellow ; claws black.

Length about 14 ; wing 9·75 ; tail 6·75 ; tarsus 1·5 ; mid-toe without claw 1·10 ; bill from gape ·85. Females, as a rule, are slightly larger.

Distribution.—Found all over the Island during the north-east monsoon. Some birds appear to breed in the hills. The species occurs over the whole of Europe and Asia, breeding mainly in temperate climates and migrating southwards in winter, when it spreads over Northern Africa as well.

Habits, &c.—The Kestrel mainly frequents open plains, cultivated tracts, dry paddy fields, &c., flying over the ground with rapid beats of its wings. Every now and then it hovers

and then drops suddenly on its prey, which consists mainly of insects, lizards, frogs, and mice. A small dark resident form undoubtedly breeds in the Travancore hills, and may probably be found nesting up-country from April to June.

The nest is generally placed on ledges, or in the crevices of cliffs, occasionally in trees. The eggs usually number four or five. They are broad ovals, generally rather pointed at one end. The colour is brick- or blood-red, with deeper mottlings and blotches. Average size about 1·57 by 1·21.

Note.—It is possible that a Falconet—probably *Microhierax fringillarius* (The Black-legged Falconet)—may be found in Ceylon. These birds belong to a group which has a toothed bill like the Falcons. They are, however, extremely small, with a wing measurement of under 5 inches. They also differ from other birds of prey in their nidification, as they lay white eggs in a hole in the branch or trunk of a tree.

The species mentioned above has a total length of 6·5; wing 4; tail 2·25; tarsus ·75; bill from gape ·55.

In general appearance it is black, glossed with metallic-green on the upper parts; the flanks and thigh coverts are black; the lower parts white, more or less tinged with rusty-red; the forehead and a broad stripe from behind the eye down the sides of the neck are white.

This species is found in the Malay Peninsula, Southern Tenasserim, Sumatra, Java, and Borneo. Its presence in Ceylon was suspected by E. E. Green (*vide Spolia Zeylanica, Vol. VIII., p. 287*). He once saw a tiny Hawk pounce on a Bulbul and fly away with it. On another occasion a planter described to him how he had seen in Hewaheta two "black birds" fighting, and how one of them killed the other and flew away with it.

Fig. 1.

Fig. 2.

Fig. 3.

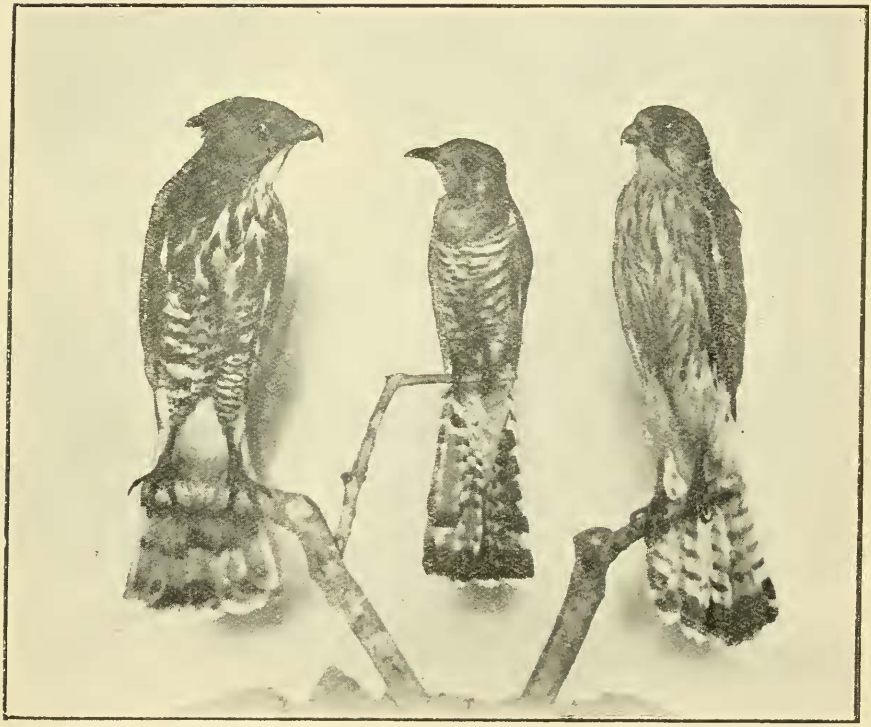


Fig. 4.

Fig. 5.

Fig. 1.—Photodilus assimilis.
Fig. 2.—Haliastur indus.
Fig. 3.—Falco peregrinator.
Fig. 4.—Lophospizias trivirgatus.
Fig. 5.—Tinnunculus alaudarius.

NEW CEYLON DIPTERA.

By R. A. Senior-White, F.E.S.

(*With two Plates.*)

Mycetophilidæ.

Platyura talaroceroides n. sp. (Pl. I., Fig. 4.)

Male.—Head : Vertex brownish, face and palpi yellowish. Antennæ yellow, apparently only fifteen-jointed, the two scapal joints somewhat broader than those of the flagellum, and very small. The first twelve flagellar joints each bear a finger-like pectination, nearly as long as the whole flagellum, the first nine joints closely sessile and very small, gradually lengthening from tenth to twelfth, the latter as long as the two preceding joints. The pectinations of the first five joints are decumbent, the rest gradually arise to nearly porrect in the last three, though the apices of these bend slightly downwards. Apical joint simple, as long as preceding three together. The pectinations closely set with fine hairs, and bearing a terminal black bristle.

Thorax.—Dorsum brown, unmarked, with minute black bristles, pleuræ concolorous, metapleuron with black bristles. Scutellum small, with marginal row of chætæ, longer than width of scutellum.

Abdomen.—Slender, eight-segmented, bristly, especially apically. Tergal plates of hypopygium twice the length of the sternal. First segment wholly yellow, second to sixth with basal half black and apical yellow, seventh and eighth and genitalia wholly black. Venter banded similarly.

Legs.—Yellow. Tibiæ and tarsi closely set with minute black setæ. Spines of mid-tibiæ much longer than those of front pair.

Wings.—A little longer than the abdomen, venation normal. Basal section of fourth vein about one-third length of fork, sixth vein not quite reaching wing margin. Colour

pale smoky-yellow, apex slightly darker, only markedly so from upper branch of third vein to upper branch of fourth. Halteres paler yellow than thorax.

Long : 3 mm.

Described from unique male in perfect condition, except for loss of both hind legs beyond trochanters, taken on window. Suduganga, Matale, Ceylon, August 30, 1918.

Type in my own collection.

The fifteen-jointed antenna is a doubtful point ; it may possibly consist of sixteen joints, as in the remainder of the genus, the appearance of the first flagellar joint indicating that it possibly consists of a fused first simple with pectinate second joint. This is the second species of the genus to be described with an eight-segmented abdomen.

EXECHIA ARGENTEOFASCIATA n. sp.

Female.—Head wholly orange-yellow, frons and vertex with fine golden hairs, a few black bristles along upper interior orbit. Eyes minutely pale pubescent. Middle ocellus absent. Antennæ arising from lower margin of an elliptical depression, of which the upper margins extend to halfway between root of antennæ and the ocelli, yellow, the apical six or seven joints of the flagellum very slightly darker, the whole flagellum with minute whitish pubescence. Palpi brown, the apical joint slender.

Thorax.—Dorsum orange, minutely golden pubescent. Above the dorsopleural suture a broad silvery stripe (width about one-third of orange area), which appears black, with only a fine silvery lower margin viewed from front or side. Pleuræ yellow. A row of stiff dark bristles around dorsopleural suture, weaker on anterior margin. Humerus with three strong bristles, a strong one on each posterior corner of thorax, and a præscutellar pair. The dorsopleural fascia has some bristles along its upper margin, and a few on the silvery area, irregularly placed. Scutellum concolorous with dorsum, very small, with traces of silvery pubescence, in certain lights, along its apical margin, above which is a row of small bristles. Metanotum steep, carinate. Metapleuræ with a few dark bristly hairs.

Abdomen yellow, laterally strongly compressed, with short yellow hairs. Segments slightly darker at base, a black median line on basal half of third to sixth segments. Hind margin of first segment dark. Belly pale. Genitalia consist of a pair of small lamellæ, below which is a conical organ with darker ovipositor at tip.

Legs yellow, except tarsi, which are blackish.

Wings slightly shorter than abdomen, pale yellow. Halteres slightly darker.

Long : 3 mm.

