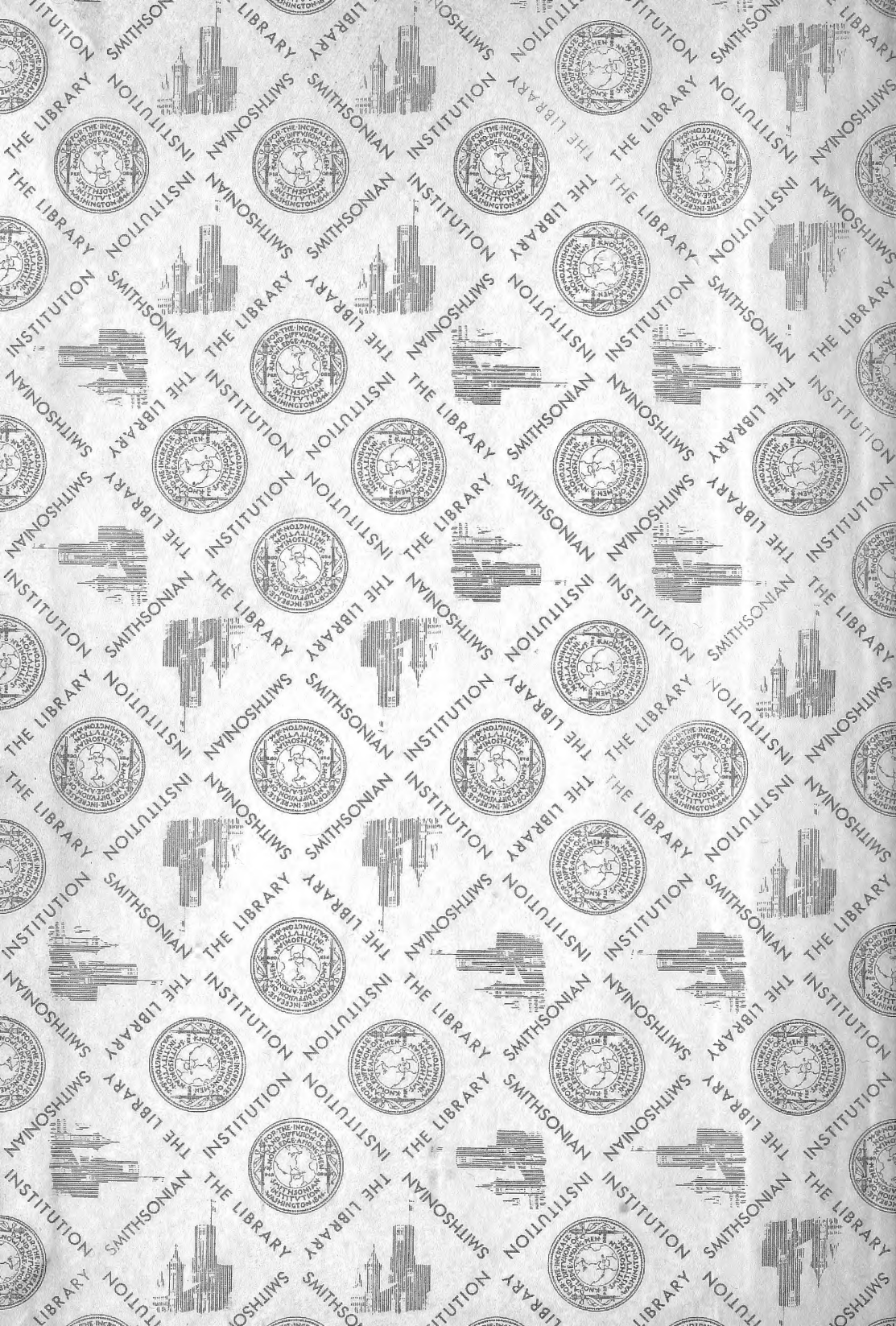
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THE ORANGE-BELLIED CHLOROPSIS, (GREEN BULBUL.)

(Chloropsis hardwickii.)

MALE & FEMALE.

S. C. S. Baker del.

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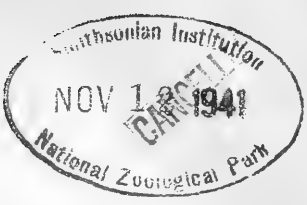

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THE BULBULS OF NORTH CACHAR.

By E. C. Stuart-Baker.

Part V.

(*With a Plate.*)

(*Read before the Bombay Natural History Society on 19th April, 1893).*

Hemixus maclellandi.

The Rufous-breasted Bulbul.

Oates' "B. of B. B." No. 72, Vol. I., p. 171; *Hypsipetes maclellandi*, Jerdon's "B. of India," No. 447, Vol. II., p. 79; Hume; "Nests and Eggs," (2nd Ed.), Vol. I., p. 168; Oates' "Fauna of India," Vol. I., p. 275.

Description.—Forehead, crown and back of head bright vandyke-brown, the shafts being pale reddish-white give the head a streaky appearance. Remainder of upper plumage, including wing-coverts and tertiaries, olive-green; brightest and sometimes inclining to yellow on the upper tail-coverts; primaries and secondaries brown edged with olive-green; tail bright olive-green; lores and cheeks grey, or grey and white; ear-coverts, sides of neck, breast and

flanks chestnut ; belly albescent, more or less suffused with rufous ; chin and upper throat white ; under tail-coverts flavescent-rufous. Bill, upper mandible dark blue-grey, culmen, tip and base of lower mandible dusky, remainder fleshy-white ; legs dull yellowish to purplish-brown ; irides of various shades of reds and red-browns.

Male—Length 9·5″ ; wing 4·4″ ; tail 4·4″ ; tarsus ·75″ ; bill at front ·8″, and from gape 1·2″.

Female—Length barely 9″ ; both wing and tail as nearly as possible 4·2″, the wing sometimes as much as 4·25″ or even more.

NIDIFICATION.—I have taken a considerable number of nests of this species, all of which were of almost exactly the same description. They are placed in trees at heights varying from twenty to forty feet, more often nearer the former than the latter, and in every instance the nest has been suspended from a fork of a small branch. It is suspended much in the same manner as an Oriole's, and not like that of *Hypsipetes* and other bulbuls. The main portion of the nest is made of coarse grasses, bamboo leaves, soft bark in long shreds, and of other suitable fibrous materials. Moss is never used, moss roots and fern roots very seldom, except in the lining, which is sometimes composed of the latter.

The grass is so used as to pass under and through the base of the nest, and is then brought inside and over the fork, round the nest again and over the fork on the opposite side. This is carried out with all, or nearly all, the longer materials, so that the nest assumes a rather bulky and, often, very untidy appearance. It is, though, very strong, and it requires no inconsiderable force to detach it from its support.

The lining is generally composed of rather fine grasses, more or less mixed with fine, *soft* fern roots. In some nests it is composed almost entirely of the last material, and in a few there is little or no lining of any sort whatsoever.

They are rather shallow, as a rule, but differ considerably in this respect. I have taken nests of depths ranging from 1·2″ only to over 2·9″. In breadth they vary from 3·2″ to very nearly 5″.

The branch selected as a site for the nest is generally one towards the outer part of the tree, and it is, therefore, often very difficult to obtain without cutting off a large portion of the branch.

The normal number of the eggs is three, four is quite exceptional, and two very common.

The ground-colour is a very pale reddish-white or dead-white, and they are spotted profusely throughout with dark brownish-red. Underlying these marks are numerous tiny specks of pale inky, which, however, are not noticeable until the egg is very closely looked into.

In a few eggs the general tone is rather brighter, and in these there is also more of the ground-colour to be seen, but the typical egg is decidedly dull-coloured.

Towards the large end the markings generally tend to form a cap or, less often, a zone.

In shape they are typically a rather long regular oval; in a few eggs a little compressed towards the small end. Abnormal specimens tend towards the short broad oval or broad peg-top form.

The shell is smooth and fairly close in texture, but none of my eggs exhibit any gloss.

In size they vary more than any other bulbuls' eggs that I know. I have them varying in length from ·74″ to 1·1″ and in breadth from ·58″ to ·71″. The average size of 19 eggs is ·91″ × ·66″, or rather more both ways.

They are rather late breeders. June is the month in which most eggs will be taken, and nearly as many in July. My earliest and latest dates are the 23rd May, 1890, and 22nd July, 1888, respectively. They, no doubt, lay well on into August, but I have never been in their principal breeding haunts during that month.

I have only once or twice observed this bulbul as low as 2,000 feet, even in the cold weather, but it does sometimes descend into the Plains.

They are most common between three thousand and four thousand feet, breeding chiefly at and above the latter height up to nearly 7,000 feet. I have not personally observed it in flocks; and from the little that has been recorded of its habits, it does not appear to be sociable during the cold weather as are most bulbuls.

They keep much to the higher branches of tall trees, but do not hesitate to descend lower, even to scrubby bushes when these are rendered attractive by the plentitude of their berries. I have examined a good many birds, but have never discovered any remains of insects, and I believe they are *almost* entirely, if not quite, vegetable feeders.

It has a very pleasant call, and its many other and diversified notes are all, more or less, agreeable, none that I have heard being at all harsh in character. It has also a full sweet song, consisting of three bars, which it constantly repeats, but I have only heard this uttered during the breeding season. When singing, it erects its crest, the feathers of which, though short, are full. The lanceolate feathers of the chin and throat are often also puffed out, giving the bird the appearance of having a most disproportionately large head.

It is not a shy bird, and I have frequently watched either a single bird or a pair within less than twenty yards. They have not been at all disturbed by my

appearance on such occasions, but continued to feed until I tried to approach still nearer, when they would fly away for a short distance and recommence feeding.

The flight is rather quicker and straighter than most bulbuls', but not as strong as, though more level than, that of *Hypsipetes*.

It is nowhere very common, and is rather local in its habits. I have noticed that where *Psarisomus* is to be found, there are nearly always a few of these birds also. This species, however, keeps to the outskirts of the forest, and will not be found in the interior. Its favourite resort is scattered trees, with an undergrowth of grass (not bush). I have also seen it in thin scrub jungle, in cultivation *jhums*, and very often amongst the jungle of nullas which are surrounded by open country.

Micropus melanocephalus.

The Black-headed Bulbul.

Brachypodius melanocephalus, Hume's Cat. No. 457 *bis*.; Hume and Davison, S. F., Vol. VI., p. 318 ; *Micropus melanocephalus*, Oates, "B. of B. B.," Vol. I., p. 181 ; *id.*, "Fauna of B. I. Birds," Vol. I., p. 294.

Description.—Whole head and throat, extending to the upper breast, black, brilliantly glossed with blue and purple ; remainder of upper plumage olive-green, brighter on the rump and yellow on the upper tail-coverts ; breast and flanks the same, shading into bright yellow on the belly and under tail-coverts. Tail olive-green for half its length, then black and tipped yellow, narrowly on the centre feathers and increasingly broadly on the others.

Primary-coverts dull black, very narrowly edged olive-green ; other coverts wholly olive on the visible portions. Primaries and secondaries black, the first almost imperceptibly, the latter broadly-edged olive-green; the tertiaries, with the outer webs, all of this colour.

The feathers of the rump and upper tail-coverts are very dark grey at the base and then black, the tips alone being broadly yellow, consequently the rump nearly always looks as if barred with black, though, in a perfect specimen, in which the rump feathers lie properly, these black markings scarcely show at all. Bill very dark plumbeous, nearly black ; irides pale blue, varying a little in depth of colour, but never at all dark ; legs dark plumbeous, claws black, mouth and gape bluish, tinged fleshy occasionally.

Length 6·8″ to 7·1″; wing 3·2″ to 3·35″; tail 3·3″; tarsus ·5″; bill at front ·55″ and from gape ·8″.

Nidification.—I have taken but one nest of this bird, and on this the male bird was trapped. The nest might easily have been mistaken for one of the

common Bengal bulbul (*Molpastes bengalensis*). It was a good deal stouter, however, than 8 out of 10 of the nests of that bird, and was also more neatly and compactly made. Outwardly it was made of the tough brown stems of a climbing plant, together with a few fine soft twigs, and one or two coarse pieces of grass blades; inside these was a scanty, but neat, lining of fine grass-stems and a single skeleton leaf. It was placed in the fork of a stout branch of a thorny bush, some three feet from the ground. The surrounding country was dense jungle, merely a little lighter and clearer in the immediate vicinity. Heavy rain had fallen on the two days previous to my finding the nest, and when taken, it was sopped through and through, but it still, when removed, held well together, and was just as strong and compact as before when it again dried.

The eggs were three in number, slightly incubated, and they, like the nest, may also be matched by many eggs of either *M. bengalensis* or *burmanicus*. The ground-colour is a pale fleshy-pink, and the markings consist of large and small blotches and freckles of reddish and purplish-brown, the underlying marks being a pale dull inky. Some of the primary blotches are very large varying from ·1″ to nearly ·3″ in length and up to ·17″ in breadth.

The distribution of both blotches and freckles is fairly equal, and in two eggs very numerous over the whole surface. In the third egg the marks are fewer in number, with the exception of the very pale secondary blotches. The texture is just the same as in the eggs of *Molpastes*, but there is a very faint gloss.

They measure ·97″ × ·65″, ·96″ × ·60″ and ·93″ × ·64″. In shape they are long ovals, rather compressed towards the smaller end and slightly pointed.

The nest was taken on the 12th of May, 1891, at an elevation of about 1,600 feet.

This bird is by no means rare in North Cachar, but I think it must be partially migratory in its habits, for some years it is quite plentiful, and during others hardly a single bird can be obtained.

During the cold weather, and well on into May, it is found in large flocks in company with the next species (if it is a good species), keeping, as a rule, to scattered forest or light jungle of some kind, rarely being found in quite open country, and very nearly as seldom in heavy forest. It appears to be most common in valleys which are well wooded, but at the same time have frequent open spaces at no great distance from one another, and the Jatinga Valley and the low hills surrounding the Tea Estates to the North-West of Cachar seem to be their most favourite haunts. It never, during the cold weather, seems to descend to low bushes, keeping almost entirely to the higher trees and to the

tops of even such. Now and then, tempted by some unusually luxuriant growth of fruit or berries, it may descend to the higher bushes ; but, generally, they seem to withstand temptation, and I have seldom seen them lower down than the tops of small saplings. The very few birds I have come across during the breeding season alter their habits greatly, and I have most often seen them in thick bushes or undergrowth, sometimes in the interior of dense forest, more seldom just on the outskirts of it. At this period, too, they become very silent, though at other times their loud and musical chirp is constantly being uttered. The "melancholy double whistle," mentioned by Davison as being one of their notes, I do not think I have heard, but I once, during a rainy afternoon in March, 1892, heard some bird giving vent to his sadness in a long, soft whistle, suddenly terminating in a lower key, and this note may have been that of either *M. melanocephalus* or *M. cinereiventris*. It was more like the rainy weather call of *Ægithina typhia* than that of any other bird I know, but it was far deeper and softer.

The bird appears to be almost entirely a fruit-eater, but that it is not altogether so was proved by my finding two wood-lice in the stomach of one and the remains of a small green grasshopper in another. White ants, of course, these birds eat, but I know of no fruit or grain-eating bird that will not readily, even greedily, eat those insects.

I have never come across this bird above 2,600 feet (about), but in Burma it seems to ascend far higher.

Two of the birds of this species in my collection, as also two of the next, I owe to Mr. H. A. Hole, of Jellalpur, and the notes he has sent me about the birds agree with my own experiences.

Microprus cinereiventris.

The Grey-breasted Bulbul.

Brachypodius cinereiventris, Hume's Cat. No. 457 ; *quat.;* Hume and Davison, S. F., Vol. VII, p. 319 ; *Micropus cinereiventris*, Oates' "B. of B. B.," Vol. I., p. 295 ; *id.*, "Fauna of B. I. Birds," Vol. I., p. 295.

Description.—Breast and flanks pure grey, darker nearest the head and paler lower, where it gradually merges into the yellow of the belly and vent. In some birds the grey extends over a great part of the abdomen, in others only over the upper portion. The interscapulary plumage generally, and the hind neck always, the same colour as the upper breast.

I can discover no other difference between this bird and the last. The margins to the primaries seem to me to be much the same in both birds. I know nothing in its habits, &c., to distinguish it from *M. melanocephalus*. In 1891 I also took a nest containing three young which, unfortunately, were merely naked squabs when found, and all died within two days, in spite of the most anxious care being bestowed on them. The female which I trapped on the nest was alone caught, and the male bird I never saw, so that I could not say whether it was of this or the last species.

I have spent a good deal of time and trouble in trying to find evidence to prove either that *M. melanocephalus* and *M. cinereiventris* are one and the same bird or that they are distinct.

In the first place, neither Mr. Hole nor I have ever seen a *flock* of either kind unmixed with the other, and the only times I have taken either kind on the nest, the pair to it was not obtained or even seen.

It is queer that all the specimens of *M. melanocephalus* in my collection should be males, whereas all those of *M. cinereiventris* except one, should be females. The one exception is a young male in imperfect plumage. One of my specimens of *M. cinereiventris* (given me by Mr. Hole) shows very narrow, obscure margins of olive-green on the grey feathers behind the neck.

Again, one of the birds in Lord Tweedale's collection is said by him to be "in a stage of transition from yellow to grey."

The amount of grey is not constant on the lower plumage, and on the upper is sometimes entirely absent. Personally I believe the two birds to be identical, but it would certainly seem that neither sex nor age can have anything to do with the differences in coloration. In Lord Tweedale's bird the change is from yellow to grey, whereas in mine, if it is changing, the reverse would seem to be in process. Thus in the former bird it would appear that age was destroying the power of secreting the yellow pigment, whereas in the latter the assumption would be that the young bird had not developed the power. I have had several collectors kind enough to give me the sexes of their specimens and of the sexed birds. I have only heard of two male *M. cinereiventris* and of but one female *M. melanocephalus*. The birds in the Asiatic Museum are not sexed. Had sex, however, been the cause of the difference in coloration, it would most certainly have been ascertained in the fine collection in the British Museum, if not in those of private persons.

The nest I have above mentioned was exactly like that of the former species already described, and was found in the same valley and on the following day. It was in a bush placed at about two feet from the ground, and, as it was surrounded by cane, was only got at with a good deal of difficulty.

Chloropsis aurifrons.

The Gold-fronted Chloropsis.

Phylornis aurifrons, Jerdon's "B. I.," Vol. II., p. 99 ; Hume and Davison, S. F., Vol. VI., p. 326 ; Hume's Cat., No. 465 ; *id.*, S. F., Vol. XI., p. 184 ; *Chloropsis aurifrons*, Oates' "B. of B. B.," Vol. I., p. 205 ; *id.* "Fauna B. I." Vol. I., p. 234.

Description.—Forehead and crown golden-orange ; chin, cheeks and extreme upper throat brilliant purplish-blue ; remainder of throat, ear-coverts, round the eye, lores, and a narrow line up to the top of the nostrils black. An indistinct supercilium and a broad line surrounding the black golden ; a patch on the wing, consisting of nearly all the lesser coverts, bright pale blue ; edge of wing rather darker blue ; inner and concealed part of wing-feathers dark brown ; lower aspect of tail lead-colour ; remainder of plumage bright grass-green, lighter below and sometimes inclined to an emerald tinge.

The female has the gold collar far less developed and often almost absent, the blue of the throat mixed with black, and the colour of the crown less vivid.

The young bird in its first plumage has the head wholly green, a moustachial streak of the same colour as the wing-patch in the adult ; chin and throat tinged with the same. Primaries and secondaries edged with brilliant greenish-blue ; tail suffused with the same, and with the under surface wholly pale dusky-blue.

A young bird in the Spring of the second year has the forehead golden ; the upper throat and chin green ; the black of the lower throat mixed with green, and with only two or three traces of the golden collar. The moustachial streak is small, and the wing patch the same.

Bill black ; gape and base of lower mandible horny ; mouth bluish ; irides light to dark brown ; legs pale, clear to dark, dusky-plumbeous ; the younger the bird, the brighter and clearer the colour.

Male—Length 7·5″ to 7·8″ ; wing 3·7″ to 3·85″ ; tail 2·7″ to 2·9″ ; tarsus ·7″ ; bill at front ·7″ and from gape 1″.

Female—7·2″ to 7·5″ ; wing 3·5″ to 3·65″ ; tail 2·4″ to 2·6″.

Nidification.—The nest is a rather shallow cup, varying in breadth from about 3·5″ to about 4″ and in depth from about 1·3″ to 1·8″, few nests being more than 1·5″. It is made of very fine twigs, moss roots and the tendrils of climbing plants, outwardly bound together, and also interwoven with grasses, moss, cobwebs, and a material which appears to be the inner bark of some tree. Some nests have no lining at all, but others are lined with fine grass-stems or, less often, with fern and moss roots. One nest taken in 1887 was lined with

the dead dry fronds of a species of fern moss, and another one had a number of dead leaves mixed with the lining of grass-stems.

Most nests are placed in between two or more horizontal twigs in a semi-pendant position, not like the nest of the genus *Oriolus* but more like the nests of the genera *Hemixus*, *Hypsipetes*, &c., having little more than half the depth of the nest below the supporting twigs. About one nest in three is placed in an upright fork, and in such cases they are rather less strongly built, and fewer cobwebs are used for attachment purposes. As a rule, the nest is very neat, but some few have the outer surface covered with scraps merely hanging on by a cobweb or two.

The eggs appear to be of two fairly distinct types. In the most common the ground varies from very pale cream to a reddish-cream, deep tinted eggs being exceptional. Most of the spots are very small, and in colour a dark reddish-brown; intermingled with these are sometimes a few streaks and short irregular lines of brown, so dark as to appear black unless closely looked into. The second type of egg has the ground-colour a clear pale cream, and the whole surface blotched and mottled with reddish and reddish-brown, and again with others, beneath these, of pale purple and lavender.

These last eggs show a strong resemblance to some badly-marked, dull-coloured eggs of *Criniger flaveolus*. In shape they are a long, pointed oval, or a long regular oval, hardly compressed at all towards the smaller end. The shell is fairly close grained and smooth, but rather delicate. About two eggs in three show a faint gloss. Fifteen eggs taken in North Cachar average ·94″ × ·69″, and vary in length between ·86″ and 1·1″, and in breadth between ·62″ and ·69″. They commence breeding in the end of May or beginning of June, and their nests may be found throughout June and July up to nearly the end of August.

The earliest date I have recorded as having taken eggs is the 12th May, 1891, and the latest the 16th of August, 1892. This bird is the most common *Chloropsis* to be met with here, and is found in great numbers all the year round, descending in the cold weather to the plains, and sometimes, if but rarely, remaining there to breed, for in July, 1891, I had a nest sent to me containing two eggs, undoubtedly belonging to a bird of this genus and, I think, this species, which was taken at the foot of the hills to the north-west of Cachar. As a general rule, they keep much to the higher trees, small saplings, &c., in their quest for food; but they do sometimes come down to low bushes, even quite close to the ground. They are nearly always to be seen in my compound any time from November up to the end of March, or even later, clambering about some tall shrubs which are covered during these months with clusters of red flowers—the attraction for numerous insects of all kinds and also for many other birds, besides those of this species. Unfortunately, this

bird is most dreadfully pugnacious and quarrelsome, and whilst feeding on these bushes will allow no other bird to come near. I found out this trait very soon after I first became acquainted with the bird. I was engaged in watching a small party of Flower-peckers (*Dicæum olivaceum*) feeding on a babul tree, when a green bulbul appeared on the scene and promptly commenced chasing the unoffending small birds who, one by one, were forced to take shelter in a densely foliaged tree close by. The same day a King-crow, a bird usually so bumptious and aggressive, was badly hustled and punished by a pair of *C. aurifrons*. This occurred some time between the 25th November and the 5th December, so could not well have been the result of any grievance which the bulbuls had against the shrike on nesting grounds. They do not mind what kind of bird they bully, and if they can get nothing else to quarrel with, will fight amongst themselves. Twice have I picked up birds mortally wounded in these fights. Once, as I was walking to Cutcherry, I noticed two of these birds fighting in a cotton tree, and whilst I watched, one fell to the ground dead. Another time I was out for a stroll with a planter and his nephew, when, just in front, two of these birds fluttered fighting to the ground. One of my companions at once rushed forward towards the birds, whereupon one flew away, but the other, after a few convulsive movements, lay dead. On yet a third occasion, one of my servants succeeded in catching two males by rushing forward and throwing his *puggree* over them as they struggled in some grass, too engrossed in their quarrel to notice his approach. On this occasion neither bird was very badly wounded, though both of them showed signs of blood on the shoulders and heads.

The only bird of its own size with which it does not care to compete is its first cousin *C. hardwichii*, and rather than fight with this bird, it will even leave a choice feeding-ground.

During the cold weather it assembles in fairly large flocks, generally numbering nearly a dozen individuals, though sometimes only three or four, and very rarely they may be seen alone or in pairs. The separate members of the flock are very independent, and they often wander some distance from one another ; but, if driven away, they make off in the same direction, and keep up an intermittent conversation between themselves.

They seem to be almost entirely insectivorous, and of the birds which I have examined, none contained seeds or other vegetable food in their stomachs, with two exceptions.

These two had in them numerous small black seeds which had been taken from the pods of a bean-like climbing plant, and when I carefully examined the plant, I found that many of these pods, which had burst, were crowded with

tiny blue beetles, so it is possible that the seeds may merely have been swallowed by the birds, either by mistake for, or together with, the insects.

I was once watching some Bronzed Drongo-shrikes catching white ants, when my attention was attracted by some other birds joining in the pursuit. At first I could not make out what they were, but one of them uttered a note which I recognised as being that of the genus *Chloropsis*, and on shooting the bird which uttered it, I found it belonged to this species. They were making swoops into the air from the top of a lofty tree, and before returning to their perch, they seemed to seize two and even three ants, whereas all the other bulbuls I have seen catching insects on the wing invariably perched after making one attempt to capture, whether successful or not. I noticed also that though the white ants were rising to our right and the birds were on our left, yet they appeared to see and give chase to insects which had disappeared far beyond the range of sight, either of myself or the more sharp-sighted Naga who accompanied me.

The ordinary cry of this bird is, as many observers have already remarked, a low sweet rippling note, very like the softened cry of a Drongo-shrike. It has, however, a most wonderful range of notes, some like those of *Molpastes* and *Otocompsa*, and others harsh, loud and jarring; a very common sound, uttered more especially during the breeding season, is just like the plaintive little chirp of a very young chicken which has lost the hen. This note, like most, seems to be common to the whole genus.

The song is very pretty, but short and rather interrupted, and very inferior to that of the next bird, though perhaps rather louder.

The flight is fairly quick and strong, and consists of long rises and dips alternately. They sometimes hover in front of a flower, exactly in the same way as many of the sun-birds do, and the movements of their wings when thus engaged are incredibly rapid.

All the birds of this genus have a habit of spreading their tails whilst feeding, very much in the manner of *Siphia*, or, still more, like *Myiophoneus temminckii*.

It is a very early rooster, retiring directly the sun sets, sometimes even before this, and always before it becomes in the least dark.

It does not always roost on high trees, and I am inclined to think that, more often than not, it prefers high, thick bushes to any other place.

I have twice disturbed it from patches of sun-grass when coming home at dusk, and I have known it stay during the night in a dense orange-tree in my compound. It is, like the other members of the genus, a great mimic, and when in captivity, soon learns to imitate sounds made near it.

Chloropsis hardwickii.

The Orange-bellied Chloropsis.

Phyllornis hardwickii, Jerdon's "B. of I.," Vol. II., p. 100; Hume's Cat., No. 460; *Chloropsis hardwickii*, Oates' "B. of B. B.," Vol. I., p. 206; *id.*, "Fauna of B. I., Birds," Vol. I., p. 236.

Description.—*Male.*—Whole upper plumage, tertiaries and greater coverts next the back rather bright green; the forehead, above the eye, down the neck tinged strongly with yellow. Lores, the ear-coverts and behind them on the sides of the neck, dead black; chin, throat and upper breast black, velvety in appearance, and strongly glossed with deep purply-blue, moustachial streak bright dark ultramarine. Tail above purply-blue, the inner webs dusky black; lesser wing-coverts verdigris-blue; other coverts black, edged purple; primaries the same, secondaries black on the inner and green on the outer webs; flanks green; remainder of lower plumage bright deep orange.

Female.—A moustachial streak bright pale cobalt; lesser wing-coverts the same as in the male; primaries and secondaries brown, the former very narrowly, the latter broadly, edged green; remainder of wings and whole upper plumage green; flanks and sides of the abdomen and breast green; centre of lower breast, abdomen and under tail-coverts orange.

Young birds in their first plumage are wholly green, there being only a faint indication of the blue on the lesser wing-coverts.

First a cobalt moustachial streak appears, then the orange belly, &c., in patches, together with patches of black on the breast. As the black develops, the lesser wing-coverts assume their proper colour, and the moustachial streak deepens into the ultramarine blue of the adult, and, finally, the yellow on the head appears in the autumn of the second year, with the bright deep tints on the wing and tail.

Bill black; irides vary considerably; in some they are almost a bright red-brown, in others dull and almost black, and they range between these extremes; legs, plumbeous-blue, brightest and clearest in the young, and dull and dark in old birds.

Length 7·3″ to 7·6″; tail ·3″ to 3·1″; wing 3·7″ to 3·95″; tarsus ·71″; bill at front ·67″ and from gape ·98″.

The female seems to be but little smaller than the male, and I have measured none under 7·25″ and from that up to 7·5″, the wing varying from 3·6″ to 3·75″.

Nidification.—There is practically no difference between the nests of this bird and those of *C. aurifrons*, though two were rather deeper than any I have seen of that bird, one measuring 1·8″ and the other 2·05″ in depth. They build in just the same sort of places, but, generally, rather higher, and I have seen no nest under about 25 feet from the ground.

The few eggs I have seen could not possibly be distinguished from those of the last bird. One clutch of two is of the blotched type, and five are of the other. In my remarks on this bird in the *Asian*, by mistake I wrote "the blotched eggs number four in every five taken" it should have been number only two to five of the other kind taken. Seven eggs average ·91″ × ·67″; in length they vary between ·89″ and 1·05″, and in breadth between ·56″ and ·7″. The largest egg is very much larger than any of the others, measuring 1·05″ × ·7″ whereas the next largest is only just ·95″ × ·67″.

I have never seen this bird in as large flocks as those in which *C. aurifrons* assembles. As a rule, not more than five or six are seen together, and often they are found in pairs. They do not, either, descend as low as *C. aurifrons* does. I have never heard of their being found quite in the plains, and only once or twice have I met with them anywhere below some 600 feet. Although they are very nearly entirely insectivorous, they are not altogether so, and in a caged state accustom themselves to a wholly vegetable diet. I have seen them two or three times, when wild, eating berries, and one I once shot in my compound had its stomach full of oranges about the size of a No. 4 shot.

This bird and its mate lived in my compound, and did a good deal of damage to the one orange tree they particularly fancied. At first I flattered myself that they were destroying the red ants which infested the tree, but I soon discovered my mistake and did my best to drive them away, finally having to shoot one, that being the only way of ridding myself of their company. In captivity they seem to thrive on plantains and similar food, though they are grateful for any insects which may be offered to them, and more especially for any grasshoppers. A great friend of mine in Silchar had one of these birds in a cage, which was a most charming pet. It soon got to know that certain people gave it grasshoppers or other dainties, and would become most excited whenever they came into the verandah, coming to the side of its cage and calling loudly to attract their attention. When I last saw it, it was beginning to sing, but had not come to its full powers, though it possessed, even then, a very sweet and musical little song. This bird had a habit of turning complete somersaults from off the top perch of its cage on to one of the lower ones, and this it would do some half-dozen, or even more, times in rapid succession. This trick, however, is one which is common to the species—and, I believe, to the genus—and in a wild state they may occassionally be seen indulging in these acrobatic feats. In turning these somersaults, the bird does not appear to open its wing in the least; it suddenly turns round on its perch, and drops, with closed wings, on to the place it desires to reach, either seizing something edible as it first turns round, or else directly after arriving on the lower twig.

It is not nearly so quarrelsome a bird as its cousin already described, but it is quite as bold and plucky, and seems to be even a more finished fighter, for, as I have mentioned before, *C. aurifrons* does not care about attacking this bird, and gets the worst of it when he does.

The song is the fullest and most prolonged, as well as by far the sweetest, of any bird of this genus, and it shares with the other members of it the wide variety of notes and wonderful power of mimicry.

I have one female of this bird, which, however, is not an adult, which measures as follows :—

Length ·7″; tail 2·8″; wing 3·5″.

This is the bird whose measurements I gave in the *Asian*; but now, with my greater experience of the species, I think that these figures are abnormally small, or that the bird would have become slightly larger with increased age.

Chloropsis chlorocephala.

The Burmese Chloropsis.

Phyllornis chlorocephala, Hume's Cat., No. 463, *bis.* ; *Chloropsis chlorocephala*, Oates' "B. of B. B.," Vol. I., p. 208 ; *id.*, "Fauna of B. I., Birds," Vol. I., p. 237.

Description.—Lores, feathers under and in front of the eye, cheeks, chin and throat, black ; forehead and a broad band from eye to eye passing round and encircling the throat pale yellowish-green ; front of the crown above the forehead and a broad streak passing over the eyes and ear-coverts pale green ; a very short moustachial streak cobalt ; crown of the head and nape golden-green ; back, rump, upper tail-coverts and scapulars deep green ; tail blue ; primaries and their coverts black, edged with blue ; secondaries black on the inner, blue on the outer webs, and edged with green ; tertiaries and inner-coverts green tinged with blue ; lesser coverts glistening smalt-blue ; medium and greater-coverts green, tinged with blue at the base, under plumage bright green, tinged with yellow on the breast (*Oates*).

I have only seen one male of this species, and that in such bad condition that I give Oates' description.

The female has no black on the head, these parts being bluish-green ; the moustachial streak is paler and less glistening, and the plumage generally is duller.

Length ·7″; tail 2·7″; wing 3·3″; tarsus ·75″; bill from gape ·9″ (*Oates*).

I have only seen a single pair of these birds in North Cachar. They were shot at Gunjong, in January, 1891, feeding on a very high cotton tree. I know of nothing in their habits differing from those of the other members of the genus.

The male several times uttered a cry exactly like one of the lower notes of the large Racket-tailed Drongo-shrike, and for some moments I thought that it was one of these birds calling, nor did I find out my mistake, until I shot the bird which uttered it and saw that there were no others in the tree.

Chloropsis jerdoni.

Jerdon's Chloropsis.

Phyllornis jerdoni, Jerdon's "B. of I.," Vol. II., p. 97; Hume's Cat., No. 463; *Chloropsis jerdoni*, Oates' "Fauna of B. I., Birds," Vol. I., p. 238; *id.*, Hume's "Nests and Eggs," Vol. I., p. 155 (2nd Ed.).

Description.—*Male.*—Whole visible plumage, with the exceptions noted below, bright grass-green, paler below and brightest on the head, rump, and upper tail-coverts; shoulder-patch, formed by the lesser wing-coverts, bright smalt-blue, moustachial streak bright purplish-blue or ultramarine, chin and throat, lores, and over the moustache, black surrounded by yellowish, commencing from the forehead and continuing through the eyes downwards.

The *female* has no black, and the moustachial streak is paler and inclined to greenish-blue.

The young are wholly green.

Nidification.—If I confine my notes on this subject to those nests taken in North Cachar, I can give practically no information beyond what is already known, for, most undoubtedly, the bird is not an inhabitant of these hills, and the few which have been seen are only the progeny of tame birds let loose.

As far as I can ascertain, the original birds, some three or four, were brought up to Gunjong by some sepoys in, or about, the year 1883, and released when the sepoys left the stockade. The first bird I ever saw was shot by Mr. Hughes, of the Frontier Police, at Gunjong, and two more birds were obtained by me that same year.

In 1886 I found a nest containing three eggs, and this is the only one I have actually taken in North Cachar itself. It was just like those described as belonging to *C. aurifrons*, and was built in a small tree quite close to the cotton tree, on which the first bird was shot.

The whole of my eggs, including the three found in Gunjong, average ·91″ × ·60″, but I have only had a very small series pass through my hands, and out of this series two pairs were abnormally large, the four eggs measuring between ·1″ and 1·06″ in length and ·68″ and ·7″ in breadth.

Deducting these four eggs, the remaining nine average only ·86″ × ·58″ even narrower than the dimensions given by Oates (*vide* "Nests and Eggs").

A pair of eggs which I took in Nuddea has not been included in these measurements.

In captivity this species also seems to be fed by natives principally on a vegetable diet, and it appears to thrive on this; but I have noticed—it may be only fancy—that birds fed thus are duller in colour than those fed on a meat or insect diet. Such is certainly the case with *C. hardwickii*, the blue parts being duller and the green the same, and, moreover, tinged with blue, much as is the case with caged green magpies (*Cissa sinensis*). The first bird of this species I ever saw in captivity belonged to one of my servants, and I have never seen one as tame since. As it was allowed to fly about without restraint, it naturally gave free vent to its appetite for insects, and thus retained its proper coloration; but at the same time it by no means despised plantains, and when shut up, as it sometimes was, ate them freely. I was told by the servants that this bird caught and devoured wasps and bees, but could get none at the time to test the truth of the assertion, and shortly afterwards the bird died a violent death.

This habit of catching wasps may have been copied from a tame Racket-tailed Drongo (*Dissemurus paradiseus*) which shared with it its semi-imprisonment. It was remarkably noticeable how the small bulbul "bossed" its much larger companion who, had he wished, could have easily killed him. As a rule, they got on very well together, but the bulbul was very jealous and resented any attention being shown to the shrike.

I am much afraid that this bird, like *Myiophoneus temminckii*, has died out, for, since 1890, I have not seen a single bird, of course, amongst the many *C. aurifrons* that I am constantly seeing, it is quite possible that I may overlook one or two birds of this species, and it is to be hoped that such may be the case.

LES FORMICIDES DE L'EMPIRE DES INDES ET DE CEYLAN.

Par Auguste Forel,
Professeur à l'Université de Zürich.

Part III.

2me Genre Polyrachis, Shuck.

Tableau des ouvrières des espèces de la faune de l'Empire des Indes et de Ceylan.

1. Yeux proéminents, perpendiculairement tronqués à leur face inférieure-postérieure (comme la moitié d'un œil). Hemioptica (Roger)... 2
   Yeux arrondis, de forme ordinaire 4
2. Une fente verticale, profonde, étroite et sinueuse entre le mésonotum et le métanotum. Thorax convexe, sans épines, non bordé. Glabre. Ecaille bidentée .....P. scissa (Roger).
   Thorax sans fente, ni échancrure, convexe, avec deux longues épines au pronotum. Poilues. Thorax bordé. Ecaille bispineuse 3
3. Luisante, faiblement chagrinée. Pubescence très éparse. Métanotum inerme, bordé .....P. aculeata (Mayr).
   Subopaque ou opaque ; rugueuse-striée ; abdomen densément coriacé-ponctué. Une pubescence jaunâtre formant toison. Métanotum bidenté, bordé entre ses deux faces. L : 5 Mill.....
   P. pubescens (Mayr).
   Angles supérieurs, latéraux de l'écaille prolongés en lobe large, bispineux, aliforme. L'épine anterieure est courte, dentiforme.
   var : alatisquamis, nov. var.
4. Thorax fortement bordé latéralement dans toute sa longueur ; ses côtés verticaux.....5
   Thorax non bordé, ou bien le métanotum seul est distinctement bordé ; pronotum nullement bordé 17
5. Thorax armé de quatre larges épines ; celles du pronotum sont les plus courtes. L'écaille a deux longues épines qui embrassent l'abdomen et deux dents entre deux. Abdomen bordé devant et à ses angles antérieurs. Corps court et large. L : 4·5 à 5·3 Mill.....
   P. jerdonii (Forel).
   Thorax n'a que deux épines ou n'en a pas.....6
6. Pas d'épines au pronotum, qui n'a que deux angles plus ou moins arrondis ou deux dents 7
   Deux épines aigües au pronotum. Pas d'épines au métanotum, tout au plus deux petites dents et en général une arête transversale entre elles...12

7. Ecaille avec une épine impaire ou un cône au milieu 8
Toutes les dents ou épines de l'écaille sont paires.....11

8. Ecaille nodiforme, avec un cône médian et deux angles latéraux. Pronotum avec deux angles. Le métanotum a deux cornes deprimées, courbées en dedans, formant ensemble un croissant (quart de lune) P. SELENE (Emery)

Ecaille avec une longue épine médiane 9

9. Ecaille squamiforme, quoique, épaisse, trispineuse. Les faces antérieure et postérieure de l'épine médiane sont la simple continuation des faces antérieure et postérieure de l'écaille. Tête carrée, à peine plus longue que large, à peine plus large derrière que devant. Métanotum avec deux fortes dents obtuses et verticales. Arêtes frontales aussi rapprochées derrière que devant, non divergentes. Dents de l'épistome plus écartées que chez les *P. frauenfeldi* et *thrinax**. L : 6 Mill. D'un jaune roussâtre .....P. SAIGONENSIS (Forel).

Ecaille nodiforme, aussi épaisse que large, ou peu s'en faut, avec une surface supérieure convexe, au milieu de laquelle l'épine médiane est implantée. Tête plus longue que large et bien plus large derrière que devant...10

10. L : 8 à 9·5 Mill. Arêtes frontales comme chez la *P. saigonensis*. Tête et thorax mats, densément réticulés-ponctués, sans rides. Dents du métanotum aussi courtes ou plus courtes que celles du pronotum. Dents latérales de l'écaille longues et pointues. Noire ; extrémité des funicules et des tarses d'un jaune brun...P. FRAUENFELDI (Mayr).

L : Environ 8 Mill. Noire, avec le front, l'épistome les mandibules, l'extrémité des funicules et celle des tarses d'un brun roussâtre. Tête et thorax ridés. Métanotum avec deux épines trés courtes. Ecaille avec deux courtes épines latérales (d'après Smith†) ..... P. TEXTOR (Smith).

L : 4 à 5·5 Mill. Arêtes frontales divergeant en arrière où elles sont bien plus écartées que devant. Tête et thorax réticulés et longitudinalement ridés, mats ou subopaques, épines métanotales assez longues, subverticales. D'un brun plus ou moins chatain ou roussâtre ..... P. THRINAX (Roger).

L : 5 à 5·5 Mill. D'un brun roussâtre. Ecaille avec deux dents ou spinules latérales pointues.....race : P. THRINAX id. sp.

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* La *P. thrinax* race : *javana* (Mayr) de Java a l'écaille à peu près conformée comme la *P. saigonensis*, mais les caractères de la tête sont comme chez la *P. thrinax*.

† C'est avec doute que je place cette espèce sous le chiffre 10, car je ne l'ai pas vue. Smith et Mayr ne disent pas si l'écaille est nodiforme et ne parlent pas de la forme de la tête, les arêtes frontales, &c.

L: 4 à 5 Mill. D'un brun chatain. Ecaille au moins aussi épaisse, sinon plus épaisse que large.....var : P. LANCEARIUS n. var.

[L : 5·5 Mill. Ecaille plus mince, trispineuse, (épines subégales). Dents du pronotum plus fortes. Java. race : P. JAVANA(Mayr).]

11. Bord supérieur de l'écaille faiblement convexe, portant au milieu deux dents pointues et à ses angles latéraux deux épines assez longues, droites, dirigées en haut et en dehors. Tête et thorax fortement ridés en long, et réticulés-ponctués. L : 6·4 à 7 Mill.....
P. HALIDAYI (Emery).

Bord supérieur de l'écaille fort convexe, armé de deux longues épines medianes très rapprochées l'une de l'autre et à peu près verticales. Les deux épines latérales sont situées plus bas que chez l'*halidayi* et sont en général un peu plus courtes que les médianes. Dents du métanotum plus aplaties et plus horizontales. Tête et thorax réticulés-ponctués, avec de fines rides longitudinales moins apparentes. L : 5 à 7·3 Mill.....P. CLYPEATA (Mayr) [= INDICA (Mayr).]

L : 7·5 Mill. Tête et thorax régulièrement et très distinctement ridés longitudinalement.....race : P. RASTRATA (Emery).

Ecaille quadridentée. Dents du métanotum verticales. Subopaque, finement pubescente (pruineuse). Yeux sphériques. Abdomen réticulé-ponctué. Tête et thorax ridés-ponctués. Noire. L : 5 Mill. (d'après Roger) .....P. PUNCTILLATA (Roger).

12. Tête plus large derrière que devant. Robuste. Grossièrement striée-ridée. Ecaille avec quatre épines courtes, subégales. Noire. Poilue. Eparsément pubescente. Arêtes frontales divergentes. Thorax à bord biincisé. L : 9 à 10 Mill.....P. STRIATO-RUGOSA (Mayr).

Ecaille comme chez la précédente. L : 5·5 à 6 Mill. Pruineuse. Ridée-ponctuée. Une pubescence grisâtre sur le corps, jaunâtre sur l'abdomen. Pilosité dressée presque nulle. Thorax fort convexe .....
P. CONVEXA (Roger).

Ecaille armée en haut de deux longues épines verticales ou subverticales, de côté de deux dents ou petites épines beaucoup plus courtes. Tête aussi large ou plus large devant que derrière 13

13. Tête fortement rétrécie en arrière, à partir des yeux, sans autre bord postérieur que l'articulation occipitale. La distance d'un œil à l'angle postérieur de la tête est aussi grande que celle d'un œil à l'autre. Opaque, réticulée-ponctuée ; thorax et tête en outre striés. Noire. Pilosité noirâtre. Faiblement pubescente. Thorax étroit, allongé, à peine plus large devant que derrière. L. 9 à 10 Mill.....
P. STRIATA (Mayr).

Tête pas ou à peine rétrécie derrière les yeux, avec un bord particulier, distinct, en avant de l'articulation occipitale. Yeux bien plus éloignés l'un de l'autre que des angles postérieurs de la tête. Plus robuste...14

14. Une pubescence plus ou moins grisâtre, dorée ou argentée, formant un duvet très abondant et apparent, qui cache la sculpture, au moins sur l'abdomen 15

Une pubescence courte, espacée, ne cachant pas la sculpture et ne formant pas de duvet apparent. Tête et thorax striés. Noire 16

15. Arêtes frontales très rapprochées l'une de l'autre, à peine distantes comme $\frac{1}{4}$ ou $\frac{1}{3}$ de leur longueur. Pronotum aussi large derrière que devant. Epines latérales de l'écaille très courtes et bimucronées. Pilosité éparse. Pubescence plutôt argentée ou faiblement dorée. Taille un peu moins robuste que chez la *P. mayri*. L : 8 à 9 Mill .....
P. PROXIMA (Roger).

Arêtes frontales distantes de la moitié de leur longueur environs. Pronotum un peu élargi devant. Taille robuste et courte. Pubescence grise-dorée, parfois plus gris âtre ou un peu argentée. L : 7·5 à 9 Mill...
P. MAYRI (Roger).

Pilosité abondante sur le corps et sur les pattes. Pubescence dense et d'un gris doré. Arêtes frontales très distantes...race :
P. MAYRI, id. sp.

Pubescence grise et peu dense sur l'abdomen...var : PAUPERATA (Emery).

Pilosité dressée très éparse partout. Abdomen avec une pubescence grise ne formant qu'un assez faible duvet. Abdomen brun. Arêtes frontales plus rapprochées que chez le type
race : P. INTERMEDIA (Forel).

Stature trapue et pubescence dorée dense de la *P. mayri*, i. sp. Arêtes frontales presque aussi rapprochées que chez la *P. proxima*. Pilosité très éparse, comme chez la *P. intermedia*...
var : PROXIMO-MAYRI, n. var.

16. Epines médianes de l'écaille courbées en arrière près de leur extrémité et plus rapprochées l'une de l'autre à leurs bases que des épines latérales. Pas de pilosité dressée, sauf quelques poils roussâtres au deux extrémités du corps. Pubescence jaunâtre très courte, formant sur l'abdomen un très faible duvet pruineux. Abdomen subopaque, très finement réticulé. L : 8 à 9 Mill. Pas de dent médiane entre les épines supérieures de l'écaille .....P. YERBURYI, n. sp.

Epines médianes de l'écaille droites, bien plus éloignées l'une de l'autre que des épines latérales. Pilosité dressée abondante sur le corps, les pattes et les antennes. Abdomen mat, ridé-ponctué ou strié. Pubescence grise, plus éparse que chez la précédente. Une dent médiane entre les épines supérieures de l'écaille. L : 9 à 12 Mill.
P. SUMATRENSIS (Smith).

Epines supérieures de l'écaille de longueur médiocre ; dent médiane forte, spiniforme. Métanotum sans dents distinctes. Abdomen ridéponctué .....race : P. SUMATRENSIS, id. sp.

Epines supérieures de l'écaille longues ; dent médiane très faible et obtuse. Métanotum avec deux fortes dents verticales. Abdomen strié .....race : P. HAMULATA (Emery).

17. Luisantes, lisses ou faiblement chagrinées. Thorax sans épines ou avec deux dents ou épines plus ou moins caduques, grêles dès leur base, au métanotum seulement. Pas de pubescence.....18.

Sculpture accentuée. Mates ou subopaques (sauf chez la *P. lævigata*). Thorax épineux .....19.

18. Pronotum avec deux angles antérieurs aigus, dentiformes. Ecaille à peine quadridentée. Métanotum inerme. Noire ; pattes rougeâtres, sauf les tarses. L : 5·5 à 6·2. Mill.....P. LÆVISSIMA (Smith).

Abdomen et pattes d'un roux jaunâtre. Antennes et devant de la tête rougeâtres .....var : DICHROUS (Forel).

Pronotum avec ses angles antérieurs arrondis. Ecaille quadrispineuse (épines latérales courtes, épines médianes rapprochées). Noire ; pattes brunâtres ou rougeâtres. L : 5 à 6. Mill...P. RASTELLATA (Latreille).

Métanotum absolument inerme.....race : P. RASTELLATA, id. sp.

Métanotum armé de deux épines grêles, plus ou moins caduques, aussi étroites á leur base que vers leur extrémité ..... race : P. LÆVIOR (Roger).

Mêtanotum armé seulement de deux petites dents...var : DEBILIS (Emery).

19. Mésonotum armé de deux fortes épines, recourbées en arrière 20

Mésonotum inerme. Ecaille bispineuse 22

20. Métanotum armé de deux fortes dents. Epines du pronotum fortement courbées en dehors. Ecaille surmontée d'un pilier d'où partent deux longues épines médianes, d'abord verticales, parallèles et contigues, puis divergentes et recourbées en dehors en cornes de chamois à leur sommet. Thorax, sauf les épines, base de l'écaille, devant du premier segment abdominal d'un roux foncé ; le reste noirâtre. Pubescence peu dense. L : 8 á 9 Mill .....P. BELLICOSA (Smith).

Métanotum armé de deux tubercules dentiformes plus ou moins obtus, souvent peu distincts. Epines du pronotum longues, recourbées à la fois en dehors et en arrière. Taille plus grande 21

21. Ecaille comme chez la *P. bellicosa*. D'un roux vif. Tête, antennes, tibias, tarses, articulations, extrémité des épines et moitié postérieur de l'abdomen noirâtres. Pubescence longue, abondante, jaunâtre L : 9·5 à 10 Mill .....P. BIHAMATA (Drury).

Les épines de l'écaille divergent dès le sommet du pilier d'où elles partent, comme les branches d'un Y. Abdomen très large. Tubercules

du métanotum presque nuls. Entièrement noire, avec la base de l'écaille, et parfois une partie du thorax, d'un roux brunâtre. Pubescence plus grisâtre que chez la *P. bihamata*. L : 10 à 11 Mill .....P. YPSILON (Emery).

22. Lisse et luisante. Noire. Angles antérieurs du thorax aigus. Métanotum avec deux longues épines divergentes, dirigées en arrière, ce qui la distingue de la *P. lævior*. Cuisses et hanches ferrugineuses. Ecaille avec deux longues épines embrassant l'abdomen. L : 5 à 6 Mill (d'après Smith) .....P. LÆVIGATA (Smith).

Corps, en partie du moins, avec une sculpture bien distincte, mat ou subopaque .....23.

23. Pronotum avec deux angles antérieurs aigus, subdentés. Deux épines au métanotum. Ecaille avec deux épines dirigées en arrière et embrassant l'abdomen. Sutures du thorax assez nettes. Subopaque ; tête et thorax finement réticulés-ponctués. Abdomen réticulé. Pilosité dressée nulle. Pubescence extrêmement courte et très éparse. Noire, avec un reflet métallique bleuâtre foncé, surtout apparent au métathorax. Funicules et pattes, sauf les métatarses, testacés. L : 4 à 4·7 Mill.....P. HIPPOMANES (Smith). Race : CEYLONENSIS* (C. Emery).

Pronotum armé de deux épines .....24.

24. Suture méso-métanotale distincte. Ecaille simplement bispineuse. Pilosité dressée à peu près nulle. Métanotum ordinairement bordé...25

Suture méso-métanotale indistincte ou nulle. Souvent deux dents entre les épines de l'écaille. Métanotum nullement bordé 31

25. D'un noir verdâtre bronzé. Métanotum bordé. Beaucoup plus grêle que la *P. venus*. Tête et thorax densément réticulés-ponctués ; les points ou réticulations fines sont plus ou moins disposés par groupes de 5 ou 6, séparés les uns des autres par une maille réticulaire un peu plus élevée, souvent peu distincte. Abdomen subopaque, assez luisant, assez faiblement et très finement ponctué-ridé transversalement. Tibias et scapes comprimés. L : 7 Mill...P. ÆDIPUS, n. sp.

D'un noir brunâtre mat ; uniformément et densément réticulées-ponctuées. Abdomen parfois d'un brun roussâtre. Tibias et scapes comprimés, ces derniers du moins vers l'extrémité 27

D'un bleu foncé, métallique en tout ou en partie. Deux longues épines au pronotum. Subopaques ; abdomen luisant, finement chagriné.

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* Je dois a mon ami M. C. Emery la connaissance des caractères qui distinguent cette race de l'*hippomanes* id. sp. C'est donc sous son nom et avec sa signature que je publie la diagnose de ce tableau.—*A. Forel.*

Face basale du métanotum subbordée. Epistome échancrée au milieu de son bord antérieur. Scapes, cuisses, et tibias, comprimés. Dépourvues de pilosité dressée et de pubescence. L : 8 à 9 Mill. 26

26. Tête rétrécie fortement derrière les yeux. Epines du métanotum plus courtes que celles du pronotum, parallèles, dressées. Thorax étroit, allongé, finement rugueux transversalement, nullement convexe dessus. Ecaille avec deux longues épines, très écartées et très divergentes, courbées en arrière. Tête, prothorax et méso-thorax noirs... P. CHALYBEA (Smith).

Tête non rétrécie derrière les yeux. Epines du métanotum extrêmement fortes et extrêmement longues, longues comme plus de deux fois l'intervalle de leurs bases, très fortement divergentes, beaucoup plus longues que les épines pronotales, dirigées en arrière et en haut. Thorax plus robuste que chez la *P. chalybea*. Pronotum et mésonotum un peu convexes. Ecaille comme chez la *P. chalybea*. Tête et thorax réticulés-ponctués ou réticulés, et subopaques ou faiblement luisants, sauf la face basale du métanotum qui est très luisante et faiblement chagrinée. En outre une ponctuation éparse, assez effacée. D'un bleu métallique foncé, uniforme. Pattes et antennes d'un noir bleuâtre .....P. VENUS, n. sp.

27. Tête considerablement rétrécie par lignes convergentes, presque droites, derrière les yeux, sans bord postérieur distinct de l'articulation occipitale ; l'extrémité postérieure de la tête est aussi étroite que l'articulation occipitale. Antennes, pattes, et palpes très longs et très grêles. Les palpes et les scapes dépassent en arrière la suture promésonotale. Corps très étroit. Chaque article du funicule renflé à son extrémité. Epines métanotales parallèles, de la longueur des épines pronotales et des épines de l'écaille ; ces dernières, assez dressées et courbées en arrière. Métanotum non bordé. Tout le corps mat, densément réticulé-ponctué et glabre ou peu s'en faut. L : 7. Mill.....P. MÜLLERI, n. sp.

Tête médiocrement rétrécie par lignes, plus ou moins convexes, derrière les yeux, avec un bord postérieur plus ou moins distinct, ou indistinct, mais toujours plus long que l'articulation occipitale à son extrémité postérieure. Palpes et scapes n'atteignant ou ne dépassant pas la suture pro-mésonotale. Métanotum bordé ou au moins subbordé..28

28. Front et arêtes frontales élevés, proéminents. Pas de dent sous l'extrémité antérieure du 1er segment abdominal. Pubescence extraordinairement courte et diluée, presque nulle. Côtés de la tête faiblement convexes entre l'œil et le bord postérieur. Corps relativement robuste ou médiocrement grêle. Abdomen souvent d'un brun roussâtre 29

Front et arêtes frontales peu élevés, peu proéminents. Une dent lamelliforme sous l'extrémité antérieure du 1er segment abdominal. Une pubescence grisâtre, fort distincte, qui rend l'abdomen un peu pruineux, sans former de duvet. Côtés de la tête derrière les yeux plus fortement convexes que chez 28. Corps grêle, étroit, mais les antennes ne sont pas longues 30

29. Ecaille épaisse mais non cubique, surmontée de deux fortes et longues épines divergentes, dirigées en haut, en arrière et en dehors, médiocrement courbées en arrière, plus longues que les épines du métanotum. Ces dernières divergentes, légèrement courbées en dehors, pas plus longues que celles du pronotum ; leur bord antérieur ne se continue pas à sa base en une arête bordant la face basale du métanotum. Cette dernière plane, faiblement subbordée. Tibias postérieurs et médians armés à leur bord interne de deux ou trois petits piquants très courts et très obliques. Stature relativement robuste, presque comme *P. armata*. L : 10 Mill.....P. ACHILLES, n. sp.

Ecaille cubique, avec un angle plus ou moins droit entre sa face antérieure et sa face supérieure qui s'élève dans sa moitié postérieure en bourrelet, d'où partent deux épines assez longues, dirigées en arrière, en dehors et un peu en haut, assez fortement courbées en arrière. Face basale du métanotum concave, en gouttière longitudinale, bordée d'une arête qui se continue directement dans le bord antérieur des épines. Ces dernières très longues, droites, à peine divergentes, plus longues que celles du pronotum et de l'écaille. Tibias sans trace de piquants. Stature moins robuste. L : 8 à 9 Mill .....

P. ABDOMINALS (Smith) ; [= PHYLLOPHILA (Smith).]

30. Vertex bas, faiblement convexe, de même que le front. Tibias armés de piquants distincts à leur bord interne. Nœud du pédicule plus long que large, avec les stigmates fort proéminents. Face basale du métanotum bordée et concave de droite à gauche. Epines du métanotum et de l'écaille comme chez la *P. abdominalis*, mais les premières encore plus longues, extrêmement longues, pointues et plus divergentes. Articles 1 à 4 du funicule très distinctement épaissis à leur extrémité. Tête à peine rétrécie derrière les yeux. Pronotum un peu concave entre les deux épines. L : 7·8 Mill.....

P. MUTATA (Smith) ? race : AJAX. n. st.

Vertex plus fortement convexe. Tête fort distinctement rétrécie derrière les yeux. Tibias sans trace de piquants. Nœud du pédicule un peu plus large que long, armé derrière de deux épines fort courtes, dirigées presque horizontalement en arrière et en dehors, courbées

de façon à embrasser un peu l'abdomen. Métanotum comme chez l'espèce précédente, mais les arêtes qui bordent la face basale sont plus faibles et les épines un peu plus courtes et plus divergentes. Articles 1 à 4 du funicule à peine épaissis à leur extrémité. Pronotum faiblement convexe entre les deux épines. Très voisine de l'espèce précédente, mais L : 5·5 Mill, et pubescence un peu plus accentuée .....P. BINGHAMII, n. sp.

31. Pédicule comme chez la *P. ypsilon*, c. a. d. surmonté d'un pilier épais et élevé qui porte deux longues épines, divergeant en Y, un peu inclinées en arrière et recourbées en dehors à l'extrémité, comme les cornes d'un chamois. Tête large derrière, nullement rétrécie derrière les yeux. Pronotum et mésonotum fort convexes ; métanotum très abaissé, surmonté de deux épines très longues. Abdomen globuleux, atténué devant, en dessus. Tête et abdomen lisses et luisants. Thorax et pédicule très grossièrement réticulés-ponctués. Très poilues. Noire, avec les pattes, les funicules, et souvent l'abdomen d'un roux plus ou moins brunâtre. L : 5·3 à 5·6, Mill....P. FURCATA (Smith).

Tête distinctement rétrécie derrière les yeux. Epines du métanotum plus courtes. Pilier du pédicule plus grêle et plus bas, surmonté de deux épines, abaissées, très divergentes, dirigées en dehors et à peine en haut, courbées en arrière et embrassant plus ou moins l'abdomen ; les épines de l'écaille ne sont recourbées que tout près de leur extrémité où elles forment un petit crochet. Avant ce crochet très atténué, elles sont comprimées et larges. D'un roux jaunâtre testacé. Tête (sans les mandibules) et extrémité des épines noirâtres. Scapes bruns. L : 4·5 Mill.....race : P. GRACILIOR, n. st.

Pédicule sans pilier ; ses épines nullement recourbées à l'extrémité.....32

32. Epines du métanotum longues, fortes, recourbées en dehors à leur extrémité, en forme de cornes de chamois. Tête sans tubercules. Epines de l'écaille embrassant l'abdomen, deux dents verticales entre elles, au sommet de l'écaille. Une petisse dorée sur l'abdomen et sous les métatarses. Presque pas de poils dressés. Noire, mate. L : 8. Mill .....P. RUPICAPRA (Roger).

Epines du métanotum recourbées en dehors à leur extrémité, mais plus faiblement, ne formant pas de corne de chamois aussi accentué. Deux gros tubercules proéminents sur la tête, à l'occiput, un derrière chaque œil. Ecaille comme chez la *P. rupicapra*. Abdomen presque subbordé et un peu avancé devant, en dessus. Mésonotum presque plan de profil ; pronotum fortement convexe devant. Noire, mate, finement reticulée-ponctuée ; thorax, tête et écaille en outre

grossièrement réticulés. Pilosité presque nulle. Pubescence très diluée. L : 6·8 à 7 Mill.....P. TUBERICEPS, n. sp.

Epines du métanotum non recourbées en cornes de chamois, tout au plus faiblement courbées en dehors vers leur extrémité. Tête sans tubercules 33

33. Tête et thorax grossièrement et profondément réticulés-ponctués ainsi que l'écaille, finement ponctués au fond des mailles. Abdomen finement et densément réticulé-ponctué et mat. Pedicule subcubique, bidenté à ses angles antérieurs supérieurs, surmonté derrière de deux longues et fortes épines divergentes, courbées en arrière. Epines du pronotum et du métanotum longues et robustes ; l'espace qui separe leur bases un peu concave d'une épine à l'autre. Epistome bidenté devant. Presque glabre. Mate ; noire ; abdomen souvent d'un brun roussâtre. L : 8 à 10 Mill .....P. ARMATA (Le Guillon).

Abdomen d'un roux clair. Pattes, antennes, thorax et pédicule bruns. L : 7 Mill : seulement.....var : MINOR (Forel).

Tête et thorax avec de grossières réticulations qui sont faibles, plus ou moins effacées ; du reste finement et densément réticulés-ponctués et mats comme l'abdomen. Pronotum fort convexe devant. Epines du thorax assez courtes, surtout celles du pronotum. Celles du métanotum divergentes, courbées on dehors. Ecaille et abdomen comme chez la *P. tubericeps*, mais les épines, et surtout les dents supérieures de l'écaille, sont plus courtes. Noire, mate ; pubescence très courte et extrêmement diluée ; pilosité presque nulle. L : 4·8 à 5·8 Mill.....

P. SIMPLEX (Mayr).

[=SPINIGERA (Mayr)].

Réticulations de la tête et du thorax presque entiérement effacées. L : 4 à 4·5 Mill.....var : OBSOLETA, n. var.

La tête, le thorax et l'abdomen n'ont guère qu'une sculpture fine. Poilues on pubescentes 34

34. Les épines de l'écaille n'embrassent pas l'abdomen ; elles sont divergentes, dirigées en haut et pas ou à peine courbées en arrière. L'intervalle de leurs bases n'a pas de dents. Epines du métanotum parallèles, un peu courbées en dedans. Pilosité dressée assez abondante sur le corps et sur les pattes. Pubescence jaunâtre, assez abondante, assez grossière et contournée, laissant voir la sculpture dans ses intervalles. Epines médiocres. Noire ; abdomen, pattes, antennes et mandibules d'un rouge brunâtre. L : 6 à 6·5 Mill ..... P. BICOLOR (Smith).

Les épines de l'écaille sont abaissées en arrière, divergentes, courbées en dedans et embrassent la base de l'abdomen. L'intervalle de leurs

bases a deux petites dents. Pilosité dressée presque nulle. Pubescence serrée, formant un duvet argenté ou doré 35

35. Epines du pronotum assez grêles ; épines du métanotum à peine plus longues qu'elles, assez dressées, divergentes et courbées en dehors près de leur extremité. Une impression transversale entre le pronotum et le mésonotum. L'écaille a trois dents entre la base de ses épines ; l'une d'elles est médiane et située devant les deux autres. Les tibias ont à leur bord interne quelques petits piquants. Pubescence d'un gris doré. Epistome avec un lobe antérieur. Quelques rugosités plus grossières sur la tête et le thorax. L : 4·5 à 7 Mill...
P. DIVES (Smith).

Epines du pronotum robustes. Epines du métanotum bien plus longues qu'elles, très divergentes, bien moins dressées, robustes, pas ou à peine courbées en dehors. Epines de l'écaille plus longues ; seulement deux dents dans l'intervalle de leurs bases. Stature bien plus robuste. Thorax plus large, bien plus convexe, sans impression transversale Tibias sans trace de piquants 36

36. Côtés du mésothorax renflés. Noire, avec une pubescence d'un doré pâle. Epines de l'écaille plutôt grêles. Noire. Eperons testacés. L : 4·5 à 5 Mill. (d'après Smith) .....P. AFFINIS (Smith)
[=VICINA (Roger)]

Côtés du mésonotum non renflés. Pattes rougeâtres. Epines de l'écaille robustes. L : 5 à 6 Mill.....37

37. Le pronotum et le mésonotum forment une bosse très proéminente. Tout le corps convert d'une pubescence argentée très dense. Robuste.....
P. ARGENTEA (Mayr).

Le thorax est moins fortement convexe et l'est uniformément, d'avant en arrière. Taille moins robuste. Pubescence moins dense, laissant voir la sculpture sur la tête et le thorax, d'un grisâtre moins argenté, souvent en partie d'un doré pâle sur l'abdomen. Trés voisine de la précédente ; peut-être simple race.....P. TIBIALIS (Smith).

LISTE DES *POLYRACHIS* DE L'INDE AVEC DESCRIPTION DES ESPE'CES NOUVELLES, SYNONYMIE ET GEOGRAPHIE.

1. *P. scissa* (Roger).

Hemioptica scissa (Roger).

Ceylon (Major Yerbury, Roger).

♂ :—L : 5·7 à 6·2 Mill. Entièrement noir. Ailes brunes. Valvules génitales jaunâtres, avec l'extrémité de leurs prolongements d'un brun noirâtre. Assez finement chagriné et assez luisant. Yeux allongés, assez comprimés dans le sens transversal, mais non tronqués derrière.

2. *P. aculeata* (Mayr).

Ceylon (Major Yerbury) ☿ ♀ ♂ ; Kanara (E. H. Aitken) ♀ ; Travancore (H. Ferguson) ☿.

♀ :—L : 6·5 Mill. Comme l'ouvrière, mais les cuisses et les fémurs sont noirs et les ailes teintées de brunâtre. Pronotum avec deux courtes épines. L'écaille a, au lieu d'épines, à ses angles supérieurs deux prolongements lamelliformes, comprimés, bituberculés à l'extrémité. La pubescence grise est aussi plus abondante sur le devant de la tête et sur le thorax. C'est peut-être une variété.

♂ :—L : 5·8 Mill. Tête plus courte que chez la *P. scissa*. Yeux arrondis non comprimés ni tronqués. Tête et thorax réticulés-ponctués et subopaques. Ecaille en nœud arrondi.

3. *P. pubescens* (Mayr).

Birmanie et Tenasserim (Fea).

var: *alatisquamis*, n. var.

Birmanie (Major Bingham) (voir tableau).

4. *P. jerdonii* (Forel).

Ceylon (Major Yerbury) ☿ ♀ (voir Forel : *Die Nester der Ameisen*, Zürich, 1892, et le tableau ci-dessus).

♀ :—L : 5·7 à 6 Mill. Ailes teintées de brun. Nervures et tache marginale foncées. Large, trapue ; thorax déprimé en dessus. Epines du thorax un peu plus courtes que chez l'ouvrière à laquelle elle est du reste identique. Le thorax est subbordé.

5. *P. selene* (Emery).

Tenasserim (Fea).

6. *P. saigonensis* (Forel).

P. thrinax var : *saigonensis* (Forel).

Saigon (par M. L. Lortet).

7. *P. frauenfeldi* (Mayr).

Ceylon (ma collection).

8. *P. textor* (Smith).

Malacca (d'après Smith).

9. *P. thrinax* (Roger).

Ceylon (Major Yerbury) ; Calcutta (G. A. J. Rothney) ; Travancore (H. Ferguson) ; Kanara (T. R. D. Bell).

♀ :—L: 6·8 à 7·5 Mill. Ailes jaunâtres ou d'un jaune brunâtre, à nervures pâles. Le pronotum n'a que deux angles obtus. Epines du métanotum plus courtes que chez l'ouvrière. Ecaille moins épaisse, moins cubique, avec l'épine médiane plus courte et les épines latérales plus longues que chez ☿, ces dernières presque aussi longues que l'épine médiane. Du reste comme ☿.

♂ :—L: 5·7 à 6 Mill. Brunâtre, varié de brun jaunâtre; funicules plus foncés. Chagriné, assez luisant. Pédicule avec un nœud plus ou moins distinctement bituberculé ou trituberculé au sommet.

var : *lancearius* n. var. (voir tableau) ☿ ♀.

Trevandrum (H. Ferguson); Kanara (E. H. Aitken).

10. *P. halidayi* (Emery).

Tenasserim (Fea).

11. *P. clypeata* (Mayr).

Polyrachis indica (Mayr) (d'après Emery in litt):
Camponotus indicus (Forel).

Thana District (F. Gleadow); Kanara (T. Bell); Poorce, Bengale (Tull Walsh); Orissa (Jas. Taylor); Travancore (Ferguson); Ceylon (Mayr).

race : *P. rastrata* (Emery).

Polyrachis rastrata (Emery).

Tenasserim (Fea).

12. *P. punctillata* (Roger).

Ceylon (d'après Roger).

13. *P. striato-rugosa* (Mayr).

Birmanie (d'après Mayr).

14. *P. convexa* (Roger).

Ceylon (d'après Roger).

15. *P. striata* (Mayr).

Singapore (Dr. Arthur Müller).

16. *P. proxima* (Roger).

Birmanie (Major Bingham et Fea); Singapore (Dr. A. Müller).

17. *P. mayri* (Roger).

Polyrachis relucens (Mayr); nec Latreille.

Ceylon (d'après Roger et Major Yerbury); Kanara (E. H. Aitken); Siam Frontier (Major Fulton); Birmanie (Major Bingham); Tenasserim (Fea); Darjeeling, près de Sikkim (Christie); Travancore (H. S. Ferguson).

var : *pauperata* (Emery).

Tenasserim (Fea).

race : *P. intermedia* (Forel).

Sibsagar, Assam (Wood-Mason).

var : *proximo-mayri* n. var. (voir tableau).

Birmanie (Major Bingham).

18. *P. yerburyi* n. sp.

Ceylon (Major Yerbury).

☿ :—Mandibules striées, mates, avec quelques points et 5 dents. Epistome sans caréne, avec un lobe antérieur arrondi et convexe, non échancré. Dessous

de la tête bordé d'une arête latérale faible. Front convexe et assez proéminent. Arêtes frontales plutôt rapprochées. Scapes cylindriques. Tête plus longue que large, à côtés convexes. Epines du pronotum fortes et assez divergentes. Pronotum et mésonotum plus larges que longs (chacun) ; face basale du métanotum un peu plus longue que large, à peine plus large devant que derrière, terminée derrière par une arête transversale et par deux dents verticales très accentuées et comprimées dans le sens antéro-postérieur. Thorax biincisé, bordé d'une arête vive un peu moins prolongée que chez la *P. sumatrensis*. Ecaille épaisse à sa base et amincie vers le haut. Epines latérales de l'écaille plus fortes que chez la *P. sumatrensis* et surtout que chez la race *P. hamulata*.

Tête et thorax striés en long (striés-ridés sur les côtés du thorax et le devant de la tête), finement rugueux entre les stries, ce qui les rend mats ou soyeux. Pédicule rugueux ; abdomen densément et très finement réticulé. Sur la tête et sur le thorax la pubescence est plus jaune (moins grise) que sur l'abdomen. Entièrement noire, avec les palpes et le dernier article des tarses roussâtres. Pas de reflet métallique distinct (voir du reste le tableau). Stature bien moins robuste que chez la *P. pruinosa*.

♀ :—L : 10 Mill. Ailes brunâtres avec les nervures et le pterostigma foncés. Absolument semblable à ☿ ; épines aussi longues que chez elle et disposées de même. Très voisine de la *P. pruinosa* (Mayr) de Borneo dont elle diffère par la forme du métanotum et de l'écaille.

19. *P. sumatrensis* (Smith).

race : *P. hamulata* (Emery).

Birmanie (Major Bingham) ; Tenasserim (Fea) ; Sibsagar, Assam (Wood-Mason).

La race *sumatrensis* id. sp. ne se trouve qu'à Sumatra.

20. *P. lævissima* (Smith).

Polyrachis globularia (Mayr).

Barrackpore (Rothney, Minchin) ; Birmanie (Major Bingham et Fea) ; Orissa (Jas. Taylor) ; Calcutta (Wood-Mason) ; Bangkok (Sigg).

var : *dichrous* (Forel).

Sibsagar, Assam (Wood-Mason).

21. *P. rastellata* (Latreille).

Polyrachis busiris (Smith).

Polyrachis euryalus (Smith).

Ceylon (Major Yerbury) ; Kanara (E. H. Aitken et T. Bell) ; Birmanie (Major Bingham) ; South Konkan (R. C. Wroughton).

22. *P. bellicosa* (Smith).

Singapore (Dr. A. Müller).

23. *P. bihamata* (Drury).

Formica affinis (Le Guillon ; nec Smith).

Birmanie (Major Bingham) ; Tavoy (Wood-Mason) ; Tenasserim (Fea).

24. *P. ypsilon* (Emery).

Ceylon (Tristschler) ; Malacca (reçue du Dr. Emery).

25. *P. lævigata* (Smith).

Malacca (d'après Smith).

26. *P. hippomanes* (Smith).

Race : *P. ceylonensis* (Emery).

M. Emery publiera plus tard le diagnostic de cette race qui diffère de la vraie *P. hippomanes* de Celebes.

27. *P. chalybea* (Smith).

Singapore (d'après Smith).

28. *P. venus* n. sp.

Ataran Valley, Birmanie (Major Bingham).

☿ :—Tête au moins aussi large derrière que devant. Thorax plus large devant que derrière (aussi large devant que derrière chez la *P. chalybea*.) Les mandibules sont très finement striées et éparsément ponctuées. Bord antérieur de l'épistome avec une impression médiane. Epistome sublobé devant. Une marche d'escalier assez distincte du mésonotum à la face basale du métanotum. Stature plus robuste que celle de la *P. abdominalis* (*phyllophila*), presque aussi robuste que celle de la *P. armata*. Tout le corps est d'un magnifique bleu foncé, métallique, rappellant celui des espèces bleues des coleoptères du genre *Meloe*. La teinte du thorax et de la tête tire un peu sur le verdâtre, tandis que le bleu de l'abdomen est pur (voir du reste le tableau).

Mes amis les Prof. G. Mayr et C. Emery m'ont indiqué les differences qui existent entre la *P. venus* et la *P. chalybea* en la comparant à leurs types, ce dont j'ai a les remercier ici.

29. *P. œdipus* n. sp.

Ceylon (Major Yerbury).

☿ :—L : 7 Mill. Longueur d'un scape 2·6, d'un tibia postérieur 3·3 Mill. Mandibules armées de 6 dents, finement striées, avec une ponctuation espacée. Epistome avec une faible carène et un lobe antérieur trapéziforme, très court, à bord antérieur rectiligne et subcrénélé. Arêtes frontales fort rapprochées. Front proéminent. Tête assez arrondie derrière, d'un œil à l'autre ; côtés de la tête à peine convexes devant les yeux. Dessous de la tête sans arêtes latérales. Thorax long et étroit, sans convexité dorsale, sauf le pronotum qui est légèrement convexe ; pronotum et mésonotum chacun beaucoup plus long que large. Pronotum nullement subbordé ; mésonotum fortement subbordé.

Face basale du métanotum $1\frac{3}{4}$ fois plus longue que large. Le dos du thorax est à peine convexe d'avant en arrière. L'écaille est conformée tout à fait comme chez la *P. abdominalis* (voir le tableau), aussi épaisse que large, mais ses épines sont plus abaissées et embrassent un peu l'abdomen. Pubescence d'un jaune grisâtre, courte, assez éparse partout, plus abondante sur l'abdomen où elle forme un léger duvet grisâtre. L'abdomen a encore une ponctuation espacée très fine.

Tout le corps, les pattes et les antennes d'un verdâtre bronzé, très foncé, en partie noirâtre, ayant souvent des reflets d'un rouge cuivré (voir du reste le tableau).

30. *P. müller*i n. sp.

Singapore (récoltée par le Dr. Arthur Müller auquel je la dédie).

♀ :—L : 7 Mill. Longueur d'un scape 3·2, d'un tibia postérieur 3·9 Mill. Epistome fortement caréné ; du reste l'épistome, arêtes frontales et mandibules conformés comme chez l'*Ædipus*. Front beaucoup plus proéminent et vertex beaucoup moins convexe que chez la précédente. Thorax encore plus étroit et plus allongé que chez l'*Ædipus* mais sans apparence de bordure nulle part. Une légère échancrure entre le pronotum et le mésonotum, ce qui donne au dos du thorax deux covexités très faibles. Le mésonotum est deux fois aussi long que large, la face basale du métanotum $2\frac{1}{2}$ fois aussi longue que large. Epines métanotales légèrement courbées en dedans (comme chez la *P. bicolor*), assez grêles comme celles du pronotum. Ecaille haute, conique, avec deux épines divergentes. Pubescence extrêmement éparse. Scapes élargis et déprimés vers l'extrémité seulement. Noire ; abdomen en partie d'un rouge ferrugineux foncé (voir du reste le tableau).

31. *P. achilles* n. sp.

Birmanie (Major Bingham).

A part sa taille plus robuste, la forme de l'écaille, la face basale du métanotum non bordée et ne continuant pas ses bords dans l'épine, enfin à part les petits piquants des tibias, cette espèce est identique à l'*abdominalis* (*phyllophila*) dont elle n'est peut être qu'une race locale (voir le tableau).

32. *P. abdominalis* (Smith).

Polyrachis phyllophila (Smith).

Tenasserim (Fea).

33. *P. mutata* (Smith) ?

Race : *P. ajax* n. st.

Birmanie (Major Bingham).

♀ :—L : 7·8 Mill. Longueur d'un scape 2·6, d'un tibia postérieur 4·1 Mill. Mandibules finement et densément striées, armées de 5 dents distinctes. Epis-

tome à peine subcaréné, brièvement lobé devant, largement et faiblement échancré au milieu de son bord antérieur. Thorax allongé, étroit, sans convexité dorsale c. à. d : le mésonotum est concave d'avant en arrière, ce qui donne une faible convexité à la région de la suture pro-mésonotale. Pronotum et mésonotum chacun un peu plus long que large ; face basale du métanotum deux fois aussi longue que large. Mésonotum fortement subbordé, pronotum nullement. Epines du pronotum longues et divergentes. Abdomen ovale. Noire. Abdomen d'un noir brunâtre. Tibias très comprimés (voir du reste le tableau).

Est-ce bien une race de la *P. mutata* (Smith) ? La description de Smith ne suffit pas pour le prouver, mais cela me parait probable. Smith en disant " entirely destitute of hair" aura negligé la pubescence, comme il le fait souvent quand elle est faible. La couleur ne concorde qu'à moitié et les tibias ne sont pas " without spines." Du reste la figure de Smith ne convient pas mal à notre type.

34. *P. binghamii*, n. sp.

Birmanie (Major Bingham).

♀ :—L : 5·5 Mill. Longueur d'un scape 2·1, d'un tibia postérieur 2·5 Mill. Epistome sans apparence de carène, avec un lobe court, trapéziforme, nullement échancré à son bord antérieur. Antennes faiblement mais visiblement renflées vers l'extrémité. Mésonotum légèrement concave. Tibias moins déprimés que chez la précédente. Voir du reste le tableau qui indique les autres caractères qui distinguent cette espèce de la précédente.

La *P. binghamii* est du reste extrêmement voisine de la *P. mutata* race : *ajax*, mais les caractères indiqués (antennes, forme de la tête, écailles, piquants, tibias, dimensions, &c.) sont assez importants pour que je croie qu'il faille l'en séparer spécifiquement.

35. *P. furcata* (Smith).

Sibsagar, Assam (Wood-Mason) ; Birmanie (Major Bingham) ; Tenasserim (Fea).

Les exemplaires de ces diverses provenances ont l'abdomen noir, tandis que le type de Smith (Birmanie) l'avait d'un roux testacé.

Race : *P. gracilior* n. st. (voir le tableau).

Trevandrum (H. Ferguson) ; Sibsagar, Assam (Wood-Mason).

36. *P. rupicapra* (Roger).

Ceylon (d'après Roger).

37. *P. tubericeps*, n. sp.

Barrackpore et Benares (Rothney).

☿ :—L : 6·8 à 7 Mill. Voisine de la *P. rupicapra* et de la *P. spinigera*, dont elle se distingue cependant du premier coup par le tubercule proéminent situé de chaque côté de la tête, un peu en dessus de l'angle postérieur. Epistome subcaréné, avec un lobe court et étroit, subbidenté. Sculpture grossière beaucoup plus forte que chez la *P. simplex*. Tibias cylindriques, sans petits

piquants. Les deux dents, entre les épines de l'écaille, sont très pointues. Epines métanotales fort distantes à leur base. La fine sculpture réticulée-ponctuée est très dense. Couleur absolument noire partout. Un peu plus robuste que la *P. simplex.*

38. *P. armata* (Le Guillou).

Polyrachis pandarus (Smith).

Polyrachis defensus (Smith).

Birmanie (Major Bingham et Fea) ; Sibsagar, Assam (Wood-Mason), Myingyan, Birmanie inférieure (E. Y. Watson).

var : *minor* (Forel).

Sibsagar, Assam (Wood-Mason).

39. *P. simplex* (Mayr).

Polyrachis spinigera (Mayr).

Poona District (R. Wroughton) ; Calcutta et Barrackpore (Rothney) ; Mussoorie, N.-W. P. (Rothney) ; Thana District (F. Gleadow) ; Siwaliks, N .W. P. (H. M. Phipson) ; Birmanie (Major Bingham) ; Trincomali, Ceylon (Major Yerbury) ; Myingyan, Birmanie inférieure (E. Y. Watson).

Certainement l'espèce la plus commune du genre en Inde.

♀ :—L : 7 Mill. Ailes subhyalines, faiblement teintées de jaunâtre. Le pronotum n'a que deux dents triangulaires fort petites. Mésonotum et scutellum avec une grossière ponctuation espacée, en partie un peu effacée, outre la dense ponctuation réticulaire. Sur la tête, le métathorax et le prothorax, de grossières ponctuations divisent la fine ponctuation réticulaire en groupes. Du reste comme ☿.

Var : *obsoleta* n. var.

Poona (R. Wroughton).

40. *P. bicolor* (Smith).

Barrackpore (Rothney) ; Birmanie (Major Bingham).

41. *P. dives* (Smith).

Pegu Hills, Birmanie (Major Bingham) ; Tounghoo, Birmanie (E. Y. Watson) ; Ceylon (Major Yerbury) ; Bangkok (Sigg) ; Hongkong (Dr. Ris) ; Singapore (d'après Smith).

42. *P. affinis* (Smith ; nec Le Guillou).

Polyrachis vicina (Roger).

Birmanie (d'après Smith).

43. *P. argentea* (Mayr).

Kanara (E. H. Aitken).

Variété à thorax un peu moins convexe et à stature un peu moins robuste que les types de Manille que je dois à l'obligeance de mon ami le Prof. Emery.

♀ :—L : 6·5 Mill. Comme ☿, mais les épines plus courtes. Ailes brunâtres, a nervures bien marquées.

♂ :—L : 5 à 5·5 Mill. Pubescence plus grisâtre et moins dense, n'ayant qu'un faible reflet argenté. Ecaille arrondie, ayant à peine deux angles latéraux arrondis. D'un noir en partie un peu brunâtre. Pattes d'un brun jaunâtre. Pas trace d'épines. Métanotum arrondi. Mandibules sans dents. Epistome subcaréné. Tête aussi large que longue.

44. *P. tibialis* (Smith).

Barrackpore, près Calcutta (Minchin) ♀ ; Birmanie (Major Bingham).

M. E. H. Aitken et M. Bell ont récolté à Kanara des exemplaires qu'il est difficile à rapporter à la *tibialis* ou à l'*argentea*, car ils forment assez le passage, de sorte que je pense qu'on en viendra à considerer l' *argentea* comme race de la *tibialis*.

Dans le tableau j'ai été obligé de ne tenir compte que des espèces qui me paraissaient assez nettement décrites pour pouvoir être déterminées. Il reste plusieurs espèces de l'Inde et de Ceylon qui sont indéchiffrables, ainsi que d'autres dont la ♀ seule est décrite, ce qui ne permet pas de fixer leur identité, ni leur position dans la systématique. Voici la liste de ce reste dont on ne sait que faire :—

45. *P. hastata* (Latreille).

Indes orientales.

S'agit-il de l'Inde continentale ? C'est peu probable, car c'est à Celebes qu'on a retrouvé plus tard cette espèce.

46. *P. relucens* (Latreille).

Ne se trouve probablement pas sur le continent Indien, ni à Ceylan.

47. *P. sexspinosa* (Latreille).

Ne se trouve probablement pas sur le continent Indien, ni à Ceylan.

48. *P. nidificans* (Jerdon).

Indéchiffrable.

49. *P. sylvicola* (Jerdon).

Indéchiffrable.

50. *P. lacteipennis* (Smith).

♀ Seule décrite.

51. *P. hector* (Smith).

Insuffisament décrite.

52. *P. piliventris* (Smith).

♀ Seule décrite.

53. *P. flavicornis* (Smith).

Insuffisament décrite.

54. *P. modesta* (Smith).

♀ Seule décrite.

55. *P. carbonaria* (Smith).

Indéchiffrable.

56. *P. nigra* (Mayr).

♀ Seule décrite.

57. *P. acasta* (Smith).

D'après Forel, Indian Ants, Part II. Je doute maintenant d'avoir eu la veritable *P. acasta* sous les yeux. Je n'ai plus l'exemplaire de Sibsagar sur lequel j'ai fait cette détermination mais je soupçonne qu'il s'agissait de la *P. tibialis.*

Les déterminations provisoires dont M. Wroughton s'est servi dans son travail " Our Ants " doivent subir quelques modifications.

La *P. lævior* race : *debilis* de ce travail est la *P. rastellata.*

La *P. chalybea* est la *P. venus.*

Une partie des *P. argentea* (Barrackpore) sont la *P. tibialis.*

La *P. indica* est synonyme de *clypeata.*

La *P. sumatrensis* est la race : *P. hamulata* (Emery).

La *P. sp.* (40) est la *P. tubericeps.*

La *P. spinigera* (Mayr). Se trouve être synonyme de la *P. simplex* (Mayr). Les ♀ récoltées par M. Wroughton m'ont amené à établir cette synonymie.

NIDS DES POLYRACHIS.

Dans un travail récent sur les nids des fourmis (Die nester der Ameisen, Zürich, 1892, Neujahrsblatt der Naturf : Gesellsch) : j'ai parlé des différentes manières dont les fourmis font leurs nids. Dans " Our Ants " M. Wroughton a décrit divers nids de fourmis des Indes. Il a eu l'obligeance de m'en envoyer un grand nombre.

Le nid des *Polyrachis* est unique en sont genre, et se distingue de celui de tous les autres genres de fourmis, en ce qu' il n'a qu'une seule cavité, tapissée de soie, comme le nid d'une arraignée.

J'ai été frappé du fait que ces nids présentent évidemment des faits de mimétisme qui servent à les rendre cachés. Ils simulent souvent la couleur des féuilles en partie sèches (*P. argentea*) ou l'aspect d'une feuille tordue par les galles d'autres insectes (*P. scissa*). Dans le nid de la *P. argentea* que je viens de recevoir de M. Wroughton, on peut bien observer comment les fourmis tapissent la feuille de soie pure, tandis qu'elles recouvrent la partie libre du nid de débris végétaux grisâtres, fixés à la surface extérieure des tissus, de façon à donner à cette portion du nid, qui ferme l'aperture de la feuille à demi ouverte, l'aspect grisâtre de la portion desséchée d'une feuille en partie morte. L'ouverture par laquelle sortent les fourmis est situeé à une place cachée, là où le tissus de soie touche la feuille.

Un nid de *P. rastellata* était situé entre deux feuilles et ainsi entièrement caché.

Les *Polyrachis* ne paraissent pas tous faire des nids de soie filée ; c'est surtout le fait des groupes *armata* et *ammon.* La *P. mayri* fait un nid en carton qui rappelle celui des *Dolichoderus* et des *Cremastogaster*, et dont les matériaux sont unis par une substance gluante, non filée, mais évidement sécrétée, comme la soie, par les glandes mandibulaires des fourmis.

The illustrations for this paper (*Plates K, L and M*) will be issued in a subsequent number of the Journal, as soon as they arrive from England. The paper is published at once at the special request of the author.—*Ed.*

ON NEW AND LITTLE-KNOWN BUTTERFLIES FROM NORTH-EAST SUMATRA COLLECTED BY HOFRATH Dr. L. MARTIN.*

By Lionel de Nicéville, F. E. S., C. M. Z. S., &c.

(*With Plates K, L, and M.*)

All the butterflies described below were obtained by Hofrath Dr. L. Martin in North-East Sumatra, the rarer ones almost entirely from the little-known Battak Mountains. Dr. Martin has already enriched my collection with 265 species from Sumatra, and has sent me a list giving the names of 324 species contained in his own collection. All of these were collected within a comparatively small radius, so that it may probably be safely assumed that when the whole island is explored and thoroughly collected over, it will be found that fully 600 species inhabit it, of which perhaps 50 may be endemic. The only papers of which I am aware written solely on the butterflies of Sumatra are by Heer P. C. T. Snellen, and are as follows :—

I. "Tijdschrift voor Entomologie," vol. xx, p. 65 (1877), enumerating 35 species.

II. "Tijdschrift voor Entomologie," vol. xxxiii, p. 215 (1890), enumerating 48 species.

III. "Midden-Sumatra, Lepidoptera" (1892), enumerating 104 species.

Family NYMPHALIDÆ.

Subfamily Danainæ.

1. DANAIS (*Caduga*) TYTIOIDES, n. sp., Pl. K, Figs. 1, ♂ ; 2, ♀.

Habitat : Battak Mountains, Sumatra.

Expanse : ♂, 3·2 to 3·5 ; ♀, 4·0 inches.

Description : Male. Upperside, *forewing* black, with the following pale bluish hyaline markings :—the posterior half of the discoidal cell bearing anteriorly and outwardly a fine black line ; two small oval costal spots divided by the second subcostal nervule ; followed by a very short and narrow streak in the subcostal interspace ; then another streak twice as broad and three times as long as the one above it in the upper discoidal interspace ; an oval spot in the lower discoidal interspace ; two nearly equal-sized spots in the upper median interspace, the outer spot rectangular, the inner triangular ; two similar spots in the lower median interspace, except that the inner spot of the two is twice as large as the outer one ; a very large streak occupies nearly the whole of the

* A short preliminary description of the new species described in this paper appeared in vol. vii, page 555, of this Journal.

submedian interspace from its base to one-fourth from the margin; a narrow streak in the sutural area from the base reaching to one-fourth from the outer margin; a curved submarginal series of seven rounded spots; a few obscure marginal dots towards the anal angle. *Hindwing* with the outer third castaneous darkening to the margin, the rest of the wing pale hyaline bluish; the discoidal cell bears outwardly two narrow castaneous streaks; two small subapical round bluish spots divided by the second subcostal nervule; the usual secondary sexual characters of the subgenus at the anal angle. UNDERSIDE, *forewing* marked as above, but the black ground-colour at the apex and outer margin tinted with dull castaneous. *Hindwing* as above, but the outer margin bears an anterior decreasing submarginal series of small round spots, and an incomplete (not reaching the apex) marginal series of dots. FEMALE, differs from the male only in its much broader wings, the outer margin of the *forewing* slightly, instead of deeply, emarginate, the *hindwing* has the outer margin rounder, less obliquely cut off, and the castaneous colouring much redder; the male secondary characters, of course, are absent.

Allied to, but quite distinct from, *D. tytia*, Gray, which occurs throughout the Himalayas, Assam, Burma, with a slight variety in the Malay Peninsula. Differs therefrom in its much smaller size, conspicuously narrower wings, the male has the outer margin of the forewing much more deeply excavated, the hindwing with the outer margin nearly straight instead of rounded, greatly cut off obliquely; in both sexes the forewing has the hyaline portion of the cell less than half as wide, the streak in the subcostal interspace very small and narrow; the hindwing in the male deep dull castaneous instead of ferruginous.

Of the *D. tytia* group of the subgenus *Caduga* there are at present known, besides that species, *D. niphonica*, Moore, from Japan and doubtfully from Askold, North Formosa, and Chekiang, North China*; and *D. loochooana*, Moore, from the Loo Choo Islands. The occurrence of a fourth species so far south as Sumatra is very interesting.

D. tytioides is admirably mimicked by *Hestina carolinæ*, Snellen, an insular modified race of the continental Indian *Hestina nama*, Doubleday.

Described from three males and three females, which show but slight individual differences.

2. EUPLŒA (*Narmada*) MARTINII, n. sp., Pl. K, Figs. 3, ♂; 4, ♀.

HABITAT: Battak Mountains, Sumatra.

EXPANSE: ♂, 3·9 to 4·1; ♀, 4·1 inches.

* This species is entirely ignored by Mr. J. H. Leech in his "Butterflies from China, Japan, and Corea;" he considers that the species occurring in those regions is *D. tytia*, and records it from "China common, is found all over Japan, and has been recorded by Oberthür from the Isle of Askold."

DESCRIPTION: MALE. UPPERSIDE, *both wings* very deep and rich velvety dead black. *Forewing* with a minute costal white dot placed between the first and second subcostal nervules; four subapical spots—the uppermost small and oval placed between the fourth and fifth subcostal nervules, the second and third much larger and oval placed in the subcostal and upper discoidal interspaces, the fourth equal in size to the first placed in the lower discoidal interspace. In two specimens there is a fifth smallest spot on the costa placed between the third and fourth subcostal nervules. This series of spots is placed obliquely outwards and appears to run into and coalesce with the marginal series at the eighth spot (counting from the apex),which latter series consists of fourteen small spots, decreasing in size from the inner angle to the apex, placed in pairs in the interspaces; the two sexual brands as usual in the submedian interspace—the upper short and narrow, the lower broad and twice as long as the upper. *Hindwing* with the costal area broadly whitish, followed by a broad pale castaneous area reaching to the middle of the discoidal cell, the abdominal area fuscous, all the rest of the wing deep black as in the forewing; a marginal series of thirteen rounded spots, with an inner series of seven spots from the second subcostal nervule to the submedian nervure. In two specimens these two series of spots, instead of being quite distinct and well separated, completely coalesce and form short streaks. UNDERSIDE, *both wings* olivaceous-fuscous, the marginal series of spots as on the upperside. *Forewing* with an additional small spot at the lower outer end of the discoidal cell, two on the costa making a complete series one in each interspace divided by the subcostal nervules, and two in each median interspace; the inner margin broadly shining fuscous. *Hindwing* with two additional spots to the inner marginal series placed anteriorly, and a dot in the second median interspace just beyond the end of the cell. *Cilia* of both wings alternately black and white in equal proportions. FEMALE. UPPERSIDE, *both wings* very much paler than in the male, black, but not of a deep, rich, velvety shade. *Forewing* with three costal spots in a cluster; a complete submarginal series of eight spots; two small spots in the median interspaces; the marginal series of spots as in the forewing, but rather larger. *Hindwing* with the two marginal series of spots almost entirely coalesced into streaks; only anteriorly are they free. UNDERSIDE, *both wings* coloured as in the male. *Forewing* as on the upperside, but the two spots in each of the median interspaces larger; the inner margin broadly white; a short white streak in the submedian interspace. *Hindwing* as on the upperside, but with an additional spot at the outer end of the cell, and a complete series of five beyond the cell—one in each interspace.

I know of no species with which this can be compared. The beautiful deep velvety black of the male on the upperside is only matched, as far as I know,

by the same sex of *E.* (*Anadara*) *gamelia*, Hübner, from Java. The coalescing of the submarginal with the marginal series of spots on the forewing in the male is, I believe, quite a unique character.

Described from four males and two females in my own collection; several others of both sexes are in that of Hofrath Dr. L. Martin, after whom I have great pleasure in naming the species as a slight tribute to his entomological knowledge, zeal, and enterprise in sending natives into the mountains of Sumatra to collect in spots inaccessible to Europeans.

Subfamily SATYRINÆ.

3. LETHE DARENA, Felder, Pl. K, Fig. 7, ♂.

Debis darena, Felder, Reise Novara, Lep., vol. iii, p. 498, n. 862, pl. lxviii, figs. 4, 5, *female* (1866).

HABITAT: Java (*Felder*); Sumatra.

EXPANSE: ♂, 2·8 to 3·1 inches.

DESCRIPTION: MALE. UPPERSIDE, *forewing* black, but the basal three-fourths overlaid with long hair-like rich ferruginous scales; an orange-coloured spot on the costa beyond the end of the discoidal cell; a round whitish spot at the apex; five marginal rich ferruginous spots one in each interspace from the lower discoidal nervule to the inner margin, the series of spots gradually, but regularly, approaching the outer margin of the wing—the posterior spot on the margin at the anal angle, the anterior spot well removed from it. *Hindwing* with the base fuscous, but so heavily overlaid with long ferruginous setæ as to almost entirely hide the ground-colour, the outer half of the wing rich ferruginous free of long hairs; a submarginal series of five almost blind round black ocelli, the uppermost ocellus much the largest, the middle one quite small in one specimen, but in two other specimens the three posterior spots are equal-sized; the second spot anteriorly second also in point of size; two submarginal closely approximated dark brown lines. UNDERSIDE, *both wings* richly variegated, the ground-colour purplish-brown. *Forewing* with a broad rich deep brown bar across the discoidal cell at about its middle; a still broader bar beyond; a chevron-shaped mark across the submedian interspace at the point where the first median nervule originates, with its angle outwards; a broad discal irregular band immediately beyond the outer end of the cell, commencing on the costa, ending in the middle of the submedian interspace; a narrower, decreasing, pale purplish-white band placed outwardly against the first band; followed by a large rich deep brown triangular area, its base on the costa, its apex in the first median interspace; two whitish apical spots; posterior to which in the discoidal interspaces are two perfect ocelli, the upper twice as large as the lower; two submarginal rich deep brown lines ending posteriorly about the first median nervule, the inner line lunulated, the outer straight; the submedian interspace

outwardly beyond the chevron mark rich chrome-yellow, this colour outwardly extending into the interspace on either side of the submedian one. *Hindwing* with a broad discal rich deep brown band crossing the middle of the cell, widest on the costa, dislocated and slightly shifted outwardly posterior to the cell, fading away to nothing in the submedian interspace; a broad outer discal irregular similar band, anteriorly it curves round the large anterior ocellus and throws out inwardly a spur placed on the lower disco-cellular nervule, ending posteriorly on the submedian nervure; a submarginal series of six perfect ocelli, the anterior one much the largest, the fifth the next largest, the second, fourth and sixth the next in size and equal-sized, the third the smallest, the sixth bipupilled; two submarginal lines—the inner one broad and deep red, the outer narrow and deep brown; *cilia* pale yellow inwardly defined by a fine dark thread. *Antennæ* with the shaft red, the club black with a red tip.

Described from three male examples obtained in the Battak Mountains. The species was originally described from a female example. It is the most beautiful species of the genus known to me, and is probably very rare, as out of some thousands of Javan butterflies I have received, I have not found *L. darena* amongst them.

Subfamily NYMPHALINÆ.

4. TERINOS TEOS, n. sp., Pl. K, Figs. 5, ♂; 6, ♀.

HABITAT: Sumatra.

EXPANSE: ♂, 2·85; ♀, 2·90 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich shining purple, all the veins more or less narrowly defined with reddish-ochreous. *Forewing* with the usual velvety-black shining sexual patch occupying half the surface, commencing on the inner margin at less than half the length of the margin from the base and reaching the anal angle, reaching to the lower discoidal nervule, and extending on the disc along the first median nervule and submedian nervure, but never quite touching the discoidal cell; a similar black streak extends broadly along both sides of the upper discoidal nervule. *Hindwing* with a large velvety-black shining sexual patch at the apex, ending abruptly at the second subcostal nervule; the outer margin rather, and the abdominal margin very, broadly fuscous. *Cilia* of the hindwing reddish-ochreous, of the forewing posteriorly reddish-ochreous, anteriorly black. UNDERSIDE, *both wings* castaneous, crossed by numerous more or less zigzag shining pale purple lines. *Forewing* with a round white subapical spot. *Hindwing* with a discal series of five oval deep castaneous spots, one in each interspace from the submedian to the upper subcostal, except the discoidal which lacks a spot, the middle spot the smallest. FEMALE. UPPERSIDE, *both wings* fuscous. *Forewing* with the basal area extending just beyond the disco-cellular nervules rich shining purple; a broad discal somewhat obscure dark fuscous fascia outwardly touched with the purple

colour; a submarginal narrow waved similar fascia, the outer margin, especially at the apex, broadly dark fuscous. *Hindwing* with the base and a large discal area rich shining purple, the latter area inwardly bounded by the false termination to the discoidal cell, anteriorly by the second subcostal nervule, posteriorly by the first median nervule, outwardly not reaching the margin; a waved, rather broad, submarginal line. UNDERSIDE, *both wings* as in the male, but the ground-colour and the shining pale purple lines all paler.

Nearest to *T. robertsia*, Butler, from the Malay Peninsula, from which it differs conspicuously in both sexes in lacking the two white (sometimes tinted with ochreous) spots on the upperside of the hindwing near the outer margin in the upper median and discoidal interspaces; and on the underside of the hindwing in having the marginal narrow slightly waved line, and the submarginal highly waved broad line, pale purple throughout, in *T. robertsia* they are white.

Mr. A. R. Wallace describes a "*Local form* **A**" of *T. robertsia* from Sumatra* thus :—"Browner [than *T. robertsia*], with the blue portions more violet, and the white posterior spots replaced by rufous." In *T. teos* these spots are barely traceable. "The [lower] disco-cellular [nervule of the forewing] meets the median nervure at the origin of the second median nervule." In the four specimens of *T. teos* and eight of *T. robertsia* before me as I write, I find that the lower disco-cellular nervule of the forewing, though varying a hundred per cent. in position, always meets the median nervure well before the origin of the second median nervule, which agrees with Mr. Wallace's remarks on the neuration of the latter species, and would appear to separate his *Local form* **A** and my *T. teos* from it. It is interesting to note that *T. atlita*, Fabricius, and *T. teos*, de Nicéville, differ precisely in the same way, *i.e.*, in the absence of the white spots on the upperside of the hindwing, these spots being present in their Malay Peninsula correlatives, *T. teuthras*, Hewitson, and *T. robertsia*, Butler.

Described from three male specimens in my own and one female in the collection of Dr. L. Martin.

5. ATHYMA ASSA, n. sp., Pl. K, Fig. 8, ♂.

HABITAT : Battak Mountains, Sumatra.

EXPANSE : ♂, 2·3 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* black. *Forewing* with the following milky-white markings :—a very narrow streak in the discoidal cell extending beyond it but for a very short distance; three narrow subapical spots, the middle one the largest; a large oval spot in the first median interspace, a quadrate one below it filling the interspace and indented at both sides, a small elongated spot on the sutural area, these three spots outwardly marked with pale blue; a discontinuous submarginal whitish line, broken in the upper

* Trans. Ent. Soc. Lond., 1869, p. 342. Heer P. C. T. Snellen also records *T. robertsii* (sic) from Sumatra in Tijd. voor Ent., vol. xxxiii, p. 218 (1889-90).

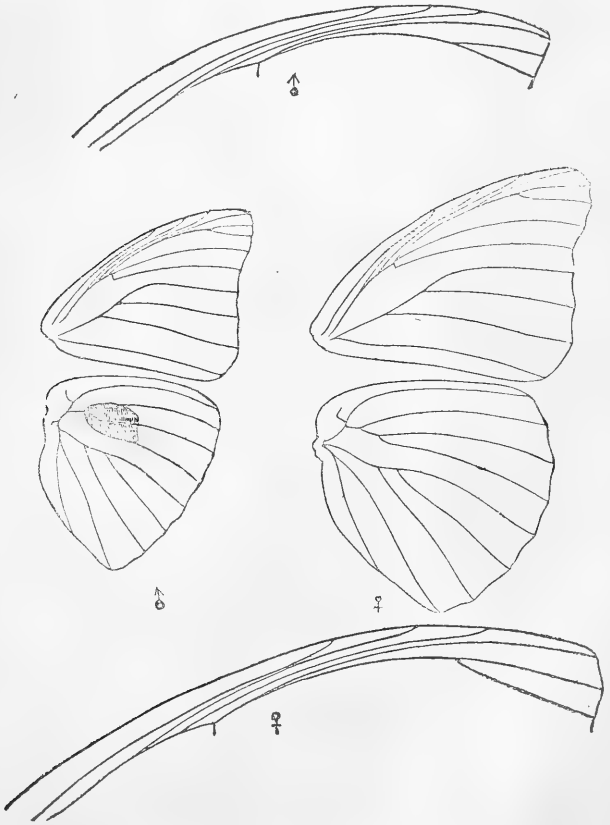
median interspace, being there curved inwards towards the base of the wing; a very indistinct pale marginal line. *Hindwing* with a broad, outwardly-blue-edged, discal white band, commencing broadly at the costal nervure, increasing in width to the submedian nervure, where it terminates; a prominent but narrow submarginal band, divided into spots by the veins, gradually increasing in width from the costa to the submedian nervure, where it ends; a pale indistinct marginal line. UNDERSIDE, *both wings* reddish-brown, all the white markings more prominent than above, and tinted with shining bluish. *Forewing* has the three subapical spots joined to the submarginal line; an oval black spot in the submedian interspace, placed internally at the base of the first median nervule; a diffused blackish spot in the same interspace between the large discal white spot and the submarginal line. *Hindwing* with an additional curved basal white streak, placed anterior to the costal nervure; the abdominal margin broadly metallic greenish. *Cilia* of both wings black, bearing a white dot in the middle of each interspace. *Abdomen* at the base above with a broad bluish-white band.

Nearest to *A. nivifera*, Butler, from Nepal and Assam (sic, *Butler*), the Malay Peninsula, Sumatra, Nias, and Borneo. Differs from Straits and Sumatran specimens in having the discoidal streak of the forewing narrower and much shorter, the three subapical spots half as wide, the two posterior of the discal spots narrower, thereby all combining to make the black ground-colour of the wing of considerably greater extent. In the hindwing the discal band is broader, and instead of ending anteriorly in a small round spot, it is continued uninterruptedly and widely to the costal nervure. The first subcostal nervule of the hindwing on the upperside is black not prominently snow-white as it is in *A. nivifera*. On the underside of both wings the ground-colour is reddish-brown or castaneous, not hair-brown; in the forewing the discoidal streak is longer and quite undivided; there are no black streaks placed on the ground-colour between the veins, on the hindwing the discal band is wider, especially so at each end, and the series of rounded blackish spots between the discal and submarginal bands in *A. assa* is larger, more diffused, and deep castaneous instead of blackish. I have not seen *A. nefte*, Cramer, from Java, but that species is probably distinct from *A. assa* to judge from Mr. Moore's figures of it in Proc. Zool. Soc. Lond., 1858, p. 13, n. 7, pl. l, fig. 5, *male* and *female*. *A. reta*, Moore, from Sumatra, is another closely allied species, but differs apparently from *A. assa* in the forewing in having the terminal spot well separated from the rest of the discoidal streak, in the presence of an additional spot in the second median interspace, and in the hindwing in having the discal band widest on the costa, narrowest on the abdominal margin, while in *A. assa* the reverse is the case.

Described from two male specimens in my collection.

Genus EUTHALIA, Hübner; subgenus NORA, nov.

MALE. Differs from the subgenus *Felderia*, Semper, in the FOREWING being shorter, the *apex* acute, not truncate, the *outer margin* slightly, instead of strongly, excavated below the apex, the *inner margin* straight, not outwardly bowed, all the *subcostal nervules* free, instead of the first anastomosing with the costal nervure. HINDWING very triangular, the anal angle forming the apex of the triangle, instead of almost quadrate; a patch of shining glandular black scales at the base of the costa occupying the base of the subcostal interspace, anteriorly bounded by the costal nervure, posteriorly by the second subcostal nervule, the "male mark" being almost similar to that in *Felderia*, but is not perhaps quite so dense or conspicuous. FEMALE. FOREWING shaped much as in the male, the *apex* not quite so acute; the *first subcostal nervule* anastomosing with the costal nervure as in both sexes of *Felderia*. HINDWING broad, quadrate, shaped as in *Felderia*. Type, the "*Adolias*" *kesava*, Moore.



EUTHALIA (*Nora*) KESAVA, Moore.

This subgenus will comprise the following species :—

Euthalia (*Nora*) *kesava*, Moore.
,, ,, *discispilota*, Moore. } Probably one species.
,, ,, *rangoonensis*, Swinhoe. }
,, ,, *ramada*, Moore.
,, ,, *decorata*, Butler.
,, ,, *bipunctata*, Vollenhoven.
,, ,, *salia*, Moore.
,, ,, *erana*, de Nicéville.
,, ,, (?) *laverna*, Butler.
,, ,, *lavernalis*, de Nicéville.

All these species I possess, except *E. laverna* and *E. lavernalis*. There are probably other described species which should also be included in the list which I have not seen. The subgenus is a very compact and natural one, all the species being closely allied.

I give below a key to the subgenera which I would admit in the genus *Euthalia*. To my mind there is something peculiar and distinctive in all *Euthalias*. As far as is known, their transformations are similar, and in the field they have the same habits. They have a bold flight, settle with wings both closed and open, the former more especially when alarmed. They are particularly partial to the juices of over-ripe fruit. I deprecate as much the splitting up this genus into numerous genera as I do those of *Danais*, *Euploea*, *Lethe*, *Mycalesis*, *Neptis*, *Charaxes*, *Papilio*, and others. At the same time, for classificatory purposes, it is most convenient to institute subgenera for the various groups into which the above-named and other large genera can be divided. If these subgenera be raised to the rank of genera, at once all connection between them appears to be lost, a *Dophla* becomes as good a genus as an *Euthalia*, this being very far from the case, while *Dophla*, *Euthalia* and, say, *Charaxes* are all genera of equal rank, which misrepresents the facts, as *Charaxes* is entirely distinct from the other two, which latter are closely allied.

Key to the subgenera included in the genus Euthalia.

A. Forewing with the discoidal cell closed.
  a. Forewing, apex much produced.
    1. DOPHLA, Moore, type *E. evelina*, Stoll.
  b. Forewing, apex not produced, the outer margin slightly concave.
    2. LEXIAS, Boisduval, type *E. æropus*, Linnæus.

B. Forewing with the discoidal cell open.
  a. Male, hindwing, upperside with a glandular patch of black scales below the costa.

a 1. Male, forewing, apex produced, truncate, the outer margin deeply excavated, first subcostal nervule anastomosed with the costal nervure ; hindwing quadrate.

3. FELDERIA, Semper, type *E. phlegethon*, Semper.

b 1. Male, forewing, apex not produced, acute, the outer margin not deeply excavated, first subcostal nervule free from the costal nervure ; hindwing triangular.

4. NORA, de Nicéville, type *E. kesava*, Moore.

b. Male, hindwing, upperside with no "male-mark."

a 1. Palpi with third joint not slenderly produced, bristle-like.

a 2. Hindwing triangular, anal angle produced.

5. EUTHALIA, Hübner, type *E. lubentina*, Cramer.

Aconthea, Horsfield, type *E. primaria*, Horsfield,=*E. aconthea*, Cramer.

Adolias, Boisduval, type *E. aconthea*, Cramer.

Itanus, Doubleday, type *E. phemius*, Doubleday and Hewitson.

b 2. Hindwing quadrate, anal angle rounded, not produced.

6. SYMPHÆDRA, Hübner, type *E. thyelia*, Fabricius,=*E. nais*, Forster.

b 1. Palpi with third joint slenderly produced, bristle-like.

7. TANAËCIA, Butler, type *E. pulasara*, Moore.

6. EUTHALIA (*Nora*) ERANA, n. sp., Pl. L, Figs. 1, ♂ ; 2, ♀.

HABITAT : Sumatra.

EXPANSE : ♂, 2·3 ; ♀, 2·7 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* dark brown. *Forewing* with the usual black linear markings in and below the discoidal cell ; a whitish brown-sullied discal lunular band, consisting of six portions, the two uppermost the widest, the third subequal to the fifth, the fourth rather smaller than the first and second, the sixth duplicated ; this band bears outwardly a fine highly lanceolate white line, itself outwardly narrowly defined with black ; the outer margin towards the anal angle paler than the rest of the wing. *Hindwing* with the usual black markings in the cell ; a broad discal white band from the costa where it is widest to the submedian nervure, bearing a prominent highly lanceolate narrow black line, which anteriorly divides the band almost equally, but posteriorly approaches the outer border of the band ; the outer margin broadly from the anal angle, but decreasingly towards the apex of the wing, blue, the posterior interspace green ; the three apical interspaces marginally of the colour of the ground ; the abdominal margin greenish-white. UNDERSIDE, *both wings* rich ochreous, with the usual basal black markings. *Forewing* with the discal band of the upperside but bluish-white, prominently outwardly defined with black. *Hindwing* with an even discal bluish-white

band, outwardly defined with the lunulated blackish line of the upperside ; the abdominal margin tinted with bronzy-greenish. FEMALE. UPPERSIDE, *both wings* much paler than in the male, dull ochreous-brown ; with the discal whitish band much as in the male, but with no outer blue band on the *hind-wing*. UNDERSIDE, *both wings* almost precisely like the male, except that the outer margins are tinted with opalescent-whitish.

Nearest to *E. salia*, Moore, from Java,* from which *E. erana* differs in the male on the upperside of the forewing in the discal band not being "margined outwardly with dull blue," and on the hindwing in having the lanceolate black line much more deeply zigzagged, the discal white band twice as broad. The female differs on the upperside of the hindwing in having the discal white band much less prominent, sullied with brownish instead of pure white, and considerably narrower.

The species figured as *E. laverna* by Butler in his "Lepidoptera Exotica," p. 174, pl. lx, fig. 5, *male* (1874), from Borneo, appears to be another closely allied species, differing at a glance from *E. erana*, however, in the discal band of the hindwing on the upperside in the male being blue instead of white, and with no blue region beyond. It is very close to *E. decorata*, Butler, but, as figured, has the discal band of the forewing on the upperside anteriorly composed of a double series of pure white highly angled lunales, while in *E. decorata* the band throughout is sullied with fuscous. As Mr. Butler has elected to consider the female of his *E. laverna* from Penang and Malacca as the type of his species (both sexes of which are described and figured by Mr. Distant in his "Rhopalocera Malayana"), I propose to name the male figured by Mr. Butler, *Euthalia lavernalis*, as it is at present unnamed.

E. erana is described from a single pair of specimens in my collection.

7. EUTHALIA (*Tanaëcia ?*) ELONE, n. sp., Pl. L, Fig. 3, ♂.

HABITAT : Battak Mountains, Sumatra.

EXPANSE : ♂, 2·7 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* dark hair-brown or fuscous. *Forewing* with the usual linear black markings in and beneath the discoidal cell ; a discal very obscure pale band, to be seen only in some lights, broad on the costa, rapidly diminishing in width to the third median nervule ; the anal angle bearing three increasing metallic green spots divided from the margin by a fine line of the ground-colour and from each other by the veins.

* Heer P. C. T. Snellen in Tijd. voor Ent., vol. xxxiii, p. 217 (1890), records "*Adolias*" *salia* from Sumatra, but the species here described was apparently not recognized by him as a species distinct from *E. salia*.

Hindwing with the usual linear black markings in the cell; a discal series of six small obscure black spots, followed by a broad submarginal pure white band crossed by the black veins, decreasing in width at either end, bounded anteriorly and posteriorly by a narrow metallic green line, both lines increasing in width towards the abdominal margin where they meet in a point, the anterior line through four interspaces divided from the broad submarginal white band by narrow lunules of the ground-colour; abdominal margin broadly pale fuscous. *Cilia* of both wings very narrow, white. UNDERSIDE, *forewing* reddish-brown; the discoidal black markings very prominent; a discal irregular lunulated black band; a slightly curved submarginal series of six increasing round black spots; the apex and outer margin decreasingly pale violet. *Hindwing* pale violet, the outer margin fuscous; the white submarginal band as above, inwardly bounded by a series of round black spots between the veins, the innermost spots linear, recurved to the abdominal margin; followed by a series of four linear black spots from the third median nervule to the submedian nervure; then an angulate series of eight spots extending right across the disc of the wing, the discoidal cell and the base marked with numerous black spots.

Nearest to *Tanaëcia nicévillei*, Distant, from Perak, the type and two males of which I am able to compare with *T. elone*, differing conspicuously on the upperside of the forewing in having a very small metallic green area at the anal angle instead of a large blue area, and on the hindwing in having a large submarginal pure white band defined on both sides by metallic green, and not reaching the outer margin, not bearing a series of black spots at its middle, instead of a much broader blue band extending right up to the outer margin. On the underside of the hindwing the black macular markings are very well marked and prominent, much more so than in *T. nicévillei*, and the white band is again a conspicuous differential character. *E. zichri*, Butler, from Sarawak (Borneo) and Malacca, appears to be another allied but quite distinct species.

Can the genus *Tanaëcia* be retained as a full genus? As at present understood it contains a very heterogeneous collection of euthaliad butterflies; but, as Mr. Doherty has pointed out,* the one character by which I once thought it could be separated from *Euthalia*, *viz.*, by the anastomosis of the first subcostal nervule with the costal nervure of the forewing, has been shown by him to be utterly inconstant, even in the same species, and there appears to be, therefore, no other generic character left, unless the slender bristle-like terminal joint to the palpi be considered of sufficient generic significance, but, as far as my collection goes, only *T. pulasara*, Moore, which is the type of *Tenaëcia*, *T. aruna*, Fe.der, and *T. martigena*, Weymer, possess this feature, all the other so-called

* Jour. A. S. B., vol. lviii, pt. 2, p. 121 (1889).

Tanaëcias, including *T. nicevillei* and *T. elone*, have the palpi normal and as in typical *Euthalia*. At best *Tanaëcia* can, I think, only be retained as a subgenus.

E. elone is described from a single specimen in Dr. L. Martin's collection.

8. CYRESTIS (*Chersonesia*) CYANEE, n. sp., Pl. L, Figs. 6, ♂; 7, ♀.

HABITAT : Battak Mountains, Sumatra.

EXPANSE : ♂, ♀, 1·65 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* rich deep orange. *Forewing* with a short black basal line ; two subbasal lines filled in with fuscous ; the disco-cellular nervules enclosed by two exceedingly fine lines, the space between them of the ground-colour, these two lines themselves enclosed in two other lines filled in with fuscous ; a broad discal single line ; a pair of submarginal lines enclosing two short lines, the anterior of these placed between the discoidal nervules, the posterior between the second median nervule and the submedian nervure ; a marginal line—all these black lines almost straight, and reaching from the costa to the inner margin. *Hindwing* with no basal line ; the two following pairs of lines as in the forewing, but the outer pair, instead of enclosing two fine disco-cellular lines, has a single line on its inner edge ; the discal and submarginal lines as in the forewing, but the latter pair enclosing a continuous broad black line, ending at the anal angle in two detached spots ; a marginal diffused line, and a very fine anteciliary line. UNDERSIDE, *both wings* as above, all the black markings very prominent, the two basal pairs of lines not filled in with fuscous, the ground-colour a trifle paler perhaps than on the upperside. FEMALE, much as in the male, but the wings broader, the ground-colour very much paler, all the black markings less intense.

Nearest to *C. risa*, Doubleday and Hewitson, which occurs from Kumaon to Assam, in Burma, and again in Java, but not in the Malay Peninsula ; differs therefrom in the male in its darker ground-colour, the two basal pairs of lines on the upperside being filled in with fuscous, the discal single line being much broader, and especially in the absence of all violet markings in the space enclosed by the submarginal pair of lines, this being a very conspicuous feature in *C. risa*. In the hindwing of *C. cyanee* these purple markings are replaced by a broad black line ; also in *C. risa* there is always a more or less conspicuous series of pale yellow triangular markings in both wings, but more especially in the hindwing, placed internally to the inner of the two submarginal lines, which is quite absent in *C. cyanee*.

Described from a single pair in my collection.

Family LEMONIIDÆ.

Subfamily NEMEOBIINÆ.

9. ABISARA AITA, n. sp., Pl. L, Fig. 10, ♂.

HABITAT : Battak Mountains, Sumatra.

EXPANSE : ♂, 2·1 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* dull hair-brown. *Forewing* with two pale, almost straight, discal bands, extending from the costa to the

inner angle, rather far apart on the costa, close together posteriorly, the inner band twice as wide as the outer; a short obscure fine marginal white line at the inner angle. *Hindwing* outwardly becoming pale brown; the outer third of the wing pure white, but apically and anally of the brown ground-colour; a small white spot at the apex, then two large jet-black spots divided by, and bounded anteriorily and posteriorly by, the rich ochreous terminations of the second subcostal, discoidal, and third median nervules, the anterior black spot surrounded on three sides by a white line, the posterior spot marked anteriorly and posteriorly by a white line; a rather large triangular brown spot at the base of the tail; a very small brown spot in the first median interspace; a duplicated jet-black spot divided only by the fold in the submedian interspace; a narrow black line at the anal angle along the margin, with similar, but still narrower, decreasing black lines in the three anterior interspaces; a very narrow marginal black line; *tail* white. *Cilia* of the forewing brown, of the hindwing pure white. UNDERSIDE, *both wings* with the ground-colour much paler than above, hoary at the base. *Forewing* with the discal lines more prominent than on the upperside, pure white; the fine white line at the inner angle more prominent. *Hindwing* marked much as above, but the outer white area is seen to bear inwardly an almost continuous brown line, it being broken only in the median interspaces, where it is represented by two brown spots, and is recurved to the abdominal margin above the anal angle.

In the ground-colour of the upperside, *A. aita* resembles *A. neophron*, Hewitson, but the two whitish bands of the forewing ally it more nearly to *A. savitri*, Felder, which also occurs in Sumatra. *A. aita* is abundantly distinct from all its allies by the presence of the large outer white area on both sides of the hindwing.

Described from two examples in my collection.

Family LYCÆNIDÆ.

10. YASODA PITANE, n. sp., Pl. L, Fig. 5, ♂.

HABITAT: Battak Mountains, Sumatra.

EXPANSE: ♂, 1·35 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich orange-yellow. *Forewing* with a very broad deep black outer border with its inner edge evenly curved, the border broadest at the apex, nearly three millimeters broad at the inner angle; a minute black dot in the second median interspace; the base of the wing powdered with dusky. *Hindwing* with more than the outer half of the wing deep black, this black area commencing very narrowly on the costa, then broadly on the outer margin as far as the discoidal nervule, when it is continued across the wing to the abdominal margin parallel with the costa; the

"male-mark" defined by a thin orange line; the base of the wing powdered with dusky; *tail* black. UNDERSIDE, *both wings* brownish-orange, with the usual annular fine macular markings. *Hindwing* powdered with violet and black in the anal area.

Nearest to *Y. pita*, Horsfield, which I have from Sumatra and Java, differing therefrom in the broader outer black margin to the forewing, and especially in having more than half the area of the hindwing black, in the male of *Y. pita* the outer margin alone is narrowly black, with a broad black streak along the "male-mark."

Described from a single male in my collection.

Family PAPILIONIDÆ.

Subfamily PIERINÆ.

11. DELIAS DANALA, n. sp., Pl. L, Fig. 9, ♂.

HABITAT: Battak Mountains, Sumatra.

EXPANSE: ♂, 2·2 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* dead chalky white. *Forewing* with the costa as far as the subcostal nervure dusky; the apex very broadly (extending, in fact, almost to the outer end of the discoidal cell), but rapidly decreasing to the anal angle, where it ends in a point, dusky, bearing three indistinct whitish spots between the veins anterior to the third median nervule. *Hindwing* with the outer margin posteriorly narrowly black, the black colour extending inwardly slightly between the veins in a dusky powdering. UNDERSIDE, *forewing* as above, but the veins outwardly, rather broadly, defined with black; there are also five subapical spots between the veins, of which the uppermost on the costa is very small, the next the largest and pale yellow, the three following decreasingly smaller and dusky white. *Hindwing* clear yellow, all the veins narrowly black, the outer margin with a rather broad blackish border, bearing five lunular spots between the veins, of which the three posterior ones are whitish, the two anterior yellow.

Nearest to *D. singhapura*, Wallace*, known to me by the figure and description only, from Singapore and Borneo, differs in its smaller size, that species being 3·12 inches in alar expanse, the forewing rounded, not conspicuously elongated, and with the apex rounded, not highly pointed; on the underside of the forewing the veins—especially the median nervure—are less broadly defined with black, the marginal spots are smaller and only five, instead of six, in number; on the hindwing the outer black border is narrower, less deeply black, the spots smaller, less distinct, entire, not divided by the internervular folds, five instead of six in number, the uppermost one of *D. singhapura* in the upper subcostal interspace being wholly wanting. Other allied species are *D. agoranis*, Grose

* Trans. Ent. Soc. Lond., third series, vol. iv, p. 353, n. 29, pl. vii, fig. 2, *male* (1867).

Smith, Rhop. Ex., vol. i., *Delias* I, figs. 7, 8, *male* (1889), from the Siamese frontier of Burma, and *D. kuehni*, Honrath, Berl. Ent. Zeitsch., vol. xxx, p. 295, pl. vi, fig. 2, *male* (1886), from Bangkai Island, near Celebes.

Described from a single example in Dr. Martin's collection.

12. DELIAS DERCETO, n. sp., Pl. L, Fig. 4, ♂.

HABITAT: Battak Mountains, Sumatra.

EXPANSE: ♂, 3·0; ♀, 2·7 to 3·4 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* deep black. *Forewing* with two white spots at the end of the discoidal cell defining the disco-cellular nervules; a submarginal series of seven oval whitish spots placed between the veins. *Hindwing* bearing a large, anteriorly white powdered with dusky, posteriorly pale primrose-yellow, area divided by the veins, occupying the outer end of the cell, this area is bounded outwardly by a broad black border, which at the anal angle dwindles away to nothing. UNDERSIDE, *forewing* with the ground-colour black, but with a large area from the inner margin extending on to the disc powdered with whitish; the discoidal and submarginal spots as above, but pure white, larger, and much more prominent. *Hindwing* with the immediate base of the wing black; then a broad curved rich crimson area, commencing on the costal nervure and ending on the abdominal margin, crossed by the black veins, slightly sprinkled with black scales; followed by a rather narrow highly irregular black band; the outer half of the wing pale chrome-yellow, gradually darkening to a deeper chrome in the two posterior interspaces, the veins crossing this area black, from the first median to the second subcostal nervule gradually outwardly dilated and forming between those veins a broad black border. FEMALE differs from the male only in the wings being somewhat broader, *forewing* with the apex more rounded.

Apparently nearest to *D. ninus*, Wallace*, from Mount Ophir, Malacca, Malay Peninsula, but unknown to me except by the original description and figure, from which it differs in its larger size, both wings much broader, the forewing on both sides less heavily marked, two discoidal and seven submarginal spots only, no basal bluish patches whatever, the hindwing with no crimson basal patch on the upperside; on the underside the crimson patch and the black band following it are twice as broad, thus reducing the chrome-yellow area in the discoidal cell by half. It is even more closely allied to *D. crithoë*, Boisduval, from Java, as identified by me, but may at once be known by the crimson band on the hindwing below being twice as broad, and with its outer edge evenly curved, instead of straight, and no discal white patch on the upperside of the forewing.