Described from a single female, taken flying round *Lantana* scrub in shade. Suduganga, Matale, Ceylon, May 4, 1919.

Type in my own collection.

EXECHIA CRISTATA n. sp.

Female.—Head : Frons black, covered with somewhat widely separated silvery-yellow pubescence. A transverse row of short black bristles over root of antennæ. Eyes minutely black pubescent. Antennæ, scape yellow, flagellum black, with minute pale pubescence.

Thorax yellow, with pale pubescence. Posterior half of dorsum with a dark brown circular patch, reaching nearly to wing roots, into which extends from in front a V-shaped yellow patch, the apex of which is nearly in a line with the wing roots. At posterior corners of thorax are small yellow patches extending inwards for about one-third the dorsal breadth, medianly the brown colour reaches the root of the scutellum. Pleuræ yellow, except ptero- and meta-pleuræ, which are grayish-brown. A row of small black bristles on anterior margin, five long dorso-centrals from anterior margin to base of V-mark, each row erect, but inwardly inclined, forming a dorsal crest. The two rows are continued, inwardly converging, by smaller, posteriorly directed bristles, along the margins of the yellow V-mark. Many irregularly placed small black bristles on the remainder of the dorsal area. Humerus with four strong bristles, a strong one above root of wings and on posterior corners. Scutellum large, dark brown, with two long parallel apical dark bristles reaching to middle of second abdominal segment. Meta-pleuræ with two strong black bristles. Metanotum dark.

Abdomen laterally compressed, tergum black, sternum yellow, except the last two segments, which are all black, the whole with pale pubescence. First segment with apical yellow dorsal band, segments two to five with apical black bands extending somewhat indefinitely into yellow sternal area.

Legs, coxæ and femora pale yellow, tibiæ appear darker from more closely set setulæ. Tarsi black.

Wings pale gray. Halteres yellow.

Long : 2½ mm.

Described from a single female, taken on window at dusk. Suduganga, Matale, Ceylon, January 19, 1920.

Type in my own collection.

Exechia ampullata n. sp.

Female.—Head : Frons black, with thick silvery pubescence. Eyes very minutely pubescent. Antennæ and palpi pale yellowish, apical half of flagellum slightly darker.

Thorax white, the dorsal surface occupied by a black ovoid mark with a short anterior narrower extension (on extremity of which the colour fades to brown), the pattern resembling an earthenware vessel. Pro-, meso-, and ptero-pleuræ dark brown, remainder of pleural area white. A small brown patch at costal root of wing. Some strong setæ on anterior and lateral margins and on propleuron. Scutellum black, barely separated by a paler area from the thoracic pattern, apically two long erect setæ, interior to which is a pair of smaller porrect setæ, apically crossed.

Abdomen yellow, dorsally the whole of the first and second and posterior half of third to sixth segments black. Venter yellowish.

Legs.—Coxa and femora whitish, extreme tips of posterior femora darkened. Tibiæ slightly darker, tarsi blackish.

Wings slightly yellowish. Fork of fifth vein, short, occurring slightly exterior to origin of third vein. Halteres pale.

Long : 3½ mm.

Described from a female in good condition taken on a window. Suduganga, Matale, Ceylon, March 15, 1920.

Type in my own collection.

EXECHIA ZEYLANICA n. sp.

Male.—Head : Frons very dark brown, a paler yellowish margin to upper orbits. A transverse line of black bristles above antennæ. Antennae with scape yellow, flagellum blackish. Eyes minutely pale pubescent.

Thorax yellowish-brown, with minute black dorsal pubescence. A row of stiff bristles along anterior margin, five on each humerus, the two lower declinate, the upper reclinate, the two uppermost smaller. A few bristles along dorso-pleural suture, a strong supra-alar and two postalar bristles, and some, irregularly placed, on dorsum. Scutellum darker brown, with a pair of small, erect, subapical bristles. Pleuræ pale yellow, meso- and meta-pleuræ darker, the latter with stiff hairs.

Abdomen strongly laterally compressed, yellow, with basal black bands, narrow ventrally, but broadening dorsally to reach anterior margins of the segments. Fifth and sixth segments wholly black. First segment with narrow apical pale band, conspicuous viewed against the otherwise wholly black dorsal surface. Genitalia swollen, conspicuous, consisting of a pair of large, at least two-jointed, claspers, the basal joint the larger, brown, the apical blackish. Beneath the claspers are a pair of blackish, horny processes, from the underside of which, near tip of each, arises a yellow, arcuate spine, black tipped. Abdomen and genitalia bristly.

Legs.—Coxæ and femora pale yellow, tibiæ pale blackish-yellow, tarsi blackish.

Wings extending to tip of abdomen, grayish. Fork of the fifth vein short, commencing somewhat distal of the origin of third vein. Halteres, scape pale, capitellum black.

Long : 2½ mm.

Described from a unique male, in good condition, taken on window, at dusk. Suduganga, Matale, Ceylon, April 15, 1920.

Type in my own collection.

This species differs from *E. basilinea* (Brunetti) in the much shorter fork of the fifth vein.

Tipulidæ.

Teucholabis annuloabdominalis n. sp.

Male, Female.—Head : Frons very wide, shining black. Cheeks brownish to yellowish. Nasus and palpi dark brown, the latter with a few scattered hairs. Antennæ, first scapal joint cylindrical, second subglobular, both brownish-yellow, darker apically. First flagellar joint more robust than the remainder, which are elongate-oval, brownish, paler basally, each joint with a whorl of a few hairs about as long as the joint itself. Flagellum distinctly fourteen-jointed, apical joint very small.

Thorax.—Neck and anterior portion entirely pale yellowish. Mesonotum pale yellowish, a broad præsutural black band with a median broad extension forward to collare, along each side of which is a line of dark hairs, and a pair of black circular supra-alar patches. Scutellum pale yellow, metanotum black. Anterior pleuræ pale yellow, with large black mesopleural spot divided from mesonotal black band by a yellow line along dorsopleural suture. Metapleura black. Thorax shining, naked, except for the above-mentioned median præsutural rows of hairs and a few scattered hairs postsuturally and on scutellar margin.

Abdomen black, the segments with prominent yellow apical dorsal bands, venter yellowish, except sixth segment in male, which bears a tuft of black hairs arising from a dark patch. Male genitalia dark, female yellowish-brown.

Legs.—Coxæ to tibiæ pale yellowish, the tips of femora and tibiæ broadly black, tarsi black, the whole thickly dark pubescent.

Wings.—Membrane slightly smoky, costal cell more yellowish. An indefinite dark patch at origin of second vein. Stigma dark, from which an indefinite brownish suffusion extends over the cross veins to fifth vein. Venation as in normal *T. fenestrata.* Halteres, scape black, capitellum elongate, very pale yellow.

Long : 5–6 mm.

Described from five males and one female, all from Suduganga, Matale, Ceylon.

Type male and female taken on December 19, 1918, resting on *Cajanus indicus* bush.

Types and other specimens in my own collection.

Tabanidæ.

HÆMATOPOTA RHIZOPHORÆ n. sp. (Pl. I., Fig. 1).

Female.—Face grayish, with white pubescence, a black band between the eyes below the antennæ. Palpi yellowish-gray, with basal pale hairs and black pubescence. Antennæ dark brown, the first joint very large, incrassate, shining, viewed laterally as broad as third joint at its widest, with black pubescence. Second joint very small, with thick black pubescence. Third joint broad and flattened on its basal annulation, the last three annulations forming a small apex. Apical annulation paler. Frons gray with sparce whitish decumbent pubescence, mixed with black erect pubescence, also sparce, but somewhat thicker posteriorly. Paired spots sub-triangular, touching eyes posteriorly, widely separated from frontal callus. Frontal callus dark brown, shining, almost straight on both borders, reaching eyes on lower border, slightly downward produced at angle between eyes and base of antennæ. Space between antennæ black, base of antennæ ringed yellowish above exteriorly.

Thorax brown with short pale whitish pubescence on dorsum, the three gray stripes distinct, narrow, the lateral ones ending in a gray spot at the suture. At base of thorax two slightly larger gray spots, above which the pale pubescence is thickened on each side of median stripe up to two-thirds of distance to suture. Pleuræ gray, darker below, with long whitish pubescence above sternopleural suture. Scutellum concolorous with mesonotum, with similar pale pubescence, except apically.

Abdomen brown, first three segments lighter reddish-brown, posterior margins of segments with pale pubescence, broader laterally. Underside dark brown.

Legs black. Femora slightly black pubescent. Fore tibiæ slightly incrassate, basally yellowish-white. Posterior tibiæ

with two yellow-white rings each, basal three-quarters of posterior meta-tarsi yellowish-white. Tibiæ without hair fringes.

Wings brownish-gray, veins brownish, paler anteriorly. Stigma very dark brown and prominent, as in *H. sinensis*. Apical band double, the outer row of four spots, of which the lowest is widely separated from the other three ; the inner line confluent with the outer at topmost spot just below second vein, continuous to lower branch of third vein, concave towards apex. The white spot exterior to stigma with dark centre. First rosette containing a white spot on each side of erect portion of anterior branch of third vein. Second rosette distinct, centered over the outer side of discal cell. Third rosette distinct, oval, centered over the cross-veins. Outer side of fourth rosette fairly distinct. A double marginal line of lunules in each posterior cell, and a double zig-zag line from base of third rosette to axillary angle.

Long (with antennæ) : 12 mm.

Described from a unique female in perfect condition captured on Beach road through mangroves, Trincomalee Harbour, on October 7, 1919.

Type in my own collection.

Very close to *H. litoralis* Ricardo, but differing in abdominal colour and pattern.

Drosophilidæ.

PHORTICA XYLEBORIPHAGA n. sp. (Pl. II.).

Male, Female.—Head : Back of head gray. Frons yellow, ocellar triangle dark. Paratrontalia narrow, silvery. Face silvery gray, epistome dark at sides, centre white, with more or less defined very narrow black median line. Proboscis dark brown, palpi yellow-brown. Antennæ yellow, third joint with fine pale pubescence. Arista with the small basal joint yellow, remainder black. In male the arista is bare, with only vestiges of rays, expanded apically into a leaf-like process. Female arista with weak short rays, no apical process. Cephalic bristles black ; verticals strong ; postverticals weak, parallel ; ocellar strong ; fronto-orbitals, superior two pairs,

inferior one pair, strong. Occipital row present. Central area of frons below ocellar triangle with many short bristles (generic character).

Thorax brownish-gray, thickly covered with short black bristles (generic character). A median and dorso-central dark bars, varying in intensity in various specimens, from anterior margin to level of wing roots. Scutellum concolorous bare. Pleuræ silvery. Dorso-central bristles, two pairs on hind margin, the anterior weak, posterior long and strong. Præscutellars shorter than the posterior dorso-centrals. Anterior to præscutellars a pair of the short thoracic bristles are almost sufficiently strong to be differentiated as macrochætæ. Humeral and both notopleurals strong, supra-alar two, sternopleurals strong, two. Remaining bristles absent. Scutellum with four strong bristles, the apical pair crossed. All bristles black, and more strongly developed in the female.

Abdomen.—First two segments yellowish-white, the central and anterior marginal areas of the second more or less brown. Remaining segments very dark brown, the hind margin of the third (and in the female of fourth and fifth) narrowly edged pale. The whole with short dark bristles, more numerous posteriorly. Male genitalia concealed, in one specimen a pair of small black-tipped thorn-like processes are visible.

Legs.—Entirely yellow, with fine black setæ. Fore tarsi of male not dilated.

Wings.—Unmarked. veins yellow, venation normal. Halteres pale yellow.

Long : $1\frac{1}{2}$–2 mm.

Described from four males and one female. One male (type) in fair condition from Narangalla estate, Badulla district, Ceylon, November 28, 1919 (F. P. Jepson) ; the others in poor condition from Hunasgiriya Group, Wattegama district, Ceylon, March, 1920 (F. P. Jepson). The female (type), from Diyaluma estate, Koslanda district, Ceylon, June 10, 1915 (E. R. Speyer). The female in good condition, but gummed on card.

Type male in my own collection. Type female in collection Department of Agriculture. Peradeniya, No. 5.091 B.

There is nothing in Schiner's generic description of *Phortica* to prevent this species being included therein. Williston's figs. ("North American Diptera," fig. 118, 1 and 2) show a much greater marginal convergence of veins 3 and 4 than in the species now described, but his note on page 301 of the same work shows that there are species included in the genus with the first posterior cell wide open. (Schiner says "thence parallel to each other to the wing margin.") As regards the dilated front tarsi of *Ph. scutellaris* referred to by Williston (*id. loc. cit.*), this would appear to be contrary to a generic character, which states "legs simple." The genus will probably have to be divided up when overhauled by a specialist.

The species described above is almost certainly that referred to by Rutherford (Trop. Agric., XLII., p. 220), but his specimens are not to be found. When he wrote, the habits of the insect were in doubt, but recently Mr. F. P. Jepson (Entomologist in charge of Shot-hole Borer Investigations) informs me (*in litt.*) that he has seen the larva eat a pupa of the beetle, tunnelling completely inside, and sucking it dry in about 20 minutes. The specific name suggested is proposed, therefore, on account of this.

Trypetidæ.

RIOXA MAGNIFICA n. sp. (Pl. I., Fig. 2).

Female.—Head: Frons yellow, a brown median stripe, expanding indefinitely below lower superior orbital. Face yellow. Parafacialia with silvery pubescence, epistomal margin black. Antennæ yellow, arista plumose, but basal third of underside nearly bare. Palpi black, proboscis yellow. Cephalic bristles all black. Inferior orbitals two, lower weak. Between superior and inferior orbitals on each side a pair of very small bristles. Ocellar nil, outer vertical wanting, genal strong, occipital row well-developed. Back of head yellow, bristly, a noticeable tuft of short bristles above junction of neck.

Thorax.—Yellow, scutellum concolorous. A black stripe dorso-centrally from anterior margin to root of scutellum, another along dorso-pleural suture to wing root, a third from

propleuron to slightly beyond mesopleural bristles, a fourth along sternopleural suture, broadening on to whole of metapleuron and metanotum, thus ringing lower and hind margins of thorax with black. All bristles black, præsutural wanting, pteropleural and sternopleural weak. Intermediate scutellar weak. Halteres pale yellow.

Abdomen.—Broadest at junction of second and third segments. Yellow, with slight concolorous pubescence dorsally. A black transverse band occupying basal half of second segment and a broad black longitudinal stripe along dorsal margins of third to sixth segments, leaving only the median area yellow. Venter yellowish throughout. Ovipositor as long as whole abdomen, yellow, darkening apically. Short black bristles along sides of segments two to six.

Legs yellow, posterior tibiæ black, except apices. Front femora with seven bristles beneath, basal three weak. Mid tibiæ without bristles.

Wings.—Ground colour yellow, stigma wholly black. Beyond stigma a marginal black band gradually broadening from end of first vein to middle of third posterior cell, where its width is nearly half that of the wing, extending into discal cell. Along third vein this band is broadly and rectangularly extended as far inwards as a point in line with extremity of first vein. A hyaline marginal lunule in second posterior cell. From stigma a broad black band extends basally to sixth vein beyond anal cell, apex of which alone is infuscated. There is an outward extension of this band over the anterior cross-vein almost to join the inner margin of apical band in discal cell, the area of separation being itself faintly infuscated. Axillary and second basal cells slightly infuscated.

First vein ending in the middle between the auxiliary and second veins. Anal cell prolonged to a point hardly in advance of second basal cell. No costal bristle.

Long (with ovipositor) : 9 mm.

Described from a unique female in good condition taken on window. Suduganga, Matale, Ceylon, March 4, 1920.

Type in my own collection.

This species apparently comes in *Rioxa*, though the absence of the præsutural bristle is contrary to a generic character.

STAURELLA ZEYLANICA n. sp. (Pl. I., Fig. 3).

Female.—Head yellow-gray. Occiput slightly raised, ocellar triangle brownish-orange, from whence a very indefinite darker band down centre of frons to frontal lunule, which is pale yellow, and prominent. All bristles black, lower orbitals three (there is also a smaller bristle between the two lower ones on right side); the superior orbital not inserted upon a prominent tubercle. Ocellar bristles present. Postverticals strong, *crossed*. Antennæ yellow, the third joint with pale pollination. Arista darker yellow, long, pectinate on both sides. Proboscis and palpi yellow.

Thorax yellow-brown, with short black pubescence. Humeral calli pale yellow. All bristles black, three mesopleural. Pleuræ concolorous with dorsum, but black pubescence somewhat sparce. Pteropleuræ very pale yellow between root of wings and pteropleural bristle. Metanotum concolorous, shining, with pale pollination. Scutellum pale yellow, triangular, with slight black pubescence, stronger towards outer margins, the four bristles strong and long, the median pair crossed at apex. Halteres slightly paler than pleuræ.