Described from one male and two females in my collection.

* Trans. Ent. Soc. Lond., third series, vol. iv, p. 347, n. 9, pl. vii, fig. 1, *male* (1867).

13. DELIAS DATAMES, n. sp., Pl. L, Fig. 8, ♂.

Habitat : Battak Mountains, Sumatra.

Expanse : ♂, 2·3 inches.

Description : Male. Upperside, *forewing* dead chalky-white ; the costa as far as the subcostal nervure, the apex very broadly reaching almost to the end of the discoidal cell, and the outer margin decreasingly, black, bearing a series of five prominent small round white spots, of which the fourth from the costa is the smallest, the fifth the largest ; the disco-cellular nervules defined with black. *Hindwing* white, but not of as pure a shade as in the forewing, the black colour of the underside appearing to show through by transparency, especially at the base of the wing, and broadly along the outer margin, where it may almost be said that the wing has a broad outer diffused blackish border, more intense anteriorly. Underside, *forewing* with the inner margin broadly white, gradually merging in the submedian interspace into the yellow colour of the disc and base ; the black apical and outer marginal areas much as on the upperside, but extending narrowly into the outer end of the cell ; bearing six submarginal spots, of which the two anterior ones are clear yellow, the rest white ; there is also a second white spot in the lower discoidal interspace midway between the submarginal spot and the lower disco-cellular nervule ; the base and disc of the wing reaching anteriorly to the costal nervure clear yellow. *Hindwing* dull bronzy-black throughout except a small streak of clear yellow anterior to the costal nervure ; a submarginal series of six small clear yellow spots placed between the veins, the one in the submedian interspace geminated.

This species is perhaps one of the most remarkable in the genus. On the upperside it has somewhat the appearance of *Huphina nama*, Moore, which I have also from the mountains of Sumatra, and for which it would certainly pass without notice when flying. *D. datames* is very closely allied to *D. momea*, Boisduval, from Java, the male differing from the same sex of that species in the costa of the forewing being black up to the subcostal nervure instead of white, the black apical area of greater extent and reaching the inner angle, which it does not do in *D. momea* ; in the hindwing the black powdery outer border is unmarked, in *D. momea* it bears three white spots placed one in each interspace between the second median and second subcostal nervules ; on the underside of the forewing the yellow coloration is of a deeper shade, and is more extensive, in *D. momea* the white coloration of the inner margin extends outwardly as far as the second median interspace, thus greatly reducing the yellow area ; the two anterior spots of the submarginal series are yellow, in *D. momea* they are white ; in the latter species there are three discal white spots, in *D. datames* only one ; and in the hindwing there is no discal series of

streaks between the veins as there is in *D. momea*. I possess a single pair only of *D. momea*.

Described from a single male example in Dr. Martin's collection.

Subfamily PAPILIONINÆ.

14. PAPILIO (*Dalchina*) SARPEDON, Linnæus, Pl. L, Fig. 11, ♂.

P. sarpedon, Linnæus, Syst. Nat. Ins., ed. x, p. 461, n. 14 (1758).

The very remarkable melanoid aberration or "sport" of *P. sarpedon* figured was obtained on the Battak Mountains of Sumatra by Dr. Martin's Battak collectors. The upperside of both wings is entirely black, save in the forewing the anterior spot of the broad macular discal blue-green band of normal *P. sarpedon*, and in the hindwing the four middle submarginal blue-green lunules of the series of six of the typical form, are alone present. The markings of the underside similarly differ, the broad discal blue-green band of both wings of the normal form being reduced to the anterior spot of the forewing only, the submarginal lunules of the hindwing as on the upperside, but all the crimson and deep black markings of the normal *P. sarpedon* are present.

This unique butterfly is in Dr. Martin's collection.

15. PAPILIO (*Pangerana*) SYCORAX, Grose Smith, Pl. M, Fig. 1, ♂.

Papilio sycorax, Grose Smith, Ent. Month. Mag., vol. xxi, p. 247 (1885); id., Distant, Rhop., Malay., p. 468, n. 29, pl. xlii, fig. 10, *female* (1886); *P. egertoni*, Distant, Ann. and Mag. Nat. Hist., fifth series, vol. xvii, p. 251 (1886).

HABITAT: Perak, Malay Peninsula (*Distant* and *collection de Nicéville*); Sumatra (*Grose Smith* and *collections Martin* and *de Nicéville*).

EXPANSE: ♂, 6·0 inches. (My largest ♀ expands 7·0 inches).

DESCRIPTION: MALE. UPPERSIDE, *both wings* very deep indigo-blue, slightly glossed with a greenish tint in some lights. *Forewing* obscurely streaked with greyish outwardly between the veins. *Hindwing* with the abdominal margin broadly twice folded over above; the outer margin broadly dull olive-green, this area bearing anteriorly four rounded black spots, the anterior spot coalescing with the indigo-blue ground-colour, the posterior spot hidden beneath the fold; a marginal series of five black spots. UNDERSIDE, *both wings* deep black. *Forewing* with the discoidal cell, as well as all the other interspaces, streaked with pale greenish-white. *Hindwing* with the outer half pale greenish-white, this area sharply defined, just reaching the cell at the bifurcation of the third median and discoidal nervules, bearing inwardly five oval black spots, the uppermost with its anterior end coalescing with the ground-colour, and outwardly six round similar spots. *Face* posteriorly with long black hairs, anteriorly these hairs are pale buff-yellow, as also is the *thorax* anteriorly; posteriorly the thorax, and the anterior third of the *abdomen* above is black, the posterior two-thirds of the abdomen above is dull olive-green,

bearing on each side a series of four round black spots; thorax beneath and *anal valves* black; abdomen beneath bright chrome-yellow, the spiracles black.

It is a very remarkable fact that in certain groups of *Papilios* the females are far more often met with than the males. This is especially noticeable in the small group which contains *P. sycorax*, *P. priapus*, Boisduval, and *P. hageni*, Rogenhofer, all of which are remarkable in having the face and anterior portion of the thorax above pale buff-yellow. Even the Battaks have noticed this curious feature, and call the butterfly "white-head." *P. sycorax*, as Mr. Grose Smith points out, is obviously close to *P. priapus*, from Java, but having only three female specimens of the latter, I am unable to make a comparison between the respective males of the two species. The females differ chiefly in the outer area of the hindwing on both sides of *P. sycorax* being greenish, in *P. priapus* buff-yellow.

Dr. Martin has only obtained three males of this fine species, two of which he has generously presented to me, together with four females. Mr. J. Wray, Jr., has also sent me a female from the Perak Hills.

16. PAPILIO (*Pangerana*) HAGENI, Rogenhofer, Pl. M, Fig. 2, ♀.

Papilio hageni, Rogenhofer, Verh. zool.-bot. Gesellsch. Wien, vol. xxxix, p. 1 (1889).

HABITAT: Sumatra (*Rogenhofer* and *collections Martin* and *de Nicéville*).

EXPANSE: ♀, 6·0 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *forewing* sordid-white, semi-transparent, the base, costa, apex and outer margin fuscous, all the veins broadly marked with fuscous, the discoidal cell bearing four longitudinal black streaks, the interspaces beyond the cell also bearing a black streak each. *Hindwing* shining black, the basal half tinted with dark olive-green; the disc bears a large white area crossed by the black veins and by four large oval black spots, the anterior of these almost merged into the black ground-colour, the white area anterior to these spots pure white, posterior to them sprinkled with black scales. UNDERSIDE, *forewing* a little paler than above, similarly marked. *Hindwing* with the ground-colour throughout deep black, the white area a little larger, almost pure white throughout, the anterior oval black spot better defined, anteriorly only coalescing with the ground-colour. *Head* in front and *thorax* anteriorly pale buff-yellow, thorax and *abdomen* above black, thorax beneath black, abdomen beneath rich crimson, cross-banded with black, and bearing on each side a series of small black spots.

This very fine species is closely allied to *P. priapus*, Boisduval, and to *P. sycorax*, Grose Smith, and has the face and thorax above anteriorly of the same colour as in those species. Dr. Martin has given me the specimen figured; he has a male (still nondescript) and other females in his collection, but the species appears to be a very rare one.

EXPLANATION OF THE PLATES.

Plate K.

Fig. 1. *Danais* (*Caduga*) *tytioides*, n. sp., ♂, p. 37.
„ 2. „ „ „ „ ♀, p. 37.
„ 3. *Euplœa* (*Narmada*) *martinii*, n. sp., ♂, p. 38.
„ 4. „ „ „ „ ♀, p. 38.
„ 5. *Terinos teos*, n. sp., ♂, p. 41.
„ 6. „ „ „ ♀, p. 41.
„ 7. *Lethe darena*, Felder, ♂, p. 40.
„ 8. *Athyma assa*, n. sp., ♂, p. 42.

Plate L.

Fig. 1. *Euthalia* (*Nora*) *erana*, n. sp., ♂, p. 46.
„ 2. „ „ „ „ ♀, p. 46.
„ 3. „ (*Tanaëcia ?*) *elone*, n. sp., ♂, p. 47.
„ 4. *Delias derceto*, n. sp., ♂, p. 52.
„ 5. *Yasoda pitane*, n. sp., ♂, p. 50.
„ 6. *Cyrestis* (*Chersonesia*) *cyanee*, n. sp., ♂, p. 49.
„ 7. „ „ „ „ ♀, p. 49.
„ 8. *Delias datames*, n. sp., ♂, p. 53.
„ 9. „ *danala*, n. sp., ♂, p. 51.
„ 10. *Abisara aita*, n. sp., ♂, p. 49.
„ 11. *Papilio* (*Dalchina*) *sarpedon*, Linnæus, ♂, p. 54.

Plate M.

Fig. 1. *Papilio* (*Pangerana*) *sycorax*, Grose Smith, ♂, p. 54.
„ 2. „ „ *hageni*, Rogenhofer, ♀, p. 55.

BOTANY OF THE LACCADIVES, BEING NATURAL HISTORY NOTES FROM H. M. I. M. SURVEY STEAMER "*INVESTIGATOR*," COMMANDER R. F. HOSKYN, R.N., COMMANDING.

Series II., No. 5. By D. PRAIN.

(*Continued from Vol. VII., page* 486.)

Incomplete.

NYCTAGINEÆ.

122. **Mirabilis Jalapa** Linn., Sp. Pl. 177 ; Roxb., Hort. Beng. 16 ; Watt, Dict., v., 253. The *Marvel of Peru.*

Akati ; cultivated, *Fleming !* Minikoi ; cultivated, *Fleming !*

Native of America, but widely cultivated throughout tropical Asia on account of the supposed purgative properties of its root, and as a garden plant.

123. **Boerhaavia repens** Linn : Hook. f., Flor. Brit. Ind., iv, 709.

VAR. *typica. Boerhaavia repens* Linn., Sp. Pl., 3.

Akati ; *Fleming !* Améni *Hume !*

A weed of fields, waysides and wasteplaces, cosmopolitan in tropical and sub-tropical countries. The more usual form of this species in India (VAR. procumbens *Hook. f., Flor. Brit. Ind.*, iv, 709 ; Boerhaavia procumbens, *Banks* in *Roxb. Flor. Ind.*, i, 146) does not appear to occur in the Laccadives ; the present form is that characteristic of the drier parts of India, of Beluchistan, Arabia and North-East Africa.

VAR. *diffusa* Hook. f., Flor. Brit. Ind., iv, 709. *B. diffusa* Linn., Sp. Pl. 3.

Bitrapar ; on the shore, *Hume !* Anderut ; on the beach, *Alcock !* Kadamum ; *Fleming !* Minikoi ; *Fleming !*

A littoral plant, cosmopolitan on tropical sea-shores. The sea-shore form differs so markedly in appearance from the usual inland forms and agrees so well with the description of VAR. *diffusa* Hook. f., that it might be convenient to restrict the varietal name "*diffusa*" to it alone. It does not, however, deserve specific rank, for, as is pointed out in the *Flora of British India*, it is impossible by their morphological characters to draw a line between the various forms. Even if recognised as a species, it could not be dealt with as *B. diffusa* Linn. since the probability is that Linneus based his descriptions, at least in part, on the examination of inland specimens.

The "weed" has probably been introduced unintentionally by man. The "shore" form very probably owes its introduction to the agency of sea-birds, though it may have been introduced by ocean-currents.

124. **Pisonia alba** Spanoghe *in* Linnæa, xv, 342 ; Hook. f., Flor. Brit. Ind., iv, 711.

Bitrapar ; *Fleming !*

A littoral species confined, if Spanoghe's species be really distinct from all the Polynesian and Malayan ones, to the Andamans and Nicobars. The species is rare in the Andamans beach forests (*Kurz*), but it is plentiful on the shores of Narcondam and on those of Batti Malv—one of the Nicobar group. The tree is only known in India and Ceylon as a cultivated species ; but as it does not occur on any of the other islands of the group, and as Bitrapar is an uninhabited island, the presence of the species in the sea-coast jungle here must be independent of human interference. Its fruits *may* have been introduced by birds, since the glutinous lines along their angles admirably adapt them for this mode of dispersal ; but as the majority of the birds that visit Bitra must be sea-fowl, it is much more likely that the species has been introduced by means of ocean-currents. Though not wild, it is frequently cultivated in Ceylon (*e.g.*, at Colombo) near the sea—indeed away from the sea it refuses to grow—and, if the tree does not exist in Malaya, Ceylon, cultivated trees may be supposed to have yielded the fruits that have reached the Laccadives. One point, however, against the species being confined, as an indigenous tree, to the Andamans is that the species has been long cultivated in India and Ceylon, and it is therefore extremely unlikely that the plants originally introduced into India came from that group of islands, with which, save for a short period in the end of the last century, there was, till thirty years ago, practically no communication. It appears, indeed, as Sir Joseph Hooker suggests, to be little more than a form of the Polynesian *Pisonia inermis* Forst.

AMARANTACEÆ.

125. **Amarantus viridis** Linn., Sp. Pl. (ed. ii), 1405 ; Roxb., Flor. Ind., iii, 605 ; Hook. f., Flor. Brit. Ind., iv, 720.

Minikoi ; *Fleming !*

A weed of waste places, cosmopolitan in the tropics.

126. **Æerua lanata** Juss. *in* Ann. Mus., xi, 131 ; Hook. f., Flor. Brit. Ind., iv, 728. *Achyranthes lanata* Linn., Sp. Pl. 204 ; Roxb., Flor. Ind., i, 676.

Bitrapar ; *Hume !* Kalpéni ; *Alcock !* Kadamum ; very common, *Fleming !* Akati ; *Fleming !* Minikoi ; common, *Fleming !*

A weed of waste places and also, as here, a common littoral species throughout tropical and subtropical Africa, the Mascarene Islands, Arabia and South-Eastern Asia ; here almost without doubt a sea-introduced species.

127. **Achyranthes aspera** Linn : Hook. f., Flor. Brit. Ind., iv, 730.
VAR. *typica*. *Achyranthes aspera* Linn., Sp. Pl. 204 ; Roxb., Flor. Ind., i, 672.

Minikoi ; *Fleming !*

A weed of waste places, cosmopolitian in the tropics.

VAR. *porphyristachya* Hook. f., Flor. Brit. Ind., iv, 730. *Achyranthes porphyristachya*, Wall., Cat. 6925.

Bitrapar ; *Hume !* Bangáro ; *Hume !* Kalpéni ; *Alcock !* Kiltán ; *Fleming !* Kadamum ; *Fleming !* Akati ; *Fleming !* Minikoi ; *Fleming !*

A weedy climber common in the littoral zone of the Indian and Malayan coasts ; also in the moist valleys of Sikkim, Chittagong, etc.

The common weed is only reported from Minikoi, from which island also (and from most of the others) comes the usual littoral condition which in habit simulates *A. bidentata*, Bl., but which has the fimbriate staminodes of *A. aspera*. While *A. aspera* is undoubtedly a plant introduced unintentionally by man, there is no doubt that here, as often elsewhere, *A. porphyristachya* is a sea-introduced plant.

POLYGONACEÆ.

128. **Polygonum barbatum** Linn., Sp. Pl., 362 ; Hook. f., Flor. Brit. Ind., v., 37. *P. rivulare* Koenig *in* Roxb., Flor. Ind., ii, 290.

Kalpéni ; *Alcock !*

In wet places throughout tropical Asia and Africa.

PIPERACEÆ.

129. PIPER BETLE Linn., Sp. Pl. 28 ; Roxb., Flor. Ind., i, 158 ; Hook. f., Flor. Brit. Ind., v, 85.

Akati ; Kiláth ; Kadamum ; Minikoi ; in all the islands cultivated and, as is the custom generally in Southern India, trained round the trunks and over the branches of the *Agati* (*Sesbania grandiflora*). "This plant is an object of great care" (*Fleming*).

Native of Malaya, where, and in the hotter parts of India and Ceylon, it is cultivated.

LAURINEÆ.

130. **Cassytha filiformis** Linn., Sp. Pl. 35 ; Roxb., Flor. Ind., ii, 314 ; Hook. f., Flor. Brit. Ind., v, 188.

Kiltán ; on *Wedelia scandens* in the coast zone, *Alcock !* Kadamum ; on *Pleurostylia Wightii*, *Fleming !*

A leafless parasite, common on sea-shores, cosmopolitan in the tropics.

131. **Hernandia peltata** Meissn. *in* DC., Prodr., xv., pt. i, 263 ; Hook. f., Flor. Brit. Ind., v, 188. *Hernandia ovigera* Gaertn., Fruct., i., 193, t. 40, f. 3 ; Roxb., Flor. Ind., iii, 577, *nec* Linn.

Korát *Hume !* Minikoi ; *Fleming !*

A littoral species extending from the Mascarene Islands and Eastern Africa to Ceylon, the Andamans, Malaya, Australia and Polynesia ; like *Ochrosia borbonica* this does not occur on the coast of India, though it is found as far north as Great Coco on the west and as Mergui on the east of the Andaman Sea.

Meissner (*DC. Prodr.*, xv, pt. 1, 262—264) omits to quote, and the *Flora of British India* (v, 188) does not cite Roxburgh's account of *Hernandia ovigera* (*Flor. Ind.*, iii, 577-578), which his own diagnosis clearly shows to be a species different from *Hernandia ovigera* Linn. (*Amœn. Ac.*, iv, 125), founded on Rumf's figure (*Herb. Amboin.*, iii, 193, t. 123) of *Arbor ovigera*. Roxburgh notes the discrepancies, and explains them by depreciating Rumf's drawing. In reality, however, Roxburgh's description is a most vivid and accurate one, made from living specimens, of the species named by Meissner (*DC. Prodr.*, xv, pt. i, 263) *Hernandia peltata*. Roxburgh cites Gaertner's figure (*Fruct.* i, 193, t. 40, f. 3) as a " very accurate" delineation of the fruit of this tree—an exceedingly just remark, which, however, Meissner has overlooked, for he quotes Gaertner's description and figure as referring to Linnaeus' species, though they differ very materially from both Rumf's figure and Meissner's own description of the fruit of *Hernandia ovigera*.

Hernandia peltata, the species now under review, is a purely old-world plant which has been treated by Linnaeus and, with the exceptions of Gaertner and Roxburgh, by all botanists subsequent to Linnaeus till the appearance of Meissner's treatise (1864) as conspecific with the American *Hernandia sonora ;* even now Sir J. D. Hooker (*Flor. Brit. Ind.*, v, 189) suspects that *H. peltata* is no more than a variety of *H. sonora*. And the basis of the differentiation by both Gaertner and Roxburgh of the present plant from *H. sonora* does not lie in the differences between the two plants that Meissner has pointed out, but in the fact that Linnaeus included under *H. sonora* not merely the American tree to which Meissner would restrict that name, as well as the Ceylon tree which is undoubtedly *H. peltata*, but also—though doubtfully and with the remark " *sed fructus alienus*" (*Amœn. Ac.*, iv, 117)—the tree figured by Rumf (*Herb. Amboin.*, ii, 257, t. 85) under the name *Arbor regis*. Believing, apparently, that Rumf's *Arbor regis* was, as Linnaeus thought, a *Hernandia*—a belief perhaps partly just—but realising that it could scarcely be the tree he had before him, and seeing that it agreed so thoroughly with the figure and description of *H. ovigera* given by Gaertner, Roxburgh, not having in his possession specimens of the true *H. ovigera*, followed Gaertner in bestowing that name on this species. This course was hardly just to Rumf if Gaertner and Roxburgh believed Rumf's figure to be correct, hardly just to themselves if they had any grounds for supposing it to be erroneous. It now appears that Rumf's figure is wonderfully reliable, for, besides his

figure from a tree in Amboina, there are before the writer specimens of undoubtedly this species from Java (Zollinger n. 2861, which, however, Zollinger himself has identified with *H. sonora*) and specimens recently collected by the officers of the "*Egeria*" in Christmas Island, where *H. ovigera* occurs (Hemsl., *Journ. Linn. Soc.*, xxv, 357) on the summit, elevation about 1,200 feet, a rather remarkable fact, since, according to Rumf, it occurs, like the other *Hernandias*, "*semper in arenoso solo circa litora.*"*

As has been remarked, the belief of Linnaeus, and of Roxburgh that Rumf's *Arbor regis* is a *Hernandia* is probably partly justified, for it is possible, from his account of the habitat of his tree—"*occurrit tam in litore inter leves ac humiles "silvas"* (quite the situation affected by *Hernandia peltata*) "*quam in montibus "et altioribus silvis"* (where to find *H. peltata* would be somewhat surprising) — that Rumf has included two trees in his description. His figure, moreover, bears out this, for some of the leaves are without, while others exhibit, a pair of glands where the petiole joins the leaf. The figure as a whole, however, suggests at once, as Lamarck (*Encyc. Meth.*, iii, 123) a century ago pointed out, a Euphorbiaceous plant, while Rumf's description of the fruit is altogether suitable to that of a species of this order. The first authors to recognise Rumf's *Arbor regis*, however, were Teysmann and Binnendyk, who described it as *Capellenia moluccana* (*Nat. Tijds. Ned. Ind.*, xxix, 239), founding a new genus to accommodate it ; as, however, *Capellenia* does not differ generically from *Endospermum*, the tree has been re-described by Beccari as *Endospermum moluccanum* (*Malesia*, ii, 38) in his treatise *Piante Ospitatrici*, where another species from New Guinea (*Endospermum formicarum* Becc., *Malesia*, ii, 44, t. 2) is described, which shares with Rumf's tree the character of sheltering a species of ant in its hollowed stems and branches. Teysmann and Binnendyk described their species from trees grown in the Botanic Garden at Buitenzorg ; Beccari does not mention the habitat of the New Guinea species ; in the Calcutta Herbarium there are, however, examples of another closely related species, with the same hollow branches, collected in Sumatra by H. O. Forbes, which were obtained on the volcano of Kaba at 3,500 feet elevation. This fact, therefore, does not oppose, if it does not corroborate, the surmise that Rumf under *Arbor regis* has included two trees, one found only on

* Two parallel instances known to the writer of littoral species ascending to a considerable height are met with in Narcondam, where *Morinda bracteata* ascends to 2,300 feet and in Barren Island, where *Terminalia Catappa* ascends 1,100 feet. The explanation of all three cases is doubtless the same ; these "littoral" species being amongst the first to appear on the respective islands were able to spread unchecked from the shore to the summit of their peaks, and the invasion of inland species has not subsequently been sufficiently great to compel them to retire completely from the unusual localities they had at first invaded.

the coast (*Hernandia peltata*) and one found inland and on the mountains (*Endospermum moluccanum*).

EUPHORBIACEÆ.

132. **Euphorbia Atoto** Forst., Prodr. n. 207; Hook. f., Flor. Brit. Ind., v, 248.

Améni; *Hume!*

A littoral species; seashores of India, Malaya, N. Australia and Polynesia.

133. **Euphorbia hypericifolia** Linn., Hort. Cliff. 198; Hook. f., Flor. Brit. Ind., v, 249. *E. parviflora* Linn., Syst. Veg. (ed. x), ii, 1047; Roxb., Flor. Ind., ii, 472.

Kadamum; *Fleming!* Kiltán; *Fleming!* Minikoi; *Fleming!*

A weed of waste places and fields, almost cosmopolitan; not occurring in Australia or in Polynesia.

134. **Euphorbia pilulifera** Linn., Amœn. Acad., iii, 114; Hook. f., Flor. Brit. Ind., v, 250. *E. hirta* Linn. Amœn. Acad., iii, 114; Roxb., Flor. Ind., ii. 472.

Anderut; *Alcock!* Kadamum; *Hume! Fleming!* Kiltán; *Alcock! Fleming!* Minikoi; *Fleming!*

A weed of cultivation, cosmopolitan in tropical and subtropical countries.

135. **Euphorbia thymifolia** Burm., Flor. Ind. 2; Roxb., Flor. Ind., ii, 473; Hook. f., Flor. Brit. Ind., v, 252.

Minikoi; *Fleming!*

A weed almost cosmopolitan in tropical countries, not found in Australia.

136. PHYLLANTHUS EMBLICA Linn., Sp. Pl. 982; Roxb., Flor. Ind., iii, 671; Hook. f., Flor. Brit. Ind., v, 289. The *Amla.*

Améni; cultivated, *Hume.*

Distributed, wild or cultivated, throughout South-Eastern Asia; here an intentionally introduced plant.

137. **Phyllanthus maderaspatensis** Linn., Sp. Pl. 982; Roxb., Flor. Ind., iii, 654; Hook. f., Flor. Brit. Ind., v, 292. *P. obcordatus* Willd., Enum. Hort. Berol., Suppl., 65; Roxb., Flor. Ind., iii, 656.

Améni; *Hume!* Anderut; *Alcock!* Bitrapar; *Fleming!* Kiltán; *Fleming!* Kadamum; *Fleming!* Minikoi; *Fleming!*

A weed of dry places and fields throughout tropical Africa, Asia and Australia, probably unintentionally introduced by man even into the island of Bitra, which, though not inhabited, is regularly visited.

138. **Phyllanthus Urinaria** Linn., Sp. Pl. 982; Roxb., Flor. Ind., iii, 660; Hook. f., Flor. Brit. Ind., v, 293.

Kalpéni; *Alcock!* Minikoi; *Fleming!*

A cosmopolitan tropical weed.

139. **Phyllanthus Niruri** Linn., Sp. Pl. 981 ; Roxb., Flor. Ind. iii, 659 ; Hook. f., Flor. Brit. Ind., v, 298.

Anderut ; *Alcock !* Akati ; *Fleming !* Kadamum ; *Fleming !* Kiltán ; *Fleming !* Minikoi ; *Fleming !*

A weed of cultivation almost cosmopolitan in the tropics, not occurring in Australia.

140. **Phyllanthus rotundifolius** Klein *in* Willd., Sp. Pl., iv, 584 ; Hook. f., Flor. Brit. Ind., v, 299.

Kiltán ; *Fleming !*

A weed of cultivation distributed throughout tropical Africa, Arabia, Southern India and Ceylon.

141. PHYLLANTHUS DISTICHUS Muell.-Arg. *in* DC., Prodr., xv, pt. ii, 413 ; Hook. f., Flor. Brit. Ind., v, 304. *P. longifolius* Jacq., Hort. Schoenb., ii, 36, f. 194 ; Roxb., Flor. Ind., iii, 672. *Cicca disticha* Linn., Mantiss. 124.

Minikoi ; cultivated, *Fleming.*

In gardens throughout Malaya, India and the Mascarene Islands.

142. **Claoxylon Mercurialis** Thwaites, Enum. 271 ; Hook. f., Flor. Brit. Ind., v, 412. *Tragia Mercurialis* Linn., Sp. Pl. (ed. ii) 1391 (*in parte*) ; Roxb., Flor. Ind., iii, 576. *Mercurialis alternifolia* Desv. *in* Lamk, Encyc. Meth., iv, 120. *Acalypha Mercurialis* A. Juss., Euphorb. Tent. 46. *Micrococca Mercurialis* Benth. *in* Hook., Niger Flora 503. *Microstachys mercurialis* Dalz. and Gibs., Bomb. Flor. 227.

Akati ; *Fleming !* Bitrapar ; *Fleming !* Kadamum ; *Fleming !* Kiltán ; *Fleming !* Minikoi ; *Fleming !*

A tropical weed distributed throughout Africa, Arabia and India ; there are also specimens at Calcutta from the Malay Peninsula. *Mercurialis alternifolia* Desv. is not the same plant as *Mercurialis alternifolia* Hochst., *Un. It.*, which is an *Acalypha* (A. Hochstetteri *Muell.-Arg.*).

143. **Acalypha indica** Linn., Sp. Pl. 1003 ; Roxb., Flor. Ind., iii, 675 ; Hook. f., Flor. Brit. Ind., v., 416.

Akati ; *Fleming !* Kadamum ; *Fleming !* Minikoi ; *Fleming !*

A weed of cultivation common in tropical Africa and S.-E. Asia.

144. **Acalypha fallax** Muell.-Arg. *in* Linnæa, xxxiv, 43 ; Hook. f., Flor. Brit. Ind., v, 416. *A. indica* Prain, Laccad. List. 7, *nec* Linn.

Anderut ; *Alcock !* Akati ; *Fleming !* Minikoi ; *Fleming !*

A weed of cultivation confined to South-Eastern Asia.

145. RICINUS COMMUNIS Linn., Sp. Pl. 1007 ; Roxb., Flor. Ind., iii, 689 ; Hook. f., Flor. Brit. Ind., v., 457. The *Castor-oil Plant* ; *vernac.* "undel" (*Robinson*).

Kiltán; cultivated, *Hume*, *Fleming!* Anderut; cultivated, *Alcock*. Kadamum; *Fleming!* Améni; cultivated for its oil, *Robinson*. Bitrapar; growing near the centre of the island, *Fleming!* Minikoi; cultivated and a very common escape, *Fleming!*

A native of Africa, cultivated generally in the tropics for its oil, but readily escaping and becoming naturalised, its presence in the uninhabited island of Bitra being an excellent instance of the readiness with which it runs wild. It is noteworthy that it was not present in Bitra when Mr. Hume visited that island in 1875.

URTICACEÆ.

146. FICUS BENGALENSIS Linn., Hort. Cliff. 471, n. 4; King *in* Hook. f., Flor. Brit. Ind., v, 499. *F. indica* Linn., Amoen. Acad. (ed. iii), i, 27, n. 6; Roxb., Flor. Ind., iii, 539. The *Banyan*.

Améni; planted, *Hume*. Kadamum; four trees seen in the neighbourhood of some deserted huts, from their arrangement in a row evidently planted, *Fleming*. Minikoi; planted, *Fleming*.

Planted generally throughout India, wild on the lower slopes of the Himalayas and of the Deccan hills.

147. **Ficus retusa** Linn., Mantiss. 129; King *in* Hook. f., Flor. Brit. Ind., v, 511. *F. Benjamina* Willd., Sp. Pl., iv, 1143; Roxb., Flor. Ind., iii, 550 *nec* Linn.

VAR. *nitida* King, Ficus, 50; Hook. f., Flor. Brit. Ind., v, 511. *F. nitida* Thunbg, Ficus 14.

Minikoi; *Fleming!*

A large tree common throughout Eastern and South-Eastern Asia and extending to New Caledonia. Mr. Fleming does not note if the tree be planted in Minikoi. It is possible that it may be, but as its figs are a favourite food with many of the migratory fruit-pigeons, there is no reason why it should not be a "wild" bird-introduced species.

148. ARTOCARPUS INCISA Forst., Pl. Escul. 23; Roxb., Flor. Ind., iii, 527; Hook. f., Flor. Brit. Ind., v, 539; Watt, Dict., i, 330. The *Bread-Fruit Tree*.

Kiltán; does not thrive well, *Robinson*; not much appreciated, *Hume*; *Alcock*. Améni; grows most luxuriantly, *Robinson*, *Hume*. Anderut; cultivated largely, *Alcock*. Akati; only one tree, in a garden, *Fleming!* Minikoi; cultivated, *Fleming!*

A native of Polynesia and Eastern Malaya, occasionally cultivated in the hotter parts of India. The Laccadive Archipelago must be near the northern

limit of its successful cultivation, a fact that is corroborated by the evidence given above of the want of success, and the small extent, of its cultivation in important islands like Kiltán and Akati.

149. ARTOCARPUS INTEGRIFOLIA Linn. f., Suppl. 412 ; Roxb., Flor. Ind., iii, 522 ; Hook. f., Flor. Brit. Ind., v, 541 ; Watt, Dict., i, 330. The *Jack-fruit.*

Anderut ; a stately-looking tree, with dark green foliage not unlike the broad-leafed elm, *Wood.*

Dr. King, to whose attention the passage in Lieut. Wood's paper has been brought, suggests that the notice refers most probably to the Jack. The tree is generally cultivated throughout the hotter parts of India and Indo-China and throughout Malaya ; it is said by Beddome to be truly wild in the Western Ghâts above the Malabar Coast. That its cultivation should not have spread in the Laccadives is not at all surprising; doubtless the islanders generally view the Jack, as those of Kiltán, according to Mr. Hume (*Stray Feathers*, iv, 437), regard the Bread-fruit : trees that are all very well in their way, but considering that, instead of fruiting all the year round like the coco-nut, they all flower and fruit together, and their fruiting season lasts at the outside only two months out of twelve, they are hardly worth the trouble of propagating.

150. **Pouzolzia indica** Gaud. : Wedd. *in* DC. Prodr., xvi, pt. i, 220 ; Hook. f., Flor. Brit. Ind., v, 581. *Urtica suffruticosa* Roxb., Flor. Ind., iii, 584.

VAR. *typica.* *P. indica* Gaud. *in* Freycinet, Voy., Bot. 503.

Kalpéni ; *Alcock !* Kiltán ; *Fleming !* Akati ; *Fleming !* Kadamum ; *Fleming !* Minikoi ; *Fleming !*

A weed of cultivation common throughout tropical and subtropical Eastern and South-Eastern Asia.

VAR. *alienata* Wedd. *in* DC. Prodr., xvi, pt. i, 221. *P. alienata* Gaud. *in* Freycinet, Voy., Bot. 503.

Minikoi ; *Fleming !*

A common Indian form of the same weed.

Monocotyledones.

SCITAMINEÆ.

151. MUSA SAPIENTUM Linn., Syst. Veg. (ed. x), ii, 1303 ; Roxb., Flor. Ind., i, 663 ; Watt, Dict. v, 290. The *Plantain.*

Anderut ; cultivated, *Wood.* Améni; cultivated, *Robinson.* Kiltán ; cultivated, *Hume.* Kadamum ; four plants seen near some deserted huts, evidently planted, *Fleming.* Minikoi ; cultivated, *Fleming.*

AMARYLLIDEÆ.

152. **Pancratium zeylanicum** Linn., Sp. Pl. 290 ; Roxb., Flor. Ind., ii, 124 ; Hook. f., Flor. Brit. Ind., vi, 285.

Minikoi ; *Fleming.*

India, Ceylon, Malaya.

153. AGAVE VIVIPARA Linn., Sp. Pl. 323. *A. Cantula* Roxb., Flor. Ind., ii, 167 ; Watt, Dict., i, 143. The *Bastard American Aloe.*

Anderut ; cultivated, *Alcock.* Kiltàn ; introduced from the mainland and grows well, *Fleming.*

A native of America, cultivated and naturalised in most warm countries.

TACCACEÆ.

154. TACCA PINNATIFIDA Forst., Plant. Escul. 59 ; Roxb., Flor. Ind., ii, 172. The South-Sea Taro ; *vernac.* "teerny," *Robinson.*

Anderut ; cultivated, *Wood, Alcock.* Chitlac ; cultivated, *Robinson.* Akati ; cultivated, *Fleming !* Minikoi ; cultivated, *Fleming !*

A littoral species common on South-Eastern Asiatic and Polynesian coasts, but also extending inland either as a wild or cultivated species. Though a very common species on the Andaman coasts, the plant is here only found as a cultivated one.

DIOSCOREACEÆ.

155. **Dioscorea bulbifera** Linn., Sp. Pl. 1033. *Wild Yam.*

Minikoi ; *Fleming !*

A common species in a wild state throughout India, Indo-China, and Malaya; possibly conspecific with the next. Mr. Fleming does not note if it is a cultivated or a wild species. It is sometimes cultivated, and both the root and leaf-tubers are eaten. The latter are also in Ceylon used as a fish-bait.

156. DIOSCOREA SATIVA Linn., Sp. Pl. 1033 ; Watt, Dict., iii, 133. The *Garden Yam.*

Améni ; cultivated, *Robinson, Hume.* Cultivated generally in the tropics, native country unknown. There are no specimens either in Mr. Hume's or in Dr. Alcock's collection, and it is, therefore, not impossible that it is not *D. sativa* but *D. bulbifera* that is grown in Améni.

LILIACEÆ.

157. **Gloriosa superba** Linn., Sp. Pl. 305 ; Roxb., Flor. Ind., ii, 143.

Anderut ; plentiful, *Alcock !*

Wild throughout South-Eastern Asia, but also often cultivated as an ornamental plant, and on account of the poisonous properties reputed to reside in its

roots. It is *not* cultivated, however, in Anderut, and as it is a common littoral species throughout the Andamans and Nicobars, it is here quite possibly a sea-introduced species.

COMMELYNEÆ.

158. **Aneilema ovalifolium** Hook. f., *ex* C. B. Clarke *in* DC. Monogr. Phan., iii, 218.

Minikoi ; *Fleming !*

A herbaceous weed of jungles and grassy places confined to Southern India.

159. **Cyanotis cristata** Roem. & Schult., Syst., vii, 1150. *Commelina cristata* Linn., Sp. Pl. 42. *Tradescantia imbricata* Roxb., Flor. Ind., ii, 120.

Kadamum ; *Fleming !* Kiltán ; in grass along with *Leucas aspera*, *Fleming !* Minikoi ; on ground and also epiphytic on *Cocos nucifera*, *Fleming !*

A weed of grassy places in the Mascarene Islands, India and Malaya.

PALMEÆ.

160. ARECA CATECHU Linn., Sp. Pl. 1189 ; Roxb., Flor. Ind., iii, 615 ; Watt, Dict., i, 291. The *Betel-nut Palm.*

Améni ; cultivated, *Robinson*, *Hume*. Anderut ; cultivated, *Wood*, *Alcock*. Kiltán ; does not thrive, *Robinson*. Minikoi ; cultivated, *Fleming*.

Cultivated in tropical countries.

161. COCOS NUCIFERA Linn., Sp. Pl. 1188 ; Roxb., Flor. Ind., iii, 614. The *Coco-nut Palm.*

Améni ; *Robinson*, *Hume*. Anderut ; *Wood*, *Alcock*. Akati ; *Fleming*. Bangáro ; *Hume*. Bitrapar ; *Robinson*, *Hume*. Chitlac ; of slow growth and not productive, *Robinson*. Kadamum ; *Robinson*, *Hume*, *Fleming*. Kalpéni, *Alcock*. Kiltán ; *Robinson*, *Hume*, *Alcock*, *Fleming*. Koráti ; *Hume*. Minikoi ; *Fleming*.

Lieut. Wood's list gives the coco-nut as present on all the islands except Kalpéni Féti and Akati Féti, which are mentioned as mere sand-banks, but the sand-banks of Pirmalla and Pitti and the coral islets on Cherbaniani and—if, indeed, there are islets there—on Cheriapani reefs are quite devoid of vegetation, and if visited at all by the islanders are visited for the purposes of fishing or egg-collecting, not for coco-nuts and coir. Bitra, however, which is uninhabited ,has coco-nuts and is visited on account of these by people from the northern islands. The coco-nuts there, from their position as described by Robinson and Hume and from the accounts of the people, are evidently only planted. Bangáro and (apparently) Tangáro, two uninhabited islands on the Akati reef, have coco-nuts clearly, from Hume's account of the former, sea-introduced and not planted. Whether there are coco-nuts on Suheli is not clear ; according to Wood's list,

they occur, but the people misinformed him concerning so many of the other islands, that till there is direct evidence, the point must remain doubtful.

The question whether the appearance of the coco-nut in this archipelago preceded that of man, or if the first settlers there did not rather take the coco-nut with them, is one that it is somewhat difficult to answer. The species is pretty certainly indigenous in the Malay countries and, perhaps, Polynesia, and seems to have spread thence to India, the Mascarene Islands and Africa. It occurs also in America, but the question—which has been seriously discussed—as to whether it found its way to the New World from the Old or *vice versa*, has not yet been satisfactorily answered. The introduction of the coco-nut into Ceylon at all events has been in all probability a deliberate act, and, as M. de Candolle reminds us (*Origin of Cultivated Plants*, p. 435), at a period so recent as to be almost historical. That the geographical extension of the tree is largely due to human agency does not admit of question, but that it has been in every place where it occurs intentionally introduced, it is neither possible nor necessary to believe. Its fruits are highly capable of ocean-distribution and form a constant feature of ocean-drifts on tropical shores, and it is one of the earliest species to appear on newly emerged coral or volcanic tropical islands.

As regards the Laccadives, if man did not first settle there on account of coco-nut trees being already present, it is difficult to conceive what he went there for ; the surface is not adequate, nor are the conditions favourable for extensive cereal or pulse cultivation, and as for a certain period of the year the people have to take their boats away from the islands to places of safety on the Malabar Coast, it is clear that fishing could never have been a general or constant industry among them. On the other hand, the coco-nut is in the strictest sense a cultivated species on all the inhabited islands, and is a planted species even in Bitra which, on account of its want of a water-supply, is only a visited island ; and though in Bangáro it is not cultivated or planted, this island may have only been stocked by nuts from Akati, the main island on the same atoll, subsequently to a deliberate introduction of the species into Akati itself.

Still the state of affairs in Bangáro proves that the tree here can be, at least locally, sea-dispersed ; and taking into account the uninviting appearance that the islands must offer, were they destitute of coco-nuts, one cannot but think it probable that the species reached the archipelago independently of human agency and prior to human settlement, while the necessity for constant renewal and, as the population increased, for planting to the greatest advantage, has insured that now in all the inhabited islands none but cultivated trees are to be found.

In most of the islands it is deemed necessary to raise the seedling coco-nuts with care and attention till they are a year old, when they are transplanted and

watered for a few weeks till they become firmly established. After this the young trees are left entirely to themselves, and are neither watered nor manured ; they come into bearing in Kiltan in from 8 to 10 years, and produce fruit so vigorously and plentifully that it is sometimes necessary to support the luxuriant growth of nuts artificially *; in this island, moreover, the preliminary attention to seedlings is not required.

In some of the other islands, as in Chitlac, where the soil is much poorer, the trees do not come into bearing till they are 15 to 20 years old, each tree at best producing only about 50 nuts *per annum* as against 80 to 85 nuts a year in Kiltán. In Kadamum, too, backward though the cultivation in that island is, the average *per annum* is about 80 nuts per tree ; in Améni, where the cultivation is almost as extensive as in Kiltán, the average is only about 60 nuts a year from each tree. These figures are given by Robinson, after careful and prolonged enquiry, as representing the yield in 1844 and 1845 ; Hume gives the average all over for the four British islands in 1875 at 80 nuts per tree *per annum*†—doubtless rather a high general estimate, though probably representing the yield of what the people in any of the islands would themselves consider a *good* tree. Robinson thinks that 60 to 70 nuts would be a pretty fair general average for the whole of these islands, and this is likely to be nearer the truth than the higher estimate. The islanders try to plant only *first class* trees, and they aim at obtaining such as will come into full bearing in about 10 years, throwing out every month after that age is reached a fruiting-spike bearing 15 to 20 nuts, and so yielding 180 to 250 nuts a year, and going on bearing at this rate till they are 60 years old. They often do go on bearing, it is said, till they are 70 or 80 years of age, and some are believed by the people to be more than a century old. But a tree that produces a fruiting-spike every month is quite a rarity ; 9 to 10 fruiting branches are all that can be hoped for in twelve months, and from accidents and casualties among the nuts, 8 to 10 a spike is a very high average of nuts. Indeed, it is only trees with an eastern exposure and trees growing in the *kat* in the centre of the islands that yield so highly ; those with a south-westerly exposure or those on the drier parts of the best islands yield as poorly as those of Chitlac, where the conditions, as a whole, are unfavourable.

There is very little exportation of coco-nuts from the islands, much the greater portion of the crop being required for home consumption. As, moreover, the great product of the islands is coir, not coco-nuts, an immense proportion of the crop is gathered before the nuts are perfectly ripe and before the kernel is in the best condition for yielding oil. If allowed to remain on the

* Robinson, Madras Journal, n. s. xiv, 24.

† "Stray Feathers," iv, 410.

tree for twelve or thirteen months, which is the time required for perfect ripening, the husk becomes hard and woody and the coir difficult to separate from the woody particles, requiring longer soaking in its preparation, which darkens its colour and spoils it for the market ; being harder and coarser, too, it becomes, though not weaker than the best coir ought to be, much more difficult to twist. If, on the other hand, the nuts are gathered too soon, the coir obtained, though excellent in colour and easy to manipulate, is too weak for yarn, though quite good for minor purposes, such as a stuffing material for mattresses.

The proper age of nuts for coir-making is ten months ; at the end of the tenth month they are cut and husked, the husks being thrown into soaking-pits, where they are left for a year. These soaking-pits are simply holes in the sand on the lagoon-shore of the various islands, in which the husks are buried and covered over by heaps of coral-blocks to protect them from the ripple of the waves. After twelve months' soaking the husks are taken from the pits and the coir is separated from the refuse of the husk by beating. If taken out earlier, it is very difficult to rid the coir of impurities and woody particles ; if left longer, the fibre is found to be weakened. In Améni, where, as has been said, the island occupies the whole lagoon-space, and there is, therefore, no protected seashore suitable for coir-soaking, the husks have to be buried in pits dug through the coral-crust within the body of the island. The coir is here, therefore, soaked in fresh, instead of salt water, one result of which is that the Améni coir is weaker than that produced in the other islands ; this is, no doubt, the result of the action of some of the products of decomposition in the water of these tanks. A further effect of this method of soaking is a discolouration of the fibre, for the water in the tanks never being changed becomes foul and dark-coloured by the decaying vegetable matter, and imparts this tinge to the coir. The two effects taken together, or perhaps rather the second, used by the buyer as an index of the first, renders Améni coir a less marketable product than the coir of the other islands and reduces it to the level of most of the coir manufactured on the Malabar Coast itself, which is practically all made in this way, protected seashores on which to bury the husks being exceedingly rare except within the lagoons of coral islands.

In separating the coir after the beating by sticks to break up the adhesion and remove impurities, the coir is hand-rubbed, chiefly by the women, to remove the woody tissue between the fibres. It is then rolled into loose pads as thick as one's finger by the palms of the hands before being twisted into yarn, of which two strands are made at once.*

* J. Shortt, F.L.S. ; Monograph of the Coco-nut-palm, p. 16, Madras, 1888.

The yield of fibre is estimated by Robinson at one pound of coir from each 10 nuts, giving 35 fathoms of yarn. He adds* that "2 lbs. of such yarn, "measuring from 70 to 75 fathoms, are made up into *soodies*, of which there are "fourteen to a bundle, averaging about a maund of 28 lbs. A Mangalore candy "of 560 lbs. will, therefore, be the produce of 5,600 nuts, and should contain "about 20,000 fathoms of yarn."

In contrast with this yield, Robinson mentions that it takes only three of the large coarse coast nuts to yield a pound of coir, but that this coir will only produce 22 fathoms. A ton of Laccadive coir will thus produce 80,000 fathoms of yarn as against 50,000 yielded by a ton of Malabar coir.

By Mr. Robinson's figures, it will take over 20,000 nuts (22,400) to yield a ton of coir, which should produce 784,000 fathoms of yarn. Mr. Hume (*Stray Feathers*, iv, 440) says it takes about 30,000 nuts to yield a ton of coir.

It is clear from what has been written regarding the Laccadives that they yield by far the best coir produced in India, and it will be equally evident from what has been said here that their superiority lies altogether in the facilities for sea-soaking offered by their lagoons. Yet from all the information that a consultation of the ordinary trade returns will yield, an enquirer into them might, as Watt remarks,† conclude that the Laccadives export no coir. In trade returns the Laccadive coir from British Islands is given along with that from the Malabar Coast, and in European markets the best Malabar or Indian coir is spoken of as Cochin coir. As a matter of fact, little coir comes from Cochin, and it does not present any features peculiar to itself or superior to those of coir from other parts of Malabar. What the European merchant means by Cochin coir is pretty certainly Laccadive coir. Even when the coir is known to be from the Laccadives, some misunderstanding is produced by its being spoken of as Kiltán coir or Améni coir. As a matter of fact, Kiltán coir has not quite the local reputation of either Chitlac or Kadamum coir, whereas Améni coir is distinctly inferior to that produced in any of the other British islands. The application of the term Améni coir to the best qualities arises from two circumstances—the fact that the island of Améni is one of the largest and often gives its name Amendivi to the whole group, and that, till quite recently, the lower caste people of Kadamum, where excellent coir is produced, were in some degree subject to their higher caste neighbours of Améni, and were compelled to ship their produce to the mainland in Améni boats.

Besides coir manufacture, a certain amount of coarse sugar (*jaggery*) manufacture is carried on, not at all extensively, however, in the British islands, since

* Robinson, Madras Journal, n. s., xiv, 16.

† Dict. Econom. Products of India, ii, 421.

the higher prices given for their coir render its manufacture more profitable to the people. In the Cannanore Islands, where coir is under monopoly and the Cannanore Raj gives much poorer prices for that article than the inhabitants of the British islands obtain, large quantities of *jaggery* are produced both for home consumption and for export to the people on the British islands, the chief islands in which it is manufactured being, according to Robinson, those of Anderut and Koráti.

PANDANEÆ.

162. **Pandanus odoratissimus** Linn. f., Suppl. 424 ; Roxb., Flor. Ind., iii, 738 ; Balf. f., Jour. Linn. Soc., xvii, 54.

Bangáro ; abundant, *Hume.* Kadamum ; very abundant, *Hume.* Améni ; *Hume.* Kiltan ; only a few plants, *Hume.* Kalpéni ; *Alcock.* Minikoi ; *Fleming !* a regular sea-fence of this plant surrounds the island, *Hamilton.*

A littoral species extending from the Indian Coasts to Malaya, Australia and Polynesia.

In the Laccadive Islands proper there is not, in densely peopled and carefully planted islands like Kiltán, more than the merest remnant of a *Pandanus* sea-fence left, though in uninhabited islands like Bangáro and in partially occupied ones like Kadamum, it is well represented. But, curiously enough, it is quite absent from the uninhabited island of Bitra, where also *Cocos nucifera* does not occur as a littoral and sea-introduced species. In Minikoi, however, where the island is fully occupied and carefully planted, the *Pandanus* sea-fence has been allowed to remain as a belt all round the island. This belt of jungle harbours an immense number of rats (*Mus rattus* VAR. *rufescens*)*, which here, as in the other islands, prove very destructive to the coco-nut crop. Captain Wentworth Hamilton, Port Officer of Gopalpur, who commanded the S. S. "*Martha Heathcote*" during a recent official visit to Minikoi, informed thewriterin 1889 that the disturbances which led to the visit arose out of a Government order to cut down this jungle and, by removing their shelter, to render possible a systematic attempt to exterminate the rats. The populace objected most strongly to the order, on the ground that this belt of jungle is the abode of evil spirits that would be certain, were their domain invaded, to retaliate by bringing misfortune on the island. Minikoi, as has been already said, though Laccadive as to political connection, and as much Laccadive as Maldive as to situation, has a Maldive population ; there is no evidence of superstition so gross among the Mappila population of the other Laccadives ; at all events, they do not appear to have any scruples about clearing away the *Pandanus* belt.

* Hume, "Stray Feathers," iv, 433.

ARODEÆ.

163. **Colocasia antiquorum** Schott: Engler *in* DC., Monogr. Phanerog., ii, 491.

VAR. *typica*. *C. antiquorum* Schott, Meletem. i, 18. *Arum Colocasia* Linn., Sp. Pl. 965; Roxb., Flor. Ind., iii, 494. The *Kachu* or *Indian Taro*.

Améni; cultivated, *Hume*. Anderut; cultivated, *Alcock*. Kalpéni; both cultivated and wild, *Alcock!* Kiltán; wild, *Fleming*. Kadamum; wild, *Fleming*. Akati; wild, *Fleming*. Minikoi; wild, *Fleming*.

A native of India, cultivated in nearly all tropical and subtropical countries. There is little doubt that this has been intentionally introduced; it receives, however, slight attention in any of the islands, and in nearly everyone of them it has established itself as a weed.

CYPERACEÆ.

164. **Cyperus hyalinus** Vahl, Enum., ii, 329; Clarke, Ind. Cyperus 46.

Kadamum; *Fleming!*

A very rare South Indian weed.

165. **Cyperus polystachyus** Rottb., Descr. et Ic. 39, t. 11, f. 1; Roxb., Flor. Ind., i, 193; Clarke, Ind. Cyperus 51.

Minikoi; *Fleming!*

A cosmopolitan tropical and subtropical weed, especially in islands and on sea-shores.

166. **Cyperus compressus** Linn., Sp. Pl. 46; Roxb., Flor. Ind., i, 194; Clarke, Ind. Cyperus 97.

Kalpéni; *Alcock!*

A cosmopolitan tropical weed.

167. **Cyperus pachyrrhizus** Nees *ex* Boeck. *in* Linnæa, xxxv, 545; Clarke, Ind. Cyperus 111.

Bitrapar; *Hume! Fleming!* Kadamum; *Fleming!* Bangáro; *Hume!*

A littoral species, confined to the coasts of India. Mr. Clarke, however, in a letter to the writer, in which he has kindly criticised the former Laccadive List, states that in Dr. Trimen's opinion the purely maritime *C. pachyrrhizus* cannot be specifically distinguished from *C. conglomeratus* (Rottb., *Descr. et Ic.*, 21, t. 15, f. 7; Clarke, *Ind. Cyperus*, 112), a plant occurring in the deserts of North-East Africa and South-West Asia (Nubia, Arabia, Syria, Socotra, Beluchistan).

168. **Cyperus pennatus** Lamk *in* Poir., Encyc. Meth., vii, 240; Clarke, Ind. Cyperus 194.

Anderut ; *Alcock !* Kalpéni ; *Alcock !* Akati ; *Fleming !* Minikoi ; *Fleming !*

A littoral and estuarine species, extending from the Mascarene Islands to India, Malaya and North Australia.

169. **Cyperus dubius** Rottb., Descr. et Ic., 20, t. 4, f. 5 ; Roxb., Flor. Ind., i, 189 ; Clarke, Ind. Cyperus 197.

Minikoi ; *Fleming !*

A littoral species, extending from Indo-China and Malaya to India, Ceylon, the Mascarene Islands and the African Coast.

170. **Kyllinga brevifolia** Rottb., Descr. et Ic., 13, t. 4, f. 3.

Minikoi ; in the sward underneath the coco-nut trees, *Fleming !*

Cosmopolitan in the tropics.

171. **Fimbristylis diphylla** Vahl., Enum., ii, 289. *Scirpus miliaceus* Roxb., Flor. Ind., i, 227.

Kalpéni ; *Alcock !*

The solitary specimen is not a good one, and the identification is not absolutely certain. The plant is, however, not any of the other *Cyperaceæ* enumerated.

Common on seashores and in wet places throughout the tropics.

GRAMINEÆ.

172. **Panicum sanguinale** Linn., Sp. Pl., 57.

VAR. *ciliare*. *P. ciliare* Retz., Obs., iv, 16 ; Roxb., Flor. Ind., i., 293.

Akati ; dwarfed specimens, *Fleming !* Minikoi ; very abundant, *Fleming !*

Cosmopolitan in the tropics ; the variety present here seems, however, confined to the Eastern Hemisphere.

173. **Oplismenus Burmanni** Beauv., Agrost., 54. *Panicum Burmanni* Retz., Obs., iii, 10 ; Roxb., Flor. Ind., i, 298.

Akati ; *Fleming !* Kadamum ; *Fleming !* Kiltán ; *Fleming !* Minikoi ; *Fleming !* Everywhere abundant, as is the next species.

Cosmopolitan in tropical and subtropical countries.

174. **Oplismenus compositus** Roem. & Schult., Syst., ii, 484. *Panicum compositum* Linn., Sp. Pl., 57. *P. lanceolatum* Roxb., Flor. Ind., i, 294.

Améni ; *Hume !* Akati ; *Fleming !* Minikoi ; *Fleming !*

Widely distributed throughout the tropics of the old world.

175. **Setaria verticillata** Beauv., Agrost., 51. *Panicum verticillátum* Linn., Sp. Pl. (ed. ii) 82 ; Roxb., Flor. Ind, i, 301.

Améni ; a crop, *vernac.* "badag," *Robinson.* Bangáro ; *Hume !* Kadamum ; *Fleming !* Kiltán ; *Fleming !* If cultivated at the time of Mr. Robinson's visit (1844), apparently not cultivated when Mr. Hume was at the Laccadives (1875) ; its presence in the uninhabited island of Bangáro indicates, moreover, that

here, as elsewhere, the species is one that readily becomes established as a weed.

Cosmopolitan in the tropics.

176. **Thuarea sarmentosa** Pers., Synops., i, 110.

Bangáro ; *Hume !* Kadamum ; *Fleming !* Minikoi ; *Fleming !*

A littoral species, extending from the shores of Polynesia to Malaya, the Andamans and Nicobars, Ceylon (Thwaites C. P. 2260), the Laccadives, and the Mascarene Islands. As with a number of other littoral species exhibiting the same distribution, this has not yet been collected on the coast of the Indian mainland.

177. **Spinifex squarrosus** Linn., Mantiss., 300.

Bitrapar ; everywhere in huge patches inside the belt of *Ipomœa biloba*, *Hume !* Minikoi ; *Fleming !*

A littoral species found on the Western Indian Coast from Canara (*Thomson*) to Malabar (*Rheede*) and on the east from Puri (*Clarke*) and Gopalpur (*Prain*) to Madras (*Wight*) and Ceylon (*Thwaites*). Besides extending to the Laccadives, it occurs in Java (*Kurz*), Siam (*Schomburgk*), and China (*Hance*). But in the Calcutta Herbarium there are no specimens from Burma, the Malay Peninsula, the Andamans or the Nicobars. The headquarters of the genus is Australia, where several species occur ; and if this species has originally come from the south-east to India, it has apparently only reached the western, not the eastern, side of the Sea of Bengal, first perhaps reaching Ceylon, whence it has crept northward along both the coasts of the Indian Peninsula. Why it should not have become dispersed northward from Java, along the coasts of Sumatra, the Nicobars and Andamans to Burma, it is difficult to conceive.

178. Oryza sativa Linn., Sp. Pl., 333 ; Roxb., Flor. Ind., ii, 200 ; Watt, Dict., v, 498. The *Rice* crop.

Anderut ; a small quantity of rice is grown in the rainy season, not more than 15 or 20 days' consumption, *Wood.*

Generally cultivated throughout the tropics ; probably originally a native of India, where it often occurs, as Roxburgh says he has himself seen it in the Circars, in a truly wild state, that is, *not* as an escape from cultivation. It occurs thus, for example, in the Sunderbuns along with another species (*Oryza coarctata* Roxb., *Flor. Ind.*, ii, 206), which is perfectly distinct from *O. sativa* in any of its forms, is never found anywhere else than in the Sunderbuns, and of which no use whatever is made.

The notice by Lieut. Wood is the only intimation of the Laccadive islanders cultivating the rice crop ; but though they do not apparently attempt to grow it now, there is no reason to suppose that Wood was misinformed or mistaken. For though Robinson does not mention rice as a crop in 1844-45—it will be

noted that he did *not* visit Anderut then—he gives a circumstantial account of the cultivation of certain millets and pulses in Améni and Kadamum, but says that in Chitlac field-cultivation was then quite insignificant and that in Kiltán it had given way altogether before the planting of coco-nut trees. Writing thirty years later, Mr. Hume says* that "in former days a certain amount of "millets used to be grown in all the islands; now, even in Améni, little or "none appears to be cultivated, and the people are wholly dependent for their "supplies on the mainland, whence they bring, not only rice, but tobacco and "salt, which, curiously enough, never seems to have been manufactured on the "islands, the people being allowed to get duty-free salt from Goa."

In Anderut, judging from Dr. Alcock's brief notice of the island, there appears to be even to this day more cereal cultivation than in most of the other islands; still he does not speak of rice as being grown, and says that the staple crop is *ràgi* (*Eleusine Coracana*).

179. SACCHARUM OFFICINARUM Linn., Sp. Pl. 54; Roxb., Flor. Ind., i, 237.

Minikoi; cultivated, *Fleming*.

Cultivated throughout the tropics.

180. **Ischaemum ciliare** Retz., Obs., vi, 36. *I. tenellum* Roxb., Flor. Ind., i, 323.

Kalpéni; *Alcock!* Akati; *Fleming!* Bitrapar; *Fleming!* Kadamum; *Fleming!* Kiltán; *Fleming!* Everywhere very plentiful.

Confined to China, India and Indo-China.

181. **Ischaemum muticum** Linn., Sp. Pl. 1049. *I. repens*, Roxb., Flor. Ind., i, 323.

Kalpéni; *Alcock!* Minikoi; *Fleming!*

Extends from S. E. Asia to Australia and Western Polynesia; is very common on the coast in the Andamans and Nicobars.

182. **Andropogon contortus** Linn., Sp. Pl. 1045; Roxb., Flor. Ind., i, 253.

Kiltán; *Alcock!* Kadamum; very plentiful, *Fleming!*

A common grass of dry places, cosmopolitan in the tropics.

183. ANDROPOGON MURICATUS Retz., Obs., iii, 43; Roxb., Flor. Ind., i, 265; Watt, Dict., i, 245. The *Khus-khus* grass.

Kiltán; a little clump found growing near the mosque, *Fleming!*

Cosmopolitan in the tropics; here probably introduced. Haeckel (*DC., Monogr. Phanerog.*, vi., 542) identifies *A. muricatus* Retz. with *A. squarrosus* Linn. f., but omits to cite Roxburgh's description of the Khus-khus grass or to say whether

* "Stray Feathers," iv, 441.

in his opinion *A. squarrosus* is, or is not, the Khus-khus. There can, of course, be no possibility of doubt as to the grass intended by Roxburgh, though there may be some as to the identity of Roxburgh's plant with that of Retzius.

184. SORGHUM VULGARE Pers., Synops., i, 101. *Andropogon Sorghum* Roxb., Flor. Ind., i, 269. The *Sorghum, vernac.* "Jowa."

Améni ; cultivated, *Robinson.* Kadamum ; cultivated, *Robinson.* Minikoi ; grows well, but very little cultivated, *Fleming.*

Cultivated throughout warm countries.

185. **Apluda aristata** Linn., Amoen. Acad., iv, 303 ; Roxb., Flor. Ind., i, 324.

Kadamum ; filling all the outskirts of the jungle, *Hume !* Minikoi ; very abundant, *Fleming !*

In woods and hedges throughout South-Eastern Asia.

186. **Cynodon Dactylon** Pers., Synops., i, 85. *Panicum Dactylon* Linn., Sp. Pl. 58 ; Roxb., Flor. Ind., i, 289.

Kalpéni ; *Alcock !*

Cosmopolitan in the tropics. The plant from Bangáro, referred with doubt to this species by Mr. Hume (*Stray Feathers*, iv 452), is in reality *Thuarea sarmentosa.*

187. **Eleusine Ægyptiaca** Pers., Synops., i, 82 ; Roxb., Flor. Ind., i, 344.

Améni ; *Hume !* Kadamum ; *Fleming !*

A cosmopolitan tropical weed of cultivation.

188. ELEUSINE CORACANA Gaertn., Fruct., i, 8, t. 1, f. 11 ; Roxb., Flor. Ind., i, 343 ; Watt, Dict., iii, 237. The *Ràgi* crop; the *Marua Millet.*

Améni ; *Robinson.* Anderut ; *Alcock.* Kadamum ; *Robinson.* Kalpéni ; *Alcock !* Minikoi ; *Fleming !*

A field crop in India, Egypt and Japan.

189. **Eleusine indica** Gaertn., Fruct., i, 8 ; Roxb., Flor. Ind., i, 345.

Minikoi ; *Fleming !*

A cosmopolitan tropical species, occurring as a weed in waste places and on waysides.

190. **Eragrostis plumosa** Steud., Gram., i, 266. *E. tenella* Trin. VAR. *plumosa* Trin., Act. Petrop, vi, i, 398. *Poa plumosa* Retz, Obs., iv, 20 ; Roxb., Flor. Ind., i, 327. *P. tenella* Linn. VAR.——— Spreng., Syst. Veg., i, 341.

VAR. *typica.*

Kalpéni ; *Alcock !* Akati ; *Fleming !* Kadamum ; *Fleming !* Kiltán ; *Fleming !* Minikoi ; *Fleming !*

VAR. *paniculis fastigiatis.*

Akati ; *Fleming !* Kadamum ; *Fleming !* Minikoi ; *Fleming !*

A common grass in Indian fields and waste places.

191. **Lepturus repens** R. Br., Prodr. Flor. Nov. Holl., i, 207.

Bangáro ; *Hume !* Bitrapar ; *Fleming !* Minikoi ; *Fleming !*

A littoral species, extending from Polynesia and Australia to Ceylon, the Laccadives and the Mascarene Islands.

CRYPTOGAMIA.

LYCOPODIACEÆ.

192. **Psilotum triquetrum** Swartz, Syn. Fil., 117 ; Baker, Fern Allies, 30.

Minikoi ; *Fleming !*

Cosmopolitan in the tropics.

FILICES.

193. **Nephrodium molle** Desv., Mem. Soc. Linn., vi, 258 ; Bedd., Ferns of Brit. Ind., 277. *Polypodium parasiticum* Linn., Sp. Pl. (ed. ii) 1551. *P. proliferum* Roxb., Flor. Ind. (ed. Clarke), 752.

Anderut ; *Alcock !*

Cosmopolitan in the tropics.

194. **Nephrolepis cordifolia** Presl., Tent. Pterid. 79 ; Bedd., Ferns of Brit. Ind., 282. *Polypodium cordifolium* Linn., Sp. Pl. (ed. ii) 1549.

Anderut ; *Alcock !*

Cosmopolitan in the tropics.

CHARACEÆ.

195. **Chara** sp., Alcock, Adm. Rep. Marine Survey, 1891-92, p. 10.

Akati ; in fresh-water tanks, *Alcock.*

Unfortunately, no specimens were collected. It is not at all improbable that *Zanichellia palustris* (*Naiadaceæ*) may be found associated with *Chara* in this place ; it often is in similar localities.

MUSCI.

196. **Calymperes Dozyanum** Mitt. *in* Journ. Linn. Soc., iii, Suppl. 42. *C. mollucense* Dozy & Molk, Bryol. Jav., i, 47, t. 37, *nec* Schwaegr.

Minikoi ; *Alcock !*

Extends from Samoa and the Admiralty Islands to the Philippines, Java, the Andamans (Great Coco Island, where it is very plentiful), Ceylon, India (*teste* Mitten *l.c.*) and Minikoi, where it is plentiful. It is the only moss reported

from the island ; Dr. Alcock, writing from the "*Investigator*," remarks on the presence of so much moss and fungus at Minikoi as compared with the other islands, where there are hardly any fungi and there is apparently no moss. On this point he adds :—" But the island is near the equatorial belt of condensation."

LICHENES.

(N. O. Lichenacei.)

197. **Physcia leucomela** Michx, Flor. Bor. Am., ii, 356 ; Nyland., Synops. Lich., i, 414.

Minikoi ; on coco-nut trees, *Alcock !*

Cosmopolitan in tropical and temperate regions on tree trunks.

198. **Physcia obscura** Fries, Lich. Eur., 84 ; Nyland., Synops. Lich., i, 427.

Minikoi ; on coco-nut trees, *Alcock !*

Cosmopolitan on trees and rocks.

FUNGI.

(N. O. Hymenomycetes.)

199. **Pleurotus cuneatus** G. Massée, *sp. nov.* pileo carnosulo, tenui, exacte laterali, flabelliformi postice in stipitem brevissimum producto, glabro, albo ; lamellis decurrentibus, divergentibus, subconfertis, angustis, albis, siccitate pallide ochraceis ; sporis ellipsoideis.

Minikoi ; on coco-nut trees, *Alcock !*

Nearest to *Pleurotus scabrellus*, Berk.

200. **Pleurotus tenuissimus** Jungh., Enum. Fung. Jav.

Minikoi ; on dead screw-pines, *Alcock !*

Java.

201. **Schizophyllum commune** Fries, Syst. Mycol., i, 330.

Kiltán ; on rotten branches of *Ricinus communis*, *Fleming !*

Cosmopolitan.

202. **Polyporus sanguineus** Fries, Epicris. 404.

Kadamum ; on decayed coco-nut stumps, *Fleming !* Minikoi ; on dead branches of screw-pine, *Alcock !*

Cosmopolitan in tropical and subtropical countries.

203. **Polyporus igniarius** Fries, Hymen. Eur., 559.

Minikoi ; *Alcock !*

Cosmopolitan, or nearly so.

204. **Trametes Muelleri** Berk., Jour. Linn. Soc., x, 320.

Minikoi ; *Alcock !*

Australia, Brazil.

205. **Hirneola polytricha** Mont., Syllog. Gen. & Sp. Pl. Crypt., 181.
Minikoi ; " from a wooden house-post," *Alcock !*
Almost cosmopolitan in tropical and subtropical countries.

ALGÆ.

206. **Nostoc verrucosum** Vauch., Conf., 225.
Minikoi ; covering the ground in damp places, *Alcock !*
Cosmopolitan.

There are also some Marine Algæ, at least in Minikoi on the reefs of the weather-side of the island (Alcock, *Adm. Rep., Marine Survey,* 1891-92) ; of these no specimens were collected.

CHARACTERISTIC FEATURES OF THE FLORA.

The list given above includes 206 species, representing 156 genera and 61 natural orders ; 191 of the species are *Phanerogams* and only 15 are *Cryptogams*, giving a proportion of flowering to flowerless plants of about thirteen to one ; the percentages are :—

Phanerogams, 93· °/₀ ;
Cryptogams, 7· °/₀.

Of the *Phanerogams* 150 are *Dicots* and 41 are *Monocots*, the proportion here being nearly four to one ; the percentages are :—

Dicotyledons, 78·5 °/₀ ;
Monocotyledons, 21·5 °/₀.

Only three vascular cryptogams have been found in the Archipelago, with only one moss, while at least one species of *Chara* occurs ; two-thirds of the *Cryptogams* obtained are *Fungi* or *Lichens*. It ought not to be concluded, because one of *Fungi* enumerated has as yet been reported only from Minikoi that it is truly endemic in that island ; in all probability it will yet be found to occur elsewhere. The Marine Algæ mentioned above will in all probability be found when they are at length collected to belong to some of the commoner Indian Ocean forms.

A synoptic view of the Flora is given in the table which follows :—

Table III.—Systematic Synopsis of Laccadive Flora.

Phanerogams	54	144	191
Dicotyledons	43	114	150
Polypetalæ	23	53	68
Thalamifloræ	8	14	17
Disciflorae	8	12	15
Calycifloræ	7	27	36
Gamopetalæ	13	43	53
Incompletæ	7	18	29
Monocotyledons	11	30	41
Cryptogams	7	12	15
Vascular	3	4	4
Ferns and Lycopods	2	3	3
Characeæ	1	1	1
Cellular	4	8	11
Mosses	1	1	1
Lichens	1	1	2
Fungi	1	5	7
Algæ	1	1	1
Total.....	Nat. orders..... 61	*Genera* 156	Species 206

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Of the 60 natural orders, 28 are represented by only one species ; 10 by two species ; 7 by three species. The most extensively represented natural orders are *Leguminosæ* (21 sp.) and *Gramineæ* (20 sp.) ; followed by *Euphorbiaceæ* (14 sp.) and *Compositæ* (10 sp.) ; *Malvaceæ* (9 sp.), *Rubiaceæ* and *Cyperaceæ* (each 8 sp.) ; *Convolvulaceæ* and *Fungi* (*Hymenomycetes*) (each 7 sp.) ; *Rutaceæ*, *Cucurbitaceæ* and *Solanaceæ* (each 6 sp.) ; *Acanthaceæ* and *Urticaceæ* (each 5 sp.) ; *Verbenaceæ* (4 sp.).

The land-mark height of the islands of the group is usually about 60 feet ; none of them exceed this. Deducting, therefore, the 12 to 15 feet of coral formation that composes the islands, we find that none of the trees in the group are more than 45 to 50 feet high. The tallest trees, and those that in all the inhabited islands, except Kadamum, form at the same time the bulk of the vegetation, are the coco-nuts, which are cultivated ; the majority of the remaining arboreal forms are also cultivated species, most of them being fruit-trees like *Anona muricata*, *Artocarpus incisa*, *Mangifera indica*, *Tamarindus indica*, or trees like *Moringa pterygosperma*, with an immediate, or, like *Sesbania grandiflora*, with an indirect economic interest. There are only five arboreal species that are at all likely to be truly " indigenous " in the accepted sense of the term ; four of these—the *Thespesia*, the *Calophyllum*, the *Pisonia* and *Terminalia Catappa*—are probably sea-introduced, the fifth (*Ficus nitida*) is perhaps a bird-introduced species ; four, however, as it happens, are known to be planted by the inhabitants at least in some of the islands, though three of them are undoubtedly " wild" as well as planted.

In the interior of the majority of the islands there is no true jungle, the whole cultivable area being occupied by coco-nut groves with small patches of garden-land (*kat*) ; on this account there is, as might be expected, only a flora of tropical cultivated species, with the usual tropical weeds of cultivation and Indian garden escapes reported from the centre or the islands, and with some common Indian Ocean littoral species from the sea-fence that lines the shore. In the interior of the smaller uninhabited islands, such as Bitra and Bangáro, a dense jungle does, indeed, exist ; it is, however, composed of littoral species that have spread inward from the beach on both sides of the island till the two sea-fences have met and coalesced in the middle. In these islands the jungle is shrubby, hardly even subarboreal. The only island where there are considerable tracts of unoccupied ground, and where a true interior jungle exists, is Kadamum. Here also the jungle is of the nature of " scrub," and though there are present in it some quite characteristic inland forms, such as *Pavetta*, *Pleurostylia* and *Flacourtia*, which are not reported from the other islands, these do not exclusively compose the central jungle; characteristically " littoral" species, *Premna*, *Morinda* and the like, enter largely into its formation.

Only 47 species are woody, 20 of these being trees, 25 shrubs, and 2 climbers. Of the 20 trees, 15 are cultivated species ; 4 of the remaining 5 are "littoral." Of the 159 herbaceous species, 119 are herbs proper, 28 are climbers, and 12 are of the class of "tree-herbs" or "shrub-herbs" like *Musa* or *Carica* and *Agave* or *Calotropis*.

From the nature of the group we are led to expect that none of the species are really indigenous ; further, that the majority of the species must have been introduced by man, and that next to human agency that of the sea has been most active. Detailed examination confirms these anticipations, for we find that as many as 127 species (three-fifths of the whole flora) are species that have been introduced by man. Of these, 52, or a fourth of the whole flora, are purely cultivated plants ; 7 others that appear mostly in an apparently wild state are likewise cultivated ; 4 that are cultivated occur occasionally as escapes. These figures refer to plants grown for economic reasons, but there are 13 other species that are "garden escapes" in the more usual sense, being bright-flowered or sweet-smelling species originally grown deliberately. The remaining 64 species are mere weeds.

Of the balance, the larger moiety (41 species or one-fifth of the whole flora) consists of "littoral" sea-introduced species ; the remainder includes 9 marsh or water species (a very small proportion of the flora) and 27 inland species.

The people of Minikoi cultivate 40 species as against 24 cultivated in Ameni, 18 in Anderut, 13 in Akati, 13 in Kiltán and 11 in Kadamum. The figures for the other islands are not at all complete. Doubtless, for some of these they are imperfect, but there is no reason to doubt that the numbers given are approximately true ; they place the islands in a series which accords very well with the general accounts that have been given by those who have visited the islands, of the relative wealth and comfort of the people.

The cultivation of most of the species is the direct result of the intercourse of the people with the Indian mainland, perhaps the chief exception is their use of the South Sea Islanders' *Taro* (*Tacca pinnatifida*). Of the cultivated plants, 10 are originally American, 5 originally African, 2 originally Chinese, the rest either Indian or Indo-Malayan ; the cultivation of nearly all the species is now, however, cosmopolitan in the tropics.

The weeds, like the cultivated plants, are by no means evenly distributed throughout the Archipelago. Of the whole 64 species, as many as 20 are reported from only one island ; even if we allow for the possibility of a species having been here and there overlooked, the proportion is very high. Without going into too great detail, it may be noted that 8 of these weeds—one-eighth of the weed-list—are reported only from Minikoi ; more remarkable still, 31 species—very nearly one-half the list—occur in one or other of Laccadives proper, but not in Minikoi. The meaning of this is not very clear ; it may be partly due to there being no large waste area in Minikoi, as there is for instance in Kadamum; perhaps, too, the people hold less intercourse with India than do those of the other

islands. That they do hold some may be surmised from the presence in Minikoi of one species, *Aneilema ovalifolium*, which is found in India only, not appearing even in Ceylon or in any of the other Laccadive Islands. It is, of course, not impossible that this is a bird-introduced species, in which case its peculiarly limited area of distribution is difficult to explain. As regards Kadamum, the same remarks apply to the even more restricted *Cyperus hyalinus*; perhaps, however, this species may not be in South India so rare as we at present think.

So far as their general distribution goes, 26 (40 %) of the weeds are cosmopolitan in the tropics—a few have not been reported from the Mascarene Islands, though they occur in Africa itself; other 10 are nearly cosmopolitan, being present in both hemispheres—of these, 4 are absent from Polynesia, 2 from Australia, 3 from Australia and Polynesia, and one, which is confined to South-Eastern Asia and America, from Africa also. Altogether, therefore, 36 of these species, or 56 % of the weeds, occur in the tropics of both hemispheres.

Of the species absent from the new world, there are 2 which extend from the Eastern Hemisphere to Polynesia, and 2 more that extend to Australia without reaching Polynesia. As many as 11 species, or 17 % of the weeds, are common to Africa and South-Eastern Asia; but 4 of these are African only in the sense that they occur as weeds, no doubt introduced from India, in Mauritius. Of the whole, 13 species, or 20 % of the weeds, are confined to Asia; all of them occur in India, though it is noteworthy that no fewer than 9 of them appear to be unknown in Ceylon; this being so, we are not surprised to find that 14 of them are unknown in Malay countries.

Considering next the species of the "sylvestrian" class as opposed to those introduced by human agency, we expect that as the islands appeared above sea-level, they must first have afforded a footing for littoral species. Such plants could scarcely in point of time be preceded even by species of the wind-introduced class, while the conditions on the islands would be much more favourable for sea-introduced than for wind-introduced ones. Introduction by birds could only become active after species of the other classes had been established and had rendered the islands sufficiently attractive and conspicuous for birds to alight on them. We anticipate, therefore, that of the three kinds of species mentioned the littoral sea-introduced class should be comparatively numerous, the other classes relatively scarce. This expectation is fully borne out by the facts.

The coast-flora includes 41 unequivocally sea-introduced plants, and forms a fifth, or 20 %, of the entire Flora. Of these 41 species, 12, or 29 % (nearly a third), are cosmopolitan on tropical seashores. Of the remainder, 11 species, or nearly 27 %, extend from Polynesia to these islands, no fewer than 9 of them extending further west to Africa, or the Mascarene Islands, or both. There are 3 species that do not extend further east than to Australia and 13 that do not

extend further than Malaya. On the other hand, 2 species (*Launea pinnatifida* and *Cyperus pachyrhizus*) find on the Laccadives and the adjacent Indian Coasts their extreme eastmost extension ; the *Cyperus* is a plant characteristic of the western coasts of India and of Arabia, the *Launea* occurs on the coasts of Eastern Africa—across the Arabian Sea—as well. With these two exceptions, however, all of the littoral species occur on Malay Coasts, and it is significant of the extent to which the sea-board flora is Malayan rather than Indian. When we observe that though 39, or over 97 °/₀, of them are found in Malaya, no fewer than 8, or 20 °/₀, of them are absent from the neighbouring Indian Coasts. The islands come, therefore, more within the influence of those ocean-currents that sweep up from the south-east from Malayan Seas than does the Indian Coast ; their shores, therefore, have some of the species characteristic of nearly every tropical coast from Fiji to the Seychelles that are wanting in India.

Of inland as opposed to littoral species those that are wind-introduced, as being likely to appear earliest, are the first to be considered. These are Phanerogams with seeds or fruits fitted for wind-carriage—of which there are here but two unequivocal examples (*Tylophora* and *Leptadenia*)—and small spored Cryptogams, of which there are 14. The two Phanerogams are species confined to South-Eastern Asia ; of the Cryptogams, on the other hand, 10 are cosmopolitan in the tropics ; one (*Trametes Muelleri*, which occurs likewise in Australia and in South America) is nearly so ; another (*Calymperes Dozyanum*) occurs throughout South-Eastern Asia and in Polynesia ; only two are confined to South-Eastern Asia, and of these one has, so far as is at present known, been found only in Minikoi.

Of the species introduced by birds, whether by being carried in pellets of mud or otherwise attached to their feet or their feathers, or carried as undigested seeds in their crops, the flora affords very few examples.

Of the former subgroup, consisting of marsh weeds with small seeds or fruits, there are but 9 unequivocal examples. They are, as a rule, widely distributed species ; here, for example, three occur in both hemispheres—two are found throughout the tropics of the old world ; one extends from India to Polynesia. Only one is confined to South-Eastern Asia, and of one—the *Chara*, whose specific identity is unknown—we cannot speak.

Of the second subgroup, species with soft fruits but resistent seeds, there are only 8 clear examples. Their most notable feature as compared with the last is their confined distribution. None are cosmopolitan, only one extends eastwards as far as Polynesia, and this one (*Ficus nitida*) does not even in that direction pass beyond New Caledonia ; at the same time only one (*Datura fastuosa*) extends to America, and though its introduction by birds is clearly possible,* it is, no doubt, more usually introduced by man. While three species extend to Australia and four to the Mascarene Islands or Africa, it is worthy of note that none of

* Prain, Proceedings of the Asiatic Society of Bengal (1891), p. 171.

them occur both in Africa and in Australia. Indeed, one species, *Pleurostylia Wightii*, exhibits the peculiarity of being restricted to Ceylon, Southern India, the Island of Kadamum and Mauritius; with this solitary exception, however, all the species of this kind occur in Malaya, as well as in India and Ceylon.

Reviewing in tabular form the facts indicated in the preceding paragraphs, we find the number and proportion of the species that have been certainly, or possibly, or probably influenced by the various distributive agencies to be as follows:—

Table IV.—Modes of introduction of Laccadive Plants.

Introduced by	Certainly.		Possibly.		Probably.	
	No. of Sp.	Per cent.	No. of Sp.	Per cent.	No. of Sp.	Per cent.
Man	115	56 %	139	68 %	129	63 %
The Sea	35	12 %	45	22 %	41	20 %
Winds	16	8 %	18	9 %	17	8 %
Birds	15	7 %	21	10 %	19	9 %

At the same time, omitting from consideration the cultivated species and garden escapes, the majority of which are exotics, as well as the undetermined *Chara*, the general distribution of the Laccadive Flora may be tabulated as follows:—

Table V.—Synopsis of Distribution of Laccadive Species.

Cultivated species, garden escapes, undetermined species		66	31·6%
Cosmopolitan in the tropics		51	25·1%
Almost so: present in both Hemispheres		12	6 %
Absent from Polynesia only	4	2%	
Absent from Australia only	2	1%	
Absent from Australia and Polynesia	4	2%	
Absent from Africa, Australia, Polynesia	2	1%	
Confined to Old World		77	37·3%
In Africa, Asia, Australia, Polynesia	13	6·3	
In Africa, Asia, Australia	5	2·2	
In Africa and Asia	19	9·3	
In Asia, Australia, Polynesia	4	2	
In Asia, Australia	2	1	
In Asia, Polynesia	2	1	
Confined to S.E. Asia	32	15·5	
Total		206	100 %

NOTES ON SPORT IN SOMALI LAND.

By C. G. Dodgson, I. C. S.

(*Read before the Bombay Natural History Society on 21st June* 1893.)

I spent 10 weeks in Somali Land during the past cold season; at this time of year there is very little water in the country, almost all the nullahs being dry, and water being obtainable only by digging deep down into the sandy beds of the streams, and occasionally found in pools which are drying up. The Somalis are nearly all to be found north of the range of hills which runs east and west parallel to the coast line and at a distance of about 30 or 40 miles from it. The high lying plateau to the south of these hills is almost devoid of human habitation during the dry season; the result is, that the lions, dependent as they are, to a great extent, on the peoples' sheep and camels for food, are generally fairly close to the Somalis' "karias," or temporary settlements. The antelope, on the other hand, are mostly further south far away from water, which they can do without, and undisturbed by camels and cattle grazing and by the sight of man.

The maritime plain extends for about 30 miles inland up to the foot of the high range of hills which runs east and west; there is, at all events in the dry season, very little game to be seen between Berbera and the hills. I was told that south of Bulhar, which lies to the west of Berbera, things are better in this respect; as far as my experience goes, the best country is to the south of the range of hills on the plateau, which is, roughly speaking, about 4,000 feet above the level of the sea. The ground here is good for tracking, consisting, due south of Berbera, of loose red soil, free from stones; as one, however, marches further west, the plateau becomes more undulating. The lower lands, which contain the densest vegetation, are excellent for tracking over; the higher lands, which are mostly covered with a scanty growth of small thorny bushes, are freely strewn with stones and pebbles, which in some parts are so numerous as to render it absolutely impossible to follow an animal for a yard by his footprints.

The following is a list of the game animals to be found north of the "Haud," or waterless tract of country which runs east and west across the high plateau :—

	English name.	Latin name.	Somali name.
1	Sand Antelope	Neotragus saltianis	Săgāro.
2	Waller's Gazelle	Gazella walleri	Gerenouk.
3	Oryx.....	Oryx beisa.....	Be'id.
4	Soemmering's Gazelle...	Gazella soemmeringii.....	Awal.
5	Gazelle	G. spekii or naso and G. pelzelni.	Dhero.
6	Larger Kudu	Strepsiceros kudu	Godir.
7	Lesser Kudu.....	Strepsiceros imberbis ...	Anderio or Arreh.
8	Klipspringer	Nanotragus oreotragus ...	Alakud.
9	Warthog	Phacocœrus æthiopicus ...	Dophur.
10	Panther.....	Felis pardus	Sheybelle.
11	Lion.....	Felis leo	Libăh.
12	Elephant	Elephas africanus	Marode.
13	Wild Ass	Equus somalicus	Duber.
14	Spotted Hyæna	Hyæna crocuta.....	Wărāba.
15	Striped Hyæna.....	Hyæna striata	Lidda.
16	Hartbeest	Bubalis swaynei	Syg.

Besides the above-mentioned animals, there are also to be found ostriches, hares, 2 species of foxes, jackals, porcupines, and lynx. Of the 16 animals in the above list, I succeeded in shooting specimens of each of the first eleven kinds, besides seeing specimens of Nos. 12, 13 and 14.

I will now briefly describe such animals as I became acquainted with. I do not propose going into detailed descriptions of colour of skin or shape of horns. Such descriptions have already appeared in this Society's Journal, No. 4, Vol. VI, in the paper read by Mr. J. D. Inverarity in September, 1891, and I could add but little, if anything, to them.

The commonest and most widely distributed of all the antelope is undoubtedly the tiny sand antelope ; he is to be seen close to Berbera among the small scattered bushes which grow on the maritime plain, and among the ravines at the foot of the high range of hills which I have already spoken of as running parallel to the coast-line. He is also found on the plateau to the south of this range and also in the hilly wild country in the far west. It seems to him to be quite immaterial whether he lives in long grass, under the shade of bushes, or hidden away among the aloe plants which are common in many parts of Somali Land. This antelope is only about 12 inches in height, and though he affords pretty shooting with a rook rifle, can best be secured with a shot gun and No. 4 shot ; the pace with which he manages to dart in and out of the bushes is extraordinary, and makes him anything but an easy object to hit. There appears to be no difference in colour between the males and females, the general colour being

dark grey. The males are distinguishable from the females by having short upright horns and a tuft of dark chestnut hair on the forehead. They are generally found in couples, and, like almost all the other antelope of Somali Land, appear to be quite independent of water. The Somalis seldom eat it, saying that they do not like the taste; but to me it tasted very much like that of other antelope. Somalis in talking to a European about this antelope call it the Dik-Dik, believing this word to be English; it is not a Somali word, the word used by the natives of the country being Săgăro. A peculiarity of the horns of this antelope is, that when looked at from in front, the flat part or side is seen better than if looked at from the side; the horns, if looked at from behind, present a rounded appearance.

Next to the sand antelope, the commonest antelope is Waller's gazelle. I saw these antelope in every kind of country, both near to and far from water; they are extremely shy and when once alarmed seldom give one a chance of getting near them again. The males are somewhat darker in colour and larger in body than the females, and are easily to be distinguished from them by the fact that the latter have no horns. The most striking peculiarity about this antelope is the length of its neck; the distance from between the horns to the top of the shoulder-blades of a full grown buck which I measured was, to the best of my recollection, about 24 inches. The other measurements which I took of this particular animal were—

From nose to insertion of tail ... ... 4 ft. 5 in.
Height at shoulder ... ... 3 ft. 4 in.
From point of elbow to heel ... ... 2 ft. 2 in.

These figures show that the animal is long and slightly built; his long legs and long neck are most useful to him in helping him to reach high up to the branches of trees. On several occasions I saw these antelope standing on their hind legs, with their forefeet resting among the branches of a tree and themselves busy nibbling at the leaves, in exactly the same way that goats do; doubtless, nature has provided the long neck to assist them in this habit. The largest herd of Waller's gazelle which I ever saw consisted of 11 animals; as a rule, a herd consists of about 6 or 7 animals. Between the horns on the top of the head there is a triangular patch of brown hair, darker on the bucks than on the does; with age it turns greyish. The following are the measurements of the 4 largest pairs of horns in my possession :—

	Round upper curve from base to tip.	Straight line from base to tip.	Tip to tip.	Circumference at base.
	Inches.	Inches.	Inches.	Inches.
1	$15\frac{1}{2}$	$12\frac{1}{4}$	$2\frac{1}{2}$	$5\frac{3}{8}$
2	$14\frac{1}{2}$	$11\frac{3}{4}$	$3\frac{1}{2}$	$5\frac{1}{4}$
3	$12\frac{7}{8}$	$10\frac{3}{4}$	5	$5\frac{1}{4}$
4	$12\frac{1}{2}$	$10\frac{7}{8}$	4	5

The oryx is probably the next most generally distributed of the antelopes; he is extremely shy, and I never saw one anywhere near human habitations.

Until I had seen a considerable number, I was always unable to distinguish between the sexes, the horns of the does being quite as long as those of the bucks, and I consequently, shot some females. If one can, however, get to within 100 yards of a herd, which, by the bye, it is extremely difficult to do, the heavier head and shoulders of the male enable one to pick him out from among the females. The general appearance of this antelope is at first sight somewhat disappointing ; his extremely heavy shoulders and high withers, his broad muzzle, his manner of carrying his head low, the muzzle pointed almost straight downwards when galloping, and his heavy lumbering action, take away considerably from his game-like appearance. I exhibit a photograph which gives a very fair idea of his appearance. Oryx are to be found in large herds ; on several occasions I saw herds of between 20 or 30, and on one occasion counted no less than 52 animals in one herd. This large herd was grazing in a vast open plain. As far as the eye could reach, there was not a sign of a shrub or bush of any kind—nothing but a sea of yellow grass. The oryx were extremely wild, and there being absolutely no cover, it was impossible to get anywhere within shot of them. I was greatly struck with the precision of the movements of this large herd. Among bushes a herd of oryx, when disturbed, gallops away in a dense throng, without any order or attempt to keep in line. On this open plain, however, the herd grazed along, keeping an excellent line, the animals all walking side by side ; when disturbed, they galloped away, keeping the same correct line. They wheeled to the right and left, with almost military precision, and also, when turning to the right or left, travelled along in single file, one behind the other, in perfect order. As a general rule, the horns of the females are apt to be somewhat longer than those of the males, but less thick ; this will be seen from the following measurements, which are those of some of the horns in my possession :—

		Length from base to tip.	Circumference round base.	Circumference 12 inches above the base.
Males.	1	34 (right) and 31⅛ (left).	6¼	4⅛
	2	31½	6½	4¼
	3	31½	6	3⅞
	4	27½	6½	4⅛
Females.	1	33½	5½	3⅜
	2	32⅜	4¾	3¼
	3	30	4⅝	3¼

The two oldest males which I shot are those shown above as Nos. 1 and 4. The horns of No. 4, though heavy and massive, are much blunted and worn

away at the points ; in the case of male No. 1, there is a considerable difference between the length of the two horns. I found some difference in nearly every pair of horns I secured. Somalis, I am told, ride down and spear oryx in the rainy reason ; their grass-fed ponies have, I believe, no difficulty in overtaking these antelopes. One day one of the Somalis with me pursued on a pony a herd of oryx, one of which I had wounded and although the ground was stony and the pony not a particularly good one, he soon managed to get up to and ride alongside of the herd. The oryx are said to turn to bay at times when thus pursued, and I quite believe it, for on one occasion when 2 Somalis with me ran up to cut the throat of an oryx which I had fired at and knocked down, the animal managed to spring to his feet and dash forwards for a few yards at the two men—a proceeding which made them beat an uncommonly hasty retreat. I had to put another bullet into this antelope before the men could "halal" him. I have recorded no measurements of the height of oryx, but I consider him to be between 3 ft. 9 in. and 4 ft. at the withers.

Like Waller's gazelle and the oryx, Soemmering's gazelle is also a desert antelope, living far from water, and picking up in the dry season an apparently precarious livelihood on stunted tufts of dried-up grass. I saw these antelopes both in bush-covered country and on the vast open plain, which I have mentioned above as the place where I saw the large herd of oryx. Soemmering's gazelle generally go in herds, but I at times saw solitary bucks. The herds contain, as a rule, about 20 members ; but on two or three occasions I saw much larger numbers, a herd of probably not less than 70 animals being the largest which I came across. This antelope is much easier to approach than any other antelope in Somali Land, and, even when disturbed, will generally not run far, but will allow one, time after time, to get within shot. Their behaviour always reminded me strongly of Indian black buck. A herd will let you approach to within, say, 200 yards, but will then begin to show signs of uneasiness, gradually moving off, without, however, at once breaking into a gallop ; if still followed, they will probably start away at a trot, but after going 200 or 300 yards, will again subside into a walk and go on grazing as if nothing had occurred to alarm them. On one occasion it was not until I had fired 3 shots at a herd bagging 2 bucks that they made up their mind to go off altogether. When galloping, they cover the ground at a tremendous pace, but I never saw them indulge in the high bounds into the air which Indian black buck are so fond of. The females have slightly annulated horns, of just the same length as those of the males, but somewhat thinner ; this fact makes it sometimes very difficult to distinguish between the sexes, if the antelope are standing at, say, 150 yards among bushes. The following are the measurements of some of the best horns in my possession ; I give the

length, &c., of the does', as well as of the bucks' horns, for the sake of comparison :—

		Straight line from base to tip.	Round curve from base to tip.	Tip to tip.	Circumference round the base.
Females.	1	13	$16\frac{1}{2}$	$3\frac{3}{4}$	3
	2	$14\frac{1}{4}$	$15\frac{7}{8}$	$6\frac{1}{8}$	$3\frac{1}{4}$
Males.	1	$15\frac{1}{2}$	$17\frac{3}{4}$	3	$5\frac{3}{4}$
	2	$14\frac{5}{8}$	$17\frac{1}{2}$	$4\frac{1}{4}$	$5\frac{1}{2}$
	3	14	$16\frac{3}{4}$	4	$5\frac{7}{8}$
	4	$13\frac{1}{2}$	17	6	$5\frac{1}{4}$

Of the above horns, the best pair (male No. 1) was picked up by me in the jungle ; the rest I shot myself. The distance between the tips varies considerably in different animals. In the case of one small buck which I shot, whose horns were about 4 inches long, the tips actually overlapped each other. Not only do the dimensions vary in different animals, but there is also a great difference in shape. Out of seven pairs of bucks' horns in my possession, the tips of 4 point forwards and of 3 point backwards ; the does' horns which I have also point backwards.

There is some doubt as to whether *Gazella spekii* (or *naso*) and *Gazella pelzelni* are different species or not. There certainly appeared to me to be some difference between the gazelle of the plain near Berbera and those of the high plateau to the south ; all the gazelle which I saw on the plateau struck me as having a dark stripe of brown, and sometimes almost black, hair along the side. I do not remember ever seeing this stripe on the gazelle of the plain near Berbera. Both the gazelle of the plain and those of the plateau have loose skin on the nose, but it is much more marked among the latter than among the former. The first gazelle which I shot in Somali Land was about 15 miles from Berbera. I looked for the loose pouch of skin on the nose said to be characteristic of *G. naso*, and found that the skin was no doubt loose and could be pulled up, but this characteristic was so very slightly defined that I should not have noticed it had I not looked for it. In the case of the next gazelle which I shot, this time on the plateau, I at once caught sight of the pouch or flabby loose skin which lies wrinkled up on the top of the nose ; it was most marked. I shot altogether 8 gazelles—4 on the plateau and 4 on the Berbera plain, and in every case I noticed the above-mentioned differences ; besides the absence of the dark stripe on its side, the skin of the gazelle of the maritime plain is, to my mind, of distinctly lighter colour and more yellow than is the gazelle of the plateau, the latter being much browner. Whether these differences are sufficient to justify a division of the animals into 2 different species is a question to be decided by more learned naturalists than myself ; as far as my experience

goes, there is no difference whatever between the horns of the 2 species. The Somali gazelle closely resembles the Indian chinkara (*G. bennettii*) in behaviour and general character ; it would be difficult, if not impossible, to distinguish between the hours of the African and Indian species.

The larger kudu is not a desert antelope. He lives on steep hillsides, chiefly among well-wooded ravines and in good shade. In character he always reminded me of sambar, living in much the same style of country, and having the same capacity of dashing at full speed through, what at first sight might appear, an impenetrable thicket. He is seldom found very far from water, although he does not drink daily. I believe that in South Africa these antelope can be ridden down and killed off horse-back. This would be impossible in Somali Land owing to the nature of the ground. The does have no horns and are of a pale brown colour, the bucks being dark blue, very much like Indian nilgai in colour. Both sexes have a ridge of hair along the spine and transverse white stripes running down the sides. The stripes on the female are more numerous than those on the male, but I cannot say exactly how many the females have. The number of stripes on the males differs with different animals. I shot 2 males, one of which, a very old animal, had 7 stripes on each side, the other having 6 stripes on one side and 5 on the other. The Somalis say that the number of stripes diminishes with increasing years. This I do not believe. The old male which I shot had lost large patches of hair all over his body and head, evidently from old age ; but the remains of the 7 stripes on each side can easily be counted. If any one of these had entirely disappeared, it would have been because all the hair had gone, leaving the skin exposed to view, not because the hair had changed colour. The number of white spots on the cheeks also varies in different animals, some having 2, some 3 spots. The Somalis say that young kudu are born in April and May. This is very likely correct, as I saw, at the end of November, fawns which might have been 6 or 7 months old. The following are the dimensions of the horns of the 2 larger kudu which I shot :—

	Straight line from base to tip.	Along the curve from base to tip.	Tip to tip.	Circumference round base.
1	$36\frac{3}{4}$	$47\frac{1}{4}$	32	$9\frac{7}{8}$
2	36	$49\frac{1}{2}$	$21\frac{3}{4}$	$10\frac{1}{2}$

No. 1 was an older animal than No. 2 ; he measured 4 ft. 8 in. at the shoulder, and 6 ft. 7 in. from the nose to the insertion of the tail.

The lesser kudu, like the larger kudu, is, I believe, seldom found far from water, but, unlike him, does not live on hill-sides. He prefers dense milk bush jungle and rough broken ground at the foot of the hills. He is not an easy animal to shoot, owing to the thick cover in which he lives, enabling him at the first sign of danger to put a bush or other shelter between himself and the sportsman.

His beautiful marking makes him one of the most lovely of antelopes. The females have no horns, and, as in the case of the larger kudu, are brown, whereas the males are dark slate-colour. I shot 2 bucks, one having 9 white stripes on one side and 10 on the other, the other having 13 on one side and 14 on the other. These 2 antelope measured, respectively, 3 ft. 7 in. and 3 ft. 7½ in. in height at the shoulder. Lesser kudu seem extremely fond of aloes, a species of milk bush, and a creeper with thick fleshy leaves. They are frequently seen in small herds. The largest herd I saw consisted of 2 bucks and 5 does. The photograph which I exhibit is that of a lesser kudu, wounded, but alive ; it gives an idea of the nature of the bushes among which he lives.

The klipspringer lives solely among the hills, and is generally found among high boulders and rocks. His tiny little hoofs, which are very high, enable him to secure a footing on what look like perfectly inaccessible rocky slopes, and the manner in which he bounds from one boulder to another is astonishing. When disturbed, he utters a loud hissing sound, which is at times apt to betray his presence, for his brown colour blends wonderfully well with the rocks among which he lives. The females have no horns, those of the males being short, upright, and between 3 and 4 inches in length. The Somalis affect to despise the flesh of this antelope ; to my taste, it is quite worth eating. Klipspringers are seldom found alone. I always saw 2 or 3 together, and on one occasion saw 5 in a herd. The hair is most peculiar, being stiff and about an inch long, and rather suggestive of a porcupine's bristles on a small scale.

Of the warthog I can say very little, as I did not succeed in getting a boar. I saw warthog on two occasions, and was at once struck by the almost total absence of neck, the formidable-looking tusks, and the position of the tail, which appears to be always carried pointed straight up in the air. The colour of these animals seemed to me to vary with the locality in which they were. Out on a vast grass-covered plain, with little or no cover on it, these pigs looked quite yellow, thus matching the dried-up grass ; in bush-covered land, with an undergrowth of aloes, their colour was grey, like that of ordinary Indian pig. I shot a sow, whose tusks looked quite as big as those of most boars in India. Very little of the tusk is embedded in the gum, nearly the whole of it protruding.

The panther of Somali Land is exactly the same as the Indian animal, except that the skin is somewhat paler in colour. They appear to do a great deal of damage among the sheep and goats of the Somalis, but, I believe, very seldom kill ponies or donkeys. On two occasions a panther came close to my zeriba, but he took no notice of the donkey which was tied outside. This particular panther, which I afterwards shot, measured 4 ft. 1 in. from the nose to the insertion of the tail, which was 2 ft. 8 in. long. An Indian panther, with a body 4 ft. 1 in. in length, would have made short work of the donkey. I cannot help thinking that the Somali panther is less powerful than his Indian brother. I shot three,

measuring, respectively, 4 ft. 1 in., 3 ft. 11½ in., and 3 ft. 11 in., from nose to the insertion of the tail (I leave out all mention of the measurement of the tails, because the length of an animal's tail has nothing whatever to do with his size and strength). None of these were particularly small animals, but the fact that they confine their attention to small animals, like sheep and goats, seems to show that ponies and donkeys are too big for them.

The lion is, undoubtedly, the animal most in request among sportsmen in Somali Land. Large numbers have been killed, and, before much longer, it will be necessary to go very far inland for them. I did not see one until I had travelled nearly 200 miles in one direction and another, and was about 100 miles in a straight line from Berbera. The lions depend very largely for food upon the sheep, donkeys and camels belonging to the natives of the country; they are, consequently, generally to be found somewhere in the neighbourhood of the Somali "karias" or temporary settlements. They can be shot either by day, by means of tracking and beating, or by night, the sportsman lying hidden in a small thorn enclosure, with a live donkey or, better still, an animal that has been recently killed by a lion, close by outside, and with a hole in the enclosure to fire through. I never had a liking for night shooting, and though I tried it three or four times in Somali Land, soon gave it up. All the sport I had with lions was in the daytime. The country is mostly excellent for tracking, and, provided one can find fresh tracks fairly early in the morning, there is every chance of, at all events, seeing the animal before the evening. The lions sometimes lie up during the daytime in the cool shade of patches of long grass or of dense thickets of bushes. When a lion is marked down in some such place as this, he can be driven out by beaters or, if necessary, by means of fire. In the country in which I was there were very few places to which one could point as being more likely to hold a lion than others: the ground was covered with small bushes scattered here and there, and a lion might lie up anywhere. The result was that, when tracked up to, the lions, which were practically out in the open, constantly sprang up before me and galloped off. They, however, never went far, and by dint of constant tracking, it was generally possible to come up to them again and again until by stalking and running forward a shot could be obtained. Such shots are, however, apt to be fairly long. I found men mounted on ponies to be of great assistance in this style of country. If the lion takes alarm and makes off, the horsemen follow him and try to keep him in sight. By shouting they save the trackers and sportsmen a great deal of trouble, as the latter merely have then to follow the sound; and if the country is at all open, the horsemen can generally head the lion and either drive him back to the gun, or, what I found generally to happen, the lion, finding that he cannot escape, lies down and lets you come up and have a close shot at him. As compared with a tiger, I consider the lion in no way physically inferior; on the contrary, the lion's hind-quarters appeared

to me to be more in proportion to the rest of his body than is the case with the tiger. The difference between the pugs of a lion and those of a lioness is much more marked than in the case of tigers ; that of the female is long and narrow, that of the male is broader and more square. In the case of the tiger the same rule applies, but it is, as far as my experience goes, much easier to be mistaken as to the sex of the animals whose tracks one is looking at in India than in Somali Land. All the lions I shot had a tuft of hair on the elbow. The mane is disappointing, not being nearly so full as is seen on lions kept in zoological gardens. A mane with hair 10 inches long, I should consider a very fine one. At the end of the tail there is a tuft of black hair. If this were shaved off, a small prickle of horny substance would be seen attached to the skin. This prickle is less than $\frac{1}{4}$ of an inch in length and is not sharp. The colour of lions varies considerably ; most appear to be of a dark straw colour ; but some are occasionally found very much darker, being in fact of a distinctly brownish-grey hue ; the manes too vary in colour, some being pure yellow, others having a considerable quantity of brown or even black hair intermingled with the yellow ; the brown and black hairs lie along the top of the shoulder-blades, and also stretch downwards in front of the shoulder at right angles to this ridge.

I was fortunate enough to see a lioness kill an antelope in broad day-light. I had tracked a lioness one afternoon till about 5 P.M., when the tracks went up on to high-lying stony ground, such as I have already described, on which it was impossible to follow them for a yard. I, however, walked on in the direction in which they led, more with the idea of shooting anything that I might see than with any thought of finding the lioness ; after going about half a mile over the stones, I saw a herd of Soemmering's gazelle, which I succeeded in getting close to, firing two shots at them ; the 2nd shot hit a buck low down on the shoulder, knocking him over but not killing him ; the whole herd bolted, the wounded animal struggling to his feet and limping slowly after the rest ; at this moment a lioness, evidently the one I had been tracking, rushed out from behind a small leafless bush about 30 yards from where I was and passing close by me made for the wounded antelope, overtaking it. She rushed out from behind the bush without uttering a sound and covered the ground at a great pace; although she was not more than about 130 yards from me when she came up with the antelope, it was not easy to see how she really killed it ; she seemed to rush right over it and I saw her grip it with her jaws by the back of the neck, both animals then sliding along the ground for some yards in a cloud of dust. I next saw her shake the antelope violently, much as a terrier would do with a rat and then lie down, apparently sucking the blood which poured from the neck. Had I had the patience to wait a little longer I should no doubt have seen her either drag away the dead body or eat it on the spot, but I stopped all further proceedings by firing and knocking her over. I afterwards examined the dead

body of the antelope ; the neck was not broken and the lioness had not used her paws at all, the skin being free from claw marks ; life seemed to have been simply shaken and crushed out of the antelope, and I do not wonder at it from the way in which the lioness swung the body from side to side. It is curious that the lioness apparently took no notice either of me or of the first shot which I fired ; she must have been close by at the time and have heard the report, for the 2 shots were fired from almost exactly the same place and the interval of time between them was certainly not more than a minute.

I obtained two lion cubs from some Somalis who had found them in the grass in the absence of their mother ; the men who found them said that their eyes were not open when they first came across them ; I got them 3 days later, their eyes being then open ; they were probably not more than a fortnight old when they came into my possession ; they were at that time each about 20 inches long including the tail ; the hair of each cub was long and fluffy, the whole body was covered with black spots which were especially dense about the head and along the top of the back ; the last 2½ or 3 inches of the tail from the end were marked by 2 or 3 black transversal stripes like a tiger's, and there were also 2 or 3 similar black bars across the back of the hind legs above the hocks ; the cubs had no teeth whatever when I first got possession of them ; but after a week the front teeth began to appear ; I parted with the cubs about 10 days later, *i. e.*, when they were about 4 or 5 weeks old ; the front teeth were then well forward, but there were as yet no signs of any but the small front teeth ; the cubs grew about 3 inches in length during the 16 days they were with me, besides increasing considerably in bulk and strength ; I fed them solely on goat's milk.

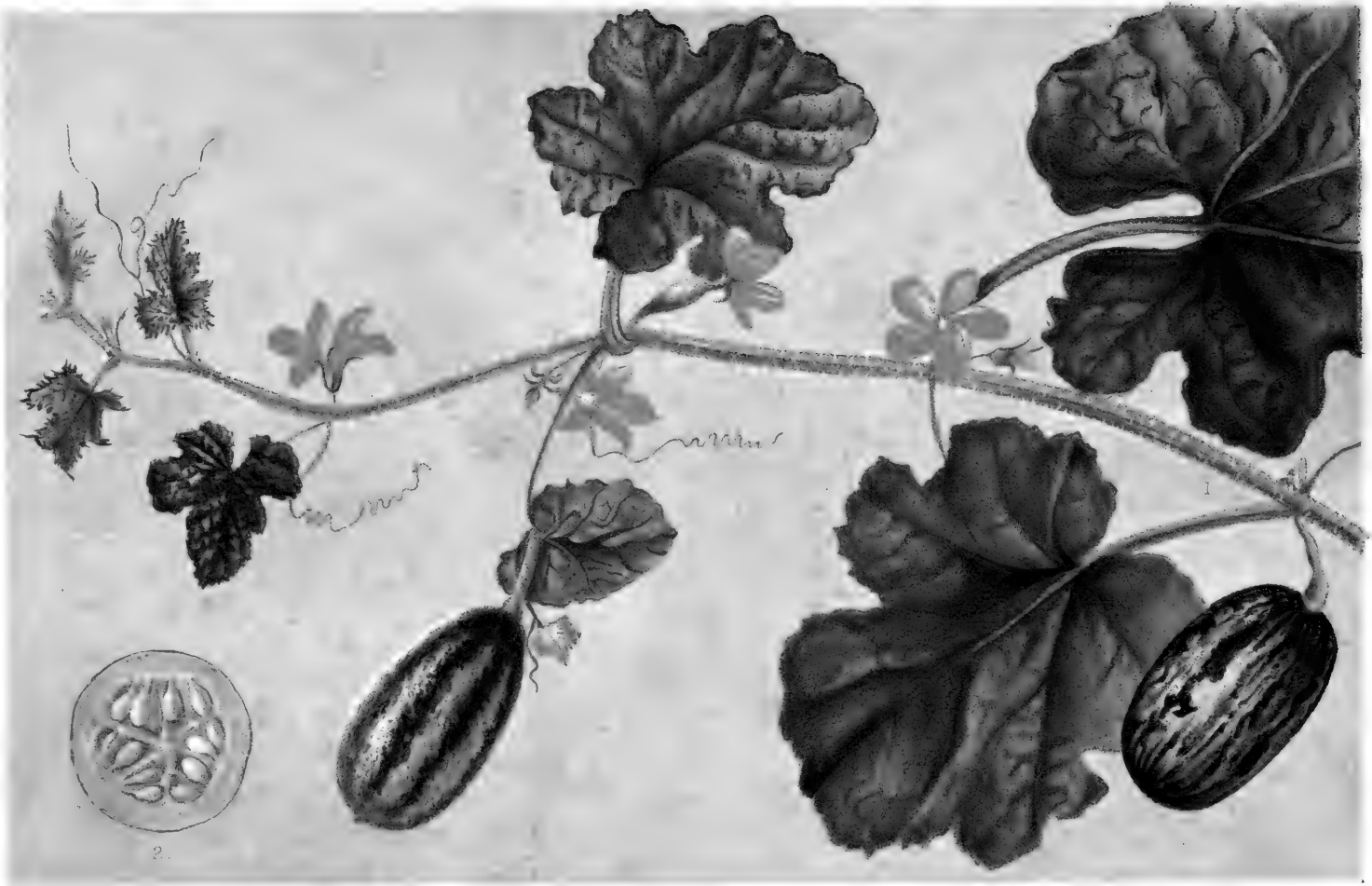
Of animals which I did not shoot, but saw, the largest was undoubtedly the elephant. Not many years ago, elephants were fairly common in the hills South of Berbera, but owing to having been constantly pursued of late years by sportsmen, they have retreated far to the west ; those I saw were about 160 miles south-west of Berbera ; when I got close to them, they turned out to be a cow and 3 young ones ; I accordingly left them alone. I never came across a bull, not having sufficient time at my disposal to stop long enough in the elephant country ; I saw the track of what I was told was a bull, in firm, damp sand ; the impression of the front feet was 18 inches long by 14 inches wide, and of the hind feet 17 inches long by 11 or 12 inches in width. The elephants appear to travel immense distances every night both to and from water ; those I saw must have walked about 10 or 12 miles from the water where they drank and from which I followed them, before I came up with them ; it was then early in the afternoon and they showed no signs of stopping. Considering the weight of an elephant, it is surprising how very trifling an impression his feet leave on the ground ; on hard stony ground, there is practically

no imprint, the grass knocked away by his feet being practically the only indication of his having passed by ; on firm sandy soil the impression is clear but not deep. The elephants appear to feed largely on a particular kind of creeper which is very common in Somali Land, and also on aloes, the broken pieces of which lay strewn all along the path of those I followed. The country in which I found these animals was hilly; the vegetation consisted of the usual low thorny bushes and also of a high species of cactus to which I regret I am unable to give a name ; these cactus plants grow to a height of about 40 feet, the branches shooting out from the trunk about 6 feet from the ground ; they are sometimes found in clumps covering several acres of ground ; their arching branches afford dense shade, the gloom of which appears most popular with the elephants, as I always found many signs of these animals having been in such places ; the photograph, which I exhibit, gives some idea of what these cactus groves are like. Somali "Midgans" (a low caste tribe of hunters) kill elephants with poisoned arrows.

Although I never shot a spotted hyæna, I saw three and came on their tracks almost every day ; they are most voracious animals and will eat almost anything ; they do a considerable amount of damage among the Somali sheep and goats. Somalis repeatedly assured me that 4 or 5 spotted hyænas would not hesitate to make a joint attack on a lion and drive him off his prey, and that lions were occasionally killed in such encounters ; this, if true, gives a high impression of the hyænas' strength and courage.

I twice saw wild donkeys but did not succeed in getting within 400 yards of them on either occasion. Their colour struck me as being much lighter than that of tame donkeys and in height they seemed to be higher ; their action when trotting gave them a very game-like appearance.

I one day saw an ostrich, but he was about a thousand yards away and I could only make him out with the help of a telescope. The moment he saw me he made off without giving me a chance. I saw 2 porcupines, exactly the same as the common Indian species ; a lynx which I saw was a young one, which a Somali had caught ; he seemed to me to be just the same as the common species in this country (*Xelis caracal*) ; the animal appears to be rare in Somali Land, for the Somalis with me had no name for it. I noticed two kinds of foxes, one with a black back and tail, the other quite brown; a jackal which I shot was very handsomely marked with a broad black mark about 4 inches wide running down the back from head to tail, the sides being yellowish-brown and the tail black. I noticed two kinds of squirrels, one quite brown, which appears to live entirely on the ground, bolting into holes when disturbed and apparently never taking to trees ; the other having a fringe of white hairs on either side of its tail ; a species of field-rat with a long pointed snout about 2″ or 2½″ long was also common. Hares, which are common, seem to be the same as in India.



Isaac Benjamin del

Mintern Bros. Chromo lith. London.

THE POISONOUS PLANTS OF BOMBAY.

Cucumis trigonus (Roxb.) Nat. Ord. Cucurbitaceæ.

(½ Natural Size.)

THE POISONOUS PLANTS OF BOMBAY.

BY

SURGEON-MAJOR K. R. KIRTIKER, I.M.S; F.L.S.

PART V.

(*With Plate G.*)

(*Continued from Vol* VII., *page* 493.)

CUCUMIS TRIGONUS.—(*Roxb.*).

(Natural Order—CUCURBITACEÆ.)

MARATHI—KÂRÎT. (कारीट.)

The plant grows wild in the Konkan ; it is an annual, succulent, scabrous creeper, trailing along the ground or over hedges for several yards at a stretch.

ROOT.—Perennial ; trailing a good distance above ground sometimes, throwing out rootlets into the soil ; reddish outside, green inside ; juicy ; bitter.

STEM.—Succulent, quadrangular ; tendrils short, wavy, simple lateral and formed of abortive stipules. Rarely bifurcated at apex.

LEAVES.—Alternate ; deeply palmately-lobed, cordate at base ; lobes 5, rounded, repandly and sharply toothed ; margin crenulate ; colour deep green. " Lobes of leaves," says Wight, " very broadly ovate and almost touching each other at their broadest part, sinus rounded." Roxburgh, however, states that the lobes are quite distinct, sinus widening upward. These appear to me to be mere differences in development due to local influences. PETIOLES $\frac{1}{4}$ to $\frac{1}{2}$ inch. The size of leaves C. B. Clarke puts down as 1—2 inches in diameter (Hooker's Flora Br. Ind., Vol. II, p. 619), but I have seen the leaves quite double that size if not more. Leaves and petioles " scabrid, not softly hairy," says Clarke, but the plant is both scabrous and covered with soft hair throughout. The hair markedly white.

FLOWERS.—Monœcious, axillary, unisexual, peduncled.

Male flowers.—Crowded in axils of leaves, opening in succession, 1—$1\frac{1}{2}$ inch in diameter.

Female flowers.—Solitary short-peduncled, 1—$1\frac{1}{2}$ inch in diameter.

Calyx of male and female flowers 5-toothed ; tubular-campanulate ; segments subulate, scarcely of the length of the tube ; calyx of female flowers short.

Corolla of male and female flowers 5-parted ; petals entire, scarcely united together or with the calyx ; those of the female flowers being sessile besides. Nerves prominent from base to apex.

Stamens.—5, triadelphous.

Filaments.—Inserted below the mouth of the calyx-tube.

Anthers.—Exserted from the tube, free ; one, 1-celled ; two, 2-celled ; cells conduplicate ; connective produced in a crest.

Pistil—

Style.—Short.

Stigmas.—3, very thick, obtuse ; 2-lobed, velvety.

Ovary.—Inferior, adhering to the calyx-tube ; of 3 carpels, densely hairy ; hair short, white, soft-silky. Placentas, 3 parietal.

Fruit.—A pepo ; fleshy internally, pale cream-coloured ; coriaceous externally ; indehiscent ; oval, rounded at both ends or sometimes flattened ; obtusely 3-angled, the depressions at the angles corresponding to the union of the carpellary margins ; about $1\frac{1}{2}''$ long, $1\frac{1}{4}''$ broad ; often almost twice as large in Thana. The outer surface of the fruit is not *smooth* as stated by Roxburgh, but tuberculate ; tubercles of the size of a small pin's head; brown when old; irregularly scattered all over the fruit, but principally over the mid-portion of it. Each tubercle is capped with a fine white soft hair. These tubercles are liable to be detached by the gentlest touch as the fruit gets old; hence they are often not observed when the older specimens of fruit are examined. But yet their position can be distinctly noted on the epicarp by a depression surrounded with raised circular yellow markings. The readiness with which these tubercles get detached may possibly account for Roxburgh's saying that the fruit is smooth. The epicarp is leathery, $\frac{1}{12}$ inch thick ; striated ; striæ 10, irregular, varying from light to deep yellow colour. The fruit keeps for several months without shrinking on account of its tough coriaceous exocarp or rind.

Seed.—Sharp, ovate, compressed, not marginated, acute at hilum, mostly smooth, enveloped in a juicy mucilaginous arillus of white colour.

Number varying from 150—250. Even a small fruit, one inch in diameter all round, was found by me to contain as many as 120 seeds.

TESTA.—Coriaceous.

ALBUMEN.—None.

EMBRYO.—Straight.

RADICLE.—Next to hilum.

COTYLEDONS.—Foliaceous, palmate-nerved.

REMARKS.

The synonyms of this plant have been variously given by various Botanists. What principle they have followed it is difficult to understand. In describing the Tribe *Cucurbiteæ* of the Natural Order *Cucurbitew*—a tribe to which Wight and Arnott have consigned the species we are now describing, *viz.*, *Cucumis trigonus*, they very rightly observe (*vide* their Prodromus Flora Ind., Vol. I., p. 341), that the difficulties attendant upon the description of the species from dried specimens are insurmountable. They admit, however, and very rightly too, that they consider it "more prudent to follow Roxburgh as closely as possible, as his opportunities of examining both seeds and stamens must have been most ample," as they really were, for his descriptions appear as a general rule drawn up from fresh specimens—a circumstance which must have given him greater facilities for noticing the minuter details of the species he describes. The following are the various synonyms of *C. trigonus* :—

C. madraspatanus Roxb. (Hooker's Fl. Br. Ind., Vol. II., p. 619). (Wight and Arnott's Prod. Flor. Ind., Vol. I, p. 342).

C. turbinatus, Roxb. (Hooker op. cit.)

C. melo, var. *agrestis*, Naud. (Hook. op. cit.)

C. pubescens., Willd. (Hook. op. cit.)

C. pseudo-colocynth, Royle. (Hook. op. cit.)

C. eriocarpus, Boiss. et Noé (Naudin Ann. des. Sc. Nat., 4 Series, Vol. XI, pp. 1-87) ; (Hook. op. cit.)

Bryonia cullosa, Herb Rottler (Hook. op. cit.)

C. pyriformis, Roxb. (Naudin op. cit.)

C. villosus, Boiss. et Noé. (Naudin op. cit.)

Why the plant is considered synonymous with *C. madraspatanus* it is difficult to understand, especially as Roxburgh describes the latter as a distinct plant, having the fruit no bigger than a partridge's egg; whereas the size of the fruit of *C. trigonus*, Roxburgh puts down as that of a pullet's egg. Moreover the fruit of *C. madraspatanus* is oval, downy, maculated, without any tendency to be three-sided. The fruit of *C. trigonus*, besides, is bitter and not edible, whereas that of *C. madraspatanus* is said by Roxburgh to be much used in food by the natives and much esteemed. The synonym *C. pseudo-colocynth* appears to be used by Dalzell and Gibson on the authority of Royle. The synonym *C. pubescens* (Willd.), as given by Clarke in Hooker's Flora of British India, is somewhat puzzling. Dalzell and Gibson describe it in their Bombay Flora (p. 103) as a distinct species from *C. trigonus* and add that it is cultivated in Sindh under the name of "*Chiber*." It is 1—1½ inch long. This is "confusion worse confounded." The fruit known as *Chibûd* or *Chiber*, as Englishmen would ordinarily pronounce it, is strictly speaking the genuine *Cucumis melo* and is a much larger fruit than either *Cucumis pubescens* or *Cucumis trigonus*. It is besides edible uncooked. It is seldom if ever cooked. Again Dalzell and Gibson make *C. madraspatanus* and *C. turbinatus* synonymous with *C. pubescens*, although Roxburgh describes *C. turbinatus* as a distinct species with a turbinate fruit, pyriform in shape, absolutely three-sided, with much larger flowers than *C. trigonus*. Note again another source of confusion. Dr. Lyon calls *C. trigonus*, *Indrâyan Bislumbhi*, on the authority of the Pharmacopœia of India, edited under the supervision of able Indian Botanists. But *Indrâyan* is *Citrullus colocynthis*. In this I am borne out by Dr. Dymock; and *Indrâyan* is a much more powerfully drastic purgative, with a larger and much rounder fruit, of the size of an ordinary orange or wood-apple. It may be noted, however, that *C. trigonus* is occasionally used as a substitute for Colocynth to produce purgation. To pass on to another writer;—Naudin most emphatically says that *C. trigonus* is certainly the species which MM. Boissier and Noé have described under the name of *C. eriocarpus*. Naudin adds further that it will be necessary also to unite to this species the one described by Baron Sir Ferdinand von Müeller under the name of *Cucurbita micrantha*, an Australian plant which is probably a species

of *Cucumis* and which appears to be analogous to the plant under description (J. Mitra).

A still further confusion arises in the naming of the fruit known in the Konkan as *Takmak*. Dr. Dymock calls it *C. trigonus*, var. *pubescens* (*vide* Dr. Dymock's Materia Medica of Western India, 2nd Edition, p. 339). Dr. Dymock says *Takmak* is less bitter than *C. trigonus*. As a matter of fact *Takmak* is not bitter at all. If any thing, it is sweetish ; if not that, it is almost insipid. It is not therefore easy to find out why *Takmak* is considered to be a variety of *C. trigonus*. The two plants appear to me to be quite distinct. *Takmak* is edible and perfectly harmless. It is cooked as a vegetable. It can be eaten even uncooked, though never much valued in any condition. Wight and Arnott's description of *C. pubescens* shows that the fruit of it is no bigger than about 1 or 1½ inch long ; whereas the fruit of *Takmak* is often as large as a medium-sized pomelo or water-melon, 6 inches long and 9 inches sideways ; and it is glabrous. The fruit of *C. pubescens*, on the other hand, as described by Willdenow, and Wight and Arnott is oval and pubescent. It is doubtful therefore whether *Takmak* could be called *C. pubescens*, or a variety of *C. trigonus*.

Kurz separates *C. trigonus* with *solitary* peduncles from *C. pubescens* with *clustered* peduncles and makes the latter a variety of *Cucumis melo*, Linn. (*vide* Journal Asiatic Soc., 1877, Part II, page 103). I think Kurz is right in doing so. In every way *Takmak* is more allied to *C. melo* than to *C. trigonus*. The only objection I have to calling *Takmak C. pubescens* is that the size of *C. pubescens* as described, namely, that of a partridge's egg, is considerably smaller than that of the smallest sized *Takmak*. On the whole, it appears necessary to write a fresh description of *Takmak* and rename it once for all. The present name it has been given as a pubescent variety of *C. trigonus* is morphologically inaccurate and unsatisfactory. The plants marked by Indian Botanists as *C. pubescens* are said to have been reduced to *C. trigonus* by Naudin in the Kew Herbarium. It is here, I believe, that the initial source of inaccuracy lay. For although that illustrious French Botanist can claim the credit of having furnished us with an exhaustive monograph on the Cucurbitaceous order, he has added to the confusion of synonyms in no small degree.

From the above remarks it will be amply apparent that there is a considerable difficulty in confirming and finally establishing the synonyms of *C. trigonus*. It seems to be absolutely necessary to remove all this confusion by a fresh and exhaustive attempt at identifying the plants and renaming them after a careful examination *locally* of every species belonging to the Cucurbitaceous order. One thing must be remembered particularly, with a view to obtain a thoroughly accurate description. The Cucurbitaceous plants are extremely delicate, especially as regards their hairy appendages. They must therefere be examined *in situ*—in the places where they grow ; not certainly from dried specimens, nor even from fresh specimens taken to a distance and examined leisurely, perhaps long after the delicate hairs have withered or fallen off, and thus destroyed the minuter distinguishing marks so necessary for accurate identification.

As regards the root of *C. trigonus* Clarke (in Hooker's Flora of British India *loc. cit.*) remarks that from the perennial character of the root of *C. trigonus* alone can it be distinguished from *C. melo* according to Naudin, but, says Clarke, "the examples seen and collected in India *are almost invariably less than one year old.*" (*N. B.*—The italics are mine.—K. R. K.) As a matter of fact, it is not so. I have seen the plants growing wild in the jungles and hedges of Thana and I have observed the same root throwing out fresh sprouts every rainy season for years together. The plant dries up after the monsoons and the fruit may be gathered even in the hot weather following. The plant is so persistent that the fruit can be seen hanging on the dry creeper even when every other part of the creeper withers and dries up. The fact of the fruit remaining hanging fresh as ever even in the succeeding hot weather, is, I admit, no indication whatever of the living condition of the root underground. But wait till the next rainy season, and you will find a fresh plant from the old root, from where the creeper of the former rainy season sprouted. The root does not dry up, decay or die, even although the surrounding soil is parched and cracked in the hot weather, with hardly any moisture to nourish it. The perennial nature of the root, therefore, must be considered undeniable, even under such adverse circumstances.