Abdomen narrow and elongated, broadening from base to junction of the fused first and second segments with the third segment, thence tapering uniformly. First and second segments, and median area of third, yellowish, fourth and fifth blackish. Third segment with median dark lunule, and a large brown oval mark at edge of dorsal margin. Bristles black, prominent at sides of first, second, fourth, and fifth segments. Venter yellowish. Ovipositor circular in section, longer than abdomen, narrow and truncate apically, shining black, covered with dense black pubescence, which appears gray against ovipositor in certain lights.

Legs.—Uniformly pale yellow.

Wings without costal bristle, veins brownish. Stigma brownish, the colour continued below to third vein. Apical half of wing very dark brown. There are three narrow hyaline areas along outer margin in submarginal and first and second posterior cells respectively. A very small lighter patch in

first posterior cell in angle made by junction of third vein with the anterior cross-vein, and another, somewhat larger, and sagittiform, in outer half of discal cell. The dark colouration is prolonged inwards in first basal and discal cells nearly to the anterior basal cross-vein. As in *S. nigripeda* the anterior cross-vein is slightly beyond the middle of the discal cell. There are two small bristles on third vein immediately beyond its separation from second vein.

Long : 7 mm.

Described from a unique female in good condition taken on *Lantana* scrub. Suduganga, Matale, Ceylon, March 30, 1919.

Type in my own collection.

The crossed postvertical bristles are contrary to a family character, whilst Bezzi, in his generic description (*Mem. Ind. Mus., III., p. 121*), says nothing of their direction, from which it may be assumed that they are normal, *i.e.*, parallel or diverging. In the species here described they would appear to be stronger than the generic character lays down. The three mesopleural bristles are abnormal, but in all other respects the species agrees well with Bezzi's genus, wherein I leave it for the present.

Sciomyzidæ.

Trigonometopus zeylanicus n. sp.

Male.—Head frons flattened, horizontal (generic character), at its narrowest (opposite fronto-orbital bristles) about one-third width of head ; widened at vertex, brownish-yellow, paler along eye margins. Ocellar triangle well below vertex, situated in the anterior half of an ovoid slightly darker area extending to behind vertex, the area between the actual ocelli very dark brown. Verticals two, interior converging, exterior diverging. Postverticals crossed. Ocellar small. Fronto-orbitals two pairs, occipital row strong. The central area of frons, below ocelli, with a double row of small bristles, and on anterior border, between lower fronto-orbitals and antennæ, the whole area bristly. All cephalic bristles black. Face very retreating (generic character), carinate below antennæ, wholly yellow. A small cuneiform dark brown spot extends from anterior eye margin to root of antennæ. A row of black

bristles from lower edge of facial carina to back of head. Postocular area laterally blue dusted, sharply defined from yellow genal area below. Proboscis yellow, geniculate. Antennæ brownish-yellow, second joint spinulose at tip, with an upper and two lower erect bristles apically. Third joint twice as long as first and second together, microscopically pale pubescent. Arista long, minutely pubescent, black except for extreme base, yellowish.

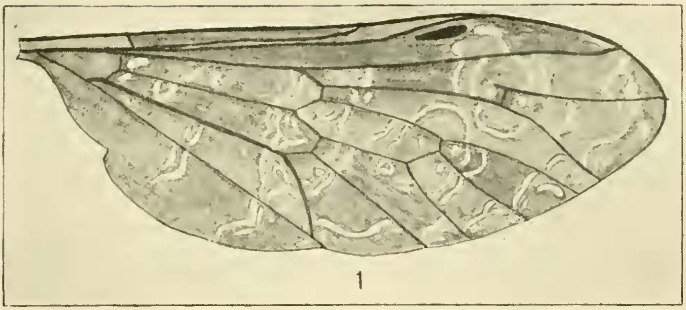
Thorax dark brown-yellow, violet-gray dusted. A median and two dorso-central somewhat ill-defined narrow yellow stripes, the median continued to tip of concolorous scutellum. Pleuræ concolorous, a yellow line along dorso- and sterno-pleural sutures, widened posteriorly over most of ptero- and hypo-pleuræ. Præscutellar present, dorso-centrals three, the anterior at about one-third from front margin of thorax, humeral and posthumerals (2) strong, præsutural weak. Meso-pleural and sterno-pleural strong, ptero-pleural wanting. Anterior supra-alar strong. Scutellum with four strong bristles, apicals parallel. All thoracic bristles black.

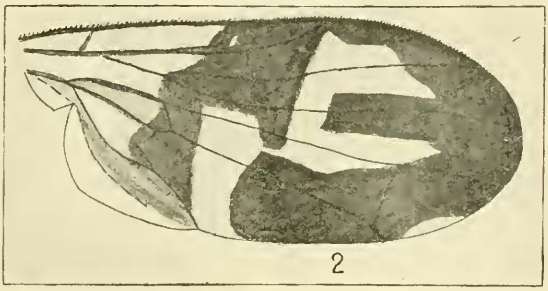
Abdomen.—Dark or pale brown, paler ventrally, black pubescent. Genitalia consist of a broad brown-yellow plate bearing apically a pair of prominent bristly black lamellæ.

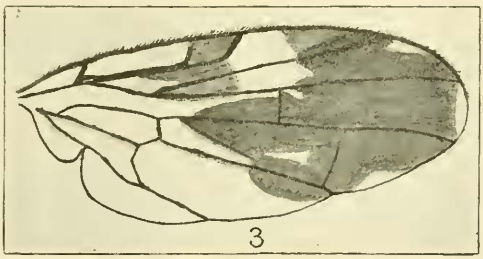
Legs.—Pale yellowish, except apical four joints of fore tarsi, which are dark. Fore femora with a number of stiff hairs above and below, posterior femora nearly bare, and with a small bristle before tip. Fore and hind tibiæ with pre-apical bristle, mid tibiæ with extensor surface bristle much nearer tip and thicker.

Wings.—Pale gray, a dark suffusion above second vein, behind which it gradually merges into ground colour of wing. Cross-veins, especially posterior, somewhat suffused. Auxiliary vein distinct throughout from first vein, which ends a little beyond it at about one-third of wing. Second, third, and fourth veins approximately parallel, third ending at wing tip. Anterior cross-vein at middle of discal cell, posterior cross-vein at less than its own length from tip of fifth vein. Anal cell as long as second posterior.

Long : $3\frac{1}{2}$ mm.







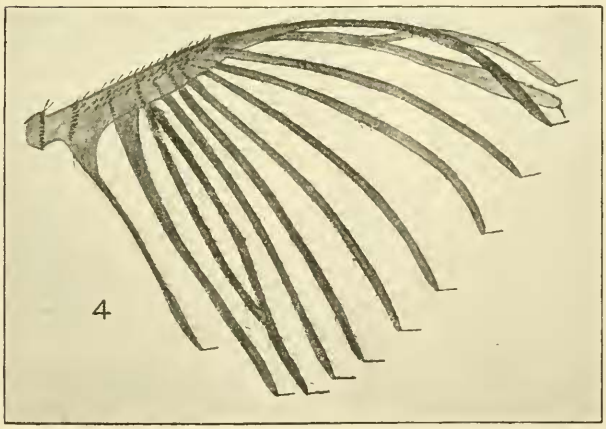


Fig. 1.—Hæmatopota rhizophoræ, wing.
Fig. 2.—Rioxa magnifica, wing.
Fig. 3.—Staurella zeylanica, wing.
Fig. 4.—Platyura talaroceroides, ♂ antennæ.

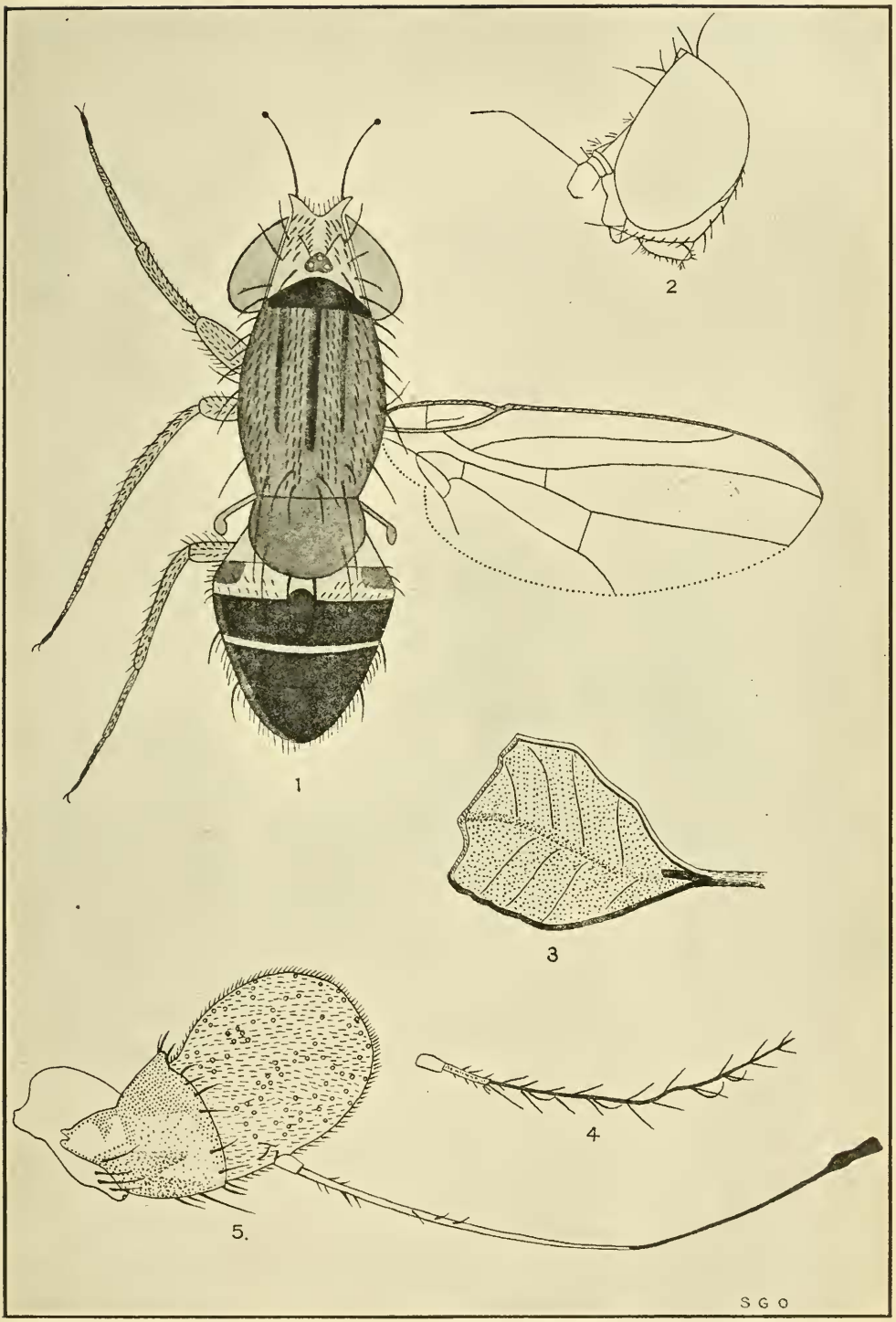


FIG. 1.—Phortica xyleboriphaga, ♂.
FIG. 2. Do. ♂ head from the side.
FIG. 3. Do. terminal process of ♂ arista (× 1000).
FIG. 4. Do. ♀ arista.
FIG. 5. Do. ♂ antenna.

Described from three males, all in perfect condition, taken on *Hibiscus rosa-sinensis* hedge on January 16 and 18 (type) and on *Lantana* scrub, February 6, 1920. Suduganga, Matale, Ceylon.

Type and other specimens in my own collection.

Mimics a Jassid in appearance and movements very closely.

This is the first species of the genus to be described from India south of the Himalaya.

NOTES ON SOME CEYLON SNAKES.

By Lieut.-Colonel F. Wall, C.M.G., C.M.Z.S., F.L.S., I.M.S.

DR. PEARSON has submitted me for examination two collections of snakes, one from Anasigalla Estate, Matugama, Kalutara District, at about 50 feet elevation above sea level, made by Mr. W. W. H. Phillips, and the other from Vavuniya, in the Northern Province, made by the District Mudaliyar.

Both collections are of unusual interest, as they were made during the months July to September, during a period when many snakes are breeding, and the fact that the collectors affixed dates to their captures makes both collections exceptionally valuable. If others would collect with similar care, a very great deal of information would soon be available regarding the diet, breeding, distribution, &c., of Ceylon snakes, about which we now know very little or nothing.

Family **TYPHLOPIDÆ.**

Typhlops braminus (Daudin).

A specimen 140 mm. (5½ inches) long was extracted from the stomach of an *Ancistrodon hypnale* from Anasigalla. The head is semi-digested, but the scale rows 20, a tail ending in a caudal spine, and the colour all agree with *braminus*.

Family **ILYSIIDÆ.**

Cylindrophis maculatus (Linné).

Five Specimens. All from Anasigalla.

Date.	Lengths in mm.	Costals.			Ventrals.	Subcaudals.	Remarks.
		Two Heads-lengths behind Head.	Midbody.	Two Heads-lengths before Vent.			
1920.							
July 19	311	19	21	19	200	4	Last ventral 3 fid.
Aug. 4	343	19	19	19	197	4	Last ventral 3-fid.
Aug. 6	330	19	21	19	196	5	Last 2 ventrals 3 fid.
Aug. 11	305	19	21	19	201	4	Last ventral 3 fid.
Aug. 11	202	19	21	19	191	5	Last ventral 3-fid.

Family **UROPELTIDÆ.**

Rhinophis oxyrhynchus (Schneider).

A very fine specimen 520 mm. (1 foot 8½ inches) long was killed at Vavuniya on August 10. The costals two heads-lengths behind the head are 19, at midbody 17, and two heads-lengths before the vent 17. Ventrals 211. Subcaudals 5 (the last 4 entire). This proved to be gravid, and contained ten eggs about 16 by 9 mm. No trace of embryos could be discovered.

Family **COLUBRIDÆ.**

Polyodontophis subpunctatus (Dumeril & Bibron).

Two specimens from Anasigalla.

A ♀ 324 mm. (12¾ inches) long killed on July 14 has 170 ventrals and 50 subcaudals. A ♀ ? 317 mm. (12½ inches) long, date uncertain, has 171 ventrals and 56 subcaudals. In both the supralabials are 10, the 8th cuneate and not reaching the margin of the lip, the 4th, 5th, and 6th touching the eye.

Nerodia piscator (Schneider).

One variety *asperrimus* from Anasigalla.

One variety *typica* from Vavuniya is uniform brown dorsally in the posterior two-thirds of the body. Anteriorly there are four series of smallish, black, rather indistinct, quincunciate spots, the outer row almost obsolescent. In both these specimens the keels are exactly alike, being absent in the last row only in the anterior part of the body, but present and rather feeble before the vent.

Amphiesma stolatus (Linné).

Two specimens from Anasigalla and one from Vavuniya. A ♀ 628 mm. (2 feet ¾ inch) long, killed at Anasigalla on August 17, is gravid and contains five eggs. Both the Anasigalla specimens have unusually large, black, well-defined, lateral, ventral spots, especially anteriorly.

Aspidura guentheri Ferguson.

Nine specimens were collected from Anasigalla, details of which are shown below :—

Date.	Sex.	Lengths in mm.	Costals.			Ventrals.	Subcaudals.	Remarks.
			Two Heads-lengths behind Head.	Midbody.	Two Heads-lengths before Vent.			
1920.								
Sept. 18	♂	140	17	17	17	105	28	Gravid. Two small eggs in abdomen.
?	♀	127	17	17	17	108	21	—
Sept. 18	♀	145	17	17	17	115	21	An earthworm in stomach. Second subcaudal divided.
Sept. 21	♀	152	17	17	17	114	21	—
Do.	♀	66	17	17	17	115	20	—
Do.	♀	69	17	17	17	114	22	—
Do.	♂	63	17	17	17	108	29	—
Do.	♂	69	17	17	17	106	25	—
Do.	♂	63	17	17	17	104	26	—

The gravid ♀ may have been killed between July and September, but the label was unfortunately detached. The last five specimens were all found together, and evidently constitute a brood just hatched or born. This is the most diminutive of all the Colubrine species known to me, being mature as shown by the gravid ♀, when only 127 mm. (5 inches) long. All the other four species of the genus are up-country snakes.

CERCASPIS CARINATUS (Kuhl).