With regard to the flowering of *C. trigonus* Rheede observes (Hortus Ind. Mal., Vol. VIII, page 21) that the plant grows in jungles

around Cochen, flowering and fruiting throughout the year. I may observe that in the Konkan, *C. trigonus* flowers and fruits only in the rains. It begins to dry up as soon as the cold weather sets in, and is shrivelled and leafless before the hot weather is on. The fruit, as I have already said, remains hanging unshrivelled and unshrunken even in the succeeding hot weather.

THE POISONOUS PROPERTIES.

Being a congener of Colocynth, one would naturally expect that the juice of the bitter fruit of *C. trigonus* would be a purgative of the irritant type, and so it is more or less. Dr. Lyon, however, states in his Medical Jurisprudence (p. 199) that the plant possesses another poisonous property. He says that in 1883 a case was reported to the Bombay Chemical Analyser's office in which it was stated that this plant had been administered for the purpose of procuring abortion.

In the Pharmacographia of India (Vol. II., p.67) Dymock, Hooper, and Wardell note that they digested the dried fruit with 84 per cent. of alcohol and concentrated the resulting tincture until most of the alcohol had been expelled; they then agitated the mixture with water and petroleum ether. This solution, still containing some alcohol, was heated on the water bath to get rid of the alcohol; the remnant then mixed with water and agitated with acetic ether containing some acetic acid. This yielded a reddish brown extract, very bitter, and partly soluble in boiling water. The insoluble residue was brittle when cold and very bitter, and had the properties of a resin, which would appear to correspond with the resin of Colocynth. The scientific world owes a deep debt of gratitude to this trio of distinguished pharmacologists for thus advancing our knowledge regarding the active principles of *Kârît*.

I need hardly enter here into a detailed description of the poisonous properties of Colocynth. They are well known to every student of the British Pharmacopœia. Suffice it to say that Colocynth and its congeners are irritant drastic purgatives. These properties were well known to the ancients, both Eastern and Western. I may note, however, what has been observed by Dr. Schmeidberg of Strasberg (*vide* Elements of Pharmacology, Dixon. 1887, p. 109) with regard to the relative therapeutic action of the crystalloids and colloids in Colo-

cynth, and presumably in the allied species like *Kârît*, that crystalline soluble Colocynthin, when pure, does not, under all conditions, cause diarrhœa ; hence it is apparent that the crystalline element needs the presence of colloidal substances such as occur in Colocynth, for it to be with certainty carried into the intestine to produce any irritant or drastic effects.

It will be perhaps easy to account for the abortifacient effects of *Kârît* if we remember how powerful irritants of the intestinal canal and of the rectum especially affect the pelvic organs. Increased peristalsis produced by intestinal irritants known as "aperients" means increased hyperæmia of the mucous membrane of the intestines. This hyperæmia extends to the neighbouring pelvic organs when powerful irritants attack the lowermost part of the intestine. "Thus in gravid uterus," says Schmeidberg, "contractions may be caused ending in abortion and premature labour." It has ever been held a golden rule in pregnancy not to give acrid or powerful purgatives at any time during pregnancy. The abortifacient effect of *Kârît* may be presumed, in the cases recorded, to be probably of a secondary nature, although it is not so stated in the Bombay Chemical Analyser's report, there being no details of the case forthcoming in that report.

Description of Plate G.

1. Terminal branch of the plant with leaves, fruits, male and female flowers, in the axils of leaves.

2. Section transversely through the middle of the fruit.

BOMBAY GRASSES.

By Dr. J. C. Lisboa, F.L.S.

PART VI.

(*Continued from Vol. VII., p.* 390.)

HORDEÆ.

Triticum, *Linn.*

T. vulgare, Linn.

Ver.—*Gohun*, Mar. and Hind.

Several varieties of this cereal are cultivated in this and in other presidencies. These varieties are chiefly distinguished by the colour (white or red), hardness or softness, translucency or opacity, the size of the grain, and by their being bearded or unbearded. Generally speaking, wheat is grown in those parts of India which are situated to the north of the river Tapti in Guzerat, Khandesh and Deccan ; but rarely is it cultivated anywhere south of the Deccan. It is said that the wheat cultivated on the high table-land of the Deccan and in Mahableshwar has in a given bulk about $\frac{1}{5}$ more weight than that raised on the plains. Below the Ghâts wheat does not grow, as the climate does not suit it.

For the benefit of those who have no access to the Atlas prepared by Mr. E. C. Ozanne, Director, Land Records and Agriculture, Bombay Presidency, I copy here the following extract :—

" *Wheat.*—A cognate species, *Triticum speltum* or spelt, is commercially and agriculturally a variety of wheat. Bombay shows samples of almost every variety in considerable areas, except the soft whites, which command high prices in the English market. The hard wheats are prized on the Continent for macaroni and some confections. Till the English miller can make free use of hard wheats, there is little prospect of increased exports of Bombay wheats to England, though Bombay and Karachi will continue to export the soft wheats of Sind and the Punjab and North-West Provinces. Experiment has clearly proved that it is futile to attempt to grow soft wheats where the climate favours the hard varieties, and as futile to substitute red for white or *vice versa*, for the colour is due to soil and not to the action of the cultivator. As wheat is either grown alone or with rows of safflower or strips and borderings of linseed, the complaint of admixture of mustard and other impurities of this kind cannot apply to Bombay. Safflower ripens after wheat, and linseed is easily separated in the winnowing. The admixture of earth from the threshing floor can be appreciably diminished if the higher price for clean wheat will pay the cultivator to exercise more care ; but it cannot be eliminated till the practice of pulling the crop is superseded by cutting it with a sickle or by machine.

The admixture of earth made by middlemen and merchants for the purposes of trade will last till the speculative dealings of the Bombay wheat traders are superseded by sales based, not on sample for forward delivery, but on the quality and condition of the wheat as it reaches the home markets. Even steam wheat threshing, which is being introduced, cannot under present conditions produce a perfectly clean sample, for particles of earth of the size and specific gravity of the wheat grain must remain. Still the percentage of such impurities is greatly reduced, say, to under one per cent., while the refraction allowed is 3 or 4 per cent. Steam threshing cheapens the preparation for the market, sets free the plough cattle from a harmful process, and gives the chance to the grower of a larger share of the profits, which now unnecessarily goes into the pockets of middlemen."

In Bombay, as has been said, the wheats which are grown are not largely in demand in England, and there is no prospect of a largely increased area. The growth of wheat is not as greatly influenced by the price as some suppose. Wheat is a late sown crop, and its area depends on the area of suitable land left available after cotton or the early cereals have been provided for. Where cotton is an early crop, its area is made as large as the season will allow, and in other places land fit for wheat is always sown with other crops when the early rainfall gives prospect of their success. There are not extensive areas of land now uncultivated fit for wheat cultivation, nor will the extension of railways in this Presidency have as large an effect in encouraging the growth of wheat, aided by brisk export demand, as some writers allege. There is hope that the out-turn of present areas will be increased, perhaps very greatly increased, by better cultivation and more liberal use of manure. But the manure must come from outside in the shape of artificial manure, and the improvement in cultivation must be first studied and then taught by experiment, without which no large increase in yield can be expected.

The usual division into hard and soft white and hard and soft red applies to the Bombay wheats. The spelt variety is classed as a hard red. It is important to specify clearly the areas in which each variety is successful.

Hard white is the dry crop wheat (*hânsia*, &c.) of all Guzerat, except certain parts of Ahmedabad ; and of the Deccan (*pivla*). It shares with hard red the wheat tracts of Khandesh, while in that district hard white (*bansi*) is also largely grown under canal, channel, and well irrigation. In the Deccan a very fine variety of hard white (*bakshi*) is grown in the elevated plateau of Parner Taluka as a dry crop, and it is well known all over the Deccan and Bombay Karnatak as the best irrigated variety, though its growth is circumscribed by its great liability to rust; and in these provinces the result is, that spelt, which is

practically rust-proof, is by far the most common of the irrigated wheats. The dry-crop hard white has everywhere an occasional and sometimes a normal tendency to become bellied (*potha*) or soft. In the finest wheat tracts of Nasik and Ahmednagar the *pivla* wheat usually keeps its hardness and colour. But with heavy rain in December the percentage of soft grains is very large, and this tendency cannot by cultivation, care, or otherwise, be lessened. In moister tracts, bordering on such localities as those named or elsewhere, the normal condition of the hard white is a semi-softness, and the most characteristic semi-soft white is the *dáud khání*. These names refer greatly to the consistency and colour of the varieties, though their origin is presumed by some to be the result of importation, which theory has little support.

Hard red wheat is the dry-crop wheat of the Bombay Karnátak, where dry white wheat is unknown. The irrigated spelt common, as above shown, in the Deccan and Karnátak is classed as a hard red. It has at times been in extraordinary demand on the Continent. It is a large cropper and a safe crop, but these advantages are somewhat counterbalanced by the adherent glume which necessitates pounding to separate it from the grain, as careful and severe as in the case of rice. The hard red wheats of the Karnátak are the best of the kind. Hard red is the largest grown dry variety in Khandesh and a large crop in the south talukas of Ahmedabad in what is called the Bhál country (*see* Ahmedabad Summary). Hard red is grown under irrigation in some parts of Guzerat, practically the same as those which grow the soft red *vajia* to be described, though perhaps the area of such hard red is larger than that of the soft red and perhaps more extensive, penetrating further on all sides beyond the limits of soft red. This variety is not liked by millers, who assert that its strength is diminished by irrigation.

Soft red is only largely grown in Ahmedabad and with irrigation. It is the commonest irrigated wheat of that district and of parts of Broach and Kaira, which are close to the southern talukas of Ahmedabad. It is called *vajia*, *i.e.*, garden wheat ; but it has been seen that the *vajia* is also an irrigated hard red.

Soft white is only grown in the Maval taluka of Poona. It may be occasionally seen in parts of the Panch Mahals. Its area in Bombay is thus exceedingly small, and it is not susceptible of increase. Soft white from the Central Provinces and from Australia have been successfully grown on experimental areas in Khandesh ; but though the out-turn after the second year is very excellent, the change in consistency is enough to cause the merchant to class it as a mixed hard and soft.

Wheat straw is a poor fodder, but it is in wheat tracts the chief food of the cattle. As all the wheats of the Bombay Presidency out of Sind with which

province these crop notes do not deal are bearded wheats, and as the crop is trodden out by cattle, the fodder must be broken very fine indeed to prevent the awns sticking in the gullets of the cattle. The bruising is well done by the steam thresher, which largely separates the innutritious awns from the chaff. Spelt straw is almost inedible by cattle.

Wheat is a rotation crop generally, but the red dry wheat of the Bhâl country of Ahmedabad is always, and the *pivla* of Nasik and Ahmednagar, is sometimes, grown continuously.

Wheat in this country is exceedingly liable to damage from weevil, especially if storage in Bombay is attempted. It is preserved with great skill in grain pits, and it may be noticed that in Guzerat the preservation is improved by throwing a handful of quicksilver into a large pit. Samples in airtight bottles with quicksilver in very minute quantities can be kept sound for years. The high specific gravity of the mercury makes separation very easy and complete.

As to the composition of wheat, the following extract is taken from Church's "Food Grains of India," p. 93 :—

"The composition of wheat grain shows some variations, but they are almost entirely limited to the relative proportions of starch and of nitrogenous matters, although the mineral matters or ash, and indeed all the minor constituents of the grain, are, of course, not quite fixed in amount. Still if a wet season increases the percentage of ash, if a thin-skinned, well-developed sample contains less fibre, and if a plump dark-coloured specimen has a larger proportion of oil or fat, all such variations are quite unimportant in comparison with those exhibited by the starch and albuminoids. The starch, always constituting as it does something like two-thirds of the weight of the grain, does not show the difference in so marked a manner as the albuminoids. If the latter amount to 18 to 20 per cent. instead of 13, the former constituent will not be reduced (from 68) to less than 63 or 61 per cent.—a reduction which, in comparison with the total amount present, is much less conspicuous than a rise from 13 to 20 in the nitrogenus compounds."

Besides the general dryness of the grain of Indian wheat, which as imported in bulk in this country and analyzed properly contains at least 2 per cent. less moisture than average English wheat, the albuminoids are decidedly higher. I have never yet met with an Indian wheat containing less than 10 per cent. of albuminoids ; but a large number of samples of first rate English, Canadian and Australian samples give numbers between 8 and 9. The average percentage of albuminoids in the Indian examples yet analyzed is about 13·5, but some specimens have been as low as 10·3 and some as high as 16·7.

Much of the Indian wheat, whether white or red, has that translucent aspect which generally indicates a high percentage of albuminoids.

In 1867 ("Practice with Science," i, pp. 101—111, 345—348) I pointed out some of the chief relationships between the aspect, density, weight per bushel, productiveness, and chemical composition of wheat grain, showing more particularly that the exclusion of small proportion of the lightest of the grains in a seed corn tells very favourably upon the yield, and also that there is a very intimate connection between the translucency or horny character of a grain and a high percentage of albuminoids, and, again, between the softness and opacity of a grain and a high percentage of starch. Such differences in the composition of wheat grain show themselves, not merely in different varieties of wheat, but even in the same variety of wheat when it has been grown under different conditions of climate or season. Even in the grains from a single ear similar differences may be seen—analysis showing sometimes 3 or 4 per cent. more albuminoids in some of such grains than in others. Often a single ear will be partly horny and partly opaque and soft; in that case its composition will correspond with its intermediate aspect. By examining the cut surface of a grain which has been cut transversely with a sharp knife, a fair notion of its richness or poverty in albuminoids may indeed be easily gained.

Average composition of Indian wheat—

	In 100 parts.	In 1 lb.
Water	12·5	2 oz. 0 grs.
Albuminoids	13·5	2 „ 70 „
Starch	68·4	10 „ 413 „
Oil	1·2	0 „ 84 „
Fibre	2·7	0 „ 189 „
Ash	1·7	0 „ 119 „

The nutrient ratio is here 1 to 5·2 and nutrient value 84·6. It should be added that the starch above-named contains a small quantity (about 2 per cent.) of the sugar or sugars found in many cereals, but this may be regarded as not appreciably lowering the nutrient value of the 68·4 parts set down as "starch."

The ash of wheat, though not large in amount, is of great importance as a source of mineral nutrient when this grain is used as human food, about 30 per cent. of it being potash and 45 per cent. phosphoric acid.

There is no record of this useful cereal having been found in a wild state. It has been cultivated everywhere time out of mind. There are authors, however, who think that it is the result of the cultivation of a species of *Ægylops*, which is now admitted to be a section of *Triticum*. It is stated by Bentham and Hooker (Genera Plantarum, 1204) that *Ægylops* is represented

by a few species, "quarum 203 facile formas hibridas gignunt cum *Triticis* cultis et a nonnullis pro typis primordiabilis Triticorum habentur."

Some people in Poona confound with wheat grass a species of *Andropogon* common in the Deccan named *Andropogon triticeus*, R. Br. (*Heteropogon insignis*, Thw.). In external form of inflorescence they slightly resemble each other.

OROPETIUM, *Trin.*

O. thomæium, Trin., Tund. 98; Kunth Suppl. T. 38, fig. V; Dalz. and Gibs., Bomb., Flor. 300; *Rattbœllia Thomœi*, Willd. Sp. I. 466; Roxb. Cor. Pl. 133.

Culms many together, erect, one inch high. Ligula small, membranous. Leaves numerous, bifarious, subulate. Spike one inch long, terminal, solitary, cylindrical, subulate. Spikelets one-flowered, hermaphrodite, sessile, imbricate and immersed alternately like those of *Rottbœllia* and *Ophiurus* in the excavations of the rachis. Two outer glumes empty, the first or the lowest linear, membranous; the second boat-shaped, acute; the third or the flowering glume membranous, hyaline, shorter than the empty glumes.

This curious diminutive grass is confined to India, and said to grow on old walls. My specimens are from Sind, where it is stated to be not uncommon. It grows also in open ground in the plains of the Punjab; also in Rajputana, in Agra and Etawa.

Nothing is known about its uses. It is too small to be of any value as fodder.

HORDEUM, *Linn. Gen.*

H. vulgare, Linn. Beau. Agr. T. 21, Fig. I.

H. hexastichon, Roxb. Fl. Ind. I., 358.

Ver.—*Sattu*, *Jaw*, *Yaw*, *Jave*, *Godhi* (Mar. and Hindi, Bombay), *Jab*, Bengal (Watt.), *Juba* (Roxb.), *Chak*, *Jawa*, *Jhotak*, *Soa*, *Yangma Wo*, Barley.

It is cultivated in various parts of the Presidency in Guzerat, Ahmedabad, Kaira, and in the Deccan; in the latter country chiefly as an offering to gods, and in the north of Guzerat is used as food. It makes much better broth than that made with pearl barley. The authors of the "Bombay Flora" state that the brewing of beer from malted barley has been tried in Mahableshwar, Poona, and Karachi, but uniformly without success, the mean temperature being too high during fermentation. Mr. Meakin prepares beer in Dapory, but it is not ascertained whether the barley used was malted in this country.

There are two varieties cultivated in India, one the two-rowed (*H. distichon*), and the other the six-rowed (*H. hexastichon*). The latter is much cultivated in Northern India and in most of the temperate parts of Hindustan during the cold season, either alone or mixed with wheat, gram, linseed, mustard, &c.

The following information is kindly furnished from the Office of the Director, Land Records and Agriculture, Bombay Presidency :—

"In the Bombay Presidency barley is not a principal cereal. In 1889-90 the total area under barley cultivation was only 35,800 acres, or about 0·3 per cent. of the total area. The details are shown in the margin. In the Presidency proper the principal barley cultivation is seen in Ahmedabad and Kaira, where, owing to the fact that it is not subject to the wheat blight, it is a favourite rain crop in the *Gorat* or light brown tracts. It is generally an after-crop in garden rich lands, or in soils too sandy and open for wheat. It is always irrigated and manured. The grain is less appreciated than wheat, and the straw, which is considered more nourishing than wheat straw, is chopped and given to cattle with the husk. It is less important in the Deccan, where it is used chiefly in the preparation of a ready-cooked food called *Sátuche pith*. The grain is parched, then ground and mixed with a small proportion of gram and wheat flour, and flavoured with spices. The grain is also used in certain religious ceremonies. The two-rowed naked barley (*H. gymnodistichon*) from the North-West Provinces and Oudh is being experimentally cultivated on the Bhadgaon Farm with fair success."

	ACRES.
Ahmedabad	19,627
Kaira	6,558
Panch Mahals	1,364
Ahmednagar	135
Poona	1,174
Sholapore	1,364
Satara	5,245
Karachi	17,583
Hyderabad	5,935
Shikarpur	3,003
U. S. Frontier	194
Thar and Parkar	475

As to the composition, I copy here the following from Church's "Food Grains of India":—

"Barley is sown and cultivated in the same way as wheat, but needs fewer ploughings. It is often grown with wheat or pulse.

Composition of barley (husked)—

	In 100 parts.	In 1 lb.
Water	12·5	2 oz. 0 grs.
Albuminoids	11·5	1 „ 368 „
Starch	70·0	11 „ 87 „
Fat	1·3	0 „ 91 „
Fibre	2·6	0 „ 182 „
Ash	2·1	0 „ 147 „

The nutrient ratio is here 1 to 6·3, and the nutrient value 84·5.

The above analysis of a roughly-cleaned or husked sample of Indian barley shows that it contains a higher percentage of albuminoids than average European barleys. This fact is confirmed by the examination of other Indian samples. At the same time it must be recollected that it is inferior to Indian wheat in this particular, just as the hundreds of analyses which have now been

made of European barley show that it likewise gives a lower average percentage of albuminoids than European wheat. When barley is completely cleaned or pearled, it loses a very large proportion of its albuminoids, so that European pearl barley (barley yields but 38 per cent. of pearl barley) does not usually show more than six or seven per cent. of albuminoids. The "pearl dust" and "fine dust" separated in its preparation, and amounting together to 40 per cent. of the original grain, are, however, much richer, containing 12 or 14 per cent. of albuminoids. Indian pearl barley would, however, in all probability contain as much as ten per cent.

Barley, as it is prepared for human food in India, is generally considered to be rather difficult of digestion. It is grown and eaten throughout the whole of the Patna Division. With wheat it forms an important staple diet in the Benares and surrounding divisions. The grain is usually cleaned by pounding in wooden mortars and winnowings. The grain is treated in one or other of the following ways :—

(1) Ground into coarse meal and made into *chapatti*, either alone or with wheat meal. In Tirhut a mixture is used of barley one part and Indian corn three parts.

(2) Parched and ground into coarse flour called *Suttu*; this is stirred up with sufficient water to make a thick paste, to this a little salt is added, and the preparation is eaten with garlic, onions or chillies. This mixture, generally admixed with flour of gram or other seeds or grains, forms the chief food of the larger part of the peasantry of Shahabad.

Barley alone, or even in admixtures, is generally thought to be rather difficult of digestion, at least in the form in which the grain is prepared for food in India. Barley mixed with horse gram forms an excellent food for horses, and is known as "*adour*."

From an observation made in a preceding paragraph, it will have been remarked how very closely the pearl barley prepared in Europe approaches rice in its nutrient ratio. The Indian cleaned barley is, as we have seen, much richer in albuminoids. This arises from two causes, one of which is the higher percentage of nitrogen naturally present in the average whole barley grain as grown in India ; the other is the imperfect way in which the Indian barley is cleaned previous to use as food. Some room there is evidently for improvements in the mode of carrying out the cleaning or pearling operation. A recently invented Dutch process might be used. It produces a pearled grain of larger size than that obtained by the usual operation. The pearled grain attains a higher percentage ; its shape is not spherical, but much resembles

that of the whole grain, and it is richer than the ordinary sort in oil, mineral matters and albuminoids.

BAMBUSEÆ.

This tribe is represented in this Presidency by five or six species. I have received flowering specimens of only three. Of the remaining my knowledge is derived from books.

BAMBUSA, *Schreber.*

B. arundinacea, Retz., Roxb. Cor. Pl. t. 79 ; Fl. Ind. II. 191 ; Dalz. and Gibs., Bomb. Fl., 299 ; Bed. Fl. Sylv. t. 321.

Ver.—*Vansa*, *Bans*, *Mandgay* (Bombay), *Man Venduru* (Telugu).

Stem tall, up to 30 to 80 ft. high, green, shining densely cespitose in clumps of 30 to 100, hollow-jointed, with numerous spinescent branches. Cavity small, walls thick. Thorns double or triple, at the root of the branches ; when triple, the middle one the largest ; all strong, sharp and sometimes curved (rarely absent). Leaves sheathing, 2 to 8 in. long, ½ to 1 inch broad, short petioled lanceolate, broader at the base, rounded at the apex, generally glabrous, the upper surface and margins backwardly hispid, sometimes scattered short hairs on the under surface. Sheaths coriaceous, 1·2 in. long, somewhat downy, with scattered hairs on each side of the mouth. Spathe deciduous, 1 to 1½ feet long, glaucous inside, and terminating in a long point. Flowers appear at long intervals, probably at the age of 30 years. During inflorescence, the stem with a few scattered leaves ; the whole covered with numerous half-verticelled spikes ; each verticel composed of several sessile, glabrous, 6 to 12 flowered spikelets ; fertile flowers 3 to 10 in each spikelet. Empty glumes 2 to 4 ; flowering glumes 3 to 10, the upper generally sterile or staminiferous, all thickened and mucronate, glabrous, sometimes shorter than the palea, not ciliate at the edges. Palea often longer ; edges fimbriate. Scales two, hyaline, fimbriate. Stamens 6, free at the base ; anthers with an obtuse glabrous point. Ovary glabrous ; style slightly enlarged at the base, soon deeply divided in 2 to 3 long plumose branches. Caryopsis linear oblong, ½ inch long, enclosed in the flowering glume and palea.

This bamboo occurs in Belgaum, Khandeish, Dangs, at Sironcha on the Godavery, Malabar and Canara ; abundant throughout the Madras Presidency, up to the elevation of 3,000 ft; at the base of the Satpura range ; Jubbulpore, Bengal, and cultivated in the sub-Himalayan tract in the Punjab and elsewhere.

The culm which attains a height of 60 to 80 ft., or higher along the coast, and a diameter of 6 to 8 in., is by far the most important of several species. It supplies poles and rafters for building purposes, scaffolding, ladders, fencing, trellis-work, fishing rods, window and door blinds, and in the manufacture of chairs, sofas, baskets and winnowing fans, &c. The rhizome and young shoots are made into preserves, pickles, and cooked with spices is made into relishing dishes. Mr. Lettridge says that this and other species are capable of being employed in the manufacture of paper. Long immersion of bamboos in water,

or, better still, in salt water, for 3 to 4 days, or in a solution of sulphate of iron or lime water renders them more durable. Salt water is said to make them proof against attacks of insects (Bostrichi and their larvæ).

This bamboo and several other species flower in about 30 to 32 years ; the cultivated, I believe, at shorter periods. When such an occurrence takes place, the whole tract, extending over many miles, is in full flower. It sometimes happens, however, that a few bamboos of a cluster flower in each year, when the flowering goes on every succeeding year with the other bamboos of the cluster. Both in this species and in others the flowering is followed by the death of the stems, so that, after seasons of general flowering, a whole district presents for some time the spectacle of a large forest of dried up clumps (Bedd.). The product of the flowering of the bamboos is a fruit called by the Indians rice or seed, which is consumed by the poorer classes in lieu of common rice or other grain. A very palatable bread is said to be made of the flour of the bamboo seed, although its colour is somewhat dark. Diarrhœa and dysentery and even fever are caused by the use of this diet. Indians believe that fever is severer in those years in which the general flowering takes place. In the scarcity of 1812 in Orissa, of 1864 in Kanara, and of 1866 in Malda, this rice formed the principal article of food of the poor population of those districts ; hence, perhaps, the belief entertained by some Government officials that the bamboo only flowers in seasons of general scarcity. General Munro says that the rice of *B. arundinacea* furnished in 1864 food for 50,000 persons in Kanara. In the hollow of this and of some other bamboos there is a silicious substance named *Tabashir*. This is at first in a rather liquid state, but in time becomes solid. It is employed by the hakeems in the treatment of paralytical affections and as a stimulant and aphrodisiac. The ashes of all bamboos are rich in silica.

Composition of bamboo grain (husked)—

	In 100 parts.	In lb.
Water	11·0	1 oz. 332 qrs.
Albuminoids	11·8	1 „ 388 „
Starch	73·7	11 „ 346 „
Oil	0·6	0 „ 42 „
Fibre	1·7	0 „ 119 „
Ash	1·2	0 „ 84 „

The nutrient ratio is here 1 to 6·4, and the nutrient value 87. The food value of bamboo grain, after the removal of the husk, is high ; its defects are due to the low proportion of oil and of mineral matter. Of course, it cannot be looked upon as a staple cereal, but as an occasional substitute for a deficient rice or millet crop it has several times proved most serviceable. The grain of other kinds of bamboo is, in all probability, similar in composition to that of *B. arundinacea*.

The bamboo described under the name of *B. spinosa* by Roxb. Fl. Ind. II ; Munro. Monograph 104 ; Bedd. Fl. Sylv. 231, appears to be a

variety of the last species, and differs from it in more solid culm, the triple thorns, the central larger and often compound, and almost always present throughout the whole plant, very strong and sharp ; leaves generally smaller, often hairy on the lower surface ; a paler-coloured and more striated flower, panicle smaller and more coriaceous spikelets and with fewer flowers. It is not mentioned in Dalz. and Gibs. *Bombay Flora*, nor in Graham's *Catalogue of Bombay Plants*.

B. vulgaris, Wendl., Munro, Monogr. Bomb. 106 ; Dalz. and Gibs. Bomb. Fl. 299 ; Bedd. Fl. Sylv. Manual 233 ; Brand. Forest Fl. 568 ; *B. thouarsii*, Kunt. I. 356 ; *B. arundinacea*, Aiton.

Ver.—*Kulluk*, or *Bambu* (Bomb.) ; *Una gass* (Ceylon).

Culm 20 to 50 ft. high, unarmed, green, yellow or mottled green and yellow ; joints 4 to 6 in. diameter ; walls of the hollow stem thin. Branches green, striated or sulcated. Sheaths hirsute above with dark hairs. Leaves thin, linear-lanceolate, acute, 6 to 10 in. long, $\frac{3}{4}$ to $1\frac{1}{2}$ in. broad. Flowering branches often leaf bearing. Spikelets sessile, oblong-lanceolate, laterally subcompressed, $\frac{1}{2}$ to 1 in. long, glabrous, 4 to 12 flowered, distichous, appearing as bifid, fasciculate or on long paniculate spikes. Empty glumes 2 ; flowering glumes ovate-lanceolate, narrow at the base, mucronate and ciliate at the apex ; fimbriate keels of palea appear at the top of the flowering glume. Lodicules transparent, thin. Anthers with short hairs at the apex. Style long, filiform, hirsute, divided at the end into 2 or 3 stigmas.

This species grows in Ceylon, where it is known as *Una*, Indian Archipelago, tropical America, and the West Indies (Brandis, For. Fl.). Cultivated in the Western Deccan, Poona, Satara, Kholapore, Silhet, Cachar, Chittagong, and in the Eastern Punjab. Those who go to Mahableshwar through the Satara Road must have seen it planted along its margins.

For remarks on the uses of this species see notes appended to the description of *B. arundinacia.*

B. arundo, Klein. Nees, Linn. IX, 471 ; Stend. Synop. Pl. Gramin I. 329 ; Dalz. and Gibs. Bomb. Fl. 299.

Culm thorny ; mouths of the sheaths naked ; leaves (floral) orate-lanceolate, 6 to 7 in. long, 4 to 5 lines broad, rounded at the base, shortly-petioled, smooth ; spike terminal, ample, leafy, the branches spreading, simple or compound ; spikelets an inch long, erect, approximated in threes, upper ones alternate, 6 to 8 flowered ; culm 8 to 9 ft. high. Native name "Chiwaree." On the Ghâts. Of this walking sticks are sold at Mahableshwar."

I have not seen this flower.

Oxytenanthera Stocksii, Munro, Monog. 130.

Mr. Beddome has copied from Munro the following description, see p. 233:—

"Culms slender ; internodes 4 to 7 in. long, glabrous ; the nodes with few branchlets ; leaves linear, lanceolate ; inneronato acute at the apex ; cordate

rotundate at the base, or attenuated into a flat petiole, 3 to 4 in. long by 4 to 6 lines broad, hirsute or glabrous above, hirsute beneath; primary veins 4 to 5 on each side, inconspicuous; sheath striated, often pubescent when young, glabrous in age; mouth fimbriate, inflorescence as in No. 1; verticels sometimes $1\frac{1}{4}$ inches in diameter, very dense, almost echinate; spikelets about 6 lines long; sterile, very acute, glabrous, 4 to 5 flowered, the 2 lower florets unipaleaceous, shining on the back, mucronate at the apex; the 2 next bipaleaceous and fertile, the upper one very short or obsolete, the lower palea membranaceous; striato nervose subulate, with a long spine at the apex; margin glabrous; the upper palea in the fourth flower convex obtuse, in the third bicarinate obtuse, the keels fimbriate. Stamens 6 monadelphous shortly mucronate or nearly obtuse or apiculate with 1 to 2 greenish hairs. Style 2 to 3 cleft at the apex; ovary (young) hirsute at the apex."—*Munro. Monogr.*, p. 130.

Konkan Ghats. I have not seen this; its leaves are said to be exactly like those of *Dendrocalamus strictus*; it is distinguished from the last by the short points to the anthers and its striated membranous lower palea.

I have received an imperfect flowering branch of a bamboo cultivated in Cumpta. It approaches in part to *O. monostygma* of Beddome.

Dendrocalamus strictus. Nees, Munro. Monogt. Bom. 147; Bedd. Fl. Sylv. t. 325; Brand. For. Fl. 569; *Bambusa stricta*, Roxb. Fl. Ind., II, 193; Dalz. and Gibs. Bomb. Fl. 299.

Ver.—*Bas*, *Bans* (North India), *Bas*, *Udha* (Dalz and Gibs.).

Culms straight, up to 30 to 40 ft. high, nearly solid, or with a very narrow cavity, variously bent; branches often leafless, numerous, rigid or flexuose, horizontal or spreading in all directions. Sheaths at the base of the branches striated, coriaceous, very smooth and shining inside, 8 to 10 in. long, terminating into a long apex. Leaves shortly-petioled, lanceolate distichous, hairy above and below, rounded at the base, variable in size, generally 3 to 9 in., $\frac{1}{4}$ to 1 inch broad. Spikelets spinescent, 3 to 9 lines long, in dense globular heads. 1 to $\frac{1}{2}$ inch in diameter, arranged in long interrupted spikes. Empty glumes 2 to 6, flowering glumes 2 to 3, acute or with a spinescent point. Palea of lower flower sometimes 2-keeled. Keels ciliate of upper flower convex, glabrous. Stamens 6. Ovary stipitate hairy. Style long hirsute. Stigma plumose, entire. Caryopsis ovoid 3 to 4 lines long, ovate, narrowed into the hairy style.

Indigenous and cultivated everywhere in this Presidency, common also in Madras, up to 3,500 ft. in Bengal, Burma and Punjab. Absent from Sind. In Ceylon it is found only in a cultivated form.

The three most important species are *B. arundinacea*, *B. vulgaris*, and *Dendrocalamus strictus*. The latter attains, as already stated, 20-40 ft., sometimes in good soil 100 ft. All this growth is attained within a year. The stem dies after flowering and ripening its seed. I have seen it in flower during the months of December and January. Its stem is solid and elastic, and is used for

making spear handles, baskets, roofing, and for all the purposes for which *B. arundinacea* is used.

CONCLUSION.—In these Papers I have described all the species of grasses received from Guzerat, Deccan, Thana, Bassein, Dharwar and North Kanara. No specimens were sent from Sawuntwary, Rutnagherry, Malvan, and from Sind. A few which have been enumerated in my papers as belonging to the latter place were supplied to me by Mr. Woodrow, Professor of Botany and Agriculture of the Poona College of Science. I have reasons to believe that the lists from Guzerat and from other localities explored by me are far from being complete. I have received lately specimens of—

Oplismenus undalitifolius, Roem et Schult. Syst.II,482; Trin. Sp. Gram. t. 196.

Polytoca, Sp. Nova, from the Konkan, hitherto undescribed.

Pennisetum chenchroides, Rich in Pers. Syst.; Nees in Linnei VII, 277; Kunth. Enumi, 162.

Trichœlena teneriffæ, Libth. Fl. Græc. t. 53 (Saccharum); Trin. Sp. Gram. t. 317. From Sind, given by Mr. Woodrow.

Latipes senegalensis, Kunth Gram. t. 42; *Lapago biflora*, Roxb. Fl. Ind. I, 281; Dalz. and Gibs. Bomb. Fl. 295. From Sind (by Mr. Woodrow). In Mr. Graham's Catalogue of the Bombay Plants, Domus is given as a locality where this grass is found to grow.

Even in their present state, my papers must be considered as a useful contribution to the Bombay Agristology, and will, I hope, be acceptable as a guide to those who may wish to enter into this field of study, which is not as yet exhausted.

Persons who have never considered the subject are not aware of the difficulties one has to encounter in an undertaking of this kind. I had to work, as stated elsewhere, under great disadvantages; but I went on with patience and cheerfulness, because the work I had undertaken was a labour of love.

I reiterate here my heartfelt thanks to the Government of Bombay for their Resolution recommending the Forest Officers to supply me with grasses of their respective districts to assist me in my studies, and also to the officers themselves for having willingly complied with the recommendation of Government. My thanks are also due to Mr. Campbell, Collector of Customs, for having first drawn my attention to, and urging me as it were to undertake, this study of Bombay Grasses, the description of which was incomplete and imperfect.

Before I finish this, I must mention that at the end of the description of the species I have given, as far as possible, their uses as fodder grasses.

THE LOCUSTS OF BENGAL, MADRAS, ASSAM, AND BOMBAY.*

By E. C. Cotes.

(*With one plate.*)

A report has recently been issued on the subject of *Acridium peregrinum*, which is *par excellence* the locust of North-Western India.† In gathering together the materials upon which this report was based, information was obtained concerning other locusts which have from time to time proved destructive in Bengal, Madras, Assam, and Bombay. The present report, therefore, is intended to record what has been ascertained about these other locusts. To complete the subject, a short *résumé* has been added of what is known of the chief locusts that are found in other parts of the world.

The principal sources of information have been the reports and specimens furnished by the Revenue and Agricultural Department of the Government of India, and by the Agricultural Sections of the various Local Governments in India, but reference has also been made to the more important papers published in the United States, Algeria, and Europe, on the subject of locusts.

A short preliminary sketch of a portion of this paper was submitted in November, 1889, since which date a good deal of fresh information has accumulated.

The writer takes this opportunity to acknowledge the help which has been most kindly afforded by Dr. Henri de Saussure in identifying species.

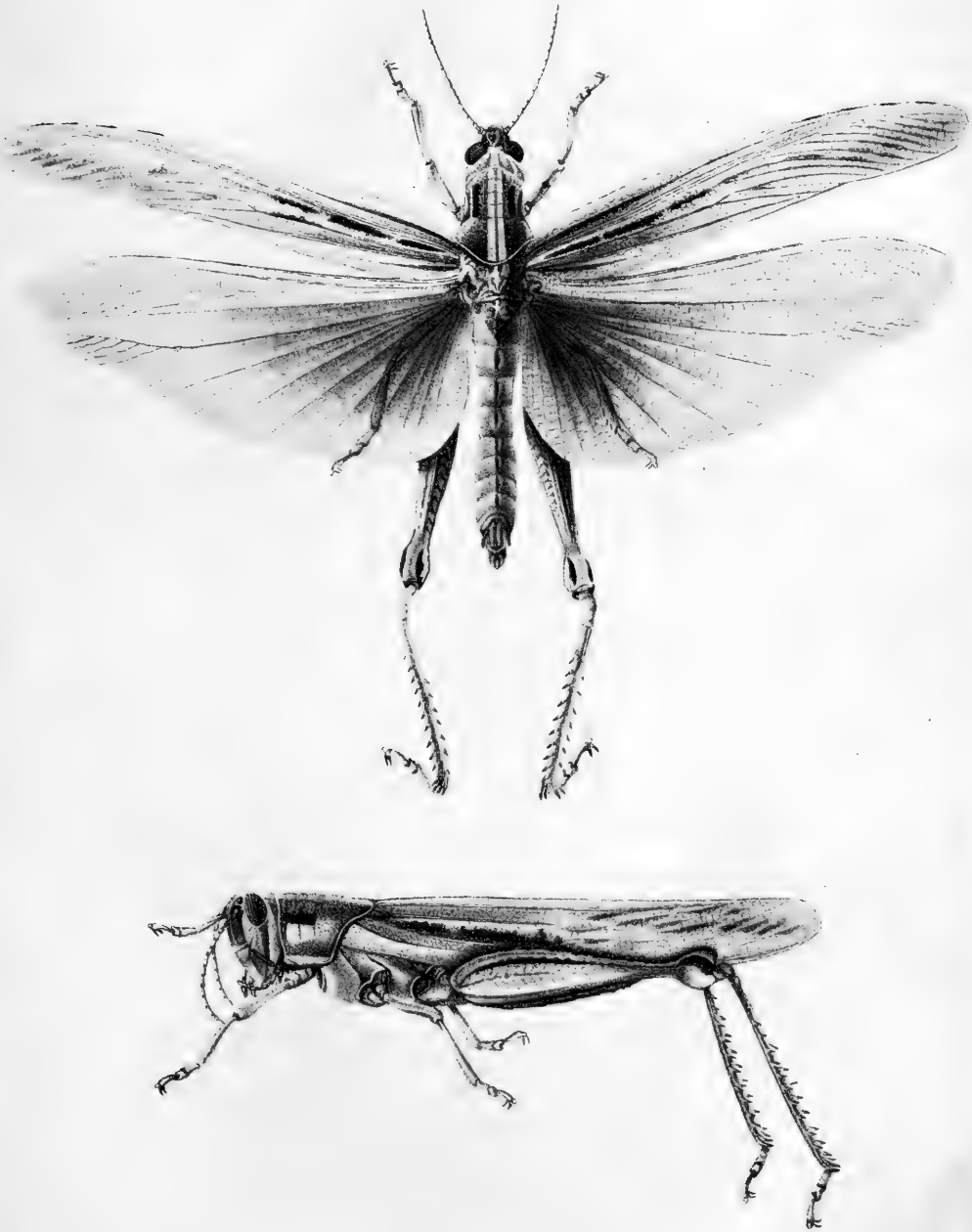
Locusts in Bengal.

In Bengal, it is chiefly in the comparatively dry country to the west that locusts appear, though occasionally flights traverse the whole of Bengal and even penetrate into Assam. These flights are composed of insects belonging to different species, and there are at least three distinct sources from which they come. In the first place, flights of *Acridium peregrinum* occasionally penetrate from the North-West frontier into Bengal. This was the case both in 1863 and 1890. An account of what is known of these flights is given in the report on *Acridium peregrinum*. Secondly, flights occasionally penetrate into Bengal from the highlands of Southern India, and in these cases they probably belong to some of the various species which occasionally prove destructive to crops in the Madras and Bombay Presidencies and in the Central Provinces[1]. This was probably the case with the flights of 1877 and 1878, notices of which are given below. Thirdly, flights are believed occa-

* Reprinted from *Indian Museum Notes* with the permission of the Trustees.

† See Journal, Bombay Natural History Society, Vol. VI, page 242.

[1] The chief of these species are said to be *Acridium succinctum*, *Pachytylus cinerascens*, *Acridium æruginosum*, *Acridium melanocorne*, *Tryxalis turrita*, *Hieroglyphus furcifer*, *Caloptenus erubescens*, *Caloptenus eruginosus*, *Cyrtacanthacris ranacea*, *Oxya furcifera*, *Euprepocnemis bramina*, *Oxya velox*, and *Chrotogonus* sp.



ACRIDIUM SUCCINCTUM LINN.

ukrabotty, del.

sionally to arise locally[2]. This is probably what happened in 1881, when a flight invaded the Manbhum District from hills in Hazaribagh. No information has yet been obtained on the subject of the identity of these local species; they may, perhaps, in some cases have belonged to the species *Acridium succinctum*.

Whatever the origin of the flights, the injury done by them in Bengal has never been very extensive, and no special measures have been adopted against them. According to a report, dated 14th July, 1883, by Mr. W. H. Grimley, low-class Mahomedans and Hindoos are said to store the locust, both for food and also in order to extract an oil believed to be useful in the treatment of gout and rheumatism, but upon the whole the pest is of no very great importance.

The following is an abstract of the records of the invasions of locusts other than *Acridium peregrinum* in Bengal :—

In 1862 locusts visited Monghyr and did considerable damage to the crops (Report, dated 26th June, 1890, by the Commissioner of Bhagulpore and the Santhal Parganas). We have no clue to the identity of this locust, except that in this, as in the following instances, the year was not one in which *Acridium peregrinum* was prevalent in its regular breeding grounds in North-Western India; so it is pretty certain that the species was not *Acridium peregrinum*. In 1865 locusts passed over Manbhum, without, however, doing serious damage to the harvest (Hunter's Gazetteer); they also appeared in this year in Durbhunga (Mr. W. H. Grimley's Report, dated 14th July, 1883).

In 1873 they are said to have passed over part of the Burdwan District (Commissioner of Burdwan's Report, dated 28th April, 1890). In 1877 they visited Monghyr and did considerable damage to the crops (Commissioner of Bhagulpore and the Santhal Parganas' Report, dated 26th June, 1890); a flight was also observed in this year in the neighbourhood of Patna (Mr. Scott's Note), and a specimen obtained from it on 1st July, 1877, by Mr. Scott has recently been identified by Dr. Henri de Saussure as closely allied to the species *Acridium succinctum*. In 1878 locusts, which had probably strayed from the flights then prevalent in the Madras Presidency, appeared in the Patkour subdivision of the Santhal Parganas from the south, but did not alight (Commissioner of Bhagulpore and the Santhal Parganas' Report, dated 26th June, 1890). They also appeared in small numbers in Orissa, but did no appreciable damage (Babu C. N. Ghose's Report, dated 20th February, 1890), and passed over Chumparan (Mr. W. H. Grimley's Report, dated 14th July, 1883). In 1881 a flight of local origin appeared in Manbhum and did some

2 With regard to the origin of locusts in the Durbhunga District, the Commissioner of Patna reported (16th July, 1890) that the swarms were said to come from the Darjeeling Hills, though some authorities were of opinion that they breed in the large tract of grass jungles that fringe the river Ganges. The supposed inability of these local species to cross any large body of water is noticed in this report.

slight injury. The following is an extract from a report, dated 14th July, 1883, by Mr. W. H. Grimley on the subject :—

"The subdivisional officer of Gobindpore, in the district of Manbhum, reports that, in June, 1881, a swarm of locusts visited the subdivision, extending over an area about ten by five miles, and about a quarter of a mile high. They are said to have emerged partly from the Lagoo Pahar, and partly from the Paresnath hill, in the Hazaribagh District. Considerable numbers alighted on the young *dhan* seedlings, Indian-corn and *gondlee*, which has just sprouted, and destroyed them. Much damage is said to have been caused by the insects, but they did not stay for more than four or five hours." The insects were "about four inches long with heads and wings of a red colour. A large number were destroyed by the people, and some were eaten up by the kites and crows, also by low-caste aborigines. They are said to possess the flavour of shrimps or lobsters."

Locusts in Madras.

Both in 1889 and 1890 flights of *Acridium peregrinum* from North-Western India penetrated into the Madras Presidency, and did slight damage over considerable areas ; generally speaking, however, the locusts, which occasionally prove destructive to crops in Madras, are of more local origin. There does not appear to be any one species which is invariably complained of, but in years of drought numerous species, which are ordinarily present in small numbers, multiply so as to injure the crops, some of them, however, being much more destructive than others. An account of what has been ascertained about the flights of *Acridium peregrinum*, which penetrated into the Madras Presidency in 1889 and 1890, has been given in the report on that species. The following is a summary of what is known of the other species of locusts that have proved injurious in the Madras Presidency :—

In 1866, a year of scarcity, locusts appeared in one of the villages of the Chingleput District, in the Madras Presidency, and did some damage (Mr. W. R. Robertson's Report, dated 23rd April, 1883). No information has been obtained as to the identity of this insect.

In 1878, the last year of the great South Indian famine, locusts invaded the whole of the Madras Presidency, not generally doing a great amount of injury, though in some cases the injury was sufficient seriously to increase the distress caused by the famine. The young locusts began to appear in January, and were found in great numbers in different districts from that date on till September and October, the earlier swarms being found in the west and south of the Presidency, and the latter ones in the north and east. The winged locusts were first observed in the end of March and beginning of April in the south-west (Wynaad and Nilgiris), and they afterwards spread over the Presidency to the east and north, not finally disappearing in the north-east until about November and December. They were supposed, at the time, to have originated locally in hills and waste lands in different parts of the Presidency. The evidence, however, seems rather to point to the locusts

having started, in the early part of the year, from the Wynaad and Nilgiri Hills, in the south-west, and thence to have worked their way, with the prevailing wind, over the Presidency to the north and east, occasionally stopping to feed or to deposit their eggs in the ground ; for it is otherwise difficult to account for the fact of their appearing so much earlier in the south-west than in the north-east. Little is known of the life-history of the insects, but it may be noticed that locusts were observed pairing in the Salem District in the latter part of June, and also that the young locusts, which were found in the early part of May in the Udamalpet taluq, were supposed to be the offspring of the large flights of winged locusts which had appeared in the preceding February in the same taluq. The connection between the autumn broods of young locusts and those which appeared in the early part of the year has not been made out satisfactorily.

Of the measures adopted against these locusts, the most successful seem to have been :—the destruction of the swarms of young wingless locusts by driving them into lines of burning straw ; the preventing of the flights of winged locusts from settling in the fields by lighting fires, beating drums, and waving branches and cloths in the air, as soon as a flight appeared ; and the driving of the winged locusts out of the fields, when they had already alighted, by beating through the crops. It is said that in cases where winged flights were driven persistently through a number of villages, without being allowed to settle, the locusts perished without doing injury. The above account of the Madras locust invasion of 1878 is chiefly taken from the official reports preserved in the Proceedings of the Revenue and Agricultural Department of the Government of India. With regard to the identity of the insects concerned in the Madras locust invasion of 1878, nothing seems to have been ascertained at the time of the invasion, though the insects were spoken of in one of the reports as belonging to the species *Locusta migratoria*. This, however, may possibly have been due to the fact that the locust of Central Europe is often referred to in old entomology books under this antiquated name ; much importance, therefore, cannot be attached to the indentification, and the only clue which we possess lies in the specimens preserved in the collections of the Central Museum, Madras. From this museum a set of specimens, which are supposed to represent the Madras locust of 1878, have been kindly furnished by Mr. Edgar Thurston. They have been identified by Dr. Henri de Saussure and prove to comprise no less than six very distinct species, which are as follows : (1) *Acridium æruginosum*, Burm., represented by five or six specimens which vary a good deal in the arrangement of the wing markings, (2) *Acridium melanocorne*, Serv., var., (3) *Tryxalis turrita*, Linn., (4) *Mecopoda* sp., (5) *Euprepocnemis* sp., represented in each case by one or at most two specimens, (6) a specimen, in a very poor state of preservation, which belongs either to the species *Pachytylus migratorius* or to *Pachytylus cinerascens*.

In July, 1890, locusts were noticed in the Ganjam collectorate, the following being the Collector's report to the Revenue Board, Madras, on the subject :—

"I have the honour to inform you that on the 24th instant I visited Purushottapur in order to see whether anything could be done to destroy the locusts reported to be doing so much mischief there.

"I had two large 'bag nets' made of bamboo matting, 15 feet long, and hoped that I might have been able to do something with them; but am sorry to say that all attempts ended in failure. I also attempted to drive the insects into trenches, but without success. The reason for the failure is, that the insects, which are of four or five different kinds, succeed in evading the net or the drive, the large ones by flying away when approached, the smaller ones by dropping to the ground and clinging there, so that nothing would remove them which would not at the same time root out altogether the crop. The number of large brown insects which seem to be really locusts is comparatively small, the great bulk are small brown and green grass-hoppers, which are in myriads. A great deal of damage has undoubtedly been done. The pest extends over about 10 square miles, chiefly in the Pubbakhandam mutah of the Berhampore taluk. Of one hundred and four villages (including Agraharams and Mokhasas) in the mutah, fifty-five are more or less affected and ten have suffered seriously.

"All the villages most affected are near the Dalibhillo Tampara, the embankment of which breached in the floods of last year and has not yet been repaired, in consequence of which a large expanse of ground, usually under water, has been lying dry. The ryots report that the insects first made their appearance in the vicinity of the Tampara, and I think it probable that they were brought out in unusual quantities owing to the unusual extent of dry ground there. Steps are being taken now to repair the embankment, and I trust that next year the Tampara will not afford so convenient a breeding ground, and that the insects will either not re-appear or do so in diminished numbers."

Specimens were forwarded to the Indian Museum and were found to consist of (1) ten adults and eight larvæ of *Pachytylus cinerascens*[1], (2) four

[1] These specimens were identified by Dr. Henri de Saussure ; the species is so closely allied to *Pachytylus migratorius*, which is the common migratory locust of Central Europe, that it is very doubtful as to whether the two forms are separable. Koppen indeed (*vide* Zool Record, 1872, page 398) considers that *P. cinerascens* is only a variety of *P. migratorius*, and the specimens of the two forms in the Indian Museum (as determined by Henri de Saussure) seem to point to this being the case. According to the synopsis given on page 119 of Dr. Saussure's *Prodromus Œdipodiorum*, in *P. cinerascens* the male is smaller than the female, the punctation on the pronotum is somewhat coarse, the notch in the carina is well marked, and the teeth on the posterior femora are large ; while in *P. migratorius* the male is much the same size as the female, and the punctation on the pronotum, the notch on the carina, and the teeth on the posterior femora are less marked. To these characteristics Mons. Frey Gessner adds that the carina on the thorax of *P. cinerascens* is elevated into a well-marked ridge, while that of *P. migratorius* is much less distinct. These characteristics, however, seem in the absence of any well-marked geographical boundary between the areas in which the two forms occur, to be of scarcely sufficient importance to justify their separation into two species, this being especially the case, as Dr. Saussure writes, that the females of the two forms are often almost indistinguishable.

specimens of *Tryxalis turrita*, Linn., (3) one specimen of *Oxya velox*, Burm., (4) one specimen of a species which is probably *Epacromia dorsalis*, Thumb., (5) one larvæ of a grass-hopper probably belonging to the genus *Œdalus*. Of these the immature specimens are probably the "small brown and green grass-hoppers," alluded to by the Collector as present in myriads, while the full-grown specimens of *Pachytylus cinerascens* are likely to have been the "locusts" mentioned as present in comparatively small numbers. Now, *Pachytylus cinerascens* is one of the chief migratory locusts of Europe, where it sometimes does a great deal of damage. The insect is essentially an inhabitant of the temperate zone, and this would make it appear probable that its permanent breeding-ground lies somewhere in the Nilgiri or other hills, whence it might easily be carried upon the south-west monsoon across the Presidency. The presence of nearly full-grown larvæ shows that the original flight must have remained in the district sufficiently long to have laid their eggs, and for the eggs to have hatched, and for the larvæ to have passed through most of the early stages, a process which probably occupied some months. In the Palæarctic zone *P. cinerascens* is said to lay its eggs in the autumn, the young hatching out in the following summer, but we are as yet entirely in the dark as to the habits which the insect acquires when it passes out of a temperate climate into a tropical one.

Locusts in Assam.

Assam is not generally troubled by locusts, though in the cold weather of 1890-91 a stray flight of *Acridium peregrinum* from North-Western India penetrated into it. In 1879 also both the autumn and winter crops in Nowgong were reported by the Director of Agriculture to have been largely destroyed by locusts, which were said to have come from the tall grass jungle at the base of the Khasi and Mikir Hills, where they breed permanently. Nothing is known of the identity of this locust, though it may possibly have been the insect *Phymateus miliaris*, which was sent to the Indian Museum in September, 1890, by General Collett, with the information that it was common in the neighbourhood of Shillong. The following is taken from a report, dated 15th February, 1883, by the Director of Agricultural in Assam :—

"I spent three weeks marching in the Nowgong District, and visited most of the district, except the hill tracts. The *Kakotiphoring*, or Paper grass-hopper, as the locust is called, is very well known. It is said to attain a length of six to seven inches. It breeds in the tall reed and grass jungle, especially in the jungle at the foot of the hills along the south of the district (the Khasia and Mikir Hills). The time of the appearance of the insect is in the early spring, and it continues to feed till July.

"Local visitations of locusts are common enough. I found it generally stated that they took place every two or three years. But one general invasion was well remembered everywhere; the date was 1879 : it began early and ended late, so as to include both mustard and rice in the area of devastation. The mustard ripens in January.

"The direction in which the locust swarms moved was somewhat different in

different places. Near the Khasia and Mikir Hills they seemed to come from the south, *i.e.*, from the submontane jungle. In the Chapari Mahals, between the Kalang and Brahmaputra, the direction of their course was eastwards. They seem to have moved with great regularity from west to east along this tract, a distance of some 50 miles. The ryots, moved perhaps by rumours of the Afghan War, which had penetrated thus far, told one another that they came from Cabul. Their numbers were such that the reeds and grass of the jungle were bowed down by their weight when they alighted, and they made a clean sweep of all the fields in their way. The Mikirs and Lalungs eat locusts after parching them in the fire. Locusts can commonly be had in the month of Bohag (April-May). The only remedy adopted against locusts is one which the people appear to have invented for themselves. They sprinkle the threatened crops with water in which salt has been dissolved, and in which onions have been steeped. This remedy is said to have been effectual in 1879, after some time probably the locust would have moved on in any case."

Locusts in the Bombay Presidency, excluding Sind.

General.

In the autumn of 1890 flights of *Acridium peregrinum* from North-Western India penerated into the Bombay Deccan and Konkan, and did slight damage over considerable areas. An account of these flights has been given in the report on *Acridium peregrinum*, and we are now chiefly concerned with the locusts which invaded the Presidency in 1882-83, though it should also be noticed that, according to Hunter's Gazetteer, locusts appeared in 1878 in Kolaba and damaged the cold weather crops of 1878-79, nothing further, however, being recorded about them.

In 1882-83 locusts proved destructive throughout the whole of the Bombay Deccan and Konkan, and though the identity of the insects concerned was not altogether definitely ascertained, the history of the invasion was very completely recorded in numerous official reports. The sections, therefore, on the history of the invasion and on the remedies adopted have been taken, much of them *verbatim*, from the reports of the Bombay Government by Mr. J. Nugent, as recorded in the Records of the Revenue and Agricultural Department of the Government of India. The section on the life-history of the insect is from a report by Mr. Hatch, as reprinted in the *Indian Forester*, Volume X.

The history of the invasion.

In May and June, 1882, locusts were noticed in the south-west of the Presidency (Dharwar and Kanara Collectorates), but they attracted little attention, as such swarms are annual visitors of the Kanarese forests, and neither in Kanara nor in Dharwar did they cause any material injury. With the setting in of the south-west monsoon, however, they spread in flights over the Presidency, to the north and north-east (Satara, Poona, Nasik, Ahmednagar, and Khandesh), and early in the rains proceeded to lay their eggs and die. These eggs hatched in the end of July, or beginning of August, and the young locusts

did a large amount of damage, over a wide area, through the months of August and September. In the early part of October, with the setting in of the north-east monsoon, the young locust, which had by this time acquired wings, took flight and travelled with the prevailing wind in a south-westerly direction, doing some injury in the Poona Collectorate as they passed. They then struck the Western Ghâts and spread slowly over the Konkan in November, and thence travelled into the Native State of Sawantwari and the Kanara district. During the remainder of the cold season and the hot weather (December, 1882, to the end of May, 1883) the flights clung to the line of the Ghâts occasionally venturing inland into Belgaum, Dharwar, the Kolhapur State, and Satara, and devouring the spring crops in the coast districts, but ordinarily returning to the vicinity of the hill ranges. With the commencement of the south-west monsoon, however, in the latter part of May, 1883, the flights began to move in a north-easterly direction, as they had done the preceding year, but in larger numbers.

At the commencement of the rains they began to alight in vast numbers over an immense tract of country comprising the six Deccan collectorates of Sholapur, Poona, Khandesh, Ahmednagar, Satara, and Nasik, and also in the three coast collectorates of Ratnagiri, Kolaba, and Thana. They deposited their eggs and died, and early in August the young locusts hatched out in countless numbers, but were apparently more backward and possessed of less strength and stamina than were those of the preceding year. The unusually heavy rainfall killed vast numbers of these in different parts of the country, and elsewhere the insects seemed stunted and feeble, and grew but slowly. They were destroyed in vast numbers by the vigorous measures initiated by the officials, and were also said to be diseased and attacked by mites and *nematode* parasites. As late as November, the mass of the young locusts appeared unable to fly and made no general movement to the south-west, as they had done the year before. The invasion was, in fact, at an end, and though (according to Hunter's Gazetteer) swarms appeared in Sawantwari in 1883-84, no further injury of a serious nature seems to have occurred.

The injury occasioned to the rain crops by the locusts was very considerable over a great portion of the Deccan and Konkan both in 1882 and 1883. But though some relief works were started, especially in the coast district, it was found, at the end of the invasion, that the abundance of the cold weather crops had compensated to so great an extent for the injury occasioned to the rain crop, that no wide-spread injury had been occasioned.

The life-history of the locust.

Mr. Hatch describes the life-history of the locust, as observed in the Konkan, as follows[1] :—

"In the Konkan locusts coupled in great numbers between the 15th May and the 15th June, 1883, and died off naturally immediately after the eggs had been deposited. The eggs are deposited mostly in flat and gently sloping land of soft friable soil, rocky

[1] From his report, as reprinted in the *Indian Forester*, Vol. X, p. 425.

and sandy soil being avoided, and land which has been ploughed up, and the lee side of banks, where the soil has accumulated, are mostly selected. The eggs are piled in a small cylindrical hole, parallel to its sides, and are attached to one another by some cohesive siccable substance. Filling the mouth of the hole is a plug, consisting of a soft fibrous substance, and below it the eggs, arranged as described, averaging 70 in each hole. The holes are from 1·5 to 2 inches in depth, and in a good locality four might be found in a span. They are not easily visible, but when one is found, others are generally near it. Brushing off the loose dust and digging here and there facilitates search.

"The eggs themselves are of a dirty ochre colour, in length ·2 to ·3, and in diameter ·05 to ·08 of an inch, rounded in section, with a slight curve, and tapering very slightly towards the rounded ends. . . When fresh, the contents of the eggs are of a dirty orange colour, liquid but slightly viscous, with a somewhat acrid taste. The envelope apparently consists of two layers, the outer one coloured and tough, and the inner one white and fragile. When broken, the eggs give off an odour like a broken root. As the eggs approach maturity, they assume a distinctly greenish hue, and the young locust bursts the shell down the middle on issuing into life. I experimented on some eggs by placing them in damp and very damp soil, but the water did not affect the hatching.

"The young locusts appeared in myriads in my district (Chiplun taluka) between 1st and 20th August, so that the period the eggs required to hatch was a little more than two months, say seventy days.

"The young locusts vary somewhat in colour, most being a dullish light green, some light green, but hardly verdant, and a few almost white and only tinged with green. A few minutes after hatching they are strong enough to jump . . . . The antennæ are darksome and short, whilst on the thigh-cases small black spots, and on the upper side of the abdomen a faint black line, are just visible. . . . .

"The young locusts generally cast their slough for the first time about 15 days after birth, and in their new skin the black line and spots become darker and the green colour of a deeper hue. They now leave the grass land and seek the shelter of the crops, and are in length ·8 of an inch.

"After another interval of 15 days they again cast their slough and enter on the third stage. In this the black line becomes very intense, as also do the spots, which lengthen and form the so-called 'Koranic verses'—they do show a certain similitude to some letters of the Arabic alphabet. They are now 1·2 of an inch in length.

"They enter the 4th stage by casting their slough after another 15 days, and assume, including the antennæ, a yellow colour, which, towards the end of the stage, becomes pinkish-grey. The black line and the 'Koranic verses' are now very intense in colour, and the insect attains the length of 1·6 of an inch.

"A great transformation is witnessed on entry into the 5th stage after 15 more days. The female is now two inches long, whilst the male is somewhat less. The colour of the head, prothorax, and abdomen is a grey or drab, speckled on the prothorax, and darker along the upper side of the abdomen. The ringed antennæ are deep yellow, the eyes chestnut and striated, whilst for the first time appears an oblong mark under each eye, indigo-green in colour, and bordered on each side by yellow. The Arabic letters have now disappeared, whilst the spots on the thigh-cases are

obsolescent. The young wings, too, now first appear. At first very small, they grow during the period of this stage—20 days. The contents of the wing-sprouts are at first liquid, and the young wings may be seen forming within the semi-transparency. When they are fully formed, the insect is of a dark brownish-grey colour, whilst on the prothorax and elsewhere may be distinguished the colouring of the next stage.

"In its 6th and perfect stage the insect presents a brilliant appearance. The female is now 3 inches, and the male 2½ inches, in whole length, from head to tips of wings which overlap the abdomen by ·5 of an inch, and are rounded. On casting the slough the wings dry and unfold, and the body of the insect, at first soft and moist, gradually hardens in the sun. The antennæ are ·8 inch in length, and of a bright yellow colour; the head is a brownish-yellow, and the eyes, finely striated, are of a deep chestnut. The prothorax is alternately banded with a bright yellow and a rich brown, parallel-wise to the body, and the legs are of an ochreish hue. Along the upper rim of the femur runs a deep brown stripe, and the knee-caps are of the same colour. The tibia, tarsus, and foot are a bright ochre, and the first is armed with 8 black-tipped spurs on the outside and 11 on the inside, while there are a pair of spurs on each side of the ankle-joint and on each side of the foot. The outer wings, or wing cases, have the colours on the prothorax extended to them, and on the back they form a flat surface, tapering to the extremity. They are strongly veined and finely reticulated, and towards the extremities are irregularly brown marked. The inner wings, which are expansive, are hardly coloured. The abdomen is a light brown, darker along the ridge, and in the female there are four spiky processes at its extremity, the upper pair curling up and the lower pair downwards. In the male the lower pair is replaced by one spiky process, larger and stronger.

"The locust now packs with its kindred, and they form the swarms which ravage the country. After a month or so they assume a red tinge, which gradually deepens and continues until their death, which takes place after the sexual function has been performed in May or June. The proportion of males to females appeared to me about 1 in 6.

"The whole life of the insect, including the egg-period, is exactly one year."

Remedies.

Various methods were employed in the Bombay Presidency in 1882-83 to destroy the locusts, which were to a large extent kept under by the energetic measures taken against them. The Cyprus screen system[1] was found utterly inapplicable and had to be abandoned. The search for eggs also was not found successful as a means of

[1] The Cyprus screen system consists in erecting a long line of screens, each two to three feet high, in front of an advancing swarm of young wingless locusts, pits being dug at intervals, close to the screens and at right angles to them, on the side towards the advancing swarm, the object being that the young locusts, on arriving at the screens, may turn to the right and left, and thus pour into the pits, where they can be destroyed. The chief advantage of the screen system is, that it enables a series of pits, dug at intervals, to take the place of the continuous trench that would otherwise be necessary to catch the whole of a swarm. The material hitherto chiefly used for the screens has been cloth bound along the top with a strip of slippery oil-cloth, about four inches wide, to prevent the locusts climbing over, but smooth mat screens are likely to be cheaper for use in many parts of India. The pits are usually furnished with overhanging zinc edges to prevent the locusts escaping.

destroying the pest. A plan was tried of marching lines of beaters, armed with bundles of twigs, through the fields, beating the ground so as to crush the young locust. This was to some extent successful in short grass, but could not be made use of with growing crops. The plan of dragging country blankets rapidly over a field where locusts were to be found, and squeezing up the cloth every few yards to kill the insects which had been caught, was found useful in bushy tracts, but required, for its successful working, a good deal of activity and intelligence. The most successful method consisted in dragging over the fields a capacious bag, five or six feet deep by eight or ten feet long and much like a huge bolster case, but open at the side, instead of at the end. This was held by two men, one at each end, and was run along over the grass or young crops, to catch the locusts, which tumbled in, and, being unable to escape could, from time to time, be killed by twisting up the bag. This was found to be a simple and easy means of destroying the locusts, and the people took to it readily all over the locust-affected area. Little or no injury was done to the crops by the men working it, and millions of insects were killed.

With regard to the numbers destroyed during the locust invasion, the Collector of Nasik reported the destruction in his collectorate alone of some forty-five tons of locusts, which he estimated must have represented about a thousand millions of individual locusts. Similarly in the Satara collectorate one hundred and eighty tons were reported to have been destroyed by the local officials. The numbers destroyed in these two collectorates were no doubt greater than in most of the collectorates which suffered from the locusts, but the figures give some idea of the extent of the invasion.

The identity of the locust.

With regard to the identity of the locust of 1882-83, Dr. Macdonald in his report in the *Indian Forester*, Vol. X, advanced the supposition that the insect was *Acridium peregrinum*, and this name was adopted in most of the official reports which subsequently appeared. There seems, however, to be conclusive proof that the insect belonged to some other species. In the reports, both of Lieutenant-Colonel Swinhoe and of Lieutenant-Colonel Bradford, the locust of Rajputana, which is undoubtedly *Acridium peregrinum*, is spoken of as distinct from the Bombay locust of 1882-83. *Acridium peregrinum* has been shown to be essentially the inhabitant of sandy deserts, while the Bombay locust of 1882-83 originated in the tropical forests of the Western Ghâts. The habits also of the Bombay locust of 1882-83 differed materially from those of *Acridium peregrinum*, in that the young wingless larvæ of *Acridium peregrinum* can be readily driven into traps, while those of the Bombay species entirely declined to be destroyed in this manner. Again, specimens said to be "locust" were sent from the Bombay Presidency in 1883 to the well-known entomologist Mr. F. Moore, who identified them as belonging to no less than five species, namely :—*Acridium succinctum, Caloptenus erubescens, Caloptenus caliginosus, Cyrtacanthacres ranacea*, and *Oxya furcifera; Acridium peregrinum* being unrepresented—a

circumstance which is not likely to have occurred if this had been the species which was at that time swarming over the Presidency. Again at a meeting of the Entomological Society of London, held on the 4th of April, 1883, Mr. W. F. Kirby, of the British Museum, exhibited specimens of a locust which he identified as *Acridium succinctum*, and which he had received from Mr. T. Davidson, who stated that it was the species which had lately been destructive in the Deccan and other parts of India. In the absence, therefore, of actual specimens, which do not seem to have been preserved, it may be concluded as most probable that while numerous species of *Acrididæ* may have been present in great numbers in the Bombay Presidency in 1882-83, the insect chiefly responsible for the injury to the crops was *Acridium succinctum*, which, therefore, would be the one spoken of by most of the observers who, from their reports, seem to have noticed but one kind of insect.

Locusts in other parts of the world.

General.

Many species of *Orthoptera* occasionally increase vastly in numbers, so as to cause serious injury to agricultural crops; and there are, in different parts of the world, certain species, which are known distinctively as *Locusts*, and which possess this habit to a remarkable degree, often migrating in swarms which devour the crops over wide areas of country. Migratory locusts usually breed permanently in tracts where the vegetation is sparse. In years when they increase excessively, they descend in flights from their permanent breeding-grounds, upon cultivated districts, where they destroy the crops, lay their eggs, and maintain themselves for a limited period, but are unable to establish themselves permanently, usually disappearing in the year following the invasion, to be succeeded, after an interval of years, by fresh swarms from the permanent breeding-ground.

Generally speaking, the life circle of a locust extends through one year, in which period it passes through its various stages of egg, young wingless larva, active pupa, and winged adult which lays the eggs that are to produce the next generation, the only recorded exception being *Acridium peregrinum*, which is believed to pass through two generations in the year in India.

The eggs are laid in little agglutinated masses in holes which the female bores with her ovipositor in the ground. In temperate climates the eggs are usually laid by the end of the summer, and the parent locust dies before the winter commences, the eggs remaining in the ground during the winter months, and hatching out in the following spring. In sub-tropical countries, where there is but little winter, the winged locusts live on through the cold season, and do not die off until the following spring, when they deposit their eggs. In this case the eggs hatch after lying in the ground for about a month. In both temperate and sub-tropical regions alike, the young wingless locusts on emerging from the eggs in the spring or early summer feed voraciously and grow rapidly for one or two months, during which period they moult at intervals finally developing wings and becoming adult. The adult locusts fly about in

swarms, which settle from time to time and devour the crops. The damage done by locusts is thus occasioned, first, by the young wingless insects, and afterwards by the winged adults into which the young transform after a couple of months of steady feeding.

The following are the chief species of locusts found in different parts of the world other than India :—

Pachytylus migratorius, the chief migratory locust of Europe, occurs especially in Eastern Europe and Southern Russia, also in Central Asia, Siberia, North China, Japan, the Fiji Islands, New Zealand, North Australia, Mauritius, Madeira, and possibly in South Africa, very little, however, being known about its distribution in the Southern Hemisphere (McLachlan : article *Locust*, Encyclopædia Britannica). It may be looked upon as the chief locust of the temperate zone, excluding America. An elaborate account of this species in South Russia is given by Köppen (Horæ Soc. Ent. Ross., iii, pp. 89—246 ; reviewed in Zool. Record, 1867, p. 457). From eggs laid in the autumn the larvæ hatch in the spring (April and May), and moult four times before they become adult larvæ, band themselves together, and move in search of nutriment, feeding chiefly on *Gramineæ* and doing a vast amount of damage. The imagos emerge about July, copulate soon afterwards, and oviposition extends from August to October. Each female copulates and oviposits about three times, at intervals of about a month ; each time laying from 50 to 90 eggs, in a hole bored by her horny ovipositor in the soil. This hole is about 1½ inches deep and is lined with frothy matter, which hardens into a case for the eggs. The eggs have been found to withstand as low a temperature as 26° F. below zero. The dry steppes constitute the chief haunts of the locust, which avoid damp places. The females generally oviposit in solid virgin soil, and seldom visit ploughed land for this purpose. Köppen is of opinion that the countries in which the swarms are seen are also, generally speaking, the countries of their origin.

Pachytylus cinerascens, Fabr., and *Œdipoda tatarica*, Motsch., which have been described by different authors as distinct from *P. migratorius*, are considered by Köppen to be but varieties of one and the same species (Horæ Soc. Ent. Ross., iii, 1867). *P. cinerascens* is the form which has usually appeared in England and Belgium, in the latter of which countries Köppen notices that it probably breeds (Zool. Record, 1872, p. 398). It also occurs in India.

Pachytylus pardalinus has been described as destructive in South Africa (Trans. Soc. Afr. Phil. Soc., i, p. 193, 1880).

Pachytylus stridulus, *Œdipoda vastator*, *Stauronotus vastator*, and *Pezotettix alpina* have been noticed amongst other locusts as occasionally destructive in Southern Russia, especially when associated with the common migratory species *Pachytylus migratorius* and *Caloptinus italicus* of that region (Köppen, Horæ Soc. Ent. Ross., iii, 1867).

Caloptenus spretus, the Rocky Mountain locust (see Reports of United States Entomologists—Riley, Pachard and Thomas—Washington, 1877—79), caused

injury, between the years 1874 and 1877, estimated at 200 million dollars. It breeds permanently only in a broad and comparatively barren region in the north-west of America, whence the invading winged swarms swoop down upon the fertile plains of the south and south-east, not appearing in the Mississipi valley until the latter part of July or the beginning of August, when wheat, barley and oats have generally reached perfection and been harvested. This, it is reported, renders it possible to prevent serious injury by relying chiefly on these crops when there is reason to fear incursions. On arrival the locusts devour everything green to be found, until they deposit their eggs and die in the autumn. From these eggs are produced in the spring, vast hordes of young which devour everything green they can find, travelling along the ground (not having yet acquired wings) from the fields they have exhausted to fresh ground. They may be destroyed in vast numbers by systematic rolling, collecting by hand, drawing bags over the field, &c., and their advance may be prevented by digging ditches in front of them with a streak of tar at the bottom, and also by driving them into heaps of straw to be then burnt, the trees being protected by bands formed of poisonous or impenetrable substances. When the larvæ are full-fed and acquire wings, they rise up, by this time followed by hosts of insect parasites (*Tachinæ, Ichneumonidæ*, &c.), and, weakened by disease, make their way more or less directly towards their permanent breeding-grounds ; they perish by millions on the road, so that but few ever reach their home in the high and barren north-west, where alone they are able to propagate permanently. They leave (it is reported) a great part of the country sufficiently early to allow of corn of rapid growth being produced after their departure, and succeeding swarms avoid the parasite-stricken districts which their immediate predecessors have deserted. Hogs, poultry, and all kinds of birds, besides various insects, destroy vast numbers of the locusts; and as they can only exist permanently in the comparatively barren north-west, it is supposed that when this breeding-ground is irrigated and settled the locusts will gradually be exterminated.

Caloptenus italicus occurs on the European side of the Mediterranean (Italy, Austria, &c.) ; it is also found in North Africa and South Russia (Verz. Zool. Bot. Ges. Wien., xviii, p. 930 ; Bull. Ent. Ital., xiii, p. 210). It has been reported as destructive.

Stauronotus cruciatus has proved injurious in Italy and Sicily (Bull. Ent. Ital., xiii, p. 210). It also periodically invades Cyprus and the Troad (Proc. Ent. Soc. Lond., 1881, pp. xiv & xxxviii ; also, Brown :—Report on the Locust Campaign of 1885-86 in Cyprus).

In Cyprus the locust is indigenous to the island. The young hatch out about the middle of March, and take about six weeks to become adult, when they acquire wings, take flight, and soon afterwards copulate and oviposit. The eggs are laid in uncultivated rocky ground, ploughed land and light soil being avoided. Each egg-pod contains about 33 eggs. Some damage is done

by the winged swarms, which, however, generally disappear by about the middle of June, the eggs remaining in the ground until about the following March, when they hatch.

Serious loss is often occasioned by the locusts, and of late years a regular warfare has been waged against them by the Government of the island. The following was found to be the most satisfactory method of destroying them: Cloth-screens, about three feet high and bound at the top with a strip of oilcloth to prevent the locusts from climbing over, were erected in front of the advance of the young locusts, pits being dug at intervals close to the screens and at right angles to them on the side towards the locust swarm, the edges of the pit being protected by frames made of cloth and wood, with zinc edge arranged to prevent the young locust from escaping from the pits. A swarm, on arriving at the screen, was found invariably to turn right and left along it, apparently endeavouring to go round it; the young locusts thus poured in vast numbers into the pits dug to receive them, and, being unable to escape, were destroyed wholesale. In the case of the locust invasion of 1886, Brown reports (*vide* official report presented to both Houses of Parliament by Her Majesty, February, 1887):—

"There were very few places where the locusts were sufficiently dense to justify the use of screens and traps, and they were in most cases destroyed by covering the ground they occupied by a thin layer of dry brushwood or rubbish and setting fire to it. By this means large areas were burned. Where the locusts were so sparsely scattered, or the scarcity of brushwood rendered this method inapplicable, they were destroyed by beating (an improved beater or locust-flap of leather, weighted with lead, having been introduced by me this season). The weak point of these methods, as compared with the screen and trap system, is that, although the locust may be greatly reduced, it is practically impossible absolutely to exterminate them, whereas our experience of 1883 and 1884 abundantly proved that when carefully worked it is possible, by the continuous screen system then first introduced, to completely clear large tracts of land where the locust swarms were most dense."

Stauronotus moroccanus.—This insect, which is found in most of the countries bordering on the Mediterranean, and which has also been reported from Badghis in Afghanistan, has of late (1887—89) proved very destructive to grain crops in Eastern Algeria, where its increase has been favoured by drought. Unlike *Acridium peregrinum*, which periodically invades Algeria from the south, it breeds permanently on the sparsely vegetated hill ranges in Algeria itself (Batna, M'lila, M'sila, Bordj, Rendir, &c.,) and thence descends in countless numbers into the cultivated plains towards the shores of the Mediterranean. The invading flights appear in the summer, and the females proceed, on arrival, to deposit their eggs in holes about an inch deep, which they bore with their ovipositors in the ground. About thirty or forty eggs are deposited in a mass of mucilage in each hole. These eggs remain in the ground throughout the autumn and winter, and hatch in the following spring (eggs laid in the end of June and beginning of July, 1888, hatched in April, 1889). After hatching out,

the young locusts band themselves together and march through the country devouring the crops. The loss occasioned in 1888 was estimated in the Consular report at about a million sterling. In 1888 measures were taken upon a large scale by the French Government for the destruction of the eggs, about 600,000 francs being said to have been expended in buying eggs, at the rate of 1 fr. 52 c. for two decalitres, from the Arabs. These measures, however, proved insufficient, and were considered unsatisfactory, M. Künckel d'Herculais indeed showing that whereas a man can rarely collect as much as 2·60 litres of egg-cases, containing some 72,000 eggs, in a day, he can destroy about a million young locusts by collecting them after they have emerged from the eggs. In 1889, therefore, the Government introduced the Cyprus screen system upon a considerable scale for the destruction of the young locust. About 300 kilometres of screen were procured, and 100,000 people were employed in destroying the young locusts. These measures seem to have been attended with considerable success, though definite information has not been received as to what extent the country was cleared of the pest[1].

Acridium peregrinum.—This is the chief locust of Northern Africa, Arabia, Persia, Baluchistan, and North-Western India. It has been fully dealt with in the report already issued.

Acridium paranense has been described as the migratory locust of the Argentine Republic, though some writers are of opinion that it may perhaps be the same as *Acridium peregrinum* (*vide* McLachlan : Encyclop. Brit., article *Locust*).

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[1] The above account is chiefly drawn from (1) Reports I and II by Mons. J. Künckel d'Herculais, dated May and August, 1888 ; (2) Diplomatic and Consular Report on Agriculture in Algeria, No. 469 ; (3) Papers which have appeared in the *Illustrated London News*, *Le Mobacher* published in Algiers, and *Insect Life* published in Washington.

REVIEW.

* Beast and Man in India.

The first thing to consider is, whether this review ought to be written for the Bombay Natural History Society's Journal, or for that of the chum Society,—the Anthropological. It is true, indeed, that Natural History includes Anthropology ; but this is not a popular view of the subject, and, therefore, hardly applicable to a "popular sketch." By the way, how did Mr. John Lockwood Kipling know that his sketch *would* be "popular," as it certainly is, before he published it? He had a right to expect in Bombay and the Punjab a *success d'estime* and his surname has been a good deal before the world of late ; and, perhaps, that may have encouraged him, and the *event* and editions have justified him. To return to the writer's own choice, Mr. Kipling and most of his public think that "Natural History" deals rather with "Beasts" than with Men. And he has, with conscious or unconscious sarcasm, put his Beast first. So here goes.

We will take in hand his discourse of beasts, and leave that on men mostly on one side, especially so much of the book as is composed of newspaper articles and ballads by another hand. Like Dante and Virgil "We won't discuss these, but glance at them and pass on."

The introductory chapter is mostly full of explanations of Indian character foreign to our somewhat limited view of the subject. But two somewhat curious limitations in our author's are revealed at p. 13, where he says that "in a few generations we may hope for an Indian student of Natural History. At present this splendid field is left entirely to European observers, who mostly look at nature along the barrel of a gun. Which is a false perspective." The full stop at "gun," we may remark, is false punctuation ; but, perhaps, the printer's.

But in what world does Mr. Kipling live? Any month in Bombay we could show him a room full of Indian students of Natural History, and as to the Europeans who "look at nature along the barrel of a gun," many of them have taken that view of the tiger and the panther. Whether their perspective was true or false, let the re-peopled villages

* "Beast and Man in India, a popular sketch of Indian Animals in their relations with the people". By John Lockwood Kipling, C.I.E. London, Macmillan & Co.

of Khandeish (for instance) tell. Whether a sportsman can be a naturalist or not, our own columns bear abundant witness here. And as a matter of fact, there never was a sporting society less animated by a mere love of slaughter, or more by a taste for observation and inquiry, than that of Western India at this present moment. You will scarcely find even a Griffin in the mofussil who would not be somewhat ashamed to own to "shooting for the bag." As a practice, pigeon-shooting, indeed, belongs to another order of things. It is not "looking at nature" in any sense, but simply looking at a target,—unfortunately alive,—which represents a fraction of a prize,—unfortunately a money-prize. But it seems to be fast falling off in public favour. Indeed, there is little wonder in that the trapped birds generally supplied to Indian Gymkhanas are poor fliers compared to the birds bred for the trap in Europe. Bazaar-bred birds turn the shooting into a farcical lottery for those who can make up their minds to shoot at them. To others, of course, it is a tragedy. But those who do not shoot trapped pigeons (including the present writer) are bound, in fairness, to acknowledge that that exercise requires great skill in the use of arms, and involves, when properly managed, no more cruelty than any other method of killing birds.

Mr. Kipling's first bird is "the parrakeet (*Palæornis cupabius*)." But he only recognises one species out of three that he can hardly have failed to see—the Alexandrine, plum-headed, and rose-ringed, which are in every bazaar. The rose-ringed paroquet is our common Bombay species, the most beautiful and stupid of the three. The plum-headed is common enough on the Ghâts and in deep jungles near them. It is easily recognized on the wing by its light-tipped tail. The Alexandrine is apparently rarer in our province; at least the present writer has not seen it in the forest; but its colouration is not such as to identify it on the wing except from above. Wild parrots are not often looked upon *de haut en bas* nor often shot for identification. Dr. Jerdon established one habitat of this bird by such a chance as killing a falcon which happened to have just caught the paroquet.

Only these three paroquets are common in our bazaars as "forest produce" of this Presidency, though other parrots, in great variety, but small in number, are imported, and seem to be outside our present purview.

Mr. Kipling passes from the parrot to the weaver birds (*Ploceus*), whose plumage he oddly describes as "of quaker-like simplicity." When did quakers wear yellow caps or yellow ribbons in their caps?

From these, through a list of "song birds" so wide as to include the hill-minah (*Eulabes religiosa*), he passes on to the fighting birds and to the more important crow. About the first he has nothing new to say, but has hit a new idea in Indian crow-life by allowing "two hill-crows" to steal and hide ice. "To the last," he says "the disappearance of the ice was a wonder." And no wonder.

As regards kites, he says that *Milvus govinda* is commonly "spoken of by Europeans as the Brahminy kite." But in our province this misname is more commonly given to a *Neophron*—Pharaoh's chicken. The true Brahminy kite which Mr. Kipling correctly describes by that name, and as "an eagle in miniature" (he might have said a sea-eagle in miniature if he had been a naturalist) is *Haliastur indus*. Our author's dealings are with such creatures as are in close relation with man. He does not, therefore, mention that really noble variety or species of kite indicated by Hume's name *Milvus major*.

Under head "Cranes and Herons" (birds really very far apart) he gives us a fact worth record, namely that the Adjutant Stork, which is neither a crane nor a heron, has of late years ceased to frequent Calcutta—probably better cleaned up than of yore by its Municipality.

After some remarks about cocks and hens, rather anthropological than ornithological, he passes on to the old legend of the Brahminy duck or Ruddy Sheldrake, which we beg to give at more length for his and others' edification. A certain Brahmin's wife eloped, and the gods, at the outraged husband's prayer, smote the lovers with the curse of cowardice. They lost each other at a ford, and to this day one cries to the other, "Come over to me, Chakwi," and is answered, "No, come over to me, Chakwa." This, at least, is the tale of the Tapti, on which they are common, and although by no means borne out by observation, is not less so than Mr. Kipling's more insipid version of the legend.

Our author passes on to the peacock, which he describes, in Gujarat and elsewhere, "as common as rooks in England." Peacocks

abound in parts of Gujarat, but a rookery of peafowl remains to be seen. Of pigeons he has little to say, and nothing so good, as a native official said to the present writer in Rajputana many a year ago, "You mustn't shoot pigeons here. It's not that they are sacred, but the Rajputs have a fellow-feeling for the bird, because it is 'bholo' —just like themselves."

To do our Rajput members justice, their affection for a bird which habitually makes friends with man has a nobler root than the sarcastic Brahmin would allow them, and is exactly the same as the English love for house martins and the Dutchman's attachment to his almost sacred stork. It is below the dignity of a warlike and generous race to wage or allow war on a bird that will nest under our eaves and in our wells, and often wheels round, after a first shot, to expose itself to a second, rather than lose sight of its nest. The "blue rock," moreover, is not much to swear by on the table.

Sir Walter Scott in "St. Roman's Well" notices the reasonable objection of Musalmans to the slaughter of doves in connection with that of Hussein (or, as he says, Ali). But the Prophet's *own* bird was probably not a dove but a "blue rock" of the northern species; differing but slightly from ours. The legend of its flying out from the cave wherein he lay in hiding is as probably true as any story of the sort, and not in the least improbable. The present writer has seen the like.

In this very pleasant way Mr. Kipling discourses of various fowls, including, in his very unconventional ornithology, flying foxes. He had a tame flying fox which escaped, and was beaten home again by crows "who had never seen such a creature before," because, says he, "crows go to bed early;" and it would seem that, wherever this happened, the flying foxes are equally regular in their habits. In Western India these moral ways have suffered much infraction; and there is no crow in the Konkan who has not seen many flying foxes on the wing.

One really good bit of bird folklore is rather spoiled by a misnomer that can hardly be more than a slip of the pen. It is not the sandpiper (as Mr. Kipling says, but surely does not think) who sleeps supine with heels in air to avert the fall of Heaven. The "Did ye do it?" (*Lobivanellus goensis*) is credited with this remarkable precaution against the crack of Doom.

Reason why.—The "Did ye do it" is of all shore fowls the fussiest, and most given to informing every one of the ill-intentions of every one else. May his father be roasted ; he has saved many a duck from the shot gun, and many a crocodile from the rifle. The sandpipers, on the other hand, are as modest in demeanour as in plumage, much given to minding their own affairs, and so little suspicious as to be too often converted into snipes upon the unlearned shikari's gamestick. We have seen them in dozens at the Tanna Railway Station on a Sunday evening, and sorrowed for them.

Mr. Kipling's birds are followed by his monkeys, whereof he has many good yarns. One is, that some Hindu evolutionists suppose the English to be descended of Hanuman, or, as we call him in Western India, Maruti (the monkey-god). All the ingenuity of the West can invent no theory that is without parallel in Asiatic parable or paradox. It is true that all Europe once believed that Englishmen had tails, and Colonel Yule quotes authority to show that the King of Cyprus mortally offended Richard Cœur de Lion by an offensive allusion to the hero's tail, which was then lashed to the effect of lashing the impertinent princeling out of his island, and Richard made a Christmas-box of it to a friend in right-royal fashion. The mythology of the "missing link" would make a big book, and cannot be allowed more of our limited space. The chapter has one or two delightful illustrations that should be borrowed (with permission) by the man who writes that big book. Mr. Kipling passes on to asses, but we have lately dealt at length in these columns with the *Equidæ* over the signature, alas ! of a vanished hand. Nor need we linger here over his two chapters of "oves and boves," except to notice the last paragraph of the cow Sura, which relates how M. de Buffon got his name for *Bos indicus*, "Zebu" from a travelling showman. Mr. Kipling thinks "this fragment of a French showman's bonnement" to be indelibly branded on the poor "bile ; but the truth is, that the word is fast passing out of anything like zoology, and will probably soon disappear even from "popular science."

It is very characteristic of our author that he excludes buffaloes from the company of respectable *Bovidæ* to chum them upon pigs, of which latter he justly remarks that "there is nothing to be ashamed of in the

character and conduct of wild pigs," unless, indeed, it be an occasional lapse into carrion diet.

All these beasts get in between the asses and the horses and mules, which have over forty pages, full mostly of matter outside our subject. After them come the elephants, of whom we get some good stories. One is Colonel Lewin's, who found the elephants' ball-room in some Indo-Chinese forest (but it was not a ball night). And a very good characteristic one is that of a ship-load of elephants (in India we sometimes do things on a largish scale), who found that by merely keeping time they could turn a large steamer into a suitable rocking chair. They very nearly managed to produce the very oddest shipwreck on record. How would "Lloyd's" hold that an ordinary insurance policy covered perils of playful elephants?

After Mr. Kipling's elephants come his camels, and he makes just remark upon the wide range of variety of these poor brutes, and notes the rudimentary second hump of the dromedary recorded by Signor Lombardini. One odd little illustration of his own observation does not seem to have come in his way. If there is anything odious and even dangerous to most hill or plain camels, it is slime. But camels can be and are bred in marshes, and these grow up "bog trotters." The present writer has seen such a camel carrying two men at least five miles an hour across the Little Ran of Kachh, where footmen painfully toiled along at little better than two, not without an occasional fall.

The strangest thing about the camel is, that an animal so very undomesticable hardly exists except in servitude, borne with exceeding ill-grace. It may be guessed that the clumsiness and stupidity of the original wild camel led to the extermination by the great carnivora of such camels as had not the aid of man in the struggle for existence. As far as diet and clothing go the creature would seem capable enough of survival.

"The camel," say the men of Gujarat who understand him in his quiddity, "put a hump upon his back," with a view to avoiding his share of the mutual obligation. "But then the man made his saddle." The application is to the sulky hopeless opposition met at every clumsy turn by superior resource, which marks the struggle of civilisation with barbarism, and ends by the reduction of the savage into

some form of utility and respect for the bonds of society ; for, in India, it does not end in his extinction. The imperceptible series of degrees between the civilised man and the wild human animal prevent such annihilations of the latter, as have been seen in the great colonies, most speedy where the gulf between the two societies was greatest.

Mr. Kipling's chapter on " Dogs, foxes, and jackals " is short, and wolves, he says, are out of his line, and passes on to cats. Then he has a chapter on animal calls ; but these are calls to, and not of, animals, and the next is on " Animal training " with a similar meaning. He doesn't think much of the art as practised in India, and goes on to reptiles.

And here, for the first time, we have to complain of what is distinctly a " false perspective," as he would say himself. The chapter is headed with what he calls an " Anglo-Indian Nursery Rhyme," which runs as follows :—

" And death is in the garden
Awaiting till we pass,
For the krait is in the drain-pipe,
The cobra in the grass."

Now there *may* be gardens in India where these things are ; but even in such a garden of *horrors*, the snakes do not lie in wait for the passing of children to bite them. As the child passed, the " krait " would shrink further into his drain-pipe, and the cobra glide away through his grass. And when was any Anglo-Indian nursery ever the worse of either, that these morbid terrors should be admitted into it, by any sensible mistress, to poison her children's enjoyment of their few times and places of outdoor play ? If there is any place where the Gruesome ought not to come, it is a nursery.

Nor is there much more in this chapter to call for remark from the naturalist's point of view. The next is upon "Animals in Indian Art," and is extremely valuable, as the work of a past master in his matter, and then come on " Beast fight," to which, when brought about by human backers, we object as a sight or a subject. A good fair natural duel in the wilderness is, indeed, a fine sight for the man lucky enough to watch it, and capable of taking no unfair advantage of the combatants.

The present writer once stalked a black buck, to whom, just as the stalk was drawing to a close, came another on battle bent. It was a very pretty fencing match, and the spectator, lying flat with uncocked rifle along the friendly bank of a rice field, could hear the panting of the combatants and see their eyes flash. He had the pleasure of seeing the matter end by the retreat of one champion, sore, pummelled and exhausted, but not mangled. The victor seemed to have had enough, and did not care to pursue, but walked off to where the ladies had been when the fight began. They, however, had long ago resented the intrusion of "strangers in the gallery," by walking off, so the buck sniffed at the ground where they had stood, and presently seemed to "get their line" and trotted off with little further attempt to puzzle it out. To the end he never saw that he had a human neighbour.

There *was* a pleasure in watching that fight, but a battle of elephants *in a ring* is as vulgar as a "dog-worry." If there is any exception to be made at all, it should be in favour of cock-fighting. The natural man, however disciplined, has a secret joy in a cock-fight, though he knows it is wrong. With the beast-fights, and with one illustration of a doctrine of his own, we part with so pleasant a writer as Mr. Kipling. He delights in remark upon the "topsy-turveydom" of things oriental, as all great Western travellers in the East have done since Herodotus compared the ways of Greeks and Egyptians.

But of all the "contraries," in religion and nature, between England and India, the most contrary is the Indian Daddy Longlegs that *does* say his prayers,———and is "chucked" all the same.

MISCELLANEOUS NOTES.

No. I.—THE HABITS OF THE COPPERSMITH.

Since Jerdon's time it has been sometimes matter of doubt whether the Coppersmith Barbet (*Xantholæma indica*) climbs and taps like a woodpecker.

Some eighteen years ago I shot a Barbet which I saw so employed on a banyan tree in the Thana District, but had no books with me then and lost the specimen.

Long afterwards at Rohe, with a fresh specimen and books before me, I made sure of the species to my own satisfaction, and had ample opportunity of watching these birds feeding in the large wild fig tree before the Travellers' Bungalow at Poladpur, then in full fruit. But neither the Rohe specimen nor the Poladpur birds tapped the tree. The former was singing when shot, and the others were eating the fruit with very much the action of green pigeons similarly employed.

On the 15th March, 1893, in the Thana District, I heard a tapping in an old mango tree, less powerful than a woodpecker's, and less like the roll of a drum in rhythm. After a few minutes' dodging around the tree, I was able to see the Coppersmith climbing up a limb, in woodpecker fashion, only a few yards from me. The green streaks on the breast were distinctly visible. Another, probably its mate, had just flown out of the tree disturbed by my movements, and was uttering the usual note on the next tree.

W. F. SINCLAIR, I.C.S.

THANA DISTRICT, 12*th March*, 1893.

Since writing to you about the tapping and climbing habits of the Coppersmith, I have again heard the same tapping in the same tree, and upon examination and disturbance of the tree, found no bird in it but the Coppersmith, who flew from the spot where the tapping seemed to be, and allowed me to identify him at pretty close quarters with a powerful field glass.

I have long had no doubt about the habit myself, and I think that I have given evidence enough of it. But I am tempted to make another observation which I should not have hazarded on my own account. Many of our readers know Mr. Wallace's theory that brilliance of colour is (or may be) a result of high vitality in the animal, and especially in the organ. This Barbet and some woodpeckers show very brilliant colour on the head and neck, which must be highly vitalized for such an effort as their hammering on the trees.

Is there any other reason for this curious resemblance of their coloration?

W. F. S.

THANA DISTRICT, 15*th March*, 1893.

No. II.—WOLF HUNTING IN THE SOUTHERN MAHRATTA COUNTRY.*

I have been tempted by the interesting account of your correspondent, Mr. C. W. Waddington, on the subject of Wolf Hunting, published in Vol. VII of this Journal, to recount a somewhat similar experience that I had last year. My experience, however, differs in one important respect, which, of course, considerably qualifies my pleasure in the recollection of it, and that is, whereas "C. W. W." was riding with a spear, I was riding (by an unlucky circumstance) with a gun. As, however, my object in writing this is to show the staying powers of a country-bred horse as against those of a full grown male wolf, and as the point of my story is in no way affected by my having had a gun instead of a spear, I hope it may still be of interest to your sporting readers.

In the month of February, last year, I was encamped in a remote village, Ootgee, in the Jath District of the Southern Mahratta Country. I went to this village, because I had heard that great annoyance was being caused in the neighbourhood by wolves who carried off sheep and goats, and attacked children. On the evening of my arrival I was told that a pair of large wolves, male and female, with a couple of cubs, had taken up a position in a "cave" (as it was called) within a mile or so of my camp, close to a thoroughfare, and that the parents were in the habit of watching for passers-by and attacking them. My informants persisted that the jungle was impenetrable and riding an impossibility. In the morning I went to look at the place (taking both a gun and a spear), and found it to be a very large babul plantation, several hundred acres in area, thick in some places, but more or less rideable in others, though not sufficiently so for there to be any hope of spearing a wolf; and, moreover, it seemed impossible to imagine that any animal would be foolish enough to leave such an extensive shelter and trust itself to the open country outside. I, therefore, gave up all idea of spearing, and wandered about with my gun, looking for the wolves; but not seeing anything of them, I went back to camp, leaving men on the watch. At 12 o'clock one of these men ran in to say the large male wolf was lying under a tree close to where I had been in the morning. I immediately galloped off, taking, unluckily, only my gun with a few ball cartridges, and little thinking that I should never cease to regret not having taken a spear. I soon came on the wolf, and, dismounting, I approached him for the shot; but before I could get within range, he moved off, first slowly, then faster, so I called out for my horse and followed him, as well as I could, through the babul, keeping on the inside of the circle in which he was going, and between him and the centre of the cover. After a while I saw the open country before us, and so did the wolf, for he stopped short, turned inwards towards me, and stood still, allowing me to ride close up to him and fire. I saw the bullet strike the ground, and my horse at that moment, being a bit startled at the shot, reared straight

* This appeared in the *Times of India* on 22nd March, 1893.

up and faced the other way. When I was able to get him round again, the wolf was still there, and snarling. I fired the second barrel, and again (my horse being very unsteady) the bullet struck the ground; but to my intense satisfaction it had the effect of determining the wolf to head for the open, and go away over the most perfect country I have ever seen—light sandy soil, absolutely flat, with only some small nullahs, and a few stones here and there—crops down, and not a bush or anything else to obstruct the view.

The horse I was riding was a short-backed 14·1 country-bred, five years old, and in the hardest possible condition, as he had been doing fifteen or twenty miles a day for some time. So, with everything in my favour, I made up my mind that, though I had the wrong weapon, I would try and compromise the matter by not using the gun till I had arrived at as close quarters as would have been necessary had I had a spear. Having headed for the open, the wolf at first went a great pace, evidently thinking that I was going to do the same ; but I had no such intention, for I was anxious to get him well away from the cover, and, moreover, from what I saw of the country, there was no necessity for hurry. I, therefore, went comparatively slowly, and in a couple of miles he began to come back to me, and we strode along together, he at a comfortable lobbing canter, and I at an ordinary staging pace, about nine or ten miles an hour. This sort of thing lasted about half an hour, when we came to a small group of babuls, into which the wolf for a moment disappeared. I at once pulled up into a walk, and yelling at him as I went slowly through, I caught sight of him through the trees, going away at his best pace on the further side, still in the same direction. This gave my horse a breather which the wolf did not get, so I calculated I had scored the first point. Then again we settled down to the same steady gallop for the next four or five miles (150 yards separating us), when I saw the wolf was beginning to tire, and so was my horse, and I wondered how it was going to end. All of a sudden the wolf vanished, and on reaching the spot where I had last seen him I found myself at the edge of a steep bank of the river (Boor), and there immediately below me was the wolf's head emerging from the water, as he swam about enjoying his bath. The opposite side of the river was fringed with oleander bushes, which continued for some distance, and beyond again, about a mile or two distant, I saw what seemed to me to be another plantation. It was obviously necessary, therefore, to get to the other side as quickly as possible, and turn the wolf back, for I knew he could never get home again the ten miles that I judged it to be. I got across the river lower down without being noticed, reaching the other side while he was still in the stream, and was able to give my horse another breather and let him have a few mouthfuls of water.

Thus I scored my second point, for the wolf in the meantime was tiring himself with swimming about. Instinctively, as an old pig-sticker, I waited for him to charge, as a good old boar would have done after his bath ; but he came quietly out, gave himself a shake, and dived into the oleander bushes.

I then trotted slowly up alongside the bushes for about half a mile, keeping him in sight and preventing him from breaking on my side, till suddenly he plunged across the water again, back up the bank, and headed away at a great pace for our original starting point. My horse being comparatively fresh, I soon got up to him again, and we went along together at the same steady pace till we came near the group of babuls, where the first check had been ; but instead of entering this he began to bear round to the right, and I saw he was making for what looked like a large cover to our right front about a couple of miles distant, and I knew I must "ride" him now or never, so for the first time in the run I began to press him. It was astonishing with what ease he got away from me at first, but he soon came back, and I could see he was done. He had had three spurts and a swim, which had all been against him. My horse had had no spurts, but two good breathers and some water. So he had decidedly the advantage, as he proved by soon bringing me alongside, and then it was I would have given all I possessed for a spear. The wolf jinked, but went on—a couple more rushes, a couple more jinks, till (both of us going slower and slower) the wolf stopped and sat down on his haunches, got up and went on, stopped again, and sat down altogether unable to go another yard. I jumped off, slipped in a cartridge, and placing my gun up against his side put an end to him within a quarter of a mile of the forest lands of Boorgee, the shelter he had been making for. I felt a good deal of compunction in deliberately shooting him after such a run, as somehow it did not seem consistent ; but remembering that if I had had a spear I should have killed him a mile sooner, and also remembering that he and his friends had never had any compunction in destroying whatever they could get hold of, I thought it was legitimate to use what weapon I had. The little horse was exhausted, but by no means "dead beat," and a few mouthfuls out of my saddle flask soon revived him, and constitutionally he was none the worse the next day. The wolf was a large male, in excellent coat and condition, and stood thirty-three inches at the shoulder.

Now as regards the length and duration of the run. The start was about two miles short of Hullee village. The turn at the river was opposite the village of Madgeehal, and I deduct three miles for rounding the corner. The finish was close to the forest lands of Boorgee, and about two miles from the Boorgee village. By the map Hullee village to Madgeehal village is thirteen miles ; Madgeehal village to Boorgee village is twelve miles ; total twenty-five miles. Deduct seven miles as above, and it makes the whole distance traversed as nearly as can be estimated eighteen miles. It was 12-40 when I looked at my watch shortly before seeing the wolf for the first time, and it must have been nearly one o'clock when he broke away. It was 2-45 exactly when I killed him. Taking the average pace throughout the run to have been nine or ten miles an hour, I imagine my estimate of eighteen miles in $1\frac{3}{4}$ to 2 hours is a fairly correct one. I must apologize for the length of this letter, but I have

gone into details on purpose to try and show that it is not impossible with an exceptionally good country and lots of it, and a horse in hard condition with a fair stride, for a single horseman to ride a wolf to a standstill.

J. W. WRAY, Major.

March, 1893.

No. III.—THE BREEDING SEASON OF THE SARUS CRANE.

On the 15th ultimo I took three eggs of the Sarus (*Grus antigone*); two from one nest were partly incubated, while the third, from another nest, was fresh. On the 12th of this month I found two more eggs slightly incubated. As a rule, these birds breed, in these parts, during the monsoon months—July, August, and September—so I think the above fact is worth recording. I have also taken this month two full clutches (4) of the Red-wattled Lapwing, quite fresh.

H. BULKLEY.

KHARAGHORA, 16*th April*, 1893.

No. IV.—A BUTTERFLY ATTRACTED BY TOBACCO SMOKE.

Insects and their like are generally supposed to dislike tobacco, but I have met with a butterfly to-day which evidently enjoyed it. I was sitting in the verandah, about 3 p.m., when one of the large black and white butterflies, common here now, appeared and began flying about me, so I sat perfectly still to watch him. He seemed to be attracted by the cheroot I was smoking, for he fluttered about it and actually settled upon it three or four times, once on the ash which dropped off under him. He settled on my forehead several times, and once or twice on the arm of my chair on the leeside, where he got the smoke. He went off to the garden, but soon came back and repeated his performance. This is so entirely different from the behaviour I should expect in a butterfly, that I think the incident is worthy of record in our Journal.

R. G. OXENHAM.

MATHERAN, *April*, 1893.

No. V.—HABITS OF THE INDIAN ROBIN.

Every one is aware that our English robin has a tendency to build its nest in all sorts of odd nooks and corners, and this peculiarity is shared to a great extent by its Indian representative, the "brown-backed robin" (*Thamnobia combaiensis*). At the present moment there is a nest containing young ones in the Mess of the 22nd Bombay Infantry, which is placed in the fold of a curtain, where it is looped up. The curtain separates the ante-room from the dining-

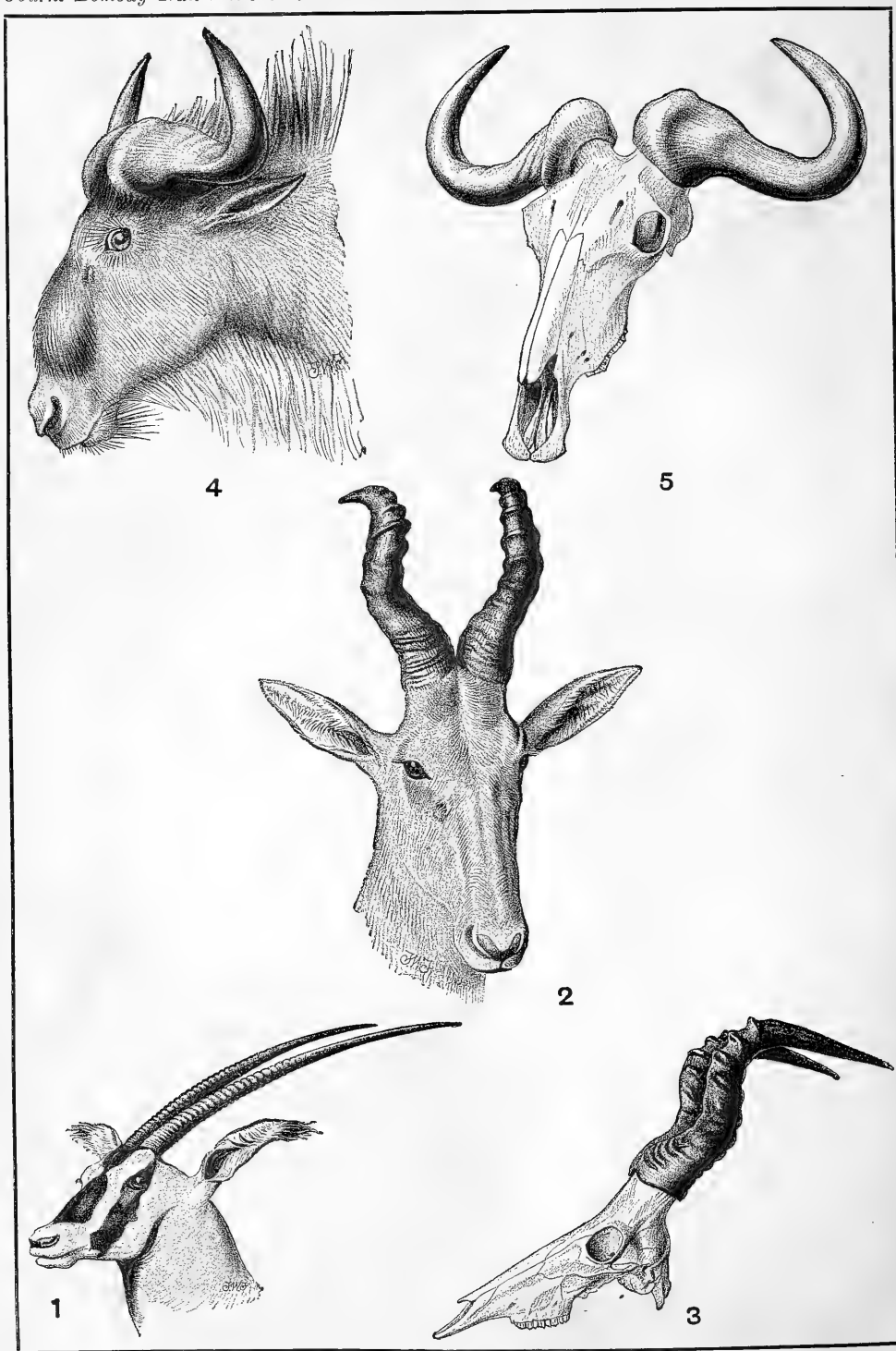

Fig. 1. Head of Oryx Callotis. Fig. 2. Head of Jackson's Hartebeeste (Bubalis Jacksoni).
Fig. 3. Skull of Jackson's Hartebeeste (Bubalis Jacksoni).
Fig. 4. Head of White-bearded Gnu (Connochœtes albo-jubatu). Fig. 5. Skull of White-bearded Gnu.

room, and is constantly being pushed aside by persons passing in or out ; but the bird soon got accustomed to these interruptions, and only moved when the fold was opened to permit of a closer inspection.

A. NEWNHAM, 22nd Regt., Bombay Cavalry.

AHMEDABAD, 10*th April*, 1893.

No. VI.—NEW AFRICAN ANTELOPES.

I have had the good fortune to recognise three new species of African animals under conditions that are noteworthy. Amongst the vast number of heads and skins that come to me for preservation, particularly from Africa, I frequently discover many points that have not been noticed by the owners of the specimens ; and now and then the discovery is of greater importance, inasmuch as it leads to the recognition by experts of a new species. For example, looking carefully over a collection of antelopes from Kilimanjaro and Masailand, I found what appeared to me to be a new species of *Oryx*, and so it proved to be ; for though at first sight it resembled *Oryx beisa*, a comparison showed many points of difference ; as will be seen in the annexed figure. The long tufted ears, which suggested to its describer, Mr. Oldfield Thomas, the specific name *Oryx callotis*, are particularly noticeable. It differs, moreover, from other species of *Oryx* in the general colour of the skin, which is much browner than that of its congeners, particularly on the head. So far as at present known, this antelope is found only in Masailand and contiguous regions. The example of which the head is now figured came from Kilimanjaro, and was described by Mr. Oldfield Thomas, F.Z.S., at a meeting of the Zoological Society in March last ; the type being now in the national collection at South Kensington. I may add that this species has been several times shot in Eastern Africa by sportsmen, among others by Sir John Willoughby, Sir Robert Harvey, the late Hon. Guy Dawnay, Mr. H. C. V. Hunter, Mr. T. W. H. Greenfield, Mr. E. Gedge, Mr. F. J. Jackson, Mr. Astor Chanler, Mr. R. P. Carroll, Dr. Abbott, and Count Teleki. But having been hastily identified as *Oryx beisa*, and so called for several years, its specific distinctness has until recently escaped notice. During his last visit to London, the late Sir Victor Brooke examined the specimen referred to with me, and our discussion was adjourned to enable further comparison with more examples of *Oryx beisa*. But before that could be effected, to the infinite regret of all naturalists and sportsmen, his untimely death was announced. Thus the opinion of one of the best authorities on deer and antelopes was lost.

A second species discovered in like manner is a hartebeeste which has been named *Bubalis jacksoni* by Mr. Thomas. It was collected in Uganda by Mr. F. J. Jackson, who directed my attention to it. In general form and colour it is very like the South African *Bubalis caama*, figured in the *Field*, June 6, 1891. Its horns curve in much the same way, though not so sharply,

as will be seen on reference to the annexed cut. But its distinguishing features are the uniform colour of the face; *Bubalis caama* has black face markings, *B. jacksoni* none at all. In this respect the new species resembles Coke's hartebeeste, the head of which is figured by Sir John Willoughby in his volume on "East Africa and its Big Game" (pl. 1, fig. 1), and which also has no face markings. But a comparison of the two heads will show a considerable difference in the character of the horns. In Coke's hartebeeste the horns diverge laterally, in Jackson's species their direction is vertical and backwards.

A third new form, perhaps only a variety, is a wildebeeste, or Gnu. It is a fine creature, closely allied to the South African brindled Gnu (*Connochætes taurinus*), but having the beard white, instead of dark brown.

It is commendable that in so short a space of time as six months so many new forms should have been brought to light, it may be said, through the enterprise of English sportsmen, to whom naturalists are so much indebted for discoveries in Africa. How many other novelties have been lost for want of proper identification it would be difficult to say; but if sportsmen having trophies which they are unable to name would refer them to experts on their return home, they would lessen the chances of being forestalled in the discovery of new species. It is with the view of clearing up confusion in regard to the species here figured that I venture to send you these notes for publication.

ROWLAND WARD.

166, Piccadilly, London, W.

[The above appeared in the *Field* last year, and is reprinted with the permission of the author who has kindly supplied us with the accompanying illustrations.—Ed.]

No. VII.—THE OCCURRENCE OF THE HYÆNA IN SOUTH TRAVANCORE.

I think the following fact is worth recording. My brother writes to me from Quilon, forty miles north of this place :—

"A female hyæna has been shot at Pundalam, about 15 miles north of Quilon. There is no doubt about it, as I have got the skin. I also examined the old man who shot it, and took down his statement. A large number of people saw the dead animal when it was brought to the Cutcherry for the reward, for it was supposed to be a kind of cheetah."

This is the first occurrence to my knowledge of the hyæna in Travancore.

H. S. FERGUSON.

Trevandrum, South Travancore,

11*th April*, 1893.

No. VIII.—NOTES ON *ARGYNNIS NIPHE*, LINNÆUS, A NYMPHALID BUTTERFLY.

During this last cold weather (1892-93) I was very much surprised to see females of *Argynnis niphe*, Linnæus, in my garden at Bankipore, Behar. I had never seen this butterfly here, though I had often caught it at Mussoorie in the Western Himalayas. Mr. de Nicéville tells us that the food-plant of the larvæ is usually the wild violet. So far as I could find out, this does not grow in Bankipore ; and I, therefore, tried shutting up a female in a cage with a pot of garden violets, but she did not lay. Very soon after this, I picked up a caterpillar which I found crawling on the ground in a bed of pansies. Further search led to the discovery of others *on* the pansies. These were all put on a growing pansy under a cage. The caterpillar is black, with a broad orange band down the back, and has thorn-like black spines projecting laterally. It keeps itself carefully concealed under the leaves, but it feels the cold during the night ; and when the sun gets warm in the morning, it leaves the plant, and takes a little promenade on the ground, and frequently lies basking in the sunshine. When it has got comfortably warmed up, it returns to the food-plant with renewed vigour and a keen appetite. This made it easy to find them, and saved one the trouble of hunting under the leaves. Those in the cage behaved in the same way, and always left the plant in the forenoon to lie on the ground and bask in the warm sunshine.

They are very good-natured caterpillars, and easy to move about ; they have good appetites, and seem happy and contented with things as they are, and do not sulk and mope, or spend their time rampaging about in a vain endeavour to escape, as so many others do.

The butterflies seem to have preferred the pansies (*Viola tricolor*) to the violets (*Viola odorata*), because the violets were in pots, whereas the pansies were in the ground. I found that a female which refused to lay when caged on a pot of pansies laid freely when caged over pansies planted out. She *walked* about over the plant depositing an egg here and there, sometimes on the leaf, sometimes under it. Occasionally she would flit from one place to another. The eggs are cone-shaped, slightly flattened on the top, and when first laid, are pure white. They gradually take a bluish-green tint.

I have also observed a female laying eggs in freedom. She kept partially opening and shutting her wings while she walked along the ground. Then she would get well into a plant, curl her body round the edge of a leaf, and deposit an egg on the under surface. Then she walked on the ground to another plant, opening and shutting her wings the while ; she always laid *under* a leaf, except when she laid on a half-opened one, and then she deposited the egg well down and on the upperside. She laid only one egg on each leaf at one time. On one occasion she went back and laid a second egg on a leaf—at some distance from the first. After laying three or four eggs, she would refresh herself with a sip of honey from the flowers, and then begin to lay again. She

showed no sign of fear, and on one occasion left the pansy and sat for some time on my dress.

In going from one plant to another she sometimes dragged her body along the ground as if in the act of laying, but deposited no eggs.

She sometimes curled her body round leaves of *Phlox* that were growing among the pansies, but seemed to recoil from their rough surface, and left no egg on them.

Most of the eggs were laid on the underside of the outer leaves, a few on the stalk of the plant. I did a great deal of searching and reading in Mr. de Nicéville's invaluable book "The Butterflies of India, Burmah and Ceylon," to find out what my caterpillars were, but in vain. Mr. A. Grahame Young's description of the larva of a Kulu specimen there given is as follows :—"*Larva.* Head and legs black, body black ; this colour, however, almost obscured by the orange-tawny markings ; a broad orange-tawny dorsal stripe ; four straight horizontal simple black spines on the head ; spines on the pectoral segments black ; on the abdominal segments pink, tipped with black ; on the caudal segments pink, faintly black tipped." Mine were all black, except the orange-tawny dorsal stripe ; and all the spines were black.

Presently they went into pupæ, suspending themselves by the tail from the top of the cage. When the imago emerged, I was equally surprised and delighted to find it a beautiful *Argynnis niphe.* Males and females emerged in about equal numbers. One *lusus naturæ,* a male, had one wing as in the ordinary male, and the other as in the ordinary female !

I expected to have a second brood from the eggs laid by the female caged on the pansies, but the ants ate up every one. I cannot imagine how anything can escape these little pests. I suppose that the first batch of eggs escaped only by being laid when it was too cold for the ants to move about.

Shortly after the imago emerges, it exudes a few drops of a bright crimson fluid. It is this fluid which has given rise in Europe to the tales of "showers of blood." Sometimes species of *Vanessa* and *Pyrameis* emerge as butterflies in large numbers simultaneously, each butterfly deposits its drops of red fluid, and hence the popular scare of a bloody shower !

I saw an imago on the wing to-day (9th April) ; but I have seen no second brood of caterpillars.

The following is the biography of a beautiful specimen from the egg to the killing-bottle :—

February 18th.—Put into a cage a pansy with one egg on it.

March 6th.—Larva emerged, made its first meal off the egg-shell, and then proceeded to eat a tender shoot of the pansy. It changed its skin on the night of the 12th, again on the 20th, and again on the night of the 24th. It left the food-plant on the 27th. On the 30th the larva suspended itself by its tail to the top of the cage, and on the morning of the 31st I found it in chrysalis.

April 7th.—The imago emerged—a beautiful female.

MRS. S. ROBSON.

NOTE BY MR. DE NICÉVILLE.

Argynnis niphe in its various forms is one of the most interesting of butterflies. Of all the species of the genus it has the widest geographical range—from Abyssinia, throughout Southern Asia, to Australia. A more exact list of localities where it is found may be of interest.

Africa—Abyssinia.

Continental Asia—Throughout the Himalayas, Assam, Shan States, Northern Burma, Punjab (Campbellpore and Rawal Pindi), North-Western Provinces (Agra), Oudh, Western Bengal (Bankipore and Durbungha), throughout Southern India (Bombay, Nilgiri and Pulni Hills, Trichinopoly, Travancore), China (Omei-shan, Wa-shan, Moupin, Chia-kou-ho, Chia-ting-fu, Chang-yang, Ichang, Ningpo).

Ceylon.

Sumatra.

Java.

Formosa.

Japan.

Australia—Hunter River, Nerang River, Moreton Bay.

Mr. H. J. Elwes remarks that, except *Argynnis hanningtoni*, Elwes, from Central Africa, *A. niphe* is the only species in the whole genus which has a tropical habitat. It may also be noted that though it appears to thrive in the tropics, it is equally happy in temperate climates, where at one stage of its existence, at any rate, it is annually exposed to severe frosts and snow.

Another most interesting feature is the fact of the great divergence usually found in the coloration and markings of the opposite sexes. The male is not strikingly different from other species of the genus *Argynnis*, but the female with the apical half of the forewing on the upperside deep purple crossed by a broad white band is an entirely unique animal. There is no doubt that this distinctive type of coloration has been acquired by the female as a protection against its enemies, as, on the wing, that sex passes very well for a *Danais* (*Limnas*) *chrysippus*, Linnæus, which is a highly protected butterfly. In Java the female has assumed a slightly different dress, the ground-color of the upperside being considerably deeper and richer than the Indian form, the butterfly mimicking *Danais* (*Limnas*) *bataviana*, Moore, which is a dark red geographical race of *D. chrysippus*. This geographical race of *A. niphe* has been named *javanica* by Monsieur C. Oberthür.*

But the most wonderful feature of all with regard to *A. niphe* is the occurrence in South India (Trichinopoly and the high range of hills in Travancore) and in Australia (Hunter and Nerang Rivers and Moreton Bay) of two geographical races which have females, to all intents and purposes, similar to their respective males, the distinctive purple ground and white band

* Bull. Soc. Ent. France, sixth series, vol. ix, p. ccxxxv (1889).

of the forewing above having entirely disappeared! The two species (as they have been called, though it is perhaps better to treat them as geographical races) may be indistinguishable the one from the other. I have only seen the Indian form, which has been named *A. castetsi* by Oberthür,* the Australian form being called *A. inconstans* by Butler.† It is highly probable that this form represents the ancestral (atavistic) one of the species, and the typical *A. niphe* a more recent development. It is a matter for interesting speculation why in all Asia the form found in a most limited area in extreme Southern India should alone have remained unaltered, while the form occurring over the immensely wide area enclosed between extreme Eastern Africa and extreme Western Asia should have shown such great sexual divergence in coloration and markings.

There are two other points which I may mention. One is the curious fact that *A. niphe* does not exist apparently in Southern Burma and the Malay Peninsula, though it is found to the north in Upper Burma and to the south in Sumatra ; the other point is the presence in the males of both forms (typical *A. niphe* and *A. castetsi*), occurring in Southern India, on the upperside of the forewing of raised modified scales (androconia) along a portion of its length of the first median nervule. This feature is, moreover, absent from Ceylon specimens, which is again an extraordinary fact, Ceylon being so close to India, divided from it only by a narrow shallow strait. I may also note that were sufficient material available from South India, it would probably be found that typical *A. niphe* and *A. castetsi* merge into one another, as I possess female examples of the former from the Nilgiri Hills, which have the purple area indistinct and the white bar narrow of the forewing on the upperside, showing by the partial obsolescence of these especial features a distinct approach to the ancestral form, as I am inclined to believe *A. castetsi* and *A. inconstans* to be.

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* Bull. Soc. Ent. France, sixth series, vol. ix, p. ccxxxv (1889); idem, id., E'tudes d' Ent., vol. xv, p. 9, pl. i, fig. 1, *female* (1891).

† Cist. Ent., vol. i., p. 164, n. 36 (1873).

No. IX.—SMALL GAME SHOOTING IN THE NEIGHBOURHOOD OF BOMBAY.

SEASON 1892-93.

The season of 1892-93 as regards small game sport within a radius of forty miles of Bombay was a very poor one ; in fact, if a record had been kept of previous seasons, I believe it would be found to be the poorest we have had within the last ten years. The heaviest monsoon on record in Bombay (126·75 inches) and the fair distribution of rain over other parts of Western India had, I think, a good deal to do with the sport being so bad.

The snipe began to arrive towards the end of September, and one or two were killed as early as the 17th of that month, but no decent bags were made before the middle of October, when to all appearance a fairly good season for snipe might have been expected. During the Diwali holidays (20th to 23rd October) we had several thunderstorms with heavy rain, flooding the *juggers* which had previously held snipe, scattering the birds over the country and driving a good many away altogether. The rains continued until late in the season, 35·75 inches falling in September, 2·24 in October, and 1·80 in November, so that the paddy was not cut until fully a month later than usual. This was also against sport, as October and November are our two best months for snipe. Jack snipe, if anything, were more abundant this season, judging from the proportion in the bags of snipe recorded.

There was plenty of water everywhere up-country, and duck were consequently anything but plentiful near Bombay and there is little inducement for them to come and stay any length of time about Bombay, unless the tanks up-country are low and the feeding poor.

Quail were conspicuous by their absence, and on *juggers* where forty to fifty couple were killed in a day's shooting during January and February, 1892. The best bag made in the same months of 1893 was 8 couples for two guns, and the total killed for this season did not exceed 60 head, chiefly of course because sportsmen did not find it worth while going after them, the *khubber* brought in being so poor. I myself, although shooting pretty regularly throughout the season, only saw two quail which I shot, one on the 30th October and the other on the 20th November. There being plenty of grass and cover for quail up-country accounts for the scarcity down here, although even in Guzerat the quail season was not so good as in former years.

Partridges and hares were much the same in number as last year, and little need be said about them, as the sport is so poor and will decrease each season as long as netting and snaring is allowed to be carried on around Bombay during the whole year.

Golden plover also made a better show than in former seasons, and six to seven couple picked up in a day's snipe shooting was not exceptional.

Curlew were in fair numbers along the creeks, and early in the season were not difficult to obtain, but later on they got very wily and were not easy to approach.

Of rare cold weather visitants shot or seen I have received no information. I did not notice any myself.

As far as I can make out, there were twenty-eight sportsmen shooting this season, and they were out 473 days. The amount of small game killed was 4,022 head, showing the poor total of 8·50 head per gun per diem. The two largest bags, made of snipe in one day, by three guns, were 104 and 103 head in November.

Small game killed during the season—

	Full Snipe.		*Jack Snipe.*	
September.....	20		.....	
October.....	862		40	
November.....	1,184		169	
December.....	801		72	
January.....	386		49	
February.....	124		30	
	3,377	+	360	= 3,737
Duck.....	120			
Quail.....	55			
Hares.....	10			
Partridges.....	100			
	285	+	3,737	= Total...4,022 head.

I have to thank the sportsmen who have kept records of their bags and who have kindly sent them to me. I only hope that more will do so in the coming season. I shall be happy to send any one game books gratis for that purpose if they will apply to me.

The season of 1892-93 is the first in which any sort of record has been kept of game shot within a radius of forty miles of Bombay, and although from inadequate information it can only be called "approximate," still, if it is kept up year after year, comparisons can be made, and the causes shown why one season is better or worse than another. This will be of interest both to sportsmen and naturalists.

E. L. BARTON.

BOMBAY, 1*st June*, 1893.

PROCEEDINGS

OF THE MEETING HELD ON 23RD FEBRUARY, 1893.

The usual monthly meeting of the members of this Society took place on Thursday the 23rd February, 1893, Dr. D. MacDonald presiding.

NEW MEMBERS.

The following new members were elected :—

His Imperial and Royal Highness Archduke Franz Ferdinand of Austria d'Esté (Vienna), the Hon'ble Mr. A. C. Trevor (Bombay), Major C. B. Wilkieson (Bangalore), Mr. A. W. Turner (Devacolum), Mr. John A. Douglas (Bombay), Mr. H. S. Jacob (Shohagpur), Mr. B. Bruce Foote (Baroda), Mr. A. Corrodi (Bombay), Mr. E. H. Hankin (Agra), Mr. Henry Rodgers, M.R.C.V.S. (Bombay), Mr. R. St. J. Walley, M.R.C.V.S. (Bombay), Lieutenant-Colonel J. M. Hunter (Kathiawar), Mr. A. Conley (Bombay), Lientenant H. H. Nurse (Ahmedabad), Mr. T. R. Lawrence (Bombay), Dr. E. H. Cooke, M.A., M.B. (Bhusawal), Surgeon-Major C. G. W. Lowdell (Poona, C. I.), Lieutenant R. W. Burton (Raichore), Mr. G. Bildt (Bombay), Mr. G. Bower, B.C.S. (Mirzapore), Mr. W. Fraser Biscoe (Secunderabad), Mr. W. D. Sheppard, C.S. (Karwar), His Highness the Maharajah of Kolhapore, and Lieutenant G. E. Bruce (Rangoon).

LIFE MEMBERS.