Three specimens of this little-known snake were collected at Anasigalla, the details of which are below :—

Date.	Sex.	Length in mm.	Costals.			Ventrals.	Subcaudals.	Remarks.
			Two Heads-lengths behind Head.	Midbody.	Two Heads-lengths before Vent.			
19^{20}.								
July 15	♂	635	17	21	19	192	58	15 white indistinct bands on body.
Aug. 11	♂	349	17	19	17	193	57	17 + 6 white more or less distinct bands. A skink (*Acontias burtoni*) in stomach.
Aug. 15	♀	628	17	19	17	189	52	17 + 3 more or less distinct white bars. Gravid. Contained seven eggs about 9 by 12 mm.

DRYOCALAMUS NYMPHA (Daudin).

One very nice little specimen was obtained at Vavuniya 298 mm. ($11\frac{3}{4}$ inches) long on August 10. The ventrals are 210, subcaudals 78, and the costals 13 in the whole body length. There are 22 whitish bands on the body, and 18 on the tail. The anterior bands have brown spots arranged transversely, and the posterior are divided into pairs by irregular, transverse, brown cross bands.

ZAOCYS MUCOSUS (Linné).

A juvenile specimen from Anasigalla.

COLUBER HELENA Daudin.

One small specimen from Anasigalla 355 mm. (14 inches) long killed on October 17.

DENDROPHIS BIFRENALIS Boulenger.

A fine ♀ 920 mm. (3 feet and $\frac{1}{4}$ inch) long was killed at Vavuniya on August 10. The ventrals are 162, and

subcaudals 146. The stomach contained a much-digested, large, tree frog with dilated toes (*Rhacophorus* spec ?).

Dendrelaphis tristis (Daudin).

A single ♂ specimen from Anasigalla 983 mm. (3 feet 2½ inches) long was killed on September 18. Ventrals 165. Subcaudals 120. It contained a much-digested skink (? *Acontias*) in the stomach. As in all the other Ceylon specimens I have seen, there is a conspicuous yellow vertebral stripe for a limited extent anteriorly.

Oligodon arnensis (Shaw).

A juvenile specimen 209 mm. (8¼ inches) long is from Anasigalla, killed on July 13. The ventrals are 164, and subcaudals 50. It has 13 blackish bars on the body, and 6 on the tail.

Oligodon templetoni Günther.

A good ♂ specimen of this uncommon snake is from Anasigalla. It was killed on September 16, and measures 209 mm. (8¼ inches). The ventrals are 128, and the subcaudals 33.

Oligodon sublineatus Dumeril & Bibron.

The first four referred to below were obtained at Anasigalla, and the two last from Vavuniya :—

Date.	Sex.	Length in mm.	Costals.			Ventrals.	Subcaudals.	Remarks.
			Two Heads-lengths behind Head.	Midbody.	Two Heads lengths before Vent.			
1920.								
Aug. 15	♂	241	15	15	15	136	34	—
Aug. 23	♀	234	15	15	15	149	30	—
Aug. 23	♀	266	15	15	15	148	32	Contained two soft-shelled eggs in the stomach (anguine or lacertine) 17 mm. long.
Sept. 21	♂♀	228	15	15	15–13	136	37	—
Aug. 10	♂♀	238	15	15	15	137	35	—
?	♂♀	241	17	15	15	144	26	—

Dryophis mycterizans (Linné).

Two from Anasigalla :—

Date.	Sex.	Length in mm.	Costals. Two Heads-length behind Head.	Costals. Midbody.	Costals. Two Heads-lengths before Vent.	Ventrals.	Subcaudals.	Remarks.
1920.								
July 18	♂	857	15	15	13	179	165	—
July 13	♀	1054	15	15	13	178	125	Tail deficient. Gravid. Contained two sacs 35 mm. long.
Do.	♀	298	15	15	13	184	151	Fœtus of above folded nine times.
Do.	♂	324	15	15	11	179	171	Fœtus of above folded ten times. Genitalia not exserted.

Dryophis pulverulentus (Dumeril & Bibron).

One ♂ specimen from Anasigalla killed on September 23 is 1.007 mm. (3 feet 11½ inches) long. Ventrals 187. Subcaudals 182. A lizard (*Calotes* spec ?) in stomach.

Chrysopelea ornata (Shaw).

A ♂ specimen from Vavuniya killed on August 10 measures (tail slightly deficient) 755 mm. (2 feet 5¾ inches). Ventrals 206. Subcaudals 113 ? Unlike every other specimen of this species I have seen the last ventral is not bifid.

This constitutes a colour variety quite new to me. The ground colour dorsally is olive-brown. The body is crossed by black zig-zag bars narrowing in the flanks, and most conspicuous in the anterior part of the body. Ventrally yellowish-gray, most ventrals with a black spot in the suture just outside the keel. Head with the usual double crossbars.

Bungarus ceylonicus Günther.

Seven specimens, all from Anasigalla :—

Date.	Sex.	Length in mm.	Costals.			Ventrals.	Subcaudals.	Remarks.
			Two Heads-lengths behind Head.	Midbody.	Two Heads-lengths before Vent.			
1920.								
Aug. 2	♂	489	15	15	15	222	39	19 + 5 white bands.
Aug. 3	♂	666	15	15	15	222	36	20 + 4 white bands.
Aug. 3	♂?	432	15	15	15	224	34	16 + 4 white bands. A snake (*Aspidura guentheri*) in stomach.
Aug. 6	♂?	482	15	15	15	224	34	17 + 3 white bands. A snake (*Aspidura guentheri*) in stomach.
Aug. 6	♂	495	15	15	15	226	35	18 + 3 white bands.
Aug. 9	♀?	425	15	15	15	230	36	18 + 4 white bands. A skink (*Acontias burtoni*) in stomach.
Sept. 16	♂	445	15	15	15	227	36	18 + 3 white bands. A snake (*Aspidura guentheri*) in stomach.

Naia tripudians Merrem.

A single specimen from Anasigalla killed on September 22 measures 523 mm. (1 foot $8\frac{5}{8}$ inches). This is a very distinct variety new to me. Dorsally it is brown, finely but distinctly mottled with darker tones, with a tendency to form transverse barring. Ventrally pale brown with 19 well-defined black bars before the vent, the most anterior beneath the hood involving 5 ventrals, the succeeding bars involving fewer ventrals till only one is involved posteriorly. A binocellus on the hood. Head sutures blackish.

Family **VIPERIDÆ.**

Ancistrodon hypnale (Merrem).

Eight specimens, the first six detailed below from Anasigalla, the last two from Vavuniya :—

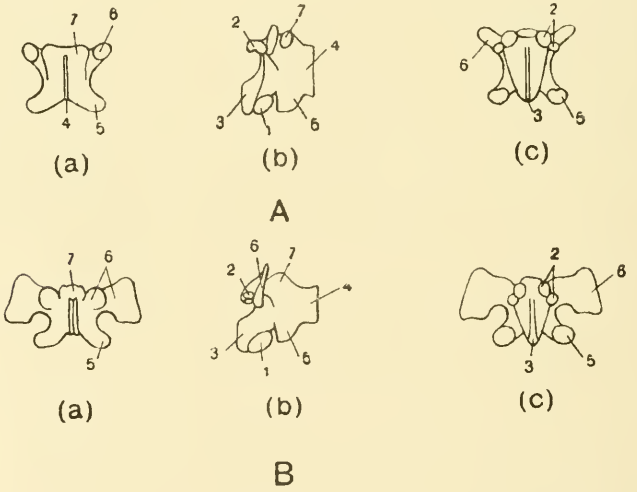
Date.	Sex.	Length in mm.	Costals.			Ventrals.	Subcaudals.	Remarks.
			Two Heads-lengths behind Head.	Midbody.	Two Heads-lengths before Vent.			
1920.								
July 13	?	292	17	17	17	146	?	A snake (*Typhlops braminus*) in a convoluted mass in stomach.
July 19	♂	356	17	17	17	151	45	—
July 20	♀	311	17	17	17	145	36	—
Aug. 3	♂	305	17	17	17	153	41	—
Aug. 7	♀	400	17	17	17	149	37	—
Aug. 9	♂	361	17	17	17	151	47	—
Aug. 10	♂	?	17	17	17	147	41	—
Aug. 10	♂	345	17	17	17	152	40	—

The lepidosis in all these agrees in the following respects. There is a small boss on the snout involving from 3 to 5 scales. The supraoculars are as long as the parietals, and distinctly broader than the frontal. The second supralabial does not enter the loreal pit.