The Honorary Secretary stated that the following members had availed themselves of the new Rule and had compounded their subscriptions for life :—(1) H. H. the Maharajah Scindia of Gwalior, (2) Mr. G. C. Whitworth, C.S., (3) Mr. K. R. Kama, (4) Mr. D. J. Tata, (5) Mr. H. M. Phipson, (6) H. I. H. the Archduke of Austria, (7) Mr. Bomonjee D. Petit, (8) Major H. D. Olivier, R.E., (9) H. H. the Maharajah of Kolhapore, (10) Major Gerald Martin, (11) Mr. J. M. Coode.

CONTRIBUTIONS DURING JANUARY.

The Honorary Secretary acknowledged having received the following contributions since the last meeting :—

Contribution.	Description.	Contributor.
1 Snake (alive)	Simotes russellii	Mr. P. Benn.
1 Large Scorpion	Scorpio swammerdami	Col. D. Robertson.
1 Snake	Trimeresurusnamallensis	Do.
1 Short-nosed Fruit Bat	Cynopterus marginatus	Mr. W. George.
1 Snake	Vipera russellii	Mr. B. H. Elsworthy.
1 Red Spur Fowl	Galloperdix spadiceus	Capt. P. L. Cox.
A number of Butterflies	From Singapore	Miss N. Prentice.
4 Golden Orioles	Stuffed and mounted in case	Mr. C. Maries.
3 Eggs of the Ring-tailed Fishing Eagle	Haliactus leucoryphres	Mr. M. D. Mackenzie.
2 Eggs of the Grey-backed Sea Eagle	Haliactus leucogaster	Mr. E. A. Bulkley.
1 Indian Monitor (alive)	Varanus bengalensis	Dr. D. A. d'Monte.

Contribution.	Description.	Contributor.
4 Eggs of the Large Cormorant	Phalacrocorax carbo	Mr. H. Bulkley.
3 Eggs of the black-winged Kite	Evlanus cæruleus	Do.
1 Snake	Vipera russellii	Capt. B. A. Cole.
1 Black-backed Goose	Sarcidornis melanonotus	Mr. E. A. Bulkley.
Curiously deformed feet of Black Buck	Antilopa cervicapra	Mrs. Gilbert.
1 Otter's Skull	Lutra vulgaris	Capt. Sutton Jones.
1 Snake	Lycodon aulicus	Mr. V. S. Simmonds.
1 Trap-door Spider's Nest	From Belgaum	Mr. R. C. Wroughton.
Skeleton of Lynx	Felis caracal	Surgeon-Captain B. Drake-Brockman.
Teratological Specimen	Domestic fowl	Do.
1 Turtle	Trionyx leithii	Mr. B. A. Gupta.
1 Fish	Platax teira	Mr. P. Messant.
1 Cobra	Naga tripudians	Mr. C. E. Kane.
A large piece of crystal	From Zanzibar	Mr. Isaac Benjamin.
1 Cobra	Naga tripudians	Mr. P. J. Tonkin.
1 Skin of the Nilgiri Wild Goat	Hermitragus hylocrius	Mr. A. W. Turner.
2 Snakes	Tropidonotus piscator and Oligodon subgriseus	Mrs. Grattan Geary.
1 Phrynus	From Lanowli	Do.
Photographs of Sambur	From Life	Mr. J. D. Inverarity.

MINOR CONTRIBUTIONS

Were also received from Mr. H.H. G. Dunlop, Mr. John Wallace, Mr. J. E. Whiting, Mrs. D. Robertson, Mr. R. Bruce Foote, Mr. S. Melling, and Miss H. Caddick.

CONTRIBUTIONS TO THE LIBRARY.

Life Histories of North American Birds (Bendire) ; in exchange.

List of the Batrachia in the Indian Museum (Sclater) ; presented by the Trustees of the Indian Museum.

Proceedings of the Manchester Literary Society, Vol. II, No. 2 ; in exchange.

The Victorian Naturalist for November 1892 ; in exchange.

Scientific results of the second Yarkand Mission ; presented by the Government of India.

The Canadian Entomologist, November, December, 1892, and January, 1893 ; in exchange.

Le Monde des Plantes, No. 15 ; in exchange.

Proceedings of the Linnæan Society of New South Wales, Vol. VII, Part 2 ; in exchange.

Actes de la Société Scientifique du Chili, Tome II ; in exchange.

Records of the Geological Survey of India, Vol. XXV, Part 4 ; in exchange.

Journal of the Trinidad Field Naturalists' Club, presented by Dr. Bevan Rakes.

Histoire Naturelle des Hymenopteres de Madagascar. Les Formicides, par Mons. A. Forel; presented by the Author.

The Indian Forester, Vol. XIX, No. 2; in exchange.

EXHIBITS.

Mr. C. G. Dodgson, C.S., exhibited some handsome skins of lions which he had recently shot in Somali land.

JOURNAL No. 3, VOL. VII.

The Honorary Secretary stated that, owing to a mistake on the part of the publishers, a certain number of the Journals of No. 3, Vol. VII, had been sent out without any plates. He hoped that members would examine their copies and return them to him if they contained no illustrations.

ACCOUNTS FOR 1892.

Mr. Andrew Murray, the Honorary Treasurer, placed before the meeting the accounts for the year ending 31st December, 1892, which showed a cash balance in favour of the Society of Rs. 2,100-11-9. The accounts were duly passed, subject to the usual audit, and a hearty vote of thanks was voted to Mr. Andrew Murray for the trouble he had taken.

PAPERS READ.

The Honorary Secretary read extracts from the following papers:—(*a*) The Plant and its effects on Cattle, by Mr. Jaikrishna Indrajee; (*b*) Indian Breeds of Dogs, by Mr. W. F. Sinclair, C.S.; (*c*) Food of the Flying Fox, by Mr. W. F. Sinclair, C.S.; (*d*) Moonlight Shadows, by Mr. W. F. Sinclair, C.S.; (*e*) Note on *Psilotum triquetrum*, by Dr. D. G. Dalgado; (*f*) Birds observed breeding in Kharaghora, by Mr. H. Bulkley; (*g*) A Gazelle's Food, by Lieutenant S. D. Vale, R.I.M.; (*h*) On the Occurrence of the Spotted Grey Tree-Creeper at Ahmednugger, by Lieut. H. E. Barnes, F.Z.S.; (*i*) Measurements of Black-bucks' Horns, by Mr. B. W. Blood.; (*j*) A Lynx attacking a Man, by Dr. H. E. Drake-Brockman, F.Z.S.

PROCEEDINGS

OF THE MEETING HELD ON 19TH APRIL, 1893.

A meeting of the members of this Society took place on Wednesday, the 19th April, 1893, Dr. G. A. Maconachie presiding.

NEW MEMBERS.

The following gentlemen were elected members of the Society :—

Mr. Richard Whately (Godra), Mr. C. W. Waddington (Rajkote), Lieutenant C. R. M. Hutchinson (Bakloh), Mr. J. F. Snuggs (Hurdah), Mr. W. A. Wallinger (Surat), Colonel H. Wylie, C.S.I. (Nepal), Dr. Popat Prabhulal Vaidya (Bombay), Surgeon-Captain Baman Das Basu (Rajkote), Mr. Tribhovandas Kalliandas Gujjar (Baroda), Dr. Eduljee Nusserwanjee (Bombay), and Mr. G. R. Lowndes (Bombay).

CONTRIBUTIONS.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions which had been received since the last meeting :—

CONTRIBUTIONS DURING MARCH.

Contribution.	Description.	Contributor.
A five-horned Sheep (alive).	From Arabia	Mr. N. M. Patel.
1 Indian Monitor (alive)	Varanus bengalensis	Mr. P. J. Tomkins.
1 Lynx (alive)	Felis caracal	Capt. H. Parry.
2 Bears (alive)	Melursus ursinus	Do.
1 White-handed Gibbon (alive)	Hylobates lar	Mr. H. P. Gallwey.
1 Large Kudu Skin	Strepsiceros kudu	Mr. C. G. Dodgson, C. S.
1 Dik-dik Skin	Neotragus saltianis	Do.
1 Gazelle Skin	Gazella scemmerringii	Do.
1 Oryx Skin	Oryx beisa	Do.
1 Gazelle Skin	Gazella walleri	Do.
1 Snake	Lycodon aulicus	Mr. B. W. Blood.
1 Shoveller	Spatula dypeata	Mr. E. L. Barton.
A Collection of Sea Fish	From Colombo	Major W. G. Forbes.
A Collection of 48 Birds' Skins	From N. Cachar	Mr. E. C. Stuart-Baker.
1 Hedgehog (alive)	Erinaceus collaris	Mr. P. B. Foote.
A Collection of Precious Stones	.....	Mr. F. Fischer.
1 Large Ant Nest	From Nasik	Mr. H. M. Gibbs.
Bones of a Dodo	From Rodriguez	H. E. Adml. Kennedy.
1 Booby	Do.	Do.
8 Panther Cubs	Fœtal specimens	Mr. W. F. Sinclair, C.S.
2 Red Jungle Cocks' Skins.	Gallus ferrugineus	Mr. F. S. Bullock.
5 Wild Cats' Skins	Felis bengalensis Felis ornata Felis sp. (unidentified)	Capt. Thornhill.
1 Shieldrake	Tadorna cornuta	Lt. G. Farquharson, R.E.
Various botanical specimens	From Goa	Mr. C. de Figueiredo.
1 Snake	Simotes russellii	Mr. A. Francke.
1 Cobra	Naga tripudians	Mr. E. A. Cooke.
1 Hornbill's Nest	Ocyceros birostris	Col. W. Scott.
1 Vampire Bat	Megaderma lyra	Mr. W. B. Smith.
1 Snake	Silybura brevis	Mr. H. S. Ferguson of Travancore.
1 do.	Silybura maculata	Do.
1 do.	Platyplectrurus sanguineus.	Do.
1 do.	Lycodon travancoricus	Do.
1 do.	Lycodon aulicus	Do.
4 do.	Oligodon subgriseus	Do.
4 do.	Coluber helena	Do.
4 do.	Dendrophis pictus	Do.
4 do.	Trop. beddomii	Do.
3 do.	Trop. stolatus	Do.
1 do.	Trop. plumbicolor	Do.
4 do.	Dipsas ceylonensis	Do.
4 do.	Dryophis mycterizans	Do.
4 do.	Trim. anamallensis	Do.
2 do.	Trim. macrolepis	Do.
1 Tiger Cub	Fœtal specimen	Mr. W. A. Wallinger.
Geological Specimens	From Australia	Capt. Mortleman.
1 Indian Oriole (alive)	Oriolus kundoo	Dr. Douglas Bennett.
1 Snake (alive)	Trop. plumbicolor	Dr. A. K. Stewart.
1 Grey Hornbill	Ocyceros birostris	Major Fenton.
1 Cobra	Naga tripudians	Dr. K. R. Kirtikar.

MINOR CONTRIBUTIONS.—From Mr. H. F. Hatch, Col. C. E. Hussey, Mr. C. Hudson, Mr. John Griffiths, and Mr. H. E. M. James, C.S.

CONTRIBUTIONS TO THE LIBRARY.

The Bombay Materia Medica (Khory), from Dr. M. D. Gama.

The Oriental Sporting Magazine from 1858 to 1879, from the Hon. Mr. A. F. Beaufort.

Records of the Geological Survey of India, Vol. XXVI, Part I ; in exchange.

Memoires de la Société Zoologique de France pour 1892 ; in exchange.

DESIDERATA.

The Honorary Secretary stated that he was anxious to obtain sketches or photographs of typical specimens of the different breeds of Indian dogs, such as the *Wanjari Hounds* (*Brinjaris*), *Thilari Hounds*, *Luts*, *Polygars*, *&c.*, for reproduction in the Journal, and he hoped that members up-country would assist the Society in this respect. He further stated that a series of coloured plates would appear in the Journal, illustrative of the indigenous orchids of Western India. Good specimens in flower were wanted, and should be sent by post, packed in cotton wool (up to 1st June), to Mrs. Griffiths, Matheran, who had kindly offered to make the sketches.

PAPERS READ.

The following papers were then read, and a vote of thanks was passed to the contributors :—(1) The Fauna and Flora of the Kachin Hills, by Capt. G. H. H. Couchman ; (2) The Poisonous Plants of Bombay, Part IV, by Surgeon-Major K. R. Kirtikar ; (3) Miscellaneous Notes :—(*a*) A Bold Panther, by Captain P. L. Cox ; (*b*) Measurement of Sambur Horns, by Col. Kenneth Mackenzie ; (*c*) Ducks, by C. D. Lester ; (*d*) The Giant Betel-nut Palm, by C. Hudson ; (*e*) The Habits of the Coppersmith Barbet, by W. F. Sinclair, C.S. ; (*f*) The Breeding Season of the Sarus Crane, by H. Bulkley ; (*g*) A Butterfly attracted by Tobacco Smoke, by R. G. Oxenham.

E. C. S. Baker del. Mintern Bros. Chromo lith. London.

STAPHIDIA CASTANEICEPS.
The Chestnut-headed Staphidia

JOURNAL

OF THE

BOMBAY

Natural History Society.

No. 2.] BOMBAY. [Vol. VIII.

THE BIRDS OF NORTH CACHAR.

A CATALOGUE OF THE *PASSERIFORMES*, *CORACIIFORMES*, AND THE ORDER *PSITTACII* OF THE SUB-CLASS *CICONIIFORMES*,

By E. C. Stuart Baker,

(*With Plate A.*)

(*Read before the Bombay Natural History Society on 6th September*, 1893.)

The three orders abovenamed include all of what are popularly known as "small birds." To take up the remaining orders of the *Ciconiiformes* and the other two sub-classes, *Galliformes* and *Struthioformes*, I should require to expend at least two years in thoroughly working up the heavy bheel land running along the foot of the hills, the whole of which swarms with water-birds all the year round, and in the cold season is visited, in addition, by numerous migrants. To do this I have neither time nor opportunity, and I therefore make known the results of six years' work amongst the sub-classes mentioned, in a country teeming with bird-life, thinking it better to do this than wait until I can give a

complete list of all the birds obtainable—a thing to be desired no doubt, but which I may never accomplish.

Before commencing the catalogue itself, it may be advisable to give a brief description of the country in which I have worked. North Cachar in a small space gives as great a variety of country as most places of more than fifty times its area. To the whole of the south the country is covered with ranges of rugged hills, the principal of which is the Barail range. The mountains of this part are in height from 2,000 feet up to some 4,000 feet, or rather more, and the only valleys of any importance are those of the Jetinga River in the West and of the Jiri and Jennam in the East ; these two latter running parallel with one another for about forty miles almost due south, and finally meeting in the plains of Cachar. As the centre of the sub-division is approached, more especially in the centre and west, the hills become less rugged, and do not run, with the exception of a few isolated peaks, above 2,500 to 3,000 feet. In the central east the Hungroom and Léré range towers above all others. Hungroom stockade is some 5,400 feet high, and all round are peaks 600 to 800 feet higher, whilst a few miles distant across the Jiri and in Manipur territory are hills yet higher than these. Leaving Gunjong, which is just about the centre of the district, and working due north, the hills grow lower and lower until at the extremity of the sub-division one comes to a quantity of low-lying ground, in part covered, during the rains, with swamps and marshes overgrown with dense ekra and sun grass, but principally bearing evergreen forest, more or less broken up by patches of dry sun grass land and bamboo jungle. To the west and north-west is a lovely country of rolling hills and plateaux—a country consisting almost entirely of sun grass land, bearing a scattered growth of oak-forest, intermixed here and there with a few pines, whilst in the pockets and hollows the very thickest of forest, with close undergrowth, grows unrestrained. Here also are one or two upland valleys, of which the Umrang plateau is the chief, a great open space of gently undulating ground, covered with grass and merely dotted with single trees or small clumps growing on the higher parts : during the rains and even to a certain extent at other periods the hollows contain either stagnant water or slowly-running springs, some of which are brackish and entice every kind of wild animal into their neighbourhood. At the lowest

part of this runs the Kopili, a largish stream, but full of rapids and water-falls, rendering even the transport of timber impossible. Thus, then, there is a country to meet the needs of almost every kind of bird ; on the bigger rivers the bolder king-fishers and bee-eaters, many fly-catchers, thrushes, fork-tails, &c., breed, whilst the densely-shaded nullahs, in gloomy evergreen forest, afford shelter to the Great Indian King-fisher and other shy, water-loving birds ; in the marsh lands running along the south all kinds of babblers, reed warbles, &c., have a haunt after their own hearts, and such as require open dry grass country have only to visit Umrang, the hot springs, or similar places. Hungrum and its lofty peaks afford a home for the tits, rarer thrushes, and babblers, who will not descend below 400 feet. Even the tree-creeper, wryneck, and many wrens find this part sufficiently lofty to tempt them to stay and breed ; whilst nuthatches abound in the evergreen forest in the valleys of the two small streams Laisung and Mahor.

As regards classification, all I need say is that I have adopted that of Oates as given in the volumes of the Avifauna in the Blanford Series ; for though there are certain details with which I do not agree in this work, still there is no system which pleases every one, and I do not know of any existing classification which is better or, indeed, as good ; whilst as regards making one for myself, I am utterly incapable of doing so, and fortunately have not yet developed sufficient self-conceit to attempt the task. One word I must say, and that is, that it seems to me as if Oates, good and thorough ornithologist as he is, has thought fit to create a sub-family (*Liotrichinæ*) merely as a sort of waste land with a placard up, "All rubbish may be shot here," and in the waste land he has shot whatever he did not know how to dispose of otherwise. No argument on the formation of their bones will make me believe that *Cutia*, *Ægithina*, *Chloropsis*, *Melanochlora*, *Psaroglossa*, and *Chalcoparia* (*Eulables* too Oates suggests) should be massed together as they are.

The only references I have made are to Oates' work and to Hume's catalogue, and this latter, of course, includes Jerdon.

The notes I have given are for the most part very brief, and I have only launched out into lengthy details in regard to birds about whose nidification or habits nothing has yet been recorded, or about which I

think I have something new to tell. In one or two cases I have also given brief notes as to measurements and descriptions. The principal fact that will be noticed is the very large number of Burmese forms given, and how they and the Indian forms come together. Again, in a few cases, such as *Hemipus obscurus* and *Cisticola cursitans*, forms re-appear here with apparently an immense extent of country intervening between North Cachar and the place where they next appear.

Sub-Class **PASSERIFORMES.**

Order PASSERS.

Family CORVIDAE.

Sub-family *Corvinæ*.

(1) CORVUS MACRORHYNCHUS.—The Jungle Crow.

Oates, No. 4 ; *Hume, No.* 660.

Common everywhere. Breeds in these hills principally in the latter part of March and April. Wing averages here about 13·4″. Bill 2·45″.

(2) CORVUS SPLENDENS.—Indian House Crow.

Oates, No. 7 ; *Hume, No.* 663.

Only occurs in the hills as a very rare straggler, and that only very close to the plains.

(3) UROCISSA OCCIPITALIS.—The Red-billed Blue Magpie.

Oates, No. 12 ; *Hume, No.* 671.

I have only met with one specimen of this bird—a female caught on the nest. This was obtained at Hungrum at a height of about 5,200 feet.

(4) CISSA CHINENSIS.—The Green Magpie.

Oates, No. 14 ; *Hume, No.* 673.

Common from the plains up to about 4,000 feet. Often feeds on high trees, especially during the cold season. Is occasionally found in small parties, probably consisting of the parent birds and their last brood. It seems possible that this bird may sometimes have two broods in the year, for, though the majority of eggs are to be found in April and early May, I have found them again breeding in the end of July and August. In May, 1890, a nest containing three young

ones was found in a well-wooded ravine, and in August the same year another nest was taken from the same tree containing four eggs.

They lay from four to five eggs.

(5) DENDROCITTA RUFA.—The Indian Tree Magpie.

Oates, No. 16 ; *Hume, No.* 675.

Rare in this district, being replaced by the next.

(6) D. HIMALAYENSIS.—The Himalyan Tree Magpie.

Oates, No. 18 ; *Hume, No.* 676.

The common type in North Cachar.

(7) D. FRONTALIS.—The Black-browed Tree Magpie.

Oates, No. 19 ; *Hume, No.* 667.

This bird is by no means rare on the higher peaks, but does not appear ever to descend below 3,000 feet, and very seldom below 4,000. In its habits there is little to note that is different from the better known species of the genus, but it is on the whole a less noisy bird. The flocks number from 4 to 7 or 8, and I am inclined to believe consist merely of the old birds and their last brood of young ones. The nest is in most cases a very flimsy construction, in general shape and size much like that of *D. himalayensis*, but perhaps even more flimsy and smaller. The materials consist of fine elastic twigs, and the coarse tendrils of some climbing plant ; occasionally the latter article is alone used. There is seldom any lining, though I have once or twice seen hair used, and now and then a little stout grass or fern roots may be placed at the bottom of the nest. In size the nests average about 5″ in diameter, the hollow being from one to two inches in depth. They are often placed very low down and generally below 6 feet. One nest taken at Hungrum was on a strong weed, in a fork about two and half feet from the ground.

The eggs resemble those of the *D. himalayensis*, but are, as a rule, more densely and boldly marked. The most common ground-colour is a greenish-grey, and the markings consist of blotches of dark olive-green. I have taken no eggs with the pale salmon tint, so common amongst the eggs of *D. rufa*. They average rather smaller than the eggs of the other species, and are also comparatively a somewhat broader oval ; 28 eggs averaged 1·10″ × ·84″.

The bill is black, legs almost quite black, sometimes with a dull brown tinge. The irides are crimson or crimson-brown.

Sub-Family *Parinæ*.

(8) PARUS ATRICEPS.—The Indian Grey Tit.

Oates, No. 31 ; *Hume, No.* 645.

Very rare here.

(9) P. MONTICOLA.—The Green-backed Tit.

Oates, No. 34 ; *Hume, No.* 644.

I obtained a single specimen of this bird at Guilong—about 4,000 feet elevation—in 1888.

(10) ÆGITHALISCUS MANIPURENSIS.—Hume's Red-headed Tit.

Oates, No. 36.

Not very rare towards the eastern part of the district. Those observed by me were all feeding on high trees keeping in small parties and uttering a constant, rather loud, chirp.

(11) SYLVIPARUS MODESTUS.—The Yellow-browed Tit.

Oates, No. 40 ; *Hume, No.* 632.

Recorded by Godwin-Austen from the Barail range. I have never met with this bird.

(12) MACHLOLOPHUS SPILONOTUS.—The Black-spotted Yellow Tit.

Oates, No. 41 ; *Hume, No.* 649.

I have only seen this bird in the scattered oak forests towards the north-west of North Cachar, and even there it is by no means common.

Sub-Family *Paradoxornithinæ*.

(13) PARADOXORNIS FLAVIROSTRIS.—The Yellow-billed Crow Tit.

Oates, No. 51 ; *Hume, No.* 373.

The female differs from the male in having the chin and throat suffused with earthy-brown.

This bird is not uncommon at a good many places about 3,000 ft., generally keeping to the valleys, where there is lots of sun grass or ekra jungle. It frequents, however, almost any sort of jungle other than deep forest. I have most often met with it in mixed grass and bamboos. Throughout the cold weather it is found in flocks, sometimes numbering as many as a dozen individuals, but more often only about 7 or 8. It is a very shy bird and very chary of taking to flight, but is a great

adept at concealing itself, so that one may often be within a few yards of a party, their movements shown by the waving of the grasses, yet never obtain a sight of one of them. When they imagine themselves free from observance, they often mount to the tops of the reeds and now and then take short flights into the air, much in the manner of some of the *Prinias*. This bird is undoubtedly in part a fruit-eater, for in the stomach of one I examined there were a few seeds, which proved to be the seed of a small plum-like berry, the fruit of a climbing plant, which was very abundant at the place where the bird was shot. The nest is a deep cup, very strongly and compactly made. The diamater across the top is from 3·3″ to 4″, and in depth it is rather more than 2·5″ to nearly 3″. Internally it measures about 2·5″ across by 2″ in depth. Now and then the nest is shallow in shape, but such are very rare.

The materials are composed of shreds of grass, a few narrow strips of bamboo leaves, occasionally a dead leaf or two, and still more rarely a few very fine elastic twigs. The lining is always the same and consists invariably of very fine pieces torn from the inner bark of ekra stems, which are in colour a bright yellow. There appears to be but little attempt at concealment. If the nest is placed on a tree, it is generally fixed to a small upright fork, some 6 to 10 feet from the ground, which is almost devoid of foliage and, if placed in a bamboo clump, it is always near the outside and often in a most conspicuous situation.

The most common type of egg has the general colour a very pale greenish-white, and the markings consist of scanty spots varying in size from minute freckles to large blotches, and in colour a pale umber or olive-brown with other markings underlying them of a still paler shade of the same colour. Here and there are also a few very short-twisted lines of dark umber. In other eggs the markings are the same, but the ground-colour has a brownish or yellowish tinge, and in a few the ground is very nearly white.

One clutch of two eggs in my collection is quite white with a few very faint pinky or purply-brown specks at the larger end. With the exception of this clutch, in none of my eggs do the markings tend to form a ring or cap, though they are very irregularly distributed over the surface of the eggs. The eggs vary in number from two to four ; I have found the former number hard set on three occasions. The texture is fairly close, though chalky and fragile, and the surface

is smooth, in one or two cases showing a faint gloss. In shape the eggs are fairly regular ovals, though less so than those of *Scœorhynchus*.

They measure from ·86″ to ·92″ in length and in breadth from ·63″ to ·68″ ; the average of 11 eggs is ·88″ × ·66″.

(14) P. QUTTATICOLLIS.—Austen's Crow Tit.

Oates, No. 52 ; *Hume No.* 373.

I had a bird of this species brought to me at Laisung. It was said to have been killed from the same party as were two birds of the last species which were brought to me at the same time.

(15) SUTHORA RUFICEPS.—The smaller Red-headed Crow Tit.

Oates, No. 58 ; *Hume, No.* 377.

Recorded by Godwin-Austen from Cachar.

(16) S. ATRISUPERCILIARIS.—The Black-browed Crow Tit.

Oates, No. 59.

A distinct ring of white feathers round the eye ; the feathers of the lores and chin with prolonged black shafts. Maxilla fleshy, the culmen and base a little darker and becoming bluish close to the forehead, mandible pale fleshy, the gonys almost white, irides light, rather bright brown, legs pale, clear bluish plumbeus, claws paler still, length 5·85″, wing 2·3″, tail 3·9″ ; bill at front ·41″ and from the gape ·46″, tarsus ·88″. The first bird of this species that I ever saw was one shot by one of my collectors, who, with one discharge, killed three of these birds (two being lost by him afterwards), and a *Scœorhynchus ruficeps*. The birds were shot in rather heavy bamboo jungle, and were part of a flock of some 16 to 20 birds, the Suthora being in the majority. The bird from which the above details of description were taken was a male in beautiful condition. Its stomach contained a mass of grasshoppers and a few small beetles. The bird was shot on the 11th November, 1892.

Afterwards, during the cold weather, I obtained four more specimens ; all were clambering about in grass or bamboos when shot, and, strange to say, twice I saw them in company with *Scœorhynchus ruficeps*, so it would seem that these two birds are in the habit of keeping together sometimes as well as are *S. ruficeps* and *Paradoxonis flavirostris*.*

* Since writing the above I have taken the nest and egg of this Crow-tit. The former is much like that of *Scœorhynchus*, but smaller, the egg, however, being totally different in colour, this being a uniform bright pale blue.

(17) Scæorhynchus ruficeps.—The Red-headed Crow Tit.

Oates, No. 60 ; *Hume, No.* 375.

The legs of all my birds have been of a dark slaty-blue ; the soles paler and duskier.

This bird is by no means rare here. On the Hemeo peak, where it was obtained by Godwin-Austen, and the surrounding peaks, Hungrum, the Ninglo range, and Laisung it may constantly be met with, and it is found, though less often, down to 2,000 feet, and sometimes even in the plains at the foot of the hills. The description of the nest given by Gammie would serve for nine-tenths of those found by myself, though they average somewhat smaller than his. The lining is either of strips of bamboo or ekra or of fine grasses, but whatever the material may be, in colour it seems invariably to be a bright yellow.

The eggs vary from two to four in number, and are very much like those of the *Paradoxornis*, already described, but are more profusely marked, and there are generally a good many secondary markings of very pale purple-grey or neutral tint. In shape they are a regular oval, and the surface is not as smooth as in the eggs of *P. ruficeps*.

The shell is also less fragile. The average of 15 eggs is ·8″ by ·62″.

They breed from May to the beginning of August. As so little is known of this bird, I reproduce here the notes which I sent to the "*Asian*" some years ago :—"Their favourite haunts are thin bamboo jungle, which they frequent in pairs or small parties of from four to six, and in such cases I believe the flocks consist merely of the parent birds and their last brood. Jerdon states that it does not shun observation, but this remark does not agree with the results of my own experience. True, as long as the observer is perfectly motionless and silent, the birds hop about, clambering about the shrubs and creeping amongst the bamboos in their search for food, taking but little notice of him, but should he move hand or foot, or open his mouth to speak, in a minute every bird has disappeared, not by flying away, but by scrambling from branch to branch, or at once hiding in dense thicket or the undergrowth and fallen rubbish. When on trees it is very tit-like in its motions and spends much of its time in clambering about the smaller twigs and branches, sometimes hanging head downwards, and in this fashion proceeding along the lower side of some thin bough. I have also observed it

amongst reeds and in long grass, where it moves about like the babblers, taking short flights from reed to reed, alighting on the ground and then climbing again to the summit of a reed before once more taking flight. Once when I was camping in a *jhum* or cultivated clearing on a hill-side, in which the rice was almost ready for reaping, a pair of these birds used to come daily to feed, one or the other of them constantly flying off to a clump of bamboos at the edge of the *jhum*, where, on investigation, I found a nest containing four young birds fully fledged and quite ready to fly and, before I left the camp, they used to come with their parents into the rice field, where they were fed on the spot by them. They seemed quite unable to assist themselves, and from what I could observe the duties of dry nurse were divided between the old birds, each of them taking care of two young ones. This was in October and unusually late for the young birds to be still nestlings.

The principal sound I have heard them utter is a note sounding like *chir chirrup* repeated two or three times quickly. I have heard them use this note when feeding only. The young birds, when being fed, fluttered their wings and gave a prolonged chir-r-r.

Another cry, and one which seems to be common to this genus and *Paradoxornis*, is exactly like the bleat of a kid, so much so that, when I first heard it, I mistook it for that sound.

Their flight is level but weak and never long sustained, their feet being their favourite means of locomotion. If they have to fly across an open space, they alternately flutter their wings and then spread them out and sail for a yard or two. When flying, their wings make a soft whirr unlike that of any other bird I know.

They are chiefly insectivorous, but sometimes eat grain as well, though both the rice and berries which I have taken once or twice from their stomachs *may* have been swallowed together with the insects which were adhering to them."

(18) S. GULARIS.—The Hoary-headed Crow Tit.

Oates, No. 61 ; *Hume, No.* 374.

In nidification, habits, and distribution closely similiar to the last bird.

26 eggs average ·78″ by ·58″.

Family CRATEROPODIDÆ.

Sub-family *Crateropodinæ*.

(19) DRYONASTES RUFICOLLIS.—The Rufous-necked Laughing Thrush.

Oates, *No.* 62 ; *Hume*, *No.* 410.

Common up to about 3,000 feet, above which it is seldom met with.

(20) D. CÆRULATUS.—The Grey-sided Laughing Thrush.

Oates, *No.* 65 ; *Hume*, *No.* 408.

Fairly common towards the north-west of the district. All my eggs are very *pale* blue-green.

(21) D. SANNIO.—The White-browed Laughing Thrush.

Oates, *No.* 67 ; *Hume*, *No.* 409.

I have only found this bird on the higher peaks towards Manipur, and on only one is it at all common.

The nests are very much like those of *D. ruficollis*, but are, as a rule, rather more massive, in some cases measuring as much as 7″ across the top and about 4″ in external depth. Internally they measure much the same, about 3·2″ × 2″. The lining is almost invariably of coarse roots and fern stems, and I have never known any other material used for this purpose. The nests are generally placed in small saplings or high bushes between 5 and 10 feet from the ground, but one was found in a sapling about 20 feet high. The eggs are either two or three in number. I have not taken any nests with four eggs, and have often seen two eggs much incubated. They are a beautiful soft blue-green in colour, about the same shade as in the eggs of *D. cærulatus*, yet easily distinguishable by their satiny appearance. The texture can be best described by the word already used, *satiny*, and the surface is very fine and close, displaying a slight gloss, always more than in the eggs of *D. cærulatus* and never as much as in those of *D. ruficollis*. The texture is the same as in the eggs of *Trochalopterum virgatum* and *T. lineatum* and of *Statocichla merulina*, but can be distinguished from the former by their greater size, and generally from the latter by their shape, which is a long oval, somewhat drawn out towards the smaller end, which is rather blunt.

A series of twenty-four eggs average in size 1·19″ × ·79″, and range in length from 1·12″ to 1·26″ and in breadth from ·76″ to ·83″.

This bird is found, as far as I know, only in the thickly-wooded ravines which run down the sides of bamboo-covered mountains or evergreen forests. I have never seen the bird during the cold season, so cannot say whether it collects in flocks or not. It has a fine, loud, double whistle. I have not heard it chattering like the other laughing thrushes.

(22) D. GALBANUS.—Austen's Laughing Thrush.

Oates, No. 68 ; *Hume, No.* 409, *Quat.*

I have had two nests of this bird brought to me, together with one of the birds which had been trapped on the nest, and they are therefore most likely authentic. The nests were deep, massive cups composed of bamboo leaves, creepers, tendrils, fine twigs and grass and were lined with coarse fern roots and fern stems. In size they were about, externally, 8·5″ across by some 6″ deep, internally about 4″ by 4″. Another nest much the same, but less massive, was shown to me as belonging to this bird ; but it was apparently deserted, for, though I waited a long time to watch for the parents, neither of them turned up. All three nests were placed in tangles of wild raspberries and other creepers. The normal number of eggs seems to be three, and in appearance they are hardly to be distinguished from the eggs of *Garrulax lencolophus*, which they closely resemble in colour (pure white), shape and texture, but they have their surface less pitted and they also average larger, *viz.*, 1·22″ by ·93″.

(23) GARRULAX LENCOLOPHUS.—The Himalyan White-crested Laughing Thrush.

Oates, No. 69 ; *Hume, No.* 407.

Common everywhere.

(24) G. PECTORALIS.—The Black-gorgeted Laughing Thrush.

Oates, No. 73 ; *Hume, No.* 413.

My eggs, a series of 100, average longer than Hume's measurements and at the same time are not so broad, being 1·2″ by ·83″ as against 1·07″ by ·85″ in " Nests and Eggs" (vol. I, p. 81). I have some eggs quite as pale blue as the eggs of *Dryonastes ruficollis*, but they are devoid of any gloss.

(25) G. MONILIGER.—The Necklaced Laughing Thrush.

Oates, No. 74 ; *Hume, No.* 412.

Common everywhere.

(26) G. GULARIS.—The Macclelland's Laughing-Thrush.

Oates, No. 74 ; *Hume, No.* 409, *Ter.*

This bird has already been recorded from Luckipur in Cachar. I have found it fairly common to the east of the district at heights over 3,500 ft., very rare below this and never below 2,000 ft., whereas Luckipur is in the plains and well away from the Hills. The nest is a typical laughing thrush's, much like that of *G. moniliger*, but the bird seems to have a strong predilection for tendrils, and I have seen nests composed entirely of this material and lined with the usual black fern and moss roots.

The nest is placed at all heights from the ground up to about 20 feet, generally from 4 to 6 feet. The eggs are either two or three in number, and are, strange to say, of two types, either pure white or very pale blue ; the same colour as the eggs of *D. ruficollis*. In shape they are rather long ovals, often rather drawn out and pointed ; the shell is very stout with a fine close texture and has a decided gloss, almost as much as in the eggs of the *Dryonastes* just mentioned.

Twenty-eight eggs average 1·15″ by ·80″ or rather less ; they vary in length from 1·04″ to 1·21″ and in breadth from 76″ to 84″. My series of eggs originally embraced eggs of every shade from pure white to decided blue, and with many eggs, when placed by themselves, it was difficult to say whether they had any tinge of blue or not, nor was it until they were placed beside really white eggs that the blue tint showed.

(27) GARRULAX ALBIGULARIS.—The White-throated Laughing-Thrush.

Oates, No. 76 ; *Hume, No.* 411.

Very rare everywhere.

(28) IANTHOCINELA CINERACEA.—The Ashy Laughing-Thrush.

Oates, No. 79 ; *Hume No.* 418, *Ter.*

I shot two of these birds, both males, in June, 1890. The birds were two of a largish flock which were scrambling about some brushwood by the side of the road running over the Hengmai Peak at an elevation of about 6,000 feet. This party of birds were chattering and calling to one another just like a party of *Garrulax leucolophus*.

(29) I. RUFIGULARIS.—The Rufous-chinned Laughing-Thrush.

Oates, No. 80 ; *Hume, No.* 421.

Common above 4,000 feet. Often lays two eggs only. Breeds here from April to June, seldom later.

(30) I. AUSTENI.—The Cachar Laughing-Thrush.

Oates, No. 81 ; *Hume, No.* 417, *Bis.*

I note this bird simply on the strength of its name. I have not either volume III or volume XI of Stray Feathers with me to refer to, and do not know in what part of Cachar Godwin-Austen obtained it.

(31) TROCHALOPTERUM CHRYSOPTERUM.—The Eastern Yellow-winged Laughing-Thrush.

Oates, No. 84 ; *Hume No.* 415, *Bis.*

The habits, nidification, and eggs of this bird are just the same as those of *T. phœnicium*. The eggs average 1·1″ by ·76″.

(32) T. PHŒNICIUM.—The Crimson-winged Laughing-Thrush.

Oates, No. 92 ; *Hume, No.* 420.

Common everywhere.

(33) T. SQUAMATUM.—The Blue-winged Laughing-Thrush.

Oates, No. 92 ; *Hume, No.* 420.

I have seen no birds here of the *T. melanurum* type, all having bronze tails, not black. I believe that eventually *T. melanurum* will prove distinct from *T. squamatum*.

Oates is undoubtedly right in what he says regarding the colour of the lores in relation to the sex of this species, two females taken by me on their nests in May, 1891, both had grey lores; a male shot the same month had lores which might have been described as fulvous-grey.

(34) T. VIRGATUM.—The Manipur Streaked Laughing-Thrush.

Oates, No. 98 ; *Hume, No.* 425, *Bis.*

Is not very rare on the high peaks to the east of the district where it breeds.

The nest is much like that of *Ianthocinela*, but is more stoutly built and much deeper. The tendrils also, of which it is to a great extent composed, are always much mixed with grasses, roots and fine bents, and sometimes also with a few bamboo leaves, the last more especially when it is built close to the ground. The lining is always of fern roots and fern stalks with a few moss roots intermixed. As a rule I have found the nests either in thick high bushes or in small trees standing amongst the same and built between four and eight feet from the ground, but on more than one occasion I have taken it from a mass of

vegetation where it rested, practically, on the ground itself. It appears to be a more compact and smaller nest than that built by its nearest ally, *T. lineatum* (Hume's "Nests and Eggs," 2nd edition, Vol. I, p. 65). The eggs are the same in colour as those of that bird, *i. e.*, of a pale blue green, rather brighter than the average run of Laughing Thrush's eggs, and having the peculiar satiny texture already referred to in describing the eggs of *S. merulina*.

Eighteen eggs, average 1″×73″, which is almost exactly the same as the average of the fifty-eight eggs of *T. lineatum* measured by Oates.

(35) GRAMNOPTILA AUSTENI.—Austen's Striated Laughing-Thrush.

Oates, No. 102.

I got two of these birds in 1887 on the Hengmai Peak, and at that time wrongly identified them as a local variety of *G. striata*. They were undoubtedly, however, of this species. The following year I got another bird which, like the former two, was caught on its nest, and this time the nest contained three eggs.

This, the only one of the three nests I examined, was exatly like that described by Gammie in the second edition of Hume's "Nests and Eggs" (Vol. I, p. 67), but was just one inch broader—that is to say, it was 8·5″ across at the widest part and was rather less than 6″ deep; internally it was 5″ in diamater and 2·3″ deep. There were a good many scraps of bracken fronds used in its construction, besides masses of green moss, grasses and few tendrils. The lining was of moss roots only. This nest was in a bush, well hidden and less than 5 feet from the ground.

The eggs, which, alas have since been broken, were, as far as I remember, exactly like a pair of eggs I have in my collection of *G. striata* which were given to me by Mr. H. Edwin Barnes. They measured 1·3″×·93″, 1·3″×·92″ and 1·26″×·87″. The third egg was very remarkably smaller than the other two. There were no signs of marks on them.

(36) STACTOCICHLA MERULINA.—The Spotted-breasted Laughing-Thrush.

Oates, No. 103; *Hume, No.* 413, *Bis.*

I never came across this bird until April, 1891, and during that month I obtained at least a dozen and about the same number of nests

with eggs, most of the birds being caught with hair nooses on their nests. These are bulky, rather shallow cups made of moss and moss roots, grass, bamboo leaves, and fern and bracken fronds, the lining being generally of fern and moss roots, sometimes of very fine twigs or tendrils. The materials are generally fairly well put together, and the nest, when new, is strong and compact, but, owing to the situation in which it is placed, soon becomes damp and rotten. It averages some 7″ across by about 4″ externally, the hollow being about 3·5″, or rather more in diameter, and seldom over 2″ deep. It is invariably placed near the ground and often almost, if not quite, on it. All the nests I saw were taken from evergreen forest with an undergrowth of fern, bracken and brambles.

The eggs, three in number, closely resemble those of *G. moniliger*, but are broader on the whole and the surface is far more satiny, often showing a fair amount of gloss. Thirty eggs average 1·14″ × 81″.

All my eggs were taken in April and May.

I have only met with this bird in one place, namely, the valley of the Laisung, at an elevation of about three to four thousand feet. The birds kept principally to the evergreen forests, but were also noticed in bamboo jungle on several occasions. At this place it is very common, but I have not met with a single specimen elsewhere. It is a very shy bird and, as Hume says, a terrible skulk.

(37) Argya earlii.—The Striated Babbler.

Oates, No. 104; *Hume, No.* 439.

Only occurs as a straggler from the plains in the low-lying grass lands on the borders of Nowgong.

(38) A. caudata.—The Common Babbler.

Oates, No. 105; *Hume, No.* 438.

I have been told by a friend that this bird had been killed by him at the foot of the North Cachar Hills, but I very much doubt whether it was correctly identified.

(39) A. longirostris.—The Small Rufous Babbler.

Oates, No. 109; *Hume, No.* 386.

(40) Crateropus canorus.—The Jungle Babbler.

Oates, No. 110; *Hume, No.* 434.

(41) POMATORHINUS SCHISTICEPS.—The Slaty-headed Scimitar Babbler.

Oates, No. 116 ; *Hume, No.* 402.

The common type below 3,000 feet. Often lays only three eggs, and sometimes only two.

(42) P. OLIVACEUS.—The Tenasserim Scimitar Babbler.

Oates No. 118; *Hume, No.* 403, *Bis.*

In 1888 I had a female of this species brought to me which had been trapped in the nest.

(43) P. FERRUGINOSUS.—The Coral-billed Scimitar Babbler.

Oates, No. 122 ; *Hume, No.* 401.

The nests I have taken of this bird have been of the usual rough and loose manufacture typical of the species and were not at all well made like the one mentioned by Gammie (Hume's "Nests and Eggs," vol. I, p. 86). Most of those I have found were placed at the foot of bamboo clumps and more or less buried amongst the dead leaves and rubbish collected round them. As with the other *Pomatorhini*, this species frequently lays only two eggs.

(44) P. PHAYRII.—Phayre's Scimitar Babbler.

Oates, No. 124; *Hume, No.* 401, *Bis.*

This species is very common about 3,000 feet, but below that height I have very seldom met with it. I have taken numerous nests, and the distinctive feature of its nesting is that it more often than not places its nest in a thick bush at a considerable height from the ground. Its nest does not differ from that of *P. schisticeps*, being the same bulky, globular affair made of bamboo leaves, etc., though from its situation it is of necessity somewhat more firmly put together.

The average of a dozen eggs is 1·16″×·71″. I once took a nest of this bird from the top of a big bush about seven feet high, and, amongst the roots, I also found a nest of *P. ferruginosus*, both nests containing three eggs. In the same valley, that day, I also took nests of *P. erythrogenys* and *P. schisticeps* and two others of *P. phayrii*. Scimitar babblers of all the species mentioned were very plentiful at this place (the Laisung valley), and *P. macclellandi* was also met with.

(45) P. ERYTHROGENYS.—The Rusty-checked Scimitar Babbler.

Oates, No. 129; *Hume, No.* 405.

Not very rare, but very locally distributed, being fairly common in one valley and not to be seen in the very next.

(46) P. MACCLELLANDI.—Macclelland's Scimitar Babbler.

Oates, No. 130; *Hume, No.* 404, *Quat.*

Godwin-Austen found this bird in the Barail Range, and I have met with it on all the ranges between this and Manipur and the Naga Hills. It is one of the commonest forms to the east, but I have never met with it on the grass-covered hills to the north and north-west, where *P. schisticeps*, *P. ruficollis*, and *P. ferruginosus* are all very common.

The eggs measure 1·09″×·76″.

The nest is like that of *P. erythrogenys*, and is usually placed amongst bamboo roots or the roots of some thick shrub growing on a bank.

(47) P. HYPOLEUCUS.—The Arrakan Scimitar Babbler.

Oates, No. 131; *Hume, Nos.* 405, *Bis* and *Ter.*

This babbler does not appear to be rare at the foot of the Hills, but does not ascend to any height.

(48) XIMPHORAMPHUS SUPERCILIARIS.—The Slender-billed Scimitar Babbler.

Oates, No. 133; *Hume, No.* 406.

A very rare bird. I have met with it barely half a dozen times in as many years. It seems to keep almost entirely to bamboo jungle, and during the cold weather collects in small, but noisy, parties. These birds have a very follow-my-leader style of going along; if one bird mounts a bush and then hops down again and climbs another, all the party are sure, one by one, to do just the same. I think these are the noisiest of all the scimitar babblers, their cries being like the softer notes of the laughing thrushes, but rather deeper in tone. It is found well up to 5,000 feet, and the lowest I have observed it was at about 2,400 feet. It is an early breeder like others of the sub-family, and by the end of April I fancy they have nearly finished laying.

Sub-family *Timeliinæ.*

(49) TIMELEA PILEATA.—The Red-capped Babbler.

Oates, No. 184; *Hume, No.* 396.

By no means common anywhere and very local in its distribution.

(50) GAMSORHYNCHUS RUFULUS.—The White-headed Shrike Babbler.

Oates, No. 137; *Hume, No.* 384.

Oates says that probably the young do not assume the adult plumage until they are about a year old. As a matter of fact I believe that they

take two years before completing it. A young male which was killed in August, 1890, and which was the father of four nearly fully-fledged nestlings, had but few signs of the adult plumage, and he must have been at least 14 months old. The female had the adult plumage fully developed. The nest of this bird was a large oval affair, much like that of the *Pomatorhini*, and was made of bamboo leaves lined with fern roots, narrow strips of ekra bark and grass. It was placed about six feet high in a thick clump of bamboos. I have never seen an egg of this bird, but the natives assure me that it is very much like that of *Trochalopterum phœnicium*, but marked with a paler colour.

In its habits it is far more like the *Crateropodinæ* than the *Timeliinæ*. It collects in large flocks like most of the members of that family and is also extremely noisy, uttering incessantly a variety of cries, all more or less like the notes of *Garrulax leucolophus*, but less harsh, nor has it the so-called laughing note of that bird ; though it has another equally fit to be called a laugh. Nearly all the birds I have seen have been in bamboo or thick grass jungle; indeed I can recall to mind no instance of ever having seen them in any other. They are not shy birds, and I have sometimes remained within easy shot of a party for nearly half an hour, following them up as they made their way along the bamboo tops, to all seeming causing them no anxiety or annoyance by my proximity, though one would now and then mount a bamboo close to me and loudly expostulate with me, not so much in fear as in contempt for my curiosity. They are comparatively active on the wing also, far more so than any other of the *Timeliinæ* that I have closely observed, and altogether I am inclined to think that it will eventually have to be placed with the *Crateropdinæ* rather than in its present position.

(51) PYCTORHIS SINENSIS.—The Yellow-eyed Babbler.

Oates, No. 139; *Hume, No.* 385.

Common everywhere in suitable localities up to nearly 3,000 feet.

(52) PELLORANEUM MANDELLII.—Mandelli's Spotted Babbler.

Oates, No. 142 ; *Hume, No.* 399, *Bis.*

The common form of *Pelloraneum* in these hills. Some time ago an article appeared in the "*Asian*" over my signature under the heading *P. ruficeps*. The description and remarks, however, all applied to this bird, and my notes must have got very much mixed up. So

little is known of these and the allied birds that I reproduce my remarks here, as also those on the other members in their right place, omitting only the descriptions of the birds themselves.

NIDIFICATION.—I think that I must take at least two nests of this bird to every one I find of all the other wren babblers collectively. Out shooting I am constantly having my attention drawn by a little lark-like bird gliding noiselessly out of some tuft of grass and almost immediately after becoming invisible. Even after the bird is seen to quit, it often takes some time to find the nest, for it is generally carefully concealed and more or less covered with fallen leaves, &c. Occasionally, when I have not been able to mark the exact spot from whence the bird has made off, I have been quite unable to find the nest, and have had to await the return of the bird in order to obtain the eggs. It is always placed on the ground, and amongst fully one hundred nests taken in the last four years, I have never yet met with 'the exception that proves the rule.'

"The situation most commonly chosen in which to place it is a tuft of coarse grass or a thick clump of rank weeds growing either in, or close to, bamboo jungle. It is very remarkable how often these birds select seemingly dangerous positions by the side of some well-worn mithna, buffalo, or elephant track. On one occasion (24th April, 1891) I was tracking up a wounded bull that I had damaged the night before, and no less than four times did I disturb this bird from one side or the other of the track. Each time I put them up, a coolie, who was carrying my drinking water, looked for and found the nest, and at the end of the tramp he gave me them with such eggs as he had not managed to smash. All four nests were taken from beside comparatively well-worn tracks. I have often taken nests from amongst the masses of dead bamboo leaves collected at the foot of bamboo clumps or even from the open ground, where it is fairly steep, and dead vegetation and leaves lie thickly enough to afford protection. Another favourite place is just at the edge of patches of sun grass, ekra, or elephant grass. I do not think they ever build inside these patches at any distance from the edge; personally I have never seen a nest more than a foot or two inside. Low bushes in which the branches come quite down to the ground, more especially such as are thorny, sometimes conceal a nest, but not one in ten will be taken from such

positions. All nests are composed of the same materials, namely, bamboo leaves alone, as far as the outer part is concerned, and, as regards the inner part, fine grasses will be found to constitute the greater portion, more or less mixed with slender moss roots, hair-like fibres, and the extremely delicate tendrils of a wild flower that looks like a yellow convolvulus. In shape the nest is generally a broad oval, sometimes rather lengthened and egg-shaped; it is placed either upright or slanting at an angle of nearly 45°. The entrance is about one-third of the way down from the top, sometimes lower and rarely almost level with the ground. It is often partially protected by the loose leaves of the upper half of the nest hanging over and concealing it. These cases appear, however, to be more the result of accident than design, and the leaves are never artificially made to form a porch, however rude.

"The nest is sometimes merely semi-domed, much like what I have already described as being built by *Stachyridopsis ruficeps*. Very rarely it is a deep cup, but even in these cases the depth of the interior far exceeds the diameter. I once took a nest of this bird from a very peculiar situation. I had killed a female bamboo rat which showed signs of having young, and in looking for these, I commenced prodding about in a pile of loose leaves and rubbish which had collected in the open by the road-side. Pushing the stick through the centre of this, I touched something which scuttled away on the ground. A closer inspection showed me a nest buried nearly six inches deep amongst the loose stuff, containing three eggs which I easily recognized as belonging to this bird. As usual it was very roughly and loosely built, not being strong enough to stand removal. I have said above that I have never seen a nest placed otherwise than on the ground, but I must modify this statement, for as long ago as 1887 I took two nests which were practically placed in the ground. Both nests were placed in holes some eight inches deep in steep banks of nullahs running through bamboo jungle; both were semi-domed, and in both cases the hollows were completely filled up with loose bamboo leaves.

The full complement of eggs is three or four, either number being about equally often laid. I have never seen five in a nest, nor have I ever taken two only which showed any signs of incubation. The ground-colour of the eggs is white, either pure or very faintly tinged

with greyish or greenish. Typically they are thickly stippled and freckled with rufous-brown and purplish-brown, the latter marks being sometimes almost black. They are most numerous towards the larger end, where they occasionally form a ring or a cap.

" In addition to these markings, there are in most eggs a few rather larger underlying dots of pale lavender and pale dull purplish. In the majority the first-mentioned marks strongly predominate, but in a few these latter gave the prevailing tint to the eggs.

" In about one egg in five there are a very few large blotches of one or two of the colours already mentioned. In a few specimens the prevailing colour of the markings is a ruddy brown or ruddy pink, and these eggs are almost undistinguishable from those of some bulbuls. On one occasion I had taken four bulbuls' nests and one nest belonging to this bird, and for some reason—I now forget what—had placed all the eggs in the same box. On my return home it was with the greatest difficulty I was able to distinguish between one clutch of bulbuls' eggs and the eggs of *P. mandellii*. I have about four clutches in which the markings are more than usually dark and are very minute. In three there is a very distinct broad ring round the top of the larger end, within which are scattered a few brown and purple spots ; in the fourth clutch the freckles form a small dark cap, many of them coalescing, and all more or less indistinctly divided from one another.

" A solitary clutch in my possession has all four eggs marked with rather light umber-brown, only here and there one of purple and a few of raw sienna. Many eggs have the markings at the smaller end rather lighter than those of the large end. In shape the eggs are rather broad and very regular ovals, in many cases the difference in size between the two ends being barely perceptible. Abnormal specimens generally incline to the peg-top shape, a few being met with rather longer and with the smaller end somewhat compressed. The surface is very fine and close, and the greater number of eggs have a slight but appreciable gloss ; in some this is absent, in others rather highly developed. In proportion to the size of the egg the shell is rather fragile. In the hundred and eighteen eggs which I have measured the length only varies between ·85″ and ·93″ ; the

difference in breadth is proportionately rather greater, the limits either way being ·63″ and ·71″. The average of one hundred eggs is ·90″ (almost) by ·675″.

"The earliest date on which I have obtained eggs was on the 4th of April, 1891, on which date I took a nest with two fresh eggs. The latest date noted is the 21st July 1888, when four hard-set eggs were taken. Of all my nests, one-half were taken between the 15th April and the 25th May, one-third between the latter date and the 25th June, and the remaining one-sixth early in April or in the last few days of June and the first few of July.

"This bird is so shy and unobstrusive that, in spite of its being so common, it is a most difficult matter to collect any materials for notes on its habits. Its knack of getting out of sight in a moment is something wonderful and has to be seen to be believed. When put up off its nest, a bird is just seen to slope away for a foot or two, or perhaps a yard or two, after which it is *non est*. I have used the word *slope* intentionally, as I think it describes best the bird's mode of progression; it cannot be said to be a hop, run, or flight, but seems to be a combination of all three in which no one mode is visible. As regards its voice, the only notes I have heard it utter have been the pleasant musical call alluded to by Oates as being the common note of *P. subochraceum*, and the chattering cries it constantly gives during the cold season, when the bird goes about in company with a few others. It also uses this note when disturbed by an intruder, such as a squirrel or another bird, but it never, I believe, utters any cry when disturbed by a human being or big animal, confining itself to performing the vanishing trick with neatness and celerity. Jerdon mentions 'a kind of crowing laugh' as being amongst the sounds they make. This, like Rider Haggard's *crabs*, 'they cannot do in my fiction,' though, like the same crabs, it is quite possible that they may 'do' so in reality, although I do not happen to have heard them myself. It is a frequenter of low scrub and brush jungle or of bamboo and grass jungle mixed, and does not haunt the tops of high trees as so many wren babblers do in the cold weather. It may often be seen feeding actually on the ground, and this more especially when the birds are collected in flocks. At this time they appear rather less shy, and the few observations I have been able to make have nearly all been collected at this period of the year. I

have often been reminded by its actions of the common Bengal Babbler (*A. terricolor*). One bird takes up the call started by another, and then each bird repeats it until every member of the flock has notified his exact whereabouts. They quarrel too occasionally, such an event being a matter of the most intense interest to each individual, who backs his particular fancy much in the same way as other bipeds in England back prize-fighters, that is, on the win, tie or wrangle system. They often appear to be very undecided as to whether some article of food is good enough to eat or not, and they contemplate it in a melancholy way with their heads on one side, until another bird decides for them by eating it himself, or else he seems to make up his mind to eat it and risk the result. I have never examined the stomach of any birds and can say nothing about their food. They are extremely active on their legs, but their flight is feeble and they never seem to travel far on the wing. They descend a long way into the plains, having been recorded from the low lands of Sylhet, and I believe they remain there all the year round. I have seen this bird and taken its nests up to 5,000 feet, but it is most common about 2,500 feet. There is one place in particular in these hills, called *The Hot Springs*, where this bird is most numerous. The country consists of open grass lands with sparse oak forest, the pockets between the hills being filled with dense scrub jungle and here and there patches of the small hill bamboo. As already mentioned, I once took four nests there in one day, and several times I found two myself and had others brought to me."

(53) P. MINUS.—Sharp's Spotted Babbler.

Oates, No. 143.

Sharp's type bird was recorded from Cachar. I have never met with it.

(54) P. RUFICEPS.—The Spotted Babbler.

Oates, No. 144; *Hume, No.* 399.

This bird, hitherto supposed to be a purely southern form, re-appears in North Cachar and is by no means uncommon. The first bird I obtained was sent by me to Mr. Barnes, and was identified by him as being of this species, and it was also, the same day I believe, identified by Mr. Murray. Since then I have met with any number of birds, and Mr. H. A. Hole has also obtained it in South Cachar, and has, I think, a specimen

now in his collection. The remarks on nidification made on *P. mandellii* would equally apply to this bird.

(55) P. PALUSTRE.—The Marsh Spotted Babbler.

Oates, *No.* 146 ; *Hume*, *No.* 399 *Quat.*

A rare bird here, and, unlike the other members of the genus, never found to my knowledge outside grass land. I have never noticed it near swamps or marshy land, as its name would seem to infer it should be found.

The nests and eggs are undistinguishable from those of *P. ruficeps* or *P. mandellii*, but the latter are smaller, averaging about ·87″ by ·64″.

(56) P. IGNOTUM.—The Assam Babbler.

Oates, *No.* 148 ; *Hume*, *No.* 399 *Ter A.*

I reproduce in full my notes from the *Asian*, which give all the information I have collected concerning this little-known bird.

" NIDIFICATION.—The nests of this bird differ in one important respect from those of the other members of the genus in that, as far as I know, it is never found on the ground. It is of course of much the same character, being either shaped like a very deep cup, one side being more or less prolonged and sometimes bent over, or it is a perfectly globular-shaped nest. The entrance is generally high up on one side about an inch from the top, sometimes it is about the centre, and rarely quite low down—so low as to allow the eggs to be seen from some distance away when the nest is not well concealed or when the covering branches have been disturbed. The materials used may be of almost any kind of grass or bamboo leaves, and it is lined only with grass. From its position it is naturally rather more compactly built than the nest of those species which build theirs on the ground, but it is also sometimes a good deal neater than nests placed in a similiar position and of the same type. I have seen one or two which were made of very fine grasses which were so neatly and strongly built that I at first sight mistook them for the nests of the *Himalayan Munia*. The majority of the nests I have personally found were taken from the dense masses of twigs growing on the lower parts of clumps of the small clump bamboo and were placed at heights varying from two to four feet from the ground, rarely higher than the last-mentioned height and, nearly equally as rarely, lower than

the first mentioned. A few nests were taken from tangles of creepers, weeds, and brambles, and one or two from small thick patches of coarse ekra, in these last cases being generally within a few inches of the round. The earliest and latest dates I have recorded as having found eggs are respectively the 29th of April, 1891 and 11th of July, 1890.

"This bird, as far as I know, does not breed in these hills below 3,000 feet and is most common above 5,000 feet. I have never taken a nest except towards the north and north-east of the sub-division, though I have met with occasional birds elsewhere. In number the eggs are generally three; sometimes, though not often, four and, on one or two occasions, I have taken two eggs only which showed signs of incubation to a greater or less extent. The most common type of egg has the ground-colour rather a decided pale pink, the markings consisting of freckles of a rather dark brownish-red, profusely scattered over the whole surface of the shell, but even more numerous towards the larger end, where they generally form either a ring or a badly-defined and irregular cap. In some few cases the markings are equally numerous everywhere, running into one another and occasionally forming small blotches where two or more of the marks coalesce. A few clutches that I have are much fainter in colour both as regards the markings and ground-colour, and these eggs bear a striking resemblance to the eggs of some of the bulbuls, such as *Xanthixus* or *Spizixus*. Again in others of my clutches the ground is a pure white, so that the freckles appear to be more boldly and strongly defined than in the pink eggs, although such is not really the case. In a very few eggs, both of the white and pink types, the markings are confined almost entirely to the larger end in the form of a ring or cap; such eggs are, however, so rare that they may be said to be abnormal.

"In shape the eggs vary but little, being of a rather regular oval, very slightly, if at all, compressed towards the smaller end and always blunt. Abnormal eggs only differ in being somewhat lengthened ovals, and it is a peculiar fact that the only two clutches I possess, in which the markings are confined to the larger end, are also those which are the most lengthened of all my eggs.

"The shell is firm and close in texture and often shows a fair amount of gloss, but for its size it is decidedly fragile. Eighty eggs that I have

measured varied in length between ·72″ and ·90″ and in breadth between ·57″ and ·62″, the average dimensions of the same number being ·78″ by ·60″. From the above measurements it may be seen that the variations in length covered no less than ·18″ of an inch, whereas in breadth they only covered ·05 of an inch. As a matter of fact very few eggs exceeded ·82″ in length, and only six eggs exceeded ·84, and again only 5 eggs are less than ·75″ in length, so that the variation in length, putting on one side the eleven eggs, which were either abnormally long or short, the remaining 69 eggs only ranged in length between ·75″ and ·84″. I know of nothing practically of any interest to record concerning the habits of this bird. Like all others of the genus, it is very shy and retiring and gives but little chance of close observation ; it is a very silent bird ; such notes as I have heard are very like the lower chuckling notes of the genus *Trochalopterum*, but are very sweet and soft. When disturbed it never makes any harsh noise, but evinces its distress or fear in a low rippling note that conveys not the slightest sign of anger, though perhaps to a certain extent it does show fear. I have repeatedly had the bird leave its nests when I was within a yard or so of it—for, in spite of its shyness, it is a very close sitter—and then flutter about at a little distance in a palpable state of fear and anxiety ; yet the only note it ever uttered was the one already mentioned. It sometimes utters a clear low whistle, probably as a call for its mate ; this note is, however, very seldom made use of, for I do not think I have heard it half-a-dozen times altogether in as many years. This species so far appears only to have been recorded from the Naga Hills and from Dibrughur, but nothing is said as to the elevation at which it has been obtained. Here I have never noticed it below 2,400 feet even in the cold season, and it is most common at Hungrum and the surrounding peaks at an elevation of some five thousand feet upwards, where it is principally found in thin brushwood and scrub jungle or in bamboo jungle whenever there is such available. As the lower hills are reached and the bamboo jungle becomes more plentiful, the bird seems to keep almost entirely to it. It is found very plentifully towards the north and north-east of these hills, and thence extends into Manipur and the Naga Hills."

(57) Drymocataphus tickelli.—Tickel's Babbler.
Oates, No. 151 ; *Hume, No.* 399 *Tr.*

Nidification.—I have now taken fully a score of nests of this bird, and I can therefore have no doubt as to the identity of the owner, although, as will be seen, the eggs have not the slightest resemblance to those which Bingham found and which he believed to have belonged to this bird. On ten occasions I have trapped the bird on the nest ; twice I have shot it as it flew out of it and once as it rested on a branch of a bush above the nest. The nest is either a globular concern or else a very deep cup with one side prolonged and bent somewhat forward. As a rule it is made of bamboo leaves and shreds of the softer parts of sun grass, but very often there are a great many pieces of bracken and fern also interwoven with the former materials. It is much like the usual type of nest of *Pellorneum ruficeps*, but is far more compact and therefore somewhat smaller in external measurements, and also much neater, though internally averaging about the same. Most nests are placed actually on the ground, either at the foot of a bamboo clump, a thick bush or a mass of grass and weeds. Other nests are placed a foot or two above the ground in tangles of creepers or wild raspberry bushes, the latter kind of situation especially being a very favourite one. Most nests are very well concealed, but such is not always the case, for on one occasion I found a nest just by a pathway which led from my camp down to a stream and which was used by some twenty people every day on their way to and from the water. The nest was placed about eighteen inches from the ground, in a mass of wild caladium plants and raspberry creepers and, from one direction, was fully exposed to view. When I first came to the camp the nest contained a single egg, and two days afterwards, when another had been laid, the two were taken away, bulbuls' eggs being put in as substitutes in order that the bird should not desert the nest. Two more eggs were laid, and the bulbuls' eggs were taken out and thrown away. The bird was very shy at first and always used to leave the nest before a sight could be got of it, but afterwards she sat very close and would lie in her nest and blink at me when I stood barely three yards away. I regret to say that during my absence for a short time from the camp some Naga boys trapped the bird and

stole the eggs, although I had ordered them not to do so. The eggs seem to be either four or three in number, and I think I have taken as many nests with the former as with the latter number. All my eggs are alike in coloration and the character of the markings, the latter merely differing slightly in amount. The ground-colour is a pale greenish-grey, in some few eggs rather more decidedly green than in others, and the markings consist of numerous freckles and irregular small blotches of pale reddish-brown, numerous everywhere, but more so, as a rule, towards the larger end, where in most eggs they form an ill-defined cap or ring ; besides these brownish marks, there are other underlying ones varying from the very palest bluish-grey to rather dark purplish-grey. In general appearence the eggs are very like small, dull-coloured specimens of the eggs of *Copsychus saularis*. In shape they are broad, blunt ovals, very slightly smaller, as a rule, at one end than at the other. The shell is very fragile, but the texture is fine and close, in one or two eggs showing the very faintest perceptible gloss, but in most rather dull.

Twenty-four eggs average in size 81″ × 51″ and vary in length from 77″ to 88″, and in breadth from 58″ to 66″. The 29th of April, 1891, is the earliest date I have recorded as having taken eggs, and the 27th of June the previous year is the latest date.

Hitherto, with only two exceptions, I have only found it breeding on the peaks round about Hungrum, all about 5,000 feet high and some above 6,000. During the cold weather I have noticed it now and then very much lower down, occasionally as low as 2,500 feet. It is a very timid bird, avoiding observation and interference, haunting low brushwood, bush jungle, bamboo and tree forest, or indeed almost any kind of ground where there is plenty of undergrowth to screen it, though the first-mentioned sort of place is that which it chiefly frequents, and during the breeding season it is in such places alone that there is any chance of finding it. I know but very little of their habits ; all that one ever sees of the bird is a small brown object squatting on the ground in front of one for a second or two before it suddenly dives into the nearest patch of grass or other shelter, when it at once becomes invisible. I have never seen the bird fly above a few yards at a time ; even those which I trapped

and then released flew out of my hands on to the ground and began to make off in long bounding hops, using every stone and turf on its way to assist in its concealment. The only note I have heard it utter is a soft rippling chir-chir, and this sound it seems to make use of on all and every occasion—when calling to its mate, disturbed off its nest, resisting being caught, or when quietly feeding.

(58) CORYTHOCICHLA STRIATA.—The Streaked Babbler.

Oates, No. 154.

Upper mandible dark brown, lower plumbeous, darkish at the base, pale elsewhere, mouth creamy-slate colour. Irides dark red. During the hot weather and rains this bird seems to keep to the higher peaks, descending lower during the cold season. It is a very rare bird, and such a shy one also that it is impossible to find out much about its habits. Like *C. brevicauda*, it never makes use of its wings unless absolutely compelled, and it is so sharp and active on its legs that these alone are generally sufficient to carry it out of sight before one has even time to shoot at it. I have been very fortunate in obtaining several of its nests and also in obtaining nests which had eggs in them. All those I have taken (six) or had brought to me have been of the same type, *viz.*, very deep cups with one side prolonged and projecting over, making it almost a domed nest ; indeed in one or two cases it might have been termed such. The materials consist principally of dead leaves, a few fern fronds, or rarely a few scraps of grass. These are bound together with fern roots and moss, and the lining is composed merely of a few more dead leaves. All the materials used are of a dark brown tint, and so far I do not think I have seen a single light-coloured nest. The materials are fairly well put together, but from their nature they stand but little handling and soon fall to pieces when once removed from the original position. They are placed either at the root of a tree, below some log, or in a cluster of plants in a hollow on some bank, and one was found at the foot of a survey pillar wedged in between two of the stones which formed its base. Wherever they are, I believe they are always placed actually on the ground, not above it in bushes, &c.

The full complement of eggs seems to be four, but I have found a nest containing three and another only two eggs showing signs of in-

cubation; also a nest in which I found two young ones only. In shape my eggs are broad ovals, but little compressed at the smaller end, which is very blunt. They are white, and the markings consist of primary freckles and small spots varying in colour from pinky-red to pinky-brown, none of a very deep shade; besides which, there are subordinate markings of pale pinkish-purple rather larger in size than the primary specks. As a rule the spots are very sparingly scattered over the whole surface except at the larger end, where they are fairly numerous. In none of my eggs is there any indication of a ring at this end, but in some they form a very indistinct cap.

In length they vary between ·78″ and ·83″, and in breadth between ·59″ and ·62″; the average of 14 eggs is ·81″ × ·6″. They appear to breed in May and June and the latter end of April.

(59) TURDINUS ABBOTTI.—Abbott's Babbler.

Oates, No. 160; *Hume, No.* 387.

Not rare in North Cachar, but, as far as I know, keeping entirely to densely-wooded valleys at a low elevation. I have never observed it over about 1,500 feet high.

(60) ALCIPPE NEPALENSIS.—The Nepal Babbler.

Oates, No. 163; *Hume, No.* 388.

Extremely common from 2,000 feet up to the summit of the highest peaks. The eggs of this bird vary most wonderfully, and I notice here a few of the most marked varieties:—

(1) Pure white, with *most minute* speckles of purply-pink, usually forming a dense ring round the larger end; sometimes practically confined to this end, at other times fairly numerous all over.

(2) Much the same, but with a pinkish ground and the markings somewhat larger, lighter, and even more numerous.

(3) The same, but with the markings of pale reddish-pink.

(4) Ground-colour pale to deep salmon and more or less covered with blotches and clouds of pink and underlying marks of greyish, with here and there a speck or short line of deep blood red. This type can be almost matched by many eggs of *Pyctorhis sinensis*.

(5) Ground-colour from pale pink to pure white with rather sparsely scattered marks of deep purple, ranging from mere specks to largish dots and lines. In this type the marks nearly always form a distinct ring or cap.

(6) In a few eggs the marks consist almost entirely of hair-like lines intertwined with one another and forming a ring round the larger end, some ·15″ broad. Fifty of my eggs average ·69″ × ·54″; one hundred of them vary in length between 61″ × 78″ and in breadth between ·48″ × 61″.

(61) ALCIPPE PHAYRII (*Vel* PHACOCEPHALA).—The Burmese Babbler.
Oates, No. 165 ; *Hume, No.* 388 *Bis.*

I cannot with certainty assign the birds of this region either to the Burmese or Southern Indian form. The typical bird of North Cachar has either no sincipital stripe or only the very faintest indication of it ; moreover the colour of the lower parts varies considerably in individuals according to whether the plumage is abraded or not. As regards the cap, there is seldom any trace of it in the birds of these parts.

Oates seems undecided rather as to whether *A. phayrii* is a good species, and personally I think the two forms, if they can even be called such, should be combined under the name *A. phacocephala.*

(62) STACHYRIS NIGRICEPS.—The Black-throated Babbler.
Oates, No. 169 ; *Hume, No.* 391.

Very common from the level of the plains, where it remains to breed, up to about 3,500 feet, above which it is less common, but is still met with, even up to the highest peaks.

(63) S. CHRYSÆA.—The Golden Babbler.
Oates, No. 170 ; *Hume, No.* 394.

I have taken a great number of nests and eggs of this bird, which is not uncommon in a few localities, though its distribution is very confined. The majority of nests have been either completely domed or else very nearly so, but on a few occasions I have also taken cup-shaped nests, and the first year I obtained any, all I took were of this shape, so that I began to think this species differed from the others of the genus and did not build a domed nest. Since then, however, I have found out my mistake. It is formed of bamboo leaves, either whole or in strips, grasses, and, very rarely, a dried leaf or two, all loosely wound together and lined with finer scraps of the same material or with fine rootlets. On one occasion I found one lined partly with buffalo hair.

Most of my nests were found actually on the ground and had become very damp and dilapidated even before being taken. Some few were in bushes or bamboo clumps, but never more than a foot or two from the ground. The eggs are, of course, pure white. 40 eggs average ·62″ × ·46″, which is even smaller than Gammie's clutch (Hume : Nests and Eggs, vol. I, p. 112), which surprised Oates so much by their small size that he could hardly believe they belonged to the bird. My smallest egg is ·59″ × ·44″. They do not vary very much in size or shape.

(64) S. ASSIMILIS.—The Allied Babbler.

Oates, No. 171 ; *Hume, No.* 394 *Bis.*

NIDIFICATION.—Precisely the same as with *S. chrsyœa.* They lay, as with that bird, from two to four eggs, three being the number most often found. Fourteen eggs average ·61″ × ·47″. They have the same glossy white surface with close hard texture as have the eggs of the last species.

(65) STACHYRIDOPSIS RUFICEPS.—The Red-headed Babbler.

Oates, No. 172 ; *Hume, No.* 393.

Fairly common everywhere, more especially to the north-west of these hills, where I get many nests yearly. I have one very handsome clutch of eggs of this species ; the ground is, of course, pearly white, as are all others, and the markings consist of largish, boldly-defined blotches of deep reddish-brown, together with one or two of pale purplish, forming a well-marked ring near the big end. A clutch that contrasts very strongly with the last is one which is very feebly marked with pale pinkish and greyish-pink. This last type, only less feebly marked, is the one which is most common. Nearly all my eggs are broad ovals, very little smaller at one end than at the other. 48 eggs average ·63″ × ·52″. They vary from ·59″ to ·66″ in length and from ·49″ to ·54″ in breadth.

(66) S. RUFIFRONS.—Hume's Babbler.

Oates, No. 173 ; *Hume, No.* 393 *Bis.*

DESCRIPTION.—Differs from *S. ruficeps* in the following particulars : The chestnut of the head only extends to the back of the crown, where it merges into the olive-brown of the nape and back ; the lower parts

are more a dull oily fulvous or fulvous-grey than oily yellow as in *S. ruficeps*, and the flanks and thighs are strongly tinged with brownish. Immature birds have the chestnut crown duller, but in other respects are like the adult.

I cannot discern the slightest difference between the sexes, but I must own that I have seen very few specimens; indeed only five females and six males in addition to one nest of fully-fledged young which were able to fly.

Captain Bingham states (*vide* Oates) that the hen has the chestnut of the head duller.

Bill slaty blue; irides reddish-brown; legs yellowish-brown, very pale. Length 4·4″ to 4·5″; tail 1·9″; wing 2″ or rather more; tarsus ·7″; bill at front ·35″, and from gape ·55.″

The female is slightly smaller; the three I have measured were 4·3″, 4·2″, and 4·2″ in length, tail 1·7″, 1·8″; wing 1·9″ barely.

Nidification.—I regret to say that I never noticed this bird till 1889, when I had a nest with a male brought to me. It was, as usual, formed outwardly of grass and was lined with some light-coloured, fibrous material mixed with the fine ends of grass. In shape it was something like an egg placed on its large end, leaning slightly to one side, and with the small end cut off. It was 5·7″ in length and 4·2″ in breadth; inside the diameter was 2·1″.

In 1890 I took three nests; of these, two were of the ordinary globular shape, and the third was as described above.

The nest taken in 1889 was built in amongst the roots of a bamboo clump, two in between bamboos and the masses of twigs with which they were covered, one at about 4 feet, the other at about 6 feet from the ground. The fourth nest was taken from a bush, fairly thick and well covered with leaves; it was wedged in between several twigs, and was quite screened from view until a careful search had been made. It was rather less than two feet from the ground.

In shape, coloration and texture the eggs do not in any way differ from those of *S. ruficeps*. In the ten eggs I have all are regular obtuse ovals, there being no abnormal specimens. Strange to say, although the bird itself is distinctly smaller than the last, the eggs on the contrary are rather larger, those I have averaging ·64″ by ·53″. They vary

extremely little in size, in length between ·62″ and ·66″, and in breadth from ·50″ to ·55″. I have no specimens with bright reddish spots, all being of the paler type.

The nests were taken on the following dates :—29th April, 1890, female, three eggs quite fresh ; 19th May, 1890, female, four eggs slightly incubated ; 25th May, 1890, male, two eggs fresh. The eggs of the second nest have not been included in the average given above.

A nest with four fully-fledged young were brought to me on the 21st of May, 1890. In habits I do not know of any trait that it exhibits which is unlike *S. ruficeps*. It is much rarer and I think also more shy in its habits. As I have only observed it during the breeding season, it has always been in low scrub or bamboo jungle. At other times it is sure to feed, like others of this genus, on trees.

(67) Mixornis rubricapillus.—The Yellow-breasted Babbler.

Oates, No. 176 ; *Hume, No.* 395.

This bird sometimes lays unspotted white eggs. I have once taken a nest myself with such eggs, and on another occasion I took three eggs, which were so faintly marked that it was difficult to make the specks out at all. Another nest, with three white eggs, was also sent me in 1891 from Jellalpur by Mr. H. A. Hole. The hen-bird was also sent with the eggs, and there could have been no mistake about their identity. I have observed this bird feeding on the ground in the bamboo jungle, and, though it is the only time I have seen it so feeding, it is sufficient to prove that it does do so now and then. I have far more often noticed it in bamboo jungle than in tree forest. It does not seem to ascend the hills to any height, and I have not often met with it over two thousand feet, it being most common quite at the foot of the mountains or on the very low grass and bamboo-covered hills.

(68) Schœniparus mandelli.—Mandelli's Tit Babbler.

Oates, No. 179 ; *Hume, No.* 622.

This handsome little bird is not uncommon in the east of the North Cachar Hills, and what I have observed of its habits agrees with Hume's remarks on the subject. I have found about a dozen nests, all placed on the ground, amongst the roots of herbaceous plants with the exception of two, which were placed amongst ekra and were from

4 to 6 inches off the earth itself. The materials were principally dead leaves, and the description I have already given of the nest of *Corythocichla striata* would stand equally well for these; but they are on the whole, perhaps, rather more bulky. The full complement of eggs is, I think, four, but I have taken one or two nests with only three eggs and one with only two, all of which showed signs of incubation. They are in appearance the same as the eggs of *S. dubius* described by Davison (Hume's Nest and Eggs, vol. I, p. 117). The ground-colour is white with, in some eggs, a faint brownish or greenish tinge, and they are marked much in the same manner as many eggs of *Pyctorhis sinensis*. There are numerous clouds and smudges of pale vandyke-brown, and a few coarse marks and irregular lines of a dark shade of the same, beside which there are usually a good many secondary marks of pale neutral tint confined chiefly to the larger end. The surface is very fine and close, and the shell strong, often with a slight gloss. In shape they differ from those described of *S. dubius*, for they are very regular ovals, the difference between the two ends being sometimes hardly perceptible and seldom very distinct. Twenty eggs average ·83″ × ·61″. They breed in the latter end of April, May, and June.

(69) S. RUFIGULARIS.—The Red-throated Tit Babbler.

Oates, No. 180; *Hume, No.* 618 *Bis.*

I shot a male of this species in May, 1891, just on the borders of Manipur.

(70) SITTIPARUS CINEREUS.—The Dusky-green Tit Babbler.

Oates, No. 181; *Hume, No.* 620.

Legs fleshy brown or reddish; irides reddish-brown. A rare little bird, which I have only found in the Laisung Valley and at Hungrum, generally feeding in scrub jungle. Mr. Hole has also two or three specimens in his collection which he obtained at the foot of the hills in low brushwood. They go about in small parties and are very active and quick, but are very shy, moving away at once at the sound of anybody approaching them.

I have taken two nests, which were simply miniatures of those of *Schœniparus;* both were placed amongst the roots of thick plants, but not actually on the ground itself. In one nest the three eggs were ready to hatch; in the other there were also three, but so hard set that it was with

difficulty I managed to save two out of them. The eggs bear no resemblance in any one detail to those of *S. dubius;* they are white, tinged with the palest dusky green, and are marked with tiny dots and specks of brown and neutral tint, which form a very distinct ring at the larger end, being very sparsely scattered over the rest of the surface. Some of the marks are so dark as to appear almost black. In shape the eggs are rather long ovals, decidedly compressed towards the smaller end, which is blunt. The surface is fine and close, and in one egg has a faint gloss.

The two eggs measure ·69″ × ·5″ and ·71″ × ·49″. The nests were taken on the 29th April and the 5th May, 1891.

(71) SITTIPARUS CASTANICEPS.—The Chestnut-headed Tit Babbler.
Oates, No. 182 ; *Hume, No.* 619.

Very rare. I have only met with it twice in six years.

(72) LIOPARUS CHRYSÆUS.—The Golden-breasted Tit Babbler.

I shot a typical hen of this species on the Jennam River in 1888.

(73) TURDINULUS ROBERTI.—Robert's Babbler.
Oates, No. 186 ; *Hume, No.* 332 *Bis.*

A rather rare bird everywhere. I have seen a specimen shot in the cold weather in the plains and have taken a good many specimens myself in these hills.

(74) MYIOPHONEUS TEMMINCKI.—The Himalayan Whistling Thrush.
Oates, No. 187 ; *Hume, No.* 343.

Common everywhere near water. I have one clutch of eggs of this bird marked just like many of *Geocichla citrina.* The site selected for the nest varies far more than would be thought from Oates' remarks on the subject. It is, however, always built near water, most of them actually on the bank, but sometimes, where the evergreen wood is moist, cool, and shady, it may be placed some hundred yards away from the stream. A very favourite place is a hole in the bank of some deep nullah running through evergreen forest, and it was in such a position I took my first nest. It was placed in a natural hollow formed by the massive and twisted roots of a large tree, being perfectly concealed from view except from the bottom of the nullah, and even thence visible only from exactly opposite. The

internal cup was large and deep, but externally there was no exact shape, the nest being so formed as to fill up the whole lower portion of the cavity, and the outer side was alone neatly finished off; in this the breadth was all but two inches, whilst the back wall must have been fully five and the two sides nearly as much. The cup was 4·8″ in diameter and 4·1″ in depth. An immense amount of material had been used, and as the moss was all wet and mixed with a great deal of earth, the weight also was very great. The base, back, sides and outer wall were composed outwardly entirely of moss with the roots attached; the root ends with the wet earth were placed downwards and inwards; thus the visible portion of the nest was all bright green moss; inside this outer layer was another, about an inch thick, of muddy fern and moss roots, and inside this again the true lining of clean dead moss alone. Other nests I have taken from the banks of rocky streams; they may be either placed in depressions in mossy banks and be quite concealed from view by the waving bracken and luxuriant moss ferns, or they may be in bare patches and resting on ledges of rock visible to, though almost unobtainable by, every passer-by; sometimes, again, they are built in holes and hollows over a foot deep. Once I took a nest from under a large slab of rock in a gloomy ravine, over which the water was constantly running, falling with a splash into a little pool some four feet below it, sprinkling the nest and the young birds with the spray. The damp, however, did not seen to effect their spirits, for I found them out by the great chirping that was being carried on between them, and it is evident that thrushes do not suffer from rheumatism and colds.

One nest I took in 1889 was built on a dead stump, up which was growing a mass of creeping plants. The nest was completely hidden by the overhanging leaves, and I should never have found it but for the parent-bird flying off just as I passed. It was about 3½ feet from the ground and rested partly on the tangle of creeper stems and partly on the stump. In shape it was a deep cup, broader at the base than at the top; this nest was lined with grass and had also a few leaves, both in the inside and woven into the outer part as well. There was also less earth than usual, and altogether it was a lighter-built nest than are 19 out of 20. The walls at the top were about 1·3″ thick and the base about 3″.

Another nest which I found in March, 1890, was built under the "chung" (*raised bamboo floor*) of a rest-house and was placed in between three of the piles. The birds had only just commenced work, and during the ten days that I occupied the house they kept on their building operations, though making the very smallest modicum of exertion to get it finished, for when I left it was still hardly half completed.

(75) M. EUGENII.—The Burmese Whistling Thrush.

Oates, No. 187; *Hume, No.* 343 *Bis.*

Only very rarely met with towards the extreme south-east. A bird sent me by Mr. H. A Hole appears to a hybrid between *M. temmincki* and *M. eugenii.* There are but two spots on the wing coverts on one side and none on the other, the bill is unusually large for *M. temmincki,* but has the black colour normally developed.

(76) M. HORSFIELDII.—The Malabar Whistling Thrush.

Oates, No. 187 ; *Hume, No.* 342.

Specimens of this bird are found only in the Jatinga Valley and are, I believe (from information received a year ago), merely the descendants of two pairs of Whistling Thrushes, which were brought up from Travancore by a lady and released from captivity on her leaving the district. I have seen none during the last two years, and they have, I fear, died out.

(77) LARVIVORA BRUNNEA.—The Indian Blue Chat.

Oates, No. 191 ; *Hume, No.* 507.

Rare everywhere, but a permanent resident wherever found, except in the lowest valleys.

(78) DRYMOICHARES CRURALIS.—The White-browed Shortwing.

Oates, No. 197 ; *Hume, No.* 388.

Occurs from the level of the plains up to the highest peaks, but does not breed below 2,500 feet. My eggs all agree in description with those of Hodgson and Mandelli, but the only three nests I have seen were very deep cups made of moss, bound together with roots and a few fine grasses and thickly lined with black fern roots, over which were placed a layer or two of dead leaves.

(79) D. NEPALENSIS.—The Nepal Shortwing.

Oates, No. 198 ; *Hume, No.* 336.

By no means rare to the north-east on the higher peaks. My eggs vary a good deal in colour between rather bright olive-green and olive-

brown, some being more or less stippled and clouded with darker shades of the same, the stipplings being so fine that the eggs appear to be of one uniform colour.

(80) TESIA CYANOVENTRIS.—The Slaty-bellied Short-wing.
Oates, No. 201 ; *Hume, No.* 328.

Fairly common at Hungrum and the higher peaks surrounding that place, descending to the plains in the cold season. I have taken some half dozen nests of this bird, and they agreed well with the description given by Hodgson (Hume's Nests and Eggs, vol. I, p. 131), but were much smaller, measuring only about 5″ in diameter. My eggs too are all of a long oval, often considerably pointed at the smaller end. The markings, which are everywhere very numerous, vary between light pinky-red to dark clear red, always very bright, whatever the tint; 16 eggs average ·70″ × ·59″.

Sub-family *Sibiinæ*.

(81) LIOPTILA ANNECTENS.—Blyth's Sibia.
Oates, No. 208 ; *Hume, No.* 613.

This is the form of *sibia* most often met with in North Cachar, but at the same time is far from common. Hitherto I have only met with it to the east of the Guilong stockade down as far south as the range of hills dividing the Jenam and Jiri Rivers.

It breeds at Hungrum and the surrounding peaks above 5,000 feet, seldom lower. The nests I have seen have all been rather bulky deep cups composed outwardly of moss and moss roots with perhaps one or two scraps of grass or a leaf or two. The lining seems invariably to be in two parts—the innermost of fine fern and moss roots alone, the intermediate portion between the true lining and the nest being of shreds of grass more or less mixed with roots and herbaceous stems, the latter not always present. Unlike its near allies, *S. capistrata*, *L. pulchella*, etc., this bird does not select very lofty situations for its nest. As a rule I have taken them from the upper portions of saplings, the branch on which they are placed being usually a slender one towards the outside of the tree and therefore difficult of access. Little, if any, trouble is taken to conceal them, and, even if not noticed at once, the excited movements of the parent-birds are sure to attract attention. The tree selected is one

in fairly thick or evergreen forest; never I think, one in open country. The full complement of eggs is three, and less than this number I have never taken showing signs of incubation.

In general appearance the eggs are hardly distinguishable from the paler type of egg of *Actinodura egertoni*. The ground-colour is a bright, pale green-blue, and the marks consist of pale reddish-brown lines and a few blots, blotches and specks of the same. The lines are of considerable length, sometimes nearly $\frac{3}{4}$″, or even more, and are very irregular in shape. In most eggs there are also a few marks of purply-red, consisting principally of well-defined dots and also a few blurred, half-washed-out-looking blotches. In a few eggs there are less numerous lines than there are spots and blotches, but the former are never altogether absent and are usually the most numerous kind of marking.

Twelve eggs average ·87″ × ·59″, and they vary between ·85″ and ·89″ in length, and between ·58″ and ·61″ in breadth. Some eggs are not unlike weakly-marked specimens of the eggs of *Mesia argentauris*. I know absolutely nothing concerning the habits of this bird beyond the fact that it is not found much below 3,500 feet, and frequents fairly thick evergreen forest.

(82) L. PULCHELLA.—The Beautiful Sibia.

Oates, No. 210 ; *Hume, No.* 429 *Ter.*

Recorded from North Cachar by Godwin-Austen.

(83) ACTINODURA EGERTONI.—The Rufous Barwing.

Oates, No. 211 ; *Hume, No.* 427.

The middle tail feathers very distinctly barred ; fairly common between 4,000 and 5,000 feet and upwards ; rare below this height. It is very local in its distribution. My eggs are of two types—one like those obtained by Gammie and Mandelli and the other more like those of *Trochalopterum phœnicium*, the markings being far darker than in those obtained by the above collectors, mostly of a deep purply-brown or blackish as regards the coarser lines and blotches, the numerous hair-like lines being of a brighter shade. This latter type is much less smudgy also than the other. Eighteen eggs average 86″ by ·78″. They vary very considerably in size, the largest measuring 93″ × ·74″, and the smallest ·82″ × ·64″. Most of my eggs are broad ovals.

(84) Ixops daflaensis.—Austen Barwing.

Oates, No. 214 ; *Hume, No.* 428 *Bis.*

I got a single specimen of this bird at Shemkher on the borders of the Naga Hills.

(85) Staphidia castaneiceps.—The Chestnut-headed Staphidia.

Oates, No. 216 ; *Hume, No.* 624 *Bis.*

Forehead grey ; the feathers centred dark brown ; anterior crown dark rufescent-brown ; remainder brighter rufescent, almost chestnut ; nape grey ; upper back, scapulars, and upper tail-coverts greenish-grey with pale shafts ; lower back and rump grey, obsoletely tipped greenish-grey ; tail brown ; the third pair of feathers obsoletely tipped white, this white gradually increasing in extent until on the outermost pair it is about 5″ deep ; lores and a short supercilium white ; ear-coverts chestnut with white shafts ; chin, cheeks and lower plumage white, more or less suffused with grey and to a less extent with fulvous ; under tail-coverts brown, broadly tipped with white ; lesser and median wing-coverts like the scapularies ; greater coverts and inner secondaries a more decided brown and with white shafts ; other quills brown, very narrowly edged with grey.

Bill rather light reddish horny, gape and base of both mandibles slightly purplish ; after death the whole bill becomes brownish horny ; legs dull reddish or flesh-colour; claws dusky flesh-colour ; irides pale hazel.

Male.—Length 5·3″ ; wing 2·5″ ; tail 2·3″ ; bill at front ·31″ ; and from gape ·51″ ; tarsus ·55″.

The females seem to be slightly smaller ; length barely over 5″ ; wing 2·4″ ; tail 2·1″ to 2·2″ ; bill at front ·3″ and from gape ·5″ ; tarsus ·63″.

Nidification.—Until 1891 I had only taken one nest of this bird which contained eggs. It was found on the 11th July, 1890, and was taken from a high bank running parallel with, and only a short distance from, the road, where it was placed against, and partly under, a large clod of earth lying amongst the thick roots of a laurel-like shrub. The greater portion of the nest was composed of the very softest shreds of sun grass and a few scraps of equally soft bark. The outer side of the nest, where not touching the clod or roots, was more

massive and was wound round with the dead brown stems of some jungle plant, fern roots, a few very fine tendrils and one or two small leaves, all further strengthened by a few cobwebs. The lining is of the same grass as the rest of the nest, with the addition of half-a-dozen tiny feathers. In shape the nest is a compact little cup; the internal dimensions are about 2·2″ in diameter by rather over one inch in depth; externally the nest is about 1·6″ in depth and in breadth across the narrower way 3·8″, or across it, so as to include the outer side, 4·4″. The jungle in which it was found was composed of mixed clump bamboos and trees, with a scanty undergrowth of bracken and shrubs. In 1891 on the 20th April I found another nest which was placed in a low road-side bank. The place was absolutely devoid of all vegetation, and the nest could be seen from some ten paces distant in both directions. As it was empty, it was not disturbed or measured. On the 23rd I took another nest containing a single egg. In this case also it was placed in a hole about a foot deep or rather less, just below the top of a perpendicular mud wall by a pathway; there was no attempt at concealment, and the nest could not have been overlooked. Of these two nests, one was found at about 2,300 feet elevation and the other at about 4,000 feet. The nests are both like that already described, but there are no feathers in the lining of either. The nest taken in 1890 was found quite close to where the one on the 20th April was obtained. A third nest, found on the 25th, was placed in exactly the same position as the others, namely, in a hole in a bare road-side bank, but differed in being made solely of grass and in being slightly smaller. The dimensions are internally 2″ in diameter by ·9″ in depth or rather less. Since the last date I have taken more than a dozen nests, all of which were got whilst marching from one camp to another, being placed in holes by the road-side, and in shape, materials, etc., agreeing with those already described.

The first-mentioned nest contained three eggs, perfectly fresh, in colour a pure white rather profusely spotted and speckled with different shades of brown, principally of a rather light sienna; here and there are also a few minute blotches of a greyish colour, and in one egg there is also a dark hair-like mark, about ·2″ long, on the larger end. In one egg the markings tend to form an indis-

tinct ring ; in the other two they are most numerous at the extreme end of the larger half. In all three eggs they are very sparsely scattered towards the smaller end. There is a very slight but appreciable gloss on the eggs ; the texture is close and smooth and the shell extremely fragile. In shape they are broad ovals and very obtuse. They measure ·65″ × ·52″, ·66″ × ·52″, and ·67″ × ·51″. The single egg in the second nest found in 1891 differs slightly from those found in the previous year in being somewhat more darkly marked ; the size is ·68″ × ·56″.

The last described nest contained three eggs ; the ground-colour is the same—pearly white—but the markings are more of a vandyke shade than sienna as in the others. They are also more numerous, and there are many smudgy indistinct streaks as well as blotches and speckles. The secondary marks are entirely absent in this clutch. They measure ·67″ × ·5″, ·68″ × ·5″, ·66″ × ·51″. In addition to these I have 42 other eggs which, as far as the markings go, agree with one or other of the descriptions given above ; but the ground-colour in four clutches is of a very faint yet decided greenish tinge, and in one other clutch it is slightly greyish. In many of the eggs the markings are very equally distributed throughout and show no tendency to form either ring or cap. Amongst the 49 eggs there is no variation in form and but little in size. The average of 30 eggs is ·67″ × ·52″ or slightly less.

Their breeding time seems to extend over a considerable period, for, as may be seen by the dates given above, I have taken their eggs as early as the 25th April and as late as the 11th July. I also found a nest with fully-fledged young on the 29th of April. This pretty little bird is found all over these hills above 2,000 feet ; rarely, I believe, below that height. It is nowhere common, but may be most often observed between 2,500 and 3,000 feet. It keeps much to the tops of the taller shrubs and young saplings, neither ascending to the tops of bigger trees nor frequenting the very low scrub. Throughout the cold weather, up to April or May, it collects in small flocks, the members of which always keep very close together. It is an extremely active little bird, assuming all sorts of postures when engaged in clambering up and down the branches in its search for food, and is most tit-like in

its actions when so employed. On the wing it is not nearly so strong, and it seldom indulges in a flight of any length. It is not at all a shy bird and may be watched from a distance of some twenty paces without any fear of driving it away. Should it at last become frightened, it will descend lower amongst the jungle and hastily make its way deeper into it by flitting and scrambling from twig to twig and branch to branch. Its ordinary note is a rather loud chir-chit, chir-chit, repeated two or three times ; besides this it has a musical double note that can *almost* be called a whistle. Neither of these sounds are often uttered, and sometimes for several minutes together not a bird in the flock will utter a single note. There is a species of small tree to be found here, which is nearly always much infested with green *Aphidæ* ; and where there are many of these trees about, a flock of these birds may generally be met with, specimens that I have shot in such places always being full of the insects. Another favourite food is the larvæ of the common locust. I have also on two occasions taken some very hard black seeds from their stomachs, which are in size and appearance very similiar to mustard seed, but are much harder.

(86) Siva cyanuroptera.—The Blue-winged Siva.

Oates, No. 221 ; *Hume, No.* 617.

During the breeding season this bird is only found on the very highest peaks, descending to about 4,000 feet in the cold weather ; more rarely as low even as 2,000. It is a common bird here.

(87) Yuhina nigrimentum.—The Black-chinned Yuhina.

Oates, No. 225 ; *Hume, No.* 628.

I obtained this bird at Guilang this year, 1893, and also took its nest. This is a pendant cradle-like structure made almost entirely of moss-roots and attached to the moss or lichen on the under part of a bough.

The eggs are pale greenish marked with specks of pale brown, and Oates was quite correct in thinking they would prove not to be plain white.

(88) Zosterops palebrosa.—The Indian White-eye.

Oates, No. 228 ; *Hume, No.* 631.

Common to the west and north, meeting and being equally common with the next species in the centre and almost entirely replaced by it to the east and south.

(89) Z. SIMPLEX.—Swinhoe's White-eye.

Oates, No. 228 ; *Hume, No.* 681 *B.*

The common form to the south and south-east. The numerous nests and eggs I have taken differ in no way from those of *Z. palebrosa*, nor does its habits call for any remark.

(90) IXULUS OCCIPITALIS.—The Chestnut-headed Ixulus.

Oates, No. 231 ; *Hume, No.* 624.

Very rare. I have seen only two specimens.

(91) I. FLAVICOLLIS.—The Yellow-naped Ixulus.

Oates, No. 232 ; *Hume, No.* 623.

All my nests, with two doubtful exceptions, have been taken from the ground. The eggs are, as Oates says, just like rather densely-marked eggs of *Hirundo rustica*, but I think they are more brightly marked on the whole.

(92) HERPORNIS XANTHOLEUCA.—The White-bellied Herpornis.

A very rare bird in North Cachar. I have only seen it about half a dozen times, and on these occasions it was always in small flocks, and engaged in the busy pursuit of insects on the higher branches of lofty trees. I have only observed it on the outskirts of tree-forest. I do not remember ever hearing their notes, and they seem very silent birds.

Sub-family *Liotrichinæ.*

(93) LIOTHRIX LUTEA.—The Red-billed Liothrix.

Oates, No. 235 ; *Hume, No.* 614.

Fairly common on some of the higher peaks.

(94) CUTIA NEPALENSIS.—The Nepal Cutia.

Oates, No. 236 ; *Hume, No.* 612.

I have seen this bird during the cold weather, on two or three occasions, towards the north-west of the district, haunting the tops of the oak trees which are the principal timber in that part. The elevation of the highest peaks in this direction is under three thousand feet.

(95) PETRUTHIUS ERYTHOPTERUS.—The Red-winged Shrike-Tit.

Oates, No. 237 ; *Hume, No.* 609.

Not uncommon at about 3,500 feet upwards, but seldom appears to come down below this height. These birds are very shrike-like in all

their ways and manners, even more so than in their general appearance.

(96) P. MELANOTIS.—The Chestnut-throated Shrike-Tit.

Oates, No. 239 ; *Hume, No.* 611.

A very rare bird here, only found in the loftiest peaks round about Hungrum, ranging from 5,500 feet upwards.

(97) ÆGITHINA TYPHIA.—The Common Iora.

Oates, No. 243 ; *Hume, Nos.* 467-8.

A very common bird indeed. I may mention that all the eggs I have ever seen of this species have been marked with grey more or less tinged with brown, and sometimes also, but not often, one or two small marks of reddish. I have never yet seen an egg marked *only* with brown and reddish-brown, as described by Oates.

(98) CHLOROPSIS AURIFRONS.—The Gold-fronted Chloropsis.

Oates, No. 247 ; *Hume, No.* 465.

I shall make no remarks on this genus here, as I included it amongst the bulbuls of North Cachar, on which birds I have written an article which has appeared in the Bombay Society's Journal.

(99) C. HARDIWICKII.—The Orange-bellied Chloropsis.

Oates, No. 249 ; *Hume, No.* 460.

(100) C. CHLOROCEPHALA.—The Burmese Chloropsis.

Oates, No. 250 ; *Hume, No.* 463 *Bis.*

(101) C. JERDONI.—Jerdon's Chloropsis.

Oates, No. 252 ; *Hume, No.* 463.

(102) IRENE PUELLA.—The Fairy Blue Bird.

Oates, No. 254 ; *Hume, No.* 469.

This bird does not appear to ascend the hills of the north-east above 2,000 feet, and is most often met with very low down or actually in the plains themselves. I have never noticed it in parties, nor have I ever seen a single bird ; they seem always to keep in pairs. It breeds only, I believe, in evergreen forest, and generally near some small stream or other piece of water.

(103) MELANOCHLORA SULTANEA.—The Sultan Tit.

Oates, No. 255 ; *Hume, No.* 650.

This is another genus which, I think, has been taken from its former position (amongst the *Parinæ*) without good cause, and has been

chucked in amongst the *Liotrichinæ*, because Oates was at a loss where else to put it.

On the 17th May, 1890, I was fortunate enough to take a nest of this bird. I was out at the time after gaur and was going through thinly-scattered oak forest with an undergrowth of young sun grass. Whilst resting for a few minutes under a tree, I noticed a male of this species on a tree opposite carrying something in his mouth; presently he flew to a tree about a dozen paces away, and promptly disappeared into a long crevice which ran down one of the main boughs. Sending a man up to investigate, both male and female flew away, and to my delight the man announced that there was a nest with seven eggs.

Both nest and eggs were brought down for my examination. The former was a thick pad of very fine scraps of moss, compressed down until it formed an almost solid mass, in depth about 4″ and about the same in diameter at the top, whence it gradually narrowed to a point in shape the same as the hollow in which it was placed. The depression in which the eggs were laid was about 3″ in diameter by hardly ½″ deep, and this was almost filled with soft cotton down.

The eggs are exactly like those of *Maclolophus spilonotus*, differing only in size. The ground-colour is a chalky-white, and the whole surface is thickly scattered with brownish-red spots of a bold character, others underlying of a pinkish-grey and light neutral tint. The markings are more numerous towards the larger end, but do not form a cap or ring. I have eggs of *Sitta frontalis* very closely resembling these eggs, but of course much smaller. Of the seven eggs, I only managed to blow five as they were very hard set. From two eggs the young were already emerging, and these I broke in trying to clean. Three others were cleaned with a good deal of trouble, and two, which were much less hard set than the others, were blown fairly easily. In shape they are a broad regular oval, very little compressed towards the smaller end. In size the five eggs average ·76″ × ·6″.

Another clutch of eggs was brought to me, which were said to belong to this bird and were exactly like those already described, but were much larger, measuring about ·83″ × ·65″. They were, however, so damaged in addition to being hard set that it was impossible to preserve them and difficult even to measure very correctly.

I have found this bird both in the evergreen forest of some of the lower, warmer valleys, and also in the open oak forest to the north-east of the district. In its habits and actions it is essentially tit-like, but perhaps less active than the majority of these birds.

(104) MESIA ARGENTAURIS.—The Silver-eared Mesia.

Oates, No. 257 ; *Hume, No.* 615.

Very common everywhere over 3,000 feet.

(105) MINLA IGITINETA.—The Red-tailed Minla.

Oates, No. 258 ; *Hume, No.* 618.

I once met with a large flock of these birds hunting for insects on the high bushes and small saplings beside a road at an elevation of some 4,000 feet. They did not seem to visit the higher trees at all, but kept low down below 20 feet or so. They were not at all shy, and several of them came again and again within a few feet of me, so that, though I had no gun with which to obtain a specimen, I had not the slightest difficulty in identifying them. They continued to flit along the sides of the bushes in front of me for some two or three hundred yards, uttering a continuous twittering chirp.

(106) PSAROGLOSSA SPILOPTERA.—The Spotted-wing.

Oates, No. 261 ; *Hume, No.* 691.

This bird is common everywhere during the cold season, but appears to retire to the hills from 3,000 feet upwards during the breeding season.

Oates says that neither its structure, its habits, nor the colour of its eggs show any affinities with the *Sturnidæ*. I should have described its habits as being exactly the same as *Sturnia malabarica*, and its nest as being undistinguishable from that of that bird—that is to say, it makes a rough pad of straw, grasses and a few feathers in a natural hole in a tree. Its eggs are nearer to Oates' *Eulabetidæ* than to the *Sturnidæ*.

It is curious that none of the modern ornithologists seem to have mentioned one of the most distinctive characteristics of the male bird's plumage, *viz.*, the remarkably lengthened plumes at the base of the outer secondary quill feathers of the wing. For a distance of about ·75″ to ·90″ from the base the plumes of the feathers are much lengthened on the outer webs, forming a most distinct fluffy patch on this part of the wing. This feature is not present in the wing of the female.

Some of the notes of this bird are peculiarly like the conversational notes of *Molpastes burmanicus*, the Burmese Red-vented Bulbul. It also has a loud clear whistle of the same style as, but softer and much less loud than, the usual call of *Eulabes intermedia*, the Indian Grackle.

The females I have shot measure much smaller than the males. The average of 8 females is as follows :—Length, 7″ barely ; wing, 3·8″ to 3·9″ ; tail, 2·2″ to 2·3″.

Sub-Family *Brachypodinæ*.

(107) CRINIGER FLAVEOLUS.—The White-throated Bulbul.
Oates, No. 263 ; *Hume, No.* 451.

(108) HYPSIPETES PSAROIDES.—The Himalayan Black Bulbul.
Oates, No. 269 ; *Hume, No.* 444.

(109) H. CONCOLOR.—The Burmese Black Bulbul.
Oates, No. 270 ; *Hume, No.* 448.

(110) HEMIXUS FLAVALA.—The Brown-eared Bulbul.
Oates, No. 272 ; *Hume, No.* 448.

(111) H. MACCLELLANDI.—The Rufous-bellied Bulbul.
Oates, No. 275 ; *Hume, No.* 447.

(112) ALUCURUS STRIATUS.—The Striated Green Bulbul.
Oates, No. 277 ; *Hume, No.* 449.

(113) MOLPASTES BURMANICUS.—The Burmese Red-vented Bulbul.
Oates, No. 279.

(114) M. BENGALENSIS.—The Bengal Red-vented Bulbul.
Oates, No. 282 ; *Hume, No.* 461.

(115) XANTHIXUS FLAVESCENS.—Blyth's Bulbul.
Oates, No. 287 ; *Hume, No.* 452 *Bis.*

(116) OTOCOMPSA EMERIA.—The Bengal Red-whiskered Bulbul.
Oates, No. 288 ; *Hume, No.* 460.

(117) O. FLAVIVENTRIS.—The Black-crested Yellow Bulbul.
Oates, No. 290 ; *Hume, No.* 456.

(118) SPIZIXUS CANIFRONS.—The Finch-billed Bulbul.
Oates, No. 292 ; *Hume, No.* 453 *Bis.*

(119) IOLE VIRESCENS.—The Olive Bulbul.
Oates, No. 296 ; *Hume, No.* 452 *Des.*

(120) MICROPUS MELANOCEPHALUS.—The Black-headed Bulbul.
Oates, No. 310 ; *Hume, No.* 457 *Bis.*

(121) M. CINEREIVENTRIS.—The Grey-bellied Bulbul.
Oates, No. 311 ; *Hume, No.* 457 *Quat.*

THE COMMON MARINE SHELLS OF THE BOMBAY SHORE.

By A. Abercrombie.

PART I.

(*Read before the Bombay Natural History Society on 6th Sept.*, 1893.)

In an article which appeared in the 7th Vol. of the 4th Series of "Memoirs and Proceedings of the Manchester Literary and Philosophical Society," a catalogue of about 320 species of the Marine Mollusca of Bombay is given; but local collectors not having all the advantages of museums and good books of reference cannot make much use of this article which is not descriptive, and the object of the present paper will be to give some little account of the families and species most common on our shore.

The descriptions attempted must necessarily be short, and they have been made from as perfect and full-sized specimens as I have been able to obtain. Collectors must be warned against attempting the identification of worn and bleached specimens, and there is also often great variation in the colour, shape, and size of different shells of the same species, so that too much exactness of description must not be looked for. Classification proper, of course, rests upon the animal and not upon his shell; but this part of the science is so intricate and so bristling with hard scientific terms that I leave it and content myself with an endeavour to deal with the shell alone. There are many shells all duly named and classified, the animal of which has never been seen, so that at least there is some excuse for the course I am taking, and if it simplifies the study to beginners, it may find some favour. But if we set aside the question of anatomy, there is at least the live animal to interest us; but here again, I am afraid, I must fail you. When observation is possible, that is at low tides, the animal is always at rest, and in confinement he does not thrive, at least not under the conditions that I have been able to offer him. He seems also to be impressed with the fact that his shell has been given him by nature for protection and to screen him from observation, and he takes care to act up to this belief. I kept various specimens alive for three to four months in a small tank; but what impressed me most about them was the surprising power they

exhibited of keeping on doing nothing ; for instance *Planaxis sulcatus* is a common little black shell, living on rocks at about $\frac{3}{4}$ tide mark, and he ought to be pretty hardy, considering the amount of heating he can stand at one time of the year and drenching with fresh water at another ; but in confinement I could make nothing of him. He would not condescend to stop in my tank, notwithstanding daily supplies of fresh salt water, syringings to aërate it, and surroundings in the shape of slimy stones, such as must have been familiar to him. He preferred, however, an adjoining deal box, on which he had climbed, and there he sat and brooded over his misfortunes till I returned him to his element as hopeless.

The univalves are both vegetable feeders and carnivorous, and they are armed with a long rasping tongue, composed of microscopically minute calcareous teeth. This tongue, in the case of the carnivori, and, as is thought by some authorities, with the aid of an acid they have the power of secreting, enables them to bore holes in the shells of bivalves and other members of their own species. An actual case of this boring happened under my own observation—a specimen of *Urosalpinx contracta* perforating the shell of *Semele cordiformis* (a bivalve) in about twenty-four hours.

The *Semele* had, as is the custom of most bivalves, embedded itself in some sand provided in my tank for that purpose, and how *Urosalpinx* got him on to the top of the sand I can only surmise ; but it was there that the boring operation took place.

This custom of retreating into the sand is no absolute protection to the bivalves from their enemies the univalves, as many of the latter regularly burrow in search of them, which is attested by the large quantity of bivalve shells found with a circular hole drilled through them. The animals of the *Natica* family, four to five of which are very common here, are specially adapted for this burrowing. They have a large and powerful foot or gliding surface ; they are blind or nearly so, and are provided in front of the head region with a sort of shield. Their shell is light, very smooth and round, and so offers little or no resistance to the pushings through the sand ; but *Urosalpinx* belongs to a family differing widely from this description. Most members of it are heavy shell-bearers, and their shells are rough and ridged, often with varices or fringes, and they frequent, as a rule, rocks or muddy stones,

but apparently they are not above attacking the bivalves when they come across their path. Now *Semele cordiformis*, as far as my observations go, is not one of the bivalves that burrow deeply into the sand, and if, as I suspect, the shell was barely immersed, the univalve on touching it whilst gliding along would easily prevent any further burrowing.

Any one who has attempted to remove or push aside the common limpet knows what adhesive or suctional power the animal has in his foot, and it must be this power that renders the bivalve helpless when once caught. I am unfortunately unable to give any account of the actual process of the boring, as *Urosalpinx* sat on the top of his prey and performed all his offensive actions under cover of his shell ; but the *Semele* was bored as stated and devoured, and those little scavengers—the hermit crabs, of which I had several in my tank—soon scented what was up and assisted at the feast.

Conchological books inform us that certain members of the snail tribe are provided, like spiders, with a viscous thread, by which they can let themselves down from the branches of trees, and it appears that some marine shells can draw themselves up by a similar means. I was fortunate enough to find a live specimen of, I believe, *Scalaria consors*, to which was attached by a thread a small sort of anchor consisting of several bits of shell agglutinated together. The shell is extremely light, and it seems reasonable to suppose that the animal having secured its anchorage would, or at any rate could, float in mid-ocean, and the shell being a dull white would not be readily seen in such a position.

As Mr. Phipson is reprinting, with the accompanying illustration, the descriptions by Mr. Melvill of twenty-five new species found here, I have not considered it necessary to refer to any of them in this article.

THE UNIVALVES OR *GASTEROPODA*.

The order I follow is that given in the article on the Mollusca in the Encyclopædia Britannica.

DIVISION I.—Shield shape or conical hollow shells with an oval base.

DIVISION II.—Shells, the mouth of which is generally circular or semi-circular and *not* produced into a canal at the base.

DIVISION III.—Shells, the mouth of which is produced into a canal at the base. The mouth is sometimes a sort of canal in itself. When

the canal is not very obvious, there is a deep sinus or cut into the base of the shell.

Division I.

In Division I. we have really only one common shell, the limpet (*Patella aster*, Reeve), but a so-called key-hole limpet, with a small hole at the apex of the shell (*Fissurella lima*, Sow.), is also to be found, and under muddy stones there lives a little animal with a shield-shaped shell (*Scutum unguis*, Linn.)

Division II.

TROCHIDÆ.

There are a great many members of this family, several very common, and they are best known by the nacreous (M. O. P.) construction of their shells, which may generally be seen by an examination of the mouth or by removing the outer or coloured layer of the shell.

Turbo elegans (Phil.).—A large shell having four to five whorls ; whorls rounded and ridged spirally ; brown with green and yellow shadings and mottlings ; mouth circular ; length, which I shall always take as from apex to base, about 2 inches ; breadth at the widest part of the last whorl, 1½ inches.

The next three are all pyramidal in shape, the whorls being outwardly flattish.

Trochus radiatus (Gmelin) and *Clanculus depictus* (A. Ad.).—Both very common, especially the former ; both are beaded, the beadings forming spiral bands running round the shell. *T. radiatus* is much the larger and easily recognised by the broad, red or maroon, irregular stripes running down the shell. Between the stripes the colour is greenish when alive, turning to yellow or whitish when dead. *C. depictus* is yellow or grey, with similar but black stripes. I have found some specimens a light yellow-grey colour, with no stripes. Others uniformly dark grey, but black stripes are the rule.

Astralium stellatum (Gmelin).—Whorls sharply noduled at intervals at the lower margin and diagonally striated ; colour, a dull yellow.

Euchelus indicus (A. Ad.).—A dull brown, smallish shell, very common ; whorls rounded with minute beadings, forming fine spiral lines ; mouth circular.

Rotella vestiaria (Lam.).—Is the little highly coloured shining shell, so common on the sandy beach. It is often pink. The spire is depressed, and in size it is smaller than a two-anna piece.

NERITIDÆ.

Smallish, thick, semi-oval shells ; mouth large, flat, and in shape like a capital D ; columella or central pillar of shell broad, flat, and sloping inwards.

Nerita oryzarum (Recluz).—Very common on half-tide rocks or under stones ; colour white and black mottled and streaked, sometimes with a tinge of rust ; last whorl envelops nearly the whole shell and is ridged ; shell polished.

Neritina crepidularia (Lam.).—Apex bent down towards mouth of shell ; colour white, with purple transverse bandings ; shell quite smooth ; frequents muddy places on the harbour side of the shore.

IANTHINIDÆ.

Ianthina communis (Lam.).—Is a very fragile and beautiful shell. The upper half of the whorls a delicate white purple ; the under or aperture side a deep purple. It is a floating shell, and only found when washed up after stormy weather. It also, I am told, has been procured in a very perfect state from fishermen's nets.

CERITHIIDÆ.

Cerithium morus (Lam.) and *Potamides* (*Tympanotonos*) *fluviatilis* (P. M.).—These two little shells live along with *Planaxis* at three-quarter tide mark, especially where there are muddy stones. The latter seems to belie its name, at any rate as far as Bombay is concerned. *C. morus* is a blackish, small and spiral shell, with sometimes a white band ; spirally striated and heavily beaded, and regularity of shape interrupted by varices or thickened ridges ; mouth—outer lip rounded and thickened, causing the varix as the growth of the shell is continued leaving the thickened part standing out ; about $\frac{1}{2}''$ to $\frac{3}{4}''$ long. *P. fluviatilis* is a slender pyramidal shell, about $\frac{3}{4}''$ to $1''$ long. Each whorl has three rows of spiral beadings ; mouth produced and flattish at the base ; last whorl often shows marked white and black spiral bandings and is smooth.

TURRITELLIDÆ.

Turritella duplicata (Lam.) is a massive tapering shell, having ten to fifteen or more whorls ; easily known by two parallel ridges

running spirally round the centre of each whorl ; colour, rusty yellow. A good specimen would be 5″ to 6″ long.

NATICIDÆ.

Shining, globular, thinnish shells, many of them of great beauty ; last whorl envelops greater part of shell ; mouth large and somewhat semi-circular or auriform. Shells are umbilicated, *i.e.*, the axis or columella round which the whorls are formed is more or less hollow.

Natica didyma (Bolten) attains a good size, yellow or fawn-coloured young shells and apex often with a leaden hue; easily known by a chocolate-coloured callosity nearly covering in the umbilicus, this callosity having a central groove running across it. I am indebted to Mr. E. A. Smith, of the British Museum, for the information that this shell is figured in Reeve's Conchologia as *Chemnitzii lamarckiana, petiveriana,* and *problematica.*

Natica lineata (Lam.).—White, with irregular, slanting, closely set stripes of reddish-brown colour running across the whorls of the shell ; umbilical area pure white.

Natica maculosa (Lam.).—A smaller and very common shell, with brown or purple spottings or streaks. When the shell is bleached these spots become reddish.

Natica rufa (Born.).—A plain, yellow-brown shell with a distinct band of white running spirally round centre of whorl ; base very white.

Mammilla zanzibarica (Recluz.).—A white, oblong, very thin shell, with a faint central band of colour on last whorl ; mouth very large and auriform ; umbilicus nearly covered in by a long purple or brown recurvement of shell.

CAPULIDÆ.

There is one specimen of this curious family which should be mentioned. It [*Ergœa walshi* (Herm.)] lives inside dead shells and adapts itself in shape to its situation like the oysters. It is most often a flat, white, oval shell, looking like a bivalve, but the inner side is porcellaneous, and has a protruding lip, which forms a cavity and, no doubt, serves to protect the vital parts of the animal.

PLANAXIDÆ AND LITTORINIDÆ.

The authority I am following does not seem to give the former

family a place by itself, and as the only member of it lives alongside the *Littorinidæ* I take them together.

Planaxis sulcatus (Born.) has been already spoken of. The shell is small, thick, dark, and smooth with light streakings, and is strongly spirally grooved ; whorls 4 to 5 ; columella flattened, and outer lip of mouth ridged inside.

Littorina ventricosa (Phil.) and *L. malaccana* (Phil.).—These are two minute shells to be found living on the boulders of our shore, even above the reach of all tides. *L. ventricosa* is *Natica* shaped, dull yellow or grey, with incised lines running spirally round the shell.

L. malaccana is black or dark grey, and easily known by the double row of white nodules round the centre of the whorls.

Division III.

STROMBIDÆ.

There is only one member of this family at all common, the *Rostellaria curta* (Sow). It is a long tapering shell of 5″ to 6″, smooth and shining ; colour yellow to brown ; outer lip of mouth flattened and toothed, and a long pointed canal at the base.

DOLIDÆ.

Dolium maculatum (Lam.).—The largest and perhaps handsomest shell we have, and sometimes bigger than a cricket ball. Last whorl nearly envelops the whole shell, and mouth very large ; colour white with a touch of purple-grey ; raised bands encircling the shell with brown interrupted blotches ; shell thin, polished, and somewhat transparent.

TRITONIDÆ.

Ranella tuberculata (Brod.).—Common and easily known by the two opposite varices or ridges running from apex to base, and giving the shell a flattened appearance ; whorls 7 to 8, spirally, tubercularly, ridged ; mouth rounded and canal distinct ; colour dull brown ; when dead reddish-yellow and shining.

CYPRÆIDÆ.—The Cowrees.

The shape of these shells is so well known as to need no description. All highly polished and rarely obtained as dead shells in a sufficiently perfect state for identification.

Cypræa arabica (Lam.).—About the size of a hen's egg ; easily known by a sort of hieroglyphic writing over the back, interspersed with white roundish blotchings.

Cypræa pallida (Gray).—Size of a sparrow's egg ; light grey-green ground, and finely speckled with brown dots, culminating frequently in a dark blotch on the back.

Cypræa ocellata (Lam.) and *Cypræa lamarckii* (Gray).—The size of a pigeon's egg. Former rich yellow ground, and covered with white spots, which are frequently pupilled like eyes. Latter greenish-yellow ground with larger white spots without pupils. An offshoot of this family, *Ovula spelta* (Linn.) is not very uncommon ; shell smooth, white, shining, and somewhat bow-shaped ; aperture long, narrow, and produced into a canal at both ends ; length $1\frac{1}{4}''$ to $1\frac{1}{2}''$.

CONIDÆ.—The Cones.

Three varieties of this very large family are common here, and the name describes their shape. The spire is very short or almost immersed ; shell tapering with a long narrow mouth widest at the base. The same species may vary much in colour and marking.

Conus monachus (L.).—The largest of the three ; ground-colour brownish, frequently much clouded, especially towards the centre, with gray-white streakings and blotches ; encircled with dark lines interrupted in the clouded parts.

Conus mutabilis (Chem.) is a uniform yellow, dark or light, and sometimes with encircling lines.

Conus lentiginosus (Reeve).—The smallest, sharp-pointed ; raised spire ; white with burnt yellow zigzag streakings.

PLEUROTOMIDÆ.

These are shells with a tall spire and a fusiform (tapering at both ends) shape. They have also—which is peculiar to the family—a notch in the outer lip of the mouth, near the body of the shell. There are several varieties, but only four are common.

Pleurotoma javana (L.) or *nodifera* (Lam.).—A dark fawn-coloured shell ; whorls angular and noduled at the angle, with whitish knobs ; below the angle strongly spirally striated ; length, $2''$ to $3''$.

Pleurotoma fulminata (Kiener).—Smooth, polished, white with rich yellow markings. A sort of spiral band formed by the upper part of each whorl overlapping its predecessor is a noticeable feature in the shell.

Pleurotoma atkinsonii (Smith), *crenularis* (Lam.).—Very common ; whitish, rough, with strong tubercles in the centre of each whorl, almost forming longitudinal ridges ; spirally striated. Young shells often have a brown or grey tinge. Length, $1\frac{1}{2}''$ to $2''$.

Pleurotoma amicta (Smith,) *cincta* (Lam.).—A white or dirty white chalky-looking shell with an even spire and regular spiral ridges ; length, $1\frac{1}{2}''$ to $2''$.

MURICIDÆ.

Murex adustus (Lam.).—A black, rather large shell, with large frill-like varices, which get quickly worn down in the dead shell. Each whorl has three of these varices running down the shell and raised humps between them ; mouth, small, oval ; canal produced and almost covered over ; general shape fusiform.

BUCCINIDÆ.

This family and the last are very closely connected, and there are many sub-divisions, which are not always placed under the same head by Conchological authorities. Any general or leading description of these shells is impossible.

The following are common shells on our sandy shores :—

Dipsaccus or *Eburna spirata* (Lam.) (the ivory shell).—It has a thick rough epidermis, beneath which the shell is quite smooth ; colour, yellow with large blotches, and zigzag streaks of white or *vice versa* ; whorls 7 to 8 ; upper edge sharp and sloping inwards, forming a sort of spiral gutter ; mouth porcellanous ; shape ovate ; spire rapidly diminishing.

Nassa nodifera (Powis) and *Nassa ornata* (Kiener).—Both these shells are polished and somewhat similar in shape, but the former is much larger. It is of a grey-green or yellowish hue, with an indistinct white band running round the last whorl ; whorls about 8, longitudinally ridged and slightly noduled at the upper part ; mouth rather broad at the base and sinus large ; length, $1\frac{1}{4}''$; breadth, $\frac{3}{4}''$. *N. ornata* is purple-brown with a very distinct white band round the last whorl ; base also whitish ; longitudinal ridges stronger and shell shorter and stouter ; length, $\frac{3}{4}''$; breadth, $\frac{1}{2}''$.

Cyllene fuscata (A. Ad.).—A beautiful little shell about $\frac{1}{2}''$ long, thick, spire sharply pointed and beaded ; last whorl enveloping greater

part of shell ; smooth or slightly ridged longitudinally ; mouth narrow, oval, dark, and ridged inside ; outer lip thickened ; sinus deeply cut back ; colour variable—whitish, grey tinged with yellow markings.

Bullia lineolata (Wood).—A smooth, shining, thin tapering shell ; whorls 7 to 8, grooved towards the base ; colour yellow with grey tinge, and more or less streaked with longitudinal brown lines ; mouth widest at the base, and sinus broad ; length, about $\frac{3}{4}''$, breadth, $\frac{3}{8}''$.

We now come to the *Purpuras*, which live chiefly amongst the boulders of our shore at low tide mark.

Purpura bufo (Lam.).—A thick, massive, large shell, generally encrusted with limey matter hiding marking and colour ; spire depressed, last whorl enveloping the whole shell nearly, and generally with swollen tubercles towards its centre ; mouth large and oval, with a narrow but deep sinus at the base ; shell coloured by encircling lines of brown. In young shells the colour is a dull yellow with fine encircling striations.

Purpura rudolfi (Lam.), *persica* (Linn.).—Also a large shell ; colour light to dark brown with encircling striations and darker raised bands, the upper ones being slightly noduled. The bands are blackish, interrupted with white oblong spots ; mouth very large ; outer lip serrate ; columella flattish and grooved towards the base. A good specimen would be three inches long.

Purpura carinifera (Lam.).—Smaller than the last ; very common ; colour light yellow to grey ; chiefly distinguishable by a double row of sharp, upward-pointed tubercles round the upper and middle part of the last whorl ; fine cancellated striations ; mouth orange-coloured inside ; length, $1\frac{3}{4}''$; breadth, $1\frac{1}{4}''$.

Purpura sacellum (Lam.).—Shell slightly fusiform. The upper part of the last whorl and the spire bear a resemblance in outline to a pagoda. This last whorl has rows of sharp scaly ridges. Colour yellow to brown ; mouth, white ; length, $1\frac{1}{4}''$.

Purpura tissoti (Petit).—A small shell $\frac{1}{2}''$ to $\frac{3}{4}''$ long, with a tallish spire, $4''$ to $5''$ broad encircling ridges on the last whorl with an intermediate narrow ridge ; ridges slightly tubercled and sometimes dark coloured.

(See Mr. Melvill's description and figuring of *Purpura blanfordi*.)

Tritonidea (*Cantharus*) *spiralis* (Gray).—Shell has a rough epidermis, beneath which it is smooth, white and with burnt markings; whorls about 7, strongly ribbed, 8 to 9 ribs on last whorl, 3 on upper ones; last whorl undulating, and looking down on to the apex; the shell is hexagonal in outline; mouth white and porcellanous.

Urosalpinx contracta (Reeve).—Fusiform, thick, about $1\frac{1}{4}''$ long and $\frac{3}{4}''$ broad; spire tall and spirally, closely striated; old shell, often chalk-white; young brown with dark bandings; upper whorls prominently tubercled, formed in the last into longitudinal ridges; mouth oval and canal distinct.

Ricinula (*Sistrum*) *tuberculata* (De-Blain).—A small but remarkably massive shell; easily known by the strong, dark, rounded tubercles standing out of a greyish ground; mouth purple-tinged, strongly toothed inside in the mature shell; length, $\frac{3}{4}''$; breadth, $\frac{1}{2}''$.

Columbella terpsichore (Leathes).—A small shining slightly fusiform shell; white or light yellow; longitudinally fluted; ridges brown coloured and shell figured with yellow markings; mouth narrow; spire sharp; length, $\frac{1}{2}''$ to $\frac{5}{8}''$; breadth, $\frac{1}{4}''$.

OLIVIDÆ.

Oliva nebulosa (Lam.).—One of the commonest shells on our sandy shore; cylindrical; sharp-pointed, shining, thick; mouth, long and narrow and widest at the base; colour, whitish-yellow with fading grey zigzag cloudings and a broad yellow encircling band near the base of the shell; length, $1''$ to $1\frac{1}{2}''$. When bleached, the markings become reddish.

There are two other shells fairly common here, which, though belonging to none of the families or divisions given, should be mentioned.

BULLIDÆ.

Haminea galba (Pease).—An extremely delicate little oval shell transparent white or yellow; aperture the full length of the last whorl, and broadening into an oval at the base; apex instead of being pointed is indented.

SCAPHOPODA.

Dentalium longitrorsum (Reeve).—A long slightly curved cylinder open at either end; shell white and shining; length, generally $1''$ to $2''$; resembles in miniature an elephant's tusk.

THE POISONOUS PLANTS OF BOMBAY.

By Surgeon-Major K. R. Kirtikar, I.M.S., F.L.S.

PART VI.

(*With Plate H.*)

(*Continued from page* 106.)

TERMINALIA BELLERICA.—(*Roxb.*)

(Natural Order—Combretaceæ.)

Marathi—BEHEDA बेहडा,

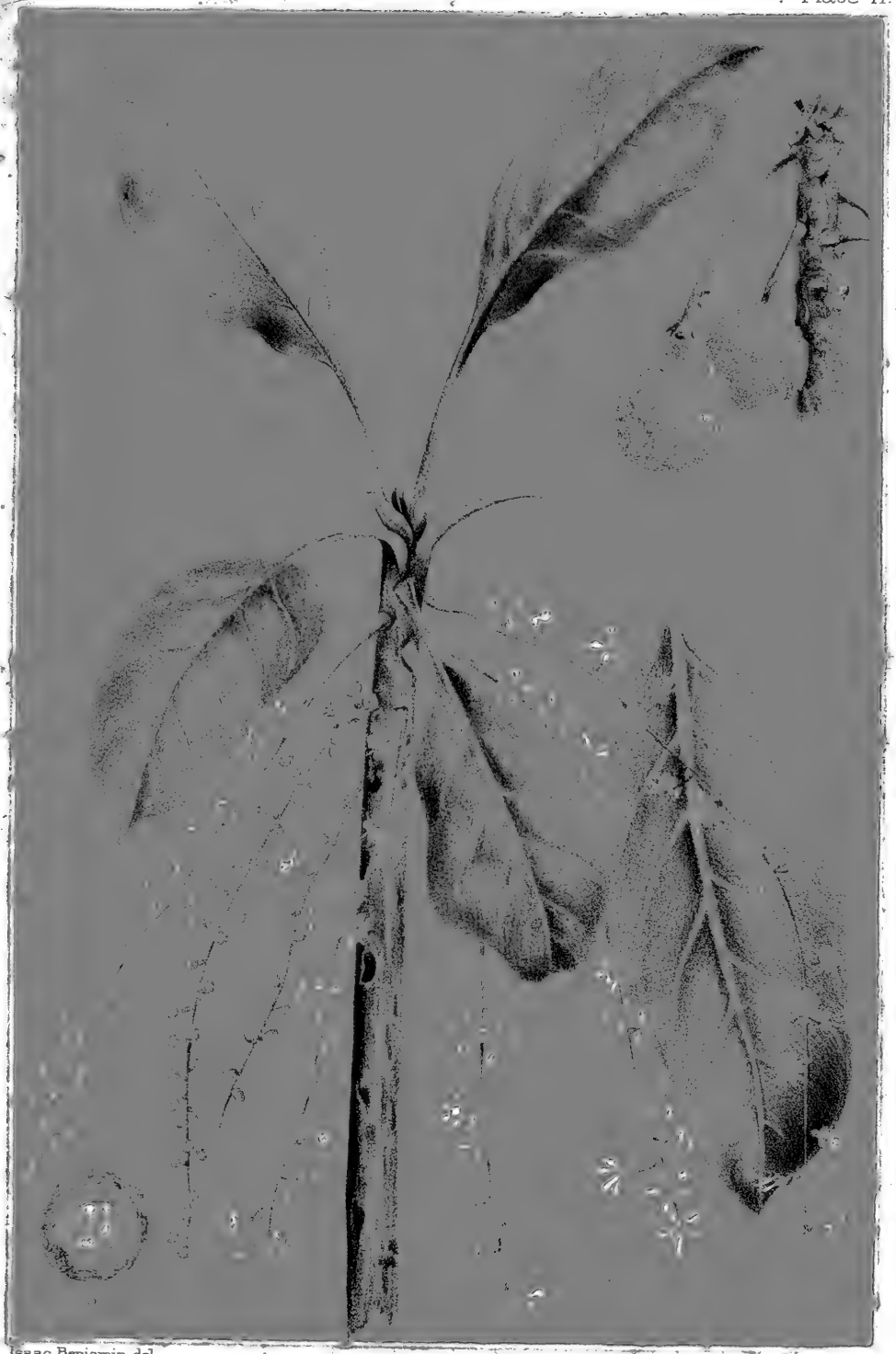
A very large tree with rusty pubescence on young branchlets and calyx; attains a height of 60—100 feet; trunk tall, erect, regularly shaped; branches spreading, forming a coppery-tinted bright, broad, massive crown when young; bright green when old. Youngest offshoots beautifully crimson.

Stem.—"Bark ½ inch thick, dark grey, uneven, and tessellated by broad longitudinal furrows crossed by short narrow transverse wrinkles, the old bark exfoliating in dry corky scales. Wood lightly grey, or yellowish, open and coarse grained, easily worked but not durable; no distinct heartwood."—(Brandis.) The girth of the stem is 6—10 feet, at times 10—20 feet.

Leaves.—Exstipulate, alternate, crowded about the extremities of branches; crenulate, pubescent; when quite young, of a bright reddish or copper colour, tinged with bright crimson; older leaves bright green, pale beneath; broad elliptic or ovate elliptic, 3—8 inches long, 2—3 inches broad; base often unequal; the lower margin of the leaf tapering as it approaches the petiole, and finally merges into the upper margin of the petiole, leaving the petiole slightly grooved on the ventral aspect. Apex of the leaf obtuse, retuse usually; sometimes acuminate, especially in the larger leaves; margin of the leaf entire; main lateral nerves arcuate, prominent, 5—8 on either side of the midrib; often reddish.

Petiole.—Roundish, longer than ⅓ length of the leaf. The tree sheds its leaves from January to March.

Flowers.—Small; male and hermaphrodite mixed on solitary simple spikes which are sometimes erect, sometimes bent, sometimes drooping; spikes 3—6 inches long, arising from the axils of fresh leaves just before or about the same time as the year's tender leaves shoot out. Sometimes the spikes shoot out from below the insertion



Issac Benjamin del. Mintern Bros., Chromo lith. London.

THE POISONOUS PLANTS OF BOMBAY.

Terminalia belerica. Nat. Ord. Combretaceæ.

(½ Natural Size.)

of the fresh leaf ; not unfrequently from either above or below the cicatrix at the insertion of the previous year's leaf. The flowers and foliage appear about the commencement of the hot weather. They can be seen in their full beauty in April and May. Roxburgh and Brandis condemn the flowers as of a dirty grey or greenish-yellow colour, but although they may be unattractive from a distance on account of their diminutive size or entire absence of petals, and positively repulsive on account of the offensive odour as they open, their bright yellow anthers and the crimson streaks on the calyx, variegated with the soft down inside and outside the calyx, as clearly seen even under an ordinary magnifying glass, are by no means unattractive ; at any rate they are not suggestive of any dirtiness in appearance. The offensive smell resembles that of *Sterculia fœtida* or of *Sterculia guttata.* Male flowers are usually to be seen on the upper part of the spikes ; they are sessile. The hermaphrodite flowers are chiefly confined to the lower part of the spike. They have short pedicels. Bracts linear ; very early caducous ; of a brownish colour ; not seen at the base of the topmost flowers of the spikes. Sometimes two or three flowers arise from the same point or base on the spike.

Calyx.—Deciduous ; free part of the calyx cup-shaped, cleft half way into five triangular segments, woolly inside with long whitish-crimson hair ; the hair outside is short.

Æstivation—Valvate. Calyx-tube of the hermaphrodite flowers above the ovary, with a campanulate mouth ; segments of calyx pointed slightly backwards, *i.e.*, towards the dorsal surface.

Corolla.—Absent.

Stamens.—10.

Filaments :—5 short, 5 long, arranged alternately, inserted below the calyx-segments ; the larger ones twice the length of the calyx. In the hermaphrodite flowers there is an epigynous brownish disc between the stamens and pistil, densely hairy. The upper part of the filaments curves over the top part of the anther as it thins out into the connective.

Anthers.—Bright yellow, bold, slightly reniform with convexity on its ventral surface ; consisting of two distinct loculi separated below, uniting at the connective ; bursting longitudinally. The loculi are joined to the connective at their topmost part on their dorsal surface.

PISTIL :—

STYLE.—Slender, filiform, tapering at the apex to half the size it has near the ovary, projecting slightly beyond the filaments.

STIGMA.—Simple, a mere depression at the apex, turning brown about the time the anthers burst and throw out their ample, impalpable offensive-smelling pollen.

OVARY.—Inferior, coherent with the tube of the calyx, 1-celled, always tomentose.

OVULE.—Pendulous from the apex of the cavity.

FRUIT.—DeCandolle, Roxburgh, Wight and Arnott, Dymock, Lyon, &c., all agree in calling the fruit a "Drupe." Clarke in Hooker's Flora of British India discards this name. A *drupe*, according to the signification assigned to the term by modern Botanists, is morphologically a different fruit; and accustomed as I am to the arrangement and terminology of Bentley as regards Fruits, I think that the fruit of *Terminalia bellerica* being inferior, cannot strictly be called a drupe, which is a superior mono-carpellary fruit, that is to say, formed of a single flower, the ovary of which is made up of a single carpel. Clarke calls it *drupaceous*, and that is a more accurate term for it. The fruit is fleshy, indehiscent, $\frac{1}{2}$—$\frac{3}{4}$ inch in diameter, ovoid, grey or tan-coloured, velvety when young, turning into reddish or deep buff-colour as it matures, with five more or less distinct furrows $\frac{3}{4}$ to 1 inch long. The skin becomes coriaceous as the fruit grows older; epicarp and mesocarp shrivel as the fruit dries up after it is detached from the parent tree. The fruit ripens during the cold season. It is so persistent that the fruit which ripened last cold weather can even now be seen in the jungles in the middle of May on the trees just as they are throwing out the fresh foliage and flower-stalks of the current season.

NUT.—Thick and hard, rough, irregularly coarse-grained, varying from $\frac{1}{2}$—$\frac{3}{4}$ inch in length; $\frac{1}{4}$—$\frac{1}{3}$ inch at its broadest part, which is about the middle.

SEED.—One, which constitutes the kernel in the nut. The nut yields a bland oil and is sweet to taste.

ALBUMEN.—None, says Clarke, as also Roxburgh.

COTYLEDONS.—Convolute; creamy white colour.

EMBRYO.—Inverse, spiral.

REMARKS.

By far the most accurate description I have seen of this plant is that given by Brandis (p. 222, Forest Flora of North-West and Central India). I have therefore tried to follow him and Wight and Arnott as much as possible in the description given above, and the remarks that are to follow.

There is one thing striking about the venation of the leaves of the tree. Half-way between the midrib and the margin of the leaf, the main lateral nerves on either side of the midrib suddenly swell out into longish irregular nodules, assume a deeper crimson tint and develop more abundant hair. This is more marked on the older green leaves than on the earliest tender crimson ones. So far as I am aware this peculiarity has not been specially noted by any observer before.

The observation of Roxburgh, that there are two opposite glands on the upper side of the apex of the petiole and sometimes near the base, is not borne out by the experience of Wight and Arnott and Brandis. I have myself failed to find the glands Roxburgh speaks of, although I have examined several specimens in the plains and hills of Thana, and at Matheran. Clarke, in Hooker's Flora of British India, in referring to the supposed occurrence of glands on the leaves of *Terminalia bellerica*, says that they are often on the petiole, *or near the base of the midrib beneath.* (The italics are mine.—K. R. K.) When Clarke speaks of glands on midrib, and on the under-surface of the leaf, just near the apex of the petiole, he was evidently thinking of or had before him the leaf of *Ain* (*Terminalia tomentosa*) instead of the leaf of *Behedâ* (*Terminalia bellerica*). I have a specimen of each of these plants before me as I am writing this paper.

DeCandolle says that the petioles are glabrous. Roxburgh also says the leaves are glabrous. It is not so. The whole organ is essentially tomentose ; so is the flower ; so is the fruit. An ordinary magnifying glass is enough to show the fine, white or buff coloured hairs or down on the petiole, midrib, nerves and their minuter ramifications ; on the upper and under-surfaces of the leaf, several weeks after the foliage appears. As the leaf gets older and assumes a brighter green, the down on the leaf shrivels. It may then disappear and perhaps the oldest and most mature leaves may appear glabrous. That is the only

way I can account for the statements of DeCandolle and Roxburgh. The down on the petioles is distinctly of a crimson or coppery tint.

Roxburgh further observes that " the Natives do not use any part of the fruit of *Terminalia bellerica* in medicine." This remark appears to be based on scanty information. As a matter of fact, *Behedâ* is one of the commonest articles used not only by learned Hindu Vaidyas and native practitioners of all sorts, but also as an ordinary domestic remedy. It is well known to the natives that *Triphalâ* is a panacea for all kinds of ailments.

Triphalâ is a combination of three fruits, *viz.* :—

Hirdâ—Terminalia chebula,

Behedâ—Terminalia bellerica,

Awalâ—Phyllanthus emblica,

vide p. 44, Ark-Prakâsh, vol. 3, Nighanta Ratnâkar.

These are pounded together, and used in the shape of a powder, decoction, or cold infusion. They are valuable for the large quantity of tannin they contain. They are valuable as astringents when given in combination. The mixture, however, acts as a laxative in children. It is generally known to give tone to the intestinal canal. It must be remembered that the part of the fruits used medicinally is the rind, not the pulp, as is wrongly said, for there is no pulp strictly so-called on any of these nuts covering the hard kernel. The kernel of the nut is never used medicinally. It is eaten for its sweet taste, sometimes in large quantities, as many as twenty-five being swallowed at a time without harm. I have heard from several reliable sources that the kernel is harmless. From other sources equally reliable I hear that if the kernel is eaten in large quantities it acts as an intoxicant. But of this more hereafter. Brandis says that the fruit of *Behedâ* is a favourite food of monkeys, deer, sheep, goats and cattle. The taste of the rind of the fruit is astringent. The taste of the kernel is like that of its congener *Badâm (Terminalia catappa)*. There is no evidence of the kernel of *T. catappa* ever having produced intoxication, eat what quantity of it you like. It is the tannin in the rind of the fruit that gives *Behedâ* its commercial value in common with its congener the *Hirdâ*, as an important ingredient, largely used in and out of India for dyeing cloth and leather and for tanning. *Behedâ* is also known in the Konkan by the name of *Yelyâ*.

An insipid gum of brown colour exudes from wounds in the bark of *T. bellerica*, in vermicular pieces, about the thickness of the finger. "It is hardly at all soluble," says Dr. Dymock, "in water, in which it swells up and forms a bulky gelatinous mass." Roxburgh's statement, that the gum is soluble in water, is nearer the truth. I have verified it myself and have just at this minute a specimen of the gum in water, and I find it is as easily soluble as the ordinary gum arabic. Dr. Dymock was not able to verify from personal observation the statement of Drury that the gum burns like a candle. From my own experience I can say that it does burn and continues to burn with a pale reddish flame, and with a spurt and a flash now and then, swelling the whole mass out and leaving a charred residue. I have tried the experiment just this minute on a fresh bit of gum obtained from a bark wounded only yesterday. Perhaps Dr. Dymock's specimen of gum was old and dry, and had got rid of its inflammable material in the process of drying, as is but natural to suppose.

Wight and Arnott observe in their Prodromus that "the tree known as *Terminalia moluccana* of Roxburgh and probably of Blume (but not of Lamarck) is allied to *T. bellerica*. It has precisely the same kind of fruit and male flowers, but the petioles are short, giving quite a different aspect to the plant."

The flowers of *T. bellerica* are of offensive odour as I have already stated above. I have alluded to an incident at Thana regarding this offensive odour in a Lecture on Indian Flowers I delivered last year before the Sassoon Mechanics Institute of Bombay. Extracts from this Lecture have already appeared in the last number of the Society's Journal wherein the incident is mentioned. I need not therefore repeat it here.

THE POISONOUS PROPERTIES.

The kernel of the seed of *Beledâ* is narcotic in its action. Dr. Lyon refers in his Medical Jurisprudence (p. 222) to two sets of cases of accidental poisoning by it. One set of cases he quotes from Dr. Norman Chevers' Medical Jurisprudence as recorded by Mr. C. E. Raddock, Sub-Assistant Surgeon of the Malwa Bheel Corps, wherein three boys are mentioned as having suffered from poisonous symptoms after eating some of the dry nuts. They all recovered however. The symptoms in two of the boys were drowsiness, headache, sickness

at stomach and free vomiting of a thick white frothy mucus. With regard to the third boy, who was weakly and seven years old, the symptoms were more severe. Briefly stated, they were as follows :— Total insensibility ; heart's action frequent and weak; legs cold, eyes rather glistening, and pupils normal but fixed ; jaw firmly closed. This boy had eaten the largest quantity, it is said between 20 to 30 kernels. He is said to have played all day and night before going to bed. He showed no symptoms of poisoning till the following morning, when he was found insensible. Notice in these cases the long time that it took for the poisonous symptoms to show themselves. In the first two boys they did not appear till about eight hours after, and in the third boy not even in twelve hours.

The other set of cases referred to by Dr. Lyon are from the Bombay Chemical Analyser's Report (1878-79, p. 14), in which a woman and two children, one of whom was a weakly girl of eight or nine years, were poisoned. Of these, the girl died and the two others recovered. The symptoms were nausea and vomiting followed by narcotism. Dr. Lyon observes that it is not known to what these narcotic properties are due. In a collection of old Sanskrit observations on Indian drugs recently edited by Mr. R. S. Lâle under the name of *Guna Dosha-Prakâsh* (1892, p. 135) the kernel of *Behedâ* is referred to as intoxicating. O'Shaughnessy seems to have heard of this property.

From all accounts I have hitherto received, it appears probable that the eating of the kernel affects different individuals differently. In some it produces intoxication ; in others it is harmless even in large quantities. This reminds one of the effect of a variety of *Arecha catechu* or *Supâri* nut, known as *Mâjri Supâri* has on different individuals. *Mâjri* means " intoxicating." True to its name in some, *Mâjri Supâri* unmistakably produces giddiness, nausea, hiccup ; whereas in others it is perfectly harmless.

In the printed Proceedings of the Grant Medical College Society for the year 1880 (*vide* Part No. 8, p. 71) there is an abstract of an interesting paper recording a case of poisoning by the kernel of *Behedâ* seed, which occurred in the practice of Dr. Tribhuvandas M. Shâh, L.M., then Assistant Surgeon at Ahmedabad, now Chief Medical Officer of Junagadh State. Dr. Tribhuvandas is one of the

most accomplished Medical Graduates of the Bombay University. He is as careful a clinical observer as he is a skilful and facile operator. I cannot, therefore, do better than give in full, with his kind permission, the abstract of his notes as published by the Grant College Medical Society :—"A child, about five years of age, was brought one morning into the Hospital in an insensible condition, the parents stating that the child had eaten some of the kernels of the nut the previous evening. The parents were dyers and used the nuts for dyeing clothes black ; the pericarp was used by them while the kernels were thrown away. The Natives are well aware of the effects produced by the eating of the kernels. About half a pound of the nuts will be eaten before they produce narcotic effect in an adult ; the effect is not rapid but takes several hours before it is exhibited. The child had apparently gone to bed all right and in the morning was found quite insensible. When seen she was totally unconscious, the pupils were of natural size, the cornea was insensible to touch, breathing was stertorous, body of natural temperature, pulse somewhat frequent, jaws partially locked." Emetics, stimulants and other remedies were administered. The child, however, died of convulsions within half an hour from the time they set in. A *post mortem* examination was made two hours after death. Herein lies the value of this paper. The stomach was found somewhat congested and contained some greenish black grumous fluid ; the intestines and all the other organs were found natural.

The question that strikes me is :—Is it that the symptoms of intoxication or narcotism may be due to small quantities of Hydrocyanic acid developed in the kernel of some of the fruits of *Behedâ* ? I leave the question to be solved by practical Pharmacologists and Chemical Analysers.

DESCRIPTION OF PLATE H.

1. The tender branchlet of *T. bellerica* with flower-spikes in bud and blossom.

2. The fruit of *T. bellerica* on the previous year's apical branchlet

3. A transverse section through the middle of the fruit. The outermost brown line showing the downy epicarp ; the green layer indicating the mesocarp which contains tannin, and which alone is used medicinally ; the next yellowish layer represents the irregular hard nut. The central white mass represents the kernel.

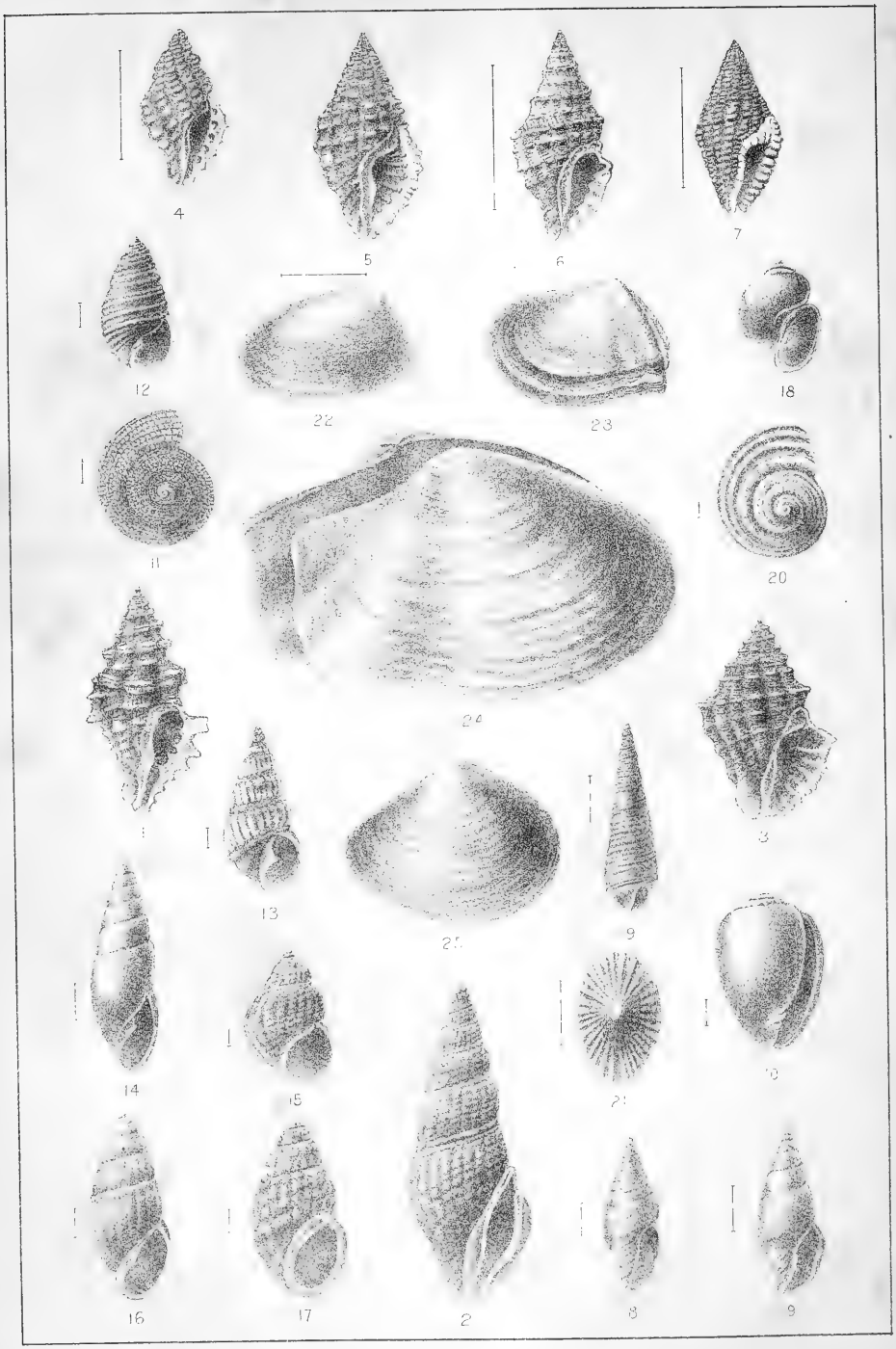
LIST OF BIRDS NOTED AT ADEN AND ITS VICINITY.

By Lieut. H. E. Barnes, M.B.O.U., F.Z.S.

1.	Gyps fulvus, Gm.	... Griffon Vulture.
2.	Neophron percnopterus, Linn.	... Egyptian Vulture.
3.	Falco peregrinus, Tunst.	... Peregrine Falcon.
4.	Falco barbarus, Linn.	... Barbary Falcon.
5.	Tinnunculus alaudarius, Gm.	... Kestrel.
6.	Accipiter nisus, Linn.	... European Sparrow Hawk.
7.	Aquila chrysaëtos, Linn.	... Golden Eagle.
8.	Aquila imperialis, Bechst.	... Imperial Eagle.
9.	Pandion haliaëtus, Linn.	... Osprey.
10.	Haliaëtus leucogaster, Gm.	... White-bellied Sea Eagle.
11.	Melierax polyzonus, Rupp.	...
12.	Milvus egyptius, Gm.	... Egyptian Kite.
13.	Elanus cœruleus, Desf.	... Black-winged Kite.
14.	Strix flammea, Linn.	... Barn Owl.
15.	Carine, sp. inc.	... Owlet, sp.
16.	Scops giu, Scop.	... European Scops Owl.
17.	Hirundo rustica, Linn.	... Chimney Swallow.
18.	Cotyle obsoleta, Cab.	... Pale Crag Martin.
19.	Cypselus, sp. inc.	... Swift, sp.
20.	Caprimulgus, sp. inc.	... Goatsucker, sp.
21.	Merops cyanophrys, Cab. et Heine	Bee-eater, sp.
22.	Merops persicus, Pall.	... Egyptian Bee-eater.
23.	Merops, sp. inc.	... Bee-eater, sp.
24.	Coracias garrulus, Linn.	... European Roller.
25.	Coracias abyssinicus, Bodd.	... Long-tailed Roller.
26.	Halcyon semi-cœruleus, Fors.	... Arabian King-fisher.
27.	Cuculus canorus, Linn.	... Cuckoo.
28.	Coccystes, sp. inc.	... Crested Cuckoo.
29.	Centropus, sp. inc.	... Coucal.
30.	Nectarinia metallica, Licht.	... Arabian Sunbird.
31.	Upupa epops, Linn.	... Hoopoe.
32.	Lanius lahtora, Sykes.	... Grey Shrike.
33.	Lanius nubicus, Licht.	... Nubian Shrike.
34.	Lanius, sp. inc.	... Shrike, sp.
35.	Hypocolius ampelinus, Bp.	... Grey Hypocolius.
36.	Terpsiphone paradisi, Linn.	... Paradise Fly-catcher.
37.	Muscicapa grisola, Linn.	... Spotted Grey Fly-catcher.
38.	Monticola cyanus, Linn.	... Blue Rockthrush.
39.	Cercotrichas melanoptera, Hemp and Ehr.	... Blue-winged Chat-thrush.

40. Argya, sp. inc. ... Babbler, sp.
41. Pycnonotus arsinoe, Hemp and Ehr. ... Hemprich's Bulbul.
42. Pycnonotus xanthopygus, Hemp and Ehr. ... Yellow-vented Bulbul.
43. Oriolus galbula, Linn. ... Golden Oriole.
44. Saxicola œnanthe, Linn. ... Wheatear.
45. Saxicola stapazina, Vieill ... Chat.
46. Saxicola pleschanka, Lep. ... Siberian Chat.
47. Myrmecocichla melanura, Tem.. Black-tailed Rock-Chat.
48. Ruticilla, sp. inc. ... Redstart, sp.
49. Prinia, sp. inc. ... Warbler, sp.
50. Phylloscopus, sp. inc. ... Willow Warbler, sp.
51. Motacilla alba, Linn. ... White Wagtail.
52. Motacilla feldeggi, Michah ... Black-headed Wagtail.
53. Corvus culminatus, Sykes ... Jungle Crow.
54. Corvus corax, Linn. ... Raven.
55. Dilophus carunculatus, Gm. ... Wattled Starling, sp.
56. Hyphantornis galbula, Rüpp. ... Golden Weaver-Bird.
57. Estrelda rufibarba, Cab. ... Red-shafted Wax-bill.
58. Nuroloncha, sp. inc. ... Munia, sp.
59. Passer, sp. inc. ... Sparrow, sp.
60. Pyrrhulauda melanauchan, Cab.. Black-crowned Finch-Lark.
61. Alauda cristata, Linn. ... Crested Lark.
62. Alœmon desertorum, Stan. ... Desert Lark.
63. Mirafra, sp. inc. ... Bush Lark, sp.
64. Treron, sp. inc. ... Green Pigeon, sp.
65. Columba livia, Bonn. ... Stock Dove.
66. Turtur senegalensis, Linn. ... Little Brown Dove.
67. Turtur risorius, Linn. ... Ring Dove.
68. Æna capensis, Linn. ... Long-tailed Dove.
69. Pterocles exustus, Tem. ... Common Sand-Grouse.
70. Pterocles lichtensteini, Tem. ... Lichtenstein's Sand-Grouse.
71. Caccabis melanocephala, Rüpp... Large Black-headed Chukor.
72. Caccabis chukar, J. E. Gray. ... Chukor Partridge.
73. Ammoperdix bonhami, Fraser... Seesee Partridge.
74. Coturnix communis, Bon. ... Common Quail.
75. Coturnix delegorguei, Deleg. ... Quail, sp.
76. Turnix lepurana, Smith ... Button Quail, sp.
77. Eupodotis arabs, Linn. ... Arabian Bustard.
78. Houbara macqueeni, J. E. Gr... Houbara Bustard.
79. Cursorius, sp. inc. ... Courser, sp.
80. Squatarola helvetica, Linn. ... Grey Plover.
81. Charadrius pluvialis, Linn. ... Golden Plover.
82. Œdicnemus scolopax, S. G. Gm. Stone Curlew.
83. Ægialitis mongolica, Pall. ... Pallas' Shore Plover.
84. Ægialitis cantiana, Lath. ... Kentish Plover.

85. Strepsilas interpres, Linn. ... Turnstone.
86. Dromas ardeola, Payk. ... Crab Plover.
87. Hæmatopus ostralegus, Linn. ... Oyster-Catcher.
88. Gallinago cœlestis, Frenzel ... Common Snipe.
89. Totokia cinerea, Guld. ... Avocet Sandpiper.
90. Numenius arquata, Linn. ... Curlew.
91. Numenius phæopus, Linn. ... Whimbrel.
92. Tringa alpina, Linn. ... Dunlin.
93. Tringa minuta, Leisl. ... Little Stint.
94. Calidris arenaria, Linn. ... Sanderling.
95. Tringoides hypoleucus, Linn. ... Common Sandpiper.
96. Helodromas ochropus, Linn. ... Green Sandpiper.
97. Totanus calidris, Linn. ... Redshank.
98. Crex pratensis, Bechst. ... Land Rail.
99. Ardea cinerea, Linn. ... Common Heron.
100. Ardea alba, Linn. ... Large White Heron.
101. Ardea, sp. inc. ... Egret, sp.
102. Ardea asha, Sykes ... Ashy Egret.
103. Ardeola podiceps, Bp. ...
104. Platalea leucorodia, Linn. ... Spoonbill.
105. Ibis, sp. inc. ... Ibis, sp.
106. Phœnicopterus roseus, Linn. ... Flamingo.
107. Anas boschas, Linn. ... Mallard.
108. Querquedula crecca, Linn. ... Common Teal.
109. Querquedula circia, Linn. ... Blue-winged Teal.
110. Podiceps nigricollis, Brehm. ... Black-necked Grebe.
111. Puffinus persicus, Hume. ... Persian Shearwater.
112. Larus, sp. inc. ... Black-backed Gull, sp.
113. Larus ichthyaëtus, Pall. ... Great Black-headed Gull.
114. Larus brunnicephalus, Jerd. ... Brown-headed Gull.
115. Larus ridibundus, Linn. ... Laughing Gull.
116. Larus hemprichi, Bp. ... Hemprich's Gull.
117. Sterna albigena, Reich. ... White-cheeked Tern.
118. Sterna minuta, Linn. ... Little Tern.
119. Sterna bergi, Licht. ... Large Sea Tern.
120. Sterna media, Horsf. ... Lesser Sea Tern.
121. Sterna anæsthota, Scop. ... Panayan Tern.
122. Sterna fuliginosa, Gm. ... Sooty Tern.
123. Phaëton indicus, Hume. ... Indian Tropic Bird.
124. Sula fiber, Lin. ... Booby.
125. Pelecanus onocrotalus, Linn. ... European Pelican.
126. Phalacrocorax, sp. inc. ... Brown Cormorant, sp.



NEW SPECIES OF MARINE SHELLS FROM BOMBAY

Drawn & Litho: Govt. Photozinco: Office Poona 1893.

DESCRIPTION OF TWENTY-FIVE NEW SPECIES OF MARINE SHELLS FROM BOMBAY, COLLECTED BY MR. ALEXANDER ABERCROMBIE.*

By James Cosmo Melvill, M.A., F.L.S.

Murex (Ocinebra) bombayanus, *sp. nov.* (Pl. 1, f. 1.)

M. testâ fusiformi, ochraceo-cinereâ, squamatâ, apice acuto, anfractibus septem vel octo, angulato-costatis, ultimo anfractu varicibus octo, in medio trinis angulorum ordinibus transversim succincto, aperturâ ovato-oblongâ, pallescente, labro intus denticulato, canali brevi.

Long. spec. typ. 31 mill.

Lat. 16 mill.

Hab. Bombay, common along the coast (*A. Abercrombie, Herford, W. T. Blanford*) (in Mus. Brit.). Ratnagiri (*A. Abercrombie*).

Evidently a very abundant species, and in all probability extending some way both North and South of Bombay. The largest of the many specimens I have seen measures 35 millimetres longitudinally. It is a very uniform species in all stages of its growth, and would appear to have been confounded with *M. luculentus* (Reeve). Its nearest ally, however, would seem to be *M. cristatus* (Brocchi) from the Mediterranean, from which, however, it is quite distinct. Some specimens are pale yellow, with faint brown transverse fasciæ.

Pleurotoma (Clavus) præclara, *sp. nov.* (Pl. 1, f. 2.)

P. testâ pyramidato-fusiformi, percrassâ, pallidé ochraceâ, anfractibus septem vel octo, ad suturas valide impressis, longitudinaliter obliqué pluricostatis, transversim regulariter liratis, aperturâ oblongâ simplice, labro exteriore in medio crassiusculo, canali brevissimâ, margine columellari obliqui-planato.

Long. 44 mill.

Lat. 16 „

Hab. Bombay, up the coast (*Abercrombie*).

A large, conspicuous species, of which all the specimens before us are somewhat worn : not sufficiently so, however, as to efface the sculpture.

From *P. atkinsoni* (Smith), *crenularis* (Lam.), *flavidula* (Lam.) it is quite distinct, being more allied to the smaller *sacra* (Reeve) in my opinion, and a member of the sub-genus *Clavus* rather than *Drillia*.

* Reprinted from the Memoirs and Proceedings of the Manchester Literary and Philosophical Society.

As Tryon, however, rightly observes, the subgenera allotted to the larger *Pleurotomæ* are not always very well defined.

PURPURA (STRAMONITA) BLANFORDI, *sp. nov.* (Pl. 1, f. 3.)

P. testâ ovato-fusiformi, crassâ, cinereo-carneâ, anfractibus quinque, longitudinaliter tuberculato-costatis, undique transversim regulariter et arcté liratosulcatis, costis in medio conspicué unangulatis, ultimo anfractu binâ serie tuberculato, aperturâ ovatâ, carneâ, labro extus biangulato intus denticulato, margine columellari recto, simplice.

Long. 27 mill.

Lat. 18 „

Hab. Bombay and Ratnagiri (*A. Abercrombie, Herford*, and also *W. T. Blanford*) (in Brit. Mus.), Kurrachee (Brit. Mus.), (*Blanford*).

This species would appear common upon the rocks of the West Coast of India. We have seen specimens from Kurrachee, and believe the small shell occurs in Ceylon.

The two specimens collected by Mr. Abercrombie, one of which is figured, are the only ones I have seen quite perfect as regards completion of growth. In size it assimilates *P. tissoti* (Pet.), with which, also abundant on these shores, it has been confounded. It is easily to be differentiated, since it does not possess the deep bisulcate transverse grooving of *P. tissoti*, nor the revolving raised ridges with small nodules equi-distant thereupon.

RICINULA (SISTRUM) SUBNODULOSA, *sp. nov.* (Pl. 1, f. 6.)

R. testâ turritâ, fusiformi, solidâ, apice acuto, anfractibus octo vel novem, in medio angulatis, transversim squamato-corrugatis ultimo anfractu bino ordine noduloso, et infra, duobus minoribus ordinibus nodulorum succincto, aperturâ oblongâ lividâ, labro extus angulato, intus livido denticulato, margine columellari recto.

Hab. Bombay. (*Abercrombie, Herford.*)

Long. spec. typ. 20 mill.

Lat. 9·20 mill.

Bearing a little resemblance to the West Indian *R. nodulosa* (C. B. Adams), but the black rows of nodules stand out more prominently upon a lighter ground, the interstices between which on the last whorl give a semblance of a *fascia*. The shell is also more elongate than *R. nodulosa*. One of Mr. Herford's specimens is larger than usual (23 mill.), the smallest with lip perfect, only 11 mill., but the essential characters are preserved in each.

RICINULA (SISTRUM) KONKANENSIS, *sp. nov.* (Pl. 1, f. 5.)

R. testâ pyramidato-fusiformi, solidâ, livido cinereâ, apice attenuato, acuto, anfractibus quinque-sex, longitudinaliter plicato-costatis, transversim nigro-nodulosis, interstitiis transversim squamulosis, apertura ovatâ cinereâ, labro extus muriculato, intus denticulato, margine columellari recto.

Long. 29 mill.

Lat. 15 „

Hab. Bombay (*Blanford, Abercrombie, &c.*).

Not unfrequent. Has been hitherto confounded, judging from the specimens in the National collection, with *R. affinis* and *R.* (*Sistrum*) *concatenata* (Reeve).

RICINULA (SISTRUM) XUTHEDRA, *sp. nov.* (Pl. 1, f. 4.)

R. testâ fusiformi, solidâ, lætè flavidâ, anfractibus sex, longitudinaliter costatis, costis albonodulosis, transversim inter costas tenuiliratis, aperturâ albâ, ovatâ, labro intus denticulato, apud marginem columellarem trinoduloso.

Long. 15 mill.

Lat. 8 „

Hab. Ratnagiri (*A. Abercrombie*).

A beautiful yellow-ochraceous species, with longitudinal white noduled ribs, mouth ovate, white, outer lip denticulated within, and two or three nodules on the columellar margin. A form on the borderland between *Sistrum* and *Engina*. Four specimens.

ENGINA ZEA, *sp. nov.* (Pl. 1, f. 7.)

E. testâ conico-pyramidali, solidiusculâ, apice acuto, anfractibus oct, transversim nodulis nitidis variegatis arcte accinctis, interstitiis duplici vel-triplici striatosulcatis, ultimo anfractu longitudinaliter costiplicato in medio transversim albizonato, aperturâ ovato-trigonali, ad basin angustâ, labro externo incrassato, variegato, intus lirato, et apud marginem columellarem crassi-striato.

Long. 18 mill.

Lat. 9·50 „

Hab. Bombay (*A. Abercrombie*). There are also specimens in Mus. Brit., collected by Mr. W. T. Blanford, F.R.S., from the same locality.

This species has apparently been confounded with *E. armillata* (Reeve), from which it differs both in form and marking. I have had

specimens for more than twenty years lying unnamed in my collection and there are others, likewise unnamed, in the British Museum.

It is a conical, sharp-pointed little shell, acutely broad in the middle giving a quadrate appearance to its contour, becoming rapidly attenuate at both ends. Round the centre of the last whorl runs a conspicuous white median band, formed of white transverse nodules, the rest of the surface of the shell being nodulous, and variegated brown and white.

The mouth is triangular-ovate, outer lip exteriorly variegated, inner with small white ridges, and on the columellar margin are several raised short white ridges.

The similarity to grains of maize (ζέα) suggested the trivial name.

COLUMBELLA (MITRELLA) FLAVILINEA, *sp. nov.* (Pl. 1, f. 8.)

C. testâ tenui, lævi, anfractibus sex vel septem, ad suturas subcompressis, transversim lineis angustis flavidis, hic illic speciminibus quibusdam interruptis, in aliis continuis, conspicuê decoratis ; aperturâ oblongâ, labro exteriore paullum angulato, intus simplice, lævi.

Long. 5 mill.

Lat. 2·50 ,,

Hab. Bombay (*Abercrombie*).

Not uncommon ; allied to *C. marquesa* (Gaskoin), of which one good specimen was also found in shell sand from the same locality. The shell is small, smooth, ornamented with painting of narrow, usually continuous, but in some specimens interrupted, yellow lines. Several examples.

COLUMBELLA (MITRELLA) EUTERPE, *sp. nov.* (Pl. 1, f. 9.)

C. testâ attenuatâ, fusiformi, tenui, subpellucidâ, lævi, anfractibus septem, infrá suturas ochraceo-flammulatis et albomaculatis, ultimo anfractu in medio angusté albo-lineato infrá arctê brevibus flammis ochraceis decorato, aperturâ angusté oblongâ, labro simplice.

Long. 6 mill.

Lat. 2·50 ,,

Hab. Bombay (*Abercrombie*).

A very few specimens, and those mostly imperfect, have occurred of this little *Mitrella*. Its whorls, seven in number, and quite smooth, are ornamented with flame-like zigzag markings at the sutures, and extending over the whorls, also ornamented with opaque white marks and blotches. In the last whorl there is a pale median transverse line

caused by the cessation of the above-mentioned flammulate markings, which recommence, however, below, towards the base, in many thin, almost straight, yellow lines. Mouth simple, narrowly oblong.

MARGINELLA (GIBBERULA) MAZAGONICA, *sp. nov.* (Pl. 1, f. 10.)

M. testâ ovato-conicâ, parvâ, subpellucidâ, lævi, anfractibus quatuor, apice obtuso, ultimo anfractu rapidé accrescente, aperturâ angustâ, oblongâ, labro exteriore intus denticulato, columellâ, quadriplicatâ.

Long. 3 mill.

Lat. 2 „

Hab. Bombay. (*A. Abercrombie*). Very abundant.

A short stout conical little species, of ivory whiteness, and quite smooth, lip denticulate within, and columellar four-plaited. Allied to *M. minuta* (Pfr.) and *M. lavalleana* (D'Orb.), with neither of which it seems exactly to correspond.

SOLARIUM (TORINIA) DELECTABILE, *sp. nov.* (Pl. 1, f. 11.)

S. testâ parvâ, profundé umbilicatâ, depresso conicâ albescente, delicatulâ, subpellucidâ, anfractibus quatuor, gradatulis, ultimo rapidé accrescente, undique transversim arcté albo-gemmulatis, interstitiis sub lente obliquostriatis, circà umbilicum bino gemmularum ordine majorum, nitentium, diposito aperturâ tenui, labro simplice, fimbriato, subrotundo, apud marginem columellarem reflexo.

Long. 2·50 mill.

Lat. 3 mill.

Hab. Bombay (*Abercrombie*).

Two or three specimens of an unusually lovely little semi-transparent white species, occurring in shingle and shell sand from Bombay. The form is depresso-conical, white beaded, wonderfully closely obliquely striated at the interstices between the beading ; this is not distinguishable without a lens. The umbilicus has two rows of beads around it, one large with coarser gemmulæ, very shining ; the other with smaller and more delicate granulation. Mouth thin, round, fimbriate, reflexed at the columellar margin.

[*N.B.*—Another species of *Solarium* (*Torinia*), probably new, occurred with the above, allied to *S. virgatum* (Hinds). This species is white, very depressed, quadrate, with similar transverse raised beading ; at the periphery the gemmulæ are larger and coarser, as also in the last row nearest the umbilicus at the base. Mouth simple, quadrate.

Apparently quite a young shell. I have provisionally named it *S. homalaxis*, but await further specimens before atttempting a full description.

Long. 1 mill.
Lat. 2·50. „
Hab. Bombay].

AMATHIS FILIA, *sp. nov.* (Pl. 1, f. 14.)

A. testâ aciculato-fusiformi, albidâ, turritâ, semi-pellucente, nucleo apicis vitreo, anfractibus septem, lævibus, ad suturas gradatulis, impressis, infrá suturas internâ lineâ plicariâ circumambiente, aperturâ oblongâ, labro simplice, columellâ spiraliter uniplicatâ.

Long. 4 mill.
Lat. 1·20 „
Hab. Bombay (*Abercrombie*).

An attenuate shining white fusiform little species, allied to *A. virgo* (Adams) from Japan ; the mouth is oblong, columella strong, spirally plaited. The whorls are turreted, smooth, semi-pellucid, with the internal plica showing through as a transverse clouded line just below the sutures. Two or three specimens only.

OSCILLA TORNATA, *sp. nov.* (Pl. 1, f. 12.)

[*Oscilla tornata*, Arthur Adams MSS. inedit.]

O. testâ fusiformi, albidâ, anfractibus septem, apud suturas profundé canaliculatis, transversim tricostatis, costis binis infrá suturas, parvo sulculo intercepto, tertiâ costâ ab his à canali profundâ divisâ, sicut apud suturas, aperturâ ovatâ, albidâ, subpellucente, labro externo sulculoso, extus et intus, columellari conspicué et recté uniplicato.

Long. 3·10 mill. (*sp. majoris*).
Lat. 1·50 „
Hab. Bombay (*Abercrombie*).

This wonderful little transversely sulcate and grooved species has some external resemblance to *Irawadia trochlearis* (W. T. Blanford), but can be at once distinguished by the plicate columella. There are four or five described species of this genus, mostly of Mr. Arthur Adams' naming, from Japan. In the British Museum is a specimen, also from Japanese seas, with the name as above, entirely comparable with our shell. He does not seem to have ever described it, as was,

unfortunately, often his practice in his later years, especially amongst these smaller and critical genera. The consequence has been to still further render unsolved and difficult the nomenclature of these extremely beautiful but very microscopic genera and species.

In *O. tornata* the transverse ribs are three in number, two below the deeply-channelled sutures, followed by a similar deep groove, and then a third transverse costa, just above the suture of the next whorl.

Three specimens obtained in shell sand. Very rare.

PYRGULINA CALLISTA. *sp. nov.* (Pl. 1, f. 13.)

P. testâ delicatulâ, subpellucidâ, attenuato-fusiformi, anfractibus septem, ad suturas profundè angulato-canaliculatis, longitudinaliter-costis regularibus subobliquè decoratis, interstitiis lævibus, ultimo anfractu infrá suturas transversim fortiter unilirato, ad dorsum bino lirarum ordine, aperturâ ovato-oblongâ, labro quadratulo, ad marginem columellarem unplicato.

Long. 4 mill.

Lat. 1·10 „

Hab. Bombay (*Abercrombie*).

One of the most exquisite little shells, so far as sculpture is concerned, that it is possible to imagine. The shell is seven-whorled, deeply angularly channelled at the sutures, with raised transverse border at either end of the whorl, the borders joined by slightly oblique liræ, smooth at the interstices, the last whorl having a conspicuous angular transverse border line, and at the back of the shell another parallel to this, the lip is subquadrate, and the columellar margin with a very conspicuous plait.

Two or three specimens in shell sand. Very rare.

RISSOINA (ZEBINA) APPLANATA. *sp. nov.* (Pl. 1, f. 16.)

R. testâ albâ, nitidâ, sublœvi, fusiformi, apice obtuso, anfractibus sex, convexiusculis, longitudinaliter obscurissimé costulatis, aperturâ ovatâ, labro paullum incrassato, simplice.

Long. 5 mill.

Lat. 1·75 „

Hab. Bombay (*Abercrombie*).

A small smooth white species, allied, no doubt, to *R.* (*Zebina*) *sublœvigata* of Nevill from the Andaman Islands, but apparently differing in

being indistinctly longitudinally costulate, whilst the *R. sublævigata* is virtually smooth.

RISSOA VERSOVERANA, *sp. nov.* (Pl. 1, f. 15.)

R. testâ parvâ, delicatulâ, ovato-oblongâ, semipellucente, anfractibus sex, ventricosis, ad suturas impressis, longitudinaliter subobliquè costatis, ad basem anfractûs ultimi feré obliteratis, transversim tenuiliratis, aperturâ rotundâ, labro tenui, simplice.

Long. 2 mill.

Lat. 1·20 „

Hab. Bombay (*Abercrombie*).

A small, very abundant species in shell sand that we cannot find has been characterized or described. The longitudinal costæ at the base of the last whorl are in most specimens only faint or entirely obliterated.

ALVANIA MAHIMENSIS, *sp. nov.* (Pl. 1, f. 17.)

A. testâ oblongâ, solidâ, corrugatâ, apice obtuso, anfractibus quinque vel sex, longitudinaliter costulatis, costis transversim cancellatis, infrá suturas et ad basin ultimi anfractûs rubrocoloratis, aperturâ ovali, labro planulato, incrassato.

Long. 2·75 mill.

Lat. 1·50 „

Hab. Bombay (*Abercrombie*).

A pretty species of *Alvania*, being lightly longitudinally ribbed, with transverse cancellations. Below the sutures there is a red transverse band, which also shows near the base of the last whorl; the lip is roundish-oval, solid, somewhat incrassate and flattened. Several specimens.

NATICINA POMATIELLA, *sp. nov.* (Pl. 1, f. 18.)

N. testâ angustè sed profundè umbilicatâ, elevato-conicâ, subpellucidâ, albidâ, feré lævi, anfractibus quinque, ad suturas canaliculatis, obscure transversim liratulis, aperturâ ovatâ, labro simplice, apud umbilicum paullum reflexo.

Long. 17 mill.

Lat. 12 „

Hab. Bombay (*Abercrombie*).

A curious species, and with the form of *Amauropsis canaliculata* (Gould). It is narrowly but deeply umbilicated, and apparently smooth and white, but under a lens the surface is seen to be very

delicately transversely grooved. This may be more apparent in a fresh specimen, ours being rather worn shells. At the sutures there is a deep channel ; the mouth is simple, white within.

One or two specimens ; rare.

CERITHIOPSIS (SEILA) BANDORENSIS, *sp. nov.* (Pl. 1, f. 19.)

C. testâ attenuatâ, brunneâ, solidâ, anfractibus duodecim, ad apicem pallidis, transversim quadriliratis, liris rotundis paullum diversis, majoribus minoribus alternantibus, vel binis æqualibus, tertiâ minore, aperturâ rotundâ, labro simplice, margine columellari recto.

Long. 7 mill. (*sp. maj.*).

Lat. 2 „

Hab. Bombay (*Abercrombie*).

A plain brown transversely round-ribbed species, a little like *Telescopium fuscum* in miniature as regards sculpture, but not so broad proportionately as that species, being uniformly attenuate. The apex is whitish, whorls about 12, transverse ribs somewhat varying in size about four in a whorl.

Rare. Two specimens only.

CYCLOSSTREMA SOLARIELLUM, *sp. nov.* (Pl. 1, f. 20.)

C. testâ minutâ, albescente, tenui, depressâ, profundè umbilicatâ, anfractibus quatuor, ultimo rapide accrescente, undique transversim tenuiliratis, infrá suturas binis gemmularum ordinibus decoratis, et ad basin circá umbilicum simili modo bigemmulatis, aperturâ rotundo-ovatâ, labro simplice.

Long. 0·50 mill.

Lat. 1·50 „

Hab. Bombay (*Abercrombie*).

A very small shell, with some of the aspect of a small *Torinia ;* it also, to some extent, resembles *C. tatei* (Angas), from S. Australia, but the double row of gemmules on the liræ below the sutures, and at the base, around the umbilicus, distinguish it from that species.

Not uncommon in shell sand.

Surely *Cyclosstrema* is neuter, being instituted by the late Captain Marryat, R.N., the famous novelist (who added the study of the Mollusca to his many other accomplishments), in 1817, as derived from κύκλος and τρημα. It has been considered feminine by most writers and authors, including Captain Marryat himself.

SIPHONARIA BASSEINENSIS, *sp. nov.* (Pl. 1, f. 21).

S. testâ subconicâ, oblongâ, tenui, lævi, nigrobrunneâ, biradiatâ, intus brunneâ, ad marginem radiatâ.

Long. 9 mill. (*sp. majoris*).

Lat. 6 „

Hab. Bombay (*Abercrombie*).

A small subconical plain smoothish brown species, with biradiate flames round the margin. I had thought this, of which very numerous examples occur in Mr. Abercrombie's collections, must be a young form of some perhaps well-known species, but I am assured this is not the case, Mr. Abercrombie having had unusual facilities for studying the growth of the species, so very abundant all round the Bassein and Mahim coasts. Mr. Edgar Smith also concurs in this view, that it is a mature species, and different from the many already described, though it presents no very important salient features.

RÆTA ABERCROMBIEI, *sp. nov.* (Pl. 1, f. 25).

R. testâ pertenui, hyalinâ, lacteâ, oblongo-ovatâ, posticè rostratâ, antice ovatâ, gibbosulâ, concentricè confertim undatoplicatâ, tumescente, cordatâ, umbonibus parvis.

Long. 23 mill.

Lat. 30 „

Hab. Bombay (*Abercrombie*).

A most beautiful, delicate, white papyraceous shell, concentrically closely wave-ribbed, belonging to a small genus which I do not find has hitherto been recorded from the shores of Hindostan, though a nearly allied species, *R. grayi* (A. Adams), is reported from Borneo. From this shell *R. abercrombiei* differs in its more close and regular transverse plications, and the greater delicacy of the shell. It would be interesting if, in years to come, an intermediate form between the two were discovered on either the Eastern coast of India, or in the Malay Peninsula ; it is more than likely other species of this genus, hitherto so restricted, will reward the collector. The type, *R. canaliculata* (Gray), is extremely common on the sandy sea coasts of South Carolina, and another larger and coarser species, *R. californica* (Sowb.), is an inhabitant of the Western coasts of the United States. *R. pulchella* (Ad. and Reeve), a very small and delicate form, occurs in the

Eastern Islands, and a few other species have been described, but are hardly known.

TELLINA KOLABANA, *sp. nov.* (Pl. 1, f. 23).

T. testâ ovatâ, albescente, solidiusculâ, convexâ, latere postico valdè bicarinato, antico oblongo, transversim concentricè liratâ, apud umbones ferè lavi, flavo tinctâ, posticè asperâ, usque ad marginem ventralem.

Lat. 27 mill.

Long. 17 „

Hab. Bombay (*Abercrombie*).

A somewhat thickened shell, as *T. balthica* (L.); white, yellow, or orange-tinted at the umboes, convex, distinctly posteriorly bicarinated, the concentric liræ becoming very rough and distinct at the posterior angle.

Rare; only one or two specimens.

TELLINA (MÆRA) LECHRIOGRAMMA, *sp. nov.* (Pl. 1, f. 22).

T. testâ albidâ solidiusculâ, donaciformi, posticè abbreviatâ, subobliquâ, anticè elongata, undique concentricé tenui-lirata, nitidâ.

Long. 14 mill.

Lat. 7 „

Hab. Bombay (*Abercrombie*).

Apparently not uncommon, but mostly in imperfect condition, half valves only. It is like *T. pygmæa* (Phil.) in shape, but of thicker consistency, pure shining white, very finely concentrically lirate, posteriorly abbreviate, anteriorly elongate, with some of the appearance of a *Mesodesma* or *Donacilla*.

THRACIA SALSETTENSIS, *sp. nov.* (Pl. 1, f. 24).

T. testâ pertenui, oblongâ, albâ, postice flexuoso-quadratâ et subrostratâ, antice ovato-oblongâ, valvâ sinistrâ subplanatâ, dextrâ convexa, valvis ambabus, præsertim sinistrâ, plicis concentricis undanter succinctis posticé fere applanatis.

Long. 36 mill.

Lat. 52 „

Hab. Bombay (*Abercrombie*).

A remarkably delicate semi-trapezoid species, of which numerous single valves were found, but no quite perfect specimen. The left valve is almost flattened, with a broad longitudinal depression, inclining, posteriorly, almost down the centre of the left valve from the umbo,

the right being convex. Posteriorly in both valves, the shell is quadratorostrate, anteriorly oblong, the transverse wavy plicæ running concentrically show this species to belong to that section of the genus of which at present there are only, including this new species, four representatives known to me, *viz.: T. magnifica* (Jonas), *T. plicata* (Desh.), and *T. granulosa* (Ad. and Reeve), the former of them being Californian, the latter Eastern species.

N.B.—The types of all the abovementioned new species have been deposited in the Mus. Brit., South Kensington.

REFERENCES TO PLATE.

1. *Murex* (*Ocinebra*) *bombayanus* (Melv.).
2. *Pleurotoma* (*Clavus*) *præclara* (Melv.).
3. *Purpura* (*Stramonita*) *blanfordi* (Melv.).
4. *Ricinula* (*Sistrum*) *xuthedra* (Melv.).
5. „ („) *konkanensis* (Melv.).
6. „ („) *subnodulosa* (Melv.).
7. *Engina zea* (Melv.).
8. *Columbella* (*Mitrella*) *flavilinea* (Melv.).
9. „ („) *euterpe* (Melv.).
10. *Marginella* (*Gibberula*) *mazagonica* (Melv.).
11. *Solarium* (*Torinia*) *delectabile* (Melv.).
12. *Oscilla tornata* (A. Adams. *sp. inedit*) (Melv.).
13. *Pyrgulina callista* (Melv.).
14. *Amathis filia* (Melv.).
15. *Rissoa versoverana* (Melv.).
16. *Rissoina* (*Zebina*) *applanata* (Melv.).
17. *Alvania mahimensis* (Melv.)
18. *Naticina pomatiella* (Melv.).
19. *Cerithiopsis* (*Seila*) *bandorensis* (Melv.).
20. *Cyclostrema solariellum* (Melv.).
21. *Siphonaria basseinensis* (Melv.).
22. *Tellina* (*Mœra*) *lechriogramma* (*Melv.*).
23. „ *kolabana* (Melv.).
24. *Thracia salsettensis* (Melv.).
25. *Rœta abercrombiei* (Melv).

REVIEW.

* The Travels of Pietro Della Valle in India.

Pietro Della Valle, a noble Roman, travelled much in Asia in the early sixteen hundreds and wrote log-letters to his friend Dr. Mario Schipano, of which he published those relating to the Ottoman Empire himself and his sons those about Persia and India.

The present volumes contain only the eight letters about India, and induce one to hope that the Hakluyt Society will some day give us the others; for these before us fully justify the high praise bestowed on the author by no less authorities than Gibbon, Southey, and (a more competent judge than either) Sir Henry Yule.

In this place we can only deal with his remarks upon Natural History, chiefly botany.

Della Valle sailed from Gombroon, near what we now call Bandar Abbas, on the 19th January, 1623, aboard "the ship called *The Whale*," commanded by Captain Nicholas Woodcock, whose consort, as befitted, was called *The Dolphin*, Master Matthew Willis. Of these ships and their commanders it may be noted that they were cheerful and hospitable. Captain Woodcock had a pair of Persian greyhounds on board, and sometimes, when becalmed near land, took them ashore for sport.

He had ranged as wide as his totem-bird, having sailed to Greenland, and Della Valle greatly praises him as a navigator. Woodcock showed him a "chart or draught of the whole straight of Ormuz made by himself with the highest exactness," including shoal soundings. And he held every day at noon a navigation class of "twenty or thirty mariners; masters, boys (? masters' boys, which seems more likely), young men, *and of all sorts*." The italics are the Reviewer's. Some of our sea-faring members may perhaps add a manuscript note of deserved admiration. Della Valle does not spare his, and contrasts the English practice strongly with the childish selfishness of the Portuguese pilots who made their art a mysterious monopoly. "This," says he, "is the reason that their ships frequently miscarry," and goes on to say worse of the

* The Travels of Pietro Della Valle in India from the old English translation of 1664, by G. Havers; in two volumes. Edited, with a life of the author, an introduction and notes, by Edward Grey, late B.C.S., London, Hakluyt Society, 1892.

degenerate countrymen of Henry the Navigator. But he has already taken us too far out of our own province.

On board *The Whale*, however, he saw one thing there and here appropriate—a bit of a narwhal's tusk—which the wandering Woodcock had dug up in Greenland ; and we learn, casually, that Woodcock's employers stood out for over £2,000 sterling for the whole tusk ; but were disappointed, and only got, in the end, about £1,200—a good price, one would say now, for 100 such tusks.

On the 24th of January " began to be seen in the sea abundance of things which I (Della Valle) took to be snakes," and which probably were sea-snakes, although his shipmates and his Editor would not have it.

On the 4th February they sighted land " which the English call Terra di San Giovanni," that is, they called it then, as now, the Highland of St. John. The Editor calls it a promontory, but it is a mountain six miles inland. The forest on the top is still very jealously preserved, lest the appearance of this important landmark be altered.

On the 10th February, they cast anchor " in sight of the port of Surat," that is, as the subsequent text clearly shows, in " Swally Roads" off the mouth of the Tapti.

As in many other cases, so in that of Surat, travellers and navigators used the name of marts far up shallow rivers or estuaries as if they were at the mouths ; and hence has arisen much of the lamentation about the shoaling of Indian ports, which do not now, and never did, float a large vessel fairly laden.

When our traveller got ashore, he and his friends in vain required " coaches" to carry them to Surat, and he observes that " the oxen which draw the same are fair, large, white, with two bunches like those of some camels." The Editor says that " two-humped oxen are occasionally found." But a better explanation is in Della Valle's own next sentence, where he says, " To the seaside came no coach." The sentence is a diary-entry made from hearsay before he had seen a Gujarat bullock.

After a day or two, he got " coaches" and went to Surat, where every one made a welcome guest of him. What he did for them if they called upon him at Rome on his return, some of us can conjecture from experience.

The first thing in our way that he saw there was "a great and fair tree, of that kind which I (Della Valle) saw in the sea coasts of Persia, called there Lul, but here Ber." Then follows a description of a Banyan tree, and of a little temple of "Parvete" (Parwati) underneath it. Mr. Grey thinks that this was the famous "Kabir Bar," but that is not near Surat but near Broach.

The tree Pietro had seen in Persia was probably the great Banyan of Gombroon, but without his earlier letters we can only guess at this. "Lul" or "Luli" is a Kolaba name for an imported *Ficus* resembling *F. bengalensis* in habit, but with paler and more acuminate leaves and bright orange fruit. There are one or two fine specimens on the Esplanade at Tanna, where the ways part for Calcutta and Madras.

Our author's next botanism is as good a description of "Pan-supari" as any of us could give to-day, and a page or two further on he describes "Trees of this climate, namely, Ambe, or, as others speak, Manghe, before described by me in my last letters from Persia, in the maritime parts whereof I saw some trees of this kind." Are there Banyans and Mangoes in the hot coast-belt of Persia now ?

Again, he notes that there is no flax in India, and is taken up by his Editor, because *Linum usitatissinum* is common. But the traveller was right, for he was talking only of the fibre, which is not yet used in India in spite of repeated experiments (*quorum pars ego magna fui*). From Surat Della Valle went to Broach and did *not* see the great Banyan tree, but *did* drink "Tari, which is a liquor drawn from the nut-trees of India ; whitish and a little troubled ; of taste somewhat sourish and sweet too, not unpleasing to the palate * * yet it inebriates as wine doth if drunk immoderately." If you do not believe our traveller, ask the Commissioner of Customs or his dear friend Mr. Dantra. He noted (not Mr. Dantra, but Pietro) that in the neighbourhood was a mine of "calcidoines and agates," of which most went to "Cambaia," as they do to-day.

Then he marched North "to an arm of the sea, or, to speak better, to the inmost part of the Gulph of Cambaia, directly where the River Mahi falls into the sea, in which place the flux and reflux of the sea is more impetuous and violent," &c., &c. ; and then follows as good an account of the Bore of the Mahi and its fords as is in any modern

work, and a correction of the contemporary geographers who would empty the Indus into the Gulf of Cambay.

Passing the Mahi, Pietro got to Cambay, where his observations, though accurate and interesting, were outside of our province.

Then he marched to Ahmedabad, and saw on the way, as he would to-day, " abundance of monkies " and " high hedges of a plant always green and unfruitful, not known in Europe, and having no leaves (this was in March), but instead thereof covered with certain long and slender branches, almost like our sparagus, but bigger, harder and thicker, of a very lively green ; being broken they send forth milk like that of immature figgs, which is very pernicious to the flesh wherever it touches. The Editor very modestly says, " Probably a species of *Euphorbia.*" Had he ridden in the Charotar, the " Garden of Gujarat," where Della Valle saw the hedges, he would have had no doubt about *Euphorbium veriifolium*, the " prickly milk-bush," cultivated in those parts to a perfection that has twice called for British Artillery to batter down the living walls of predatory villages.

Our traveller saw many things worth note in Ahmedabad, but chiefly in respect of " Homo sapiens " and without our present scope.

On his return he marched to Cambay by Barejri and Sojitra, where he saw " Batts as large as crows." It seems a little odd that he had not noticed the " Flying Foxes " before. The Editor on this subject tells us that bat is derived from a (presumably Saxon or Danish) verb " blaka " = to flutter. At Cambay Della Valle again observed the " bore " of the Gulf, and preserved a specimen of a flower, " very odoriferous, which they call Ciompá." There is nothing else to show which of all our " Champas " this was, but one would suppose that it was the " Hirwa Champa," an *Uvaria*, because it alone of them has no other merit than its scent. On the 7th of March the Kafila again passed the Mahi with some danger from the bore, which did not prevent Pietro from noticing many flamingoes ; " and" (says he) " I think they are those of whose beaks Mir Muhammad in Spahan (Ispahan) makes bowrings for the kings." The Editor has missed the point of this observation by supposing the " bowring " to be a part of the bow. It is, or rather was, a guard for the left thumb of the archer against the stroke of the bowstring, and could very well be

made of a flamingo's "upper jaw." The Kafila got safe to Broach and Surat without further adventure or observation in our way of business.

On the 26th of March, Della Valle was at Damân; and beginning to be puzzled by the creeks of the Konkan, but "Time and better observations" enabled him afterwards to interpolate in his log-letter a very good account of them. At Damân he "first tasted at the (Jesuit) father rector's table many strange Indian fruits * * and others which * * * were * * brought into East India from Brazil or New Spain, namely, Papaia, Casa or Cagiu, Giambo, Manga or Amba and Ananas. This list apparently refers to both the Indian and imported fruit, and the Editor rather unnecessarily remarks that the mango is a native of India, and identifies the Giambo with *Eugenia jambolana*, the common jambul tree of our forests and roadsides.

Della Valle's previous remarks about the mango show that he needed no correction about it, but his first tasting it in a Portuguese convent at Damân on the 26th of March is very natural. Nowhere north of that was he likely to get an eatable mango so early, if, indeed, there was at that time a tolerable mango in all Gujarat, which may be doubted. There are but few gardens there *now* that produce such.

The Giambo was probably a rose-apple (*E. jambos*), for Della Valle could not be expected to find the harsh sloes of *E. jambolana* even "passably good." The other three are all imported trees.

Touching at almost every port on the coast, including the modern Bombay-Mahim, but not Bombay proper, our traveller got to Goa on the 8th of April, having made no observation on the way that can be noticed here, but a great many that would be very interesting matter for a more general review.

Pietro Della Valle sailed from Goa on the 14th October, 1623, and got out of the river the next evening, sailing south coastwise. At "Onor" he saw a spring which he calls "Ram tirt," and which is probably to be seen there still. "The water was hot, to wit not cold," and "within it are small fishes which use to bite such as come to swim there, yet without doing hurt because they are small." Little fishes in many Indian waters do the like, to the great discomfort of an occasional "Griffin."

On the 31st October our traveller left "Onor" (Honawar) and got to "Garsopa" (Gersappa) along with a Portuguese Envoy bound for the Court of "Venktapa Naieka," a chief then important thereabouts. The country was, as usual at that season, looking its best, and "this journey was one of the most delightful passages that ever I (Della Valle) made in my life." The next day they "began to climb up a mountain which the country people call *Gat*, and which divides the whole length of this part of India." They halted at a fort "sometimes called Garicota, but now Govarada Naghar," where the schoolmaster got Della Valle to examine the school; just what would probably happen to him there to-day.

On the 4th they were ferried over the "river called Barenghi," which "they say is one of those which goes to Garsopa." It is very odd that no one seems to have told Della Valle anything about the falls of Gersappa when he was so near them; but his comrade, the Portuguese Envoy, does not seem to have been a very welcome guest; and probably every one concerned wanted to keep the whole party as much to the shortest way as possible. Under this day's date our traveller records "many trees of myrobalanes;" and gives an unmistakable description of the emblic myrobalan. At least one would have thought it unmistakable if the Editor had not suggested another identification. The myrobalans, says Della Valle, were "such as are brought into Italy, preserved in sugar. It hath leaves much like that plant which produces gum Arabick, by me formerly described" (an African Acacia), "different only in this, that in that of gum Arabick the branch, consisting of many leaves, is much less round or oval, and seems one leaf made up of many long and narrow ones; but in this myrobalane tree the branch" (leaf) "is sufficiently long, and the small leaves composing it in two rows on each side are somewhat larger. Nor is the myrobalane tree prickly like that of gum Arabick. The fruit is round, hard, of a yellowish green, smooth, shining, of little pulp, and furrowed with six circular lines."

On the 6th they got to Ikkeri, but Della Valle's observations here are chiefly outside our province. He mentions that "Giacche" (Jackfruit) were presented to the envoy as "a fruit very rare at this time" (November) and brought from far distant places. In Western India

the height of the Jack-fruit season is in May and June, but this year the crop was late (1623).

Our traveller made two observations for the latitude and found it at the second and best to be 13° 54′ 20″. The Editor gives it (from the *Gazetteer*) as 14° 7′ 20″. So Della Valle's observation was not a bad one for an amateur of the 17th century. He got tired of the place before the Envoy's business was completed, and left it on the 23rd November. He had procured by order "a little book written in the Canara language, * * * not of paper, which they seldom use, but of palm leaves, (to wit) of that palm which the Portugals call *Palmum brama*, *i. e.*, wild palm, and is of that sort which produces the Indian nut, for such are those commonly found in India, where palms that produce dates are very rare." The whole passage is very true, but has somewhat puzzled the Editor, not accustomed, as some of us are, to talk of "brab trees." The Portuguese term "Palmeira Brava" has got slightly corrupted in text and note, but the plant meant is certainly *Borassus flabelliformis*, which does bear an edible Indian nut, though not so large or good as a cocoa-nut.

On the 26th, Della Valle arrived at "Lower Barselor of the Portugals," and on the 27th he "imbarqu'd" for Mangalor.

On the way they landed a party on St. Mary's Isles, still so called, to take wild pigeons, "wherewith we made a good supper." The Editor identifies these with the Primeira Rocks, but there seems to be no reason for doubting the correctness of the traveller's nomenclature, nor the persistence of so simple a name which is on our Admiralty charts and sailing directions. (West Coast of Hindustan Pilot, 1891 ; page 163.)

Pietro Della Valle's great object at Mangalor was to visit Banghel and Olala, places now of no resort to globe-trotters, but important in the Portuguese local politics of the day. The latter was famous, indeed, for the spirit and wisdom of its ruler ; a lady whom he saw in a very informal way, and by no means in full dress. "In brief, her aspect and habit represented rather a dirty kitchen wench or laundress than a delicate and noble queen, whereupon I (Della Valle) said within myself 'Behold, by whom are routed in India the armies of the King of Spain, which in Europe is so great a matter.'" He "imagined," however, that she had been handsome in her youth, and

she was certainly very frank and civil to him. Her son, whom she kept in tutelage, asked Pietro to pot-luck, which (as the dynasty was Hindu) he had to take alone, and gives the *menu* :—" Rice served on a plantain-leaf, ' very good butter melted ' (ghi), ' and a quantity of a certain red herb called by the Portuguese Bredo (which yet is the general appellation of all sorts of herbs)."

The Editor supposes this to have been the tomato, but it was more probably a red amaranth. Several plants of this order are " lal baji " in Hindustani and " bredo " to the Goanese at this day. There were also pickled bamboo shoots and " several fruits " undescribed. There was not time to get up a good curry, but the traveller takes this opportunity to describe it very well. On the 19th he sailed from Mangalor for Calicut and Cannanore and thence returned to Goa, without adventure in our line, except that they had to anchor amongst St. Mary's Isles, " whence some men that went ashore brought me some jasmen of a very goodly scarlet colour, but for smell it had little or none at all." The Editor supposes this to have been *Bignonia venusta* ; and quotes the remark " attributed to a late Financial Member of Council," that " India is a place where everything smells except the flowers ! ! " As for the flower, it was *Ixora bandhuka,** and as for the joke, its better known attribution is Ali Baba's, *viz.* to " some jack-ass."

After his return to Goa our traveller noted a Cannella " as big a tree as any" and exotic (pellegrino), which the Editor identifies with *Canella Alba* of the West Indies. It had a yellow flower " used by the country people instead of saffron" and the leaves had " a taste of cinnamon and (were) pleasant to masticate." He preserved some ; " as also of the Arbor Tristo, with its odoriferous flowers ; which blow every day and night and fall off at the approach of day,"—our well-known Parijataka (*Nyctanthes arbor-tristis*). " Moreover, I saw and observed in the Lake," says he, " two sorts of flowers, one

* Now usually entered as *I. coccinea.* The synonym *bandhuka* is used here as more intelligible to many native members. The gardeners' trivial name is " Bakawli," but is shared with other plants. A bush with handsome bunches of bright red flowers, not a true jasmine, though the flowers are sufficiently like jasmine blossoms in shape to justify Pietro. Brandis, and Watt following him, call this bush " Flame of the Wood ;" but it is not a plant of the woods, rather of waste places and hedges. Our " Flame of the Forest" is *Butea frondosa.*

great, the other very small, both white with something of yellow in the midst ; the lesser hath no green leaves on the stalk to be seen, and the inner part of the white leaves" (petals) " is full of thick and long down. The greater flower hath smooth, long and strait petals ; and grows on a plant whose leaves are large and almost perfectly round, floating on the surface of the water. Both these flowers have a strange property ; in the night they are always closed," &c., &c.

" Evidently two kinds of Lotus," says the Editor ; and both plants *are* called lotus. He is less happy in identifying them as of genus *Nelumbium*, for the round floating leaves are evidence that the larger was *Nymphœa lotus*, those of *Nelumbium stand above* the water ; on strong stalks well able to bear their weight.

The little flower is the " Cotton-lotus," *Limnanthemum indicum*, which is not a lily or lotus at all, but a gentian. Della Valle, we think, was wrong in supposing that it closed at night ; probably misinformed. However, he has in this, as in other cases, left to us from the early sixteen hundreds a specific description recognizable to-day. This is his last, as soon after writing it he sailed for Europe, where, though he did not exactly " live happily ever afterwards," he lived long enough to marry (being already a widower) and beget no less than fourteen sons. One would be very glad indeed of a little more of his correspondence.

THE MANAGEMENT OF ANIMALS IN THE CALCUTTA ZOOLOGICAL GARDENS.*

The project of establishing a Zoological Garden in Calcutta was mooted as far back as 1842 by Dr. McClelland, the Curator of the Bengal Asiatic Society's Museum, who formulated a plea for its foundation in the pages of the " *Calcutta Journal of Natural History* " for that year. But this scheme, as set forth in his article, did not attract any notice at the time. The subject was again taken up by an anonymous writer, and discussed in the pages of the " *Calcutta Review* " for 1866 in an article entitled " The Indian Museum and the Asiatic Society of Bengal." In this article the writer advocated the establishment of a State-aided zoological collection in Calcutta, which would not only serve the purposes of a place of recreation to the public, but also be a scientific institution where the habits and instincts of the brute creation might be

* A hand-book of the Management of Animals in Captivity in Lower Bengal by Ram Brama Sányál, Superintendent of the Zoological Gardens, Calcutta, Published at the Bengal Secretariat Press, Price Rs. 5.

observed and recorded, and exotic animals acclimatised. No notice, appears to have been taken, at the time, of this admirable proposal. In 1867 however, Dr. (now Sir) Joseph Fayrer, then President of the Asiatic Society of Bengal, formulated a scheme for the foundation of a Zoological Garden in the British Indian metropolis, and his proposal seems to have met with a favorable response from the Calcutta public, who promptly came forward and raised a large amount of money by subscription ; but, as no suitable site for the location of the institution could be found at that time, the scheme was temporarily shelved. In 1873 Mr. Carl Louis Schwendler, electrician to the Government of India, and a gentleman well-known for his ardent love of natural history pursuits, again brought the subject forward and submitted a scheme for establishing a public vivarium, and for acclimatising foreign vertebrates in Calcutta, to the Bengal Government and the Council of the Bengal Asiatic Society. A sub-committee, composed of the members of the Asiatic Society of Bengal and of the Agricultural and Horticultural Society of India, was formed to consider Mr. Schwendler's proposal ; but, as in 1867, the scheme was once again placed in abeyance, as no suitable site could be found. Mr. Schwendler's suggestions were again taken up for consideration during the *régime* of Lord Northbrook; and Sir Richard Temple, then Lieutenant-Governor of Bengal, not only highly approved of the scheme, but adopted it.

It was mainly through Sir Richard Temple's liberal assistance and Mr. Schwendler's warm advocacy, indomitable perseverance and determination, that the Calcutta Zoological Gardens became a *fait accompli* in 1875. The Government of Bengal liberally granted two tracts of land, situated on the sides of the Belvedere Road, south of the Zeerut Bridge, at Alipore, for the location of the institution, and sanctioned an annual grant of Rs. 20,000 for the purchase of animals and the maintenance of the gardens in a state of efficiency, and also appointed an Honorary Committee of Management to administer the affairs of the institution. To the menagerie, then in a state of infancy, Mr. Schwendler presented his private collection of animals, birds and reptiles, and these formed the nucleus of the splendid display of indigenous and exotic vertebrates which now adorns the Calcutta Zoological Gardens. It was on the 1st January, 1876, that the first sod was turned by H. R. H. the Prince of Wales, who was then in Calcutta ; and the Calcutta Zoological Gardens were formally opened to the public on the 1st of May of the same year. Thus this institution, which was established, as is stated in the original prospectus issued in 1875, under the sanction of Government, for the purpose of developing and displaying the zoological wealth of the country, and facilitating the acclimatisation, domestication, and breeding of animals, and improving the indigenous breed of cattle and farm-stock, has now been in existence for seventeen years.

In the eyes of both God and civilised man, we owe a responsibility to the dumb creatures whom we bring from their native wilds and place in durance

vile, in order to minister to our curiosity and instruction. It is our bounden duty not only to supply them with food and shelter, but also to see that they are provided with proper accommodation for comfort ; that they get the diet which Nature has appointed for them, or, where that is difficult to procure, the nearest approach to it possible, and that they have ample space for exercise, and abundant air. The more complete the arrangements for their comfort, the roomier and airier the place in which they are confined, the more they are placed amidst surroundings resembling those of their native wildernesses, the happier and healthier they will be, the longer they will live, and the greater will be the amount of the amusement and instruction to be derived from inspecting them and observing their habits and instincts.

Since the gardens were established, the Managing Committee of the institution have not only tried, as far as lay in their power and their financial resources allowed, to discharge the duties above mentioned, but have also attempted to carry out the objects set forth in the original prospectus with more or less success. They have adopted and introduced the latest improvements in menagerie-architecture, in order that the animals under their charge may have commodious quarters, have called in the aid of medical science to cure them of the ills that brute-flesh is heir to, and, as far as practicable, have placed them amidst surroundings resembling those of their native haunts.

During the period of seventeen years during which the Calcutta Zoological Gardens have been in existence, the Committee of Management has acquired a great deal of experience in managing, in health and sickness, the various animals, both indigenous and exotic, that have, from time to time, been exhibited. The work under review embodies this experience, and sets forth the methods by which dumb creatures in captivity should be treated in health and sickness, and the best ways of providing them with comfortable accommodation and with the most suitable diet. The idea of writing the present work was suggested by His Honor the Lieutenant-Governor of Bengal, in his Resolution on the Report of the Honorary Committee for the Management of the Calcutta Zoological Gardens for the year 1888-89, published in the *Calcutta Gazette* of the 9th October, 1889, wherein he gave expression to the following opinion : "As the Zoological Gardens have now been in existence for 13 years (since 1875-76), it is presumable that many events have taken place among the large number of animals, birds, etc., exhibited from time to time, which would be of interest to the scientific world and to persons interested in zoology ; also, that considerable experience must have been gained in the management of animals, birds, etc., in confinement, and their treatment in sickness which would be of practical use to the managing bodies of other zoological gardens and to individuals who have private collections. Sir Steuart Bayley is strongly of opinion that it is incumbent on all persons who keep animals in captivity to avoid, as far as possible, anything like cruelty (such as want of space or air, proper food, or cleanliness) in their treatment,

and he recognises that the Zoological Gardens' Managing Committee set an excellent example in this respect. He would venture to suggest that from the records of the Committee and the recollections of their able Superintendent it would be possible for them to produce a hand-book, which might be of great use to the numerous nobles and other persons who, on a smaller scale, keep collections of animals or birds in captivity."

A meeting of the Committee of Management was convened on the 2nd April, 1890, for the purpose of considering the suggestion embodied in the Lieutenant-Governor's Resolution; and, as the result of its deliberations, it recommended the appointment of a Sub-Committee for the purpose of giving effect to it. A Sub-Committee was accordingly formed; and, after mature consideration, it drew up a plan for writing the suggested work. It is on the lines adopted by the Sub-Committee that the present hand-book has accordingly been prepared by Babu Rám Bramha Sanyál, the Superintendent of the Gardens, under the supervision of Mr. C. E. Buckland, C.S., one of the members of the Committee. For the purpose of writing this work, the author, as he informs us in the preface, has had to prosecute a good deal of original research in the shape of examining the collection of the vertebrata in the Indian Museum, Calcutta, for the purpose of identifying the little-known forms.

The work consists of two parts, preceded by an admirably drawn up table of contents, containing a list of all the species of animals that have been exhibited in the Gardens up to the present time, classified under their respective orders, families, genera, and species. The first part treats of the mammalia, and the second of the aves, or birds. The reptilia, which would have formed the third part of the present work, could not be included in it; for the author informs us that, "as a considerable portion of it was already in type when we commenced the New Reptile House, we did not, after all, think it worth while waiting longer to incorporate the reptiles in the present edition."

The work has been drawn up on an admirable and exhaustive plan, for under the heading of each species of animal, its nomenclature, both scientific and vernacular, and habitat are first given; in the next place the length of its life in captivity in the Gardens; then its treatment in health; then its treatment in sickness; and, last of all, the observations made in the Gardens on its habits and instincts, supplemented, in some cases, by a list of the authorities who may be consulted for further information regarding it.

Under the heading of treatment in health, suggestions, based upon experiences gained in the Gardens, as to the best way of housing, feeding, and transporting animals in captivity, as well as remarks regarding their breeding in the Calcutta Zoo, are given. With reference to housing animals in captivity, it may be observed that the old idea of keeping captive wild animals in small cramped cages and dens still prevails in this country among Indian chiefs and nobles who maintain menageries on a miniature scale. Even in England, this

idea, inherited from the Tower Menagerie and the various itinerant wild-beast shows, prevailed, even in such an excellent and well managed institution as the Zoological Society of London during its earlier years.

This practice of keeping animals in dark, narrow and ill-ventilated cages remained in vogue in this country till May, 1876, when the Calcutta Zoological Gardens were opened to the general public. Since then, the Indian public have had ample opportunities for realising the inhumane character and the unhealthy effects of the practice, by comparing the emaciated and sickly looks of animals in private menageries with the sleek appearance and improved health of the inmates of the Calcutta Gardens, due no doubt to the improved method adopted by the Managing Committee of providing them with commodious, airy, and substantial buildings, suited to the habits of particular groups of them. Among these may be mentioned the Gubboy House, with its arched Leslie patent roof, plate-glass doors and fan-lights, for excluding draught and cold and regulating the atmosphere, which has been found admirably suited to the gibbons (*Hylobates*), other varieties of monkeys (*Semnopitheci* and *Cercopitheci*) and small and rare mammals of a delicate nature. The Dumraon House is adapted to the requirements of hoolocks (*Hylobates hoolock*) and monkeys peculiar to the Indo-Malayan fauna (*Macaques*). The Ezra House, with its lofty roof and minarets and enclosed airing-grounds on the east and the west sides, furnishes very comfortable accommodation to giraffes (*Camelopardalis giraffa*), zebras (*Zebra burchelli*), and other equine animals. It is needless to multiply examples ; suffice it to say that all of them are built on the latest approved principles, and are furnished in such a way as to present their inmates, as far as practicable, with the surroundings of their native wilds.

As regards food, the experience gained in the Calcutta Zoo shows that wild animals in captivity thrive best if fed with articles of diet which Nature usually supplies to them while living in a wild state. In cases where these are difficult to procure, articles of similar character should be given them. A monotonous round of the same articles of diet, it has been found, brings on disease in menagerie animals. Changes from one sort of food to another should be frequently resorted to, and the animals are found to preserve health better when fed on varied diet each day than when fed with the same food all the year round. Animals which prey upon small mammals and birds should, in a state of captivity, be given small living birds, such as sparrows, live fowls, pigeons, or mice, guinea pigs or rabbits, for them to kill and eat ; and this expedient has been found in the Zoological Gardens to be very effective in sharpening their appetites and reviving their drooping spirits.

The larger carnivora often display an aversion to their ordinary diet ; and in such cases live kid, or fowls, and mutton are given. A sufficient quantity of food and clear water should always be provided, as the carnivora possess

the habits of drinking water after their meals. In the Alipore menagerie the larger *Felidæ* are fed only once a day; and once a week they are either starved or kept on half rations, and it has been uniformly found that this system proves beneficial to their health. Small quantities of *doob* grass ought to be given them almost daily, as it acts as an emetic, as also flower of sulphur which acts as a tonic to almost all animals in captivity—the latter to be given either in their food or in their drinking water. All the bears in the collection (with the exception of the *Ursus maritimus*) like sweets more or less, sugarcane and biscuits being a favourite food with them. They are usually fed on boiled rice, sugar, vegetables, fruits, eggs, bread, biscuits, and milk. The Polar bear (*U. maritimus*) was given only 3 lbs. of fat mutton in the evening, with a change of fish and live pigeons occasionally. All the four species of Asiatic rhinoceri in the Gardens, *Rhinoceros unicornis*, *R. sondaicus*, *R. lasiotis*,* and *R. sumatrensis*, are fond of the leaves of the jack-fruit tree, but these being costly and not always procurable, they are fed on leaves of the *gulher* or *doomoor* (*Ficus glomerata*) and other species of figs; but the experience gained in the Gardens is that it is better to restrict them to jack and gulher as much as possible, supplemented by allowances of soaked gram and bran, together with salt and small quantities of *goor*, or country treacle occasionally. Both the species of tapirs† hitherto represented at Alipore, *Tapirus malayanus* and *T. roulini*, feed on vegetable substances, such as leaves, shoots, and roots, sweet potatoes, yams, bran, and boiled rice being occasionally given to them. The *Equus burchelli* and *E. onager* thrive best on crushed food consisting of grain, &c., hay, paddy, straw, and salt. The *Bovidæ*, especially *Bos frontalis*, *B. sondaicus* and *B. gaurus*, are very fond of bamboo leaves; but, as they become reconciled to their captivity, they imbibe a taste for such things as gram, bran, hay, &c., together with a few onions. Salt is very necessary to them, and should be given daily, either mixed with gram or in small lumps for licking, together with a large troughful of clear water. Other members of the same family have been found to thrive best on grass and grain, only the Wild Buffalo of the Celebes (*Anoa depressicornis*) being fond of the green stalks of paddy plants. Of the antelopes, the Eland (*Oreas canna*), the Nilgai (*Boselaphus tragocamelus*), the Beisas (*Oryx beisa* and

* It is doubtful whether *Rhinoceros lasiotis* can be called a distinct species. Mr. W. T. Blanford is of opinion that the several points of distinction in the external appearance of the rhinoceri from Chittagong and Malacca, which led Mr. P. L. Sclater to create a distinct species, *lasiotis*, for the reception of the Chittagong form, are scarcely of any specific value. He regards the two forms—one from Malacca (*R. sumatrensis*) and the other from Chittagong (*R. lasiotis*)—as varieties only. He says that, though the most remarkable difference between them is in the shape of the head, yet it is a variable one, as has been shown by Blyth. (*Vide* The Fauna of India: *Mammalia*, p. 477.) The author of the work under review has, however, after a careful examination of both the Chittagong and Malayan species now living in the Calcutta Zoo, noted the principal points of difference between the two, most of which are found to tally exactly with those observed by Sclater. (*Vide* page 132 of the work under review.)

† A pair of American tapirs (*Tapirus americanus*, Gmal.) have been recently added to the Calcutta Zoological Gardens. See *Englishman* of 6th June, 1892.

O. leucoryx) thrive well on mixed food, consisting of gram, bran, Indian corn, wheat, paddy, &c., supplemented by hay and green grass—the last to be given sparingly. The gazelles (*Gazella arabica*, *G. bennettii*, and *G. granti*), the other Indian antelopes (*Antelope cervicapra* and *Tetraceros quadricornis*), and the North African form (*Alcephalus bubalis*) are fed on gram, bran, grass in small quantities, maize, paddy, wheat, &c., hay, onions and salt, the gazelles being very fond of babul leaves (*Acacia arabica*). The Persian Ibex (*Capra ægagrus*) and the Uryal (*Ovis cycloceros*) thrive better on various kind of leaves and hay than on grain, and are extremely fond of rose-leaves. Two to three seers of grain (maize, gram, wheat, &c., with a pinch of salt twice daily, supplemented by a few bundles of hay, constitute capital food for the giraffes in the Calcutta Gardens. It has been found that here they much relish the leaves of the *Acacia arabica* and the *Zizyphus jujuba*. Of the *Cervidæ*, the Chevrotains (*Cervulus muntjac* and *C. reevesi*) and the various members of the genera *Cervus* and *Rangifer* (*Cervus canadensis*, *C. tævanus*, *C. duvaucelli*, *C. aristotelis*, *C. equinus*, *C. porcinus*, *C. hippelaphus*, *C. moluccensis*, *C. axis*, and the reindeer (*Rangifer tarandus*), have been found to thrive best on grains, with salt and onions, taking care, at the same time, that the former be not newly-harvested, but at least three months old. Both the living species of camels which have been represented at Alipore were found to be fond of the leaves of the various species of neem (*Melia*) and babul (*Mimosa*) and hay, a change of crushed food being occasionaly given. The *Suidæ* in the gardens have thriven well on grain, vegetables, and kitchen refuse, such as boiled meat, eggs, &c. Finely minced raw meat and eggs with milk constitute a capital diet for the Great Ant-eater (*Myrmecophaga jubata*). The two species of the genus *Phascolomys* hitherto exhibited, namely, *P. wombat* and *P. latifrons*, feed on grass and leaves—a small quantity of grain and sometimes biscuits being given every morning. The kangaroos* (*Macropus giganteus* and *M. rufus*) and the Wallabies (*Halmaturus ualabatus* and *H. bennetti*) are strictly vegetarian feeders and forage for themselves, a small quantity of maize, wheat, and other grains being generally allowed to them.

The orang-outang (*Simia satyrus*) has been found to thrive well on any one of the following three different courses of diet, *viz.*, (1) plantains, boiled rice, biscuits, vegetables ; (2) soaked gram, milk, bread, fruits ; (3) plantains, raw eggs, sugarcane, &c., fruit of the sweet potato. The other anthropoid apes in the Gardens, *viz.*, the hoolock and the gibbons (*Hylobates hoolock*, *H. leucogenys*, *H. lar*, *H. agilis*, *H. leuciscus*, and *H. syndactylus*), have maintained very good health when fed on boiled rice, soaked gram, various kinds of fruit, and

* Among the Marsupials, the unadorned-footed rock-kangaroo (*Petrogale inornata*) has not been noticed in this work, though it was at one time exhibited in the Gardens. I remember having seen pretty specimens of this species in the Sonebursa House, some time in June or July, 1892. Among the other omissions is the European badger (*Males taxus*, Bodd.), which is also included in the collection at Alipore, and was, I believe, purchased at the sale of the King of Oudh's menagerie.

roots, bread, biscuits, eggs, and occasionally live sparrows and a few grasshoppers, making allowances for individual tastes. Excluding animal food of all kinds whatever, the diet prescribed for the various species of *Hylobates* and for the orang will do well for the *Semnopithecus entellus*, with the addition of a sufficient quantity of leaves. The crested semnote (*S. cristatus*) and Phayre's leaf-monkey (*S. phayri*) live best on the diet prescribed for the orang. The Assam langur (*S. pileatus*) is less fond of leaves than the other *Semnopitheci*. Several of them have exhibited a slight partiality for the leaves of a species of Amaranthus (*natya sag*). The proboscis (*S. larvatus*) and the red-haired monkeys (*S. rubicundus*) like the green stalks of paddy and wheat and young shoots of *kalmi* (*Convolvulus reptens*). Experience gained in the Gardens has shown that the *Cercopitheci*—forms peculiar to the fauna of the Ethiopian region—hitherto exhibited there, *viz.*, *Cercopithecus diana, C. cynosurus, C. callitricus, C. talapoin, C. nictitans, C. pluto, C. petaurista, C. cephus, C. patas, C. mona*, thrive well on the same kind of food as is ordinarily given to the hoolocks, hanumans and other semnotes. The monkeys of the genus *Macacus* are almost omnivorous : boiled rice, soaked gram, biscuits, pumpkins, cucumber, brinjals, and other vegetables constitute their ordinary food. Eggs are occasionally given to them as substitutes for the insects and spiders which, in their wild state, they are accustomed to eat, besides fruits and vegetables, minced meat being sometimes, but rarely, given. The *Cynocephali*,* or the baboons (*Cynocephalus hamadryas* and *C. porcarius*), do well when fed on a vegetable diet consisting of fruits, roots, grain, boiled rice, with a change of eggs and grasshoppers. The same diet as that on which the hoolock is fed has been found to constitute capital food for the mandrill (*C. mormon*). The lemurs (*Lemur mongoz, L. varius*, and *L. flavifrons*) feed on fruit, eggs, bread, and milk.

The feeding of the birds, however, is not so expensive as that of the mammals, for most of the articles of diet of which they are fond, such as maggots, berries, &c., are to be had in abundance in the Gardens themselves. The principal food of the majority of the birds are seeds, soft fleshed fruits, berries, maggots, satoo, and, occasionally, minced meat made into pellets. Some of the aquatic birds, however, find their own food, such as fish, crustaceans, &c., from the tanks and jhils in the Gardens. Experience has shown that an early meal, consisting of maize, barley, wheat, or other grain, pounded together with a small quantity of egg-shell, green food later on, and grains and seeds and a few grasshoppers or meal worms in the evening, forms a capital diet for the

* Another species of this genus, *viz.*, the Guinea baboon (*Cynocephalus sphinx*, Linn.) has been represented in the Gardens ; and I distinctly remember having seen, in 1885, a specimen of it in the Gubboy House, which was on deposit there. But I regret to find that this animal has not been noticed in the present work. There are many other omissions, which will be noticed in their respective places. A magnificent specimen of the drill (*Cynocephalus leucophœus*, F. Cuv.) has also been recently added to the collection—having been acquired in December last.

Monauls (*Lophophorus impeyanus* and *L. sclateri*), the Gold and Amherst's pheasants (*Thaumalea picta* and *Th. amherstiæ*), six species of the genus *Phasianus*, twelve species of the genus *Euplocamus*, and other members of the order *Gallinæ*, hitherto represented in the Gardens. The Tragopans (*Ceriornis satyra*, *C. melanocephala*, *C. temminckii*, *C. caboti*, and *C. blythi*) and both the Indian and the Malayan species of the Polyplectrons, or the Peacock pheasants, require the same treatment as regards food as the other pheasants, except that the former are fonder of berries and fruits than of grain.

Of the order *Casuarii*, the three species of Cassowaries in the Gardens have been found to thrive best on vegetables, fruits, and roots. In captivity the Emu is fed on biscuits, bread, crushed food, and vegetables. The Ostrich (*Struthio camelus*) and the Common Rhea (*Rhea americana*), belonging to the order *Struthiones*, are both treated in the same way as the Emu, only with the difference that the former is given a pound of beef or mutton once a week during the cold and the rainy seasons. Of the order *Grallæ*, family *Gruidæ*, seven species of Cranes (*Grus*) and the two species of Crowned Cranes (*Bælarica pavonina* and *B. chrysopelargus*) have been found to maintain very good health when fed on grain of various kinds, soaked or dry, according to individual taste, and vegetables, but some of them find a great deal of their own food, such as frogs, lizards, shells, worms, &c., only the snow-wreath (*Grus leucogeranus*) and the Crowned Cranes not being partial to this latter kind of diet. Birds of the order *Steganopodes* (Cormorants, Snake-birds and Pelicans) live well on fish, but, in captivity, they readily take to meat-diet, being fed at Alipore on $\frac{3}{4}$ to 1 seer of beef and fish. The various members of the orders *Anseres* (Geese and Ducks), *Gavidæ* (Gulls) and *Limicolæ* (Snipes and Jacanas) thrive best on grain, vegetables, and grass, supplemented a good deal by aquatic insects, worms, larvæ, &c., and are also very fond of the tender shoots of the *kalmi* (*Convolvulus reptens*) and *tokapana* (*Pistia stratiotes*), which are given to them in large quantities. Of the birds of the order *Platalea*, the Spoonbill (*Platalea leucorodia*) is fed on prawns, small fish, and occasionally minced meat. This food, it has been found, also forms excellent diet for the Black-headed (*Ibis melanocephalus*), Glossy (*Plegadis falcinellus*), and Scarlet Ibises (*Eudocimus ruber*). The Pelican Ibis (*Tantalus leucocephalus*) picks out a great deal of its own food, such as crabs, frogs, and fish, by loosening, with its right foot, the mud near the edges of the tanks. This latter habit is also possessed by the Flamingo (*Phœnicopterus antiquorum*), belonging to the order *Odontoglossæ*, which, in a state of captivity, feeds on bran and barley with water. Birds of the order *Herodiones* (Herons, Storks, and Adjutants) thrive well on fish and meat, but the Adjutants and the Black-necked Stork (*Xenorhynchus asiaticus*) mainly live on the latter article.

The birds of prey, such as the Owls, Eagles, Falcons and Vultures (belonging to the orders *Striges* and *Accipitres*), are all of them carnivorous, and, as a

rule, are fed on beef, frogs, fish, and live rats. Of the order *Psittaci* (Cockatoos, Parrots, Parrakeets, Lories, &c.), nine species of the genus *Cacatua* and other birds of the allied genera, *Licmetis*, *Microglossa*, and *Calopsitta*, have been found to maintain good health when fed on paddy, maize, gram, barley, hemp seed, chillies, and vegetables, all of them being extremly fond of sugarcane ; and this diet has also been found to answer well in the cases of the birds of the genus *Palæornis*, only the red-headed (*P. cynocephalus*) and the red-cheeked species (*P. erythrogenys*) being fond of fruits, especially papaya (*Carica papaya*). Lories of the genera *Lorius*, *Eos*, and *Trichoglossus* thrive well on a mixed diet of bread and milk, seeds, fruits and vegetables, with a change of boiled eggs for birds of the last-mentioned genus only. Grain seeds and vegetables, with crumbs of bread given occasionally, rock salt, and clean water, constitute a capital diet for five species of the Broadtail Parrots (*Platycercus*) and the New Zealand Parrakeet (*Cyanoramphus novæ-zealandæ*). Experience has shown that the same diet, only with the addition of fruits and biscuits, is admirably suited to the physical requirements of the Macaws (genus *Ara*), the Yellow-headed Conure (*Conurus jendaya*), and the three species of Amazon Parrots (genus *Chrysotis*), all peculiar to the Neotropical region. The truly African psittacine forms, *viz.*, the Vasa parrots (*Coracopsis vasa* and *C. nigra*) and the Grey Parrot (*Psittacus erythacus*) are fed like the Cockatoos. Of the order *Bucerotes*, hornbills of the various genera *Buceros*, *Dichoceros*, *Anthracoceros*, *Ocyceros*, *Aceros*, *Rhytidoceros* and *Cranorrhinus*, have been found to thrive on a diet comprising boiled rice, minced meat, figs, berries, and other fruits, with an occasional allowance of small birds and insects to sharpen their appetites. Of the sub-order *Zygodactylæ*, the Ariel (*Ramphastos ariel*) and the Sulphur-breasted Toucans (*R. carinatus*) peculiar to the Neotropical avifauna, hitherto exhibited in the Gardens, have been fed on fruits, crumbs of bread, minced meat, and eggs.

Pigeons and doves of various genera and species are fed on various sorts of grain, though, in captivity, they acquire an artificial taste for bread, biscuits, and boiled rice.

Maize mixed with other grains, such as wheat, barley, and hemp-seed, constitutes a capital diet for the larger pigeons, only the blood-breasted (*Phlogœnas cruentata*) and the Australian crested species (*Ocyphaps lophotes*) being very fond of the *moong* pulse (*Phaseolus mungo*), other grains and fruits. The soft-billed pigeons evince a partiality for satoo mixed with macerated plantain. Other species, among them being the Wonga Wonga (*Lencosarcia picta*), like hard stones of fruits, while the fruit-eating ones thrive well on various figs and berries, such as those of the Peepul and the Banyan trees. To promote their health, they should also be allowed greens, such as cabbage, spinach, &c. Of the order *Scansores*, family *Capitonidæ*, Barbets of the genera *Megalæma*, *Cyanops*, and *Xantholæma*, while in captivity, feed on

satoo, plantains and other fruits and minced meat. Of the order *Passeres*, family *Alaudidæ*, both the skylarks (*Alauda arvensis* and *A. arborea*) in the Calcutta Zoo thrive excellently on seeds of various kinds, fruits, berries and maggots, only the bush-larks (*Mirafra assamica* and *M. cantillans*) liking satoo, fruits, insects and maggots. Of the family *Sturnidæ* (same order), Mynas of various genera and species, generally speaking, do well when fed on satoo, maggots, insects, fruits and grain of various kinds, making allowance for the tastes of particular species. Of the family *Eulabetidæ*, the Grackles or Hill-Mynas (*Eulabes religiosa* and *E. intermedia*) require satoo, boiled rice, fruits, bread and milk. Of the family *Oriolidæ*, the four species of Orioles in the collection thrive excellently on satoo, insects, fruits, berries of the *Ficus religiosa*, *F. comosa* and sweet *Inga*. Of the family *Crateropodidæ*, sub-family *Brachypodinæ*, three species of Bulbuls of the genus *Molpastes*, two of *Otocomposa*, one each of *Hypsipetes* and *Picnonotus*, do well on satoo paste, prepared with *ghi*, fruits, insects and maggots. Laughing Thrushes of the genera *Dryonastes*, *Garrulax*, *Ianthocincla* and *Grammatoptila* thrive when fed on satoo, fruits, insects and worms, only the *Dryonastes chinensis* requiring minced meat. Of the family *Corvidæ*, sub-family *Corvinæ*, order *Passeres*, the various Magpies of the genera *Pica*, *Urocissa* and *Cissa*, and the Indian tree-pies (*Dendrocitta rufa*, *D. himalayensis*, and *D. frontalis*) have been found to thrive excellently on minced meat, fruit, boiled rice, boiled eggs, satoo and various kinds of insects, only the Green Magpie (*Cissa chinensis*) is occasionally given live sparrows and other small birds, and the Tree-pies various kinds of insects to sharpen their appetites. Another useful feature of these remarks is, that the approximate daily cost of feeding the large animals and birds is given.

The breeding of animals is set forth in the original prospectus as one of the objects for which the Calcutta Zoological Gardens were established. But the Committee's efforts to carry it out have been attended with but scant success, though hopes were at one time entertained that all the denizens of the Gardens would breed freely and multiply fast, so as to render it possible that additional examples of each species might be available for exchange with institutions of a similar kind, both in this country and elsewhere. The conditions which are most favorable to the breeding of animals in captivity are that they should be provided with (1) commodious quarters for their housing, grazing and open-air exercise ; (2) the diet which they are accustomed to feed upon in their wild state ; (3) that their quarters should be such as to suit their respective habits and should represent the surroundings of their native wilds ; (4) that, in the case of gregarious animals, a large number of both sexes, and, in that of the Carnivora and other species, a pair, each consisting of a male and a female, should be lodged together, so as to afford them opportunities for seeking each other's company. Experience has shown that the females of the

larger carnivorous animals naturally seek seclusion and retirement when *enceinte* so that they may enjoy freedom from disturbance by others ; and the want of proper accommodation to meet such emergencies has on several occasions been keenly felt in the Gardens. In the same menagerie, it has been found that some species of birds every year make attempts at constructing nests, but are prevented from doing so by others which annoy them at this time. In some cases they have even laid eggs, but could not incubate them, owing to the presence of other birds, which (not unfrequently) destroy them by breaking them. Some species of mammals and birds are sure to breed in captivity, if left by themselves in separate cages, and undisturbed by other species. Hence seclusion is also very necessary to their successfully breeding in a state of captivity. Though, in comparison with the existing private and other public menageries throughout the country, the comforts and conveniences of wild animals in captivity are studied and attended to with far more care and greater regularity in the Calcutta Zoological Gardens, yet all the aforesaid conditions are not fulfilled there to the same extent as they ought to be. No doubt some animals breed and rear young ones successfully every year at Alipore, as will appear from the tabular statements of such births published annually in the Managing Committee's Reports ; but their number sinks into insignificance when compared with the long lists of animals bred every year, which are appended to the Annual Reports of the London Zoological Society and the New York Central Park Menagerie. The reason why so much success in this direction has been achieved in the last two institutions is simply that the inmates thereof enjoy far greater comfort and convenience than at Alipore, for in London and New York far airier and roomier quarters, with extensive enclosures affording opportunities for exercise in the open air and the display of their natural habits, are allowed them than here.

Experience gained in the Calcutta Zoological Gardens has clearly shown that only some of the mammals have every year successfully bred and reared young ones there. Of the birds, all, except a few species, have failed to propagate. Among the monkeys, the Hanuman (*Semnopitheus entellus*), several species of Macaques (*Macacus rhesus, M. cynomolgus*, and *M. sinicus*) of the Indian and Malayan faunas, and the Malbrouck (*Cercopithecus cynosurus*), peculiar to the Ethiopic region, have successfully bred and cross-bred. The Mongoose Lemurs (*Lemur mongoz*) have also bred here, the female producing only one young at a birth. Of the *Felidæ*, the lions in the collection have not been blessed with any offspring as yet, although the Committee have provided suitable accommodation, likely to favour the happening of the longed-for-event, by building a smaller and secluded den, as an annexe to their cages in the Burdwan House, and hopes are entertained that their efforts in this direction will ultimately be crowned with success. Tigers have thrice bred, *viz.*, in May, 1880, May, 1886, and April, 1889. The Leopard and the Fishing-Cat (*F. viverrina*) are the only two other cats which have bred at

Alipore, and the males of both species sometimes devour their young ones. Of the *Ursidæ*, the Himalayan bear (*Ursus torquatus*) has bred only once, when the cub unfortunately proved a still-born one. Of the order *Chiroptera*, the Indian Fruit Bats (*Pteropus medius*) have several times produced young having only one at a birth. Of the *Hystricidæ*, only the Short-spined Porcupines (*Hystrix longicauda*) have several times bred in the Gardens and reared young ones successfully, though sometimes the young are eaten by their male parents. Of the *Dasyproctidæ*, the Agoutis* *Dasyprocta isthmica* and *D. prymnolopha*) and the Guinea-pig (*Cavia porcellus*) are very prolific and give birth to several broods in a year, the former, however, sometimes eating their young. Of the *Rhinocerotidæ*, a hybrid rhino calf was born at Alipore, of the *Rhinoceros lasiotis* and *R. sumatrensis*, on the 30th January, 1889. Of the *Tapiridæ*, female Malayan Tapirs (*Tapirus malayanus*) have twice bred, *viz.*, in May, 1877 and October, 1883. Of the *Bovidæ*, the Gyals (*Bos frontalis*) have cross-bred with the domestic cattle and produced fine hybrids, and the Bantengs (*B. sondaicus*) have also bred. The Beisa antelopes (*Oryxbeisa*) have twice reared young ones in the gardens. The gazelles, blackbucks (*Antelope cervicapra*) and four-horned antelopes have also successfully bred at Alipore, as also various species of deer belonging to the family *Cervidæ*. Of the *Tragulidæ*, only the Indian Chevrotain (*Tragulus memmina*) often produce young ones in the gardens, the female generally producing two at a birth. Of the order *Marsupialia*, only the Black Wallaby (*Halmaturus ualabatus*) have on several occasions bred.

Among the birds, the Common Myna or Salik (*Acridotheres tristis*) breeds freely in the gardens both in captivity and in a wild state, often utilising the feathers cast by other birds in the construction of its nests. Of the order *Columbæ*, the Indian Blue-rock Pigeon (*Columba intermedia*) is a regular breeder in the Alipore menagerie. One of the females of the Common Crown Pigeon (*Goura coronota*) twice laid eggs, but could not incubate them.

The Nicobar Ground Pigeons (*Calœnas nicobarica*) have twice bred in the Gardens, laying a single egg on each occasion. The Emerald Doves (*Chalcophaps indica*) have also succeeded in rearing broods. Of the order *Psittaci*, the great White-crested (*Cacatua cristata*), the Sulphur-crested (*C. galerita* and *C. sulphurea*), and the long-billed cockatoos (*Licmetis tenuirostris*) have sometimes laid in the gardens, but none could be induced to hatch their eggs, although on such occasions they were removed to secluded spots. The Crested Ground (*Calopsitta novæ-hollandæ*) and the Ring-necked Parrakeets (*Palœornis torquatus*), as also a solitary female of a Purple-capped Lory (*Lorius domicella*), have occasionally laid eggs, but never succeeded in hatching out

* Two additional species of this genus, *viz.*, a pair each of the Golden Agouti (*Dasyprocta aguti*, Linn.) and of the West Indian Agouti (*D. cristata*, Desm.) have been lately added to the collection. A pair of the Patagonian Cavi (*Dolichotis patachonica*, Shaw) have also been acquired. *Vide Englishman* of Monday, the 6th June, 1892.

broods. The Undulated Grass Parrakeets (*Melopsittacus undulatus*) have only once bred, when they succeeded in hatching two nestlings. Of the order *Anseres* a pair of Spotted bill Ducks (*Anas pœcilorhyncha*) bred during the latter part of 1885. Of the order *Fulicariæ*, the Purple Coots (*Porphyrio poliocephalus*) have thrice bred at Alipore. Of the order *Gallinæ*, the Black (*Rollulus niger*) and the Grey Partridges (*Caccabis chakar*) in the collection have frequently laid eggs, but would not hatch them. Some of the pheasants, however, such as the Silver (*Euplocamus nycthemerus*), the Lineated (*E. lineatus*) and Cuvier's (*E. cuvieri*), have bred and reared their young at Alipore. Both the species of peafowls in the collection (*Pavo cristatus* and *P. muticus*) begin laying in spring and continue doing so till the end of the rains. Of the order *Casuarii*, the Emu (*Dromœus novæ-hollandæ*) bred and reared young ones in 1885-86. Of the order *Struthiones*, only the Ostriches (*Struthio camelus*) have repeatedly laid, but have not yet succeeded in hatching out young.

Animals are frequently imported from foreign countries to the Calcutta Zoological Gardens, and it has been found that, owing to the narrowness and dinginess of the cages in which they are confined during the voyage, to the want of precautions in the matter of providing them with the food and drink most suitable for them, and to the absence of arrangements for protecting them from draughts and cold during inclement weather, much injury is done to their health during transit. When they arrive in the Gardens, they are found to be either in a miserable condition or otherwise disabled. From these injuries they never recover in spite of the most careful nurture, and after pining for a few months, they die away. A notable instance of this happened in the case of three Tapirs which were purchased at Singapore in July, 1883, and shipped thence in battened cages with open tops; "two of these animals arrived wounded and lame; during the voyage they made frequent attempts to escape, by climbing over the sides and biting through the wood-work of the cage. All Tapirs do not, of course, behave in the same manner; but the above facts indicate the kind of precaution necessary for their transport." Four specimens of the Blue-bearded Jay of Brazil (*Cyanocorax cyanopogon*) were received in the Calcutta Gardens in November, 1888, in the most miserable condition, and they never recovered from its ill-effects, and finally died in a month or two after their arrival.

The Committee of the Calcutta Gardens have also instituted a system of exchange with similar institutions both here and abroad, under which they send away Indian animals to foreign gardens or societies, and obtain in return others not exhibited before at Alipore. In "packing" these animals for transmission to foreign countries, the Committee have gained a good deal of experience as to the best methods of doing so—as to what sort of cages minister to the comfort of particular kinds of animals during the journey or voyage, what arrangements should be made for protecting their inmates from

extremes of heat and cold during transit, and so forth. Instructions based on this experience are given in this work under the sub-heading "*Transport*," for the guidance of the managers of other menageries, and of those who deal in *ferœ naturœ*, and have often to export and import them. It is advised that animals from the higher altitudes of the Himalayas should not be brought down to the plains except during the cold season, even for the purpose of sending them away to some other congenial climate. During a sea voyage, animals peculiar to cold climates should, when passing warmer latitudes, be placed near the ice-house of the steamer, and the cages containing tropical animals should, on approaching cold latitudes or during rough weather, be kept near the engine-house, as severe cold kills them. Further, most elaborate directions for the constructing and furnishing of transport-cages and selection of animals to be exported are given.

Under the heading of "*Treatment in Sickness*," detailed information is given in the work, regarding the various ailments from which animals in the Gardens have been found to suffer, the treatment adopted, and the remedies administered in each case, together with a short account of the results obtained.

The diseases from which lions in the Calcutta Gardens have been observed to suffer are paralysis, congestion of the lungs, dysentery and diarrhœa. In cases of paralysis, anodines in the shape of camphor and soap liniment are freely rubbed over their limbs with a short mop, in order to alleviate their sufferings. When the disease assumed serious proportions, strychnia in doses of $\frac{1}{4}$ grain was given morning and evening, but without effect. In a case of pulmonary congestion, the chest was alternately poulticed and fomented, while carbonate of ammonia and chloric ether, mixed with vinegar, were administered internally every two hours, but to no purpose, as the animal succumbed to the disease. Festering wounds and injuries received accidentally or in fighting have been observed to heal up on constantly injecting into the sore parts a weak solution of corrosive sublimate with a garden syringe. Rheumatism, adiposity, intestinal worms, ingrowing nails, epilepsy are some among the various ailments that afflict tigers and leopards in the Gardens. Their liability to rheumatism has been minimised by giving each of them a wooden platform to sleep upon. Ingrown nails are removed by surgical operations, and a dose or two of santonine has been found efficacious as a vermifuge. Dysentery and diarrhœa have been found to afflict the other members of the *Felidæ* at Alipore, as also the Hunting leopard (*Cynælurus jubatus*); only the Ocelot (*Felis pardalis*) suffered from severe cold and pulmonary inflammation. Some species of the *Canidæ* in the Gardens have been liable to attacks of paralysis, diarrhœa, fits or convulsions, and skin-disease, the later yielding to constant washing of the body with carbolic soap and tepid water and afterwards painting it with a solution of phenyle. Bears in the collection have been found to suffer from diarrhœa, dysentery, hepatic disorders, convulsions, ulcers, teething, and pulmonary inflammation. Ulcers yielded to the

application, to the affected parts, of a solution of corrosive sublimate, diarrhœa and dysentery are got under by giving them various preparations of the bael fruit (*Ægle marmelos*), Dover's powder and aromatic powder of chalk. The *Rhinoceri* have been observed to suffer from tetanus, pulmonary inflammation and tuberculosis of the lungs and liver. Obstruction of the bowels and galloping consumption, respectively, were the causes of the deaths of two Tapirs (*Tapirus malayanus*). The Scindian Wild Ass (*Equus onager*) and Burchell's Zebra (*E. burchelli*) have been observed to suffer from rheumatism, brought on by the dampness of the floor of their habitation ; but liability to it has been much diminished by providing them with wooden platforms 18 inches high to stand upon. The former is also very much troubled by sores and wounds, which are got under by applying to them a dressing composed of tar, soap, sulphur and carbolic acid. The *Bovidæ* and three species of African antelopes (*Orix besia*, *O. leucoryx*, and *O. reacanna*) are very liable to attacks of rinderpest, parasites and diarrhœa, the latter being cured by restricting the patients to a diet of bamboo leaves. Inflammation of the lungs is a common ailment among gazelles during the the rains and winter. They as well as the sheep and the goats in the Gardens also frequently suffer from diarrhœa. A giraffe in the collection died, it was surmised, of colic, or pulmonary inflammation. Experience has shown that the various species of deer are liable to all the ailments which afflict other members of the *Ruminantia*. The camels are subject to various kinds of cutaneous affection abscess of the liver, paralysis, hernia, prolapsus ani, and superficial ulcers ; the last can be got under only by the application of sulphur dust to the skin, as it prevents insects from lodging within the hair. The Marsupials in the Gardens have been found to suffer from paralysis of the lower limbs, pulmonary inflammation, diarrhœa and scrofula. Orang-outangs (*Simia satyrus*) in the collection are very liable to diarrhœa, dysentery, bronchitis, pulmonary inflammation and paralysis. Various preparations of *bael* and ipecacuanha have been found efficacious in checking diarrhœa and dysentery. Bronchitis yields to the administration of 5 drops of ipecacuanha wine mixed with honey or liquorice, the chest and the throat being alternately fomented and rubbed over with ammonia liniment. The hoolocks and gibbons (*Hylobates*), the semnotes (*Semnopithecus*), and the macaques (*Macacus*) suffer from diarrhœa, bronchitis and consumption. Bael overcomes diarrhœa, while in bronchitis cases 10 grains of chlorate of potash in an ounce of simple syrup, with fomentation and chicken soup, afford great relief to the patient. If symptoms of consumption are discovered, the animal, if tame, should either be allowed to run about during the day, especially when the weather is fine, or otherwise should be removed from the monkey-house and confined in a spacious and airy cage; and it should be given a teaspoonful of syrup of hypophosphate of lime twice or thrice a day and a tea spoonful of glycerine with milk twice daily. The African monkeys of the genus *Cercopithecus* are very liable to

tuberculosis of the liver, flatulent colic, paralysis, and, occasionally, diarrhœa. Flatulent colic has been found to yield to the administration of a teaspoonful of castor-oil with an equal quantity of honey. In cases of paralysis, the animal is removed to a place free from draughts and cold and provided with a blanket, while the affected parts are rubbed over with belladonna liniment morning and evening.

Among the birds, the Cassowaries and the Emus have been observed to suffer from pulmonary inflammation, bronchial catarrh, inflammation of the entire mucous lining of the mouth, and diarrhœa. Ostriches suffer from obscure diseases, of which the true natures have not yet been determined. They have, however, been known to catch colds of winter nights. Birds of the genera *Lophophorus*, *Phasianus*, *Thaumalea*, *Euplocamus*, *Gallus*, *Ceriornis*, *Pavo*, *Polyplectronan argus*, as well as the partridges in the collection, are most subject to attacks of cold, catarrh, rheumatism, gape, opthalmic inflammation, diarrhœa, tuberculosis of the lungs and liver, and leprosy tubercles. Birds suffering from cold recover from it on being given a small quantity of raw ginger with treacle. Cases of gape are treated either by the application, with a feather, of spirits of turpentine to the wind-pipes of the affected birds, which, in this state, teem with the offending parasites, or by fumigating them with carbolic acid vapour. Opthalmic inflammation has been found to yield to ablution of the eyes with alum water and subsequent painting of them with caustic solution. Birds suffering from diarrhœa are given, by way of medicine, a few drops of the tincture of opium with milk and egg food, and also a little rum in their drinking water. The partridges also suffer from abnormal and misshapen growths of beaks and nails. Almost all the Pallases (*Syrrhaptes paradoxus*) and Thibetan Sand-grouses (*S. tibetanus*) in the gardens died of hepatic or pulmonary affections. Birds of the orders *Steganopodes*, *Anseres*, *Gaviæ*, and *Limicolæ* are subject to thread worms induced by a purely fish diet, invagination of the intestines, fungoid growths in the gullets, tuberculosis of the lungs and liver, hepatic leprosy, and disease of the oil-glands—the latter being removed by washing the affected glands with tepid water, so as to cleanse them from the sticking dirt, and by keeping the sick birds in a dry place. Cockatoos of the genera *Cacatua*, *Licmetis*, and *Microglossa* are liable to attacks of diarrhœa, cold, and apoplexy brought on by adiposity. In cases of cold, the birds are treated by giving them chlorate of potash with liquorice and honey. Cold and pulmonary inflammation are commonly met with in parrakeets of the genus *Palwornis*. Birds belonging to the sub-family *Lorunæ* are most subject to fits, inflammation of the chest, and diarrhœa. The *Trichoglossi*, or Broadtails, often suffer from diarrhœa and cold. Pulmonary inflammation, rheumatism, severe cold, worms and diarrhœa are some of the ailments which are commonly met with among the Hornbills. Diarrhœa and cold are treated by giving the suffering birds one

drachm of rum with 10 drops of the syrup of lactate of iron. If difficulty of breathing supervenes, 5 to 8 grs. of chlorate of potash in water internally given relieves them instantly. The diseases from which birds of the order *Columbæ* suffer are cold, catarrh, diarrhœa, vertigo, rheumatism and other obscure ailments, which frequently break out among them in an epidemic form. The Shamas (*Cittocincla macroura*) are most liable to debility and emaciation, bad moulting, and warty growths in the legs and feet, the latter being removed by painting them with tincture of iodine. The Saliks (*Acridotheres tristis*), while young, suffer much from glandular swellings round the aperture of the cloaca. The Picarine birds have been known to die suddenly of apoplexy or rupture of some blood-vessel in all probabilty. Diarrhœa also sometimes troubles them, but is got under by administering 15 drops of castor-oil with 2 of the tincture of opium. The Laughing Thrushes of the genera *Dryonastes* and *Garrulax* have been observed to suffer from diarrhœa and recover therefrom on being treated in the same way as the Picarine birds. Chronic cold and overgrown beaks are also met with among them. The Gold-fronted Chloropsis (*Chloropsis aurifrons*) is subject to a kind of horny filamentous growth at the tip of the tongue. The Bhimraj (*Dissemurus paradiseus*) suffers from bad moult. The Grackles (*Eulabes*) are subject to an obscure form of eye disease, which is treated by washing the eyes with sulphate of zinc lotion twice daily and by keeping the birds in a warm place. The young of these species also suffer from tumours or abscesses, which appear to have a close connection with the growth of their wattles and lappets, and generally show themselves during the period when these processes are in course of development. They yield to an application of poultices composed of burnt turmeric.

No portion of a work on zoology affords greater delight to the ordinary lover of natural history than that which treats of the habits and instincts of wild animals. As they are difficult of access in their wild state these habits and instincts cannot be observed in their native haunts with the same degree of facility as in vivaria. One of the main objects for which the Calcutta Zoological Gardens were established is, the observation and recording of such habits and instincts ; and it would appear from the present work that the Committee of Management have been in no way negligent in giving effect to this portion of the prospectus of the institution. Most careful observations have been made, and voluminous notes recorded, of the temper, propensities, amusements and other occupations, moods, calls and other habits of the various mammals and birds that have from time to time, been kept in the Gardens. These notes have been utilised in the preparation of the work under review, and it is upon the materials furnished by them that the exhaustive and interesting remarks under the heading of "*Observations on the habits of Animals*" have been based.

The success of an institution like the Calcutta Zoological Gardens can be judged of only by the number of species exhibited in it, the services it renders to the advancement of zoological knowledge, and the measure of patronage extended to it by the public. We can most confidently assert that the Committee's efforts to develop the Gardens agreeably to the terms of the original prospectus and their management of the animals in it have been eminently successful. We are agreeably surprised to find that the work under review contains notices of 10 orders, 46 families, 106 genera and 241 species of mammals,* and 24 orders, 52 families, 242 genera and 402 species of birds,† that had been exhibited in the Gardens up to 1891. Considering that the Gardens are only in the sixteenth year of their existence, they rival in respect of the number of species many European and American institutions of a similar kind, among which may be mentioned .the older establishment in the London Regent's Park, which, according to the first edition, published in 1862, of the "*List of Vertebrates in the London Zoological Gardens*," had up to that year exhibited in them only 188 species of mammals and 409 of birds.

The work has been admirably got up, printed and bound in the usually excellent style of the Bengal Secretariat Press, and contains 351 large octavo pages of closely printed matter. Its value has further been enhanced by the addition of three excellent full-page photo-etchings, executed in the Survey of India Offices, respectively delineating views of the Carnivora-house, the Deer-sheds and the Water-fowl enclosure.

We are convinced from a perusal of the work that it would not only make a capital hand-book, which would "be of great use to the numerous nobles and other persons who on a smaller scale keep collections of animals or birds in captivity," but would also form an admirable text-book of zoology for those of our schools and colleges in which natural history is taught.

SARAT CHANDRA MITRA, M.A., B.L.

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* Besides the omissions noted above, the following mammals, which have already been exhibited in the Gardens, have not been included in the present work: the Black-crested Ape of Celebes (*Cynopithecus niger*, Desm.) Egyptian Fox (*Canis cerdo*, Gmel.); the Markhor (*Capra falconeri*, Hügel), and a flying-squirrel from Burma, named *Sciuropterus phayrei*, Blyth, which Dr. Blandford, in his work on Mammalia, in the *Fauna of British India* series, page 367, has identified with *Sciuropterus sargitta*.

† The undermentioned birds, though at one time exhibited in the collection, have been, most probably through oversight, omitted from this work: Yellow Troupial (*Xanthosomus flavus*, Gmel.); the Himalayan Jay (*Garrulus bispecularis*); the Neck-lace throated Laughing-thrush (*Garrulax moniliger*); *Pelecanus onocrotalus*, Linn; the Bahama Duck (*Dafila bahamensis*, Linn.); the *Prioniturus setarius* of Celebes; the Greater Bird of Paradise (*Paradisea apoda*, Linn.); the Long-tailed Glossy Starling of West Africa (*Lamprotornis aëneus*, Linn.); the Variegated Sheldrake of New Zealand (*Tadorna variegata*); the Little Brown Owl of Java (*Scops lempiji*), and the *Carpophaga chalybura*, Bp. of the Phillipine Islands.

NOTES ON INDIAN APHIDES.*

By G. B. Buckton, F.R.S.

But little attention hitherto has been given to the tropical *Aphides* of the old world. Any addition to our knowledge of the species which inhabit British India doubtless will prove of interest, both as being connected with scientific entomology and with agricultural economy.

Hitherto these *Homoptera* have been regarded as chiefly inhabiting the temperate regions of the world, but there are reasons for believing that observation only is needed to prove the existence of diverse species which control the vegetation which flourishes under the equator.

The *Aphis* which attacks the bamboo (*Bambusa arundinacea*) of Dehra Dun hardly accords with any described European species or even genus. Amongst many hundred specimens sent to me by Mr. Cotes, I was unable to find a single winged individual—a circumstance which, for the present, prevents a complete diagnosis of the species, since the wing venation is of high importance for classical grouping. The characters of the bamboo *Aphis*, however, are sufficiently distinct to justify, in my opinion, the erection of a new genus, notwithstanding that the diagnosis at present can refer only to the apterous viviparous female.

Genus *Oregma* (from ὀρέγειν to protrude), Buckton. Body globose. Vertex conspicuous from the projection of two straight horn-like processes. Cornicles small and conical. Cauda inconspicuous, often tufted with numerous setæ. Rostrum exceedingly short and rising from between the first coxæ.

Oregma bambusæ, Buckton. Body globose, less so in the immature forms. Corrugated and constricted into segments. Vertex with two cornua. Eyes very small. Notum narrow. Rostrum very difficult to see, rising from the underside of the thorax, much as in *Coccus*. Antennæ about half the length of the body, obscurely five-jointed and ending with a nail-like process as in *Lachnus*. Legs short. Tarsi with two articulations. Colour greenish-brown, more or less mottled with black. Many of the specimens preserved in weak spirit were quite black.