In addition to the above snakes, two specimens of the anguine, tridactyle lizard *Acontias burtoni*, were included in the collection from Anasigalla.

NOTES.

Notes on the vertebræ of Cercaspis carinatus vel Lycodon carinatus (Kuhl).—For many years I have had a firm conviction that the snake now known as *Lycodon carinatus* should not be placed in that genus. My view was based, however, on lepidosis alone, and until quite recently I have not been able to acquire a specimen that I could study osteologically. Thanks to Mr. Drummond-Hay, who gave me a very large example recently, I have been able to add cranial and vertebral specimens to my cabinet collection. The skull, including dentition, is so extremely like that of *Lycodon aulicus*, that one readily grasps the justification for its inclusion in the genus *Lycodon*, but the vertebræ of the two species are so remarkably different that I have no hesitation in placing *carinatus* in a genus of its own, thus supporting the views of Kuhl, Dumeril and Bibron, Gunther, and Jan. Dumeril and Bibron's name is retained to denote the genus.



A. *Lycodon aulicus.* B. *Cercaspis carinatus.*

(*a*) Dorsal aspect ; (*b*) lateral aspect ; (*c*) ventral aspect.

(1) Condyle for articulation with vertebra behind ; (2) condyles for articulation with rib ; (3) hypapophysis ; (4) neural spine ; (5) postzygapophysis ; (6) prozygapophysis ; (7) zygosphene articulating with the zygantrum of the vertebra in front.

It will be seen from the attached figures that the prozygapophyses are very remarkably developed, expanding terminally into large laminæ, a condition I have only seen in one other genus of the Family Colubridæ, viz., *Bungarus*. These laminæ are oblique, so that the anterior edge overlaps the posterior edge of the lamina of the preceding vertebra. The neural spine is slightly bifid, each lateral plate being everted so as to leave a shallow groove between.

Bangalore, July 20, 1920. F. WALL.

Notes on some Ceylon Snakes recently acquired by the Colombo Museum.—Among a collection of Ceylon snakes recently submitted to me for identification by Dr. Pearson, I find the following that are worthy of note :—

Rhinophis trevelyanus ? (*Kelaart*).—A specimen of this genus that I feel much tempted to pronounce a new species was obtained at Mullaittivu in the low-country of the Northern Province in April this year. It does not accord with any species in Mr. Boulenger's Catalogue (Vol. I., 1890), and it is noteworthy that all the Ceylon representatives cited in the work referred to are up-country snakes known from the Central Province. The fact that there is only a single specimen upon which to base an opinion deters me from describing this as new, and I therefore refer it provisionally to *trevelyanus*, to which it appears to me most closely related. It is a male specimen 248 mm. in length. The costals are in 19 rows anteriorly and 17 in midbody and posteriorly. The ventrals number 205, and the subcaudals 8 (paired). The rostral is acutely-pointed, obtusely-keeled above, and measures just half the shielded part of the head. The frontal is as long as broad, and its length equals that of the parietals. The eye is less than half, but more than one-third the horizontal diameter of the ocular. The supralabials number four. The caudal shield is about three-fourths the length of the shielded part of the head. In colour it is blackish, with the margins of the scales whitish, those on the ventral aspect being more

broadly margined than those on the dorsal aspect. There is an irregular white patch before the anal shield. The rostral is reddish.

Polyodontophis subpunctatus (*D. & B.*).—One female specimen 413 mm. in length from Niroodamunai (Eastern Province) killed in January, 1920, proved to be gravid, and contained six eggs measuring 18 by 9 mm. with no trace of embryo. The loreal is confluent with the præfrontal on both sides. The ventrals number 178 and the subcaudals 58.

Dendrophis bifrenalis Boulenger.—One adult from Mullaittivu (Northern Province). The anterior loreal is confluent with the posterior nasal on the left side, but normal on the right. Ventrals 166, and subcaudals 153.

Oligodon subgrisens D. & B.—One from Mullaittivu variety *typica*. The ventrals are 175, and subcaudals 44.

Dipsadomorphus forsteni (*D. & B.*).—One juvenile specimen measuring 502 mm. was killed at Mullaittivu in April this year. Ventrals 261. Subcaudals 113. Costals in 27 rows in midbody.

Dipsadomorphus beddomi Wall.—A juvenile specimen from Mullaittivu. The costals are in 19 rows in midbody. Ventrals 258 (?). Subcaudals 92 (?). Tail slightly deficient.

Hydrus platurus (*Linné*).—An adult from the pearl banks. It is peculiar in that it is pale yellow ventrally, and has a series of grayish rhombs dorsally. The anterior rhombs are confluent, and the posterior discrete.

Enhydris curtus (*Shaw*).—Two adult specimens from the pearl banks. The female measuring 635 mm. was killed in February this year, and proves to be gravid. It contained four eggs 32 by 13 mm., with no trace of embryo.

Ancistrodon hypnale (*Merrem*).—Two from Mullaittivu (Northern Province). Ventrals 152 and 142 (?). Subcaudals 40 and 42.

Bangalore. June 22, 1920. F. WALL.

Occurrence of Hypolais caligata (*The Booted Tree Warbler in Ceylon*).—A few months ago, while examining the duplicate skins of the Warblers in the Colombo Museum collection, I came across two birds labelled *Phylloscopus nitidus*, which had

evidently been wrongly classified. They appeared to be some species of *Hypolais*. I sent them home to Mr. E. C. Stuart Baker, who has kindly authenticated them as *Hypolais caligata*. This species breeds in Turkestan and Southern Siberia, wintering in Northern and Central India, and seldom penetrating to the very south of the peninsula. No member of the genus has hitherto been recorded from Ceylon. Both specimens were, I believe, obtained by the Museum collector in the Mannar District on the same day: February 15, 1905, one near Mannar and one at Murungan, 14 miles south-east of that town. From the distance apart of the two localities it would seem as if there had been a small invasion of this species at that time.

August 23, 1920. W. E. WAIT.

Preliminary Note on some Fossiliferous Beds in Ceylon.—It has long been known that fossil shells occur in the Jaffna peninsula and neighbouring parts of Ceylon; but, until quite recently, no serious attempt was made to determine the age of the beds and to correlate them with any similar beds which may occur in India and elsewhere.

On various occasions during the last two years of research in the Island (1914–1916), as Assistant Mineral Surveyor, the writer had occasion to study these, and other sedimentary beds, discovered during that time, and to make a collection of fossils, which Dr. Arthur Morley Davies, Palæontologist at the Imperial College of Science and Technology, has kindly undertaken to describe. Dr. Davies' army work arising out of the great war has prevented him, until quite recently, from paying as much attention to his palæontological labours as he could have wished; thus, the description of the Ceylon fossils is of necessity belated. Enough has been done, however, to justify certain general conclusions. These will be set down below.

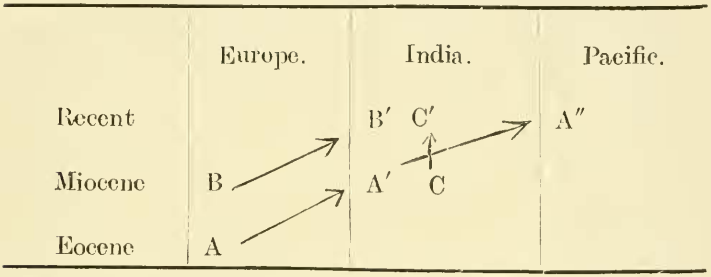
Apart from the generally known occurrences of fossiliferous beds in Jaffna and Kalpentyn, others of similar age were discovered in the interior of the Puttalam District and along

the south-eastern shore of the Southern Province at Minihagalkanda ; while another totally distinct and older set of sedimentary rocks was investigated in the neighbourhood of Tabbowa (North-Western Province). The rocks of the first group form a series of little disturbed lime stones and sandy beds of marine origin containing molluscan shells, echinoderm tests, corals and foraminifera, &c., while those of the latter are fresh-water sandstones, grits, and pipe clays containing fossil plants. These beds have been much affected by earth movements.

The general resemblance of some of the molluscan types to those of the Paris basin suggested a possible Eocene age for the Ceylon beds, while the entire absence of typical mesozoic forms, the general assemblage of genera present, and the main lines of the geology in general, pointed unmistakably to the conclusion that the limestones and associated sediments were not older than Eocene. In the absence of palæontological literature of value for comparative purposes, it was impossible to determine anything more than some of the genera present ; thus, while it was apparent that the beds were to be placed somewhere in the Kainozoic (Tertiary) group, nothing could be said with confidence of their exact position within it ; but the writer was inclined to regard them as Eocene. Dr. Davies' researches have shown this assumption to be incorrect ; for he says in a letter to the writer : "I have been able to make more exact determinations of some of the species. The similar fossils described by Sowerby over eighty years ago, and by Archiac and Haime over sixty, are in the Natural History Museum, and I have been able to compare yours with them. Altogether a great many interesting points will be raised. There can be no question about the Miocene age."