Size 0·070 × 0·050 inch.

Clusters on the upper surfaces of the bamboo at Dehra covering the foliage of the plants with its sooty-black excretion, thereby doing some injury.

The winged female and the (apterous ?) male are undescribed.

The general appearance of this insect may suggest some affinities both with the genus *Lachnus* and the genus *Chaitophorus* ; but the small size of the insect, the short legs, the peculiar front, and the position of the very short rostrum will eliminate it from the first genus, whilst the non-tuberculose and slightly hirsute characters of the abdomen, &c., will separate it from the latter.

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THE LOCUST INVASION OF 1889—92.*

By E. C. Cotes.

In the early part of 1891 a report was issued on the subject of the migratory locust, *Acridium peregrinum*, Oliv., which has recently invaded India.† This report gave a summary of the information obtained up to the beginning of December, 1890. The notes since collected on the subject of the invasion of Northern Africa, Persia, and Turkish Arabia by the same insect appeared in Vol. III., No. 1, of these *Notes*, where details are also given of what has been ascertained on the subject of the parasites and natural enemies which attack it in India. In the present report it is proposed to give a short sketch of the general features of the invasion in India, together with such fresh information as has been obtained on the subject of the habits of the insect and the methods adopted for dealing with it.

Contents.

The locusts were first noticed in June, 1889, when flights were reported from Sind and Western Rajputana. These flights, no doubt, originated in the sand-hills of the desert, where the insect is said to breed each year in larger or smaller numbers. They began laying their eggs as usual in June, when the rains of the south-west monsoon broke. During the remainder of the rainy season of 1889 the flights gradually spread throughout Eastern Rajputana, the Punjab, and Sind, egg-laying going on at intervals in various parts of Rajputana and the Punjab. The young locusts, which were born from the eggs laid in the beginning of the rains, acquired wings towards the latter part of August. In the beginning of the cold weather, owing to the extensive breeding which had taken place, the locusts seem to have become very numerous in Rajputana and the Punjab, and in November and December flights from these areas found their way throughout the North-West Provinces and Central India, and penetrated even as far as the Vizagapatam, Kistna, and Godavari Districts in the Madras Presidency. They were also reported from British Baluchistan. During January and February, 1890, stray flights were reported from various parts of India, but the cold seems to have told upon them, and they were not very active. As the hot weather of 1890 approached, however, and the soil, moistened by the winter rain, began to grow warm, the locusts again became active and commenced egg-laying. Eggs were laid throughout the north-western districts of the Punjab in March ; also in the Shikarpur District of Sind in April. By June the young locusts hatched from these eggs had acquired wings, and the flights spread in all directions. They penetrated throughout the whole of the North-West Provinces, besides over-

The history of the invasion in India.

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† *See* Journal, Bombay Natural History Society, Vol. VI., page 242.

running Sind and Rajputana, and making their way into Kathiawar. Eggs were laid towards the latter part of June, 1890, when the rains had well started, throughout the whole of Western Rajputana and in the Gurgaon District of the Punjab. The young locusts hatched out in countless numbers in July, and in the case of Western Rajputana they were reported as doing much damage in August. During August and September the flights that were still wandering about laid more eggs in parts of the Punjab. About September the young locusts that had been born in the beginning of the rains seem to have acquired wings, and from September on through the cold weather of 1890-91 the flights spread in all directions in the most remarkable manner. They made their way throughout Sind, the Punjab, and the North-West Provinces. Vast flights also moved through Central India into the Central Provinces, and thence eastwards into Bengal and Assam, southwards through Berar and Hyderabad into the Madras Presidency, and westwards into the Bombay Deccan. The flights did a good deal of injury in the restricted areas where they settled, but the people were so industrious in driving them off their crops and the birds destroyed such large numbers that the damage inflicted was small considering the vastness of the invasion. Through December, January, and February flights were still reported from all parts of India, but the cold and damp, combined with the relentless persecution of the birds and the people, had thinned their numbers and reduced them to so miserable a state that they were able to do little or no damage.

In March, 1891, some of the locusts obtained from the flight which passed over Calcutta in November, 1890, began to lay eggs in their cages in the Indian Museum. About the same time, owing, no doubt, to the increasing warmth at the close of the winter rains, the flights in the Punjab became more active, and egg-laying took place at first in the north-west of the Punjab and Sind and afterwards in Baluchistan. In May the young locusts hatched from these eggs became extremely numerous in the Punjab.

The rabi crops were generally too far advanced in growth to be much damaged by them, but the extra rabi and the early sown kharif crops—especially cotton—suffered severely. The grass in some tracts was completely eaten down, and almost every bush and tree was stripped of its leaves. Some idea may be formed of the numbers in which the insects appeared from the fact that railway trains were said to have often found it difficult to proceed, owing to the rails being made slippery by the crushed bodies of the young locusts. A regular warfare was waged against the insects, under the leadership of the district officials, who organized the people for the purpose of collecting the eggs and destroying the young locusts systematically. The military also rendered useful service in destroying the swarms that invaded cantonments.

The method that was most generally adopted was that of driving the young locusts into trenches, but the Cyprus screens described in the previous report

were also used to a small extent, and useful work was done by driving the young into heaps of straw and bushes which were then set on fire. In this way many thousands of maunds of young locusts were destroyed, and the actual crops were in many places protected. The numbers of the locusts, however, that bred in waste places in the Punjab was so enormous that success was only partial, and vast hordes became full grown and acquired wings. Towards the latter part of May large flights of these young locusts began to pass over Central India and the North-West Provinces into the Central Provinces and Bengal, at the same time penetrating into Kathiawar. During the months of June, July, and August these flights seem to have flown about from district to district, descending at intervals to devour the young kharif crops and doing a good deal of damage over restricted areas, especially in Bengal. They did not lay any eggs, however, and little was heard of them after August, the supposition being that by this time they had been pretty completely destroyed by the birds and unfavourable climatic condition of the damp regions into which they had penetrated.

The immediate result of the departure of these flights seems to have been to clear the Punjab of locusts, but the insect was still prevalent in Sind and Rajputana, and soon after the commencement of the rains of the south-west monsoon flights began to be again reported from the Punjab. During the rainy season of 1891 egg-laying went on as usual in Sind and Rajputana, while in the Punjab eggs were reported in comparatively small numbers, at first from the south-eastern districts and afterwards throughout the whole area, thus pointing to the supposition that the eggs were laid by flights from Rajputana. Breeding seems to have gone on at intervals throughout the rainy season of 1891, young locusts being still reported in the Punjab Salt Range in November. But they were very much fewer than before, and the birds—especially the Rosy-pastor (*Pastor roseus*)—destroyed them in vast numbers. The locusts themselves also were so much parasitised and diseased that the work of the people in destroying them was very much lightened, and by the close of the year the pest seems to have been pretty completely wiped out.

In March, 1892, a few locusts again appeared in Sind and the western frontier of the Punjab and laid eggs in Dera Ismail Khan, while in May some stray flights penetrated into the North-West Provinces and Bengal. Little damage, however, has been reported, and the insects seem to have been too few to cause any anxiety.

Notes on the life history of the insects.

It will be remembered that the only important points in the life history of the insect on which any serious doubts were indicated in the previous report were upon the subject of the number of generation in the year and the relationship borne by the young locusts which hatch out in the spring to those which hatch out in the autumn. An attempt has since been made to settle these

points by rearing the insect upon a considerable scale in large cages which were specially constructed for the purpose in the Indian Museum. The cages were placed under somewhat different conditions of sunlight and moisture, but in each case the insects, though reared from the egg to the imago stage without difficulty, died off before any ovipositing took place.

Considerable quantities of eggs were received from Rawalpindi and Peshawar in the spring of 1891. The first sets dried up without hatching in spite of the attempts that were made to keep them moist by watering the earth in which they were placed (1). Eggs received in the end of March, however, hatched out freely, though a large proportion are believed to have been destroyed by the parasitic flies that also emerged in large numbers (2). These young locusts were reared through all their stages without difficulty, though there was considerably greater mortality amongst them than had been the case with the ones that were reared in the Museum the previous year, and this in spite of the fact that the rearing cages were larger than before, and were kept some in the Museum and others in the open air, with a view to testing the conditions most favourable to the development of the insect. The young locusts acquired wings by the middle of May, but died off so rapidly that there was hardly any of them left by the end of the month. It was not possible, therefore, to make any observations as to the time at which they would lay their eggs.

On the 19th June, 1891, Captain C. G. Parsons wrote from Kohat that up to a few days previously locusts had been obtainable in the western portion of the district in every phase of development from eggs to fully-winged insects. He concluded that the process of egg-hatching had continued from the beginning of April until the beginning of June in tracts of country where the difference in elevation caused only a slight change of climate. We have seen that the locusts that were hatched from the earlier batches of eggs acquired wings in May, but there is evidence to show that these young locusts were not the parents of the eggs found by Captain Parsons in the middle of June, and probably not of any of the eggs laid during the rains. The flights which overran the North-West Provinces and other parts of India during the rains of 1891 were composed, as we have seen, of the young locusts in question. Large numbers of specimens from these flights were sent to the Museum from various places, but the numerous females that were dissected invariably had their ovaries far too undeveloped for egg-laying. It is clear, therefore, that these young locusts could not have been the parents of the later broods of eggs. The case of the locusts sent to the Museum from flights which visited Singbhoom in the end of June

(1) This would seem to indicate that breaking up the land to expose the eggs to the air would be useful, provided it were done soon after the eggs were laid. Later on ploughing up the land becomes almost useless as the eggs hatch out whether exposed to the air or not.

(2) Noticed more fully in No. I. of this volume, pages 34 and 35.

and beginning of July has been recorded as a typical one. The first specimens from this district were received in the Museum on the 30th June. The females were found on dissection to have their ovaries in an altogether rudimentary condition. On 7th July a number of living specimens were forwarded from the same locality. These were carefully fed in a cage in the Museum, and from time to time a specimen was dissected ; but up to the 7th of August, when the last specimen died and was dissected, though the growth which had taken place in the ova was very distinctly perceptible, yet there did not appear to be the slightest probability of the insects being ready :to oviposit for a long time to come. The impossibility of keeping the locusts in a healthy condition in confinement renders the deductions drawn from caged specimens necessarily unreliable. So far, however, as the evidence can be depended upon, it goes to show that the later broods are not the offspring of the young locusts hatched in the early part of the year. The question would be an easy one to solve for any one who lived on the borders of the deserts of Western Rajputana, where the insect is constantly to be found. All that would be necessary would be to dissect the insects present from day to day, and to trace the growth of the ovaries throughout the year. It may be suggested that the matter is one that might reasonably be taken up by some of the medical officers who are resident in the areas concerned.

With regard to the parentage of the eggs which are so often laid in the Punjab towards the close of the winter rains, it has been ascertained that eggs can be laid at this time by locusts which were themselves hatched in the preceding rains. Winged locusts from a flight which passed over Calcutta in November, 1890, and which had almost certainly originated in eggs laid in Rajputana in the previous rains, were kept in a cage in the Museum and regularly fed. In the latter part of March, 1891, they began copulating, and on the 26th March a number of eggs were laid. The earth in the cage had been previously saturated with water, in imitation of the conditions that have been shown to be favourable to egg-laying ; but the insects seemed to be too sickly to dig holes in the ground and simply deposited them on the surface. Some of the locusts lived on after laying their eggs through a great part of April ; but by the 4th of May they were all found to have died, while the eggs they had laid dried up and came to nothing. Very much the same experience is detailed by Colonel Powlett, Resident, Western Rajputana States, who writes in a report, dated 24th April, 1891, received from the Agent to the Governor-General, Rajputana, through the Government of India :—

" At and about Jodhpore most of the young brood of locusts appeared early in August. When this brood got wings in September, I caught some hundreds and put them in cages and had them regularly fed ; they died off, and by February there were less than twenty left, but two pairs of these were observed to copulate. On the 24th and 25th February two females laid eggs. They were not healthy masses of eggs, and the females did not succeed in depositing them under the soil placed in the cages, nor have they hatched. But it is

evidently difficult to keep locusts healthy in cages, and the oviposits being poor is not wondered at. It would appear, however, to be proved that the common locusts of Northern India can copulate and lay eggs six or seven months after birth, and that in all probability the eggs lately laid in the Punjab were those of insects hatched last August. The locusts which copulated round Jodhpore last July were of a bright yellow ; the survivors of their offspring, which were pink when put into the cages in September, were in February a dirty purple colour, and to the best of my recollection that was the colour of the locusts the eggs of which many years ago I helped to destroy during the month of March in the Punjab."

The habitual disappearance of locusts throughout the greater portion of the winter months in North-Western India is explained by the fact that they require little or no food during this period, and probably hybernate in a dormant condition. On 28th February, 1891, Mr. J. Cleghorn wrote that locusts had been hybernating without food in a cage kept in his house in Peshin, Baluchistan, since the 15th September, 1890, though he had found that similar insects in the summer required to be fed constantly to keep them alive.

Measures adopted against the locusts.

There is little to add to what has already been recorded upon the subject of the methods adopted in fighting the locusts, but it may be useful to notice what was actually done during the year 1891 in carrying on the campaign in different districts. The reports which have been received upon this subject are very fragmentary, but the measures they describe are probably typical of what went on over the greater portion of the areas invaded. (1)

In the cold weather of 1890-91 numbers of the winged locusts which swarmed into the Rawalpindi District were killed in the early mornings, when they were numb with cold, by the people ; and as the spring of 1891 advanced, a regular campaign was organized throughout the Punjab by the district officials for the destruction of the young locusts.

In Dera Ismail Khan, a naib-tahsildar and kanungo, with six or seven chaprasis under them, were put in charge of each tappa, and lambardars and zilladars were warned to render every assistance in their power. Five hundred rupees were spent in rewards. The wells and water-courses were kept clean to avert epidemic disease, but the people were very apathetic, and little impression was made on the vast swarms which crowded into the district.

In Rawalpindi the district was divided into circles with an officer in charge of each, whose main duty it was to look after the destruction of the locusts and their eggs. All tahsil officials were employed in the work of destruction, and a thousand rupees were spent from district funds. Millions of eggs and young locusts were destroyed, but the impression made was small, as the insects laid their eggs largely in the extensive and sparsely peopled Kala Chitta Range, where it was most difficult to get at them.

(1) The following notices are mostly taken from a report by the Director of Land Records and Agriculture, Punjab, supplemented by the information collected from crop and other reports sent to the Museum.

In Hazara some four hundred maunds of young locusts were destroyed in April in the Mansahra Tahsil under the direction of the tahsildar.

In Peshawar the villagers were turned out at once whenever young locusts showed themselves, and by the 20th April some ten thousand people were at work. When the rabi harvest began the villagers were dismissed, and five thousand hired labourers were employed until about the 3rd of May, when the barley was half reaped and the ears of wheat were too hard to be attacked by the young locusts. At a low estimate, over eighty millions of young locusts were destroyed, the cost being about eight thousand rupees. The myriads of locusts, however, which poured into the district from independent territory made it impossible to deal at all completely with the invasion.

In Kohat orders were issued to turn out the people when the locusts hatched, and the greatest exertions were made to deal with the pest. In the Kohat station itself, Captain Parsons wrote that the chief invasion lasted about ten days. During this time vast numbers of locusts were destroyed each day, the quantity amounting on one occasion to six hundred maunds. One rupee was paid for each maund weighed. Nearly all the undetained inhabitants of the city laboured, and the troops and the boys of the large High School assisted. The collection of the insects was very simple, as they could be shaken off the trees by thousands into sheets held below. Four men could collect a maund in a very short time. There were ten weighing stations established, and the district funds were freely drawn upon. According to a crop report published in June, 1891, numbers of young locusts in the Hangu Tahsil of Kohat were also destroyed by firing the dwarf palms through which they were crawling, while in the Barak ilaqua the destruction is noticed in the same report of some three thousand maunds of young locusts.

In Jhelum the destruction of eggs began early in March. From five hundred to six hundred maunds of eggs were destroyed in one tahsil. At first one anna, and later half-an-anna, a seer was paid for the eggs, while gur and atta were distributed to the people engaged in destroying the young locusts. Some Rs. 3,000 was noticed as spent from district funds in the early part of the spring upon the destruction of eggs and young locusts. But the Deputy Commissioner states that the people were inclined to be apathetic, as, from the dimensions of the plague, it seemed hopeless to cope with it.

In Shahpur the naib-tahsildar of Khushab was put in special charge, and large numbers of young locusts were destroyed, though little real impression was made upon the pest.

In Gujranwalla in March many of the winged locusts were killed in the mornings and evenings when they were inactive. Every patwari, lambardar, and policeman was made responsible for reporting at the tahsil whenever eggs were laid or young appeared. Land in which eggs had been deposited, if not under crop, was ploughed three or four times so as to expose them. Eggs

also were collected in great numbers, the usual plan being to make each house in a village furnish daily a " tind " or well-pot full of eggs.

In Sialkot bands of villagers were organised to kill the young locusts. The methods adopted were, driving them into trenches and burying them, and surrounding them with a circle of men armed with branches, who gradually drove them into straw which was then burnt.

An interesting account is given by Colonel Lance, the Officer Commanding at Ferozepur, of the methods adopted in fighting the young locusts which invaded that cantonment in May, 1891. Both British and native troops were employed in the work, and Colonel Lance writes :—

" Each corps and detachment was given certain limits within which it was to work and to do its best to destroy any swarms that came within them; corps, however, were employed at other places that were heavily threatened, as required.

" With the exception of one heavy swarm that came on the 17th Bengal Cavalry lines, the swarms came on the south-west corner of the station, and on the south-east and north-east as far as the cemetery, near the Sudder Bazar. In the Commissariat Transport lines they were in countless numbers, and for days it seemed as if they would succeed in getting into the station from that direction.

" The method principally adopted to destroy the locusts was by burning them with dry grass. When swarming in trees or bushes this seems to be the only effective method. When in open ground it is easy to drive them to lines or clumps of dry grass in which they swarm, and which is lighted when the whole swarm has collected. The objection to this method, however, is the enormous expenditure of grass, even when used economically as was done when the men became experienced in the work. Large quantities of grass were bought, but the Executive Engineer placed at my disposal a large quantity of old thatch without which it would have been impossible to have provided the quantity of grass required. Kerosine was tried with the grass. It was used chiefly to burn the locusts out of trees and bushes, but it was found after trial that in most cases the grass was nearly as effective without kerosine, a great deal of which was required to produce any result.

" It was found that grass could be much economised by digging a small trench about a foot deep and a foot wide, filling the bottom with a little grass and laying the same lightly on the earth thrown upon the side opposite to that towards which the locusts were being driven. A little more grass sprinkled round the trench after the swarm had been driven into it, and set fire to, effectively secured the destruction of the swarm with but little expenditure of grass.

" Pits were also dug into which the locusts were driven and then buried. This plan is said to answer well when the insects are small, but when, as in the present case, they are large and active, it is found that they could not be kept in the pits unless they were dug very deep, and even then many succeeded in getting away.

" I had the opportunity of trying the method said to have been used with great success in Cyprus. Low canvas screens were made from condemned tents supplied from the arsenal, and strips of American cloth, over which the locusts cannot crawl, were sewn to their upper edge. In front of these screens, which were set up in the path of the locusts, pits were dug, round which an edging of tin was placed, up which the locusts could not crawl. Driven against these screens the locusts either hopped into the pit themselves or were driven in by men, who eventually surrounded them. The advantages of this plan are the extent of ground that is covered, the comparatively few men that are required, and the completeness

of the operation, as if the screens are sound and the drive conducted with skill and patience scarcely any locusts can escape being driven into the pits. The tin rim obviates the necessity of the pits being dug deep, 2 or at more 3 feet being sufficient. The rims used were 4 feet by 2 feet, an edging of 2½ inches of tin on the ground surface round the pit, and the same width on the inside edge of it.

"I regret that I knew of this plan too late to provide sufficient screens for general use. I believe that this system will be found most efficacious, and feel confident that had we been prepared with this apparatus, the work of destruction would have been carried on with less trouble and with better results."

In Jhang, according to a crop report issued in June, 1891, twenty thousand maunds of locusts had up to that time been destroyed.

The above comprises all detailed information which has reached the Museum on the subject of what was done in the Punjab in the Spring of 1891, but numerous incidental notices have been received of the work of destruction which seems to have gone on systematically in all districts where young locusts hatched out.

With regard to what was done in Sind and Rajputana, where egg-laying also went on, little fresh information has been obtained, but the people seem, as usual, to have done what they could in the way of destroying the young locusts by driving them into trenches.

In the case of the measures taken in districts that were only visited by flights, no fresh information has been received, but the system which has proved so successful of driving the insects off the crops is believed to have been universally adopted by the cultivators.

E. C. Cotes,
Deputy Superintendent,
Indian Museum, Calcutta.

8th June, 1892.

ON IRIDESCENT COLOURS AND A METHOD OF EXAMINING IRIDESCENT OBJECTS, BIRDS, INSECTS, MINERALS, &c., SO AS TO ENSURE UNIFORMITY IN THEIR DESCRIPTION.

By Alex. Hodgkinson, M.B., B.SC.*

On taking a general survey of coloured objects, whether natural or artificial, we become aware of the fact that whilst the colours of some remain unchanged as regards tint, whatever their position in relation to the incident light, the tint of others varies with every alteration in their relationship to such light source. We thus see that, so far as their colours are concerned, all bodies may be arranged in two groups according as their colours change or do not change in tint as their angular relationship to the light varies. Nor is this classification entirely an artificial one, since, as will shortly be seen, though this change

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in tint with variation in the light source is an essential difference, it is not the only difference, even in the colour manifestations of the two groups, for it is also characteristic of the nature of the colour-producing structure. It is to the above-mentioned varying colours that we apply the term "iridescent," from the resemblance they have in the sequence or play of colours to the tints of the rainbow. The unvarying group of colours, having no equivalent term to "iridescence" to express the nature of their colour production, are spoken of as "pigmentary," or absorption colours. In naming examples of objects, natural and artificial, grouped as above in accordance with the nature of their colours, it is difficult to make a selection where all are so varied and characteristic. I have preferred, therefore, to cite only such instances as I myself possess, and am, therefore, able to show you. As examples of pigmentary colours, I need only name one or two for the sake of comparison, since the colours of most objects ordinarily met with are pigmentary. Leaves, flowers, dyes, birds, fish, insects, minerals, &c., exhibit these colours, some almost entirely, and all, excepting fish, in far the majority of instances. Of objects displaying iridescent colours we have also examples in the various divisions of the animal, vegetable, and mineral kingdoms. Amongst birds the most striking examples are found amongst the Humming Birds, Sun Birds, Birds of Paradise, &c. Insects, again, furnish numerous examples, more especially amongst tropical species, though not, perhaps, proportionally in greater numbers than amongst those belonging to our own more temperate regions. The colours of fish are almost entirely iridescent, since their very whiteness, or silvery sheen, is due to the admixture of the iridescent colours of innumerable minute thin lamellæ, too small to be seen individually with the naked eye, but plainly perceptible under the microscope. In the vegetable kingdom iridescent colours are far more numerous than is ordinarily recognized, since the surfaces of the cell-walls produce interference colours which are more or less obscured by the pigmentary colours of leaves and coloured flowers, but may be readily seen in the case of white flowers by the aid of a lens and sunlight. Under these conditions each cell may be seen to sparkle with its own iridescent colour, forming, by admixture of the interference tints of neighbouring cells, the varying shades of white seen in numerous flowers which are devoid of pigmentary colour. Mineral bodies displaying iridescent colours are also numerous ; opals, sunstone, fire-marble, felspar, mica films, tarnish on various metallic crystals, certain crystals of chlorate of potash, &c., are examples.

In describing the various natural objects for purposes of identification, or mere description, no account can be considered complete which omits all reference to their colours, and more especially is this the case where the colours constitute such a striking feature, as in the case of iridescent bodies. In innumerable instances, more especially amongst birds and insects, their specific names are taken from some conspicuous colour they possess. It thus becomes evident that a correct description of the colours of bodies is of importance,

and where these colours are of the pigmentary or unchanging kind, this is a matter of no difficulty. How different, however, in the case of objects, the colours of which not only vary with every change of position, but disappear altogether, unless viewed with special relation to the light source. Nor can it be wondered at that descriptions of these objects, even by observers of undoubted repute, vary according to the different angles from which they have been viewed, or are vague and profuse, owing to fruitless attempts to describe their changing tints produced by every movement. The fact is, no words can convey an adequate impression of the gorgeous effects produced by most of such objects, whether birds, insects, or fish, when in motion in brilliant sunshine. Some notion of the difficulties to contend with in describing the colours of humming birds, for example, may be gathered from the remarks of Wallace in his work on "Tropical Nature," when speaking of humming birds :—"In some species they must be looked at from above, in others from below ; in some from the front, in others from behind, in order to catch the full glow of the metallic lustre ; hence, when the birds are seen in their native haunts, the colours come and go and change with their motion, so as to produce a startling and beautiful effect." Most observers, in describing the colours of iridescent bodies, do so by attempting to depict the varied effects produced by casually changing the position of the object in relation to the light, omitting to mention the exact *sequence* of the play of colours, or the relation of these colours to the direction of the iridescent light, *i.e.*, whether produced by perpendicular or oblique illumination. Here is a description of the tufted neck humming bird, *Trochilus ornatus*, taken haphazard from a well-known work :—"The throat is of a fine green colour, variable in different lights to a golden hue with a yellow or brown metallic lustre, and below that the whole of the belly is a rich brown, glossed with green, and golden." Such descriptions as the above, which happen to be the first I met with in seeking for an instance, are vague, and fail to give a definite idea of the appearance of the object. But vagueness in the description of these objects is not the only result of the changing character of their colours. As might be expected, where such variation in appearance exists, the descriptions of different authors are almost as variable as the colours. Few attempt descriptions without acknowledging the hopelessness of the task. Thus Jardine, after describing this humming bird, *Chryslampis mosquitus*, remarks : "It is impossible to convey by words the idea of these tints, and having mentioned those substances to which they approach nearest, imagination must be left to conceive the rest." And I adduce this quotation as fairly expressing the feeling of naturalists in reference to the description of iridescent objects generally. Recognizing the admitted inability of observers to convey by description an idea of the appearance of these iridescent objects, and having myself, for many years, constantly experienced the same difficulty, I have been led to adopt a method for the examination of such objects, which, whilst extremely

simple and available in its application, yields unvarying results with different observers—results, moreover, which admit of the simplest description.

Before describing this method, I may say that long experience in the examination of iridescent objects has proved to me that, almost without exception, the colours of natural iridescent objects are due to interference produced by thin plates. In order, therefore, to render clear the principles on which the method I propose is founded, I will briefly refer to certain fundamental facts in connection with colour production by thin plates, and for this purpose will select a thin film of mica, which, with light at perpendicular incidence, appears red, iridescent red. If, now, this plate be inclined so that the light falls on it at a more oblique angle, it is, of course, reflected at the same angle, and now appears orange, and if the plate be still further inclined, the reflected light appears yellow, then yellowish-green, green, and bluish-green ; and if the light were not too copiously reflected from the first surface to allow of perceptible interference by further inclination of the plate, all the colours of the spectrum in their proper sequence might be observed. The same results, but much more vividly, may be seen in these crystals of chlorate of potash. Thus we see that by rendering the incident light more and more oblique, the reflected light changes from a lower to a higher tint, that is, from the red towards the violet end of the spectrum. And this is what occurs in the case of all iridescent bodies ; as the incident light becomes more oblique, the colour changes to the tint above it in the spectral order, so that, if we know what colour any such object appears when seen at a certain angle, we can infer what colour it will change to on varying the incidence. This beetle (*Sagra purpurea*), for instance, is red at perpendicular incidence ; it will, therefore, appear orange-yellow and green when examined by successively increased obliquity of light. And the same is true of all other iridescent red objects. If the object at perpendicular incidence be green, as in the case of this beetle (*Buprestis*), it will become blue and then violet as the incidence is increased. We thus see that an iridescent object varies in colour simply because it is examined by light incident, and therefore reflected, at different angles. Thus, different observers see the same iridescent object of a different colour, when they view it illuminated by light at a different angle of incidence. If, however, the object is seen by all at the same angle of the incident light, it will present the same colour ; and this is, in fact, what the method I propose ensures, *i.e.*, that iridescent objects shall always be seen by light at one and the same angle of incidence. The angle I select is one of 90°, so that the incidence and reflection are normal or perpendicular to the reflecting surface. By selecting this angle, all trouble of measuring angles is avoided, since we know that the incidence is perpendicular when it coincides with reflection. Now the reflected light may be made to coincide with the incident light by reflecting it on to the object by means of a mirror, and so adjusting the object that the light reflected from it passes to the eye through

a perforation in the mirror. When examined in this way, iridescent objects are marvellously altered in appearance, their changing colours are replaced by one fixed tint, visible only in one position—a fact which serves at once to distinguish them from bodies coloured by absorption, which remain coloured, whatever the relation to the incident light. Such methods of examining bodies scarcely takes more time than by the eye alone. The mirror may be attached to a spectacle frame so as to leave both hands free, such as the one I show, or may be a simple hand mirror. For objects too small to be seen by the unaided eye, I have so arranged the microscope that light is made to pass down the tube of the instrument, through the object glass on to the objects, and by a special arrangement, so adjusted the position of the object that the light is reflected back again through the instrument to the eye. The method is thus available for macroscopic as well as microscopic objects.

To illustrate the practical value of this plan of examination, I have here a few objects exhibiting iridescent colours, which, by trial, will be found to give the following results :—

The crest of this humming bird, *Chrysolampis mosquitus*, which, to the unaided eye, appears resplendent with all shades of red, orange, yellow, or green, according to the angle of the incidence light, appears, when examined by the mirror, of one unvarying red tint, disappearing when the object is moved, but absolutely unchanging in tint. Such an object, therefore, I should describe as "iridescent red," all else regarding its colour may be inferred. Again, the breast, or gorget, of the same bird reflects all shades of orange, yellow, or green to the eye alone ; with the mirror it is seen of a deep orange, which, as before, is unchanged in tints by any variation in position. Such an object I would describe as "iridescent orange." The gorget of another humming bird, *Calliphlox amethystina*, to the eye alone, appears crimson, orange, yellow, or green ; with the mirror it is iridescent crimson only, spectroscopically a red of the 2nd order. Amongst insects, instances of iridescent species are numberless, the results of examination are just the same as in other iridescent bodies. This butterfly, *Morpho*, to the eye alone appears either greenish-blue, blue, or violet, as its inclination to the light varies ; examined with the mirror it appears green, and should be described as iridescent green, or iridescent bluish-green. This beetle, *Poropleura bacca*, appears any shade of red, yellow, or green to the eye alone ; with the mirror only iridescent red. In this extraordinary beetle, *Chrysochroa fulminans*, we have all the colours of the spectrum in their natural sequence, beginning with red at the tip of the wing case, and ending with violet higher up the elytron. These colours vary in an indescribable manner when attentively examined at different angles of incident light with the eye alone ; with the mirror the wing cases are seen to be coloured successively from base to tip iridescent green, yellow, orange, and red, and these tints remain unaltered by change of position of the object. This piece of *Haliotis* shell exhibits indescribable changes of colour with every

movement, but the difficulty of description, though by no means removed, is immeasurably lessened by the use of the mirror. And the same with this specimen of iridescent iron ore ; its colours, which vary to the unaided eye, remain unchanged when examined by the mirror. To simplify the description of iridescent objects, therefore, I would advocate the above method, and would describe the result of such examination by recording the colour observed by aid of the mirror, and prefixing the term " iridescent" to express the changing properties of the colour. Bearing in mind the unvarying nature of these changes, a far clearer idea may be formed of the appearance of these objects than from any attempted description of what is admittedly indescribable. Time and space are also economised by the omission of lengthy descriptions. The accuracy, and therefore the value, of any description of colour, is always enhanced by mapping its spectrum ; more especially is this true in the case of iridescent colours. This is easily done, and by applying such map to a spectral chart, the order of the colour, and therefore its tint, is apparent. In examining many objects, chiefly birds or insects, by means of the mirror as above described, apparent exceptions are repeatedly met with to the fact stated above that the colour is invariable in tint and disappears by inclination of the body. Such instances are no real exceptions, but are due to the reflecting plates being curved, or having pigmentary matter beneath them, or an opalescent medium above them. In this way some of the most extraordinary and beautiful colour effects, it seems possible to conceive, are produced. Some of them I hope to bring before your notice on a future occasion.

In examining objects with the perforated mirror a single light is necessary. The sun is of course the best, and the electric light probably almost as good. I frequently employ the lime-light, but a good paraffin lamp may be used as a substitute. Ordinary gas is unsuitable. The light should be placed in front of the observer, its direct rays being prevented from falling on the objects by means of a book or partition of some kind resting on the table, and of such a height that the light can be seen above it. On placing the mirror to the eye the light may be reflected from the mirror on to the object, and the latter manipulated so as to reflect the ray back through the perforation in the mirror to the eye. The incidence is thus known to be normal, and the colour observed is the one to be recorded.

NOTES ON THE HABITS OF SOME LIVING SCORPIONS.

By R. I. Pocock.

The literature which treats of the habits of living scorpions is not voluminous, but it labours under the disadvantages of being based largely upon undetermined species, and of being often of questionable trustworthiness with regard to the statements that are made. Even accounts that have been given of late years of the same species of scorpion differ widely as to facts

of no small importance. Mons. L. Becker, for instance, asserts that the senses of hearing and seeing are highly developed in *Prionurus australis*, the thick-tailed yellow scorpion of Algeria and Egypt; Prof. Lankester, on the contrary, declares exactly the opposite to be the case. Discrepancies such as these and the deficiencies above mentioned show the need for fresh observations upon the subject, and no further excuse need be offered for publishing the following notes upon the habits of some specimens of two species of scorpions, *Parabuthus capensis* and *Euscorpius carpathicus*, which I was fortunate enough to keep for some months in captivity.

For the specimens of *Parabuthus* I gladly take this opportunity of expressing my thanks to my friend, Mr. H. A. Spencer, of Cape Town, who kindly collected them for me at Port Elizabeth while acting as medical officer on board the Union Steam Ship Company's S.S. "Mexican;" while for the *Euscorpius* I am indebted to the kindness of Dr. Gestro, of the Natural History Museum at Genoa. This last genus of scorpion Prof. Lankester has also written about; many of my observations, therefore, merely confirm those of this author. No description, however, has to my knowledge ever been published upon the habits of any species of *Parabuthus*. This genus, however, belongs to the same family as *Prionurus*, and the behaviour of the two in captivity seems to be very similar.

There is an abundance of evidence that scorpions are nocturnal, and mine were no exception to the rule. They would spend the daytime huddled together in corners of their box or under pieces of wood; at night they would wander about, presumably in search of food. It was easy, however, at any time during the day to rouse them from their sluggishness by applying a little artificial warmth to the box. One end of the box containing the *Parabuthus* was closed with a plate of perforated zinc. If this box was placed in the fender at a distance of about a couple of feet from a moderate fire, with the zinc end turned towards the grate, the scorpions would climb upon the metal plate and bask in the warmth. But immediately the box was brought near the bars of the grate they would all clamber or tumble from their position with ludicrous haste. It must not be supposed, however, that the amount of heat required to make them retreat was at all great. As a matter of fact warmth that I could without inconvenience bear for several minutes upon my hand would throw these animals at once into a state of the greatest consternation.

When walking both *Parabuthus* and *Euscorpius* carry the large pincers or chelæ well in advance of the head; these appendages thus fulfil the office of antennæ or feelers. In *Parabuthus* the body, however distended and heavy with food, is raised high upon the legs exactly as Prof. Lankester has described in *Prionurus*, and the tail is usually carried, curled in a vertical plane, over the hinder part of the back. In *Euscorpius*, on the contrary, as has also been pointed out by Prof. Lankester, the ventral surface of the body is

scarcely raised from the ground during progression, and the tail, which is very slender and relatively much lighter than in *Prionurus* or *Parabuthus* is dragged along, extended, and with a slight curl only at its hinder end. This difference in the carriage of the tail depends possibly upon the difference in its size and weight. For it seems reasonable to suppose that the heavy, robust tail of a *Parabuthus* or *Prionurus* is carried with less muscular effort when curled over the back than when stretched out behind as is *Euscorpius.*

When attempting to climb up the smooth sides of their box the *Parabuthus* would raise themselves upon the extremity of the fifth segment of the tail, and by keeping this organ perfectly rigid and in the same straight line as the body they could maintain themselves in a nearly vertical position, thus reaching considerably higher than if supported upon the hind legs alone.

The method of digging shallow pits or holes in sand, which Mons. Becker and Prof. Lankester have described in the case of *Prionurus,* is also practised by *Parabuthus.* Standing upon the first and fourth pairs of legs, and using the tips of the chelæ and the end of the tail as additional props, with the disengaged legs, a scorpion rapidly kicks the sand backwards between the legs of the last pair, very much as a rabbit or rat does when burrowing. Then with the apparent intention of removing what would prove an obstacle to its vision when crouching in the hole, it sweeps aside with its tail the heap of sand that has been thrown up, until the area surrounding its lurking place is tolerably level.

I never saw a *Euscorpius* digging in the sand. They were usually to be found during the daytime under pieces of wood, to which they were nearly always clinging belly uppermost. It is difficult to explain why this attitude should be assumed. Many terricolous arthropods, however, have the same habit, and I see no reason for thinking that in the case of *Euscorpius* it has any connection with the copulation of these animals as Prof. Lankester suggests.

All scorpions appear to be carnivorous, and there seems to be little doubt that they live principally upon insects or other articulated animals. My specimens of *Euscorpius* would eat blue-bottles and small flies, small cockroaches (*E. germanicus*), wood-lice, small spiders, and centipedes (*Lithobius* and *Geophilus*). The *Parabuthus* were fed principally upon the common house-cockroach and upon blue-bottles. It is interesting to note in connection with this last fact that Prof. Lankester's examples of *Prionurus* would not eat this common cockroach, nor did they seem to care for blue-bottle flies. This difference of instinct in the choice of food is remarkable, seeing how similar these two scorpions are in other particulars, both of habit and structure.

No one acquainted with the agility of a cockroach and the usual sluggishness of a scorpion would think that the latter would often succeed in cap-

turing the former. Yet in truth, when placed in the same box, the insect seldom has a long lease of life. Its ultimate fate is always due to its ignorance of the scorpion's nature, and to the latter's adroitness in seizing anything that comes within reach. Wandering round the box, and exploring every inch of its new quarters with its antennæ, the cockroach soon discovers the presence of the scorpion by touching it with the tips of these organs. The scorpion's sense of touch, however, is as delicate as the insect's, and the latter's antennæ, or any part of it that happens to be near, is quickly seized by the pincers of the scorpion. Should the latter be disinclined for food and take no notice of the cockroach's first approach, the insect, continuing its wanderings, will fearlessly creep over the scorpion, just as a rabbit will over a python. Obviously this fearlessness must prove its destruction in the end, if not immediately. By means of its agility and strength, a cockroach sometimes eludes the scorpion's first clutch, and sometimes, but not often, breaks away from the latter's hold. But it does not readily learn from its narrow escape the advisability of giving its enemy a wide berth the next time they meet.

Although usually trusting to their heels for escape, cockroaches occasionally resort to a method of self-defence which is sufficiently curious to be described. Advancing upon an adversary rear end foremost, and at the same time wagging from side to side this region of the body, they deliver vigorous backward kicks with their spinny hind-legs. This novel and humiliating mode of fighting, although not likely to prevail long against jaws and stings, is sufficient, nevertheless, to gain sometimes for the insects a temporary reprieve. I have indeed seen a fine female Madeira tarantula spider retreat in discomfiture before a big cockroach of the same sex, which assaulted her in the way described.

As soon as a cockroach is seized the use of the scorpion's tail is seen; for this organ is brought rapidly over the latter's back, and the point of the sting is thrust into the insect. The poison instilled into the wound thus made, although not causing immediate death, has a paralysing effect upon the muscles, and quickly deprives the insect of struggling powers, and consequently of all chance of escape. If the insect, however, is a small one—one in fact that can be easily held in the pincers and eaten without trouble while alive—a scorpion does not always waste poison upon it. Thus I have seen a *Parabuthus* seize a blue-bottle fly, transfer it straight to its mandibles, and pick it to pieces with them when still kicking. Prof. Lankester only rarely saw his scorpions feed. I was more fortunate and repeatedly watched the operation, which is always performed exactly as this author has described. An insect is literally picked to pieces by the small chelate mandibles, these two jaws being thrust out and retracted alternately, first one and then the other being used. The soft juices and tissues thus exposed are drawn into

the minute mouth by the sucking action of the stomach. It would seem, however, that some hard chitinous pieces are also introduced into the alimentary canal, for the entire exoskeleton of a cockroach is rarely, if ever, left after the meal is finished.

Feeding is a slow process ; a good-sized cockroach will last a *Parabuthus* for upwards of two hours or more. But although voracious eaters when the chance presents itself, they are able to endure with impunity starvation of several weeks' duration. Unlike spiders, which are notoriously thirsty creatures, scorpions never seem to need anything to drink. At least none of mine were ever seen to touch water, although a supply of it was at first always kept in their box.

With regard to the higher senses, the only one that seems to be highly developed is that of touch. Mons. L. Becker declares that sight and hearing are excessively developed ; but I cannot substantiate this statement in either particular. With regard to hearing, my observations agree entirely with those of Prof. Lankester, who could not detect the existence of any sense of this nature. None of my scorpions ever gave the slightest response to any kind of sound, although they were tried with tuning forks of varying tone and with shouts of both high and low pitch. These animals, in fact, resemble the hunting spiders in being apparently devoid of auditory organs. They further. resemble them in the development of their visual powers, being able to see a moving body, like a living cockroach, at a distance of only about three or four inches. Even at a distance less than this they do not seem able to distinguish form. Thus a specimen of *Parabuthus*, excited by the presence of cockroaches in the box, was seen to rush at one of its fellows that crossed its line of vision about two inches off, evidently not recognising by sight a member of its own species, for directly the pincers came in contact with the latter the mistake was discovered, the pugnacious attitude dropped, and no further notice was taken. This last observation shows that more is learnt from the sense of touch than from that of sight—an inference which is further supported by the habit, above referred to, of carrying the pincers well in front of the head as if to feel the way. There is no doubt that the external organs of touch in scorpions are the hairs which thickly or sparingly cover various parts of the body. The tail is often very thickly studded with setæ, and the poison vesicle always has some upon it. Their use upon this latter organ is very plainly seen during the act of stinging. For this act is not by any means a random thrust delivered indiscriminately at any part of a captured insect. On the contrary, a scorpion generally feels carefully for a soft spot, and then with an air of great deliberation delicately inserts its sting into it. There can be little doubt that this care is taken that there may be no risk of damaging the point of the sting against a substance too hard for it. A reckless stab against the resisting chitinous exoskeleton of a beetle, for instance, might easily chip this point, and thus deprive the scorpion of its

most efficient weapon of attack and defence. The same care of this sting is shown in the carriage of the tail, this organ being curled in such a way that the point cannot come into contact with any foreign bodies. Even when teased with a piece of stick or irritated by being crawled upon by a cockroach, a scorpion is not often sufficiently provoked as to use the sting. The tail is certainly used to knock aside the instrument or sweep off the insect, but the sides or lower surface of the organ are employed, the vesicle being carefully tucked down. Upon one occasion a *Parabuthus* was seen to kill a cockroach and retire to a corner to eat it in peace, beginning at the tail end. Presently a smaller example of the same species coming along and finding the opposite extremity of the insect disengaged, started feeding on its own account. So quietly was the process carried on by the two, that not until nothing but a few shreds remained did the larger discover the presence of its messmate. Thereupon it quickly brought its tail into use, and by beating off its unwelcome guest secured for itself the remains of the meal. But although the provocation was great the defrauded one never attempted to use its sting to punish the intruder.

In connection with the organs of touch, the pectine or ventral combs must not be forgotten. Of the function of these appendages something is known, though, no doubt, much remains to be learnt. Their situation near the generative aperture, their larger size in the males, and the modification of their basal portion in the females of some species, *e.g.*, *Parabuthus*, suggest that they are tactile sexual organs of some importance, and Gaubert's discovery of the nervous terminations in the teeth is a satisfactory confirmation of this supposition. But apart from sexual functions it is highly probable that they are useful organs of touch in other relations of life, enabling their possessor to learn the nature of the surface over which it is walking. In favour of this view may be adduced the fact that these animals have been seen to touch the ground with their combs. Moreover, it is a very noticeable circumstance that scorpions which, like *Euscorpius*, creep along with their bellies close to the ground, have very short combs ; while in others which, like *Parabuthus*, stand high upon their legs, the combs are exceedingly long. I once noticed a *Parabuthus* marching over a piece of a dead cockroach. When she had half crossed it, instead of going straight ahead, as was expected, she halted abruptly, backed a little, and, stooping down, started to devour the fragment. From the height at which the body was being carried, I am persuaded that no portion of its lower surface, except the combs, could have come into contact with the piece of food ; so there can be little doubt that its presence was detected by means of the organs in question.

Creatures which, like snakes, are both carnivorous and venomous, and present at the same time an appearance which is by no means reassuring, are always held in bad repute by mankind in general, and suffer in accordance with the principle laid down in the adage, " Give a dog a bad name and hang him."

But amongst creatures of this description it is probable that scorpions qualify for first place with respect to the number and enormity of the vices with which they have been charged. Those that are most frequently alleged against them are general ferocity, murder, cannibalism, infanticide, and suicide. And yet, in spite of this serious charge-sheet, there is no doubt that they are much-maligned animals. For in defence of the accusation of ferocity I can say that I never saw a scorpion use its destructive weapons except with the legitimate object of killing prey for purposes of nutrition, or as a reasonable means of defence when molested. Naturally enough they will not tolerate handling, but when allowed to crawl upon the hand they make no attempt to sting it, and merely evince a desire to escape to surroundings more natural and congenial than human skin. From the charges of cannibalism and murder, however, these animals cannot be so easily cleared. For there is an abundance of evidence that they do sometimes, when in captivity, both kill and eat each other. Nevertheless, so far as my experience goes, members of the same species do for the most part live together in perfect harmony. Once only did I see a large *Euscorpius* eating a small one. But since the latter showed no signs of violence, there are no reasons for supposing that it had died other than a natural death. Like many other animals, scorpions may be made to fight by artificial means, and when roused to a high pitch of excitement by too much heat, they will clutch and grab at each other with the appearance of the greatest ferocity. But I never saw any evil result from these tussels. The combatants always seemed to prefer to part company without bloodshed.

As for the accusation of infanticide, it appears to be quite groundless. For it is well known that a mother-scorpion protects her young by carrying them about on her back until they are able to shift for themselves.

The question as to whether scorpions do or do not commit suicide by stinging themselves to death, when placed in a circle of fire, or otherwise tortured by that element, is one which has excited considerable amount of discussion. The belief that they do do so, with the object of escaping from the pains of burning, is of long standing, and probably has many adherents at the present time. But the experiments of Mr. Bourne upon some Madras species have shown (firstly) that the poison has no effect upon the scorpion that possesses it, nor yet upon a member of the same or of a closely allied species, and (secondly) that these animals are easily and quickly killed by a moderately warm temperature (50° C.). Moreover, when distressed by a too warm atmosphere, or, according to Lankester, by chloroform vapour, these animals have a habit of waving their tails in the air and of thrusting the sting forwards over the head, as if to punish some unseen enemy. And if the sun's rays be focussed with a lens upon the back of a scorpion, the animal immediately brings its tail over, and attempts to remove with it the cause of

irritation. So that the true account of at least some of the so-called cases of suicide by scorpions seems to be this: the animals in reality have died from the heat to which they were exposed, and the observers have erroneously inferred that the thrusts of the tail were intended to put an end to the animal's sufferings. My own experiments are all in favour of this conclusion. I held a specimen of *Euscorpius* in a corked test-tube over a low fire. As soon as the air in the tube began to grow warm the animal, apparently in great distress, struggled about the confined space for a few seconds, brandishing its tail the while, then lapsed into insensibility. The glass of the tube at this period was only slightly warm to my hand. Taken out of the tube and placed near an open window, the animal quickly revived; but it died the third time the experiment was tried. On no occasion, however, did it attempt to sting itself. I also experimented upon *Euscorpius* and *Parabuthus* by focussing the sun's rays upon them, and by placing mustard upon the membrane between the plates of the back. Both the species attempted to remove the cause of irritation by scraping at the burning spot with the sting of the tail; but they seemed particularly careful not to sting themselves.

There seems, however, to be sufficient evidence to prove that some scorpions have been seen to sting themselves during the course of experiments of a nature similar to those described above. One observer indeed mentions, in the case of an Indian scorpion, that blood issued from the wound made by the sting—a piece of corroborative detail which enhances the probability of the accuracy of the observation. But it is *à priori* improbable that the scorpion has any intention of killing itself. It seems, however, not improbable that a random blow meant for an unseen enemy might accidentally strike and pierce the deliverer; or that when the irritation is localised, as in the cases of burning with a lens, acid, whisky,* or mustard, the scorpion, failing to remove the substance by the ordinary means of scraping with the tail, might thrust its sting into the spot affected, with the intention not of killing itself, but of destroying the agent that is causing the pain. Or, indeed, it is conceivable that the mental faculties are so deranged by torture and the approach of death, that the scorpion does not recognise its own body by its sense of touch, and stings it as it would sting any other object within reach of its tail. If a blow inflicted in either of these ways were to pierce the brains or were to seriously lacerate the great dorsal blood-vessel, it might, one can suppose, cause death of itself, independently of the burning.

So that if it be admitted that scorpions have sometimes killed themselves, our verdict, it would seem, must be—accidental suicide, or suicide while of unsound mind. (*The above appeared in Nature, 1st June*, 1893.)

* It is stated that in some parts of N. America scorpions sting themselves to death if a drop or two of whisky be placed upon their backs; and that from this manifestation of their dislike of alcohol, these animals are known to the natives as teetotallers.

MISCELLANEOUS NOTES.

No. I.—A DAY'S SPORT IN BERAR.

The following account of a day's sport in Berar, some few years ago, when game was more plentiful than it is now, may be of interest to some of the readers of our Society's Journal.

The writer's duty, as a District Officer, led him one day to the neighbourhood of a deserted village—Dharur—situated on the banks of a mountain stream which, coming down from the Satpurahs, sweeps the base of the hill on which stands the fort of Naruallha, one of those forts taken in 1803 by Sir Arthur Wellesley, subsequently Duke of Wellington, after he had defeated Scindiah and the Bhansla at Assaye and Argaon and had captured Gawilghur. Dharur, in fact, is only a few miles distant from the field of Argaon, and in the days I am about to write of was just lovely in its solitude. Mixed jungle clothed the small valley down which ran the stream on the banks of which the ruins of the village stood, and for about 3 miles of its course both banks of this stream were densely clothed with "Sendi," or the date palm, with here and there small open patches of grass.

On the day of my arrival a "kill" was reported by a herdsman who grazed cattle in the vicinity. The marks on the "kill"—a large female buffalo—indicated that one, if not two tigers had their home in the date palm. As it was impossible for a single gun to command the jungle, a message sent in to Ellichpur soon fetched out two friends—General (now Sir Harry) Lumsden of Punjab Frontier fame, at the time commanding the Hyderabad Contingent, and his Brigade-Major, the late Colonel Hugh Watson. With them came as escort officer Resaidar Beg Mahomed, a typical specimen of our splendid irregular cavalry. After a careful reconnaissance, we selected a position on a mound of earth at the foot of a big mohwa tree, which stood about the centre of one of the larger aforesaid patches of grass in the centre of the Sendi-bund, about two miles up stream. Here the General, Colonel Watson, Beg Mahomed, and the writer stood shoulder to shoulder, with a servant behind each carrying a spare rifle. Up the mohwa tree, in the shade of which we gratefully stood, was posted a Shikari of Colonel Watson's as look-out. The troopers of the escort were placed at intervals along either bank, outside the denser jungle, as stops, falling in with the beat as it came along. The beat itself, mainly composed of hill-men villagers, with a forest elephant in the centre to give direction, formed line at the village, and, provided with tom-toms, horns and rattles, started about noon. It was the 8th of March, and the sun was tolerably hot. It seemed an age before anything showed up. Presently, putting us on the *qui vive*, well in advance of the approaching beaters, came a hare or two; then some jungle cat; and finally peafowl. After all these had passed, there was another seemingly endless interval of suspense—that interval during which, as all shikaris know, strung to the

highest pitch of expectancy and excitement, one hears and feels the beatings of one's own heart, just as a steamer quivers to the pulsations of its screw. But the feeling passes away in a second, as the expected quarry comes into view. In our case the view was *five* full-grown tigers "mooning" along close together almost in line, unconscious that their way was barred by man. "Mooning" is the only suitable expression, for they came along quite slowly, heads down, with a bored expression of countenance, as if they felt the heat, and thought the hustling of them by the beat behind most inconsiderate and unkind.

When they first broke into view, about 30 to 35 yards separated us. It was a beautiful and never-to-be-forgotten sight, but the position was in a way critical. There was no time for counsel, but the General, without a moment's hesitation, whispered "Take the big fellow," expressing the necessity we each had instinctively felt of concentrating, not scattering, our fire. "Let them come on" was Watson's immediate reply. He probably felt that we required a brief moment for selection. As a matter of fact, when the General spoke, the tigers seemed much of a size, and it required some fineness of discrimination to say on the spur of the moment which was the biggest. But the matter was settled for us. Watson's voice evidently reached foe as well as friend, for one of the tigers stopped dead and looked up at us in a startled and surprised fashion. Instinctively we all banged at her (her sex, of course, we only subsequently discovered), and then there was a sight for the gods. It is really impossible accurately to describe, and it was all over in a second or two. But as the sound of our rifles and the roar of the wounded tigress woke the other four tigers up—so to speak—they just raised their heads, looked at us, jumped on one side, and roared in concert. The untouched tigers were evidently momentarily quite undecided what to do—whether to try and get past us, or to face the din and row behind them, which had very appreciably increased as the sound of our shots reached the beaters. While these tigers were thus seemingly debating what to do, the female we had fired at made a bound towards us as if to charge home ; but her heart failed her, and she turned sharp to her left and to our right, making for the shelter of the jungle. As she went across us, we gave her the contents of our second barrels, and she fell out of sight into a small nallah. As she did so, the rest turned back in the direction of the beaters. We reloaded rapidly, knowing they would soon be headed and return, but this time prepared for us. Presently I saw a tiger trying to sneak past to our left, and called out "there goes one." I raised my rifle at the same time to indicate the direction to my companions. "Fire if you see him" shouted the General. Our voices had the effect of making this tiger stop and take a good look at us ; as she was doing so, I fired. She instantly responded with a roar and charged straight down on to us. I call her "she," as subsequently we discovered that she too was a female, and a very lively and determined female. I failed to stop her with my second barrel, and it seemed to me that my three companions had emptied both theirs equally

ineffectively. At this critical moment, when she was within a few yards of us—near enough for us to see her ears back, teeth showing, a savage gleam in her eyes, and blood streaming down one fore shoulder,—when it looked as if one of us in her next bound must be knocked over, our gun-bearers from behind jumped up the mound on which we stood to hand us our second rifles. In their excitement they shoved Resaidar Beg Mahomed and the writer over the crest of the mound, and we, losing our footing, slid down the mound in a sitting posture with our rifles in our hands. For a moment it seemed as if one of us two must be seized, for the tigress was now quite close to us; but in that moment Watson, who was a very steady and cool shot, fired, hit her between the eyes, and in fact brained her. Instead of continuing to come on, she spun round and round twice or thrice and fell dead close in front of us. Had she come on, instead of spinning round, some of us might, possibly would, have been clawed. While this little scene was being enacted, the other three tigers had, it seems, come into view and again turned back. But they could not face the row the beaters were making, and again they turned towards us to force a passage through. One was passing to our left, two to the right; we fired at and wounded the former, and he doubled back on the beaters. As he did so, the other two tigers faced the stop and broke past us to the hills behind. We at once stopped and withdrew the beaters and sent for the elephant to look the wounded tiger up. It would have risked an accident to let the beaters come on with a wounded tiger in their front. The elephant was a very unsteady one; if he saw a tiger, he invariably charged it, and it was difficult to shoot off him. In such jungle, however, we had no choice but to mount him, and we went first to look up tiger number one. As we approached the nallah, where the look-out indicated she had fallen, we heard a growl, followed by a faint attempt at a charge; she was put out of pain immediately. Number three gave us a lot of trouble. He was a cowardly sneak. Nothing would draw him; he kept retreating from one thick and almost impenetrable patch of "Sendi" to another, and dodged about, till eventually he dodged us altogether; and we had to return to camp with two tigers only, which the General photographed. This ended for us a very eventful day. As to excitement, the day has doubtless been often matched in the annals of shikar of earlier times, but it is not readily to be matched in these more prosaic days, which is my excuse for presenting an account of it to the pages of the Society's Journal. As to tiger number three, subsequent information led me to believe that he died under a thick bush while we were hustling him. As it was impossible to put in men on foot and we had no dogs, and the elephant could not penetrate everywhere, we did not unfortunately know it in time.

The place I speak of is no longer a home for tigers; the jungle has given place to fields with cover barely sufficient for a hare.

KENNETH MACKENZIE, Colonel.

Chikaldah, Berar, 28*th April*, 1893.

No. II.—THE FLOWERING OF BAMBOOS.

Given an Indian witness wishing to tell the truth regarding what should be within his knowledge, let him be without training in the ways of accurate observation, failure is almost certain. In our law courts endless absurdities arise from the initial question "What is your age?" Time has but little value or meaning to the common villager. He has no fixed standard whereby to measure it. He is quite as inaccurate in his estimate of distances. A generation ago, in parts now almost within hearing of the railway whistle, one might hear a cart journey described as of so many axles, meaning that a prudent man, setting out on that adventure, would take so many spare axles on his cart to provide against the ordinary contingencies of the way. To a much later date a Bilaspur villager would naturally answer that his home lay four chúngís away, thereby indicating that, before beginning the march, he ought to have rolled four cigarettes in the fresh leaf of the sal tree and have fixed them in his pugree as provision for so long or so short a journey. If pressed to be more definite, he would admit that his village was so many coss away. "But, my Peikoo, how long is YOUR coss?" "Well, Sir, a coss is everywhere the same; it always equals two dhabs." "Quite true, friend Peikoo, but I am not quite sure that I am acquainted with the length of your dhab; how long is it?" "A dhab, O Lord of Earth, is a dhab: the distance at which a voice can be heard on a still night, that is a dhab." "But, Peikoo, suppose it be a mother-in-law's voice." "Then, O Personation of Virtue, there will be a difference! The coss will be longer."

If Peikoo be so unsettled as to hear things of the visible world, how shall he now give us assurance regarding his memories of years long gone by as to the distant and silent foldings of the wings of time?

Is there, then, any hope of determining, on native evidence, what is the life-period of our mutual friend—the Katang bamboo? We may expect nothing better than vague traditions of the last time when in any given locality the Katang seeded. Such events are not recorded save by the pale-faced strangers who are ever crazy after facts and figures. And they stay too short a time in the country to see the seedling attain maturity and pass away in the course of nature. Still these traditions are not without interest, and they may corroborate or correct stray observations of those of our own people who have gone before us.

The widest personal observation will convince no one, and trustworthy evidence is not forthcoming. It is in the hope that others, while pardoning my mistakes, will help towards solving this puzzle that I venture to accept a kind invitation to put together the following rough notes on the flowering of the *Bambusa arundinacea*, the most beautiful and one of the most useful of the Bamboo family. At any rate I may hope to indicate directions in which further enquiry promises success.

My first recollection of the Katang bamboo is derived from Jubbulpore when Sleeman's Park was still the pride of the station. And the pride of the Park lay in the luxuriance of its bamboos. Next, at the Nagpur Exhibition at Christmas time, 1865, the finest poles of the Balaghât district were shown. I can well remember their extraordinary length, but am too cautious to hazard figures. Any one curious on this point had better hunt up an old catalogue of the exhibition or apply to Colonel Bloomfield—an excellent authority on bamboos—who was the first Deputy Commissioner of the Balaghât district.

The extreme length of those poles was accounted for in this way: the bamboo clumps grew on deep soil, in a moist valley, very close to one another; having no room for lateral expansion, they could live only by growing very tall.

There were at that time, namely at the end of 1865, one or two enormous clumps of Katang in the Maharaj Bagh, the public garden at Nagpur, and on its outskirts a great number of young ones, all apparently of the same age, not more than about ten years, possibly less.

The Jubbulpore Exhibition was held at Christmas, 1866. I believe there were no Balaghât bamboos exhibited there, and for this reason, that meanwhile there had been a general flowering of the Katang bamboos in the Upper Weinganga Valley, that is, in the Bhandara and Balaghât districts. But on this point I have no personal knowledge; I have, at best, a faint recollection of what I heard long ago. It may be that the seeding in the Weinganga Valley did not occur till 1870.

The rainfall of 1868 was a disastrous failure in the old Saugor and Narbadda territories, and this followed on poor harvests in 1867 and the Spring of 1868, severe famine ensued. In May of 1869 I was transferred from Nagpur to Jubbulpore. Passing Seoni, two or three miles of projected bamboo avenue were met. Small clusters of roots had been divided off from the parent clumps, and these roots with four or five feet of stem had been planted, fenced, and well watered.

In Jubbulpore the rains of 1869 commenced very late, but were not particularly short in quantity. In the Spring of 1870 about four-fifths of the bamboos in Sleeman's Park and throughout the station burst into flower, seeded, and died. The seed would have been all used as food but for the care of the District Officers. Seed nurseries were formed, and a vast number of young plants were reared, and the surplus distributed far and wide.

Early in 1881 I was a second time Deputy Commissioner of Narsinghpur, living in the house which had once been that of Sir William Sleeman, uncle of Colonel Sleeman, the last owner of the Park at Jubbulpore. In my compound stood two superb clumps of the *Bambusa arundinacea*. These burst into flower, seeded, and died in the hot weather of 1882. From their seed was raised a considerable supply of young trees, which were distributed in great part along the Great Indian Peninsula Line of Railway. It was, to the best

of my belief, in the same year that the remaining portion of the old clumps in Sleeman's Park at Jubbulpore and the old bamboos of the Maharaj Bagh at Nagpur seeded and died.

Possibly I am wrong about the Nagpur Katangs. I remember that in or before 1879 the Forest Department, under the immediate care of Colonel Doveton, began to cultivate these bamboos at Telin Kerry, two miles west of Nagpur, for profit. The supply of Nagpur and Kamptee was aimed at. Possibly the seeds for this interesting experiment came from the old bamboos of the Maharaj Bagh.

I learn that the general seeding of the Katang bamboos at Dehra, in the Doon, occurred in the Spring of 1882.

In the hot weather of 1885 I visited the upper valley of the (Cuttack) Mahanadi river and the Jeypore Zamindari of Madras. Returning by way of Dhamtari and of Rajim (where the Pairi river falls into the Mahanadi), I found a large number of bamboo clumps coming into seed. The Zamindars and Government officials promised to save all the spare seed for me, and this they kindly did. Two sacks of well-ripened seed reached me at Ghazipur, and thence it was distributed throughout India ; some was sent to Australia, to Cyprus, to China, and even to Cornwall. The Secretary to the Agricultural and Horticultural Society of India took the rest for their corresponding societies. He also kindly brought to my notice writings of Sir William Sleeman in the printed proceedings of some society, possibly of the Asiatic Society, in which was noticed a general seeding of the bamboos at Dehra Doon in or about the year 1832.

In 1886 I revisited Rajim to find that all the clumps had died off. Here and there was to be seen an exceptional stalk, and a few attenuated and almost abortive shoots had sprung up from moribund roots. These were striving to flower and seed.

This season I visited the Malkna hills, about thirty-five miles south-east of Rajim. Here also were dead clumps ; around them young seedlings struggling for life—the outcome of the seeding of 1885.

From several sources reports were heard that all the Katang bamboos in that mass of Vindhyan sandstone hills from amid which the Jouk river begins its northward course had seeded in the previous year (1885). This mass of hills lies about thirty miles south-east of the Malkna hills, south of an imaginary village named as Tarnot on the Government maps of the Chhattisgarh Feudatory States.

It was in this year (1886) that, with a well-known member of this society, I saw the waters of the Udanti, a branch of the Tel, which again is an eastern affluent of the Mahanadi. The Udanti rises on the western side of the same mass of hills whence the Jouk runs northwards. The Udanti first runs southwards, then turns to the east. We had occasion to visit the favourite mud-bath of an old solitary bull buffalo on the banks of the

Udanti, not a dozen miles from its source. This spring was in the centre of a large thicket of Katang bamboo, said to have all grown from the seed of an isolated clump. I can only give a guess at the age of the young trees. My own reconsidered impression is that the parent clump must have seeded after 1870, but before 1882. I hope the friend who put an end to the bull's career will be able to give a better estimate of the age of the young thicket.

In 1878 I saw the beautiful bamboos of the Indore Residency. I know nothing of their history or pedigree, but imagine them to be of the same age as the young clumps I saw at Nagpur in 1865.

In 1886 I saw a number of mature clumps at Gorukpur. These must now be very near the end of their life-period.

In the Spring of the current year, 1893, we had bamboo clumps flowering in the gardens of Queen's College at Benares and in the Civil Lines at Cawnpore. It is said (this is being verified) that the fine clumps at Dhariwal in the valley of the Ravee near Gurdaspur in the Punjab seeded last year.

The building of Queen's College, Benares, dates from 1841—1843. It does not follow that the gardens were laid out at the same time. Indeed it is believed that this was done by Mr. Griffiths. The present Principal, Mr. Wright, believes, on parole evidence or tradition, that the bamboos now seeding have been in the garden for forty-five years. But granting this, it does not follow that they are only forty-five years old. They may be older. They may have been transplanted forty-five years ago from a nursery, or they may have been then raised from roots partitioned off from a clump of some years' growth.

Pass on to our native beliefs. First of all, to the *Bambusa arundinacea* is attributed a life-period of fifty to fifty-five years. Next, natives tell one that its seeding is not gregarious; on the contrary, that, however widely distributed may be the progeny or the off-sets deriving from any one general seeding, all the progeny and all the off-sets must flower, seed, and die simultaneously. Thirdly, they profess to believe that a general seeding coincides with drought or with scarcity after drought.

It has been asserted that coincident with such scarcity will be found an unusual abundance of the edible seeds of forest trees, such as of the Sal tree (*Shorea robusta*), of the Nimar Anjan (*Hardwickia binata*), or the common Shisham (*Dalbergia latifolia*), and the like, a provision of nature for such a time of want. To this it has been objected that whereas coincidence attracts attention, the opposite condition passes unnoticed. This is a theoretical objection of no great weight.

Beyond question the flowering of the common male bamboo is rightly described as gregarious. Its life-period seems to be about fourteen years. On the same hills I have seen large patches seeding in different years—in 1870 and again in 1879.

In the year 1874 I passed through the Pandooah jungle between Maldah and Dinagepore, in Lower Bengal, on so-called famine duty. Returning in May, 1875, I found all the thick, thorny bamboos of that large tract—a variety strongly resembling, but smaller than, the Katang—had lately seeded.

The general seeding at Jubbulpore in 1870 followed the Bundelkand famine.

I have heard mention of bamboos seeding at the time of the Madras famine, but cannot vouch for the accuracy of the information.

I know of no noteworthy scarcity following on drought in or previous to 1882 or 1885 or 1893.

On the second topic of belief all the evidence I have to offer is this. In Seoni strenuous efforts were made to raise an avenue by laying down off-sets from old clumps taken from the nearest source of supply, the station of Jubbulpore and Sleeman's Park. I saw these full of promise in 1869. By the following May they had prematurely budded from the stem and were withering away with their abortive seeds.

Although there may be no more evidence available, it would be rash to reject this native theory. At any rate it is pretty and is not disproved.

I cannot now refer to Sir William Sleeman's writings, but I cannot resist a belief that some of the clumps in his park at Jubbulpore and those in his garden at Narsinghpur came from the seeding in the Doon, about which he wrote. That seeding was about 1832. Moreover, there was a general seeding in the Doon in 1882. This gives an interval or life-period of fifty years.

Some late enquiries in the Doon elicited the curious answer that between two consecutive flowerings of this bamboo "a child will grow to be a man and his son will reach manhood." Nothing more definite could be learnt.

Were I an interviewer, no doubt the words of a conversation of about 1879 in the Bhandara or Balaghât district would be forthcoming. Though they cannot be given, their substance is clearly remembered. Speaking of another old man, my informant declared his friend to be old beyond computation—a hundred years old or more. Well, if the sahib was not content with that, surely it was enough to say that his friend had twice in his lifetime eaten the seed of the great bamboo. Gently pressed to try to fix the earlier time, the old man at last gave a clear clue to it. He had often heard his absent friend speak of having had to eat the seed of the Katang bamboo in the year when the Raja, Appa Sahib Bhonsleh, lost his kingdom. "All the villages were burnt by the gods, who rose in rebellion for the king's sake, and but for the seeds and roots of the forest, people had died of hunger."

There is no valid reason for disbeliving this unpremeditated story. It may then be concluded that there was a general seeding in the Upper Weinganga Valley in 1818, and another between 1865 and 1870—an interval of some fifty years.

Further information might be obtained from the Deputy Commissioner of Balaghât ; from the Secretary to the Horticultural Society at Nagpur ; from Colonel Doveton, Conservator of Forests, C. P., who knows most about their cultivation for profit ; and from Sir William Sleeman's writings. Colonel Doveton could correct me on many points.

I see that Mr. Gamble, Conservator of Forests, North-Western Provinces, advises propagation by division of roots rather than from seed. If the native theory that off-sets partake in the appointed life-period of the parent clump be correct, this plan might lead to great disappointment.

And it rarely happens that a private person is willing to afford the cost of propagation in this way, even if he can find a source of supply. It cost close on a hundred rupees to start a dozen clumps (from seedlings brought from Narsinghpur, C. P.) in the Cawnpore Memorial Gardens, although the roots were obtained gratis.

For any one trying that plan of propagation it is recommended that the roots to be removed be dug up before sunrise and the stems cut off about four feet above the roots. All but the tops of the stems should then be immersed in water in a shady place for a whole day. Pack in damp black cotton soil or in damp moss for transport. Plant in thoroughly wetted holes. The bamboo loves a gentle slope on all sides with good drainage. It abhors stagnant water.

I have often enquired about the seeding of the large bamboo, which is carefully cultivated in the eastern districts of the North-Western Provinces and throughout Bengal. Apparently natives have no traditions of its ever seeding. They say that it pines away and dies—"Udas hokar mar jata hai"—if the human habitations it has sheltered become abandoned.

We have it on the authority of an old song that "Cats don't know when it's half-past eight." Are bamboos more intelligent ? Can they tell when time is up ? Do they respond to the wants of humanity in times of drought and scarcity ? Do they obey a special and individual law of nature by which they must flower and die at a particular age ? Or is their life-period as variable as his whose days are three score years and ten ?

G. JASPER NICHOLLS, I.C.S.

OFF ADEN, *6th May*, 1893.

No. III.—JUNGLE NOTES.

I am sending you by rail a single horn of a bison (*Bos gaurus*), which I picked up in this district in March while in camp in the forest.

The remarkable point about it is that it has been broken off the skull, core and all ; and since I have never heard of such an instance, I thought it might be worth while sending you the horn for inspection.

It was found in a small glade in the forest, but, owing to the rain we have been having throughout the season, no tracks were traceable. At first I thought some bison must have died, but, on searching all round, not a trace of bones could be found, although the jungle was open. Moreover, on second thoughts it seemed to me that, even if the bison had died, no animal would have any object, granted that it had the strength, to tear the horn and core from the skull. The horn and bone of the fracture were in good condition, only somewhat dirty, and the horn was quite unattacked by insects, which fact testified clearly that the horn had come there since the last rainy season. Hence the only conclusion I can arrive at is that two bulls in fighting got their horns locked and thus one got broken off. This seems most probable, as I do not think it could have been broken off in a charge without some damaging marks on the horn being visible. It is just possible that the bull got his horn caught in a tree and thus broke it, the skin around the base of the horn supporting it for a short time. The horn may then have been dropped anywhere. No tree was noticeable near where this would have been possible. Also, if the horn was so caught in the tree that the bison could not get free without breaking the horn, it is unlikely that after breaking it he would be able to disentangle it, and then the horn would have been found near the tree. So, on the whole, the conclusion to be arrived at seems to me to be that it was broken off in fighting with another bull. The strength required to do this must have been enormous, and I certainly do not believe any other animal in these forests, except a bison, would have sufficient strength. Anyhow, if a tiger had done it (and even he would have had no object except in a fight), he must have left some marks of his claws or teeth on the horn. The horn is not large, only measuring 24″ in length (round the outer curve) and 13¼″ girth at the base in the dry state, which would mean about 14″ when alive.

I shall be very interested to hear whether horns so torn off have been found before and as to what cause you attribute the tearing off. Also as to whether you think the bison could possibly have lived after thus losing his horn. If so, I will be on the look-out for him.

The only other case that I have heard of in which a horn was thus completely torn off was in the Chanda district. The late Mr. G. H. Foster, Deputy Conservator of Forests, having wounded a buffalo (*Bubalus arni*, Jerdon) from his elephant and thinking it dead, approached it on the elephant, whereupon it charged. The elephant, not knowing what to make of this beast, which had made a huge wound in his foreleg with its horn, wound his trunk around the horn and tore it clean off core and all. Both elephant and buffalo then bolted off in opposite directions, the mahout having lost his head completely. The buffalo was tracked up by two Gonds, who found it dead two or three days after, no doubt partly from the effect of the bullet-wound and partly from the shock of losing its horn.

On or about the 5th of February, at a small tank in the village forest about a mile from the village of Thoyapar, in the Nagpur district, a large boar was killed by a tiger ; such, however, was my information, and so on the 15th I inspected the spot. The tank was to a great extent dried up, but the bed was just moist enough to show tracks in an ideal manner.

This is the story the tracks distinctly related :—

A huge boar was feeding in the tank by grubbing up the roots of the various aquatic plants, when a tiger stalked him along the edge of the tank. The boar becoming suspicious, the tiger bounded towards him and was met by the former a few yards from where he had been grubbing. Then ensued a tremendous scuffle, and the tiger was evidently having a bad time of it, as several handfuls of tiger hair scattered about testified to the boar having two or three times charged home. At this point of the combat two other tigers joined in from different directions, and of course this triple combination was too much for the boar, who succumbed. The latter tigers were a tigress and a nearly full-grown cub, called here a "pata."

This must have happened when day was breaking, for some villagers, passing along the cart-track early, saw one tiger in the open. They raised a shout, and the tiger disappeared. They then found the boar which the tigers had not commenced to eat, and, having called some comrades, carried it off to the village. This was apparently a very large boar, but unluckily the tushes were carried off by a jackal or dog after having been set aside for me.

Later on, about the end of April, another boar was killed not more than ten or twenty miles from there; this time apparently by a single tiger, but its tushes only measured 7″.

About the end of February, along the Pench River, on the borders of Seoni and Chindwara, there was a fight between two huge tigers. One killed the other and, after having half eaten him himself, went off lame and bleeding, evidently badly wounded, as was shown by his track on the sand. The tiger killed and partly eaten was discovered by some fire-guards, who had no doubt as to the fight from the condition of the ground where the battle took place. The victorious tiger succumbed also a few days afterwards, but the skin was nearly rotten when discovered. It is curious to know that tigers will eat each other in a full-grown state, although it is well known that tigers greedily devour young cubs when they can get the chance in the mother's absence.

On tour in camp I was joined by two companions, who, only just out from England, had never killed anything in the shape of big game, and so, knowing of a place where a panther's presence had frequently been reported to me, I tied up a goat and got a kill on May 21st. My two companions sat up at about 3-30 P.M., and on the panther turning up at sunset, it was killed.

On skinning her we found her milk glands greatly developed, and hence suspected she must have cubs near. So on the morrow, having sent out five

Gonds to investigate, I was rejoiced at about 4 P.M. to hear them come in and say they had found the cubs, whereupon we at once started to get them.

Coming on a small nala, a few feet broad, not more than a mile away from where the panther had been shot, we were at once able to see that this was the place where the panther had fed and exercised her young, and on looking about carefully (of course we had it pointed out to us by the Gonds), we saw a small hole, not more than 5″ in diameter, in the side of a white-ant hill on the bank of the nala. In this were the cubs. It was interesting to see how the panther had evidently been in the habit of hiding her cubs in this hole in safety while she went out to shikar her food. The hole inside was very small and not nearly large enough for the old panther to get into, but just large enough to hold the two cubs, which were probably nearly a month old. It was difficult to tell whether the panther had discovered this hole or made it herself, but possibly there was some sort of hole there and she enlarged it as required. There were claw marks on the ant-hill inside the hole, but this might have been made in the ordinary quarrels of the cubs. We had to cut the ant-hill away to enlarge the hole before getting the cubs out. They were taken to camp and are still alive and well. The panther had evidently been hard pressed for a place to put her young, and she must have been driven to think of making a hole for the cubs—a thing she would never have done, I imagine, had there been any rocky hills near.

P. H. CLUTTERBUCK,
A. C. of Forests.

NAGPUR, 6*th June*, 1893.

No. IV.—THE JACKAL OR LION-PROVIDER.

I believe it has not been clearly demonstrated how the jackal came to be called the lion or tiger provider. Few but the most credulous would believe that the jackal is in the habit of seeking game for the larger animals and taking them to where it can be found, &c.; still there must be some reason for assigning the name "lion-provider," which is not a modern term, as it is found in some of the oldest books on wild animals. The following coincidence, which happened before my eyes, may perhaps serve to throw some light on the mystery. Some time ago I happened to be in camp alongside a small rocky hill with many caves, which, I was informed, contained a small colony of hyænas. Partly to pass a dull hour and partly to try and obtain a good specimen, I made up my mind to sit up with my gun one evening. There was a creek close by, and on the banks a small hamlet of fishermen; and knowing the hyæna's partiality to fish, especially when a little stale, I obtained a basket full, which had been caught the day previous, and placed them in what I thought a good spot and sat up at sunset on a high rock about 12 yards from them. After a little time I heard a rustling amongst the

leaves and undergrowth, and presently a jackal appeared and went straight to the fish, looked at them and smelt them, and then sat down beside them. After a few moments I heard another slight rustling in the same direction, and the jackal, who was sitting by the fish, must also have heard it, for he looked up and gave one slight bark, not unlike the faint call of a cheetul, and almost immediately afterwards a second jackal appeared and joined him. The two now stood by the fish, not attempting to eat any, but looking about them in anxious expectation. After five or ten minutes they suddenly ran away on one side to a distance of about ten yards, stopped, turned round and looked in the direction of the fish. In about a quarter of a minute an hyæna appeared from a direction at right angles with the line taken by the jackals ; he was walking straight to the fish, and on coming in view of the jackals, he turned his head and glanced at them and at once proceeded to inspect the food laid out for him. The jackals now ran up to the hyæna and, on approaching him, wriggled their bodies with their bellies close to the ground, much like the attitude that a puppy often assumes when making up to a big dog. They seemed to express delight at the arrival of the hyæna, and so close did they come to him that I think they must have rubbed themselves against his sides, and here they remained whilst their lord and master, without taking any notice of them, was selecting the most dainty of the fish. The jackals made no attempt to even put their noses near the food. Darkness coming on prevented my seeing any longer, so I carried out the object for which I sat up. The jackals in this case may be said to have provided food for the hyæna, inasmuch as they did not eat it themselves, and their presence was sufficient to keep smaller animals away. In the absence of any other reliable theory, it seems probable that the term "lion-provider" has been applied to the jackal from experiences similar to what I have related, the only difference being that the lion has taken the part played in this instance by the hyæna.

F. J. A. HILL.

12*th June*, 1893.

No. V.—AN AGGRESSIVE COBRA.

On the 28th June last a number of the convicts of the Kolhapore Jail were employed in cleaning up the compound of the State Hospital, and the sepoy in charge, Husain Bux, sat, watching the party, on the flight of nine broad stone steps which leads from the corner of the hospital compound up to the quarters of Mr. McGill, the Darbar Veterinary Officer. It was about mid-day and the sepoy was sitting at the end of one of the steps, half way up the flight, with the entrance to Mr. McGill's little garden above and rather behind him to the left, when he felt a sharp smack, as from a flat object, on his back just above his waist-belt, and, as he says, thought at the moment that some one had thrown something at him. Luckily, indeed, he did not put his hand behind to feel what the object was, for on looking round under

his arm, without shifting his seat, he was horrified—and no wonder—to see a large cobra on the same steps just behind him, with hood expanded and ready to strike again.

Sidling off on to the ground, he shouted to his convicts, who with others ran up and pursued the snake, which now ascended the steps into the garden and took refuge behind some flower pots in Mr. McGill's compound.

Calming down from his fright, Husain Bux was for leaving it alone, saying that as Allah had spared him, so he would spare the snake, and no doubt, though a Musalman, he had something of the Hindu superstitious belief in the divinity of the cobra, and thought that such a peculiar visitation from the God would bring him luck. So, too, thought many natives, and when I talked over the occurrence afterwards with an old jail warder, he shook his head ominously and said, "He ought not to have killed that snake." However, killed the cobra was, and the men took it to Dr. G. Sinclair, who found it to measure 4 ft. 7 in. The snake, I fancy, must have been coming down from the garden above, when it saw the sepoy sitting on the steps, and that it should not have retreated or passed behind him, as there was plenty of room for it to do unnoticed, is curious, and such an instance of a cobra, when unalarmed, going out of its way to attack a man is perhaps worthy of record.

S. M. FRASER, I. C. S.

KOLHAPORE.

No. VI.—NOTES ON INDIAN DOGS.

In No. 4, Vol. VII, Mr. Sinclair discourses pleasantly on various "pies" and traces them up to the frontier. It may be interesting to supply a few notes of other "pies" met with in my wanderings.

In the villages lying at the foot of the Nari and Bolan Passes the dogs are decidedly bigger and more ferocious than the usual "pie," but it is not till the passes are entered that the "Afghan mastiff," so called, is met with. It need hardly be said that the dog is not a mastiff, and really only resembles one approximately in size and slightly in colour. Head, general build, coat are all different. This is only an instance of "heimweh" which leads us to bestow old familiar names on whatever reminds us of our Western home. This "Afghan mastiff" stands as high as a large greyhound and is built generally like the ordinary "pie," except that he is much heavier and more massive in every measurement and does not possess a wasp waist. His main peculiarity is his ruff, or "mane" as it is generally called. This ruff consists of deep thick soft fur, nearly three inches long, and covers and protects the neck, chest, and shoulders. The colour varies very little, being generally rufous. Like the wasp and red ant, he is invariably in a bad temper, and it is advisable to have some lethal weapon with one, as a threatening gesture is at once resented by action, which is apt to result in discomfiture. My first introduction to this dog was

in the Nari Pass. It was brought about by my bull-dog, who had a difference of opinion with one. The result was speedy and to us very unsatisfactory. With my aid the Afghan made off eventually with his ruff, somewhat disarranged ; my dog was lacerated with long deep cuts, and his mouth was very unsatisfactorily filled with fur. An English bull-dog was never intended by Providence to bite through three inches of fur before getting to flesh. The Afghan dog is, very like his master, truculent, ferocious, and untrustworthy.

Still further north a very large and heavy dog is found standing nearly as big, if I remember right, as a St. Bernard. The only one I saw was snow-white with an enormous jowl and an array of glistering white which I shuddered at. This dog was tethered by a cable to a walking six-foot Pathan, whom he dragged about with perfect ease, without even going through the formality of ascertaining his wishes.

The next breed I have on my list is found among the nomad fishing population of the Irrawaddy delta. This dog lives on fish, and, like his master, is almost amphibious. It looks something like an Irish terrier run to seed. There are two breeds, differing only in size. Their colour is much greyer than the usual "pie" fawn. The dog's body is covered with ragged tufts of hair, which form on his face a most imposing moustache. The smaller breed reminds me irresistibly of a very mongrel terrier at home.

It may be noted in passing that a very large number of "pies" in Burma are either black or white.

On the Chin frontier a breed like a large Esquimaux terrier is met with. I have seen several which looked exactly like collies, bushy manes and all, till one noticed the lightly curled-up tail. The colour varies greatly—black, black and white, lemon and white, white, and tawny. The fur is long, soft, and silky and very thick, nose and ears very pointed, the latter sometimes almost buried in the fur. They are very good-tempered as a rule, but dreadful cowards, and generally flee precipitate at the sight of a white face. The Shan dog is very like this breed, but is much larger and heavier. The manes are not so bushy, nor is his tail quite so curly.

A very interesting paper could be compiled on Indian dogs, and it is to be hoped that some member with zoological knowledge will give us an authoritative description of the various indigenous breeds. The differences among them are very great, but yet to the English eye all seem stamped with the same hall-mark, generally called "pie." This may possibly be due to the fact, as noted by Phil Robinson, that their "food is rubbish."

F. E. DEMPSTER.

RANGOON, 21*st June*, 1893.

No. VII.—A FRIENDLY BULBUL.

The common bulbul is notoriously bold and friendly. Residents of the Western India Club in 1890 will perhaps remember a nest being built on a

pair of iron bars supporting the weather-boards near the door leading out of the bar lounge. It was within reach of every passer-by and not concealed by any bush or creeper. The writer has a nest now near his front door and the birds are even more confiding. It is built in a small croton within a couple of feet of the door frame. Care was taken not to disturb the hen-bird while she was sitting on her eggs, and the first advances were made when she had hatched them out. A hand was brought close to her when she was sitting in her nest and bits of soaked gram offered. She did not seem to care for this food and pecked viciously, but she would not leave her post, and there can be little doubt she was bravely defending her chicks. Worms were offered to her and she took them greedily, but still she seemed, by her pecking, to resent the intrusion into her home. Bread crumbs were then tried, and she took them without hesitation. After she had been repeatedly fed in this way, she ceased all hostile demontrations while she was on her nest, but if she happened to return from an outing and found any one too near the nest, handling the protecting croton leaves, she would charge boldly home. Once she even struck the offending hand, and then made a rapid retreat and dodged into her nest from the opposite side. She has hopped along the rim of the pot in which the croton stands and taken food held out to her in the hand. She has so far only shown such confidence in the immediate neighbourhood of her nest, but she may be open to more general friendship. Some wretched vermin carried off two of her chicks at night, but up to this evening there was still one gaping mouth in the nest. The coch-bird has still his natural amount of shyness. It was curious to watch the process of feeding the newly-hatched birds. The hen rarely left the nest. The cock would come with a morsel in his bill and she would clear out to let him administer it, but go no further away than a rosebush which stands in a pot within 10 feet. The cock never stayed after he had done this pretty domestic office, and directly he left, the hen would return and take her family under her wings for another spell.

The exhibition is still on view, and a gentleman from Bombay went this morning away hugely surprised and pleased with it.

H. T. OMMANNEY, I.C.S.

PANCH MAHALS, 10*th July*, 1893

No. VIII.—NOTES ON THE ECCENTRICITIES OF A DOG.

There are many still in Bombay who will remember "Bodger," for he had a good many friends as well as enemies, the former chiefly bipeds, the latter mostly quadrupeds. Bodger started in life, as many other dogs have done, born of poor but honest parents (this is but supposition, for I was never able to find out who or what his father or mother were and very little clue could be gained by looking at Bodger). I called him a bull-terrier, as that was the nearest breed that he had any resemblance to. He was, however, a strong, active, and fairly well-shaped dog, rather long in the legs and a tail so long

that when he was angry it would curl over until the point seemed to dig into the centre of his back. His colour was white, or, to speak truly, a dirty white. Bodger was about four years old when given to me by some friends on Malabar Hill in 1878. Their reason for getting rid of him was that he raised his voice too much during the night when tied up, and if allowed to be loose, he used to retire to a neighbouring bungalow and pass the night on the sofas and chairs. This led to remonstrances on the part of the tenants, who threatened to shoot the dog if it is was found there again. Before accepting Bodger, I took him out for a walk on trial. Very quickly he showed his fighting propensities by attacking a dog half as large as himself and scored a victory. He then met a cat, which he killed in first-rate style. So Bodger became my property. When I say "my property," I mean I became his owner or master, at least as I understood it. But Bodger had quite a different opinion, and allowed no one to interfere with his ways and doings. He certainly made my rooms in the Fort his home when he was at home, and would at times take his meals there and allowed me to have a little more influence over him than other people, but that was all.

Why he was named Bodger I could not find out, but it was a capital name, for he looked it all over, so I let it remain. When Bodger came to reside with me in the Fort, I contemplated keeping a dog-boy to look after him, but he soon showed me that he could take care of himself without putting me to any extra expense, and his habits at first were more or less methodical. In the early morning he was generally missing ; during the day-time he would lie under my desk until the sun was off the street, when he would get up, shake himself, look up at me, and then walk deliberately down to the Frere Fountain and wait there for any strong dog that might turn up. In a short time there was a row, and on looking out, Bodger was sure to be in the thick of it. After an hour or so of this amusement he would come back (generally with marks about him showing that he had not had it all his own way) to see if I or anybody else was going for a ride, when he would accompany us. This went on for some time, until one day he saw his old master going into the Bombay Club and followed him only to be ejected. For several days he used to wait outside, watch his opportunity to sneak inside, and be driven out again at the run. Failing to get a permanent footing in the Club, he took up with a gentleman, Mr. Arbuthnot, the Collector of Bombay, in the Secretariat, and for nearly six weeks went every afternoon about 4 o'clock and laid down under his desk and remained about half an hour and then left. This gentleman never knew until afterwards to whom the dog belonged, and told me that the dog hardly ever took any notice of or attempted to follow him, simply stayed about half an hour and then walked off. Bodger tried the same game at Watson's Hotel, but this did not last long, as the Volunteers took up his attention and regularly every Saturday, when they turned out and Bodger heard the band coming out of Church-gate Street, he went out and marched at their head until it was all over. This led to some of the fellows in the office taking to painting

Bodger up, sometimes like a clown, or glueing a paper hat, with feathers, on his head with B. V. R. printed on his ribs, for these special occasions, and many a time Bodger was seen in all his glory, whilst the firing was going on, flying about in front and having a good time. Later on the dog would go out to Colaba of his own accord in the early morning to witness the rifle shooting and come back again after it was over. He was very fond of the gun, and accompanied me on several shooting trips, and would go the whole day if allowed. He was, however, of not much use except to retrieving duck, and that he was very good at and seldom lost one in rushes. He was, however, a little hard on them if they were only wounded, but did not maul them when dead. One evening, coming back from Thana, I put him loose in the guard's van. He, however, got out at Bhandup Station, and was not missed until I looked for him at Byculla. The guard, not seeing the dog in the van when he left Bhandup, thought I had taken him in the carriage with me. I was living then at the Chummery, Mahaluxmi, and although he had not been over the ground before, he turned up about 1 o'clock in the morning. Bodger had a most retentive memory. He was always open to fight any dog when set on, but when left to himself he took stock of his adversary and seldom attacked unless he felt sure in his own mind that he would get the best of it. At times his judgment was wrong and he accepted his punishment, but he never forgot the dog or forgave the man to whom the dog belonged, and whenever he met either, his whole attitude altered, the hair on his back stood up, the point of his tail dug deeper into his spine, and he would growl and walk past slowly, but never attempted to renew hostilities. We had many dogs at the Chummery and he held his own until four of them attacked him at once, and Bodger soon became the rope part in the tug-of-war. He, however, bided his time, and when he got them later on separately he warmed them. Bodger also had an aversion to being laughed at or made ridiculous. On one occasion, when our tame black buck doe came in after dinner at the Chummery to have a few scraps, I tied Bodger to the end of the rope attached to the buck and told him to keep it in order. Two dogs commencing to quarrel frightened the buck, who made for the door, capsized the boy coming in, and made off into the compound, dragging poor old Bodger with him ; we gave chase and soon found them brought to a standstill on either side of a tree. Bodger was released, but for many days he would not come into the house or have anything to do with any one in the Chummery. He was more hurt in mind than body, although he turned more summersaults in that short time than any clown in a circus.

Bodger, or rather "Chevalier de Bozè" as he was called for the occasion, appeared once at the Gymkhana dog show—I forget in what class—but for some time he was not recognised, as a mixture of burnt cork and beer had been well rubbed into his skin, which had given him a beautiful iron grey appearance. It is needless to say he did not take a prize, neither did he appear to enter into the fun of the thing, as was shown by his sulking at the show and not taking the slightest notice of those who had had a hand in changing his

colour, and he kept it up for days after he had assumed his dirty white appearance.

When I went home in 1880 Bodger saw me off, and remained for hours at the Apollo Bunder after the steamer had left, and on my return, fourteen months later, knew me at once, although I neither spoke nor took any notice of him, and seemed very pleased to see me back. In August, 1882, I left for Ceylon. Up to this time Bodger had carried on his same old game of going out and about just when and where the spirit moved him. He, however, completely altered his ways from the time he landed in Colombo. On board he seemed very miserable at leaving Bombay, and although in good health, he never seemed to recover his old spirits. He gave up all his quarrelsome ways, and would never fight unless another dog commenced and would never leave my side for a minute, night or day, up-country, where I was stationed. I had several other dogs of sorts for hunting sambhur, muntjac, and hares, and he would always join in, and seemed to like the sport, but even in the hottest sun he would not remain long away from me. By this time I had got to be very fond of the dog, and he was evidently very much attached to me, and for hours would sit looking up in my face with such a beseeching expression, which seemed to say "take me back to Bombay," and resembling so much the dog in that picture called "Sympathy." Bodger, except for the sad and wearisome look, had nothing the matter with him, and although he had always accompanied me shooting, I thought on one occasion I would leave him behind as I expected it to be pretty hot in the low country. I patted him and said goodbye, but he did not seem to understand my leaving him and tried hard to follow. I, however, sent him back and he went to my bed-room and lay down. I was only away a couple of days, and on arriving back at my bungalow, my friend, who was living with me at the time, told me the sad news that Bodger, who had hardly left my room whilst I was away, had died only two hours since. I was very much cut up, and thoroughly believe, if it is possible for a dog to die of a broken heart, that Bodger died in this way. Bodger was buried in my compound at Haldamulla under a large mango tree, on which I carved in deep letters —"Bodger, *obit* 27th January, 1883."

E. L. BARTON.

Bombay, *June*, 1893.

No. IX.—DOWN A CHIN STREAM.

We had been on a frontier expedition in the Chin hills, and our souls were sick of mule paths zig-zagging up and down uninteresting hills. One morning therefore we decided to cut out a way for ourselves and plunge boldly from our camp down to the little river 2,000 feet below and follow it up to our next camp. The next day's march by road was six miles ; we allowed twelve by stream, and found that it was a good deal more. Climbing up the Chin hills had been our hard lot from necessity ; this was our first trial at climbing

down, and there was not much to choose between them for difficulty. *Facilis descensus* may apply to Avernus. I have not been there, but it is not true of the Chin hills. Half past six one sunny morning in April found us all ready. Guns, butterfly nets, and a few gut casts and flies were our impediments which we made the pilgrim carry. He deserves a word of description. Hadji Mahomed Khan is one of those very tall solemn Pathans who seem veritable descendants of the Wandering Jew in features and proclivities. He has performed the Haj and is as good tempered and powerful as a St. Bernard pup. He exacts homage from the Hindus by his size, and from the Mussulmans by his piety.

Far below the waving sea of bamboos which clothe the hill side, we can make out the belt of heavy timber marking the little hill stream we wish to follow. The hill side is steep and covered with the dry slippery bamboo leaves. Tobogganning with wooden seats to our pants seems the best way of proceeding, but it is too late to adopt that plan. After a few casts we decided to follow down a small spur between two streams ; this decision was mainly arrived at by our both sliding down the spur in a small avalanche of rubbish. On we went—the slope getting steeper and steeper—till we had to hand ourselves down from tree to tree and had finally to take to the little stream, which here consisted of deep pools with miniature cañons and precipices. We sidled along their faces—oh, how wet the water looked !—grasping ferns, roots, and bamboos. Here and there we made impromptu bridges of nervously flexible bamboos, across which we sidled with the want of grace of the amateur rope-dancer. Each narrow shave was greeted with encouraging chuckles and inward disappointment. The nullah became more and more like a knife-gash in the hill side, and at last we came to a narrow pass a hundred yards long with perpendicular sides, through which in two feet of water we splashed and found ourselves at the foot of the hill in a little open glade. The vegetation all round was so clean that, after going 50 yards on, we could not distingush the path we had come down. We had been in deep shade the whole way down, and the only butterflies we had seen were a few *Melanitis* and one or two skippers. We disturbed one barking deer, and once a loud whirring close by told us we had startled a pheasant. It was still early when we started down the main stream. It was very beautiful, and a true wild forest landscape, with the luxuriant profusion of growth which is so hard to describe, but which tempts particularization. The charm of the early morning was on everything. The sunlight danced on the pools and sent emerald shafts of light through the little bosky dells. There were tall forest trees clothed with moss and wearing buttonholes of brilliant orchids. Here and there a fallen giant lay, partially propped up by his brethren and covered with a hoary fringe of grey-beard moss. Everywhere the bamboos rustled and filled in the spaces left between the big trees with feathery fronds. Gigantic creepers covered with blossoms tied the big trees together and spread

acres of net work, beneath which the tender ferns might grow. The little stream wandered on in close touching curves round the cliffs and with cheerful leaping over obstructions, and drinking in enjoyment at every grove we followed. Here culling a tempting bunch of orchids, or casting a fly over a ripple, there stopping to admire the exquisite effect of a bunch of maiden hair ferns set off with caladiums and begonias. On we wandered, and as the sun mounted higher, the butterflies came out and hurried past us in an endless gorgeous procession. *Charaxes* were there in half a dozen strong-bodied varieties. Delicate *Lycænidæ* gleamed a moment in the hot sun, or formed a fairy ring over some small pool. *Ornithoptera pompeus*, with his broad expanse and yellow satin under-wings, sailed by proudly, and as a rule just out of reach. Flitting in the shade a dusky *Melanitis* or an *Yphthima* would tempt us to arm-reaching tripping rushes over the bamboo roots. *Delias* sailing temptingly just over-head seemed to know our exact reach and keep beyond it. While *Enthalia, Lebadia* and *Lepidia Iomene* outspread on the shining leaves were missed over and over again. On we went, our cigarette box getting fuller and fuller of paper envelopes and alas! also our gut-casts and flies disappearing rapidly. The pilgrim followed us anxiously; he objected to pilgrimages whose route seemed so obscure, and during which he had to carry so much, what he called, "cutchra." However the sahibs are all mad, and there is but one God, so he came on gloomy but mute. We then calculate that we allowed for 12 miles, that it is now one o'clock, we have been travelling for over six hours and must have covered 12 miles; but there is no appearance of the next camp. We are now showing signs of wear and tear; we are both wet to the waist as the only road is the bed of the stream. I have lost the sole off one of my boots, and the pilgrim is rapidly losing his temper. We have a goodly stock of butterflies, and the pilgrim is laden with orchids, but we have lost all our flies and not one fish to show. We have seen nothing shootable and have nothing eatable. Inward pangs remind us that it is a long time since "chota hazri;" and the more remote our chance of satisfying the pangs become, the more we remind each other that even "bully" beef has its attractions, that under certain conditions preserved potatoes can be eaten with relish and that whisky is no despicable drink, and we are both Scots! As we go on, we begin to lose our appreciation of the scenery; here and there we distinctly disparage hill and stream; we even mutter about this beastly country. As we get tired, tumbles become frequent and are endured in gloomy silence and watched without sympathy. The pilgrim disdains our companionship, and, though keeping behind, declines to follow the route we affect. The stream has been getting broader and deeper, and we have either to wade down it or scramble along the rocky banks. Three o'clock comes and no signs of camp; but instead a heavy thunderstorm comes up suddenly and drenches us; we huddle through the worst of it in a small bat-lined cave, but are disturbed by the gloomy pilgrim who tries to prove that the stream is rising. The pilgrim's

spirits are now at so low an ebb that ours, out of sheer contrariety, rise, and in chaffing him we try and forget we are tired, cold, hungry, and wet. Thirsty we are not, but oh for something to take the edge off the water! We ask the pilgrim when he thinks we shall get in—and what ills are in store for us, and badger him till he takes refuge in a surly "Khoda Janta" and is thereafter unapproachable. We had before come up this stream for about a mile from the camp, and we now tried hard to recognise the corner which we had then reached. Again and again this rock or that tree seemed familiar, but again and again we were disappointed. Four, five, six o'clock still found us plodding on very tired, very wet, and excessively hungry. At last we sighted the corner and, after a few minutes' hesitating recognition, saw high overhead the grass huts of the camp. We hurried on, and the pilgrim smiled. Ten minutes later we were getting into dry clothes, and soon were discussing our long-looked for bully beef, commissariat biscuits, and whisky, and, needless to say, enjoyed them.

F. E. DEMPSTER.

RANGOON, *June* 1893.

No. X.—A DOG KILLED BY A DABOIA.

Mr. W. H. Traill, writing from Jhansi, Central India, states that on the 1st July one of his dogs, a large terrier, was killed by a full-grown viper (*Daboia russellii*). Although bitten severely in four places, the dog appears to have lived for about eight hours, when it died without convulsion, but with all the symptoms of paralysis. The daboia was found to contain 40 fully-developed young ones.

No. XI.—SOME SHOOTING NOTES.

In turning over the leaves of a shooting diary of recent date, I find some odds and ends which I venture to transcribe, as I think that they may be of interest to others.

Here is an extract from a letter from a friend in Somali Land, dated 25th August, 1891 :—

"I left Aden 10th July and went over to Zaila, where I found A . . . He was not able to start for a week. We set off 18th July in a boat 40 miles down the coast, where we had sent on a tent, four camels, and guns. The main body of our camp had gone up to the first wells at the foot of the hills some 60 miles off. Our camp for the first two days was by some muddy wells in the sandy maidan, and it was very hot. There were a lot of Wart Hog about; they used to come to the water; so we rode them. A . . . was too seedy to do much, but I managed to stick three boars; two of them had grand tushes quite twelve inches or more; they can go like blazes, and for pluck I never saw them equalled; every one charged false. I touched them . . . It takes a fast beast to come up

to them ; they are so quick in getting to ground. We had a shocking long night march after that, 40 miles, to our main camp. The want of water is the curse of the country ; one has to march 20 to 40 miles often without water ; where I am going to next week I shall have to send camels daily for water for the camp ; my camp consists of three shikaris, eight camelmen, a syce, a cook, a boy, a native policeman from Government, and a man to look after and drive my donkeys for lion tie-ups. I have 16 camels, all of which I had to buy ; they cost me between Rs. 600 and Rs. 700. You see I have to carry rice and dates with tins of ghee for all those men ; it is a very expensive trip ; I like what I have seen of the natives very much ; they are a cheery sporting lot, but the greatest liars I have ever met ; it is no use trying to get the truth out of them. We hurried up to the hills as fast as we could. When we got on the first pass, we got into quite a different climate—rain and two blankets at night. We were very unfortunate in not getting any lions on our way up, but they are very scarce there. We also just missed the main body of elephants as they passed up to the Abyssinian hills, but we managed by good luck to shoot five ; three of them were very fair bulls, but the last one we got was a grand beast and had very good ivory for this country, 60 lbs. the pair. I always took them behind the shoulders ; they never go far with a big bullet behind the shoulders ; your rifle (D.-B. 8-bore nominal by Greener, 12 to 14 dram E. F. B.) was just the thing for them, but it is certainly a bit heavy to run with, and I had some cruel runs after wounded ones ; they are very hard to kill ; they will drop to the shot but are up again in a twinkle. We killed every one we fired at except one . . . I have seen them knocked over twice, and yet get up and go for a mile ; I got a big koodoo on my way up, horns 36 inches. I also got two good *Gazella walleri*, also some *Oryx*, and since A . . . left me I got three more elephants and a fine lion. I have done nothing but march for the last fortnight across the foot of the hills and must have come over 200 miles. I could not go where I first intended, as there was an intertribal row and the next hill tribe was in arms because one of them had been shot by a policeman, and I have just heard that the Sultan of the place, where I have been looking forward to getting some sport, is also up in arms against the English, so I am done all round . . . If I cannot get into Kansan, where I want to go, I have a bad chance of any more lions . . . The whole of the central part of the country has been so shot over that there are no lions left . . . From what I see and hear they are a great deal bolder than tigers, but not so quick. At every water you get lots of guinea-fowl and partridge ; so I had some capital partridge shoots round the camp of an evening—twenty brace in an hour. There are two sorts. There are lots of florican and bustard, the latter smaller than the big Indian ones. I could shoot any number of them."

There is a popular delusion that a tiger once shot at from a machan is frightened away and will never come back. Personally this has been my own experience, but I will quote extracts from three letters, direct testimony

to the contrary. From these it will appear that if a tiger does not see or hear the sportsman, he is not as alarmed as one would suppose.

Extract from letter from Lieut. Hardy, R.A. :—

" . . . I sat up for him the next night, and my people coming back from my machan first met a bear, which they drove off, and then the tiger himself. At 8-30 out came a pack of wild dogs ; they stood for a long time under my tree, so I had a good look at them. I was just debating about killing one, when out came the tiger after them, and there was no end of a row. The moon was just going down, so I did not see him well enough to fire ; he chased them all over the hill and then came back. I shot at him in the dark as he was crossing some white sand, but he did not mind me ; he went for the kill, and he and another tiger were round my tree all night, but I could not see them."

Extract from letter from Surg.-Major Wolseley, M.S., dated 22nd February, 1890 :—

" We got kubber that he had killed a fine wild hog and not eaten it, so off we went. There sure enough was the pig ; his big head in a pulp, every bone being broken. I did not think a tiger could have done it ; he had put big stones over it to hide the body ; it was in a deep water course running down a gorge ; some coolies had found it in the morning and pulled it from under the stones. As we could not pug him, I decided to sit up . . . . Unfortunately I had not come prepared for a sit up and had no white rag or anything except some chalk . . . . He came about three-quarters of an hour after sunset, when it was almost quite dark. I expected that he would be very coy when he found the pig moved, but not a bit of it. He came bounding down to where he had left it, and then he stopped for a minute, having a good look round to see what had become of his pork. Then down he came and stood stock-still within about five paces of the dead pig. I could only just make him out. I put up my rifle two or three times, but could not get on him. The third time I decided to chance it and fired in his direction. Where the bullet went I never found out, except that it did not enter the tiger. Now for the most extraordinary behaviour of this beast ; he did not go off with a bound, but walked up to where he had at first stopped about sixty yards up the nullah and stood still. I thought he must be wounded ; so, after a little while, I said to my Shikari, " he is wounded." No sooner were the words out of my mouth than down he charged to within five yards of my tree, but I could not see him properly; it was so dark and thick. He then quietly went off over the hill ; it was altogether bad luck, for had it been only the other side of the nullah, I should have been able to see him and could have fired. Well, this tiger went up to a tie-up of ours only two miles off and killed it and had his supper. I fired two shots about ten minutes after he had left. These he must have heard."

As regards the tiger concealing the pig like a dog burying a bone, this seems a very peculiar proceeding, and certainly we have not known a similar

case ; but if the tiger did not do so, who did ? The natives moreover, on whose testimony it rests, could have no object in lying.

The last account I give is, I think, of the boldest tiger of all. My authority is Mr. Harriott, of the P. W. D. :—

" . . . . Two nights after I had tied up, my men reported that a panther had mauled one and had been close to my tents ; so I tied up a goat and made a machan. About 7-30 I saw a hyæna coming for my goat across a well-lighted open piece of ground. As I did not intend to sacrifice my goat to a hyæna, I shot him and he dropped without a sound. I whistled to my boy at my tents, which were near, and he and two other men started to come to me. (I wanted the hyæna removed, but I did not move myself or call out.) They had just reached the edge of the nullah on the tent's side (my machan was a little distance on the other side) when I heard a rush, and the panther was on my goat like a flash of lightning. He lay on his back for a few seconds with the goat held up in the air by his mouth and paws till it was quite dead. Then he stood up and I shot him. My men heard the report and the death growl and fled back to the tents . . . . Two days after this occurred I was told that another panther had molested one of my garas nearest to my tents, goat and machan as before, except that this time it was about 150 yards further off than the other one. I remained awake till 11 p.m. and then went to sleep. About midnight a rush woke me up, and I saw a tiger sitting on his haunches with my goat in his mouth. I must tell you that about 7-30 one of my kills got loose and came along the cattle track to where the goat was tied up. Not understanding the goat, he became frightened and began to move about in the ravine close by. Thinking he would disturb my sport, I had him tied up among some bushes to my left rear. To resume about the tiger. He evidently had not seen the buffalo. I fired and missed. I could not see the foresight at all owing to the sighting arrangement having come to grief, and as the tiger fled towards the jungle, I fired a second shot and missed again. I loaded again, but had hardly got the cartridges in when I saw him break cover again. He was bolting and obviously making for the buffalo. I fired two more shots and missed both. He bounded past between my machan and the buffalo to my rear, and I thought he had gone. I sat perfectly still however. I could not make out how I had missed, for it was a clear bright moonlight night and the tiger was within 30 paces of me every time I fired. However, I soon discovered that I had lost the linen off the foresight and that I had doubtless been taking too much foresight and firing over the beast. Fortunately I had a poultice on one of my fingers, so I took it off and tied the rag on to the foresight. All this took about five minutes, and then I again saw the tiger on the cattle track about 80 yards to my right looking at the goat and buffalo. He had gone right round the back of my machan, and was evidently thinking the position over, and was for a time undecided, for he advanced a few paces, then went back, and stood

behind a bush looking at the goat. At last he made up his mind and walked straight along the cattle track towards the goat, at the same time keeping his eye on the buffalo. He walked very slowly and deliberately. When he got opposite my machan I dropped him with a bullet in his shoulder and gave him a second as he lay. He did not make a sound, but lay perfectly still as if dead. At first I thought of getting down and having him carried in, but fortunately I changed my mind and decided to sleep where I was till morning. I had just dozed off, when the tiger got up and went off before I could get a shot in. Next morning I found a pool of blood where he lay ; he had laid down frequently, but I never got him, and he died some eight days later in a cave. My theory of the above incident is first that the tiger was very hungry. When he had got back to the jungle after the first two shots, which had doubtless gone over him and not disturbed him except by the noise, he saw the buffalo, put the noise down to it, and started to kill it. The second shots were high too I am sure, and no doubt put him quite off tackling the buffalo, and he decided to keep well away from it and content himself with the goat."

E. F. BECHER.

LONDON, 12*th April*, 1893.

No. XII.—NESTING OF THE CRAB-PLOVER.

I have posted to your address a box containing an egg of the Crab-Plover (*Dromas ardeola*) and an egg of the Spoonbill (*Platalea leucorodia*) ; so I suppose some account of the taking of these eggs, with a description of the nests, &c., will be expected. I fear I am not qualified to give a scientific description or to offer any remarks of much value ; still I trust they may be of interest, and at any rate induce others as ignorant as myself of the technicalities of the science of Natural History to follow my example and endeavour to describe what they see without waiting for the knowledge that is only obtained by study and experience.

On the 29th May, 1893, I landed on the Island of Sad-ad-din, a reef island about five miles from the town of Zeila, on the Somali coast, and with my friend, Captain E. R. Shopland, commenced to search the island for eggs, as we had heard that great numbers of seagulls breed there every year. While we were crossing the level and open plains, we saw at the north-east end of the island a sand-hill about half a mile long and raised above the level about six or eight feet. This is one of the features of reef islands ; the wind and sea throw up matted seaweed, which is covered with sand, then again more seaweed and sand, till the coast line on the weather side is several feet higher than the rest of the island. We saw on this hill a great number of white birds and a number of seagulls with them. As we approached, we saw that they were a species of plover, and from their consternation we knew they must be breeding. The gulls all flew away and left the plovers to their

difficulties as we approached. When we reached the sand-hill, to our disappointment we could find no trace of a nest. Yet the birds, some hundreds of them, seemed greatly disturbed and kept flying round calling loudly to their mates. While the flock was at some little distance, solitary birds suddenly began to start up in the most unaccountable manner as the little vegetation covering the sand-hill was far too low and scanty to have hidden these white birds from view. We then found that they came from holes in the ground. The mouths of these holes were, for the most part, hidden under the overhanging and spreading vegetation, which looked like heather, but was of course not heather. This part of the sand-hill presented the appearance of a rabbit warren, and was tunnelled all over with holes about seven or eight inches in diameter, which extended horizontally about six or eight feet. The holes which were on the top of the sand-hill went down vertically one or two feet, then turned at right angles in a horizontal direction. The roof of these tunnels was formed by the matted seaweed covered with sand and low-spreading vegetation. Underneath this matted seaweed the sand had been scraped out by the birds. I think these holes must be used from year to year, and only need a little cleaning out at the mouth or perhaps digging out a few inches past the last year's nest, for some were much longer than others. Moreover, the holes were not large enough for the birds to stand up in, so that the excavation must be a work of time, and I think it quite impossible that the time occupied in one breeding season should suffice for this labour of love. Although the sand under the matted seaweed is easily scooped out, we must, I think, consider the absence of excavated sand outside the holes as seen outside crab holes or even rabbit burrows. The birds have long straight legs like waders, which must either be bent close up to the body while the birds are at work tunnelling, or be stretched straight out behind as they are during flight. The tunnelling in that case must be done with the beak and wings alone, the legs being of no use whatever. This I do not think at all probable considering the horizontal length of the holes. We did not open one less than four feet in length, and some went to six or eight feet, and always in a straight line. Some of these tunnels entered the hill from the sea-face side, but by far the larger number from the top or from the landward side and at every conceivable angle. In many cases the tunnels crossed each other, but they never curved except when the hole was on the top of the hill, and then only close to the entrance from a vertical to a horizontal direction. At the end of each tunnel one egg was found, which appeared to me far too large for the size of the bird, and had it not been for Captain Shopland's knowledge of the habits of this bird and my having seen the birds fly out from the hole, I should not have believed the egg could have belonged to this bird. I should not have searched so far under the sand-hill for a bird's nest at all, more especially for that of a long-legged bird like the crab-plover. Captain Shopland shot one of the birds to make sure of its

identity. It had a strong black beak like a crow and feet like a plover. The nesting season of this bird must be the middle and end of May, for out of about three dozen eggs taken one-third were hard-set, one-third half-set, and the rest quite fresh.

On the 30th May, 1893, we landed on Efat island, another reef island, about seven miles from Zeila. Here I found two nests of the spoonbill (*Platalea leucorodia*) with three eggs in each about half-set. The nests were close together and built of twigs and dry seaweed on the tops of the mangrove trees, and were about five feet from the ground. There was nothing remarkable about these nests. They were merely flat platforms of sticks on the top of the mangrove trees and were only three or four feet apart. I found one of the eggs of this bird laid on the sand on Sad-ad-din Island on the morning of 31st, and it was quite fresh although far from any nest, but I suppose there is nothing remarkable about this.

THOS. G. R. FINNY,
Commander, R. I. M.

ADEN, 4*th June*, 1893.

No. XIII.—THE "GLORIOSA SUPERBA.'

In Dr. Kirtikar's paper on poisonous plants in our April number he asks for further observation of attacks of caterpillars on *Gloriosa superba* (p. 492).

The plant is a favourite of mine, and so characteristic of Tanna above all other places where I have seen it that it might almost be taken as a district badge.

I have often transplanted the bulbs in the rains, and always had the first shoot after transplantation attacked by caterpillars of sizes and colours assorted.

In the forests and hedges I never saw it so attacked. I suspect the reason is that the gardeners cannot help giving it richer soil and more water than it gets at home, producing a more succulent shoot.

W. F. SINCLAIR, I.C.S.

TANNA, *June*, 1893.

XIV.—SIND AS A FIELD FOR THE NATURALIST.

Extracts from a lecture delivered at the Dayaram Jethmal College, Karachi, on the 19*th July*, 1893, *by H. E. M. James*, I.C.S., *Commissioner in Sind.*

In the cold weather Sind is simply a paradise to the lover of birds. During the winter of 1872-73, when I was a happy young Deputy Collector of Sehwan, in a position of much greater freedom and more outdoor work than at present, a great ornithologist, Mr. Allen Hume, visited Sind, and of all the valuable series of papers which he published in his periodical "Stray Feathers," that on the ornithology of Sind is the first in order and one of the first in value. By

merely marching through the country he discovered several new species and added no less than 18 others to the avifauna of India. I had the honour of giving him one of these, the European Golden Oriole, which I obtained in the Liyari Gardens, the only specimen ever shot in India. No less than three rare sand-grouse were procured: *Lichtensteini* (the pretty painted one which you occasionally see in the hills); *Coronatus*, still rarer (of which Mr. Watson shot the first pair right and left—I procured specimens on the Manchar Lake last year); and *Senegallus*, the yellow-throated sand-grouse with the spotted female, which is very common on the Manchar, and even extends into Gujerat. Later on, other ornithologists like Mr. Scrope Doig in the Eastern Nara, Colonel Butler of the 83rd Regiment, and Colonel LeMessurier, R.E., sent many contributions from Sind. Mr. Doig rediscovered Blyth's *Passer pyrrhonotus*, a small sparrow peculiar to Sind, which had been lost for about 50 years, since Sir Alexander Burnes obtained a single specimen in his first journey through Sind, and which the great naturalist Blyth recognised as a new and separate species. But yet *Gallinula burnesii*, Sir Alexander Burnes' water-hen, very like the common one, but smaller and without the boss on the forehead, has not yet been found, and I believe myself it is a doubtful species. *Cercomela melanura*, the black-tailed wheat-ear (the wheat-ear of Sind has white feathers at the base of its tail), has also not been found, though Sir Alexander Burnes brought it from Sind, and as it occurs at Aden, it doubtless finds its way into Mekran. Mr. Doig also discovered the nests and eggs of many birds previously unknown to Indian ornithologists and some unknown to science.

Placed as Sind is, on a kind of dividing line between the peninsular of Hindustan with its tropical forms and the temperate regions of Beluchistan and Persia, it is a half-way house where vast numbers of rare birds meet. I left Sind shortly after Mr. Hume, but I had the pleasure first of adding 10 more to his Sind list. Mr. Hume's first list gave 280 birds. In 1877 the list had grown to 334, which was converted into 335 in the same year by the addition of a wood-cock killed in the Liyari Gardens by Colonel Butler. General Marston has, during a residence of 50 years, only known of 2 others, both of which fell to his gun. In 1878 Mr. Doig and Colonel Butler added eight more, and Mr. Murray added quite a long list. In 1879 the Sind list of birds stood at 378 ascertained species and 13 doubtful ones. In 1881 Mr. Doig added 2 more, one of them being the famous *Passer pyrrhonotus*. Mr. Barnes added another in 1882, thus making a grand total of 381 and 13 doubtful. Mr. Hume prophesied that the number would reach 400, but unfortunately, just before that goal was attained, he renounced ornithology.

Even about Karachi, I must tell you, most interesting birds are to be found. I shot the second specimen ever killed in India, of a rare web-footed sandpiper (*Lobipes hyperboreus*), in the harbour here. Colonel Butler, riding out to Clifton one day, saw on the wet ground to the right a number of terns (those exquisite french-grey-clad sea-swallows) wheeling about, and discovered the eggs of a

species which were (I believe) previously unknown. A very interesting and rare bird frequents the sand-hills near Clifton, *Alæmon desertorum*, or the desert lark, usually only found in the wildest and most desolate tracts, a large lark that most people would take for a plover, showing a white bar on its wing when it rises. The very curious crab plover (*Dromas ardeola*) is found in the harbour. In the cold weather many a treasure is lost by its being unrecognised, or for want of some one to prepare the skins. A friend at Sukkur last year shot the very rare *Anser erythropus*, the white-fronted goose, and—ate it. Mr. Hume recorded three geese and fourteen ducks from Sind, but many have been added since. Mr. Watson, the present Collector of Hyderabad, obtained three wild swans in 1878, the first adults of *Cygnus olor* killed in India. That rare duck, the Smew, with pointed bill and rows of teeth, is more commonly obtained in Sind than anywhere else in India. On the Manchar Lake you obtain the great Sheldrake of Europe. Mr. Hume was the first to note the marbled teal as an Indian bird. It is common in Central Sind. I added the larger whistling teal myself to the list, and my friend Mr. Hoare has recognised the very rare scaup duck in the Delta. Sir Oliver St. John killed the stiff-tailed duck in Kandahar, so it probably strays into Sind. Colonel Augustus LeMessurier certainly killed one very rare duck, the lovely clucking teal, in Sind. The common and jack snipe are common here, but the pin-tail snipe is very rare. I saw three and shot one specimen last year, and only one, I think, had been shot in Sind before. Singularly enough, my shikari recognised it on the wing as different from the common snipe, which, however, it too greatly resembles for an ordinary sportsman to discriminate it. In Sind we find six of the eight sand grouse met with in India, including the three rare ones I mentioned and of which I have brought you specimens. And we are rich in other game birds also. We have three bustards—the great bustard in the desert, the ruffed bustard or talore, and the 'leek' or lesser floriken, which is to be found at Gadap or even on the Moach plain. Colonel Wise and Mr. Mulock once made a bag of 15 on the Hubb. We have the francolin or black partridge in abundance, the common grey, the little secsee which gets up in covies with a whirr, and the chukore is found on Daryaru. As for plovers, curlews, and the like, their name is legion. The raptorial birds, which I should have mentioned first, are very numerous, including the great lammergayer and rare hawks, such as *Falco babilonicus*. Out at the Hubb you get the rare Desert or Trumpeter bulfinch, and we have a bulbul, the white-eared, peculiar to Sind and the Punjab, though it travels as far as Gujerat sometimes. The greatest find ever made was, perhaps, by Mr. W. T. Blanford, who procured a very rare African bird, *Hypocolius ampelinus*, on the Kirthar range.

In the highly important department of Mammals again there is work to be done in Sind. The *Mamh*, an almost mythical animal when I was first in Sind, has, it is true, been captured, and to our disappointment identified as a small variety of the ordinary Himalayan black bear. But Mr. Murray, I believe,

discovered a new hare out at Malir, and to discover so large a mammal at the end of the XIXth century is no small feat. Amongst the bats, rats, and mice much remains to be done. I saw a rat not long ago that I feel certain is new, for once on a time I had to study rats on account of the desolation caused in Sind by a species of rodent. And in company with rats, Sind is rich in wild cats. The tiger is nearly, if not quite, extinct in Sind, but the panther is occasionally procured. These of course are well familiar to us all, but there are also some magnificent varieties of wild cats in the forests, including the lynx or shiagosh. General Marston and I once came upon a splendid specimen in the hills that had been killed by a panther. Several smaller varieties of *Felis* also exist which require identification. Of deer, the magnificent "guin" or swamp-deer, which Mr. Watson has seen in the north of the Rohri Division, is almost, if not quite, extinct, but I believe that investigators might find the rare Arabian Chikara or ravine deer, if they looked for it, out beyond the Hubb. The hog deer is still common, but the black buck is absent except in His Highness Mir Ali Murad's preserves. The wild ass of Sind, of which we have two fine specimens in the Zoological Gardens, is perhaps our best mammal. Then we have the splendid Sind Ibex, peculiar to Sind and Mekran ; we have the great Markhor on the hills to the north-west, and the Oorial or Gud.

No. XV.—SINGLE VALVE OF *TRIDACNA SQUAMOSA*, THE GREAT SCALY CLAM, FROM TANNA CREEK.

This specimen was obtained by fishermen in the mouth of the Tanna Creek during July, 1893, and exhibited on the 31st idem.

It is the first that I have got on this coast, and the species is unknown to the fishermen ; but it is figured by Woodward as a Bombay Mollusc on the authority of Chemnitz. In the Society's interleaved copy of Woodward's Manual of the Mollusca, opposite the key to the plate, there is a remark of my own, suggesting that Chemnitz's locality may have been the bazaar rather than the harbour of Bombay. All the large clams have long been imported in a casual way to Bombay, and used for ornamental or quasi ornamental purposes. This specimen, which is large, and much worn, may have been lost from a boat on its way from Bombay to Tanna.

W. F. SINCLAIR, I.C.S.

TANNA, *August*, 1893.

No. XVI.—BIRDS OBSERVED BREEDING IN KHARAGHORA.

I write to record the finding of the Kentish Ringed Plover breeding here in the Salt Works. I found two nests of this bird, each with three eggs, and shot what I took to be the hen bird as it left its nest. I sent the skin to Lieut. H. E. Barnes, at Ahmednagar, for identification, and he writes to me that it is

undoubtedly *Ægialitis cantiana*. I took these eggs on the 6th instant and hope to find more nests later on.

I had previously taken, in the same place, numbers of clutches of the Stilt's eggs, also of Saunder's Little Tern. The latter, according to my experience, invariably lay three eggs.

H. BULKLEY.

KHARAGHORA, 12*th August*, 1893.

No. XVII.—MOTHS ATTRACTED BY TOBACCO SMOKE.

I have read with interest Mr. Oxenham's note on a butterfly attracted by tobacco smoke. I have noticed the same thing more than once. The smell of tobacco itself is hateful, if not deadly, to most insects ; but the aroma of its fumes has certainly an attraction for some naughty kinds of moths. The smell of wine is much more generally attractive to both moths and butterflies, and I need not say that they do not always draw the line at smelling it. When I have seen a moth perplexing itself to discover the source of the intoxicating fragrance, I have offered it a sip in a spoon, and the offer has been most gratefully accepted. It is rather a curious thing that this taste, among butterflies at least, is confined to certain genera, which we rarely or never see at flowers, such as *Euthalia*, *Kallima*, *Charaxes*, and most of the *Satyrinæ*. The *Papilioninæ* and *Danainæ*, which are fond of flowers, will not be tempted with liquor. Neither will the Nymphalid genera *Hypolimnas* and *Junonia*, nor any of the Blues. But those butterflies which may be caught with sugar are much attracted by the juice of certain trees exuding when the bark is cut, and they often show a taste for grosser refreshment.

E. H. AITKEN.

KARWAR, 16*th August*, 1893.

No. XVIII.—THE HABITS OF THE COPPERSMITH.

I have watched both the Common Coppersmith and other Barbets for many years to settle to my own satisfaction the question which forms the subject of a note from Mr. Sinclair in the last number of the Journal. Where doctors differ those who occupy the room of the unlearned should speak with diffidence, but if the real question at issue is the existence of some affinity in habits between the Barbets and the Woodpeckers, I have no hesitation in saying that I think Jerdon is right. Woodpeckers run up the trunks of trees, tapping for the insects on which they feed. This the Coppersmith does not do. In fact it is scarcely an insect-feeder at all. I kept one in a cage for two months and could not induce it to eat animal food in any form. It lived entirely on fruit, chiefly plantains and dry dates. I recollect once seeing one feeding on insects in a wild state, but it must have been an individual of original mind. It was capturing flying *Termites on the wing !* The idea that

the Coppersmith does sometimes follow the avocation of a Woodpecker has doubtless arisen from the fact that it nests in holes, which it excavates for itself. When doing this, it works in precisely the same manner as a Woodpecker and with surprising vigour and perseverance. I remember a nest in my garden at Matheran (not of the Coppersmith, but of the Green Barbet, *M. viridis*) in which I heard the bird hammering fiercely long after dark. In the pitchy darkness of its hole, which was several feet deep, I suppose it did not know when evening came on. The entrance to the hole is commonly on the underside of a branch, and of course when the bird is choosing a place, or just beginning work, it will be found conducting itself quite after the fashion of a Woodpecker.

E. H. AITKEN.

KARWAR, 16*th August*, 1893.

No. XIX.—WHERE DO SWALLOWS SLEEP?

Can any of the members of the Bombay Natural History Society tell me where our Swallows sleep? In the cold season most parts of India swarm with Swallows, which perch in long rows on the telegraph wires, but not on trees, in the day-time. They are not on the wires at night, and I very much doubt their resorting to trees at that time. I think it likely that they sleep in company, like Bee-eaters; but though I have often startled a company of Bee-eaters from their roosting tree, I never startled a sleeping Swallow. At one time I used to meet with large flights of Swallows circling over some flat-topped rocky hills after dusk, very near the ground. They were not hawking insects, but evidently wanting to alight, either on the ground or on the low Cajoo-nut trees which grew on the hill. I watched them patiently several evenings, but it was very dark, and if I went near enough to follow their movements, they took fright at once and went off.

E. H. AITKEN.

KARWAR, 17*th August*, 1893.

No. XX.—ESCAPE OF BLACK SWANS.

Some years ago two Black Swans were imported from abroad by His Highness the Maharajah of Darbhungah. I saw the birds swimming near his palace, and not very long afterwards several young black swans were also to be seen—about nine of them if I remember right. As soon as the young birds were able to fly, the swans rose from the water and flew away right across the station in the direction of the Nepal Frontier. They have never returned, and it would be interesting to know whether any sportsmen on the Nepal Frontier have ever shot any of these birds.

A. GOODALL.

SIMLA, *August* 20*th*, 1893.