It is interesting to note in this connection that while the fossil faunas of the three districts represented (Jaffna, Puttalam, and Minihagalkanda) are practically contemporaneous, only one species in the collections is common to all, and only two well-defined species are common to any pair. It is further to be remarked, as Dr. Davies points out, that inasmuch as some of the Ceylon fossils are related to Paris Eocene forms, the general assemblage seems to bear out Dr. Noethling's

conclusion (drawn from a study of the Burma Miocene), that there has been an easterly migration of molluscan forms in tertiary times. He puts it diagrammatically thus :—



With regard to the fossil plants of the Tabbowa beds, we may count ourselves very fortunate, in that Professor Seward, of Cambridge, has kindly consented to deal with them. His pronouncements will be awaited with interest. The writer's tentative opinion was that the Tabbowa plants belonged to the Glossopteris or some other closely related flora. If this view proves correct, it must follow that the beds containing them owe their origin to the destruction of part of the lost continent (Gondwanaland), which, according to Süess and his followers, extended from Brazil on the west to Australia on the east, and included parts of Africa and India.

May 26, 1920. E. J. WAYLAND.

Notes on the Natural History of the Tic-Polonga.—While occupying the post of Superintendent of an estate at Ambalangoda, a cooly brought me a tic-polonga, whose head had been crushed by blows from a stick.

The snake, its mouth full of blood and eyes protruding from their sockets, showed no signs of life. It was a fine specimen, 3 feet long. Knowing the vitality of these reptiles, I placed it in a cage to see if the snake would survive its injuries.

For some days the tic-polonga showed no signs of life, though there was no smell of putrefaction, a sure sign that death had not occurred. Notwithstanding this, I had to wait three or four weeks before I could detect definite signs

of life in my prisoner. After this the moribund snake quickly recovered and very soon resumed its old habits, devouring with pleasure rats and squirrels, its two favourite dishes.

In January, 1912, anticipating a move, I sent my wonderful friend to the Colombo Museum, asking the Director to look after it. He consented, and the tic-polonga became a pensioner of the State, and was exhibited to the public in the Museum Gardens.

In December of that year the Director, Dr. Pearson, sent the snake to a Russian lady naturalist (a friend of mine), who had expressed a desire to study reptiles. The box bearing the marks "Caution, poisonous snake" arrived while this lady was away on a visit up-country. It was, therefore, decided not to open the box until her return, and in consequence the unfortunate prisoner spent a miserable two months without food or drink. In the end my friend gave up the idea of reptile study, and the box containing the tic-polonga was returned unopened to my residence at Talgaswella.

Having had a cage made, I proceeded with all necessary caution to take off the lid of the box in which the snake was sent to me and to empty the contents into the cage. Imagine my astonishment on seeing, instead of a half dead snake, one full of life disporting itself in its prison.

I immediately decided to feed it. A squirrel which I had just shot was swallowed in a flash. I saw the jaws of the snake open, and the squirrel, seized by the head, disappeared bit by bit. Afterwards the snake had a drink of water. This happened on February 23, and on the 24th a second squirrel was given and consumed in the same way, a third on the 25th, a fourth on the 26th, and a fifth on the 27th. It was only when the sixth one was given to the reptile on the 28th that its appetite seemed to be satisfied, and it then appeared to be filled to repletion.

These observations, it will be seen, are of more than ordinary interest. First, in recording the unexpected revival and recovery of the snake after having sustained such serious injuries to its head that the reptile showed no signs of life for several days; and further, in proving that the tic-polonga is

able to maintain its health after a fast of two months. Finally, it is worthy of note that the snake has such an extraordinary capacity for food after a long fast.

The snake lived for several years after the above incidents, but it has now been killed.

Talgaswella, June 30, 1920. E. NICOLLIER.

Disappearance of Butterflies from certain Localities.—The disappearance is mainly due to three causes : (1) Disease ; (2) parasites ; and (3) extinction of the food plant. Of these, the first two are usually only temporary in their effect, while the third is generally permanent.

In my notes on butterflies published in the last issue of the "Spolia," Mr. Mackwood writes that *Callosune limbata* was "particularly abundant in Fort Frederick, Trincomalee." Colonel Manders also gave this locality in his notes. I have only visited Fort Frederick in October, November, and December (1917 and 1918), so may have missed the best season, but I have never seen a single specimen of this insect there. A few years ago a few spotted deer were loosed in the Fort, and there is now a big herd there. Can the disappearance of *C. limbata* be due to the destruction of the food plants by the deer ?

In my notes I mention that the activities of the Forest Department have caused the disappearance of *R. benjamini* from the jungle above Haputale. *Lethe daretis* has also disappeared from this jungle from the same cause.

Surendra discalis was formerly very plentiful at Haldummulla, but its food plant, *Acacia cæsia*, has become almost extinct, and the butterfly is now very rare. I believe the Acacia was killed out by Lantana.

Appiæ taprobana was common at Galle in 1918, especially round its food plant, *Crotæra roxburghi*, but I have not seen a single specimen in 1919. In this case I believe the disappearance was due to parasites, but I have no direct evidence.

W. ORMISTON.

PROCEEDINGS OF THE CEYLON NATURAL HISTORY SOCIETY.

Thirtieth General Meeting

The Thirtieth General Meeting of the Society was held in the Colombo Museum Library on Friday, May 7, 1920, at 5.30 P.M., Dr. A. Nell in the Chair.

A lecture entitled "The Work of a Local Natural History Society" was given by Mr. W. L. Sclater, F.Z.S., the Editor of the "Ibis."

Eighth Annual General Meeting.

The Eighth Annual General Meeting of the Society was held in the Colombo Museum Library on July 16, 1920, at 5.30 P.M., Dr. A. Nell, Vice-President, in the Chair.

The accounts and reports of the Honorary Secretaries and Treasurers for 1919 were read and confirmed.

The following office-bearers were elected for the ensuing year:—

Patron: His Excellency the Governor.

President: Sir Graeme Thomson.

Vice-Presidents.

F. M. Mackwood, Esq.
Dr. A. Nell.
Dr. Joseph Pearson.
W. E. Wait, Esq.

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The Ven. the Archdeacon of Colombo.
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E. Evans, Esq.
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C. T. Symons, Esq.
F. Lewis, Esq.

Joint Honorary Secretaries and Treasurers.

Dr. Joseph Pearson and Mr. C. T. Symons (Acting).

New Members:—Messrs. R. Somasundaram, E. van Rooyen, S. T. Jeevaratnam, C. T. Chelliah, C. M. Mohamed, G. Amaratunga, R. Caldera, G. Jayawardene, M. A. Paul, W. M. Ramasamy, H. J. Fernando, S. P. Selvadurai, G. M. Direkze, Mr. and Mrs. G. P. Madden, and Mr. G. K. Pippet.

Rev. Father Le Goc, O.M.I., gave a lecture on "Plants on the Seashore."

Some exhibits were explained by Dr. Pearson.

Thirty-Second General Meeting.

The Thirty-second General Meeting of the Society was held in the Colombo Museum Library on October 14, 1920, at 5.15 P.M., Dr. A. Nell in the Chair.

New Members:—Messrs. A. H. Malpas and A. J. Wickwar.

A paper on "Notes on a Collection of some Wayside Plants made in Nuwara Eliya" was given by Mr. E. C. T. Holsinger.

Dr. Pearson read a note sent by Dr. Hutson of Peradeniya on Glow-worms attacking the "Kalutara Snail" (*Achatina fulica*).

Dr. Pearson explained a number of interesting exhibits.

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THE COLOMBO MUSEUM,

CEYLON.

EDITED BY

JOSEPH PEARSON, D.Sc., F.R.S.E., F.L.S.,

Director of the Colombo Museum
and Marine Biologist to the Ceylon Government;

ASSISTED BY

C. T. SYMONS, B.A., F.R.G.S.,

Assistant Government Analyst,
Joint Honorary Secretary, Ceylon Natural History Society;

AND

W. A. CAVE,

Joint Honorary Secretary, Ceylon Natural History Society.

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