PROCEEDINGS

OF THE MEETING HELD ON 21ST JUNE, 1893.

The usual monthly meeting of the members took place at the Society's rooms on Wednesday, the 21st June, 1893, Mr. M. C. Turner presiding.

NEW MEMBERS.

The following gentlemen were duly elected members of the Society :— Surgeon-Major J. Parker, M.D. (Bombay); Mr. R. A. Lamb, I.C.S. (Alibag); Mr. Sambhu Nath Sukul (Benares); Mr. F. G. Brook-Fox, F.G.S. (Ganjam); Mr. F. Kinsman (Mandalay); Mr. G. C. Minniken (Simla); Major J. Clibborn, I.S.C. (Roorkee); Mr. Arthur Symthies (Dehra Dun); Mr. H. Charles Hill (Naini Tal); Major-General C. F. Sharpe (Coonoor); Akbar Saheb Nizamuddin Divakar (Kalyan); Mr. James B. W. Biddle (Karwar); Mr. C. H. Fawcett, I.C.S. (Satara); Mr. A. Kinloch (Rangoon); and Mr. C. F. Gilbert, C.E. (Burmah).

CONTRIBUTIONS DURING MAY.

Mr. H. M. Phipson then acknowledged receipt of the following contributions to the Society's collections since the last meeting :—

Contribution.	Description.	Contributor.
3 Crocodiles' Eggs	Crocodilus palustris	Mr. S. Tomlinson, C.E.
1 Hartbeest's head	Bubalis swaynii	Dr. H. F. Cleveland.
3 Panther Cubs, fœtal specimens.	Felis pardus	Mr. C. W. Davies.
1 Cuckoo	Cuculus canorus	Mr. H. Bulkley.
A skull of a Dugong found on Coast of Cutch.	Halicore dugong	Dr. Ardeshir Dadabhai.
2 Panther Cubs (alive)	Felis pardus	Mr. H. E. Winter, C.S.
Boar Tusks	$10\frac{5}{8}'' \times 2\frac{1}{2}''$	Mr. F. A. Hill.
1 Snake	Lycodon aulicus	Capt. Churchward.
Shells, Snakes and Scorpions.	From Aden	Capt. E. Shopland.
1 Leopard's Skin	Felis pardus	Major H. B. Thornhill.
5 Lizards (alive)	Sitana ponticeriana	Rev. F. Dreckmann, S.J.
1 European Roller (alive)	Coracias garrula	Capt. Durant.
Spur Fowl (alive)	From Africa	Mr. E. R. Jardine.
1 Pair of Large Kudu Horns.	Strepsiceros kudu	Dr. H. F. Cleveland.
1 Pied Cuckoo (alive)	Coccystes jacobinus	Mr. Wm. Mountain.
1 Scaly Ant Eater (alive)	Manis pentadactyla	Mr. Daji A. Khare.
1 Black Ant's Nest	From Matheran	Dr. J. C. Lisboa.
4 Painted Snipe (alive)	Rhynchœa bengalensis	Mrs. Pearson.
Eggs of Crab Plover and Spoonbill.	From Somali Coast	Capt T. G. Finny.
15 Birds' Skins	.....	Capt A. Newnham.
1 Pied Cuckoo (alive)	Coccystes jacobinus	Lord Colin Campbell.
1 Myna (alive)	Acridotheres tristis	Mr. G. V. Evans.
2 Tortoises	From Africa	Mr. J. H. Hale.
A number of Birds' eggs	From Mahableshwar	Vet.-Capt. Jas. Mills.
1 Dhaman	Ptyas mucosus	Hon. Mr. Justice Parsons.
3 Bats	Megaderma lyra	Mr. W. George.

MINOR CONTRIBUTIONS.

From Mr. R. Thom, Miss Baird, Mr. N. S. Symons, Mr. J. M. Coode, and Mr. F. A. Little.

CONTRIBUTIONS TO THE LIBRARY.

Indian Moths, Vol. 1. (Hampson) .....From Mr. W. F. Sincilair, C.S.
Transactions of the Entomological Society of London for 1892 .....In exchange.
A Hunter's Wanderings in Africa, 3rd Edition (Selous).....Purchased.
Proceedings of the Zoological Society of London, Part IV., 1892 .....From Mr. W. F. Sinclair, C.S.
Actes de la Societe Scientifique du Chili. Tome II.In exchange.
Proceedings of the Linnæan Society of New South Wales. Vol. VII, Part IV. .....In exchange.
Pharmacographica Indica (Dymock, Warden, and Hooper), Part VI. ....

PAPERS READ.

The following papers were then placed before the meeting, and extracts from them were read and discussed :—1. Notes on Sport in Somali Land, by C. G. Dodgson, I.C.S. 2. Small Game Shooting in the neighbourhood of Bombay, Season 1892-93, by E. L. Barton. 3. Habits of the Indian Robin, by Capt. A. Newnham. 4. Note on *Argynnis niphe*, a nymphalid butterfly, by Mrs. S. Robson. 5. Note on same, by L. de Nicéville. 6. On the occurrence of the Hyæna in South Travancore, by H. S. Ferguson. 7. The flowering of Bamboos, by G. Jasper Nicholls, I.C.S.

PROCEEDINGS

OF THE MEETING HELD ON THE 31ST JULY, 1893.

The usual monthly meeting of the members took place at the Society's rooms on Monday the 31st July, 1893, Brigade-Surgeon-Liutenant-Colonel G. A. Maconachie presiding.

NEW MEMBERS.

The following gentlemen were duly elected members of the Society :—Mr. J. Rivett-Carnac (Cachar) ; Mr. A. Bagshaw (Assam) ; Mr. E. G. Gahagan, C.E. (Sind) ; Mr. Alexander M. Tod (Bombay) ; Mr. R. Kennedy (Bombay) ; Surgeon-Lieutenant-Colonel H. Cook (Kamptee) ; Hon. Sec., Mhow Military Library; Captain Chas. J. Melliss (Pishin) ; Mr. G. D. Marston, C.E. (Sholapore); Mr. F. Ede, C.E. (Cachar) ; Major D. de Hoghton (Bombay).

ELECTION CANCELLED.

It was resolved that the election of Mr. Sambhu Nath Sukul of Benares be cancelled.

The Honorary Secretary then acknowledged receipt of the following contributions to the Society's Museum since the last meeting :—

CONTRIBUTIONS DURING JULY.

Contribution.	Description.	Contributor.
1 Pair of horns of Clarke's gazelle.	Ammodorcas Clarkei.....	Lt. H. E. Barnes.
1 Snake (alive)	Tropidonotus stolatus	Miss. M. Smith.
1 Lion cub (alive).....	From Somali Land.....	Mr. E. L. Cappel, I.C.S.
1 Spotted Owlet (alive) ...	Carine brama	Mr. Alex. Tod.
Shell of	Tridacna squamosa found in Tanna Creek.	Mr. W. F. Sinclair, I.C.S.
1 Snake	Lycodon aulicus.....	Mr. F. Fischer.
1 Krait (alive)	Bungarus arcuatus	Surgeon-Capt. C. M. Moore.
12 large sand Lizards (alive)	Uromastix hardwickii	Capt. C. W. F. Whyte.
1 Bustard	Eupodotis edwardsii	Mrs. N. C. Pearson.
1 Wild Cat's skin	From Somali Land.....	Capt. C. J. Melliss.
40 young Vipers.....	Vipera russellii	Mr. W. H. Traill.
1 Sea Snake (alive)	Hydrophis curta.....	Mr. J. A. Douglas.
7 Eggs of the blue-breasted banded Rail.	Hypotænidia striata	Mr. W. F. Sinclair, I.C.S.
2 Chameleons (alive)	Chamæleon calcaratus	Capt. H. F. Jacob.
1 Black Cobra (alive)	Naga tripudians.....	Mr. P. R. Mehta.
A collection of Butterflies...	From Assam	Mr. E. Litchfield.
3 Eggs of the Stilt.	Himantopus candidus	Mrs. N. C. Pearson.
1 Wild Cat's skin	From Africa	Mr. A. H. Saklatwala.

CONTRIBUTIONS TO THE LIBRARY.

Perak Museum Notes, No. 1 ..... In Exchange.
The Hawks and Owls of the United States in their relation to Agriculture (Fisher) ..... Do.
Proceedings of the Zoological Society of London. Part I of 1893 ..... From Mr. W. F. Sinclair, I.C.S.
Transactions of the Zoological Society of London, Vol. XIII., Part 6 ..... Do.
Sind as a field for the Naturalist and Antiquarian (H. E. M. James)..... From the Author.
Handbook of the Flora of Ceylon, Part I, with Plates (Trimen) ..... Do.
Journal of the Marine Biological Association ..... In Exchange.

LAND AND FRESH-WATER SHELLS.

The Honorary Secretary made a special appeal on behalf of the Society's collection of Land and Fresh-water shells. He stated that it was at this time of the year that such shells were most easily procurable, and he trusted that members in all parts of India would assist in increasing the Society's collection.

PAPERS READ.

The following papers were then read :—

1. A Day's Sport in the Berars ; by Colonel Kenneth Mackenzie.
2. The Indian Snake-bird (*Plotus melanogaster*), his Works and Ways ; by W. F. Sinclair, I.C.S.
3. The Jackal, or Lion Provider ; F. J. A. Hill.
4. Nesting of the Crab-plover ; by Capt. T. G. R. Finny, R.I.M.
5. Jungle Notes ; by P. H. Clutterbuck, A.C. Forests.

Isaac Benjamin del

Mintern Bros. Chromo-lith. London.

THE POISONOUS PLANTS OF BOMBAY.

Strychnos nux vomica. Nat. Ord. Loganiaceæ.

1. Transverse Section of Fruit. ½ nat. size.

2. Flower. 3. Seed. 4 Vertical Section of Seed. Nat. size.

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THE POISONOUS PLANTS OF BOMBAY.

By Surgeon-Major K. R. Kirtikar, I.M.S., F.L.S.

PART VII.

(*With Plate I.*)

(*Continued from page* 230.)

STRYCHNOS NUX-VOMICA.—(*Linn.*)

(Natural Order—Loganiaceæ.)

Marathi—कुचला; काजरा.

A tree over 40 feet in height, with a straight thick trunk.

Root.—Thick and with a yellowish epidermis; very bitter.

Stem.—Often 12 feet in circumference.

Branches.—Dense, irregular, covered with a smooth ash-coloured bark. Young shoots shining and deep green, often tinged with red; bark nodose, bitter, glabrous.

Petiole.—$\frac{1}{5}$—$\frac{1}{2}$ inch long; deeply grooved.

Stipules.—None, says Roxburgh in his "Coromandel Plants." Between the opposite leaves there is a raised line, which is perhaps a rudimentary interpetiolar stipule.

Leaves.—Glabrous on both sides, shining, opposite, entire, coriaceous, often decussate in an oblique manner, arising from stout nodes; ovate or rotundate, sometimes elliptically oblong; 3—5 nerved; shortly acuminate or almost apiculate. $1\frac{1}{2}$ inches × 6 inches; usually 3—5 inches long. Base obtuse, somewhat unequal.

Peduncle.—$\frac{1}{2}$—2 inches.

FLOWERS.—Many, small, greenish-white, appearing with young leaves on short slender pedicels ; collected on small terminal pubescent corymbose cymes 1—2 inches in diameter, at the end of the branchlets or on short axillary shoots ; pentamerous ; bisexual.

CALYX.—5-parted ; persistent ; $\frac{1}{4}$ or $\frac{1}{5}$ the size of the corolla.

COROLLA.—Valvate, hypogynous ; regular, tubular or funnel-shaped, with a 5-lobed reflexed short limb. Tube $\frac{1}{4}$ to $\frac{1}{3}$ inch long, glabrous at the throat, lobes valvate, about $\frac{1}{6}$ inch long ; glabrous ; a few conical hairs lower down the tube.

STAMENS.—5, epipetalous in the throat of the corolla tube, alternating with the corolla segments.

FILAMENTS.—Scarcely any, or exceedingly short ; inserted over the bottom of the division of the corolla.

ANTHERS.—Oblong, glabrous, half within the tube, half out.

STYLE.—Of the length of the corolla tube; glabrous; filiform.

STIGMA.—Small or short ; undivided, capitate ; sometimes indistinctly 2-lobed.

OVARY.—Free ; 2-celled.

PLACENTAS.—Fleshy ; adnate to both sides of the dissepiment.

FRUIT.—A berry, globose, smooth, indehiscent, with a fragile shell-like rind, orange-sized and orange-coloured when mature ; filled with a soft white jelly-like pulp, which is intensely bitter.

SEEDS,—immersed in the pulp,—2—5 in number ; $\frac{1}{2}$ inch in diameter, circular, discoid, shining, light grey, silky ; not reniform as Brandis says, but having one surface convex, and the opposite correspondingly concave, with a small *foveola* in the centre of each side.

ALBUMEN,—white, horny or cartilaginous as Gaertener calls it.

EMBRYO.—Very small, compared with the size of the seed ; straight, eccentric ; milk-white.

COTYLEDONS.—Cordate, acuminate, tri-nerved, very thin.

RADICLE.—Clavate, very small, placed near the hilum.

REMARKS.

The wood is very hard and close-grained, white or grey, with numerous medullary rays. One cubic foot weighs 52 pounds. It is used for many purposes, such as ploughs, cart-wheels, cots, and fancy

cabinet work. The tree appears to be a native of Ceylon. My description is mainly drawn from the specimens obtained from the two handsome trees growing at Bassein in the Salsette Island in a garden near the ruins of the old Portuguese Fort.

Every part of the plant is exceedingly bitter, particularly the root. The pulp of the fruit, says Roxburgh, "seems perfectly innocent, as it is eaten greedily by many sorts of birds." Colonel Drury quotes this observation in his "Useful Plants of India." The root has the reputation of curing intermittent fevers. Rheede says that when boiled and drunk, it is purgative. The bark is used as an antidote for snake-bite. Brandis says that the pulp in the fruit is orange-coloured. It is not so; it is white. It is difficult to understand how such a careful observer as Brandis says so. It is evidently a misprint or slip of the pen.

The seeds contain 0·28 to 0·50 per cent. of an alkaloid called *Strychnia*, mixed with another alkaloid *Brucia*, closely related to it. *Igasuric acid*, similar to *malic acid*, is associated with these alkaloids. It is these alkaloids which render the plant poisonous.

The late Professor Sir Robert Christison says that the bark might be advantageously substituted for the seed in the preparation of strychnia.

The tree flowers in the cold season. Kurz in his "Forest Flora of British Burma," (vol. II. pp. 166—167), says it flowers in April and May. It may be so in Burma. The trees in Bassein flower in January. The fruit is ready in the early part of the cold season. Kurz says that the tree sheds leaves in the hot season. It is not known to do so in Salsette.

Brandis says the seeds are flat. If it be so, it is quite exceptional. The general form of the seed is correctly described by Gaertener when he calls it convexo-concave.

Roxburgh observes in his "Coromandel Plants" that the shell covering the fruit is somewhat hard. It is not so when mature and dry. It has the appearance of being so when the fruit is but half developed and the pulp has not yet become jelly-like, but is dense and comparatively drier. When, however, the fruit matures and the pulp is well formed and becomes almost isolated from the shell, the thinness is apparent. It is still more so when the fruit becomes dry; the seed and the pulp then lie loose in the cavity, and the shell easily cracks with a resinous fracture when pressed between the fingers.

Hooker adds a very imporant note in the description of this plant (*Vide* "Flora of British India," Vol. IV, p. 90), which is as follows :— "Bentham also reduces to the present species *Strychnos ligustrina* (Blume, Rumphius I, 68, *t.* 25), which does not differ by any tangible character, but has smaller somewhat different-looking leaves."

Poisonous Properties.

Nux-Vomica is so well-known for its poisonous properties that it is hardly necessary to do more in these pages than state them briefly.

Strychnia, the chief active principle of this plant, is one of the most powerful poisons acting on the nervous and muscular systems. It causes tetanus—that is to say, tonic contractions of all voluntary muscles. These contractions are generally sudden and last from a few seconds to many minutes. They follow each other in rapid succession. In severe forms there is hardly any intermission. The whole body in such cases becomes "rigid, immoveable, and hard as a board" (Schmiedeberg).

The convulsions excited by this alkaloid originate in the spinal cord probably by acting directly upon the motor-cells. The reflex irritability of the spinal cord, of the medulla oblongata, and of the brain is excessively increased. This causes tetanus. When the brain and medulla oblongata are in this state, the spasms get excited by the slightest, often imperceptible, stimuli, which may meet the eye, the ear, and particularly the organs of touch, so that they apparently come on without a cause (Schmiedeberg).

Strychnia has been found in blood. It has a marked effect on circulation. The blood pressure rises ; there is arterial tension during the appearance of the convulsions ; the frequency of the pulse becomes simultaneously slowed. This Mayer believes to be due to vaso-motor spasm from increased irritability of the origins of the vascular nerves and the cardiac inhibitory fibres of the vagus.

It must be remembered that the mind is perfectly clear in strychnia-poisoning. Strychnia is a cumulative poison. It also diminishes the process of oxidation in blood—that is to say, the amount of oxygen absorbed and of carbonic acid given out by blood are diminished (Harley).

Brucia is another alkaloid found in Nux-Vomica, but in smaller quantity than strychnia. It possesses properties similar to strychnia, but as a poison brucia is less active than strychnia.

THE COMMON MARINE SHELLS OF THE BOMBAY SHORE.

By A. Abercrombie.

PART II.

(*Continued from page* 222.)

THE BIVALVES.

These shells have received a great variety of scientific names based upon the peculiarities of animal formation which the various authorities have considered best adapted for their own mode of classification, but all are agreed that it is difficult to divide them into well-defined sub-classes.

The authority which we are following places at least three-fourths of the Bombay Bivalves, which he calls

LAMELLIBRANCHIATA,

under the head of *Veneracea*, but we shall endeavour to subdivide them according to some other writers on more or less marked differences in the shells themselves.

The bivalves have the power of attracting currents of water into their shells, which they filter of all nutrimental or shell-producing matter it may contain, and then pass out again.

Some of them accomplish this simply by slightly opening the valves of their shells ; others are provided with siphons or fleshy tubes (either one with two divisions or two separate ones) which they can protrude in varying lengths from the mouths of their shells.

The opening and shutting of the shells is performed by certain muscles, and the number and arrangement of these muscles, as shown by the scars left on the interior, is our first help to the classification we adopt. Next, the presence or absence of the aforesaid siphons is also denoted by scars on the valves, but it is not always easy to detect these scars, especially if specimens are old and worn ; further we have the interlocking teeth of the hinge of the shell, which are very variable and are a distinct feature in some families ; and, lastly, the ligament holding the two valves together is sometimes external, sometimes internal.

The bivalves have very limited powers of locomotion. The oyster family, when first they come into existence, can swim about, but they soon attach themselves to rocks or stones, and then become permanently fixed. Other families, notably the mussels, spin what is called a byssus, a horny or fibrous material which passes through an aperture in the valves of the shell, and enables them to attach themselves more or less firmly to rocks or stones, but by far the greatest proportion are simple burrowers in sand, mud, or even stone.

This burrowing in sand or mud is effected by means of a fleshy lobe or foot (it is often the shape of a foot), and the process may easily be watched if a live shell be placed in a tank or basin upon some sand. When a sufficient time has elapsed to calm the fears and suspicions of the animal, it will protrude its foot from between the valves of the shell, thrust it down into the sand, and then with a jerky motion the shell is drawn vertically downwards a little ; and the process is repeated till it has disappeared. The whole proceeding occupies only a very few minutes, but some are much more rapid in their actions than others.

The depth the animal will burrow seems to depend upon the length of its siphons ; these, when it is down, are protruded until their fringed mouths lie exactly on the surface of the sand, and in this position they are quite invisible until the currents of water they attract and repel point to their presence.

The only instance of activity I have seen amongst the bivalves was some young specimens of the family *Meroë*, which, after driving their foot into the sand, jerked it out, causing their shells to shoot a distance of a few inches through the water.

We now come to our classification :

DIVISION I.—Shells with two muscular impressions or scars on the inside of the valves at opposite sides and nearly equal in size.

DIVISION II.—Shells with two unequal impressions ; but this division will not be further considered in this paper, as the only representatives of it are some specimens belonging to the well-known mussel family, and they are very uncommon.

DIVISION III.—Shells with one impression, or two or three close together and centrally placed.

Before going further, it is necessary to note that the umbo is the name given to the beak or commencement of growth of the shell, and

the ventral border is the edge of the shell opposite the umbo and which constitutes the length of the shell. The breadth is, of course, a measurement from the umbo to the ventral border in a straight line, and this measurement also determines whether a valve is equilateral or not, *i.e.*, whether the umbo is centrally placed with regard to the shape of the valve. When dimensions are given, they are of what I believe to be full-sized specimens.

Unfortunately nearly all the common bivalves belong to Division I, but two large subdivisions are fairly easily determined—the *Integripallia* and the *Sinupallia*. Still regarding the inside of the shell, there will be found running parallel to the ventral border a line or scar formed by the muscular attachment of what is termed the mantle of the animal to the shell. In cases where this line (the pallial line) simply follows the outline of the shell between the two muscular scars, it indicates that the animal has no siphons and belongs to the class *Integripallia*. Where this line is inflected and forms a sinus or bay, the animal has siphons—the *Sinupallia*.

Division I.

INTEGRIPALLIA.—Ligament External.

ARCACEA.

There are many species of this family, and it is easily recognised by the long straight row of similar and comb-like teeth of the hinge. Shells generally white and covered more or less with a rough or bristly epidermis, also radiately ribbed from the umbo.

Arca inæquivalvis (Brug.) is a large thick swollen shell with about 34 broad smooth ribs. Umboes curled over the broad ligamental area.

Length $2\frac{1}{2}$—3″, breadth 2—$2\frac{1}{2}$″, depth of double shell 2″.

Arca bistrigata (Dunker) lives attached to rocks or stones by a horny byssus coming out of the centre of the ventral border, and can only be removed by the use of a considerable amount of force. It is generally a rough dirty-looking shell often covered with limy matter and a bristly epidermis. The shell is oblong, and the hinge line is very long and straight.

Ribs numerous, slightly noduled and in pairs at the sides.

Size 2—$2\frac{1}{2}$″ × $1\frac{1}{4}$″.

Arca granosa (Lam.)—Shell nearly equilateral and strongly ribbed with about 20 noduled ribs.

Epidermis brown, thin, and scaly. Shell pure white.

Size $1\frac{1}{2}'' \times 1\frac{1}{4}''$.

Arca japonica (Reeve).—Shell oblong, very inequilateral, shining white, with 32 to 33 broad flat ribs.

Size $1\frac{5}{8}'' \times 1''$.

Arca tenebrica (Reeve) is a small oval flattish shell with the hinge line slightly curved. The ribs are close set and very numerous.

Size $\frac{1}{2}'' \times \frac{1}{4}''$, but I have one specimen $\frac{3}{4}'' \times \frac{1}{2}''$.

Arca lactea (Linn.) is the smallest of the family and very common amongst shell shingle. White or yellow tinged, hump-backed and somewhat squarely shaped, with the umbo curling over the ligamental area. Radiate ribs numerous and somewhat beaded.

Size $\frac{3}{8}'' \times \frac{1}{4}''$.

LUCINACEA.

We have two specimens of this family which are so widely different in every respect that it is hard to believe they are correctly classified.

Cardita antiquata (Lam.) is one of our commonest shells. Very massive, white beneath, with a yellow-brown epidermis, and with irregular burnt blotches or streaks scattered over the radiate ribs. Ribs broad, and about 23 in number. Hinge remarkable for long ridge, which fits into a corresponding groove.

Size $2\frac{1}{4}'' \times 2''$.

Diplodonta indica (Desh.) is a very delicate white globular little shell, smooth and shining, or very finely concentrically striated, About the size of a small marble.*

CYPRINACEA.

Cardium asiaticum (Brug.)=*coronatum* (Speng.)—This is our representative of the cockle family, and the double shell viewed sideways gives a perfect outline of a heart. The ventral border is semicircular. Shell light yellow and deeply ridged, with 33 to 34 radiate ribs, which are notched or lamellated towards the ventral border. Hinge, central teeth small, but two sharp pointed prominent ones on either side, widely separated from the others.

* N.B.—Dr. Fischer puts this shell under the *Ungulinidæ*.)

SINUPALLIA.—Ligament External.

VENERACEA.

Cypricardia bellicata (Reeve).—This is a smallish, dull, chalk-white shell, shaped something like a bean, very inequilateral ; in fact the umbo is quite at one side. It is smooth, but irregularly roughly ridged or striated with the lines of growth. Hinge teeth one small one on each valve. Sinus slight.

Size $1\frac{1}{4}'' \times \frac{3}{4}''$.

We now come to seven shells which are much mixed up in subclasses, but which I shall endeavour to take together under some leading features.

They are all polished shining shells, thickish, with $\frac{2}{3}''$ sharp closely set prominent teeth in the hinge, and are generally smooth and coloured.

Meretrix morphina (Lam.) is about the largest, very shining, thick and smooth, and of all colours, from pale buff to deep rich brown. Shell somewhat triangularly cut and ventral border rounded. Umboes nearly straight, making valve not far off being equilateral. Sinus very slight.

Size $2\frac{1}{2}'' \times 2''$.

The shells figured in Reeve as *Cytherea castanea*, *C. petechialis*, and *C. impudica* appear also to be this species.

Chione pinguis (Hind's) is also very shining and smooth, but the shell is much thinner and more swollen, especially towards the umboes. Colour generally light or dark slate with concentric bands or wavy lines. Shape ovalish, umboes curling away from the ligament side of the shell, which side is produced or elongated. Sinus broad, deep, and oval.

Size $2'' \times 1\frac{1}{2}''$.

Chione radiata (Chem.)—Similar in shape to the last, but more oval, flatter, not so shining, and with irregular concentric striations. Umboes straightish and not very prominent, *i.e.*, they do not much distort the general oval shape of the valve. Sinus deep and oval. In colouring, this shell, as is the case with many of the bivalves, defies description. Young specimens have a reddish tinge which turns to brown or grey when older, and many are marbled or clouded

with angular dark grey colourings on a light ground, also frequently radiately dark banded. The variations in colour and shape no doubt account for its having received three names and being figured in Reeve's Conchologia as *Tapes marmorata* and *T. orientalis*. The name of *C. radiata* is that applied to the adult specimens in the British Museum.

Size $1\frac{3}{4}'' \times 1\frac{1}{4}''$.

Tapes textrix (Chem).—One of our commonest shells, elongated, oval, very smooth and shining (old shells sometimes irregularly, concentrically striated), and with very pronounced blackish zigzag or net-shaped markings on a yellowish ground. Sinus rather small, not pointed.

Size $1\frac{5}{8}'' \times \frac{7}{8}''$.

Meroe solandri (Gray) and *M. effossa* (Hanley).—These are two oval, flattish, thick, very shining shells remarkable for a deep linear cut or depression in the shell behind the umboes and in which the ligament lies. Beaded on the inner edge of ventral border.

M. solandri is quite smooth and of a uniform cream to buff. Young specimens are often prettily flame marked with yellow to brownish colourings.

Sinus broad, not very deep.

Size $1\frac{3}{4}'' \times 1\frac{1}{4}''$.

M. effossa is concentrically lined or grooved, most clearly so towards the linear cut spoken of. Nearly covered with flame or sharp pointed wavy bands of yellow or light brown, often tinged with purple.

Sinus as last.

Size $1\frac{1}{2}'' \times 1\frac{1}{8}''$.

Pullastra malabarica (Chem.).—This shell differs from the others in being strongly concentrically ridged or furrowed; umboes a good deal curled; ventral border rounded, and large specimens look about as broad as they are long.

Colour yellowish with fine grey frecklings and frequently four dark radiate bands of colour.

Sinus deep and broad, extending to middle of shell.

Size $2\frac{1}{2}'' \times 2\frac{1}{4}''$.

Venus imbricata (Sow.) is a very small shell found in great quantity amongst shingle. White, sometimes yellow or purple-tinged towards the umbo. Radiately ribbed. Ribs about 18—19 and noduled.

Length $\frac{3}{8}''$ and nearly the same breadth.

Circe divaricata (Chem.).—Shell oblong, oval, flattish, thick, radiately ridged, ridges diverging from umbo and centre line of shell, also partially concentrically ridged, giving a beaded appearance in places. Colour fulvous-white, mostly streaked or blotched with red brown. Sinus inflection hardly noticeable.

Size $1\frac{1}{2}'' \times 1\frac{3}{8}''$.

Dosinia or *Artemis*.—There are four species of this genus, all more or less circular in shape and closely concentrically striated. The umboes are pointed and curled, and stand out of the circular contour more or less. Immediately under the umboes is a small heart-shaped impression indented in the shell. Sinus large and pointed, extending to middle of valve.

D. prostrata (Linn.) is a large flat fawn-coloured, shining shell. Striations at sides run into converging ridges.

Diameter about $2''$.

D. pubescens (Phil.).—White, sometimes faintly pink tinged ; finely silkily striated. Most frequently found about the size of a 4-anna piece, but grows to $1\frac{1}{2}''$ diameter.

D. rustica (Romer) is a rough chalky-looking shell about the size of a rupee. Striations fine and becoming ridged at the sides.

D. gibba (Adams) is about the same size as the last, but the umbo is much produced, destroying the circular form. The shell, too, is thinner and more swollen towards the umbo. The heart-shaped impression is comparatively large and faint ; pure white and finely evenly striated.

Donax or Wedge-shells.—We have three members of this genus. Ligament short, and side of shell on which it lies (the posterior side) truncated. Sinus deep. Shell inequilateral.

D. scortum (Linn.).—Easily known by the polished purple interior and the sharply truncated side ending in a point at the ventral border. Outwardly the shell is brownish-grey concentrically striated, forming ridges towards anterior side. Shell also radiately striated, especially on anterior side.

Size $2'' \times 1\frac{1}{8}''$.

D. abbreviatus (Lam.) is a small, thick, very inequilateral shell finely concentrically striated, varying in colour from pure white to purple-brown. When coloured there is generally a light ray from umbo to ventral border. Hinge-teeth, one prominent in one valve fitting between two smaller ones in the other.

Size $1'' \times \frac{5}{8}''$.

D. incarnatus (Chem.)=*D. dysoni* (Desh).—A pretty little whitish shell often delicately tinged with yellow, pink or purple. Smooth and shining, truncated end concentrically furrowed. Apex pointed and straight, giving the shell an angular shape.

Size $\frac{1}{2}'' \times \frac{3}{8}''$, but found much larger than this at Ratnagiri.

Psammotœa atrata (Desh.)—This shell, being the only true purple bivalve I have found, will not need much description. It is thin, oblong, somewhat transparent, generally partially covered with a greenish epidermis, and with 2 light rays running from umbo to ventral border in a slanting direction.

Length $1\frac{3}{8}'' \times \frac{3}{4}''$.

The *Tellinas* form a very numerous family generally taken by itself and even much subdivided.

The Bombay specimens are thin flattish inequilateral shells generally white, and the posterior side (*i. e.*, the side with the ligament) is truncated or more frequently plicated.

Hinge-teeth insignificant, sometimes obsolete.

Sinus in all cases very large.

The following are all white.

T. sinuata (Spengler).—Large, very flat, oval, very silky, and finely concentrically striated ; posterior side produced and slightly flexuous.

Size $2\frac{3}{4}'' \times 1\frac{5}{8}''$.

T. capsoides (Lam.).—Also flat, chalky-white, slightly rough, and clearly concentrically striated ; posterior side short, plicated, and truncated ; anterior rounded and faintly radiately striated.

Size $1\frac{3}{4}'' \times 1\frac{3}{8}''$.

T. edentula (Spen.).—Large, thin ; umbo pointed, rather swollen and angular ; inequilateral ; posteriorly strongly flexuous, anteriorly produced and oval ; smooth, shining, and striated with lines of growth.

Size $2\frac{3}{8}'' \times 1\frac{1}{4}''$.

T. ala (Hanley).—The chief feature is the pointed and plicated posterior end. Anterior end rounded ; umbo pointed, but not much produced ; silkily minutely concentrically striated ; sometimes rusty-tinged by the epidermis.

Size $1\frac{1}{4}'' \times \frac{7}{8}''$.

T. truncata (Ionas) is a very thin, pure white, perfectly smooth, oval shell, very inequilateral; umbo pointed and angular. Posterior side slightly flexuous.

Size $1\frac{3}{8}'' \times 1''$.

T. emarginata (Sow.).—An oblong, very highly polished, smooth shell with concentric agate-like veins frequently pinkish towards the umbo, or pink-rayed; posterior side sharply flexuous, forming sometimes a sort of dip in the shell.

Size $1\frac{1}{2}'' \times \frac{3}{4}''$.

EXTERNAL LIGAMENT SLIGHT OR WANTING.

Semele cordiformis (Sow.) is the name of a whity-pink, somewhat circular and thickish shell often pink-rayed and banded, especially towards the umbo. Both radiately and concentrically striated, the former being particularly permanent towards the ventral border.

Sinus deep and broad.

Central teeth obsolete, a long internal ligament taking their place. Lateral teeth two. About the size of a rupee.

The *Mactras* are chiefly known by the pecularity of the hinge-teeth. In the centre is a more or less hollowed-out triangular or spoon-shaped projection or pit which holds the internal ligament. Beside this are sharp interlocking teeth, beyond which the hinge area is more or less grooved laterally.

M. luzonica (Desh.) only occurs here as a small nearly equilateral and triangular shell, very shining, and finely concentrically striated. Colour variable, but generally a grey purple towards the umbo.

Size about $\frac{3}{4}'' \times \frac{5}{8}''$ or smaller.

Cœcella transversalis (Desh).—An oblong equilateral shell generally covered, all but the umbo, with a yellow-brown epidermis, beneath which it is quite white.

Size $1\frac{1}{2}'' \times \frac{7}{8}''$.

Of the genus *Standella* there seem to be two species—*S. capillacea* (Desh.) and *S. pellucida* (Chem.), but the hinge-teeth and ligament-pit are so exactly alike in both cases that I am in some doubt, from a recent examination of a number of specimens, as to whether we have or have not two species. If we have, *S. capillacea* is much the larger, rough, oval, and inequilateral, white or more often tinged with rusty-yellow, rough, and irregularly concentrically striated with lines of growth and fine wrinkled striations in a radiate direction, especially towards the ventral border.

Size $3\frac{1}{2}'' \times 2\frac{1}{2}''$.

S. pellucida is much smaller, and the oval shape is more pointed. Shell shining white and silkily, very finely, concentrically striated. Radiate wrinklings not present.

Size $2\frac{1}{4}'' \times 1\frac{1}{2}''$.

MYACEA.

The Bombay specimens of this family are so widely different in form that they must be taken separately.

Thracia salsettensis has been described and figured by Mr. Melvill, and a copy of his diagram and pamphlet has been reproduced in this journal.

Anatina labiata (Reeve) is an extremely fragile oblong somewhat swollen, pearly-looking shell; semi-transparent; interior vitreous, and with a single spoon-shaped projection to hold the internal ligament. The shorter side of the shell is rostrated or slightly thrown back, causing it to gape.

Solen truncatus (Sow.)—(The razor shell)—is very common; the double shell forms a long cylinder open at both ends, often covered with a greenish epidermis. Shell tinged with rusty-pink often transversely banded with this colour.

Length 3″ to 7″.

PHOLADACEA.

One species, *Pholas bakeri* (Desh.), is certainly common, and I believe these shells have been called angels' wings, the imaginary drawings of which they faintly resemble. A very elongated, pure white, thin and brittle shell concentrically and radiately roughly ridged, the ridges forming sharp points at the junction. At the umbo the shell is curled over on itself, a very marked feature. Interior porcellanous.

Length about $3'' \times 1''$.

DIVISION III.

This comprises all the oysters, and I give the following extract from the paper already mentioned:—

Ostrea crenulifera (Sow.)=*plicata* (Chem).

Ostrea bicolor (Hanley).

We give these names as most closely corresponding to the Bombay specimens that have come under our notice, but this genus is so widely distributed in all seas and the similarity of shell sculpture is so close, whilst the shape is so varied, that it is impossible to speak with absolute certainty.

O. lacerata (Hanley).—Found on stones at low tide, densely clustered and arranged vertically.

Of the genus *Anomia* we have two species.

A. achæus (Gray).—A translucent, silky, copper-tinged (yellow to red) shell with often a roughly wrinkled exterior and a very polished metallic interior. The lower valve is flat and has a large circular or oval hole extending to the middle of the valve through which the byssus passes. The animal lives attached to rocks or stones, and, like the oysters, adapts itself in the shape of its shell to its surroundings.

Muscular impressions central and so close together as often to make one scar.

Hinge-teeth absent.

Size about $1\frac{1}{2}'' \times 1\frac{1}{4}''$.

Placuna placenta (Linn.).—Circular, very flat and thin discs, often as large as a saucer. Texture like mica or talc, smooth towards the umbo, otherwise finely wrinkled with minute thread-like shining lines. Young shells faintly pink-tinged ; old ones often blackened with mud, otherwise they are white. In the interior at the umbo there are two diverging ridges.

The *Pectens*.—These well known scallop (expanded fan-shaped) shells are only represented here by one or at most two species. Umboes pointed and angular, and with wings or ears on either side ; ventral border semi-circular.

P. singaporinus (Sow.) has about 21 ribs, is whitish and generally densely covered with transverse bandings or blotchings of dark brown or rusty-red.

COLLECTING WAYS AND COLLECTING DAYS.

By Major C. T. Bingham, f.z.s., *Forest Department, Burma.*

(*Read before the Bombay Natural History Society, 13th Nov.*, 1893.)

Collecting on the Kawkareik and Myawaddy Road.

I know of no forests in all this forest-bearing country of Tenasserim so interesting as those lying in the East Salween sub-division of the Salween—Ataran Forest Division.

Apart from the fact that from a forest point of view the East Salween contains perhaps the most valuable forests in the province, the whole country, from the configuration of the land and from the character of the vegetation covering it, forms the very happiest of hunting grounds for a natural history collector. From north-west to south-east right along the whole length of the sub-division runs the range of the Dawnat mountains, covered for the greater part by dense evergreen forests, and possessing peaks running to 4,000 and 5,000 feet.

One of these, Mulayit, has been made famous by the collections made thereon by Mr. Limborg, the late Mr. W. Davison, and Signor Fea. The Dawnat range forms the water-shed between the Thaungyin river on the east and the Hlaingbwè and Haungdraw rivers on the west. For the most part it is covered by unbroken forests, and its wilder portions are only known to the wandering Karens ; no white man has penetrated to their depths. Here and there rough pathways, leading over high and rugged passes, cross the range, and being often the only breaks for miles in the dense forests are, at most times, thronged with birds and insects. In all Tenasserim I do not know any collecting ground so good as the road leading from Kawkareik, a large village in the Haungdraw valley across the Taungjah pass (1,500 ft.) to Myawaddy, a village on the Siamese frontier in the Thaungyin valley. For some reason or another, possibly attracted by the dense evergreen vegetation, many Malayan species, both of birds and insects, originally recorded from the Malay Archipelago, Malacca, or from the extreme south of Tenasserim, creep up along the Dawnat range

and have been procured by H., myself, or others on the Taungjah pass.

Witness to this fact among birds, the black-and-red broad-bill (*Cymborhynchus macrorhynchus*), the tufted tree-swift (*Macropteryx comatus*), the greater red-billed malkoha (*Rhamphococcyx erythrognathus*), and many others: among butterflies I have taken the eminently Malayan forms of *Papilio butleri* and *Sithon nedymond*, not to speak of scores of others: and in the *Hymenoptera* it is sufficient to mention as common *Sphex tyrannica*, Smith, originally recorded by Wallace from the Celebes; *Ctenoplectra chalybia*, also from Malacca and the Celebes, *Megachile atrata*, from the Philippine Islands, etc.

Years ago I was stationed at Kawkareik and knew the Taungjah pass and road well. My best collections of birds and insects were made along it and in the Thaungyin and Haungdraw valleys. Of late years however, only when professional work has taken me there, have I been able to revisit my old hunting grounds and collect during such leisure as the ever-increasing duties that press on one now-a-days have allowed me. Here is an account of one trip made along this road.

Leaving Maulmain by launch one day early in February, H. and I got up to Kyundo, a little village on the bank of the Haungdraw river, on the same day, early enough to proceed on to Kawkareik, which is fifteen miles further in towards the foot of the hills. Leaving our servants to load and bring on our baggage on carts, we started on foot with a light empty cart and a fast pair of bullocks following close behind in case we found the sun hot and decided to ride. We both carried nets, and H., who had lately taken again to bird-collecting, had a man behind carrying a gun.

The road for some miles from Kyundo is uninteresting, passing between low-lying marshy ground and paddy fields over which it is built with high embanked sides, pierced by bridges so as to allow of outlets for the water in the floods of the monsoon. At about the fifth mile, however, the road gets up among low forest-clad laterite hills, and here our collecting began, the first prize being a fine adult *Poliornis teesa*, an exceedingly rare bird in Tenasserim. H. spied it a little distance off the road, seated high upon a dead tree (*Dipterocarpus*

tuberculatus), and after a careful stalk managed to bring it down. While H. went off after the hawk, I wandered in among the bushes and undergrowth, keeping a sharp look-out for any good butterfly or *Hymenoptera*. Butterflies were plentiful enough, but all of common species. Flitting up suddenly and after a short jerky flight, dropping close to the roots of some thick bush and becoming perfectly invisible until put up again, were dozens of *Melanitis ismene*, *M. aswa*, and *M. zitenius*; I caught specimens of all three in a couple of minutes. Here were two or three *Mycalesis mineus* going with steadier flight and settling higher up on the leaves of the bushes, while *Terias*, *Ypthima*, and the delicate weak-flighted *Leptosia xiphia* were all to the fore. Suddenly I saw a flash of blue, and a little bright *Arhopala* went with a thump on to the underside of a leaf of a Yendike bush (*Dalbergia cultrata*). A careful sweep of the net, and it is caught and proves to be *Acesina aberrans*, de Nicèville, an *Arhopala* pure and simple, but with rather unusual markings on the underside of the wings. The bushes grew thick, and tramping about among them I disturb insects of all kinds, among them a rather lively solitary wasp (*Eumenes arcuata*), which gives me a good deal of trouble to get into the cyanide bottle. By the time H. has recovered his bird and returned to the road, I have at least a dozen butterflies in papers and three or four *Hymenoptera* in the killing-bottle; and so it goes on, H. helping me with my insect-collecting, while keeping a look-out for birds for himself, until we get within a mile or so of Kawkareik; then we get into the cart and rattle in in time for a bath, and get dinner later on when our servants and baggage turn up.

We stopped a day at Kawkareik, and the next morning started for the Thaungyin valley. Carts had here to be abandoned and elephants taken on. The next day what with getting our baggage straight and loading the elephants, we did not get off till after 8 o'clock. The march was going to be a short one, only to a camp at the foot of the hills, some five or six miles off; so our late start did not matter. Passing through the village, which is long and straggling, we did not get into any collecting ground until we had got clear of the Shan hamlet of Tadanku, which joins on to the east end of Kawkareik village. The morning was bright and the sun already beginning to feel hot, so that we were glad to get past all

cultivation and clearings into the cool evergreen forest. The road or pathway, for it is really only a bullock-track, follows the bed of the Kawkareik chaung, a regular little mountain torrent, shallow but swift, which or its feeders are crossed by the road some twenty-five to thirty times within a distance of four miles. A considerable trade in live cattle brought from Siam has been carried on for years, and this pathway, rough and rugged as it is, is well marked, and forms a broad winding break in the forest. The hills rise on either side of the road steep and densely crowded with vegetation, evergreen bushes with sharp recurved thorns, creepers of all sizes and lengths, huge clumps of bamboo and giant forest trees, Thingan (*Hopea odorata*), Kaungmoo (*Parashorea stellata*), Pyinma (*Lagerstræmia flos-reginæ*), and numbers of others are all jumbled together in one matted mass through which it is impossible to penetrate any distance without free use of axe and dah. All wooded scenery has a sameness that becomes, after a time, rather monotonous. But on this road the abrupt turns and the distant views obtained of bare hill and rocks between the lower wooded vistas are most striking. You ascend a height and look over a waving sea of green broken by the winding road crossed here and there by the stream. The contrast of the vivid green of the trees, with the brown-black and gleaming white boulders in the torrent's bed, and afar off a bare mountain side of rock and grass is remarkable. The whole lit up by the morning sun forms a rich mass of colour which has often held me breathless and silent.

At the first crossing we stopped and let the elephants with our baggage get ahead, telling our servants to pitch our camp at Taungcheyin (lit. "the foot of the hill") and get our breakfast ready against our arrival. In the mean time we looked about. The near bank of the stream showed a wide expanse of damp sand, and on this, as the sun got higher and warmed it, came butterflies, bees, wasps, and *Diptera* in scores, sucking up the moisture. On one or two spots, where some wayfarers—Burman, Shan, or Karen—had sat down and eaten their meal of rice and *na-pi* (fermented fish-paste), a whole crowd of waving wings made a bright patch of colour on the yellow sand. It is very difficult to say whether butterflies are attracted more by smell or by sight. In the course of my collecting I have found an over-ripe jack fruit or papaya split

open and laid out on bare rocks or sand—a fair bait for the *Papilionidæ* and *Lycænidæ*, among butterflies and for all the solitary fossorial wasps, and the *Apidæ* among the *Hymenoptera*. But then to bait of this kind insects may be attracted as much by sight as by scent, while there is not the ghost of a doubt that for all *Lipidoptera*, *Hymenoptera*, *Diptera*, &c., there is nothing to beat liquid ammonia* spilt over patches of sand where the sun is shining hot; and to this there can be no question that the insects are attracted purely by scent. For certain foul feeders, the genus *Charaxes* among butterflies pre-eminently, a sure find is the droppings, so common on jungle roads, of tiger, wild cat or dog. Again *Euthalia* and skippers and many large fossorial *Hymenoptera*, *Pompilidæ*, *Sphegidæ*, &c., are often found in numbers sucking the juice of jungle fruits shed and lying on the ground in rotting masses. On the sand for some time our nets went swooping out busily, and then H. suddenly said, "By Jove, what's that," and looking up, I saw three green birds flying on to a high tree on the other side of the stream. For a moment I thought they were parrots, but a second good look showed the beautiful cherry-pink puffed-out feathers of the throat, and I recognized them as *Nyctiornis amicta*, the "red-bearded bee-eater" to use Oates' name. This is a much rarer species than the "blue-bearded bee-eater" (*Nyctiornis athertoni*) and found only in the heaviest forests; whereas the latter species is not unfrequently seen near clearings, and I have even shot one on a solitary tree in the middle of a paddy field. The call of *Nyctiornis amicta* is quite different from that of its congener, much coarser and rougher. The bird breeds on these hills, and on two occasions I found nest holes on this very road. Unfortunately the first time I was too early; the birds had just begun digging, and on the second occasion I found the young already hatched out and feathered. They flew out as I dug down into the nest. Both *N. athertoni* and *N. amicta*, notwithstanding their popular name of bee-eaters, live quite as much on beetles as on bees. From the nest mentioned above I took out quite a hatful of the legs, heads, and wing-cases of beetles. The nest, like that of all bee-eaters, is simply a large bulbous chamber at the end of

* For the precise manner in which this ammonia is poured on the ground see Hogarth's plate of the "Enraged Musician."

a seven or eight foot tunnel dug obliquely into the bank of a stream, the side of a road or other cutting. I have no doubt that the eggs of *N. amicta*, like those of *N. athertoni*, are globular and glossy white.

H. and I stalked the birds very carefully, but succeeded in only getting one. After putting this up we slowly wandered on, adding rapidly to our collections. The profusion of bird and insect life was simply marvellous. Among birds, bulbuls of many kinds were conspicuous, *Chloropsis*, *Iole*, *Pycnonotus*, *Criniger*, twittering, flitting and fighting among the tree-tops. The beautiful male of the fairy-blue-bird (*Irena puella*) with its glistening cobalt-blue wings was uttering its sharp "be quick," "be quick", while from the lower bushes by the road-side came the plaintive monotonous call of *Turdinus abbotti*, and further in from the depths the hoarse "Hoot," "Hoot" of a *Pomatorhinus*. Every now and then too a trogon (*Harpactes oreskios*) with its brilliant colouring, or a party of that rare hornbill (*Anorrhinus tickelli*) following each other at intervals in single file and uttering their curious cackling shout, would cross the road. Above all sounds, however, from the hill sides rose the melancholy howlings of the black gibbon (*Hylobates lar*). Butterflies abounded at every crossing of the stream. Among them *Euplœas* with their blue-shot wings, mimicking *Papilios*, difficult to distinguish from *Euplœa* and *Danais*, delicate whites *Huphina*, *Terias*, *Hebomoia*, strong-winged *Charaxes*, brilliant *Arhopalas*, and jerky-flighted brown skippers all swarmed together on the bare hot sands. Mixed up among the butterflies were swarms of hymenopterous insects; of *Megachile* (leaf-cutter bees) alone I caught eleven species, of *Eumenes* (solitary wasps) four species, and numerous species of *Anthophora*, *Nomia*, *Ceratina*, *Halictus*, and *Trigona*. I collected too various *Coleoptera* and *Diptera*, which were almost, if not quite, as abundantly represented as the other orders of insects with which I am better acquainted. The jungle on either side of the road is, as I have already stated, covered with dense evergreen vegetation, and hunting about among the undergrowth, I was overjoyed to chance on the whisker plant (*Tacca lævis*) growing in great numbers. I had always considered this plant as somewhat rare, but here it was to be found literally in hundreds. It is a most curious

vegetable, as the old botanists would have said, with a leaf not unlike that of the wild cardamom, and a most peculiar, almost weird-looking flower, deep purplish-black in colour, with filaments fully three inches long, formed into two great bunches which hang down on either side of the corolla.

It was one o'clock before we got into camp, which was pitched in a lovely spot right at the foot of the ascent of the pass over the mountains. The tents were placed under the shade of what in India would have been called a tope, of magnificent Pyinma trees (*Lagerstræmia flos-reginæ*).

After changing our wet clothes and swallowing a hasty breakfast, I sat down to skin the birds I had collected, and to look over, arrange, and put away my insects. H. said he would just have a look round before he commenced skinning the specimens he had got and wandered off with a gun. Presently I heard a shot and then another, and then a long pause followed by frantic shouts for his net. One of H.'s servants ran off with the net, and in about half an hour H. returned triumphant. He had secured a lovely specimen of that most beautiful of birds, *Calyptomena viridis*, and another equally beautiful specimen of *Rhamphococcyx erythrognathus*, besides one broken and one perfect specimen of that rare butterfly, *Thaumantis pseudaliris*.

This ended our collecting for that day, and it was nearly dark before we had finished preparing and putting away all the objects we had collected.

Next morning we started somewhat earlier than we had done the previous day and climbed on for an hour without stopping to collect much, as we wanted to get well ahead of the elephants. By the time we had got the worst of the ascent over, the sun came over the hill-top and butterflies and birds became more lively. The road wound for the most part along the ridge of a long spur, and the hill-side was in many places fearfully steep, but all covered with dense ever-green jungle. In one place where the road, owing to the broadening of the spur, opened out somewhat, H. and I sat down on a fallen log and took a rest. A dead and half-rotten tree was in front of us a little off the road, and our attention was attracted to this by seeing what we both took for a woodpecker hammering away, but rather gently and with little noise, at the top. Every now

and then the up-and-down motion of the head would stop and the bird would shift its position a little. Thus moving round the trunk, it at last came full into sight. To our astonishment we saw then it was a barbet and, as we thought, the common *Cyanops asiatica*. To make certain, however, H. brought it down with a reduced charge of No. 10 shot, and our delight may be imagined when it proved to be, not *C. asiatica*, but the much rarer *C. icognita* of Hume. Subsequently I found this bird not uncommon on this Taungjah pass. Its note is altogether indistinguishable from that of its near allies, *Cyanops asiatica* and *C. davisoni*, if indeed these two latter are not one and the same bird. The curious woodpecker-like action in hammering at the bark of a tree I have not observed in any other species of barbet.

Having strung up *C. icognita* on the bird-stick, we proceeded on our way, collecting as we went. At one very steep spot on the hill-side I got into a flock of that curious shrike-thrush, *Gampsorhynchus torquatus;* they were flitting about on all sides uttering their curious grating note and threading their way with incredible rapidity through the stems of a thick clump of bamboos. The ground down which I had to climb was like the side of a house, and after innumerable shots I only managed to secure one specimen, but that was a beauty, scarcely damaged at all by the shot. Collecting on steep hill-sides, whether the quarry is birds or insects, is very trying work for the temper. I know nothing so good or so bad, as the case may be viewed, for bringing out an eloquent, if not elegant, flow of language. After I had recovered my bird and got up to the road again, H. said I had uttered frightful anathemas. However, the year before, on this very spot, he acknowledged he had been quite as bad. He was going to the Thaungyin in May and was collecting butterflies and other insects for me. Now this road in the end of April and the beginning of May that year simply swarmed with numbers of that magnificent morphine butterfly, *Stictophthalma louisa*. He had caught some half dozen, but just at this spot, where I had now got *G. torquatus*, there were some twenty or thirty *Stictophthalmas* floating about up and down the hill, and H. found himself as busy as he could possibly be for a few minutes trundling up and down the steep hill-side and making himself very hot and wet. He had just struck at a *Stictophthalma* that had disappeared with a whop into the centre of a

thick and alas! thorny bush, when buz-z-z there came flying down the road at an astonishing pace a huge sand-wasp which H. recognized as a prize, having seen one in my collection. It was *Scolia procer*, which by the way is rare in Tenasserim. He struck at it wildly and got it in, but the end of the net was hitched up in the thorny bush and the efforts of the *Scolia* to escape were terrific. McH., another forest officer who happened to be with H. at the time, told me afterwards that the sight of H. struggling with that ferocious *Scolia* in the hitched-up net and endeavouring to get the beast into a two-inch cyanide killing-bottle, while he tried at the same time to keep his own footing on the fearfully steep slope, was a thing he would never forget. McH. declares so remarkable was the language used that on the road at that spot for hours afterwards the air had a most sulphurous and brimstonic smell about it. However the *Scolia* was secured, which was the chief thing after all, and by H.'s kindness now adorns my cabinet. *Gampsorhynchus torquatus* was discovered by Davison in Northern Tenasserim, and I subsequently procured it on this very road. It extends down southwards to as far at any rate as Yè, where I came across it in the dense ever-green forests on the Minla stream.

So far as I have had opportunities of observing the bird, it occurs only in the heavy ever-green hill forests, never descending to the plains. It is always in flocks, and works noisily through the jungle exactly like *garrulax*.

By the time we got to Taungjah (*lit.* valley) itself, where the road descends from one ridge and ascends another, the sun was well up, and in the open valley here birds and insects were all abroad in numbers. We shot several specimens of a beautiful broad-bill (*Psarisomus dalhousiæ*), which was going about in small flocks of six or seven. It is one of the stupidest of birds. A flock will allow its individual members to be shot down one after another without moving from the tree they are perched on. We got here also specimens of the coral-billed hill bulbul (*Hypsipetes concolor*), and two or three of that plain plumaged minivet, *Pericrocotus cantonensis*. The species of butterflies and other insects were much the same as those procured yesterday, but I got a fine *Papilio* and two or three *Arhopalus* that I had not met with below. On the ascent of the opposite ridge to

Taungjah also I found parading about among the dead leaves on the ground, and managed to catch with some difficulty, two magnificent specimens of *Salins intermedius*, Smith, one of the fossorial hymenoptera of the family of the *Pompilidæ*. On the top of the ridge we came across a lovely snake of a bright green colour coiled round, or rather on, the root of a tree, about a foot off the ground. On these steep hill-sides the washing away of the soil under the drenching rains often leaves the roots of trees entirely bare, giving a rather curious appearance to the trees, which seem to be raised above the ground on their roots. H. pushed the snake off gingerly with a stick and, holding its vicious-looking flat head down, seized it with finger and thumb behind the jaws. As he held it up, the brute opened its mouth angrily and showed its two recurved fangs clearly, which, as in all the viper family, were rather long. Suddenly it gave a twist and a wriggle and, distinctly protruding its fangs, it managed to shake a minute drop of clear poison on to H.'s thumb. I never saw H. in such a hurry to drop anything: he flung the snake from him, wiped his thumb on his coat and then with his handkerchief, and sucked at it violently for at least a minute. However there was no abrasion of the skin and no harm done. I don't think the snake itself was a very poisonous one; it was one of the many forms of *Trimeressurus gramineus*, Shaw. This particular individual had the tail cinnamon-red.

Further along, the road narrowed somewhat, and at one bend H., who was ahead, suddenly stopped and beckoned to me. I hurried up, and he pointed out a magnificent butterfly seated with closed wings on the under-side of a bamboo by the edge of the road. Its wings on the underside were grayish brown marked on the hind wing with faint ocelli. As I approached cautiously, it half opened and closed its wings once or twice and then, spreading them suddenly to their full extent, it soared and went down the hill-side with a dash that seemed to annihilate space. A broad blue bar on the upper side of its wings flashed in the sun, and I recognized it as *Amathusia phidippus*, one of the most beautiful of the *Morphinæ* found in Tenasserim. It was hopeless following the creature, so we went on, and by 2 p.m. reached the village of Thinganyinaung in the valley of the Thaungyin, where we were to camp that night. That evening we had enough to do to

get all the specimens we had procured on the march prepared and put away, and then a bird or two had to be left over to be skinned the next day.

The third day's march brought us to Myawaddy on the bank of the Thaungyin river. The country between our camp at Thinganyinaung at the east foot of the Dawnat range and Myawaddy was quite different in character from anything we had passed over yet. The road wound over a series of low hillocks with gravelly sandy soil, parched and dry and covered with what the Burmans call "Indaing" jungle, in which the chief trees are In (*Dipterocarpus tuberculatus*), Engyin (*Pentacme siamensis*), Theya (*Shorea obtusa*), Yindike (*Dalbergia cultrata*), Kone pyinma (*Lagerstræmia macrocarpa*), Bamhuè (*Careya arborea*), and Khabaung (*Strychnos nux-vomica*), with here and there a clump of Myinwa (*Dendrocalamus strictus*), and a sparse undergrowth of coarse thekkè grass.

Just after striking and leaving camp, passing over some paddy fields, we manage to secure a magnificent specimen of Rutherford's crested serpent-eagle (*Spilornis rutherfordi*), and further on, on the bank of a tiny stream, the last water we should meet till we got close to Myawaddy, I had a busy five minutes with my net procuring specimens of *Euripus halitherses* with its queer indented wings and prominent yellow eyes ; of *Apatura parysatis*, a little velvetty-black butterfly allied to the European purple emperor ; of *Cyaniris*, *Castalins*, and *Rapala* ; and a great prize, *Thaduka multicandata*, a remarkable form among the *Lycœnidæ*, possessing three tails on the hind wing, and having the under-side of the wings curiously mottled. Among the bees and wasps I took a fine specimen of *Vespa magnifica*, a species which is not often found at such a low elevation, and a few *Megachile momia* and *xylocapa*. While I was at work with my net, H. went on, and I heard him fire twice ; when I came up I found him placing a pair of that beautiful little falconet (*Poliohierax insignis*) on the bird-stick. Soon after this we got into a flock of the white-cheeked jay (*Garrulus lencotis*), and on a dead yindike tree (*Dalbergia cultrata*) I shot a specimen of that lovely wood-pecker (*Gecinus erythropygius*). The call of this last bird is a strange one for a wood-pecker, a sort of garrulous "quitch-quatch, quitch-quatch," quite unlike the shrill ringing cry of the other *Gecini*. *Poliohierax insignis*, *Garrulus lencotis*, and *Gecinus erythropygius* are

all rare birds, being very locally distributed and occurring only in "Indaing," the kind of forest we were passing through.

The progress of our march to-day was much less interrupted by stoppages to collect. The dry hot jungle we were passing through yielded few things beyond what are mentioned above, and these, though all good and rare, were limited in numbers. It was still early in the forenoon when we got into the belt of teak and bamboo close to Myawaddy, and here we found wood-peckers plentiful; several species were associated together, and in company with numbers of *Garrulax belangeri*, *G. moniliger*, and *G. pectoralis*, and a few green jays (*Cissa sinensis*) were working in regular mobs through the forest. Of wood-peckers, beside *Gecinus erythropygius* which we had already obtained, we got the large *Thriponax feddeni*, a handsome black and white species, with, in the male, a bright scarlet crest; Blyth's three-toed green wood-pecker (*Gecinulus viridis*), *Chrysophlegma flavinucha*, and *C. chlorolophus*, *Chrysocolaptes strictus* and *Tiga javanensis* with their shining golden backs, the quaint, familiarly-tame and compact-built *Hemicercus canente*, and the pretty little rufous piculet (*Sasia ochracea*). It was a perfect paradise of wood-peckers, and I am sure we could have, if we had liked, got over a hundred specimens in the two days we stopped at Myawaddy afterwards. Myawaddy must once have been a considerable town. The remains of huge earthwork fortifications lying half a mile or more on the west and south attest to its former extent and importance. At present it contains about a couple of hundred houses—most of them mere huts, the usual three or four pagodas, kyaungs (monasteries), woots (image-houses), and zayats (rest-houses).

In one of these last we put up, and as it was getting on in the afternoon (our collecting just outside Myawaddy having delayed us considerably), we changed our clothes, scrambled through breakfast, and set to work to prepare and put away our collections.

This ended our three days' collecting for the time on the Kawkareik and Myawaddy road.

ON NEW AND LITTLE-KNOWN HYMENOPTERA FROM INDIA, BURMA, AND CEYLON.

By Major C. T. Bingham, f.z.s. (Forest Department, Burma).

The fossorial *Hymenoptera* belonging to the family of the *Pompilidæ*, Leach, are some of the most difficult of insects to classify and group into well-defined genera. One of the latest arrangements of them is that by Herr Kohl of Vienna as laid down in his paper "Die Guttungen der Pompiliden" in *Verh. der k. k. Zool. Bot. Ges. Wien, 1884.*

Herr Kohl divides the *Pompilidæ* into 15 genera. Species belonging to the following occur in the Indian region; *Macromeris*, Pel., *Pseudagenia*, Kohl, *Ceropales*, Latr., *Salius*, Fabr., *sec.* Kohl, and *Pompilus*, Fabr., *sec.* Kohl.

Salius is further subdivided into 4, and *Pompilus* into 18 groups, or subgenera. Under the *Salius* groups are included in part species belonging to the genera *Salius*, Fabr.; *Priocnemis*, Schioedte; *Hemipepsis*, Dahlbom; *Homonotus*, Dahlbom; *Entypus*, Dahlbom; *Pallosoma*, Pel.; and *Mygnimia*, Smith. And under the *Pompilus* groups, in part, species belonging to *Pompilus*, Fabr.; *Aporus*, Spin.; *Episyron*, Schioedte; *Anoplius*, Pel.; *Evagethes*, Pel.; *Salius*, Dahlbom; *Homonotus*, Dahlbom; and *Ferreola*, Smith.

I give a translation of Kohl's description of the five genera mentioned above.

"I. GEN. MACROMERIS (Tab. II, Fig. 1).

"Macromeris, Pel. Guer. Mag. Zool., pl. 29, 1831.

"Type: *Macromeris splendida*, Pel.; *Ibid*, pl. 29, 1831.

A wide space between the lower rim of the orbits and the base of the mandibles. The mesosternum in front of the coxæ of the intermediate legs, cone-shaped. Wings large, overlapping the abdomen. The radial* cell of the front wing rounded at the apex; three cubital cells, the 2nd cubital cell trapezium-shaped, a little smaller than the

* Throughout this paper I have adopted, with one exception, the English equivalents of the Latin terms used by Dahlbom (Hym. Eur., I, plate) for the wing nervures and cells. The one exception is that for Dahlbom's "1st and 2nd Venula-transverso discoidal" I have used the terms "1st and 2nd recurrent nervures" as more familiar to English and American Hymenopterists.

I give (Pl. II, Figs. 2 & 3) a diagram of the front and hind wing (*Hymenoptera*) with the names of the cells and nervures according to Dahlbom.

1st or the 3rd ; the third cubital cell also trapezium-shaped, widening out a little towards the margin of the wing beyond the radial cell. The first recurrent nervure terminates in the 2nd cubital cell before its apex ; the 2nd recurrent nervure in the middle of the 3rd cubital cell. The transverse-medial nervure is interstitial or strikes on the externo-medial nervure before the apex of the 1st submedial (interno-medial, Smith) cell. The 1st discoidal cell, as in the genera *Pepsis*, *Notocyphus* and portions of *Salius* with a hyaline spot formed in the inner angle through the upper concave discoidal line. The cubital nervure of the hind wing coalesces with the transverse anal nervure (interstitial).

Legs, very long. Tibiæ having neither spines nor hairs. Tibial spur, short. The metatarsus of the posterior legs arched. Claws with one stout tooth in the middle on their inferior edges. The 3rd ventral segment without a transverse impressed line. In the male the middle segment is short, shorter than the rest of the abdomen. Coxæ, trochanters and femora, especially of the anterior legs, thick. Femora on the underside having a sharp denticulated edge.

"III. GEN. PSEUDAGENIA, nov. gen.

AGENIA, Dhlb. (Non Schioedte), *Hym.* Eur., I, p. 454, 1845. *Pompilus*, pt., Smith, Cat. *Hym.*, P. III, p. 118, 1855. *Anoplius*, pt., Pel. *Hym.*, III, p. 440, 1845. *Sphex*, *Evania*, *Ceropales*, pt., Fabr., *Pilpomus*, Costa, Fauna del Regno di Napoli, 1859, p. 3. *Pompilidea.*

TYPE: *Agenia carbonaria*, Scop. (*punctum*, Schioedte, Fabr.).

The characters of the maxillæ resemble those of the genus *Pogonius*, Dhlb. The lower rim of the orbits reaches up to the base of the mandibles. The antennæ are at times, as in the genus *Ceropales*, inserted at a distance from the clypeus, at times close to it. Mesonotum, transverse, short. Front wing with three cubital cells; the 3rd cubital cell, trapezium-shaped or trapezoidal, much larger than the 2nd. The radial cell, long, lanceolate. The 1st discoidal cell terminating in or a little after the middle of the 2nd cubital cell, the 2nd discoidal cell in the middle of the 3rd cubital cell. The transverse medial nervure unites with the 1st transverse-submedial nervure, or strikes on to the externo-medial nervure before the apex of the 1st submedial cell. The cubital nervure of the hind wing is discharged at or after the apex of the anal cell. Antennæ and legs, long and slender.

The armature of the latter, in general, very weak or wanting. The tibiæ of the posterior legs never serrated, bearing, at the most, short, isolated spines. The tibial spur of the posterior legs not extending beyond the middle of the metatarsus. Claws having a tooth in the middle on their inferior edges. The species belonging to this genus have a tendency to a lengthening of the 2nd segment of the abdomen. The 3rd ventral segment bears a transverse impressed line, as in *Priocnemis*, *Pepsis*, *Agenia*, &c. The middle segment convex, never emarginate or bearing an impression. In the male, the clypeus is evenly truncated, rounded, or neatly incised. In the female, the clypeus seldom has its anterior margin transversely truncated, more often the centre is produced sharply.

XII. GEN. CEROPALES (Tab. II, Fig. 12).

CEROPALES, Latr., Prec. caract. Gen., MS., 1796, p. 123, 25, Gen. *Ceropales*, pt., Fabr. Syst. Piez., p. 185, 31, Gen., 1804. *Ceropales*, pt., Latr., Hist. Nat. Crust., et MS., t. XIII, p. 283, 1805. *Evania*, pt., Fabr.

Ichneumon, pt., Oliv.; *Pompilus*, pt., Illig.

TYPE : *Ceropales maculata*, Fabr., Syst. Piez., p. 185, Nr. 1, 1804.

Labrum produced below the clypeus. The eyes reaching up to or approaching the base of the mandibles. The antennæ in the female only arched, their point of insertion lying, as a rule, at a moderate distance from the clypeus. The posterior margin of the pronotum, arched. The front wing with one lanceolate radial cell and three cubital cells ; the 2nd cubital cell receives the 1st recurrent nervure after the middle, the 2nd before or in the middle.* The transverse medial nervure is interstitial. The cubital nervure of the hind wing arises at some distance after the apex of the anal cell. Legs armed only with minute spines, or altogether spineless.

The tarsal brush is absent from the anterior legs. Claws with one bent tooth in the middle or at the apex on their inferior edges. The middle segment is well proportioned, short and broad, never emarginated. The 3rd ventral segment is without a transverse impressed line. The sting-sheath in the female is produced.

* There is some error here in the text. The following is, I believe, what was intended—" the 2nd cubital cell receives the 1st recurrent nervure after the middle; the 3rd cubital cell, the 2nd recurrent nervure, before or in the middle." This is borne out by the diagram of the wing of ceropales in the plate attached to Herr Kohl's paper.

IV. GEN. SALIUS (Tab. II, Fig. 9).

Salius, pt., Fabr., Syst. Piez., p. 124, Nr. 16, 1804. *Priocnemis*, pt., Schioedte, Mon. Pomp. Kröyev, Tidsskr., I, 1837. *Hemipepsis*, pt., Dhlb., *Hym.* Eur., I, p. 462, 25, Gen. et Tab. Syn. Gen. *Pomp.*, 1845. *Homonotus*, pt., Dhlb., *ibid*, p. 441 (non p. 351), 18, Gen., 1845. *Entypus*, pt., Dhlb., *ibid*, p. 442, 19, Gen., 1845. *Pallosoma*, pt., Pel., Hist. Nat., MS., III, p. 492, 4, Gen., 1875. *Mygnimia*, pt., Smith, Cat. *Hym.* Br. M., Pt. III, p. 181, 12, Gen., 1855.

Types : *S. bicolor* and *S. punctatus*, Fabr. (Syst. Peiz., p. 124, Nr. 1, and p. 125, Nr. 3).

Eyes reaching up to the base of the maxillæ. Pronotum of very varying form and length, its posterior margin evenly transverse or arched or angular ; in many of the males it is of unusual length (*Salius*, Fabr., 1804 ; *Homonotus*, Dhlb., 1845 ; *Entypus*, Dhlb., 1845). On the metathorax, on close examination, are visible two processes ; they are placed at some distance from the base of the wing. They are often rubbed off, for one notices the pretty little pointed hollows in which they arise. Front wing with one lengthened radial cell, very frequently lanceolate in form, seldom having the apex rounded. Three cubital cells. The 2nd cubital cell receives the 1st recurrent nervure before its apex, the 3rd cubital cell, the 2nd recurrent nervure nearly in the middle. The 3rd cubital cell is trapezium-shaped or trapezoidal and somewhat larger than the 2nd. The transverse medial nervure (of the front wing) arises before the apex of the 1st submedial cell. The cubital nervure of the hind wing at its origin is received seldom in mostly after the apex of the anal cell, nearer the apical margin of the wings. Legs long, especially the tibiæ and tarsi. Claws either bearing one obtuse bent appendix as in the genus *Notocyphus*, in two portions (*Cyphononyx*, Dhlb.), or armed with one, two, or more teeth (*Hemipepsis*, Dhlb.). The tibiæ of the posterior legs angular, with in the female toothed and serrated spines. Middle segment of diverse lengths never posteriorly emarginated, in the males, with a lengthened thorax, it is likewise lengthened ; in several species of the divisions *Hemipepsis* and *Cyphononyx*, as in the species of *Pepsis*, there is an obtuse tubercle close to the stigmata. The 3rd ventral segment has, on or before the middle, a transverse impressed line.

The genus *Salius* will here, as is indicated by the sketch of the synonym given above, be taken in a wider sense than even Dahlbom's genus *Priocnemis*. I hold that the variation in the form of the claws on which was founded, for example, Dahlbom's genera *Cyphononyx* and *Hemipepsis* can only be considered useful for the establishment of groups of species all under one natural genus. Under *Salius* then the following groups can be made :—

1st Group (Subgen. *Cyphononyx*).

Claws furnished with one obtuse arched appendix on their inferior edges, the length of which makes them appear to be double. The middle segment with an obtuse tubercle always placed before the stigmata. In the inner angle of the 1st discoidal cell a wing spot is indicated, but never clearly engraved (*Cyphononyx*, Dhlb.)

2nd Group (Subgen. *Priocnemis*).

Claws with one tooth on their inferior edges. No wing-spot in the inner angle of the 1st discoidal cell or at most only an indication of such (*Priocnemis*, pt. Schioedte, Dhlb., Schenck, Taschenb ; *Priocnemis*, Thoms.).

3rd Group (Subgen. *Hemipepsis*).

Claws with two teeth on their inferior edges. The basal tooth is in many species, especially in the males, rudimentary and undetermined (in this approaching the genus *Priocnemis*). The inner angle of the 1st discoidal cell as in *Pepsis*, *Macromeris*, and *Notocyphus* engraved with a very dark wing-spot formed through the upper concave discoidal line. Middle segment mostly with an obtuse tubercle placed close before the stigmata as in the species of *Pepsis* (*Hemipepsis*, Dhlb.; *Pallosoma*, Pel.; *Mygnimia*, Smith).

4th Group.

Claws with many teeth ; on the inferior edges of the claws close to the strong curved apex spring a number of closely arranged cilia which have their apices going backwards to the claw ends. For the rest the characters as in *Hemipepsis*. (Type : *Hemipepsis heros*, Guérin, Voy. Abyss., Lefeb., VI, p. 35, 4, T. 7, Fig. 9, ♀.)

XIII. GEN. POMPILUS (Tab. II, Fig. 6).

Pompilus, pt., Fabr., Ent. Syst. Suppl., p. 246, 1798. *Sphex*, pt., Linn., Syst., Nat., I, 941, 1766. *Aporus*, pt., Spin., MS., Sig., II, p. 34,

1806. *Episyron*, pt., Schioedte, Monog. *Pomp.* Kröyer, Tidsskr. I, p. 331, 1837. *Anoplius*, pt., Pel. Hist. Nat., MS. *Hym.*, III, p. 440, 1845. *Evagethes*, pt., Pel., *Ibid*, p. 390, 1845. *Salius*, pt., Dhlb., *Hym.* Eur., I, p. 34, 18, Gen., 1845. *Homonotus*, pt., Dhlb., *Hym.* Eur., I, p. 35 (non p. 441), 1845. *Ferreola*, pt., Smith, Cat. *Hym.*, P. III, p. 167, 1885.

Types : *Pompilus viaticus*, *ursus*, Fabr., *coccineus*, Fabr., etc.

The eyes reach, as a rule, up to the base of the mandibles; only in very few cases are the cheeks developed. Forms of the clypeus, of the prothorax, and of the middle segment of extraordinary diversity. The front wing with one radial cell, which often approaches a triangular form, rarely is it lanceolate. Three cubital cells ; the 1st exceeding in size the following ones ; the 2nd is a little larger than the 3rd or equal in size to it ; the 3rd quadrangular, or triangular, sometimes also triangular and petiolated. The 1st recurrent nervure discharges itself in the middle of the 2nd cubital cell or nearer the 2nd transverse cubital nervure ; the 2nd recurrent nervure in the middle of the 3rd cubital cell, or not far therefrom. The transverse medial nervure (of the front wing), with a few unimportant exceptions, springs somewhere before the apex of the 1st submedial cell, interstitial. The cubital nervure (of the hind wing), in by far the greater number of cases, springs at or after the apex of the anal cell (*Homonotus*, Dhlb., p. 35), sometimes also before it (as in the species of *Ferreola*). Legs spined. The tarsi of the anterior legs are in the female often furnished with pectinated spines. The tibiæ of the posterior legs are cylindrical, not, as in the female of *Salius*, angular, the spines on them scattered, not serrated. The claws are toothed in the middle of their inner angles, or like as in *Salius*, Subgen. *Cyphononyx*, and *Notocyphus* in two parts by reason of an obtuse appendix. The claw-brush is either present or wanting. Middle segment posteriorly rounded, or vertically truncated, or impressed, or more frequently emarginated ; its sculpturing is very diverse. The 3rd ventral segment with few exceptions (as in species of *Homonotus* and *Ferreola*) not bearing a transverse impressed mark.

Pompilus will be treated of here in the comprehensive sense in which the genus is usually taken. I am constrained to do this by the fact, that characters which have been pointed out as separating certain

genera from *Pompilus*, have not only in the genus *Pompilus*, as I hold it, but throughout the *Pompilidæ* generally, proved, at the best, mutable. Under these mutable characters may be reckoned the form of the prothorax and middle segment, of the relative positions of the transverse medial nervure, and the 1st submedial cell in the fore wing, and of the cubital nervure and anal cell in the hind wing, and the general armature of the legs and claws. Also the *Pompilidæ* with two cubital cells, which have hitherto been known as species of the genus *Aporus*, can, according to my ideas, be classed under the genus *Pompilus*, in spite of a peculiar modification of the wing nervures, which, after all, is unessential. The following is my division of the species into natural groups :—

1st Group (*Pompilus*, Thoms.).

The transverse medial nervure of the fore wing and the cubital nervure of the hind wing interstitial. Inferior edge of the claws toothed (one-toothed). Claw-brush generally developed. The tarsi of the anterior legs (in the female) with or without pectinated spines. Posterior margin of the pronotum angular.

2nd Group (*Aporus*, pt., Tab. II, Fig. 7).

By the loss of the 2nd transverse cubital nervure, diverging from the forms of the 1st group. In other respects resembling them.

3rd Group.

The transverse medial nervure of the front wing and the cubital nervure of the hind wing interstitial. Inferior edges of the claws toothed. Claw-brush wanting. The tarsal-brush (in the female), large. Posterior margin of the pronotum arched. Antennæ short and remarkably thick.

4th Group.

The transverse medial nervure of the front wing springs in or before the apex of the 1st submedial cell, the cubital nervure of the hind wing after the apex of the anal cell. Claw toothed ; claw-brush wanting. Tarsal-brush (in the female), large. Posterior margin of the pronotum, generally arched, very seldom angular. Antennæ short and extraordinarily thick.

5th Group (*Aporus*, pt.).

By the loss of the 2nd transverse cubital nervure diverging from the forms of the 4th group. In other respects resembling them.

6TH GROUP.

The transverse medial nervure of the front wing interstitial. The cubital nervure of the hind wing arising after the apex of the anal cell. Claws toothed and possessing a claw-brush. The tarsal-brush (in the female) developed. Also the labrum (in the female) of many of the species is exerseted.

7TH GROUP.

The transverse medial nervure of the front wing interstitial. The cubital nervure of the hind wing arising after the apex of the anal cell. Claws toothed and possessing a claw-brush. Tarsal-brush (in the female) wanting. The labrum (in the female) never much exerseted.

8TH GROUP (*Aporus*, pt.)

By the loss of the 2nd transverse cubital nervure diverging from the forms of the 7th group. In other respects resembling them.

9TH GROUP.

The transverse medial nervure of the front wing and the cubital nervure of the hind wing are interstitial. Claws furnished with a curved obtuse appendix on their inferior edges, bifid. Claw-brush present or wanting. Tarsal-brush (in the female) well developed.

10TH GROUP (*Aporus*, pt., Tab. II, Fig. 8.)

Fore wing with only two cubital cells. The transverse medial nervure of the front wing interstitial. Cubital nervure of the hind wing arising after the apex of the anal cell. Claws bifid. Claw-brush wanting. Tarsal-brush developed. Antennæ often incrassate. Posterior margin of the pronotum angular. (This group, from the position of the recurrent nervures and from the closing inwards of the 2nd recurrent nervure, approaches the forms of *Pompilus* in which the 2nd and 3rd transverse cubital nervures have by degrees become united to form one single nervure. The facts can, I think, be accounted for as follows. The cubital nervures originally began to come in contact on approaching the radial cell, as, for example, in the individuals of *P. nigerrimus*, and later little by little they anastomozed against the cubital nervure in the direction of the radial nervure, until the enclosed triangular 3rd cubital cell disappeared completely.) The pedigree of this and of the following group may possibly be contained in the 12th group.

11TH GROUP (*Aporus*, pt.)

Characters as in the 10th group ; only in the *front* wing by absorption of the 2nd transverse cubital nervure one cubital cell is lost, and the posterior margin of the pronotum is arched.

12TH GROUP (*Episyron*, Schioedte).

The transverse medial nervure (of the front wing) interstitial. The cubital nervure of the hind wing arising before the apex of the anal cell. Claws in both sexes (in the male distinctly apparent) bifid, without claw-brush. Tarsal-brush developed. Antennæ in most of the species thick (*P. rufipes*, Linn., *albonotatus* v. d. L.)

13TH GROUP

(*Pomp. 6-maculatus*, Spin ; *venustus*, Wesm ; *fraterculus*, Costa).

The transverse medial nervure of the front wing and the cubital nervure of the hind wing interstitial. The 3rd cubital cell appendiculated. Claws toothed ; the claw joints furnished with a claw-brush. Tarsal-brush (in the female) developed. The middle segment prolonged posteriorly into a conical tubercle on either side.

14TH GROUP (*Aporus*, pt.).

Differs from the *Pompilus* forms of the 13th group in that the 2nd and 3rd transverse cubital nervures anastomoze.

15TH GROUP

(*Homonotus*, Dhlb., p. 35 ; *Salius sanguinolentus*, Dhlb., p. 34).

The transverse medial nervure of the front wing interstitial. The cubital nervure of the hind wing arising after the apex of the anal cell. Head posteriorly more or less excavated. Prothorax and middle segment lengthened ; the latter, as in the 13th and 14th groups, emarginated, and produced on both sides into cone-shaped projections. Claws with an obtuse appendix on their inner angles. Claw-brush wanting. Tarsi of the anterior legs without ciliated spines. 3rd ventral segment with or without a transverse impression.

16TH GROUP (*Ferreola*, pt., Smith).

The transverse medial nervure of the front wing and the cubital nervure of the hind wing interstitial. Claws toothed, seldom bifid ; claw-brush developed or wanting. Tarsi of the anterior legs not furnished with ciliated spines. Middle segment posteriorly vertically

truncated, impressed, or emarginate, and the sides frequently provided with an obtuse tooth or hook, 3rd ventral segment not bearing any transverse impression. Abdomen towards the apex not compressed laterally.

17TH GROUP (*Ferreola*, pt., Smith).

The transverse medial nervure of the front wing interstitial. Cubital nervure of the hind wing arising on the medial nervure before the apex of the anal cell. Claws in two portions (bifid). Claw-brush developed ; tarsi of the anterior legs with or without ciliated spines. The eyes frequently not reaching the base of the mandibles. 3rd ventral segment not bearing any transverse impression. The abdomen compressed laterally. Middle segment as in the foregoing group.

18TH GROUP (*Pedinaspis*, Kohl.).

The transverse medial nervure (of the front wing) interstitial, or arising well before the apex of the anal cell. Cubital nervure of the hind wing frequently interstitial, in a few cases arising a little after the apex of the anal cell. Claws toothed, very seldom bifid. The joints of the tarsi of the anterior legs thick and without ciliated spines, 2nd, 3rd, and 4th short. Head flat, clypeus generally vertically flat, seldom forming a projecting plane. Pronotum of diverse forms not unfrequently of remarkable length (*P. cubensis*, Cr.), very commonly vertically truncated in front. Middle segment rounded posteriorly, sometimes sloping at a sharp angle, or flatly impressed or even emarginate. The abdomen, at least towards its apex, visibly compressed laterally (Type : *Pompilus operculatus*, Klug.).

The following is a list of some of the *Pompilidæ*, in my collection, which I have been unable to identify or compare with already described species, and I have come to the conclusion that they are as yet undescribed.

1. MACROMERIS VIOLACEA, Pel.

MACROMERIS VIOLACEA, Pel., Hist. Nat. MS., *Hym.*, III, p. 464.

HABITAT : India, Burma, Tenasserim, and the Malay Archipelago.

The characters of the genus defined by Kohl are well marked in this species, more especially the unarmed tibiæ bearing neither spines nor hairs, the cone-shaped posterior portion of the mesosternum, the thickened coxæ, trochanters, and femora, as also the sharp denticulated inferior edge of the last.

This lovely species is fairly common in Tenasserim, and is one of the few *Pompilidæ* I have noticed as occasionally coming into buildings and houses in the jungle. In a "zayat" (rest-house) near the large village of Kawkareick in the Haungdraw valley, I found its nest in the latter end of May, and watched a female carrying a huge hairy spider to it. The nest was in a crevice between one of the wooden posts and the side walling of the rest-house. I was only passing by, and was unfortunately pressed for time, and so I am unable to record whether the insect subsequently closed up the hole with earth.

2. PSEUDAGENIA ÆGINA, Smith.

Pseudagenia ægina, Smith, Proc. Linn. Soc., II, 94, 9.

Habitat: Borneo (Sarawak), Tenasserim (Yunzalin valley, Ataran valley).

I found this pretty and well-marked little species frequenting the bushes and moving over the stones in a quick excited way in the dry beds of streams in the hot weather.

The clypeus is oval, broader than long, and in the female produced sharply to a point; in the male it is transversely truncated anteriorly. The face in front, the coxæ of all the legs, and the abdomen are in fresh specimens covered by a glistening sericeous pile in fine contrast to the dull red of the thorax.

3. PSEUDAGENIA ALARIS, Saussure.

Agenia alaris, Sauss., *Hym.* d. Novara Reise, 52.

Habitat: Ceylon, Tenasserim (Thaungyin valley).

Rare. I have only come across it on one occasion, when I caught some five or six specimens in a deserted garden close to a village in the Thaungyin valley. They were flying about and alighting every now and then on the broad leaves of a species of cucumber.

4. PSEUDAGENIA BIPENNIS, Saussure.

Agenia bipennis, Sauss., *Hym.* d. Novara Reise, 52.

Habitat: Ceylon, Tenasserim (Ataran valley).

Rare. I have one specimen, a male, which flew into my tent while in camp one day in the Ataran valley.

5. PSEUDAGENIA TINCTA, Smith. Pl. II, Fig. (nest).

Pompilus tinctus, Smith, Cat. *Hym.*, MS., B. M., III, p. 145, 132.

Habitat: India, Burma, Tenasserim.

This is the commonest of the genus *Pseudagenia*, and is generally distributed. I have specimens from all parts of Tenasserim, also from the Pegu Yoma and from near Rangoon.

Mr. Cameron (Hym. Orient., p. 441) says he has failed to notice in his specimens any green tinge about the head and thorax. In all the specimens I have taken the fine silky pile on the head and thorax is quite markedly of a beautiful greenish silvery hue.

I have more than once found the nest of this species. One nest I found in July was made in the hollow end of a bamboo projecting from the thatch of a ruined zayat or rest-house in the Domdami valley. A reference to the figure (Pl. II, Fig. 1) will show that the nest consists of a series of oval, thin, convex shells of clay, not unlike those made by the different species of *Eumenes*, only shallower, not so high. These shells were filled with spiders (*Epeira*). It was a remarkable fact that at least a dozen of the *Pseudagenia* were flying to and from the nest. In about a quarter of an hour I had caught nine of them. To a certain extent therefore this species, unlike any other member of the family *Pompilidæ* known to me, nests in societies. A still more remarkable fact was that among my captures I found not only females, but males (known at a glance by the much shorter abdomen and heavier and longer thorax in proportion). Half an hour's careful watching of the individuals left uncaught, however, showed me that it was only the females that were busy making the cells and collecting the spiders to provision them with. The males simply flew around settling occasionally on the thatch of the zayat close by. I took the nest cutting off the end of the bamboo. In November four of the cells hatched out, one insect each, all females. The rest of the cells have remained intact, not even yielding any parasite, such as *Stelis*, which attaches itself to the genus *Megachile*, or *Chrysis*, which I have seen attending *Rhynchium* and *Eumenes*. From the circumstance that I have found *Pseudagenia tincta* making its nests in February and March and again in July, I presume it is double-brooded.

6. PSEUDAGENIA BLANDA, Guérin.

Pompilus blandus, Guér., Voy. Coq., Zool., II, pt. 2, p. 260.

Habitat : India, Malacca, Borneo to Flores, Burma, Tenasserim.

This species is almost equally common as the last. It comes into houses and nests in the chinks and crevices in the wood walls, storing its nests invariably with the smaller *Lycosa* or jumping spiders. I saw a female one morning in the verandah of my house in Moulmein in hot combat with a spider rather larger than what this *Pseudagenia* generally

attacks. The two creatures rolled and struggled one over the other for a good five minutes, the spider dodging and biting and the *Pseudagenia* trying vigorously to sting, and so render its opponent insensible. At length the wasp managed to succeed, the spider lay helpless and quivering. Then Mrs. *Pseudagenia* (for it was a female) paraded round in a sort of triumph, flirting her head and antennæ, and finally picking up the spider between her fore and intermediate legs flew off to a crevice at the corner of the ceiling. This species, I believe, has also two broods during the year. I have found nests in January and again in June.

7. PSEUDAGENIA HYPSIPYLA, n. sp.

HABITAT : Tenasserim.

FEMALE : Length 16 m.m. ; expanse 28 m.m.

MALE : Unknown.

DESCRIPTION : ♀. Head black, covered with a fine, but not dense, grey pile ; mandibles black, their tips castaneous ; clypeus transversely oval, convex, its anterior margin rounded ; antennæ black, a small blunt tubercle above their base of insertion ; eyes distinctly converging above, a shallow sulcation from the anterior ocellus to the base of the antennæ ; back of the head slightly emarginate. Thorax black, covered with a thin silvery pile most dense on the sides of the metathorax ; prothorax anteriorly arched, posteriorly sub-angular ; mesothorax short, its posterior margin transverse, scutellum and proscutellum raised, gibbous ; metathorax very slightly sloping, its sides rounded and bulging, the dorsal surface rugose with fine transverse striations, and bearing an indistinct longitudinally impressed central line not reaching its apex ; wings yellowish hyaline, a dark fuscous fascia covering the base of the radial cell, and passing through the 2nd and 3rd cubital cells to the 3rd discoidal cell, nervures and tegulæ dark brown, the transverse medial nervure of the front wing arises almost 2 m.m. before the apex of the 1st submedial cell, and the cubital nervure of the hind wing the same distance after the apex of the anal cell ; legs black, covered with cinereous pile, the femora of the posterior legs bright red, their apex black, tibiæ and tarsi of the intermediate and posterior legs with minute spines, claws toothed on their inferior edges. Abdomen black with a thin sericeous grey pile, which has a tendency to form submarginal bands on the segments, like in *Tachytes* and

Larrada, posterior margins of the segments narrowly testaceous, the 1st segment petiolated, the 2nd lengthened, the anal segment with a few fuscous hairs at the apex, the whole abdomen perceptibly vertically compressed.

This species I believe has been hitherto undescribed. In general appearance it resembles *P. tincta*, from which, however, it can be distinguished at a glance by the considerably larger and more level metathorax, and from its having a fascia across the wings. It is not *P. bipennis*, Saussure, which is a much smaller insect and has "*ore clypei marginibus genis ano pedebusque* 1, 2 *antice luteis.*" *Pseudagenia hypsipyla* is rare, and I have hitherto only found it in thick bamboo jungles. Like the rest of the species of the family it seems a restless creature of quick flight, often walking rapidly among fallen leaves and hunting them over and under diligently.

8. CEROPALES ORNATA, Smith.

CEROPALES ORNATA, Smith, Cat. *Hym.*, MS., B. M., III, p. 179.

HABITAT : India, Burma, Tenasserim.

It is rather remarkable that this is the only species of *Ceropales* I have come across in Burma. It is generally distributed but rare.

9. SALIUS FLAVUS, Fabricius.

SPHEX FLAVA, Fabr., Ent. Syst., II, p. 217, 80. Drury, Ill. Exot., MS., III, t. 42, f. 4, ♀.

POMPILUS FLAVUS, Fabr., Syst. Piez., p. 197, 51. Pel. Hist. Nat., *Hym.*, III., p. 430, 21.

HEMIPEPSIS FLAVA, Dhlb., *Hym.* Eur., I, p. 123 and p. 462.

HABITAT : India, Burma, Tenasserim.

I am somewhat puzzled as to what the true *Sphex flava* of Fabricius is. The insect I identify as it, agrees best with Dahlbom's description of *Hemipepsis flava*. It is one of the commonest of the *Pompilidæ*, and very much affects the grassy sides of roads, hunting about among the tufts of grass and herbage. In May I found one digging vigorously into the bank of the drain along the side of the high road between Moulmein and Amherst. It had not dug far, and being disturbed by my approach flew away, and did not return again, though I waited and watched for nearly an hour.

10. SALIUS SEVERUS, Drury.

SPHEX SEVERUS, Drury, Ill. Exot. Hist., III, t. 42, f. 4.

HABITAT : India (Drury, Smith), Burma, Tenasserim.

I have compared specimens of a very large species, which is found not unfrequently in thick bamboo jungle on the Pegu Yoma and throughout Tenasserim, with Drury's figure, and they are identical. I once got stung by one of these insects on my thumb, and my whole hand and my arm to the elbow were quite numb for a couple of hours.

11. SALIUS INTERMEDIUS, Smith.

MYGNIMIA INTERMEDIA, Smith, Ann. and Mag. Nat. Hist., Ser. IV, Vol. XII (1873), p. 257.

HABITAT: N. India, Ceylon (Smith), Tenasserim.

A species which agrees well with Smith's description of this insect is not uncommon in April and May and again from September to November on the Dawnat range in Tenasserim at from 1,000 feet to 5,000 feet elevation.

12. SALIUS AUDAX, Smith.

MYGNIMIA AUDAX, Sm., Cat. *Hym.*, MS., B. Mus., Pt. III, p. 182, 4. Bingh., Jour. Bomb. Nat. Hist. Soc., Vol. V, p. 239.

HABITAT: Sylhet (Smith), Kumaon (Bingham), Tenasserim.

I have once met with this handsome species in Tenasserim on the Taungjah pass (1,000 feet) on the Kawkareik and Myawaddy road crossing the Dawnat range.

13. SALIUS HERCULES, Cameron.

SALIUS HERCULES, Cam. *Hym.* Orient. Mem. and Proc. Manchester Lit. and Phil. Soc. 4th Ser., Vol. IV, Pt. III, p. 447.

HABITAT: Naga Hills (Cameron), Thaungyin Valley, Tenasserim, Pegu Yoma.

This species must be rare. I have only twice come across it, both times in dense forest on low hilly country.

14. SALIUS ELIZABETHÆ, n. sp., Pl. I, fig. 9.

HABITAT: Hills of Tenasserim.

FEMALE: Length 43 to 46 m.m., expanse 83 m. m.

MALE: Length 38 m.m., expanse 80 m. m.

DESCRIPTION: ♀. Head clothed with dark golden pubescence; mandibles ferruginous-red, their tips black: labrum slightly produced; clypeus convex, twice as broad as high, its superior margin bisinuate, the anterior transversely truncate; antennæ convolute, ferruginous-red, a shallow sulcation around the base at their insertion, this sulcation coloured brown and covered with scattered punctures; eyes arched

distinctly approaching at the vertex, front slightly concave and having a short deep impressed line leading from the anterior ocellus to the base of the antennæ, the space between the two posterior ocelli equal to the space between either and the nearest orbit, but greater than that between them and the anterior ocellus; head posteriorly slightly hollowed out. Thorax ferruginous-red, the pubescence on the pro- and mesothorax, the tegulæ, the scutellum, proscutellum, coxæ, trochanters, and the outside of the tibiæ and tarsi rich glistening golden-ferruginous, the mesothorax and femora reddish without pubescence; the pronotum square in front, the shoulders projecting, its posterior margin arched; the mesonotum slightly convex, bearing a longitudinally impressed line on either side; the metanotum transversely striated, rounded, gently sloping to the apex, its sides bulging, the side tubercles and stigmata well marked and prominent; the wings deep reddish-yellow, paling towards the margins, which are broadly but very lightly infuscated, the nervures ferruginous; the transverse medial nervure of the front wing and the cubital nervure of the hind wing both arise respectively well before the apex of the 1st sub-medial cell in the one case and the apex of the anal cell in the other case, the 1st recurrent nervure unites with the 2nd transverse cubital nervure (interstitial), the latter being angled just above the apex of the 2nd cubital cell; the 2nd recurrent nervure is received in the 3rd cubital cell at a point about $\frac{1}{3}$rd the length of the base from its inner angle; a clear hyaline spot at the inner angle of the 1st discoidal cell; legs long, the tibiæ and tarsi of the intermediate and posterior legs strongly spined, the former grooved with a serrated angular edge, the claws toothed, abdomen black obscurely puniose, the 3rd segment having a transverse impressed mark, the anal segment studded with a few fuscous hairs.

The ♂ resembles the ♀, but is slighter and smaller; the antennæ are arched slightly, not convolute, and subfusiform; the legs are less spinous, and the abdomen somewhat compressed vertically.

This insect, though closely resembling *S. aureosericea*, Guérin, cannot be that species, of which Guérin says: "L'abdomen est d'un noir obscur avec les deux derniers segments garnis d'un duvet doré."

It is not uncommon here in the dense forests on the higher ranges at from 1,000 to 4,000 ft. elevation. In May I chanced on one, a ♀,

carrying a huge grasshopper clasped tightly between its forelegs. It passed me flying fairly fast and pitched on the trunk of a large tree, up the bole of which it proceeded to laboriously climb with its burden. Two or three times, owing to the tree having a smooth bark, it slipped back, but finally, having got up about 25 ft., it disappeared into a hole (apparently the deserted nest-hole of a wood-pecker). I am sorry the tree was much too large to fell easily, or I should like to have got the nest.

The figure in the plate, though perfectly correct in drawing, being that of a ♀, ought to show the antennæ convolute, not arched. The hyaline spot in the inner angle of the 1st discoidal cell has also been omitted.

15. SALIUS INDICUS, Cameron, Pl. I, fig. 10.

SALIUS INDICUS, Cam. *Hym.* Orient. Mem. and Proc. Manchester Lit. and Phil. Soc., 4th series, Vol. IV, pt. III, p. 448.

HABITAT: Tavoy (Cameron), Tenasserim generally.

This very beautiful species is common throughout the hill jungles in Tenasserim from May to October. At first sight it somewhat resembles, and might be mistaken for, *S. læta*, Smith, but apart from the fact that in *S. læta* the whole head and the thorax anteriorly are reddish-yellow, while in *S. indicus* only the antennæ are yellow, the rest of the head and the thorax being entirely black, the two insects differ in structure, *S. indicus* being stouter built and larger than one (for there are two, *vide infra*) variety of *S. læta*, and longer and less compact than the other variety.

I have hunted high and low, and have watched a ♀ of this species for hours, without having yet chanced on its nest or seen what it provisions it with.

16. SALIUS LÆTA, Smith.

MYGNIMIA LÆTA, Sm., Ann. and Mag. Nat. Hist., Ser. IV, Vol. XII, p. 257 (1873).

HABITAT: Burma (Smith), Tenasserim.

It is remarkable that there seem to be two varieties of this species absolutely indistinguishable except in size, and in the arrangement of the nervures of the hind wing. The large variety is perhaps the more common and measures ♀ ♀ 22 to 24 m.m., ♂ ♂ 17 to 21 m.m. in length. It is a much stouter, more robust insect than the other. The

cubital nervure of the hind wing arises 2 m.m. before the apex of the anal cell. The smaller variety is a slight elegant little insect measuring ♀ ♀ 16 to 18 m.m., ♂ ♂ 14 to 17 m.m. (in this agreeing with *S. lœta* (vera) as described by Smith). The cubital nervure of the hind wing springs exactly at the apex of the anal cell. I do not think the two forms can be separated.

17. SALIUS SÆVISSIMA, Smith.

MYGNIMIA SÆVISSIMA, Sm., Ann. and Mag. Nat. Hist., Ser. IV, Vol. XII, p. 256 (1873).

HABITAT : India, Bombay Presidency (Smith), Tenasserim.

A species which for the present I identify as this occurs somewhat unfrequently in May and June along the roads and in the open patches of jungles on the Dawnat range. The Tenasserim insect differs from the description and from a Bangalore specimen of this species in my collection in having the coxæ and trochanters yellow anteriorly, instead of all black.

18. SALIUS CONVEXUS, Bingham.

PRIOCNEMIS CONVEXUS, Bingh., Jour. Bomb. Nat. Hist. Soc., V, p. 237.

HABITAT : Ceylon, Tenasserim.

This species belongs to Kohl's *Hemipepsis*, not *Priocnemis* group. I described this species from Ceylon in 1890. Since I have found it occur commonly in the more open and dry jungles in Tenasserim.

(*Salius—Priocnemis* group.)

19. SALIUS MADRASPATANUS, Smith.

POMPILUS MADRASPATANUS, Sm., Cat. *Hym.* M. S. B. M., Pt. III, p. 144, 130.

HABITAT : Madras, Nicobar Islands (Smith), Burma, Tenasserim.

This species is remarkably like *Macromeris violacea* ; it is common, and I have found its nest in September, mere burrows in the wall of a deserted dry well, which it had stored with small crickets.

20. SALIUS PEREGRINUS, Smith.

PRIOCNEMIS PEREGRINUS, Sm., Tran. Ent. Soc., 1875, Part I, p. 37.

HABITAT : India (Barrackpur), Sumatra, China (Hongkong), *teste* (Smith), Burma, Tenasserim.

This is one of the very commonest of the *Pompilidæ* in Tenasserim, and, unlike *S. madraspatanus*, makes its nests in holes in trees, occasionally

in a bamboo, storing them with those soft-bodied spiders that live in the rolled up margins of leaves. It is double-brooded ; I have found nests in June and again in November.

21. SALIUS VERTICALIS, Smith, Pl. I, fig. 5.

PRIOCNEMIS VERTICALIS, Sm., Proc. Linn. Soc., II, 94, 6.

HABITAT : Borneo, Malacca (Smith), Tenasserim.

This well-marked species is rare ; I have only twice met with it. In September on a jungle road I found a ♀ carrying cock-roaches to a hole in a tree. Subsequently in May I procured a ♂ on the flowers of *Acacia pennata*. The ♂ has not previously been described.

Length, ♂, 15 m.m., expanse 37 m.m.

DESCRIPTION : ♂, Head black, mandibles yellow, their tips black clypeus and sides of the face as far as the vertex broadly yellow, the back of the head, the vertex, and front, as far as the antennæ, black, with scattered black hairs, and in certain lights a thin golden pubescence, a streak behind the eyes yellow, the latter arcuate, closer above than below ; clypeus convex, transversely oval, its anterior margin truncated ; antennæ sub-fusiform, black, the scape with a spot of yellow below. Thorax and abdomen black, the prothorax with a broad band and the mesothorax with a square spot along their posterior margins, and the scutellum and the proscutellum with a central spot chrome-yellow ; the metathorax convex sloping abruptly towards the apex, which latter is almost vertically truncated ; the scutellum and post-scutellum gibbous cone-shaped, the dorsal surface of the metathorax finely rugose, clothed with scanty fuscous pubescence, the false stigmata and tubercles on the sides well-marked and prominent ; wings golden yellow of a deeper tint than in the ♀, their tips and outer margins broadly but lightly infuscated, the tegulæ and nervures dark ferruginous-brown : in the fore wing the transverse medial nervure springs well before the apex of the 1st submedial cell, the 1st recurrent nervure is received in the 2nd cubital cell close to its apex, the 2nd recurrent nervure in the 3rd cubital cell well before its middle : in the hind wing the cubital nervure is interstitial. Legs long, slightly spinose, the coxæ trochanters and femora black, the remainder of the legs chrome-yellow, the claws black, abdomen somewhat vertically compressed, the 2nd segment remarkably long.

The nest mentioned above, when I caught the ♀, was unfinished, but some seven or eight unfortunate cockroaches were stuffed tightly in, and were all semi-unconscious but still living.

The markings on the head and thorax and the colour of the legs of the ♀ depicted in the plate are shown of a reddish-yellow instead of a clear chrome-yellow.

22. POMPILUS BRACATUS, Bingham.

Pompilus bracatus, Bingh., Jour. Bom. Nat. Hist. Soc., V, 236.

Habitat: Burma, Tenasserim.

Since describing this species in 1890, I have found it common in the more open forest along the foot of the Dawnat range in Tenasserim. In coloration it curiously resembles *Salius* (*Priocnemis*) *peregrinus*, Smith.

23. POMPILUS ANALIS, Fabricius.

Sphex analis, Fabr. Ent. Syst. II, 209, 42.

Habitat: India generally, Burma, Tenasserim, Malacca, &c.

This widely distributed species is one of those which often come into houses hunting for the smaller *Lycosa* or wolf-spiders, with which it stores its nests.

24. POMPILUS UNIFASCIATUS, Smith.

Pompilus unifasciatus, Sm. Cat. *Hym.*, MS., B. M., Pt. III, p. 145, 133.

Habitat: East India, Sumatra, North China (Smith), Burma, Tenasserim.

This common species is rather variable in colouring. The form got in Pegu has the head and thorax reddish-yellow; the Tenasserim form has the same parts more or less variegated with black. One specimen I procured on the Dawnat range is a most lovely insect, having the yellow and black on the pro- and mesothorax sharply defined, and the metathorax on its dorsal surface covered with rather long glistening golden pubescense.

25. POMPILUS HONESTUS, Smith.

Pompilus honestus, Sm., Cat. *Hym.* Ins. B. M., Pt. III, p. 144, 129.

Habitat: India, Burma, Tenasserim.

This species is rare; I have myself only procured two specimens.

26. POMPILUS CAMERONII, n. sp., Pl. I, fig. 6.

FERREOLA FENESTRATA, Bingh. (non Smith), Jour. Bomb. Nat. Hist. Soc., Vol. V, 239, 10. Cameron, *Hym.* Orient. Mem. and Proc. Manchester Lit. and Phil. Soc., Ser. IV, Vol. IV, Pt. III, p. 460.

HABITAT : Burma, Tenasserim.

In 1890 I identified this species with Smith's insect. Mr. Cameron (loc. cit.) from the description recognized it as new. I have since procured specimens of the true *P. fenestrata*, both from India and Burma, and find on comparison that the red mesothorax in *P. cameronii* is a constant and well marked difference. I have ventured to name the species after Mr. Cameron.

27. POMPILUS ILUS, Bingham, Pl. I, fig. 7.

FERREOLA FASCIATA, Bingh., Jour. Bomb. Nat. Hist. Soc., Vol. V, p. 241,12.

HABITAT : Burma, Tenasserim.

I have ventured to re-name this species as I find the name *fasciata* pre-occupied (Smith, Cat. *Hym.* Ins. B. M., Pt. III, p. 169, 8).

This species seems always to occur in dense forests by streams, In May I procured both ♂♂ and ♀♀ by the bank of a mountain torrent on the Dawnat range at about 1,500 feet elevation.

The ♂ resembles the ♀ but is smaller (16 m.m., ♀ 23. m.m.); the deep blue-black of the abdomen is duller, being only just visible in certain lights, the wings are infuscated further towards the base, and are longer in proportion than those of the ♀.

The above 27 species are all the *Pompilidæ* from Tenasserim in my collection which I have been able to identify. I possess examples of at least twice that number of species which I have not yet been able to compare with descriptions and work out.

Family *SHEGIDÆ*, Leach.

28. SPHEX REGALIS, Smith, Pl. I, fig. 11.

CHLORION REGALIS, Sm., Ann. Mag. Nat. Hist., Ser. IV, Vol. XII, p. 291 (1873).

HABITAT : Afghanistan and Sind (Smith).

A beautiful specimen of this species was kindly sent to me by Mr. Cumming of the Telegraph Department from Karachi. It is a lovely insect, and I regret the plate does not give much idea of the gorgeous purple tints of the wings, metathorax and abdomen, the rich

colouring of which is in fine contrast with the dull brick red of the head and anterior parts of the thorax.

29. SPHEX FULVO-HIRTA, Bingham. Pl. I, fig. 8.

SPHEX FULVO-HIRTA, Bingh, Jour. Bomb. Nat. Hist. Soc., Vol. V, p. 242, 14.

HABITAT : Ceylon.

I take this opportunity to figure the above species described by me (loc. cit.) in 1890.

30. SPHEX MAIA, n. sp.

HABITAT : Tenasserim.

FEMALE : Length 16 m.m., expanse 26. m.m.

MALE : Length 16 m.m., expanse 29 m.m.

DESCRIPTION. Belongs to Cameron's section IV. "Tarsal claws with two teeth (*Sphex, sensu str.*)."

Head black, opaque, finely punctured, covered with soft scattered grey hairs, the clypeus and cheeks with silvery pubescence ; the clypeus sub-triangular, slightly convex, its anterior margin transverse ; mandibles black ; antennæ arched, the scape short, the 2nd and 3rd joints sub-equal ; the ocelli very small and inconspicuous, placed in a curve on the vertex. Thorax black, finely punctured, covered with thin grey pubescence, that on the proscutellum short, dense, and silvery ; the mesothorax indented anteriorly in the centre ; the metathorax evenly rounded, the scutellum and proscutellum not raised and the latter not indented in the middle as in so many species. The wings hyaline, the anterior wings with a fuscous cloud beyond the radial and 3rd cubital cells not coming lower than level with the base of the latter, the nervures ferruginous, the tegulæ black and shining. Legs black, the apex of the tibiæ of the posterior legs clothed with rich golden pubescence on the inner side. Abdomen black, very finely punctured, the 2nd segment dark blood red, the rest narrowly margined with testaceous brown.

The ♂ resembles the ♀, but has larger wings and a more lengthened petiole.

This well marked little species is very common at the beginning of the rains on the flowers of *Acacia pennata*.

Family *BEMBECIDÆ*, Westwood.

This family, so far as I know, is represented by several species in Burma and Tenasserim. Of these three have not as yet been described.

31. BEMBEX TREPANDA, Dahlbom.

BEMBEX TREPANDA, Dahlb., *Hym.* Eur., I, p. 181.

HABITAT: India (Dahlb.), Burma, Tenasserim.

Fairly common in the plains during the hot weather. Like others of the family it is very often found frequenting flowers.

32. BEMBEX FOSSONUS, Smith.

BEMBEX FOSSONUS, Sm., Jour. As. Soc. Beng., Vol. XLVII (1878), Pt. II, p. 168, 7. Bingh., Jour. Bomb. Nat. Hist. Soc., Vol. V, p. 243.

HABITAT : Burma, Tenasserim.

This species as mentioned by me (loc. cit.) is also common.

33. BEMBEX WESTONII, n. sp. Pl. I, fig. 1.

HABITAT : Salween Valley, Tenasserim.

FEMALE : Length 22 m.m., expanse 39 m.m.

MALE : Unknown.

DESCRIPTION : ♀. Head black, mandibles yellow, their tips black, labrum clypeus, and front as high nearly as the vertex of the head, the cheeks and the scape of the antennæ in front pale wax yellow; two large spots at the base of the clypeus, a spot above them between the insertion of the antennæ, a spot at the apex of the scape and the flagellum of the antennæ black, the top of the head and occiput clothed with fuscous hairs, which are rather dense and long behind, the clypeus convex semicircular above, its anterior margin almost transverse. Thorax black, minutely and densely punctured, pubescent posteriorly; the prothorax with a broad yellow posterior margin; the mesothorax slightly convex; the metathorax short, square, and posteriorly vertically truncated; the sides of the thorax variegated with dark brick red, the pectus black; the wings hyaline and iridescent, tegulæ and nervures dark brown; legs yellow, the under side of the coxæ, trochanters, femora, tibiæ and tarsi of the anterior legs and the same parts except the tarsi of the intermediate and posterior legs streaked with black, the anterior tarsi armed on the outside with ciliated spines, the claws yellow, their tips black. Abdomen black, finely punctured, pubescent, in certain lights it is seen to be covered with very short rather sparse stiff black recumbent hairs; the 1st and 2nd segments bear a large yellow irregular macula on either side, the following segments except the anal, with biarcuate central

yellow bands ; the band on the 3rd segment is interrupted in the centre on the dorsal surface, and the anal segment is black with a few stiff black hairs studding the apex ; the macula on the anterior segments and the bands on the others are indistinctly stained with red anteriorly.

This species was first procured and given to me by Mr. A. Weston, Deputy Conservator of Forests, who informed me that he had found its nest also. As the nesting habits of all the *Bembecidæ* seem alike, and I myself found the species next described nesting, I have given all the information I am possessed of below.

This species seems excessively rare ; beyond the specimen kindly given me by Mr. Weston and one in his collection I have seen no others.

34. BEMBEX HESIONE, n. sp.

HABITAT : Maulmain, Thaungyin Valley, Tenasserim.

FEMALE : Length 24 m.m., expanse 37 m.m.

MALE : Unknown.

DESCRIPTION : ♀. Head black, labrum yellow, mandibles yellow, their tips black, the clypeus, the cheeks behind the eyes, the lower half of the front, a heart-shaped spot on the forehead, and a line, not reaching the vertex, on the inside of the orbits, yellow ; two irregular spots at the base of the clypeus, a spot above them on the short carina between the antennæ, and the flagellum black ; the scape in front and at the base above yellow ; the ocelli almost aborted, placed on a sort of raised platform between two shallow sulcations which run down on either side of the front almost to the base of the antennæ ; the vertex and back of the head fringed with soft dark brown and the cheeks and chin below with silky white hairs. Thorax black, finely punctured, indistinctly pubescent, the posterior face of the metathorax, which is vertically truncated, covered with a short scanty white down, prothorax yellow, the centre anteriorly and two spots on the shoulders black ; the posterior margin of the mesothorax transverse ; the scutellum and postscutellum have curved submarginal yellow bands, and the metathorax a yellow streak extending from the anterior angles, which widens out inwardly and nearly meets in the middle, where it is divided by a fine impressed line. Posterior shoulders of the metathorax produced and sharply angular, yellow, which

colour extends on to the posterior face of the metathorax ; the sides of the thorax variegated black and yellow, the pectus obscurely brownish with lateral black macula, the brownish portion transversely striated. The wings hyaline and iridescent, the tegulæ and nervures dark brown. The legs yellow, streaked with black on the coxæ, trochanters, femora and tibiæ above and below, tarsi and claws yellow, the former with ciliated ferruginous spines, the latter with their tips black. Abdomen black with a purple gloss, minutely and finely pitted, and seen in certain lights to be covered by short rather sparse recumbent black hairs ; the 1st segment with an elongated triangular macula on either side, the 2nd to the 5th segments with biarcuate submarginal bands of the same colour, the bands on the 2nd, 3rd, and 4th segments have in the middle on either side an oblong black macula, the anal segment and the whole ventral surface of the abdomen black. All the segments, both above and below, are narrowly edged piceous.

The first time I came across this species was in September on a road near Maulmain. She, for it turned out to be a ♀, was flying with a large blue-bottle fly tightly clasped between her forelegs. Watching her carefully I saw her enter a burrow in the side of the ditch by the road. Examining it I found the soil was sandy and the burrow not deep, so in order to get a view of the interior of the nest I began gently to enlarge the entrance. As I removed the soil the *Bembex* flew out and, after buzzing around for a few seconds, went off. The nest hole was sunk obliquely into the ground, and was about 11 inches long by about ½ inch in diameter, slightly larger or bulbous at the end. A heap of dead blue-bottle flies in various stages of decay lay piled on the floor of the nest, and one yellowish fleshy grub about ⅓rd of an inch long struggled in and out among them battening on the half putrid mass.

The smell was most offensive. While I was examining the nest the ♀ returned with another blue-bottle. She came straight for what had been the entrance, but puzzled apparently by the change in its size, kept hovering about buzzing loudly. Finally she alighted, walked to the end of the nest and deposited the fresh fly and, after parading around for a few seconds, flew off. I then caught her as I noticed she was different from the ordinary *Bembex fossorius* which is the common species here. Mr. Weston had told me that the

Bembex, whose nest he had found, was, at the time he chanced on it, feeding its grub in the same way as I now observed this *Bembex* doing, but as the proceeding was so opposed to all the previously observed habits of the *Fossores* I felt inclined to think he had been mistaken. Here, however, was strong confirmation of the fact. And a wonderful fact it is that the *Bembecidæ* of all the fossorial *Hymenoptera* should be the sole insects which, like the social bees, continually tend and feed their grubs after they are hatched. I do not know whether the *Bembecidæ* in other countries have the same habit. Judging from the following statements by Kirby and Packard, I should say not invariably. "These insects form their burrows in the sand, scratching a hole with their fore-feet like a dog, as observed by Sir S. S. Saunders, in the Ionian islands, and lay up a store of *Diptera* or *Hymenoptera* which they sometimes capture on the wing and sometimes fairly stalk down; then they deposit their eggs and *close up the hole*." (Kirby, Text-book of Entomology, p. 123.)

"The female Bembex burrows in sand to a considerable depth burying various species of *Diptera* (*Syrphidæ*, *Muscidæ*, &c.) and depositing her eggs at the same time in company with them, upon which the larvæ when hatched subsist. When a sufficient store has been collected the parent closes the mouth of the cell with earth." (Packard: Guide to the study of Insects, p. 164.) On the other hand confirmation of the facts noticed by Mr. Weston and myself is given by Professor Duncan in "Transformations of Insects," p. 239, from which I extract the following:—

"The examples we have offered showing the habits of the fossorial *Hymenoptera* have a certain sameness, for in every instance the female builds the nest, fills each cell with victims for the future larva, lays an egg close by them and shuts up the habitation, and then dies without ever seeing its progeny."

"But M. Fabre, of Avignon, has described the habits of *Bembex vidua*, which are certainly most remarkable and suggestive, and probably very rare, in the history of the *Hymenoptera*. In this species the female does not close up the cell, but penetrates into it every day, carrying a fresh victim for the larva; and it always chooses a fly. Here is a case of a female insect caring for its larva which it sees, and which it notices to eat and care for food, so that

the daily visit becomes a pleasure and a duty according to the usual laws of maternity. Of course the larvæ of this species run great risks, for their cell remains unclosed, and carnivorous insects may enter in and destroy them. Moreover the mother may be taken and killed herself, and then as no food would be forthcoming they would die from starvation. There is no doubt that the habits of this species cast a light upon those of the insects which only provide one store of provisions and then close their nests ; for it is not difficult to imagine that if the egg of a former *Bembex vidua*, the predecessor of all these, should not happen to have hatched at the second visit of the mother, she would have closed the hole and left it uncared for, not seeing the use of troubling herself to no purpose."

35. BEMBEX OVANS, n. sp.

HABITAT : Tenasserim.

FEMALE : Length 22 m.m., expanse 34 m.m.

MALE : Length 21 m.m., expanse 36 m.m.

DESCRIPTION : ♀. Head black, back of the head, vertex, upper portion of the face, cheeks and chin pubescent; labrum, mandibles, clypeus, a triangular mark above the clypeus, and the scape of the antennæ chrome-yellow ; the tips of the mandibles, a spot on the scape, and the flagellum of the antennæ above black, the under side of the flagellum and a broad streak behind the eyes not reaching the vertex fulvous, the clypeus convex, broader than long, the anterior border deeply emarginate in the centre, the sides vertical, a vertical short though well marked raised carina between the base of the antennæ. Thorax black, finely pitted but shining, slightly pubescent, the pubescence on the metathorax long and soft ; the prothorax, the scutellum and post scutellum posteriorly margined with chrome-yellow, the metathorax posteriorly truncated, the sides produced into obtuse tubercles, these latter with a band above them running from the anterior angles of the metathorax and nearly meeting in the centre chrome-yellow ; sides of the thorax yellow, pectus black : wings hyaline, tegulæ yellow, nervures ferruginous-brown; legs and feet yellow, the coxæ, trochanters and femora outwardly, and all the tibiæ on the underside, streaked with black, apical joint of the tarsi and claws ferruginous-brown. Abdomen black, with, in certain lights, obscure purple reflections, finely but sparsely pitted and covered with minute recumbent black hairs ; the 1st

to the 5th segments with submarginal bands of a glaucous-yellow, these bands anteriorly bisinuate, and on the 1st, 2nd and 3rd segments interrupted in the middle, the anal segment black with an obscure yellow sub-terminal and ferruginous terminal spot, below the abdomen is smooth and shining, with the posterior margins of the segments narrowly piceous.

This ♂ resembles the ♀ exactly, only on the under side of the 1st abdominal segment there is an obtuse tubercle.

This pretty and well marked species is not uncommon along the jungle paths in April and May. In the beginning of June I found them swarming on the side of a road over a low hill in the vicinity of Maulmain, and digging into a soft sandy bank just as I had seen *Bembex fossorius* doing in Pegu.

Tribe *DILOPTERA*, Latr.

Family *VESPIDÆ*, Steph.

36. ISCHNOGASTER RUFO-MACULATA, n. sp.

Habitat : Tenasserim (Salween Valley, Tavoy).

Female : Length 22 m.m., expanse 32 m.m.

Male : Unknown.

Description : ♀. Head black, coarsely pitted, the sides of the face as high as the base of the antennæ and the sides of the clypeus blood red, the mandibles black, clypeus pear-shaped, its centre sharply produced and bearing a short verticle raised carina; a spot in the emargination of the eyes yellow. Thorax rather pear-shaped, not so globular as in some of the species, the pro- and mesothorax rugose, the scutellum, post scutellum, and metathorax smooth and shining, a line on the posterior margin of the prothorax interrupted in the middle, a spot under the base of the wings, with a crescentic mark below that, a spot at the angles of the scutellum, a line on the post scutellum, and two spots one above the other on the posterior angles of the metathorax blood red ; the scutellum gibbous cone-shaped, the metathorax sloping steeply but regularly to the apex : wings brownish hyaline with bronze iridescent reflections in certain lights, the nervures and tegulæ dark brown ; legs black, the tegulæ and tarsi of the anterior legs in front, and a spot on the tibiæ of the intermediate and of the coxæ of the posterior legs blood red, the tibiæ of the posterior legs also clothed on the inside with a dense soft golden pubescence ; the

tibial spur on the intermediate and posterior legs double, the claws toothed. Abdomen black, the petiole smooth and shining, having a fulvous-red streak below and two yellow spots at the apex above, the rest of the abdomen finely pitted, the 1st segment with two spots at the base followed by two larger submarginal spots, and the 2nd segment with a sub-basal band interrupted in the middle bright chrome-yellow, the remainder of the segments above unmarked; on the ventral surface the 1st segment has two oblong basal spots, and the 2nd segment two small round submarginal spots chrome-yellow.

This species belongs to the section of the genus which live in pairs, building a large globular nest such as figured in my former paper in this Journal.

Like all the species of the section it is rare. The type specimen was kindly given me by Mr. Weston, Deputy Conservator of Forests, and was taken high up on the Salween river. Subsequently I procured two others on the flowers of a wild species of *Lantana* in the Tavoy district.

37. ISCHNOGASTER HAUXWELLII, n. sp., Pl. I, fig. 4.

HABITAT : Tenasserim (Ataran and Ye Valleys).

FEMALE : Length 21 m.m., expanse 31 m.m.

MALE : Length 18 m.m., expanse 33 m.m.

DESCRIPTION : ♀. Head black, densely punctured, mandibles black, clypeus and front as high as the base of the antennæ yellow with a streak of black, not reaching the apex of the clypeus, down the centre; antennæ black, clypeus triangular, its anterior margin in the middle sharply produced. Thorax black, globular, somewhat laterally compressed, the pro- and mesothorax coarsely punctured, the scutellum, post scutellum and metathorax smooth and shining, a line on the posterior margin of the prothorax not meeting in the centre, a spot under the base of the wings, a crescentic spot below that, a spot at the anterior angles of the scutellum, a line on the post scutellum and an irregular mark shaped somewhat like a chess pawn on the posterior angles of the metathorax chrome-yellow ; the wings hyaline iridescent, the tegulæ aud nervures brown ; the legs black, a streak on the under side of the femora, the tibiæ and tarsi of the anterior legs, the apex of the femora below and of the tibiæ above of the intermediate legs, two streaks on the coxæ posteriorly and the apex of

the femora below on the posterior legs, yellow ; claws black toothed, the tibial spur of the intermediate legs double. Abdomen black pruniose, two spots at the apex of the petiole, a spot on either side at the base of the 2nd segment, a larger spot following it, a band interrupted in the middle at the base of the 3rd segment, and two sub-marginal spots below on the ventral side of the 2nd and 3rd segments yellow, the underside of the petiole has a ferruginous stain, and the posterior margins of the 3rd to the apical segment are narrowly testaceous.

The ♂ closely resembles the ♀ but has the wings darker, of a brownish bronzy tint, the thorax is more compressed and the antennæ not so thick.

This species I found not uncommon in February and March frequenting the dry beds of streams and clearings made in the forest for cultivation. I have named it after Mr. T. A. Hauxwell, Deputy Conservator of Forests, who has been good enough to collect for me at various times, and to whom my collection is indebted for many beautiful specimens of rare and new species of *Hymenoptera*.

This species also belongs to the division which construct a globular nest and live in pairs.

Family *EUMENIDÆ*, Westwood.

38. RHYNCHIUM CUPREIPENNIS, n. sp., Pl. 1, fig. 3.

Habitat : South Tenasserim.

Female : Length 14 m.m., expanse 34 m.m.

Male : Unknown.

Description : ♀. Head black, very coarsely and densely punctured ; mandibles long, pointed, dark castaneous-brown, their inner margins deeply striated ; clypeus long, pear-shaped, yellow, with a large black diamond-shaped spot in the centre, the anterior margin of the clypeus ending in two sharp short teeth ; antennæ dark orange-fulvous, a cordate spot on the front, a spot in the emargination of the eyes, and a broad streak behind them and not meeting on the back of the head, yellow ; thorax black, very coarsely punctured, the punctures running into longitudinal striæ above ; the post scutellum gibbous ; the metathorax very short, emarginate posteriorly, the sides produced and sharply angular, a marked and slightly raised carina runs vertically down the posterior face of the metathorax ; wings cupreous-brown with rich

iridescent tints in certain lights ; the nervures and tegulæ black ; legs black, the apex of the femora, the tibiæ and tarsi above of the anterior legs, and the apex of the femora and last joint of the tarsi of the intermediate and posterior legs orange-fulvous ; claws black toothed below, the inside of the tibiæ and tarsi of the posterior legs clothed with a rich golden pubescence ; abdomen black, with obscure blue tints in certain lights, coarsely pitted, the posterior margins of all the segments smooth and shining, the 1st segment truncated anteriorly, the 2nd segment remarkably long and broad, nearly twice as long as the rest of the abdomen.

I procured this insect in the Tavoy forests in October on the flowers of a species of vetch growing near a village. It seems rare as I have not since come across it in any of the forests in South Tenasserim.

Family *APIDÆ*, Auct.

39. XYLOCAPA RUFESCENS, Smith. Pl. I, fig. 2.

Xylocapa rufescens, Sm., Trans. Ent. Soc., 1874, Pt. II, p. 271, 48.

Habitat : India, Java (Smith), Burma, Tenasserim.

This handsome species occurs all over lower Burma and Tenasserim up to 4,000 feet elevation. It is remarkable as being purely crepuscular in habits. I have never seen one out in the day time. Like the rest of the genus it affects flowers, and at Pegu in May and at Amherst in December I have caught numbers coming to the flowers of the *Quisqualis* creeper in the brief dark twilight of these regions. It not uncommonly flies during the night on moonlight nights, making a loud humming. I have found the nest which is similar to that made by other species of the genus, and consists of a series of round cells hollowed out in the end of a decaying log. The eggs seem to be laid at long intervals, as some of the cells of a nest I examined contained a mass of pollen with one egg deposited on it, others larvæ, and others again the bee in almost all stages of development.

40. BOMBUS MONTIVAGUS, Smith. Pl. I, fig. 12.

Bombus montivagus, Sm., Dex. News Spec. *Hym.* B. M., p. 131, 2.

Habitat : Moolai (3,000—6,000 feet), (Smith) ; throughout Tenasserim at elevations of over 3,000 feet.

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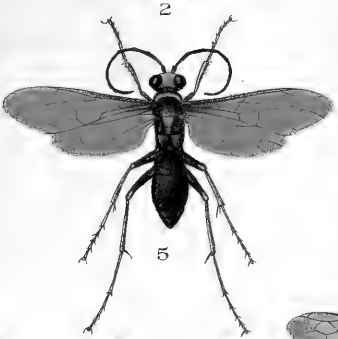

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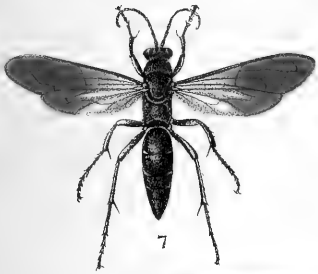

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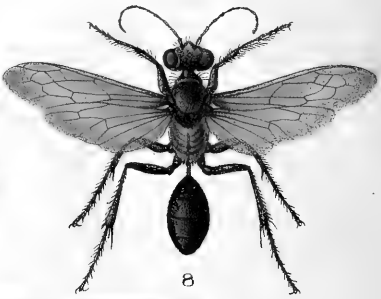

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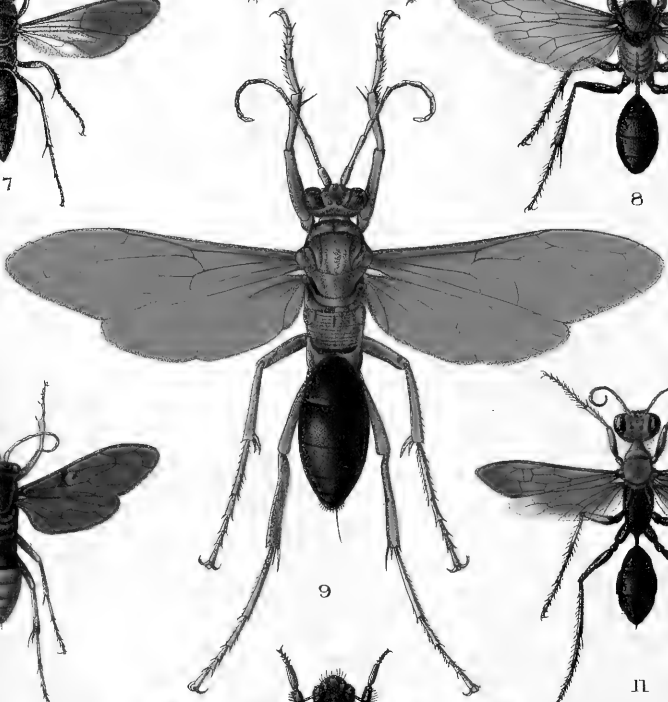

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This, one of the brightest coloured of the humble bees, I have found fairly common at elevations over 3,000 feet. The type specimen was from Moolai, a well-known peak in the Dawnat range.

The females procured by me are somewhat larger than the one described by Smith. My specimens measure length 23 to 28 m.m (10½ to 13 lines), expanse 47 m.m.

The workers are much smaller ; length 13 m.m., expanse 29 m.m. They closely resemble the ♀, the colours being perhaps a little duller.

I have found the nest. It was placed in a hollow under the roots of a bamboo bush on the Taoo Plateau (4,000 feet), and resembled exactly the nests of the humble bees that I had so often, as a boy, taken at home in the deserted nests of field mice.

DESCRIPTION OF PLATES.

Plate I.

Fig 1. *Bembex westonii*, n. sp., ♀, p. 380.
„ 2. *Xylocapa rufescens*, Smith, ♀, p. 388.
„ 3. *Rhynchium cupreipennis*, n. sp., ♀, p. 387.
„ 4. *Ischnogaster hauxwellii*, n. sp., ♀, p. 386.
„ 5. *Salius verticalis*, Smith, ♀, p. 376.
„ 6. *Pompilus cameronii*, Bingham, ♀, p. 378.
„ 7. *Pompilus ilus*, Bingham, ♀, p. 378.
„ 8. *Sphex fulvo-hirta*, Bingham, ♀, p. 379.
„ 9. *Salius elizabethæ*, n. sp., ♀, p. 372.
„ 10. *Salius indicus*, Cameron, ♀, p. 374.
„ 11. *Sphex regalis*, Smith, ♀, p. 378.
„ 12. *Bombus montivagus*, Smith, ♀, p. 388.

Plate II.

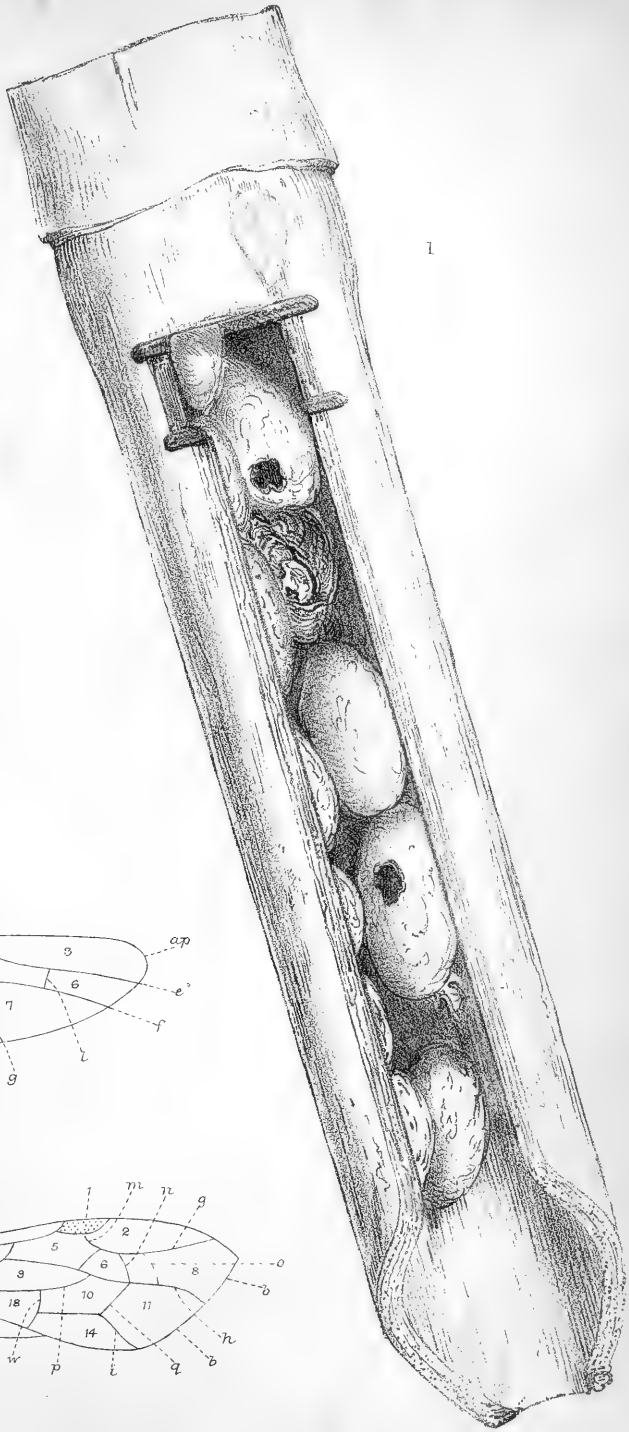
Fig. 1. Nest of *Pseudagenia tincta*, Smith.

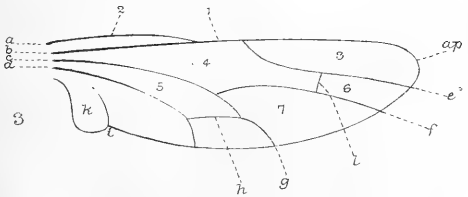
„ 2. Diagram *Hymenoptera*, Front wing.

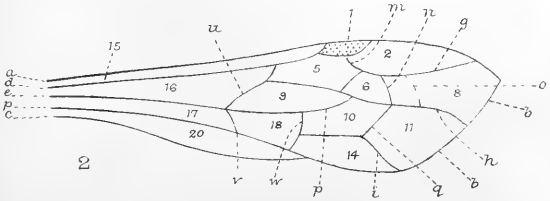
a. Anterior margin.
b. Apical margin.
c. Posterior margin.
a. Costal nervure.
d. Post costal nervure.
e. Externo-medial nervure.
f. Anal nervure.
g. Radial nervure.
h. Cubital nervure.
i. Discoidal nervure.
m. 1st transverse cubital nervure.
n. 2nd transverse cubital nervure.
o. 3rd transverse cubital nervure.
p. 1st recurrent nervure.
q. 2nd recurrent nervure.
u. Transverse medial nervure.
v. 1st transverse submedial nervure.
w. 2nd transverse submedial nervure.
1. Stigma.
2. Radial cell.
5, 6, 7 & 8. Cubital cells.
9, 10 & 11. Discoidal cells.
14. Apical cell.
15. Costal cell.
16. Medial cell.
17 & 18. Submedial cells.
20. Anal cell.

Fig. 3. Hind Wing.

a. Costal nervure and anterior margin.
ap. Apex of wing.
b. Post costal nervure.
c. Medial nervure.
d. Anal nervure.
e. Radial nervure.
f. Cubital nervure.
g. Discoidal nervure.
h. Transverse anal nervure.
l. Transverse cubital nervure
1. Region stigma.
2. Costal cell.
3. Radial cell.
4. Medial cell.
5. Anal cell.
6. Cubital cell (incomplete).
7. Discoidal cell (incomplete)

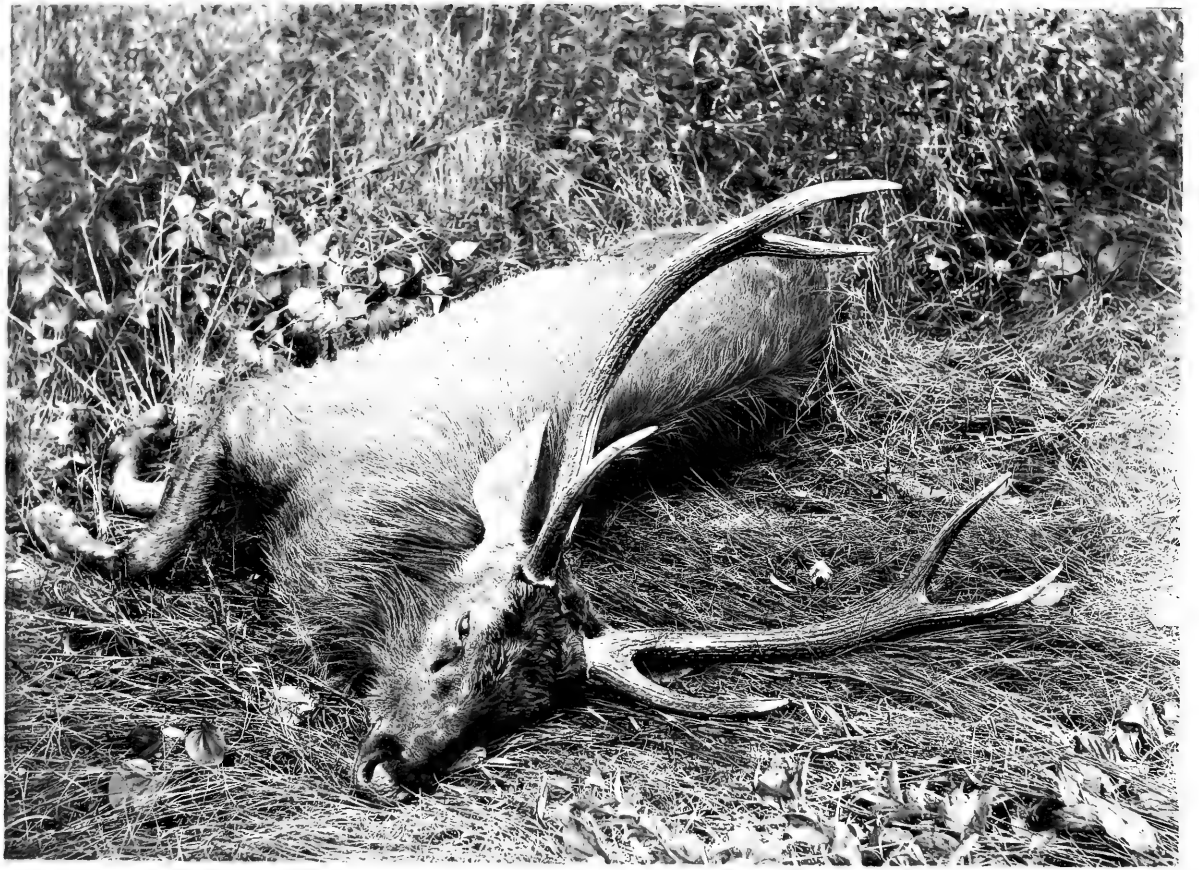






B.L. Dos, del.

West, Newman, lith.



From a Photograph by J. D. Inverarity. Mintern Bros. Photo imp. London.

THE SAMBAR OR RUSA DEER.

Cervus unicolor.

NOTES ON SAMBAR AND SAMBAR SHOOTING.

By J. D. Inverarity.

(*Read before the Bombay Natural History Society on 13th Nov.*, 1893.)

Deer-stalking in India is really not stalking at all ; there is no spying a beast from a distance, and no long approach to the animal for the shot. Instead of the open moor, there are ravines and nullahs thickly clothed with trees, long grass, and underwood, in which one seldom can see deer at a greater distance than 200 yards. Usually the shot immediately follows the first view of the stag. In fact, sambar-stalking consists of simply wandering through the jungle until you blunder on to something to shoot. Sometimes, I believe, by having men out on the hill-tops by daylight they are able to mark where a sambar lies up for the day and can take you to the spot, but I have never tried this myself. The young sportsman, when he starts to shoot, is so eager that he walks through the jungle at a terrific pace ; his legs tear through the grass and bushes, the boughs of the trees scrape along his hat and clothes, the measured tramp of his feet can be heard afar, and his progress is attended with so much noise that it is a wonder if he ever sees anything. Now if there is one thing absolutely essential to success in shooting in an Indian jungle, it is to move about quietly ; one's pace should be slow, and where, from leaves or stones, the noise of footsteps cannot be helped, the steps should be irregular so as to make a noise as little like the usual tread of the human biped as possible.

More shots are obtained by carefully working the ground than by racing over a large extent of country. If one has been out for several hours without seeing anything, one naturally gets a little slack, and many a chance is lost by carelessness. But after all the whole charm of sport consists in the fears and hopes born of previous failure and success. Who would care to shoot if one did not sometimes make a mess of it? As you stroll through the jungle there is plenty to occupy your attention. In addition to sambar you may see cheetul, the four-horned antelope, or nielgai, all of which are found in some parts of the country on the same ground. Tracks of tiger and panther are found in the streams and nullahs, though they themselves are seldom seen when stalking.

In some jungles there are a good many burrows dug out by porcupines. They have only a single hole. I only once saw a porcupine out in the day-time, and that was early in the morning. You generally make a start soon after dawn and walk about till 11 a.m. Long before that hour the deer have all lain down, and as it is supposed that there is not so good a chance of coming across them in the middle of the day, you stop till about 2 p.m. My own opinion is that, in this kind of shooting, the middle of the day is as good a time as any other, as they are bound to rise and bolt if you pass near where they lie ; and, as I said before, in samber-stalking, nine times out of ten, you simply blunder on to the deer, but as both your men and yourself require breakfast and some rest, the middle of the day is a convenient time for the purpose. If one's camp is near a river, one makes for the waterside in the early morning, on the chance of finding a stag feeding on the berries of the Ber (*Zizzyphus jujuba*), a thorny bush that grows on the river banks, and the bright orange berry of which is a favourite food of beast and bird. At this early hour a chill mist is rising from the water, and as one appears on the top of the bank, a loud noise in the bushes makes one clutch the rifle ; but it is only a peacock that sails with outstretched wings across the river. Rising from a low level, he has not sufficient way on to carry him across 200 yards and he touches the water, but a few strokes of the wing lifts him, and he lands on the opposite shore and scuttles up the bank. Flocks of screaming parroquets are feeding on the Ber berries, and, as one proceeds, the peculiar whish of the green pigeon's flight attract one's attention to a score of these beautiful birds as they fly out from a tree in which you would never have seen them if they had sat still. Numerous nullahs stretch away from the river to the hills, and the best plan is to walk along the top of a nullah a few yards from it, occasionally going to the edge. Deer lying in the nullah then don't see you until they hear you about opposite them. As you move along a loud bark and rush below you announce sambar, and you just catch sight for a moment of a hide, and as they cross an open patch see a hind and calf. Even if it had been a stag the chances are you would not have got a shot. Many chances at stags are lost by not being able in the thick jungle to see his head until just as he disappears. If fortune is favourable, you may get an easy shot as the sambar bolts up the opposite side

of the nullah, as he often stops just as he gets to the top for a moment, and in any case the running shot is an easy one. This is the usual way of settling them by disturbing them from their seats in some thicket in a nullah, or you may find one in his form in the long grass under the shed of a tree on more open ground ; here again you won't see him till he rises to fly. Sometimes you are aware of a stag standing looking at you perhaps not 50 yards off. He has either just jumped up, or suddenly come on you as he was walking through the jungle. As you raise your rifle he sometimes whips round and flies, but as often as not he will stand to be shot.

Early in the morning and late in the afternoon you may come across sambar on the move and have a kind of short stalk to get in on them. If there are deer in the jungle, there will be many trees with the outer bark rubbed off. Sambar are very fond of rubbing their horns against trees long after the horns are hard and all the velvet has disappeared ; they get the tree between the brow antler and beam and rub up and down leaving a long blaze on the tree. They seem to prefer the smoother light-coloured trees for the purpose, such as the "saler"; the dark red of the inner bark shows very conspicuously where the stag has been rubbing. At the foot of the tree will be found quite a heap of bark in shreds. If you look at a samber's horns you will find in many cases the beam for some inches above the brow antler polished quite smooth from this habit. You will also not fail to observe in their forms small heaps of fruit stones. The fruit is swallowed whole. The sambar drops the stones out when he chews the cud ; they are chiefly the stones of the Ber. If you disturb a sambar from his form you will find a fresh heap of stones quite wet, which have just before been in his interior. An old stag generally slips away quietly, a hind and young stag often give a loud bark as they start off. If you see either stag or hind and its ears are flapping, it has not seen you. As soon as they see you, their large ears are brought forward at right angles to the head and remain fixed so as to catch every sound. If you remain motionless they will stare a long time. Directly you move they are away. Sambar do not go in large herds. I think the most I have seen together are 8 or 9.

The stags, both old and young, are often found alone and also in company of the hinds. In the hot weather the stags are generally

alone, though I once shot one out of a herd of four in the middle of May. I do not believe that all stags shed their horns yearly. Most, no doubt, have shed their horns by April or May ; but I have seen them with their horns in May and June. I once saw two stags together, one with soft horns, half grown, the other had his horns unshed. I shot a stag sambar on one occasion that was in company of half a dozen hinds of the swamp deer, and I have more than once seen one or two stags in close proximity to bison.

Wild dogs are great enemies of sambar. I have twice seen them in chase. The first time they pulled down a calf about 150 yards from where I was. I heard a squealing and the loud barks of the mother, who stood close to the scene of the tragedy. Thinking a tiger had killed, I stalked up to the noise, and when close to, saw a yellow mass that I took to be a tiger, and was just going to fire when to my astonishment it split up into a dozen pieces and disappeared. I found the calf with its entrails torn out and eaten, part of the rump was eaten, and the eyes picked out—all in a few seconds. I hid myself behind a tree and in about 20 minutes the pack of dogs returned ; they passed me within 15 yards, in single file, a dozen in number, ten paces between each dog. I, with difficulty, refrained from firing. I was between them and the sambar, and they made a circuit and came up to the carcass from the opposite direction. As the leading dog reached the body, I could not wait any more. I fired and missed it, but luckily got one with the second barrel as they bolted. It was a female, and had the exact smell of a domestic dog. The second time I was sitting on the banks of the Taptee having breakfast, when a hind and calf rushed down the opposite bank into the stream, which here was shallow and running pretty strong. On reaching the middle she stood in the water with her calf under her body, and I saw two wild dogs in pursuit stop at the water's edge. They uttered loud wailing howls, but the old hind and young one seemed quite comfortable, the little one with its tail up frisking about under and around its mother. In a short time the dogs went away, and in about ten minutes afterwards the hind and calf went back to the same side they had come from and walked slowly off. You would have thought they would not have gone back to the same side as the dogs were. On the same day a couple of hours afterwards, two dogs, which I believe

must have been the same ones, ran a bull neilgai into the river opposite my tent. I did not see it myself, but my butler informed me that they tore its stomach open just as it reached the river. The neilgai swam across, and sank when half way over, the dogs not following into the water. The photograph gives a better idea of the look of a sambar than any verbal description. They have, as will be seen, a fine coat of coarse hair, which is specially long and thick on the neck. In the hot weather, however, they lose a lot of hair and have a somewhat mangy appearance.

The horns of the sambar have normally only three points on each horn. Sometimes they throw out an extra tine or two, usually in the upper fork. In most heads one horn is an inch or two longer than the other. Anything over 38 inches I consider exceptionally good : the longest I have shot myself measured 44 inches on the outside curve. Ten inches round the burr is good, though there are heads a little over 11 inches round the burr. Sometimes the inside upper tine is the longest, sometimes the outer one, though in the majority of my heads the greatest length is in the inner tine. Some are of equal length. The longest brow antler I have measured was from the burr to point (outside measurement) 2 feet, which is a very unusual length ; the next longest was 19 inches.

The most curious instance of abnormal horns was a stag I shot that had no brow antler at all to his left horn, but instead a third horn, a mere knot, but growing on a separate bony pedicle of its own three-fourths of an inch from the main horn. The length of this left horn was some inches less than the right one, which measured 36 inches. A very singular sambar horn picked up by me is figured at p. 223 of Vol. I of this Society's Journal.

The horns of the sambar of other parts of India are much smaller than the horns carried by stags in the neighbourhood of the Nerbudda and Taptee Rivers. Sambar are said by Jerdon to produce only one young at a birth ; they sometimes have two. The females of this genus have canine teeth in the upper jaw as well as the males.

LES FORMICIDES DE L'EMPIRE DES INDES ET DE CEYLAN.

Par Auguste Forel,

Professeur à l'Université de Zürich.

Part IV.

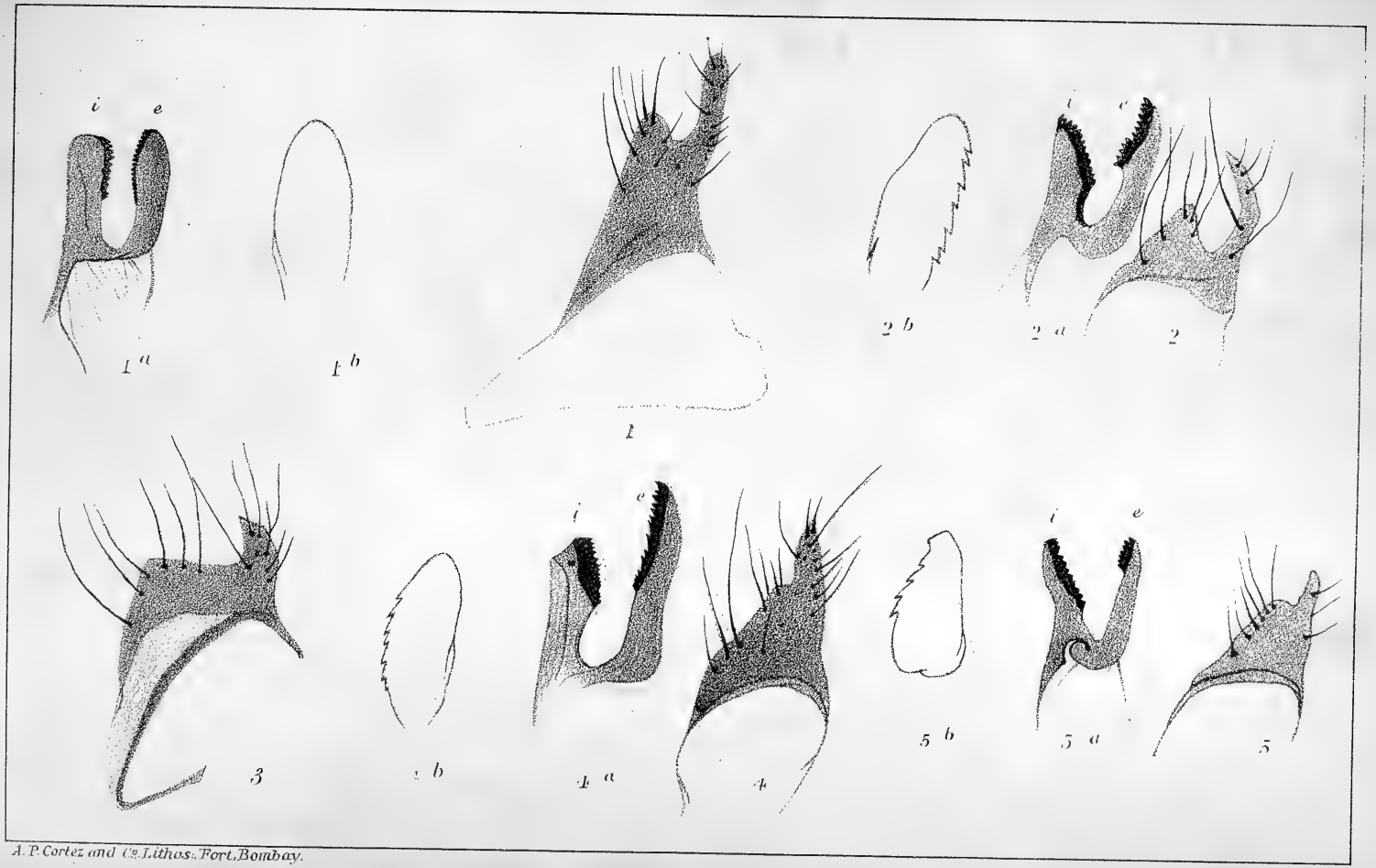
Adjonction aux Genres Camponotus, *Mayr., et* Polyrhachis, Shuck.

25. *Camponotus confucii*, nov. sp.

☿ *Major* :—L : 7, 3à, 8, 5 mill. Taille robuste. Longueur d'un scape 2, 0, d'un tibia postérieur 2, 3 mill. Tête longue de 2, 6, large de 2, 5 mill. Mandibules assez luisantes, ponctuées, finement réticulées entre les points, courtes, épaisses, armées de 6 dents. Tête en trapèze, faiblement échancrée derrière, plus large derrière que devant. Epistome aplati un peu subcaréné derrière ; sa portion médiane est plus étroite devant que derrière et forme devant, au milieu, un petit lobe arrondi qui a une forte impression au milieu. Arêtes frontales très sinueuses et très divergentes ; aire frontale très petite. Sutures du thorax profondes. Le thorax a exactement la forme de celui du *C. foreli*, Em. : le profil est interrompu entre le mésonotum et le métanotum. Ce dernier a une face basale courte, assez convexe, presque aussi large que longue (plus longue chez le *C. foreli*). La face déclive est abrupte et plus longue que la face basale dont elle est séparée par un angle arrondi ou par une courbe très rapide. Ecaille épaisse, presque carrée, convexe devant, avec un bord supérieur transversal, épais. Tibias subcylindriques, sans piquants à leur bord interne. Scapes légèrement déprimés.

Tête et thorax densément réticulés—ponctués et mats. Ecaille, abdomen et pattes finement réticulés et subopaques. Les 2/5 antérieurs de la tête ont en outre de gros points enfoncés piligères profonds et allongés, régulièrement espacés, qui donnent un aspect raboteux aux joues et à l'épistome.

Pilosité dressée d'un jaune un peu brunâtre, abondante, courte et obtuse sur le devant de la tête, assez éparse, plus longue et plus pointue sur le reste du corps, nulle sur les tibias et les scapes. Une pubescence jaunâtre abondante sur tout le corps, surtout sur l'abdomen, forme



A. P. Cortez and Co. Lithos: Fort, Bombay.

LES FORMICIDES DE L'EMPIRE DES INDES ET DE CEYLAN

partout, aussi sur les pattes et les scapes, un duvet d'un gris jaunâtre semblable à celui du *C. rufoglaucus*, mais moins fin et moins serré.

Entièrement noir. Une étroite lisiere jaunâtre aux segments abdominaux. Extrémité des tarses, articulations et éperons d'un brun roussâtre.

☿ *Minor* :—L : 5 à 6 mill. Mandibules étroites, armées de 6 dents. Epistome subcaréné, convexe, sublobé, sans impression médiane devant, en forme de trapèze, beaucoup plus large devant que derrière. Tête beaucoup plus large derrière que devant, non échancrée derrière. Les scapes dépassent l'occiput de la moitié de leur longueur (ne le dépassent pas chez la ☿ major). Une profonde échancrure entre le mésonotum et le métanotum ; ce dernier fort convexe, bien plus court que chez le *C. foreli*. Ecaille très épaisse, aussi épaisse que sa hauteur antérieure (avant la surface supérieure convexe-oblique).

Tête, thorax et pattes assez fortement réticulés et subopaques. Abdomen et écaille plus faiblement réticulés, luisants. Pas de gros points espacés, ni de poils courts devant la tête.

Mandibules en partie d'un brun rougeâtre. Pubescence plus diluée que chez la ☿ major. Du reste comme la ☿ major.

Kanara (M. Wroughton).

Dans notre tableau analytique, cette espèce se place au chiffre 2, comme groupe à part, entre les groupes 3 (*varians* et *sericeus*) et 4 (*camelinus*, etc.). Elle se distingue du groupe 3 par ses mandibules de 6 articles et son métanotum arrondi, non-concave derrière, du groupe 4 par son corps trapu, ses mandibules, son épistome, etc.

21. *Camponotus maculatus*, r. *taylori*, Forel.

Var. albosparsus, nov. var. ☿ *major* L. 7 à 7, 5 mill. ; ☿ min. 5, 5 à 6 mill. Thorax et pattes d'un brun roussâtre. Abdomen noirâtre avec quatre taches d'un jaune blanchâtre, une sur chacun des deux premiers segments, et avec une grande tache de même couleur au milieu du dessousdes mêmes segments. Les taches dorsales du premier segment confluent parfois.

Himalaya (M. Smythies). Une variété presque semblable, mais plus claire, avec la tête roussâtre chez la ☿ minor, les taches claires de l'abdomen plus grandes, confluentes, a été récoltée sur le Pic Victoria à Hong Kong par le Dr. Ris.

26. *Camponotus binghamii*, nov. sp.

☿ *Minor* :—L : 4, 7 mill. Mandibules subopaques, finement chagrinées, faiblement ponctuées, armées, de 5 dents seulement. Epistome caréné, faiblement biéchancré, sans trace de lobe antérieur (bord antérieur rectiligne). Arêtes frontales assez longues, divergentes. Tête subrectangulaire, à peine rétrécie derrière les yeux, à côtés non convexes, un peu comprimés. Yeux gros, situés au tiers postérieur. Pronotum subdéprimé, distinctement bordé antérieurement et à ses angles antérieurs, assez large. Métanotum comme chez le *C. rufoglaucus*, *r. fœc* Em., mais la face basale n'est que très faiblement concave. Ecaille épaisse, assez basse, obtuse en dessus. Tibias subcylindriques, sans piquants. Scapes grêles et cylindriques.

Entièrement et densément réticulé-ponctué et subopaque on presque mat, y-compris les pattes et les scapes.

Pilosité dressée, jaunâtre, très éparse, nulle sur les tibias et les scapes. Pubescence jaunâtre, assez longue et assez abondamment répandue sur tout le corps, sur les pattes et sur les scapes, formant un léger duvet grisâtre moins dense que chez le *C. rufoglaucus*, mais très semblable, sans cependant cacher la sculpture. Noir ; pattes, funicules et mandibules d'un brun rougeâtre. Scapes d'un jaune roussâtre vers la base et bruns vers l'extrémitè. Segments abdominaux étroitement bordés de jaune roussâtre.

Ataran Valley, Birmanie (M. le Major Bingham).

Au premier abord ou dirait un très petit *C. rufoglaucus*. Mais en réalité cette espèce est toute autre et se rattache au groupe *C. reticulatus*, *radiatus*, *niveosetosus*, *foraminosus*, etc. Dans le tableau, elle se place sous le chiffre 7, à côté du *C. reticulatus*, dont elle se distingue par sa pubescence, son pronotum bordé, sa face moins convexe, etc.

5. *Camponotus auriventris* (Emery).

Thaungyin Valley, Birmanie (Bingham).

58. *Polyrhachis wroughtonii*, nov. spec.

☿ :—Long: 4, 0 à 4, 2 Mill. Larg. 1, 3 à 1, 5 Mill.

Mandibules armées de 5 dents, luisantes, en partie lisses, avec une fine ponctuation éparse. Epistome sans carène, armé devant de deux larges dents médianes divergentes. Tête en trapèze, beaucoup

plus large derrière que devant, à bord postérieur assez droit. Yeux situés vers les 2/5 postérieurs des côtés de la tête. Arêtes frontales très sinueuses, divergentes. Front peu convexe. Vertex fort convexe à son passage à l'occiput. Deux arêtes aiguës au bord inférieur de la tête qui est concave en dessous, entre deux. Thorax plus court que la tête à peine plus long que la largeur antérieure du pronotum. Suture promésonotale située au milieu du thorax ; suture méso-métanotale très peu distincte. Dos du thorax très convexe. Les angles anterieurs du pronotum forment deux épines ou dents extrêmement larges, courtes et très obtuses, dont les côtés sont la continuation directe des bords antérieur et latéraux du pronotum. Le bord antérieur du pronotum est concave de l'extrémité d'un épine ou pointe à celle de l'autre. Epines métanotales aussi longues que l'espace interspinal, très distantes très divergentes, un peu courbées en arrière et en dehors. L'écaille, est épaisse et biconvexe. Elle a deux longues épines horizontales qui embrassent la base de l'abdomen. Entre ces épines elle porte deux petites dents obtuses, assez écartées. Abdomen très court, très large faiblement subbordé devant. Scapes grêles, un peu épaissis à l'extrémité. Tibias atténués à leur base.

Tout le corps, les pattes et les antennes entièrement et densément réticulé-ponctué, mat ou peu s'en faut. La tête (sauf l'épistome) et le thorax (sauf la face déclive du métanotum et une partie des côtés) sont en outre grossièrement réticulés.

Une fine pubescence jaunâtre, très courte et fort diluée est éparse sur tout le corps, les pattés et les scapes. Pilosité dressée nulle, sauf quelques poils épars vers la bouche et près du cloaque.

Noire. Antennes, tarses et bord des mandibules d'un jaune rougeâtre. Tibias et cuisses d'un jaune testacé assez pâle.

Hanches, genoux, base des métatarses, les deux extrémités des scapes et la base du Ier article des funicules noirâtres ou brunâtres.

Kanara (M. Wroughton).

Cette espèce est très curieuse par sa forme écourtée et par sa couleur. Elle se place dans le tableau sous le chiffre 33, à côté des *P. armata* et *P. simplex*, quoique très différente de ces deux espèces.

59. *Polyrhachis phipsoni*, nov. spec.

☿ :—L. : 4, 8 mill. Très voisine de la *P. furcata*, Sm., dont elle diffère par les caractères suivants :

Tête plus longue que large ; scapes plus grêles. Epistome sans carène ; une arête élevée en lieu et place du sillon frontal. Thorax moins convexe ; épines du métanotum plus courtes que chez la *P. furcata* typique, mais plus longues que chez la race *P. gracilior*. Le noeud ou pilier du pédicule est plus bas, beaucoup plus épais (presque aussi épais que large), avec une surface supérieure inclinée d'avant en arrière et terminée devant par une protubérance assez aiguë. Les épines du pilier sont presque horizontales, longues, embrassant un peu l'abdomen (comme chez la *P. gracilior*), mais nullement recourbées à l'extrémité. Un lobe longitudinal sous le pédicule (une dent chez la *P. furcata*). Sculpture très grossièrement réticulée, comme chez la *P. furcata ;* mais cette sculpture s'étend aussi sur la moitié postérieure de la tête qui est lisse, et luisante chez la *P. furcata*. Devant de la tête assez lisse, éparsément ponctué. Abdomen lisse et luisant. Pilosité et pubescence comme chez la *P. furcata*, mais l'abdomen est assez fortement pubescent derrière, tandis que le thorax l'est à peine.

D'un rouge foncé. Scapes, abdomen et extrémité des épines noirâtres; tibias et tarses brunâtres.

Yé Valley, Burmah (Major Bingham). Se place dans le tableau à côté de la *P. furcata*.

25. *Polyrhachis lævigata* (Smith).

M. le major Bingham vient de découvrir cette espèce dans la Yé Valley, en Birmanie. Elle correspond tout-à-fait à la description de Smith. Elle est noire luisante, avec l'abdomen, les hanches, et une grande partie des cuisses d'un brun rougeâtre. L'écaille est épaisse, élevée, et a deux très petites dents entre les deux épines. Corps très faiblement réticulé avec une ponctuation éparse très effacée. Tibias densément réticulés-ponctués et mats. Entièrement glabre. Pronotum avec deux angles dentiformes. Suture pro-mésonotale distincte ; suture mésométanotale visible. Epines métanotales longues, fortes, assez peu divergentes.

Voisine de le *P. hippomanes*. Le tableau doit être corrigé en ce sens que le corps n'est pas absolument lisse, comme l'a prétendu Smith.

3me Genre ŒCOPHYLLA (Smith).

Œ. smaragdina (Fab.)

Formica macra et zonata, Guérin.

Ce genre ne renferme en Inde qu'une espèce très commune, l'*Œ. smaragdina*, Fab. (the red Ant) dont M. Aitken a si bien décrit les

moeurs dans ce journal. L'éspéce a les caractères du genre. La ♀, grande et grosse, de couleur vert clair, a 13 à 16 mill. de long. Le ♂ est noir, grêle, beaucoup plus petit, long de 6 à 6, 5 mill. seulement. L'ouvrière est d'un rouge jaunâtre et varie de 3, 5 à 9, 5 mill. M. André a décrit les plus petites ouvrières d'une forme africaine très voisine sous le nom de *Œ. brevinodis.* Elles ont toujours le pédicule, les pattes et les antennes beaucoup plus courtes que les grandes ☿ relativement au corps. C'est le contraire des autres fourmis. M. Wroughton m'a envoyé une fourmilière commençante comprenant la mère fondatrice, 9 petites ☿ de la plus petite sorte et quelques nymphes. Le nid était filé dans l'interstice d'une feuille, comme celui d'une *Polyrhachis.* Les nids de l' *Œcophylla*, tissés d'une trame de soie blanche qui relie les feuilles des arbres, sont très considérables et bien connus dans les tropiques. *L'Œcophylla smaragdina* est répandue dans toute l'Inde, de l'Himalaya à Ceylan et de Bombay à Calcutta. Je l'ai même reçue de Dehra Dun, Nord-ouest de l'Himalaya, à 2300′ d' élévation, par M. Wood-Mason.

4me Genre Myrmecocystus (Wesmael).

1. *M. viaticus*, Fab., r. *setipes*, n. st.

La seule espèce de ce genre connue jusqu'ici en Inde est une simple race du *M. viaticus*, Fab., de la faune méditerranéenne. Elle vit surtout dans les terrains secs, dans les steppes, court sur ses longues jambes en relevant l' abdomen et fait la chasse aux insectes. Elle a la tête et le thorax d'un rouge très sombre, l'abdomen noir luisant et varie de 7 à 13 millimètres de longueur. Les caractères sont du reste ceux du genre. J'ai reçu cette espèce de Nusseerabad dans la Rajpootana (M. Glardon), de Rai Bareli (M. Simpson) et de Pachmarhi, à 3558 pieds de hauteur, près de Jubulpore, dans l' Inde centrale (M. Schurr). C'est un des représentants typiques de la faune paléarctique de l' Inde et je crois qu'il est limité au Nord-ouest et au centre de la péninsule.

☿. Diffère du *M. viaticus*, i. sp., par sa taille un peu plus svelte, ses pattes plus longues (les pattes postérieures sont de 1 à 3 millimétres plus longues à grandeur égale du corps) et surtout par le caractère suivant : les pattes sont couvertes sur toutes leurs faces de soies couchées, épaisses, courtes, d'un noir brunâtre ; la face interne des tibias

n'a que des piquants obliques et les soies de leurs autres faces sont aussi longues et aussi épaisses que ces piquants. Chez tous les *M. viaticus*, i. sp., de la faune méditerranéenne, de même que chez les *M. altisquamis*, *M. niger* et *M. megalocola*, les pattes n'ont qu'une pubescence adjacente ordinaire, roussâtre, peu épaisse, non sétiforme, tout à fait distincte des piquants roussâtres de la face interne des tibias. Ces derniers sont dressés.

La couleur du *M. setipes* est la même que celle des exemplaires du *M. viaticus i. sp.* que j'ai récoltés dans les oasis à Gabès (Tunisie), et que ceux qu'on reçoit en général de la région du désert saharien. Un exemplaire que j'ai reçu d'Abyssinie (Harar) par M. Ilg est aussi le *viaticus*, i. sp., et non le *M. setipes*. Les exemplaires tout-à-fait typiques d'Espagne, de Hongrie, de Bulgarie, de Grèce, etc., sont d'un rouge plus vif et ont le noeud souvent plus court et plus élevé. Leurs pattes sont plus courtes que celles de la variété rouge très foncé du désert qu'on pourrait appeler *M. desertorum*, n. v. Ils sont par contre d'un rouge bien moins vif que la race *M. megalocola*, sont bien plus grands qu'elle et ont l'abdomen mat.

5me Genre FORMICA, L.

Toutes les espèces de *Formica* de l'Inde appartiennent à la faune paléarctique de l'Himalaya, du Nord-ouest et du centre.

Tableau des ouvrières des espèces de la faune de l'Empire des Indes.

1. Bord antérieur de l'épistome échancré au milieu. D'un rouge de sang, un peu foncé. Front et vertex brunâtres. Abdomen noirâtre. Pilosité très éparse. L : 6 à 9 Mill .....F. SANGUINEA (Latr).

   Bord antérieur de l'épistome entier 2

2. Taille robuste ; L. 4 à 9 mill. Aire frontale lisse et luisante. Tout de corps, les pattes et les scapes couverts d'une pilosité roussâtre, courte, abondante, obtuse et dressée. Couleur de la *F. sanguinea*, mais d'un rouge plus clair et plus vif ..... F. RUFA, L.
   r. TRUNCICOLA (Nyl).

   Taille plus grêle ; L. 4, 5 à 7 Mill.....F. FUSCA, L.

   Aire frontale luisante. Tout le corps d'un noir très luisant. Pattes, antennes et mandibules d'un brun plus ou moins rougeâtre .....
   r. F. GAGATES (Latr).

   Aire frontale mate. Tout le corps beaucoup plus mat et finement pubescent 3

3. Couleur de la *F. gagates*. Peu de poils dressés ... R. F. FUSCA, i, sp., L.
D'un rouge jaunâtre terne, avec l'abdomen, le front, le vertex, l'extrémité des funicules et souvent le dos du thorax d'un brun plus ou moins noirâtre. Pilosité dressée un peu plus abondante.....
R. F. RUFIBARBIS (Fab).
Variété intermédiaire entre les *F. fusca* et *F. rufibarbis* .....
V. FUSCO-RUFIBARBIS (Forel).

Liste des Formica de l'Inde ; synonymie et géographie.

1. *F. sanguinea* (Latr.)

F. dominula (Nyl.)

Lahoul, frontière du Thibet (Major Sage). Identique aux individus européens. Ravit les nymphes de la *Formica fusca* pour en faire des esclaves.

2. *F. rufa, L., st. truncicola* (Nyl.)

=*F. simulata* (Smith) ?

Lahoul, frontière du Thibet (Major Sage). Identique aux individus européens. Une ♀ de petite taille.

3. F. FUSCA, L.

Race *F. gagates* (Latr.)
= *F. picea* (Nyl.)
= *F. glabra* (W. White).
= *F. candida* (Smith).

Lahoul, frontière du Thibet (Major Sage). Thibet (par M. Wroughton). Identique aux individus européens. Yarkand (Smith). La *F. candida* Smith est évidemment une *F. gagates*.

Race *F. fusca*, i. sp., L.
= *F. glebaria*, Nyl.

Mussorie Hills (M. Smythies). Pachmarhi près de Jubulpore, Inde centrale (M. Schurr). Indentique aux individus européens.

Race *F. rufibarbis* (Fab.)
= *F. cunicularia* (Latr.)
= *F. obsoleta* (Latr.)
= *F. stenoptera* (Först.)
= *F. fraterna* et *F. defensor* (Smith ?)

Dharmsala (Major Sage). Lahoul, frontière du Thibet (Major Sage). Identique aux exemplaies européens. La *F. fraterna* (Smith) est évidemment la *F. rufibarbis*. La *F. defensor* (Smith) est peut-être la variété suivante.

Var. CLARA, Forel. Lahoul, frontière du Thibet (Major Sage). Se distingue par sa couleur d'un rouge jaunâtre plus clair et plus vif, ainsi que par son thorax sans tache brune.

Var. *Formica fusco-rufibarbis*, Forel.

Himalaya (M. Smythies). Dehra Dun (M. Smythies). Masuri, 6,000′, N. O. Himalaya (M. Wood-Mason). Forme intermédiaire entre les races *F. fusca* et *F. rufibarbis*.

6me Genre LASIUS, Fab.

Même remarque que pour le genre *Formica*.

I. L. NIGER, L.

Pas de longs poils épais, couchés, jaunes sur l'abdomen.

Race *L. alienus*, Först.

Himalaya, 9,000′ de hauteur (M. Smythies). ♀ L. 2, 7 à 3, 2 mill. Pas de sillon frontal distinct. Brunâtre, avec le thorax les antennes et les pattes plus clairs. Scapes et pattes sans poils dressés. Comme les petits exemplaires clairs d'Europe.

Race *L. brunneus* (Latr.), var. *himalayanus*, nov. var.

Formica timida (Foerst).

Himalaya (Smythies); 6,000′ à 9,000′.

☿ :—L : 3, 6 à 4, 2 mill. Sillon frontal très distinct. Beaucoup plus large et plus robuste que le précédent. Plus robuste et plus grand que la forme typique d'Europe. Pubescence un peu plus grossière, comme chez le *L. alienus*. D'un brun assez foncé, avec les joues, les mandibules, les scapes, la base des funicules, les tarses, une partie du dessous de la tête et les articulations des pattes d'un jaunâtre sale plus ou moins rougeâtre on brunâtre (chez le *L. brunneus*, i. st., la couleur est d'un rouge brunâtre avec l'abdomen brun).

Var. *Lasius alieno-bruuneus* (Forel).

Himalaya (Smythies) ; 6,000′ à 9,000′.

☿ :—L. : 3 à 3, 5 mill. Sillon frontal distinct. Stature de le *L. alienus*. D'un brun jaunâtre pâle, y compris l'abdomen ; pattes et antennes d'un jaune à peine brunâtre. Dans son catalogue, Dalla Torre identifie cette variété au *L. lasioides* Emery. Je ne puis guère admettre cette synonymie, car le type du *L. lasioides* que je possède a un sillon frontal bien moins distinct, une couleur plus foncée et une pilosité plus forte.

2. *L. crinitus* (Smith).

Cachmir (d'après Smith).

♀ :—Jaune d'ocre. L. 8 à 9 Mill. Ailes un peu enfumées. Abdomen couvert de longs poils jaunes, couchés, épais à leur base, pointus à l'extrémité. Pattes et antennes sans poils dressés.

La ♀ seule est connue.

7me Genre PSEUDOLASIUS (Emery).*

I. P. familiaris (Smith).

Birmanie (d'après Emery).

☿ *Minor* :—L. : 2, 6 Mill. (♀ 10 Mill.). Jaunâtre ; yeux plus petits et pubescence plus abondante que chez le *P. breviceps*.

8me Genre PRENOLEPIS (Mayr).

Les espèces de ce genre difficile se distinguent surtout par les valvules génitales des ♂. Nous devrons donc y avoir égard autant que possible. Les ☿ sont souvent impossibles à distinguer les unes des autres, ce qui m'oblige à laisser indéterminées un assez grand nombre de ☿ et de ♀ reçues sans les ♂ correspondants.

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* *Pseudolasius risii* n. sp. ☿ L. 2, 4 à 3, 3 Mill. Mandibules finement et densément striées, armées seulement de 4 dents; bord terminal très-oblique. Tête échancrée derrière presque carrée, à peine plus longue que large. Palpes labiaux de deux articles ; palpes maxillaires de deux articles très courts. Yeux situés vers le tiers antérieur de la tête, tout à fait plats, composés seulement de 8 à 10 facettes mal formées. Epistome voûté, court, presque subcaréné ; son bord antérieur a une faible échancrure médiane et une petite dent latérale de chaque côté, près de l'articulation mandibulaire. Scapes dépassant un peu l'occiput ; funicules assez épais. Thorax médiocrement échancré derrière le mésonotum ; face basale du métanotum courte, arrondie. Ecaille inclinée en avant, assez épaisse, à bord supérieur tranchant. Pattes assez courtes.

Assez luisante, en partie subopaque. Très faiblement réticulée, en partie lisse. Une très fine ponctuation piligère, surtout sur la tête. Face déclive du métanotum trés lisse et très luisante.

Abondamment couverte d'une pilosité dressée, fine, pointue, d'un jaune pâle, aussi sur les tibias et les scapes. Pubescence adjacente, jaunâtre, assez abondante sur la tête, plus éparse ailleurs.

D'un jaune pâle. Tarses et mandibules d'un jaune brunâtre. Les grands individus sont d'un jaune plus foncé et ont l'abdomen jaune brunâtre.

Gésier à sépales courtes et évasées.

♀ :—L : 5, 6 mill. Comme l'ouvrière. Les mandibules ont aussi 4 dents. Tête plus large que longue, presque aussi large que le thorax. Ponctuation beaucoup plus forte et plus abondante que chez l'ouvrière, ainsi que la pubescence qui forme un duvet jaunâtre. Les poils couchés forment des séries par convergence des poils qui s'appliquent les uns aux autres à leur extrémité. D'un jaune plus ou moins roussâtre on brunâtre. Dessus de l'abdomen (sauf le bord des segments), vertex et quelques taches sur le thorax brunâtres.

Victoria Pic, Hong Kong (Dr. Ris). Cette curieuse espèce, bien distinct du *P. familiaris*, se trouvera probablement en Inde plus tard.

Tableau des ouvrières.

1. Corps allongé. Mésothorax avec un rétrécissement médian presque cylindrique, comme chez le genre *Acantholepis*.....Pr. emmæ, n. sp.†

   Corps étroit et allongé. Pattes et antennes très longues. Mésothorax sans rétrécissement au milieu. Noire. Pattes, antennes et mandibules brunâtres. L. 2, 5 à 3 mill .....Pr. longicornis (Latr.)

   Corps plutôt court. Profil du thorax échancré. Mésothorax sans rètrécissement cylindrique. D'un brun plus ou moins foncé. Corps, pattes et scapes avec des soies dressées obtuses, plus ou moins épaisses 2

2. L. 2, 5 à 3 mill. D'un brun foncé ou noirâtre. Pubescence abondante...3

   L. 1, 8 à 2, 4 mill. D'un brun plus clair. Pubescence clair-semée. Plus luisantes 4

3. Tête large, aussi large que longue, en carré à côtés arrondis. Face basale du métanotum longue comme la moitié de la face déclive. Poils dressés des pattes et des scapes assez fins. Les scapes n'en out qu'une ou deux rangées devant. Corps trapu, d'un brun foncé. Mésonotum, pattes, mandibules et antennes d'un brun rougeâtre...

   Pr. yerburyi, n. sp.

   Tête ovale, beaucoup plus longue que large. Face basale du métanotum à peine plus courte que la face déclive. Poils dressés des pattes et des scapes grossiers, obtus, d'un brun foncé. Les scapes en ont au moins deux rangées. Corps moins trapu, d'un brun noirâtre. Mandibules d'un brun rougeâtre ; pattes et antennes d'un brun foncé .....Pr. bourbonica (Forel) r. bengalensis, n. st.

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† *Pr. emmae*, n. sp ☿. L. 3 à 3, 8 mill. Mandibules étroites, lisses, luisantes, armées de 8 dents, à peine ponctuées. Tête ovale, un peu plus longue que large. Epistome échancr au milieu de son bord antérieur. Scaps dépassant, l'occiput de la moitié de leur longueur. Trois ocelles extrêmement petits. Le mésothorax est étroit, allongé, et a au milieu un étranglement colliforme court, mais très distinct, plus court et moins fort que chez l' *Acantholepis frauenfeldi*, mais bien plus fort que chez l'*A. capensis*. Les deux stigmates post mésonotaux sont tout à fait dorsaux et très rapprochés. Les côtés du métasternum atteignent le dos du thorax. Profil dorsal du mésonotum presque rectligne, sauf les stigmates qui proéminent. Métanotum très élevé en bosse de chameau courte et abrupte, Ecaille épaisse, obtuse et arrondie au sommet. Pattes assez longues.

Lisse et luisante. Epistome, pattes et scapes un peu subopaques, très finement réticulés. Mésothorax et côtés du front trés finement striés en long ; métanotum très finement et circulairement strié. Les parties striées sont moins luisantes. Une pilosité dressée, jaunâtre, eu fine, peu pointue, médiocrement abondante sur le corps, les pattes et les scapes. Pubescence très éparse, plus abondante sur les tibias et les scapes.

D'un jaune rougeâtre assez vif. Tête d'un jaune brunâtre. Abdomen, antennes et pattes 'un jaune testacé. Une bande transversale brune, assez étroite, sur chaque segment abdominal.

Victoria Pic, Hong Kong (Dr. Ris). Se trouvera peut-être plus tard en Inde.

4 L. 2 à 2, 4 mill. Face basale du métanotum seulement un peu plus courte que la face déclive. Pubescence encore assez répandue sur la tête et sur l'abdomen. Tête ovale, rectangulaire...Pr. INDICA, n. sp.

L. 1, 8 à 2 mill. Face basale du métanotum très courte et peu convexe, beaucoup plus courte que la face déclive (de moitié environ). Pubescence diluée partout .....Pr. TAYLORI, n. sp.

Tableau des mâles.

1. Valvules génitales extérieures arrondies, sans appendice particulier. Prolongement externe des valvules moyennes plus court que l'interne. Pr. LONGICORNIS (Ltr.)

Valvules génitales extérieures munies d'un appendice à leur extrémité supérieure. Prolongement externe des valvules moyennes au moins aussi long que l'interne 2

2. Valvules génitales extérieures (à l'exclusion de l'appendice et des écailles) plus larges que longues 3

Valvules génitales extérieures (à l'exclusion de l'appendice et des écailles) plus longues que larges 4

3. Valvules génitales extérieures très courtes, très larges, tronquées, noires, fortement chitinisées. Appendice en crochet court et épais, à peine plus long que la largeur de sa base. Pas de protubérance marquée à leur autre extrémité. Ecailles fort grandes (fig. 3). Valvules moyennes très larges, courtes, épaisses, obtuses, fortement chitinisées et couvertes de fortes dents noirâtres à leur extrémité (voir Forel, Fourmis de Madagascar, dans Grandidier, Pl. 3, Fig. 2a) .....
Pr. BOURBONICA (Forel.) r. BENGALENSIS, n. st.

Valvules génitales extérieures bien plus étroites, jaunâtres, bien plus faiblement chitinisées, terminées en haut par un appendice courbé, très long et très étroit, pointu à l'extrémité, en bas par une longue protubérance en triangle équilatéral. Entre l'appendice et la protubérance, une encoche longue et profonde (fig. 2). Les deux prolongements des grandes valvules moyennes assez étroits, assez pointus à l'extrémité, avec un bord terminal très oblique, couvert de denticulations noirâtres assez fortes. L'externe plus long que l'interne (Fig. 2).....
Pr. TAYLORI, n. sp.

4. Valvules génitales extérieures très longues, noires, fortement chitinisées (presque deux fois plus longues que larges, sans l'appendice), terminées en haut par un appendice très long (aussi long que la valvule), très étroit, à peine courbé, et arrondi à l'extrémité qui est plus large

que sa base. En bas elles sont terminées par une protubérance en triangle équilatéral. Entre la protubérance et l'appendice, une encoche un peu moins profonde que chez la *Pr. taylori*. Valvules moyennes petites, d'un brun noirâtre, droites, sans bords terminaux, dentelés, avec de fines denticulations sur la moitié périférique de leurs bords opposés. Prolongement interne rectangulaire, allongé, tronqué à angle droit à l'extrémité, de même longueur que l'interne qui se termine en courbe aiguë ou en pointe arrondie. Les deux prolongements sont étroits (Fig. 1 et 1a) .....Pr. yerburyi, n. sp.

Valvules génitales extérieures (sans l'appendice) moins de deux fois plus longues que larges, jaunâtres ou d'un jaune brunâtre, faiblement chitinisées 5

5. Valvules génitales petites, pâles. Les extérieures rétrécies à l'extrémité qui se termine en haut par un appendice étroit, droit et assez long, en bas par un angle à peine protubérant. Prolongements des valvules moyennes très longs et très étroits, équilongs, pointus, l'interne assez fortement denticulé, l'externe n'ayant que quelques denticules près de l'extrémité. Valvules intérieures triangulaires (Fig. 5, 5a, 5b) .....Pr. smythiesii, n. sp.

Valvules génitales grandes. Les extérieures comme chez la *Pr. smythiesii*, mais encore plus rétrécies à l'extrémité qui n'a en bas qu'un petit angle en dessous de l'appendice. Ce dernier a de petites verrues microscopiques vers son extrémité. Valvules moyennes très grandes ; leur prolongement externe très long et très pointu, l'interne beaucoup plus court et obliquement tronqué à l'extrémité. Tous deux ont de fortes dents noires sur la moitié périférique de leurs bords opposés et sont droits et étroits (Fig. 4, 4a). Valvules intérieures ovales (Fig. 4b). .....Pr. indica, n. sp.

Liste *des espèces du Genre* Prenolepis.

1. *Pr. longicornis* (Latr).
= *Formica vagans* (Jerdon).
= *Tapinoma gracilescens* (Nylander).
= *Paratrechina currens* (Motschulsky).

Très commune dans l'Inde entière, de l'Himalaya (Dehra Dun) à Bombay, à Calcutta et à Ceylan d'où on la reçoit à chaque envoi. Espèce cosmopolite, transportée par les vaisseaux.

2. *Pr. bourbonica* (Forel), *r. bengalensis*, n. st.

Calcutta (Rothney) ; Birmanie (Bingham) ; Myingyan, Birmanie supérieure (Watson).

☿ Diffère de la forme typique de l'île de la Réunion par sa tête ovale rectangulaire, plus étroite et plus allongée, très distinctement plus longue que large (presque aussi large que longue et à bord postérieur large et plus net chez le type). L'épistome est plus fortement échancré chez la *Pr. bourbonica* typique que chez la r. *Pr. bengalensis*.

♂ Les valvules génitales extérieures sont plus courtes et plus larges que chez le type ; leur extrémité inférieure n'est pas avancée en triangle (Fig. 3) ; elle est bien moins développée.

A part ces petites différences, la forme indienne est sissemblable à celle de la Réunion que je ne puis en faire qu'une race.

3. *Pr. yerburyi*, nov. spec.

Ceylan (Yerbury) ; Coonoor (Daly).

☿ Plus large, plus trapue que la précédente. Mésonotum aussi large que long. Echancrure méso-métanotale plus profonde et plus étroite. Pilosité d'un brun moins foncé. Les poils des pattes et des scapes sont surtout beaucoup plus fins. Le pronotum et le mésonotum sont aussi plus convexes. Voir du reste au tableau. Malgré tout, il n'est pas facile de la distinguer de la *Pr. bourbonica*.

♀ L. 4, 2 à 4, 4 mill. Caractères de l'ouvrière, en particulier la pilosité, et de toutes les ♀ de *Prenolepis* qui sont presque impossibles à distinguer les unes des autres. Tout le corps d'un brun foncé. Ailes fortement enfumées de brunâtre.

L. 2, 5 mill. Noirâtre, assez luisant. Tarses et anneaux fémoraux testacés. Funicules et hanches bruns. Pattes, scapes et mandibules d'un brun foncé, ainsi que les côtés du thorax. Tête large, bien plus large derrière que devant. Face basale du métanotum confondue avec la face declive. Thorax plus large que chez la *Pr. bourbonica*. Ailes enfumées. Voir du reste le tableau. (Fig. 1, 1a, 1b).

4. *Pr. indica*, nov. spec.

Poona (Wroughton) ; South Konkan (Wroughton) ; Ceylan (Yerbury).

♀ :—Tête au moins aussi large devant que derrière. Tête et abdomen d'un brun marron assez clair. Thorax d'un brun roussâtre. Pattes et antennes d'un brun jaunâtre. Pubescence assez variable. Ressemble beaucoup à la. *Pr. vividula*, mais moins luisante et un peu plus pubescente que cette espèce dont elle ne diffère du reste par aucun caractère saillant. Voir du reste le tableau.

♀ :—L : 5, 5 Mill. D'un brun foncé. Mandibules, tarses, hanches, articulations et funicules rougeatres. Ailes faiblement enfumées de brunatre. Plus grande que la *Pr. yerburyi* ♂ ; les tibias et les scapes n'ont que quelques poils fins et obliques.

♂: L.: 2, 2 à 2, 3 mill. Tête carrée, aussi large devant que derrière. Face basale du métanotum oblique, beaucoup plus longue que la face déclive, Abdomen brunâtre ; tête et dessus du mésonotum d'un brun jaunâtre ; tout le reste d'un jaune testacé un peu rougeâtre. Ailes comme chez la ♀. Voir du reste le tableau (fig. 4, 4a, 4b).

Les valvules génitales extérieures rétrécies à l'extrémité, le prolongement interne tout différent des valvules moyennes (voir Forel, dans Grandidiere Fourmis de Madagascar, Pl. II, fig. 9 et 9a), distinguent cette espèce de la *Pr. vividula*, sa voisine. Chez la *Pr. vividula*, ♂, le métanotum a deux faces distinctes, la basale horizontale, plus courte que la déclive.

5. *Pr. taylori*, nov. spec.

Orissa (Taylor).

☿ :—Un peu plus petite que le *Pr. indica*, mais du reste à peu près identique. Echancrure méso-métanotale très faible. Scapes légèrement plus longs. Couleur identique ou un peu plus pâle. Pas de caractère nettement distinctif.

♀ :—L.: 3, 5 à 4 mill. D'un brun foncé. Mandibules, antennes, pattes et ecaille d'un jaune rougeâtre. Poils despattes et des scapes brunâtres, assez dressés. Ecaille épaisse, très inclinée.

♂ :—1, 8 à 1, 9 mill. Tête ovale, un peu plus longue que large. Face basale du métanotum assez horizontale, un peu plus longue que la face déclive. Couleur comme chez le *Pr. indica*, ♂. Ailes comme chez la ♀. Valvules génitales extérieures tout à fait différentes de celles de le *indica*. Voir tableau et Fig. 2, 2a et 2b.

Malgré la différence des valvules génitales, cette espèce est trés voisine de le *Pr. indica* Valigne (enrso.)

6. *Pr. smythiesii*, nov. spec.

Dehra Dun (Smythies).

☿ inconnue.

♀ :—L.: 4 à 4, 3 mill. Assez allongée. Tête plus large derrière que devant, avec un large bord postérieur droit. Thorax un peu plus large que la tête, moins déprimé que chez les espèces précédentes. Face basale du métanotum extrêmement courte, presque nulle, mais la face déclive est distinctement séparée d'elle et tronquée en talus oblique, lisse et luisant (chez toutes les espèces précédentes, la face basale a une lougueur fort appréciable ; chez la *Pr. longicornis* elle passe par une convexité à la face déclive). Ecaille épaisse, basse et très inclinée. Abdomen étroit et allongé.

Subopaque. Pubescence fine et assez abondante (comme chez la *Pr. longicornis*). Quelques poils dressés fins et assez obliques aux scapes et aux tibias. Abdomen

d'un brun foncé, sauf le bord roux jaunâtre de ses segments. Pronotum, dessus du mésonotum et dessus de la tête brunâtres. Scutellum, tout le reste du corps, pattes et antennes d'un jaune testacé à peine un peu roussi ou bruni. Ailes subhyalines ; nervures d'un brun jaunâtre.

♂ :—L.: 1, 8 mill. Tête rectangulaire arrondie, plus longue que large. Le métanotum ne forme qu'un talus sur lequel on peut à peine distinguer une face basale de la face déclive. Couleur comme chez le *Pr. indica* et le *Pr. taylori*. Ailes comme chez la ♀. Le thorax est un peu plus large que la tête (plutôt plus étroit chez le *Pr. indica*). Le corps est plus court et plus trapu que chez le *Pr. indica* (au contraire de la ♀). Voir tableau et fig. 5, 5a et 5b.

Les *Prenolepis* de l'Inde, sauf la *Pr. longicornis* qui est cosmopolite, se rattachent toutes, ou le voit, par leurs valvules génitales, au type à appendice de la *Pr. vividula*. Ce fait est intéressant, car toutes les espèces connues de l'Amérique, de l'île de Madagascar (excepté la Réunion !), ainsi que l'espèce australienne se rapportent au type *Pr. obscura-longicornis* (voir Forel : Fourmis de Madagascar, dans Grandidier, Vol. XX, Part 2, p. 80 à 95).

Je suis obligé de laisser indéterminées plusieurs *Prenolepis* ♀ et ☿ de Ceylan et de diverses parties de l'Inde, parce que le ♂ n'a pas été pris et que je ne puis suffisamment juger de leur valeur spécifique.

La *Formica assimilis* de Jerdon paraît être une *Prenolepis*, mais il est absolument impossible de savoir laquelle. Il en est de même de la *Paratrechina vagabunda* de Motschulsky.

9me Genre ACANTHOLEPIS (Mayr).

Tableau des ouvrières.

Le mésothorax est rétréci au milieu en forme de col cylindrique, allongé et étroit. Le prothorax et le métathorax forment chacun un fort renflement aux deux extrémités de ce col .....A. FRAUENFELDI (Mayr 1.)

Le mésothorax est échancré et plus ou moins rétréci au milieu, mais sans former de col allongé ni cylindrique. Les scapes ne dépassent pas le bord postérieur de la tête de la moitié de leur longueur 2

1a. *A. frauenfeldi* ; variétés: a: Les scapes dépassent le bord postérieur de la tête des 3/5 de leur longueur. Métanotum avec deux dents ou épines. Ecaille inerme. Tête plutot ovale. En partie luisante, en partie subopaque (réticulée). Noire, avec les mandibules, les tarses, une partie des antennes et des tibias d'un jaune plus ou moins brunâtre. L. 3 à 3, 2 mill .....var. A. INTEGRA, n. var.

Comme la précédente, mais l'écaille est bidentée ou biépineuse ; la tête et le thorax sont tantôt rougeâtres, tantôt en tout ou en partie noirs. Tête plutôt comme chez la var. *A. sericea*, élargie en arrière et un peu déprimée. L. 2, 7 á 3, 3 mill..... var. A. BIPARTITA (Sm.)

b. Les scapes ne dépassent le bord postérieur de la tête que de la moitie de leur longueur. Ecaille bidentée, comme le métanotum.....c.

c. L. 2, 5 à 2, 8 mill. Tres luisante, presque lisse. Thorax en général rouge jaunâtre. Tête, antennes et pattes plus ou moins bruns ou jaunâtres. Abdomen d'un brun noir. Tête ovale-rectangulaire, à peine élargie derrière .....v. A. FRAUENFELDI, i. sp. (Mayr.)
L. 3 à 3, 5 mill. Tête plus déprimée, plus large, élargie derrière. Entièrement subopaque, très densément et très finement réticulée, en partie ridée, avec un éclat soyeux. D'un brun foncé ; thorax ordinairement rougeâtre ; pattes et antennes d'un brun jaunâtre .....
v. A. SERICEA (Forel).

2. Luisante, noire. Taille robuste, large. Tête ovale, large, élargie derrière. Pronotum faiblement convexe. Métanotum subopaque, sculpté, avec deux prolongements latéraux larges, triangulaires et obtus. Ecaille assez mince, avec deux courtes épines. Pédicule nullement prolongé derrière l'écaille. Abdomen grand, assez allongé. Pilosité dressée, blanchâtre, abondante sur le corps, nulle sur les tibias et les scapes. Mandibules rouges. Articulations des pattes, scapes et tarses testacés. L. 2, 3 à 3, 2 mill ...A. CAPENSIS (Mayr.)

Comme la *A. capensis*, mais plus grêle; mésonotum plus rétréci; métanotum simplement élargi et anguleux derrière. Ecaille faiblement échancrée, sans dents. Très luisante partout, presque lisse et presque glabre .....A. SIMPLEX (Forel.)

Comme la *A. capensis*, mais plus grêle ; mésonotum plus rétréci. Tête étroite, ovale, bien plus longue que large. Yeux situés au milieu des côtés. Métanotum avec deux fortes dents trés obtuses. Ecaille épaisse, bispineuse, avec deux angles latéraux en dessous des épines. Pilosité du corps plus longue, plus abondante, très fine et très pointue. Thorax et écaille d'un rouge jaunâtre avec des taches brunâtres sur le dos. Peutetre une race de la *A. capensis*, L. 2, 3 mill .....
A. MODESTA, nov. sp.

Entièrement mate, densément réticulée-ponctuée, sauf l'abdomen qui est luisant. D'un roux ferrugineux. Abdomen noir ou d'un roux brun. Taille plus grêle que chez la précédente. Scapes dépassant a peine

d'un tiers de leur longueur le bord postérieur de la tête. Tête presque carrée, a côtés un peu convexes. Yeux situés au milieu des côtés de la tête (en arrière chez presque toutes les autres espèces). Mandibules étroites. Epistome très convexe au milieu, subcaréné. Ocelles fort petits, mais distincts ; sillon frontal faible. Dos du pronotum presque plat, subbordé et subépaulé à ses angles antérieurs. Suture pro-mésonotale fortement imprimée, luisante. Métanotum court ; ses côtés entiers forment deux fortes protubérances latérales allongées, en forme de grandes dents triangulaires, relevées, pointues, avec la pointe un peu courbée en arrière. Mésonotum étroit. Ecaille plus épaisse que chez l'*A. capensis*, surmontée de deux longues épines étroites, droites et pointues. Pilosité dressée courte, éparse, obtuse, jaunâtre, nulle sur les pattes et les antennes. Pubescence très éparse. Pédicule avec un prolongement cylindrique assez long derrière l' écaille. Abdomen court. L. 2, 2 mill...A. OPACA (Forel).

Forme et caractères généraux de la race typique, mais le mésonotum est un peu moins étranglé et le pronotum moins élargi devant, sans épaules distinctes. Tête un peu moins courte. Abdomen plus mou ; portion postérieure du pédicule un peu moins allongée. La longueur est la même, l'abdomen étant un peu plus grand et le reste plus petit. L'abdomen est subopaque, fortement réticulé. D'un brun noirâtre ; une grande tache médiane sur le 1er segment de l'abdomen, l'extrémité des dents ou protubérances métanotales, les tarses et les articulations des pattes d'un jaune pâle ; antennes et mandibules d'un jaune testacé. Pilosité dressée, d'un jaune pâle, plus abondante que chez la race typique, surtout sur l'abdomen .....

A. OPACA, r. PULCHELLA (Forel).

LISTE DES ESPÈCES DU GENRE ACANTHOLEPIS.

1. *A. frauenfeldi* (Mayr).

var. *A. Frauenfeldi*, i. sp. (Mayr).

Barrackpore (Rothney) ; Côtes de la Méditerranée et Afrique Orientale.

var. *A. sericea* (Forel).

Poona (Wroughton) ; Mussoorie (Rothney) ; Oudh (Simpson), etc. C'est évidement, avec la *A. bipartita*, la forme la plus répandue, dans l'Inde occidentale au moins.

var. *A. integra*, nov. var.

Dharmsala, Himalaya (Sage) ; Mussoorie (Rothney) ; Pachmarhi, Inde centrale (Schurr). Voir du reste le tableau.

var. *A. bipartita* (Sm).

Dharmsala, Himalaya (Fulton); Calcutta (Rothney); Mt. Abu, Rajpootana (Gleadow); Himalaya (Smythies); Syrie et Afrique du nord.

Cette variété passe par diverses formes aux trois précédentes. Je l'avais d'abord confondue en partie avec l'*A. frauenfeldi*, i. sp. (Wroughton : Our Ants) qui paraît rare en Inde.

Les variétés *A. bipartita* et *A. integra* ont les antennes et les pattes plus longues que l'*A. frauenfeldi* typique, ce qui les rapproche un peu de l'*A. gracilicornis*, Forel, d'Aden.

2. *A. capensis* (Mayr).

Poona (Wroughton); Mussoorie (Rothney); Himalaya (Smythies); Pachmarhi, Inde centrale (Schurr); Ceylan (Simon); Afrique orientale et méridionale.

Cette espèce varie surtout par sa pilosité qui est parfois plus raide, plus grossière et plus blanchâtre, parfois plus fine, plus pointue et plus jaunâtre. Les dents du métanotum s'elargissent aussi parfois, de façon à comprendre les côtés entiers de l'organe, comme chez l'*A. opaca* ; dans ce cas, le métanotum est plus court.

3. *A. simplex* (Forel).

Orissa (Taylor). Identique aux types d'Afrique, des Somalis.

4. *A. modesta*, nov. spec.

Mussoorie (Rothney). Voir Tableau.

5. *A. opaca* (Forel).

r. *A. opaca* (i. sp).

Kanara, Goa (Aitken). Voir Tableau.

r. *A. pulchella* (Forel).

Poona (Wroughton). Voir tableau.

Les formes du genre *Acantholepis* paraissent la plupart être communes à l'Inde et à l'Afrique orientale, fait assez intéressant.

10me Genre PLAGIOLEPIS (Mayr).

Tableau des ouvrières.

1. Thorax grêle et allongé. Pattes et antennes très longues et grêles. Ecaille élevée, verticale, plus épaisse que large. Couleur jaunâtre, en partie jaune brunâtre. L. 3, 5 à, 4 mill.....PL. LONGIPES (Jerdon).

   Thorax robuste. Pattes et antennes assez courtes. Ecaille plus large qu' épaisse, assez basse, inclinée en avant 2

2. L. 2, 4 à 4, 6 mill. Segment intermédiaire enfoncé, long comme à peine le tiers du mésonotum. Thorax fortement étranglé au milieu. Métanotum presque aussi large que le pronotum. Noire .....
   PL. ROTHNEYI, nov. spec.

   L. 1, 1 à 1, 6 mill. Segment intermédiaire fort développé, à peine plu court que le mésonotum. Thorax à peine étranglé au milieu.....3

3. Noire ; trapue. Métanotum presque aussi large que le pronotum. L. 4, 1, 3 à 1, 6 mill. Aire frontale distincte 4

Jaunâtre ou d'un jaune un peu rougeâtre, varié de brunâtre sur la tête et l'abdomen. Moins trapue. Métanotum beaucoup plus étroit que le pronotum. L. 1, 1 à 1, 3 mill.....Pl. EXIGUA, nov. spec.

4. Lisse, luisante, presque sans sculpture. Ponctuation piligère à peine marquée. Epistome très convexe, sans carène. Le segment intermédiaire plus court pue le mésonotum. Pubescence presque nullee. Pilosité dressée jaune pâle, courte, pointue, assez abondante sur tout le corps, les pattes et les antennes ..... Pl. JERDONII nov. spec.

Devant de la tête (surtout le front et le vertex) très finement striè en long et subopaque. Le reste du corps, les pattes et les scapes lisses, luisants, avec une ponctuation piligère espacée assez fort et irrégulière. Epistome peu conveze, mais asses distinctement caréné. Segment intermédiaire aussi long que le mésonotum. Pilosite dressée presque nulle ; seulement quelques poils brunâtres, surtout sur l'abdomen. Pubescence espacée, mais assez longue et trés distincte, surtout sur l'abdomen, la tête, les scapes et les pattes ..... Pl. ROGERI nov. spec.

LISTE DES ESPECES DU GENRE PLAGIOLEPIS.

1. *Pl. longipes* (Jerdon).

=*Formica gracilipes* (Smith).
=*Plagiolepis gracilipes* (Mayr).
=*Formica trifasciata* (Smith).

Très commune dans l'Inde entière, à Ceylan et en Birmanie, à l'exception, semble-t-il, du Nord-est de l'Inde, d'ou je ne l'ai pas reçue. C'est une espèce de la faune indo-malaise.

2. *Pl. lothneyi*, nov. spec.

Barrackpore (Rothney) ; Belgaum (Wroughton) ; Orissa (Taylor).

♀ *Major* (voir tableau). Mandibules lisses, luisantes, ponctuées armées de 5 dents. Epistome sans carène distincte, convexe. Aire frontale, sillon frontal et ocelles distincts. Tête au moins aussi large que longue, à cotés convexes, assez rétrécie devant. Les deux stigmates post-mésonotaux proéminent doralemsent au fond de la large et profonde échancrure néso-métanotale. Métanotum fortement élargi d'avant en arrière. Sa face basale, plutot plus longue que la face déclive, passe à cette dernière par une ligne transversale droite ; c'est là que le métanotum est le plus large. D'avant en arrièré, les deux faces du métanotum passent de l'une à l'antre par une courbe très arrondie. Ecaille

épaisse, amincie et atténuée au sommet. Les scapes dépassent sensiblement l'occiput.

Tête et pronotum abondamment ponctués, médiocrement luisants. Mésonotum, métanotum et écaille lisses et très luisants, surtout le métanotum. Abdomen faiblement chagriné, plus ou moins luisant.

Pilosité dressée brunâtre, courte, assez grossière, éparse sur le corps, un peu plus abondante sur l'abdomen, nulle ou presque nulle sur les scapes et les tibias. Pubescence jaunâtre, assez abondante sur l'abdomen, les scapes et les tibias où elle forme un léger duvet qui cache en partie la sculpture, médiocre sur la tête, éparse ailleurs, nulle au milieu du métanotum.

D'un noir un peu brunâtre. Mandibules, scapes, base des funicules et tarses rougeâtres. Le reste des pattes et des funicules, les hanches, le métasternum d'un brun plus ou moins rougeâtre ou noirâtre.

☿ *minor*. Tête ovale, un peu plus longue que large, presque aussi étroite derrière que devant. Ocelles, sillon frontal et aire frontale peu distincts. Sculpture et pubescence beaucoup plus faibles que chez la ☿ major ; très luisante ; pubescence très éparse ; tête à peine ponctuée. Les parties rougeâtres chez la ☿ major sont jaunâtres ou d'un jaune rougeâtre chez la minor. Du reste comme la ☿ major, mais plus grêle.

r. *Pl. watsonii* (nov. st.).

Birmanie (Watson) ; Bangkok (Sigg).

Je n'ai pas mis cette race sur le tableau, pour ne pas le compliquer inutilement. Elle se distingue de l'espèce typique par sa pilosité abondante sur le corps, les tibias et les scapes, par l'absence d'ocelles et de sillon frontal, même chez la ☿ major, par son épistome, en partie du moins, assez distinctement carénè par son épistome, en partie du moins, assez distinctement caréné, par sa pubescence, sa sculpture et son échancrure méso-métanotale qui sont plus faibles. Du reste identique.

3. *Pl. jerdonii*, nov. spec.

Poona (Wroughton).

☿ (Voir tableau). Très semblable à la *Pl. pygmæa*, mais les yeux sont plus grands et la couleur est plus foncée. Tête à peu près carrée, un peu plus étroite devant que derrière. Funicules un peu plus grêles que chez la *Pl. pygmæa*. Le thorax est plus court et plus robuste que chez l'espèce suivante, plus fortement étranglé que chez la *Pl. pygmæa*. Le métanotum est rapidement élargi d'avant en arrière ; il ne forme guère qu'une seule surface dorsale faiblement convexe, dont le point le plus large est aux deux stigmates qui forment comme ses angles supérieurs, latéraux et postérieurs. A partir des stigmates, le métanotum ne s'élargit plus et a une courte déclivité un peu plus forte qu'avant.

D'un noir brunâtre ou d'un brun noirâtre. Scapes, premier article des funicules, tarses, tibias, anneaux fémoraux et mandibules jaunâtres ; le reste des funicules et des pattes plus ou moins brunâtre ou brun jaunâtre. Les autres caractères sont indiqués dans le tableau.

4. *Pl. rogeri*, nov. spec.

Kanara (Wroughton et Aitken). Confondue encore avec la *Pl. jerdonii* dans le travail de M. Wroughton (Our Ants).

(Voir le, tableau). Un peu plus grêle que la précédente ; métanotum un peu moins élargi, avec un peu plus de distinction entre une face basale et une face déclive, du reste de même forme. Tête un peu plus longue que large, aussi large devant que derrière. Yeux situés un peu plus en evant que chez la *Pl. jerdonii*, au tiers antérieur des côtés de la tête. Front légérement déprimé ou imprimé derrierè.

D'un noir plus foncé que la *Pl. jerdonii* ; les parties jaunâtres sont les mêmes, mais plus contrastantes. Funicules seulement un peu plus foncés vers l'extrémité.

La *Plagiolepis madecassa*, Forel, de Madagascar, ressemble beaucoup aux deux précédentes, surtout à la *Pl. rogeri*, mais son métanotum n'est pas élargi et a la forme de celui de la *Pl. pygmœa* ; sa tête est luisante et nullement striée.

5. *Pl. pissina* (Roger).

Ceylan (d'après Roger).

Ne connaissant pas cette espèce insuffisamment décrite, je n'ai pu la mettre dans la tableau. Est-ce une variété d'une des deux précédentes ? Dans ce cas, de laquelle ? D'après Roger, l'aire frontale est indistincte, l'abdomen sans sculpture ni pubescence, l'épistome imprimé transversalement devant. Je possède une ☿ de Poona (M. Wroughton) qui correspondrait assez à la description de Roger, mais l'aire frontale est distincte, l'abdomen pubescent et ponctué ; c'est une variété de la *Pl. jerdonii* avec la pubescence et la pilosité de la *Pl. rogeri*. Dans le doute, je préfère donner deux noms nouveaux.

6. *Pl. exigua*, nov. spec.

Poona (Wroughton). Kanara (Aitken).

Cette espèce, le liliputien du genre, se trouve aussi a Madagascar.

☿ (Voir tableau). Tête ovale, à côtés convexes, presque aussi large devant que derrière ; yeux situés au tiers antérieur des côtés. Les scapes atteignent l'occiput sans le dépasser, tandis qu'ils le dépassent chez les espèces précédentes. Occiput faiblement et largement échancré. Thorax très court. Une légere échancrure entre le mésonotum et le ségment intermédiaire. Aucune échancrure entre ce dernier et le métanotum. Le segment intermédiaire est aussi grand que le mésonotum. Métanotum convexe ; sa face basale courte,

sa face déclive bien plus longue. Le métanotum n'est pas ou est à peine élargi d'avant en arrière. Abdomen grand. Epistome entier, convexe, sans carène. Articles 2 à 5 du funicule des antennes plus épais que longs. Pattes courtes.

Lisse et luisante, éparsément ponctuée, surtout sur la tête et l'abdomen. Pilosité dressée jaunâtre, extrêmement courte et très éparse sur le corps, nulle sur les scapes et les tibias. Pubescence jaunâtre très fine, régulièrement espacée, surtout sur la tête, l'abdomen, les scapes et les pattes, sans former aucun duvet.

Thorax, pattes, scapes, premier article des funicules, mandibules et pédicule d'un jaune assez clair. Tête e reste des funicules d'un jaune brunâtre. Abdomen d'un brun jaunâtre, avec une bande longitudinale, médiane, jaunâtre, nuageuse, plus ou moins distincte, qui interrompt au milieu le brun de chaque segment.

♀ :—L. : 2, 7 à 3 mill. Très étroite. Abdomen très long. Caractères de l'ouvrière, mais la pubescence est plus forte et plus abondante. La tête et le thorax sont d'un jaune brunâtre ou rougeâtre. Abdomen entièrement brunâtre ou d'un brun jaunâtre. Le thorax est fortement déprimé en dessus ; l'écaille est très basse et très inclinée ; les ailes manquent.

11me Genre ACROPYGA (Roger).

A. acutiventris (Roger).

= *A. flava*, Mayr.

Poona (Wroughton) ; Ceylan (Yerbury) ; Birmanie (Fea) ; Milu, Nicobares (d'après Mayr).

Il m'est impossible de trouver une différence appréciable entre l'*A. flava*, Mayr et l'*A. acutiventris*, Roger. Il ne s'agit évidemment que d'une synonymie. Les ailes du ♂ et de la ♀ sont légèrement enfumées de brun noirâtre.

Var. *A. rubescens*, n. var. D'un jaune rougeâtre. Tête et abdomen d'un jaune brunâtre chez l'ouvrière ; tout le corps d'un jaune brunâtre chez la ♀. Chez le ♂, la tête et le thorax sont d'un brun jaunâtre, l'abdomen jaunâtre. Les ailes sont plus fortement enfumées de brun noirâtre que chez le type dont le corps est entièrement jaune. La taille de la var. *A. rubescens* est aussi un peu plus grande ; son écaille est un peu plus élevée, plus mince et plus tranchante au sommet ; la pilosité est encore un peu plus abondante.

Cette variété a été récoltée à Belgaum par M. Wroughton, dans le Kanara par M. Bell, et à Ceylan par M. Yerbury. Si Roger n'écrivait pas que la ☿ et la ♀ de son *A. acutiventris* sont jaunes, je croirais que cette variété est le type de Roger, dont l'*A. flava*, Mayr, serait alors une variété.

Genre *Myrmoteras*, nov. gen.

☿ Vessie à venin à coussinet. Aiguillon transformé. Orifice du cloaque apical, fortement cilié, circulaire. Calice du gésier très raccourci. Les quatre

sépales divergent très fortement et sont fortement chitinisées dès leur base, à partir des valvules. Elles sont très courtes et fortement recourbées à leur extrémité. Ce gésier est différent de toutes les formes connues jusqu'ici et fait probablement transition à celui des *Dolichoderides*.

Antennes de 12 articles. Palpes maxillaires de 6, labiaux de 4 articles. Mandibules insérées très près l'une de l'autre, linéaires, droites, plus longues que la tête, semblables à celles des *Odontomachus* ou plutôt des *Strumigenys* du groupes *saliens* et dentées de même. Pas d'arêtes frontales. Antennes insérées très en arrière du bord postérieur de l'épistome, dans une fossette articulaire isolée. Aire frontale et sillon frontal distincts. Yeux énormes, allongés et très proéminents, comme ceux d'un ♂. Trois gros ocelles. L'occiput a un gros bourrelet en forme de v renversé qui le sépare de l articulation du pronotum, et dont le sommet est en haut. Ce bourrelet est séparé du reste de la tête par une fente profonde. La tête est plus ou moins triangulaire (base du triangle derrière, sommet devant). Le mésothorax a un fort étranglement cylindrique, colliforme, sur lequel les deux stigmates proéminent derrière comme deux dents. Pédicule avec une écaille élevée et épaisse.

♀ et ♂ inconnus.

M. binghami, nov. spec.

☿ :—L. : 4, 7 mill. sans les mandibules, 6, 0 mill. avec les mandibules. Toutes les ☿ de même grandeur. Caractères du genre ; entièrement lisse et lui sante ; thorax éparsement ponctué. Devant de la tête strié-ponctué en long. D'un rouge brunâtre ; abdomen d'un brun rougeâtre. Pattes et antennes grêles, d'un jaune rougeâtre ; mandibules jaunâtres. Pilosité dressée éparse, très fine, plus abondante sur les pattes et les antennes. Pubescence presque nulle. Métanotum arrondi. Tête presque aussi large que longue.

Les mandibules sont courbées à l'extrémité qui est terminée par deux longues dents qui ne renferment deux petites dans leur intervalle. Le bord interne (confondu avec le bord terminal) a de plus 6 ou 7 dents étroites et pointues, de plus en plus courtes, à mesure qu'ou s'approche de la base, et séparées les unes des autres par de longs intervalles réguliers. Epistome grand, arrondi, à peine plus large que long, assez plat, avec une convexité médiane et le bord antérieur concave. Portion articulaire des mandibules large et haute. Aire frontale étroite, assez longue, pointue derrière. Sillon frontal fortement imprimé, prolongé jusqu'à l'ocelle antérieur. Articulation des antennes située tout près de l'œil, presque aussi distante de l'épistome que la longueur entière de ce dernier. L'articulation a en dedans un petit bord relevé, et derrière elle se trouve une faible impression qui représente la fossette antennaire. Pas de fossette

clypéale. Les yeux occupent plus de la moitié des côtés de la tête. La tête est élargie et tronquée derrière. A la base de la troncature, autour de l'articulation avec le prothorax proémine le gros bourrelet qui est plus épais de côté qu'au sommet et ne se prolonge pas sous la tête. Le pronotum a un assez long cou devant. Sans le cou, il est plus large que long (subitement renflé derrière le cou). Le mésothorax entier est colliforme, deux fois plus long que large. Métanotum peu élevé, convexe ; face basale deux fois plus longue que la face déclive. Pédicule allongé, surmonté au milieu d'une écaille haute, épaisse verticale, arrondie au sommet, tronquée devant, plus arrondie (subtronquée) derrière. Antennes très grêles ; pattes longues ; tibias plus épais que les cuisses. Occiput, pronotum et métanotum finement et éparsément ponctués. Devant de la tête strié-ponctué. Quelques rides sur le mésonotum. Du reste lisse et luisant.

Thaungyin valley, en Birmanie, récolté par M. le Major Bingham et reçu par M. Wroughton.

Cette fourmi est une des formes les plus singulières de l'arbre myrmécologique déja si riche en phénomènes morpho-biologiques. Au premier abord on dirait un *Anochetus* très aberrant. Mais un examen attentif et l'anatomie démontrent bientôt qu'il s'agit d'un Camponotide tout-à-fait aberrant. Les yeux énormes semblent indiquer une vie sur les arbres.

Le genre *Myrmoteras* n'étant pas dans notre tableau des genres, il faut l'intercaler au chiffre 1 comme suit :

Pas d'arêtes frontales. Antennes inserées très en arrière de l'épistome. Mandibules articulées tout près l'une de l'autre, linéaires, parallèles dentées, plus longues que la tête. Yeux énormes.....GENRE MYRMOTERAS, nov. gen.

EXPLICATION DES FIGURES.

Fig. 1 *Prenolepis yerburyi*, Forel, ♂ valvules génitales extérieures.
„ 1ª „ „ „ „ „ moyennes.
„ 1ᵇ „ „ „ „ „ intérieures.
„ 2 „ *taylori*, „ „ „ extérieures.
„ 2ª „ „ „ „ „ moyennes.
„ 2ᵇ „ „ „ „ „ intérieures.
„ 3 „ *bourbonica*, Forel, v *bengalensis*, Forel, ♂ valvules génitales extérieures.
„ 4 „ *indica*, Forel, ♂ valvules génitales extérieures.
„ 4ª „ „ „ „ „ moyennes.
„ 4ᵇ „ „ „ „ „ intérieures.
„ 5 „ *smythiesii*, „ „ „ extérieures.
„ 5ª „ „ „ „ „ moyennes.
„ 5ᵇ „ „ „ „ „ intérieures.

N. B.—Dans les figures 1ª, 2ª, 4 et 5ª, *i* signifié " prolongement interne," et *e* " prolongement externe."

NOTES ON SOME OF THE BUTTERFLIES OF MATHERAN.

By J. A. Betham.

(*Read before the Bombay Natural History Society on* 13*th Nov.* 1893.)

The accompanying lists are published in the hope that others will add to the number of butterflies mentioned therein. It would be desirable if a complete list with the correct names of all the butterflies occurring on Matheran could be got together for the help of future lepidopterists. Many of the names given in Dr. J. Y. Smith's book on "Matheran Hill: its People, Plants, and Animals," have of necessity undergone change, since further investigation of species has been made, and they now stand, as far as is known, corrected up to date. Some of the names I have been unable to trace with the limited means at my disposal.

I spent a month at Matheran during April and May, 1892. This was of course about the worst time of the year for observing Natural History, but I was able to collect 34 species of butterflies and observe 10 more. I collected chiefly in the woods about Charlotte Lake, and, being a new-comer to the Hill (although I used to be taken up as a child some 30 odd years ago), I was not aware of the best spots for collecting. I was told, just as I was leaving, that probably the best place was in the depression between Hart and Panorama Points, but I was unable to visit this place. There is, I think, a tank there, and a nala which generally holds water. It is in places like this that one can expect to make the best captures. Most of the specimens I caught were worn, and though I captured several *Kallima horsfieldii*, none were in fit condition to keep, and so I let them go. The chief thing that struck me about the butterflies in Matheran was the quantity of *Hesperiidæ* to be found almost everywhere resting on the ground in shady spots or under leaves. You kick them up individually in scores, but the number of species was very few. I made an excursion to the "Rambagh," and another to the "Mar-rai" or Palm grove, but was disappointed. The only capture worth mentioning was a *Bibasis sena* in the "Mar-rai." The two places just mentioned are belts of forest below the cap of the Hill. Another noticeable fact was the predilection that *Celænorrhinus ambareesa* had for coming into the verandas of the houses and settling

on the walls, especially if the walls were dark. I was not very successful in getting any butterflies to come to baits ; but I did capture a very fine male *Charaxes imna* in that manner. The captures made by me have added 18 species to those mentioned in Dr. Smith's book. Some more are probably mentioned in the article on Matheran Hill in the *Bombay Gazetteer* ; but, not being able to lay my hands on a copy of this work, I am unable to give their names. Some one on the Bombay side may possibly be able to add this information through the medium of our Society's Journal. At present only 78 species are noted in these lists ; but there must be numerous other species obtainable on the Hill, and it is hoped that some of the " ducks " of Bombay will add to them.

List of Butterflies mentioned in Dr. J. Y. Smith's " Matheran Hill : its People, Plants, and Animals," 1881, pp. 118—125 & 176—180.

1. *Danais aglea.*
2. *Danais limniace.*
3. *Danais chrysippus.*
4. *Danais genutia.*
5. *Danais careta.* (?)
6. *Mycalesis mineus.*
7. *Ypthima singala.*
8. *Ypthima philomela.*
9. *Melanitis leda.*
10. *Melanitis ismene.*
11. *Ergolis ariadne.*
12. *Byblia ilithyia.*
13. *Atella phalanta.*
14. *Precis iphita.*
15. *Junonia lemonias.*
16. *Junonia œnone.*
17. *Junonia orithyia.*
18. *Neptis varmona.*
19. *Hypolimnas bolina.*
20. *Hypolimnas misippus.*
21. *Athyma perius.*
22. *Pyrameis indica.*
23. *Cyrestis.*
24. *Kallima horsefieldi.*
25. *Charaxes athamas.*
26. *Poritia ?*
27. *Lampides ælianus.*
28. *Catochrysops cnejus.*
29. *Tarucus theophrastus.*
30. *Tarucus plinius.*
31. *Castalius rosimon.*
32. *Castalius roxus.*
33. *Iraota mæcenas.*
34. *Aphnæus lohita.*
35. *Zeltus etolus.*
36. *Catopsilia hilaria.*
37. *Catopsilia phillipina.*
38. *Catophaga paulina.*
39. *Eronia valeria.*
40. *Hebomia glaucippe.*
41. *Huphina albina.*
42. *Huphina phryne.*
43. *Belenois mesentina.*
44. *Terias hecabe.*
45. *Papilio polymnestor.*
46. *Papilio pammon.*
47. *Papilio polytes.*
48. *Papilio agamemnon.*
49. *Papilio epius.*
50. *Papilio sarpedon.*
51. *Papilio hector.*
52. *Papilio deiophobus.*
53. *Papilio panope.*
54. *Papilio iswara.*
55. *Papilio dissimilis.*
56. *Matapa aria.*
57. *Chapra agna.*
58. *Sarangesa purendra.*
59. *Udaspes folus.*
60. *Hesperia galba.*

List of Butterflies caught at Matheran in April and May, 1892, by J. A. Betham.

1. *Danais melanoides.*
2. *Danais limniace.*
3. *Danais genutia.*
4. *Euplœa core.*
5. *Mycalesis perseus.*
6. *Lethe nilgheriensis.*
7. *Ypthima philomela.*
8. *Melanitis ismene.*
9. *Ergolis ariadne.*
10. *Atella phalantha.*
11. *Junonia almana, v. asterie.*
12. *Neptis varmona, v. eurymene.*
13. *Neptis ophiana.*
14. *Neptis jumbah.*
15. *Athyma perius.*
16. *Charaxes imna.*
17. *Abisara suffusa.*
18. *Catochrysops cnejus.*
19. *Cyaniris puspa.*
20. *Castalius rosimon.*
21. *Tarucus plinius.*
22. *Deudorix epijarbas.*
23. *Terias œsiope.*
24. *Huphina phryne.*
25. *Delias eucharis.*
26. *Catopsilia catilla.*
27. *Leptosia xiphia.*
28. *Papilio polymnestor.*
29. *Badamia exclamationis.*
30. *Bibasis sena.*
31. *Parata chromus.*
32. *Sarangesa purendra.*
33. *Isoteinon nilgheriensis.*
34. *Celœnorrhinus ambareesa.*

List of Butterflies seen at Matheran in April and May, 1892.

35. *Danais chrysippus.*
36. *Junonia lemonias.*
37. *Junonia œnone.*
38. *Junonia orithyia.*
39. *Hypolimnas bolina.*
40. *Hypolimnas misippus.*
41. *Kallima horsfieldii.*
42. *Papilio polytes.*
43. *Chapra mathias.*
44. *Udaspes folus.*

MISCELLANEOUS NOTES.

No. I.—"O PAO DA COBRA" OR SERPENT'S WOOD OF THE PORTUGUESE.

"O Pao da Cobra" or Serpent's Wood was in great request among Europeans in India in the sixteenth and seventeenth centuries. Everybody in those days seems to have provided himself with an antidote to snake-bites. The impression of the number and extent of poisonous snakes in India then created has not yet died away. Many in Europe even now believe that a European in India is never safe from a cobra-bite. But, as a matter of fact, I do not think there are among Europeans more deaths due to snake-bites than to polo-playing or to steeple-chases. The impression is no doubt kept up by the immense number of deaths, upwards of 21,000 per year or 1 in about 10,166, of the population, that take place, due to this cause, among the natives, owing to their habit of going about barefooted and of sleeping on ground-floors. In this paper I wish to describe chiefly the three kinds of Serpent's Wood mentioned in the "Colloquios da India" by Dr. Garcia d'Orta, a work first published in Goa in 1563, and soon afterwards translated into Latin and various European languages. To judge from the descriptions given by the author, it is really astonishing to see the immense knowledge he had gained of the drugs not only of India, but even those of Persia and China. The three kinds of Serpent's Wood described by him are as follows :—

(1). "The first one known as *Rannetul* in Ceylon is a shrub growing to the height of two or three feet; it throws out few branches, that is four or five, which are very thin. The root, which is the useful part, is thin like the thinnest twig of a vine, and it is knotted, and always some portion of the root is exposed, and if it is eaten away or torn in any part, it throws out fresh roots. The fruit of this shrub is like that of the elder tree, but is red and harder; it grows in round clusters like those of the woodbine; . . . . the flowers are very red, and they grow in a round terminal cluster; the leaf is like that of a peach-tree, but a little darker in colour. The colour of the root is between white and grey, and it is smooth to the touch although not soft, and it is very bitter. This plant is to be found in many parts, also in the tableland of Goa." From this description many writers have identified the plant with *Ophiorrhiza Mungas*, Linn., N. O. *Rubiaceæ*, but it has to be noted that its flowers are not very red, nor is it to be found in Goa or in the South Konkan. The description, although not exact in every particular, appears to me to refer more to *Ranwolfia serpentina*, Benth., N. O. *Apocynaceæ*, a species common both to Ceylon and to Goa. The pedicles and calyces of the flowers of this plant are of a bright red colour, and the root is very bitter, while that of the *Ophiorrhiza* is said to have a taste like gentian. The properties of *Ranwolfia serpentina* have not yet been thoroughly

investigated. There is a strong popular belief in the South Konkan regarding its value as an antidote in cobra poison, and it is much used in dyspepsia, colic, cholera and fevers. Its present popular uses agree quite closely with those given 330 years ago by Garcia d'Orta, who says, "this root is bruised and given by the natives in snake-bite in water, and we give it in wine or some cordial water and it soon produces its effects ; it is also beaten up with sandalwood and applied to the bitten part. . . . . The people of this country use it in intestinal worms, in small-pox and measles, and in cholera. It is also said to be very useful in chronic fevers." The native name of this plant in the South Konkan is *Atki*.* It is very common in the South Konkan ; it flowers at the commencement of the rains and produces fruit in August and September.

(2) "There is in Ceylon another plant, which, when it grows alone, attains the height of a pomegranate tree, but when it grows near a tree or in the forest it becomes a creeper like the gourd plant and climbs over the highest trees. . . . Its leaves are yellowish, very beautiful ; the bark is covered with blunt spines, and it is white and thick. . . . . This tree is said to grow in the Island of Goa, but I have not seen it." There is hardly any doubt that this description refers to *Strychnos colubrina*,† Linn., N. O. *Loganiaceæ*. It grows in this Presidency on Chorla Ghâts to the east of Goa, and it is also a native of Ceylon. Garcia d'Orta says that the wood, the bark and the root are the parts used in snake-bites, but that the root is preferable. He had also some cups made of the wood, similar most likely to the quassia cups of the present day, and they were given to patients who were supposed to suffer from chronic poisoning ; no doubt it was one of the ways of administering small doses of strychnine. The wood of this plant is generally identified with the true *Lignum colubrinum*. Even now it is held in high esteem by the Portuguese. Walking-sticks made of it are supposed to drive away all serpents! That this Serpent's Wood or its alkaloid strychnine is a valuable medicine in the bites of some poisonous snakes has been clearly proved by some Australian doctors, and evidence is forthcoming that it may be useful, if properly administered, in some cases of cobra-bites. Bombay obtains its supply of this wood from the Malabar Coast.

Strychnos Beddomei, Clarke (*S. cal.*, Wl.), resembles closely the previous species except in its corolla tube, which is larger. It is a native of Ceylon and Travancore. This plant probably furnishes a portion of the true *Lignum colubrinum*.

Van Rheede in his "Hortus Indicus Malabaricus," Vol. VIII, p. 47, t. 8, describes under the name of *Modira carinam* "Pao de Cobra" or "Pao de Solor" of the Portuguese, a species of strychnos which has been named

* *Atki* is the common native name, at Mahableshwar, of *Mœsa indica*.—Ed.

† There is any amount of it on Matheran below the cliffs, near "Birdwood Walk," leading from Chauk Plateau to Little Chauk Point.—Ed.

S. Rheedii (*S. Colubrina*, Blume) by Clarke, who says: "It is only known from Rheede's figure, which may be incorrect as to flowers." The species was figured in 1688, and as yet has not been verified by any subsequent observer. Its distinctive characters are: peduncles of flowers lateral; buds subglobose; corolla tubes very short. Its full description, as given by Rheede, is as follows: "*Modira carinam* Lusitanis *Pao de Cobra* vel *Pao de Solor* cum *carinam* (Strychnos nux vomica) in prima parti descripta in omnibus pene convenit, sed hæc arbor illa herba (shrub) cujus fructus corticæ dura viridi fusco, et pulpa interiori albicante ad maturi spadiceo ingrescentes cum illi *carinam* miniate rubescant. *Modira* (hooks or tentacles) dicitur ob similitudinem mystacum, *modira* enim mystax est. Natale solum est circa *Mangotti*, *Paroe* et alia loca, semper fere vel florens vel frugens." And in the "Flora of British India" it is described thus: "Tendrils present; branches stout; leaves elliptic acute 3-nerved, 3½ by 1¾ in., base obtuse or rounded; petiole ⅛-⅙ in; peduncles ½ in. axillary; lax 3-4 flowered; corolla short-tubed 5-merous; pedicels ⅛ to ⅓ in.; berry 2½ in. diam., globose; seeds many, ¾ in. diam., circular discoid." I may mention that Roxburgh, writing in the early part of this century, and probably having in view this plant, says: "I am inclined to think there is a species different from the third or scandent species called *colubrina* (*S. colubrina*, Roxb.) as well as from the *nux vomica* tree, which yields the real, or at least another sort of the *Lignum colubrinum*. The wood of the root of this sort is esteemed by the Telinga Physicians an infallible remedy for the bite of the *naya* (cobra) as well as that of every other venomous snake. It is applied externally as well as given internally." It is worthy of note that Rheede, although he names his plant "Pao de Cobra," still does not mention that it is used in snake-bite. Probably he takes it for granted that it is used in this way.

Mr. C. B. Clarke thinks that the previous species may be really *Strychnos cinnamomifolia*, Thwaites, *S. colubrina*, Wight, *Ic. t.* 434, Roxb., *Fl. Ind.*, *I*, 578. This plant grows in Ceylon, but not, as far as it has been verified, on the Malabar Coast. Its fruits resemble those of the previous species. Roxburgh cites *Modira carinam* of Rheede as a synonym of his *S. colubrina*, but the flowers of his species are terminal, while those of Rheede's, as already noticed, are lateral or axillary. It is said that this plant also may yield a kind of *Lignum colubrinum*.

The authors of the "Pharmacographia Indica" state that a portion of Serpent's Wood may also be probably derived from *S. laurina*, Wall., a native of Cachar, Pegu and Tenasserim.

Strychnos Nux Vomica, Linn., has also been styled *S. colubrina* by Wallich and Wight, but it is the general opinion that the wood of this tree, which is extremely common in the South Konkan, is not the true Serpent's Wood, although often substituted for it. It has been found by analysis that the bark and wood of this tree do not show any traces of strychnine, while those of

S. colubrina contain it in large quantities. It would be interesting to examine chemically the woods of all the species of *Strychnos*, and to see which of them do contain strychnine, and those which contain it may be styled the true *Lignum colubrinum*, because the value of the wood depends entirely, as far as it is known, upon the presence of this alkaloid. There are about 60 species of *Strychnos* in the tropics, out of which 4 are natives of Bombay, namely *S. Colubrina*, Linn ; *S. Dalzellii*, Clarke ; *S Nux Vomica*, Linn. ; and *S. Potatorum*, Linn.

(3) "When the Viceroy D. Constatino went to Jafnapatam, which is an Island near Ceylon, they brought him a present of some bundles of a wood with its roots as a much-valued antidote in poisons. This root is aromatic and it is thin, hard, and dark in colour. These roots are said to be very common in the plains of Goa." This root is, no doubt, that of the Indian Birthwort, *Aristolochia Indica*, Linn., N. O. *Aristolochiaceæ*, a plant very common in Goa, but not in other parts of the South Konkan. This root was known in the 15th century as the "Raiz da obra" or snake-root. It is curious that the name snake-root or serpentary was given in about 1636 to the root of another species of the same genus, namely, *A. Serpentina*, Linn., a native of Virginia. It was highly praised as a remedy for the bite of the rattle-snake and of rabid dogs. The reputed properties of this plant are now quite disregarded. The properties of the Indian Birthwort (sapus, *Konk* ; sapsund, *Mar.*) are described by Rheede as follows : "Dococtum hujus plantæ cum oleo pro linimento adhibitus venenatum serpentum sanat morsum." The root still enjoys a reputation in snake-bite among the country-folks in the South Konkan, but its chief use is in the bowel complaints of children.

Before concluding I would make a historical note which may be of some interest to the inhabitants of Bombay. Garcia d'Orta, in describing the Areca or Supari Palm, says : "A melhor (areca) è a de Mombaim, terra e ilha de que El-Rei nosso senhor me fez mercê, aforada em fatiota," or that "the best supari is that of Mombaim, land and island which H. M the King granted to me by emphyteusis." From this extract it is evident, first, that Bombay or *Bombaim* was sometimes known as *Mombaim* (the first letter being M and not B) in 1563 ; secondly, that Bombay was famous in those days for its areca ; and thirdly, that the Island, with some of the adjoining land, was the sole property of Dr. Garcia d'Orta long before it was given in dowry to the Infanta Catharina.

D. G. DALGADO, M.D.

SAVANTVADI, *2nd August*, 1893.

No. II.—THE NEST OF STEWART'S WREN-WARBLER.

I send herewith two nests, made one after the other by the same *identical* pair of birds (*Prinia stewarti*). The materials are the same in both, but the construction is different. In No. 1 the birds, having chosen a small narrow-

leaved plant to build in, simply laid the nest loosely between the twigs, without any attempt at sewing. In No. 2, having selected a thick-leaved plant, they have made a regular tailor-bird's nest, using cotton freely to stitch the nest to its supports and to make one of the leaves serve as a covering for it. The birds deserted the first nest after two eggs had been laid. In nest No. 2 three eggs were laid and hatched out. Note also in No. 2 how the thick leaf has begun to sprout from the punctures made for the stitches.

G. W. VIDAL, I.C.S.

POONA, *4th September*, 1893.

No. III.—THE GENUS *PSILOTUM*, Sw., IN INDIA.

A note in this Journal (vol. VII, p. 544) by Dr. Dalgado records the occurrence of this genus in Savantvadi. This is by no means the first record for India, even if it be the first for Bombay. The earliest publication of Indian localities is in the *Cat. of Plants dist., by the Hon'ble the E. I. Coy.* (1828), where it is recorded from Nepal, S. India, Ava and Penang. Specimens from all these places were distributed from the Company's Herbarium in that year.

There are two species of the genus, and as the note referred to may induce members to look for the one there described, it seems worth while to state wherein the two differ, as in the search for one it is not impossible that both may be discovered.

Both *Psilota* are plants with short wiry root-stocks emitting stems that are simple below but copiously dichotomously branched upwards and that have minute leaves laxly disposed throughout their length. In the axils of rudimentary leaves (bracts), rather smaller than the leaves proper, are placed, all along the branches, single, free, top-shaped spore-cases slightly hollowed (umbilicate) at the apex. These spore-cases (sporangia) are three-lobed and three-celled ; they split vertically down the centre of each lobe to permit the escape of the oblong, somewhat curved, one-ribbed spores.

Seventeen different forms of *Psilotum* have been named and described, but these arrange themselves into two groups and, within each group, pass into one another by all sorts of intermediate forms. One of these groups has three-cornered, the other has two-edged, branchlets ; the branchlets in this second group are flattened out and have a distinct rib down the middle. In the first group the spore-cases and the leaves are in three rows corresponding to the angles, in the second group they are in two rows corresponding to the edges, of the branchlets.

Some members of the first group have the angles so indistinctly marked that the branches are practically round ; some members of the second group have the branches so narrow that their two edges with the strong midrib,

already mentioned, render them practically three-cornered. But no mistake is possible in either case as to the species to which the plant belongs, since one has three, the other only two, rows of leaves and spore-cases. The following brief diagnosis will enable their easy determination :—

Plant erect or suberect: branches triquetrous, many times strictly branched: leaves in 3 rows; ultimate branches three-cornered, sometimes almost round, about $\frac{1}{24}$″ in dia.	*Psilotum triquetrum*, Sw.
Plant pendulous: branches flattened, less frequently and more laxly-branched; leaves in 2 rows; ultimate branches flattened and with a distinct midrib, about $\frac{1}{16}$″ to $\frac{1}{12}$″ across	*Psilotum complanatum*, Sw.

The erect fastigiate habit of the first, the hanging spreading habit of the second generally sufficiently distinguish the two. *P. triquetrum* is usually 7-8 in. high, but dwarf specimens occur (1½-3 in. being the greatest height of specimens obtained by the writer on Barren Island); on the other hand, it is often 2-2½ feet high.

The general distribution of *P. triquetrum* is wider than Dr. Dalgado's note would indicate. It is found in South America, Central America, Mexico, West Indies, Florida, Africa, Madagascar, Seychelles, India, Indo-China, Laccadive Islands, Ceylon, Andamans, Malaya, North Australia, Polynesia, from Fiji to Sandwich Islands. *P. complanatum* is equaly widely distributed though it is the least common of the two except in Malaya and apparently the Seychelles.

The Indo-Malayan distribution, as testified by specimens in the Calcutta Herbarium, is given in full below :—

1. PSILOTUM TRIQUETRUM, Sw.

INDIA : Bengal ; Dacca, *Clarke* ! Barisal, *Clarke* ! Central India ; Pachmari, *Mrs. Morris* ! *Duthie* ! Ceylon ; centre of island, *Thwaites* ! *Walker* ! *Thomson* ! *Watson* ! Laccadives ; Minikoi, *Alcock* !

HIMALAYA : Kumaon, *Thomson* ! Nepal, *Wallich* !

INDO-CHINA : Assam ; Sibsagar, *Masters* ! Khasia Hills, *Simons* ! Burma ; Taong Doung Mts., *Wallich* ! Barren Island, *Prain* ! Siam, *Finlayson* !

MALAYA : Peninsula ; Penang, *Wallich* ! Malacca, *Griffith* ! *Maingay* ! Perak, *Kunstler* ! *Wray* ! Archipelago ; Java, *King* ! *Forbes* !

2. PSILOTUM COMPLANATUM, Sw.

MALAYA : Peninsula ; Penang, *Wallich* ! Perak, *Kunstler* ! Archipelago ; Borneo, *Lobb* !

The plant referred to by Dr. Dalgado is therefore not very rare, but as it happens to be mentioned, the writer wishes to invite members who may be interested in the matter to look not only for *P. triquetrum*, but for the other species as well. Both are found in the Mascarene Islands to the west, and both also occur in Malaya and Polynesia to the east of India ; there is therefore no good reason why both should not be found, if carefully looked for, in the Indian Peninsula as well.

The following notes taken from tickets attached to specimens in the Calcutta Herbarium will throw some light on the habitat of the plants :—

PSILOTUM TRIQUETRUM, Sw.—"Gateway of old Fort, Malacca," *Maingay* ; "interior of crater, Barren Island," *Prain* ; "growing on stone near the crater of Gunong Boddas Preanger, Java," *H. O. Forbes* ; "growing on temples, Sibsagar, Assam," *Masters* ; "growing in a hollow tree where some soil had accumulated, Perak," *Kunstler* ; "*ad saxa rupesque*, Mauritius" (no collector's name).

PSILOTUM COMPLANATUM, Sw.—"Growing under a fern on a tree, Chanderiang river, Perak," *Kunstler* ; "growing from seams of rock, Chil-hua-hua, Mexico," *Pringle*.

The largest of the living plants of *P. triquetrum* in the Royal Botanic Garden were brought about 15 years ago by Dr. King, F.R.S., C.I.E., from Java, where he found them growing among the adventitious roots of a cocoanut tree—exactly the situation in which Dr. Dalgado found his. But this does not necessarily imply, as Dr. Dalgado suggests, that the plant is 'parasitic': its habit of growing at the tops of volcanoes—where there certainly is nothing living to which it could attach itself—on ruined temples and forts, and in seams of rock, shows not only that is it not 'parasitic,' but that it is not even necessarily 'saprophytic.' That it prefers a situation where it can get plenty of decaying vegetable matter in which to bury its roots is no doubt true, for the specimens from rocks and ruins are stunted and dwarf, as compared with those from hollow trees. But this is only in accordance with the general rule that plants grown in a 'humus', rich in decaying vegetable matter, thrive better than those grown in thin, bare, rocky soil.

The treatment of the plants in cultivation is simple ; they thrive well when grown as maiden-hair ferns are grown.

D. PRAIN.

HERBARIUM, CALCUTTA, *7th June*, 1893.

No. IV.—THE ASIATIC WILD ASS.

In the *Field* of April 22, under the heading of "The Asiatic Wild Ass," was published an account of the onager, or wild donkey of Kutch. This article contains some statements which have, since the publication of Captain Nutt's article in the "Oriental Sporting Magazine," entitled "Donkey Hunting on the Runn of Kutch," been disproved.

Mr. Blanford, in his "Fauna of British India," states that there is no instance on record of wild asses being run down by a single horseman, and Mr. Tegetmeier also remarks that it is doubtful whether any onager has ever been ridden down except in cases of mares heavy in foal, and also states that even the young have only been captured by employing relays of horses.

The above has been conclusively disproved by H. H. the Thakor of Morvi, whose State, which is in Kathiawar, is situated close to the Runn of Kutch, as the onager has been ridden down and secured on several occasions during a period of three years, when riding them down was one of His Highness's favourite amusements, undertaken chiefly to disprove the exaggerated opinion commonly held as regards their speed and endurance.

On one occasion a band of eight wild donkeys were ridden down and secured on the east side of the Runn by a party of five riders, or, to be more exact, by a party of three, as the riding was really done by H. H. the Thakor Sahib and two of his riding boys. The riders averaged about 9 stones in weight, rode the same horses from start to finish, and kept together throughout the whole of the chase.

As the above may not be considered a case of running them down by a single horseman, perhaps the following instance may suffice, *viz.*, that on another occasion the Thakor Sahib and his two riding boys separated; the former succeeded in riding an onager down single-handed, and without change of mount, while the two boys secured another.

The horses used in these rides were Walers, Arabs and country-breds, and in one ride where a wild donkey was secured, a 13·3 Arab pony was used. The fact may perhaps interest people that the country-breds used were ordinary Kathiawar cobs about 14·1, and in the case of the Walers and Arabs used, no special selection was made of mounts, neither were the animals in special condition for the rides. The above-mentioned facts will somewhat tend to discount the exaggerated ideas held concerning the speed and endurance of the onager.

The rides which ended in captures usually lasted about three hours; speed varied from a walk to a spurting gallop; the going was execrably bad, being chiefly ground covered at high tide by the sea, and consisted for the most part of mud in which the horses sank fetlock deep, necessitating the greater portion of the chase being done at a walk. The distances covered in the different runs varied from twenty to twenty-five miles; no horse ever died during a chase or from the after effects.

Although the onager's speed is greater than that of a tame donkey, an ordinary 14·2 Arab can gallop them to a standstill, and the fact of the runs being so long was due more to the going than to any special endurance on the part of the wild asses. Practically, as regards endurance, they are as enduring as a horse in non-galloping condition, though the asses when caught, could hardly be called in galloping condition either.

One of the most striking points in connection with these rides is the endurance shown by the horses used in capturing the wild asses; in fact, more wonderful than the endurance of the asses who were on the ground they live on, whereas neither food not water could be obtained for the horses, riders even having to carry their own drinking water. On one occasion horses were out without food or water from 7 a.m. one morning to 4 a.m. the next.

Some twenty wild asses, big and small, were captured in these rides. When captured, the wild asses were extremely vicious, bit and kicked, and it was found necessary to rope them before they could be led away. The statement that no varieties of the Asiatic wild ass have ever been domesticated would be deprived of some of its effect, could your readers see the wild asses in the paddocks at Morvi.

Though some of the captures remained excessively vicious, others became quite tame, and were ridden and driven just like a tame donkey. The young ones are as tame as dogs, and extremely fond of being fondled and played with.

Those in the paddock at Morvi were exceedingly inquisitive and had to be kept back while a photograph was taken, as nothing would satisfy them until they could sniff round the camera and see what the seemingly diabolical instrument was.

A photograph, the only one of a batch of four taken, which turned out passably (though the gentleman in the solah tope is meant to be a European), is herewith sent in proof of what may be done with them and in it may be observed the inquisitiveness of the animals, a youngster, in his eagerness to find out what was going on, having come up behind and caused the syce on the right to move his hand. The treatment undergone by the donkey, on whose back a syce is seated, ought to be proof enough of her tameness, as her tail was held, not to keep her quiet, but to show what could be done to her. This particular donkey was ten months old when caught and frightfully wild; she is now about two and a half years old.

The engraving in the *Field* of April 22 is good with the exception of the legs and feet which are made to look much too coarse, the legs and feet of the wild ass being particularly clean, neat and well formed.

The same horses which were used to ride down the wild asses in the Runn have been used to ride down wolves and black buck (*Antelope bezoartica*), and if wished for, some particulars of these runs can be sent.

The information regarding the riding down of the wild asses on the Runn of Kutch was given to the writer by a well-known Kathiawar sportsman, whose riding weight, however, prevented him from being with the leaders in the runs when the onagers were captured.

J. L. HARRINGTON, Lieut.,
A. P. A., Kathiawar.

(The above appeared in the *Field* of 29th July, 1893.)

No. V.—SYMPTOMS OF SNAKE-BITE, THE RESULT OF FRIGHT.

Stories of recovery from apparently serious cases of snake-bite are reported from time to time, which at first sight can only be explained by believing, either that very little poison entered the wound, or that an antidote has

really been discovered at last. Such a case occurred here a few weeks ago. A boy, cutting grass close to my bungalow, was bitten on the instep by a snake which was identified by myself and others as beyond doubt a krait. He continued his work for a time, but finding the pain increase, left the field and went to the stables where his relations live. On hearing what had occurred, they held a candle before his eyes and found that he saw five flames instead of one, which natives take to be a sure sign of the giddiness which results from snake-poison. Accordingly, they carried him off to a well-known "Mantri," or worker of incantations, who lives close by, but before they arrived the boy was perfectly unconscious, and his teeth so firmly clenched that no medicine could be poured down his throat. This was about an hour after the bite. Those present thought the case hopeless, but after a time the "Mantri" brought him round, and he went away little the worse. This was a curious instance, for there was no doubt that the boy was bitten and his foot swollen, and further it was quite certain that the snake which bit him was a deadly one, the krait, so that it was natural to attribute the giddiness and collapse to the action of some portion of venom, however minute.

Another case, however, which happened here a few days ago, suggest a different explanation and makes it very probable that all the symptoms were simply the result of fright. In this instance I was told that a boy of about 18, while lying down, had been bitten on the head, and going at once to the spot I found him vomiting and in a stupefied condition. A "Mantri" had been summoned, and after giving the patient some pounded root, was working away, flitting him with his "dhotar" and repeating the incantation.

I had sent for the dead snake, and seeing that it was fortunately of a harmless kind (Mr. Phipson, to whom it was forwarded, identified it as a young "Dhâman," *Zamenis mucosus*), made the people assure the boy that he was in no danger, but he was too dazed to understand, and soon, after vomiting again, went off into a dead faint which lasted for more than twenty minutes. This time he was perfectly unconscious, his hands and feet became cold, and had I not known that the snake was a harmless one, I should certainly have thought him in great danger. Of course, later on he recovered his senses, and was as well as ever. Now, had it not happened fortunately that the snake was proved to be of a non-venomous kind, this would have been a very pretty case of apparent cure, and for an explanation we should have been kept to the choice, according to our credulity, between believing in the powdered root, the incantation, or that the amount of poison was very small. Such extreme effects from fright, so closely simulating genuine symptoms, are probably rare, but the possibility of their occurrence puts a fresh difficulty in the way of believing in the successful antidotes occasionally reported.

S. M. FRASER, I.C.S.

KOLHAPORE, *9th September*, 1893.

No. VI.—THE SNAKE-BIRD.

(*Plotus melanogaster.*)

This bird is what we in India call a "Snake-bird," because, when it swims with the whole body under water, the long writhing neck and head remind one of a snake. But another species in the warm regions of America has long been called the "Darter"; and this name is commonly used for the genus, which is represented also in Africa and Australia. It was probably given on account of the bird's habit of sitting on trees over the water, and "taking a header" when disturbed, or attracted by the sight of fish moving below.

But there has long been an idea that the bird uses its long pointed beak as a "dart" or spear, and this is best illustrated by the following quotation from *Nature* republished in the "Indian Annals and Magazine of Natural Science" from which I have extracted it. I have not been able to compare it with the original which seems to have been in the January number of *Nature* for 1883.

"The Darter in its normal position sits erect upon a branch or stump overlooking the water. When proceeding to fish, it dives head foremost into the stream, and swimming entirely under water, transfixes its finny prey with the rapidity of lightning. Emerging from the water with the fish speared upon its long slender beak, the Darter chucks the fish into the air, and catching it head foremost with unerring aim, swallows it whole. This peculiar and interesting mode of fish-catching may be witnessed every day when the Darters in the Zoological Gardens are fed with their usual meal of small fishes."

"The Darters usually exhibited in the Society's Gardens are of the South American species (*Plotus anhinga*), which, it seems, is the most easily obtained alive. But in 1878 an example of the African form, Le Vaillant's Darter (*Plotus levaillanti*), was received, and lived for some time in the Gardens, where it exhibited the characteristic mode of feeding previously observed in its American brother. In April last an example of a third species of this genus—the Indian Darter (*Plotus melanogaster*) was obtained in exchange from the Zoological Gardens of Calcutta. After living for many months in excellent health this bird died suddenly on the 21st of December last, apparently from a sudden shock produced by feeding too rapidly."

Any one reading it as reprinted would think that the bird speared the fish on its closed beak, as a regular thing. I have always doubted this; because the beak is serrated *inside* on both jaws, like those of several other birds that seize living fish, and I have observed that wild snake-birds seldom catch fish as big even as herrings. The head and neck, indeed, are too small for the bird to swallow large fish, though the gape is wider in life than it can be shown in this dry and rigid specimen on our table, and the gullet is very elastic, so I watched many wild birds, but never could see the spearing.

At last, when we had a snake-bird at the "Zoo" in London, I consulted the Superintendent, and took a wet day to watch the creature fed. The fish were very small, minnows if I remember rightly. These were thrown into the tank alive, and the bird "darted" after them from its perch on a "duck's ladder" over the water, *open-mouthed*. In the same way it pursued them under water, trying to seize them between its jaws and actually so seizing about 7 in 10, it returned to the surface,with the fish held across the beak between the jaws, jerked it round in the usual way of fishing birds, and swallowed it head foremost. But it sometimes happened that the bird, though failing to *catch* the fish between its jaws, *did* actually impale it on one or other of them, about 2 in 10 on the upper jaw, and 1 in 10 on the lower. This was evidently almost a failure, as, when a trapped pigeon is killed with the second barrel within the line, it counts; but the performance is not triumphant. The jerking round of these transfixed fish into the proper position for swallowing was a longer and more awkward job than with those properly seized, and was accompanied by the most absurd expressive gestures of impatience and disgust. One could feel that the bird wanted to swear.

It may be worth while to add that the tank was a good sized aquarium adjusted in the usual way, so that I, only a few feet from the bird, could see him in an excellent light. There was no one present but one keeper and myself; so the observation was taken under most favourable circumstances.

There is much else to be said about the snake bird; but the most of it has been said by Jerdon (Birds of India, vol. II, p. 865) and others, and I myself have written something about it in our journal.

One odd thing not yet said is that the wing bones sometimes contain what looks and feels very like *marrow*—a rare thing in birds. It is to be wished that some good authority could pronounce on this after dissection, and if we could send home a few entire specimens in spirit it would be a good thing. I have been trying to get one; but the bird is not very common on the Tanna rivers, though abundant in Kolaba and in Gujarat. It has probably been more persecuted in the former district.

W. F. SINCLAIR, I.C.S.

TANNA.

No. VII.—THE BREEDING OF THE GOURAMI.

Some ten years ago I undertook to superintend the operations for procuring a supply of fish for the Ana Sagar Tank, a sheet of water covering about a square mile, and situated in Rajputana. Previous to the operations the tank contained only Chilwa, Singee, and a small species of Murrel; I did not mind the first two, but the existence of the Murrel, small though they were, made it rather risky to introduce small fry.

After reading up Mr. Thomas' notes on stocking ponds, it was decided to send down to him in Madras for a number of Gourami, and when these duly arrived at the end of their long journey the first difficulty arose as to where to put them.

An ornamental tank in the gardens was cleaned out and precautions taken to keep out the Murrel, and the majority of the Gourami were put into this, but as I was unwilling to lose sight of them altogether, I had an aquarium made to hold about 15 gallons, and into this I put about a dozen fish.

Being new to aquarium management I made the usual mistakes, the result of which was quickly apparent by the other small fish, which I had put in with the Gourami, coming to the top and trying to prolong their lives by breathing the uppermost layer of water.

I then noticed that the Gourami did not seem troubled much whether the water was in good order or not; when it was all right they remained amongst the weeds and never came to the top except in pursuit of a mosquito, and when it was foul they came up regularly at intervals for a mouthful of fresh air, but never stayed there sucking at the upper layer. This discovery was a great relief to my mind, as the aquarium would practically be left to take care of itself during my frequent absence in camp.

I must here note that the existence of the Murrel was not the sole reason of my starting the aquarium; I had read in Mr. Thomas' book that the Gourami grows to 20lbs., and that he is capable of "being cultivated in earthen pots for the table." Consequently I had visions of half-a-dozen chatties ranged round my office each containing a four or five-pound fish destined to grace a future dinner party. Consequently again I anxiously noted the growth of the fish and tried to see a decided increase in their bulk after each absence in camp.

When they first arrived they were about an inch long, and had the large head and eyes and thin body of all young fish. When I had had them about two months they were perfectly formed and very handsome, but, alas, they were only two inches long at the outside, and when I had had them four months it was disappointingly evident that they were not going to get beyond this two inches. I had arranged a little ornamental rock-work at the bottom of the aquarium and the centre-piece consisted of a curved stone resting on two others and forming a kind of bridge.

One morning when I came as usual to look at my fish I noticed that some thing unusual had happened; all the fish but one had hidden themselves amongst the weeds and the only visible fish was a truly terrifying spectacle. He had turned a jet black and his red eyes, by contrast, shone like live coals; his fins were all erect, and he was making furious charges at any of the other fish which ventured to show their noses. Presently I espied another black-looking fish quite motionless underneath the rock-work bridge, and then I understood what was taking place. After chasing away all intruders the male came down to the female under the bridge.

Immediately after they separated the female emitted a stream of 15 or 20 eggs, and to my disgust the pair immediately set to work (apparently) to gobble them up. One or two eggs which were caught in the eddies and carried down amongst the rocks were immediately snapped up by the other fish which were hanging around for this purpose. This took place several times and at last I noticed that the pair paid frequent mysterious visits to the undersides of the hollow stone, but there was nothing there that I could see.

The next morning these visits were explained and I then noticed the female frequently rising to the surface and bringing down with her a mouthful of air which she let go against the underside of the bridge until there was a large silvery globule accumulated. The eggs had, it appeared, been plastered to the underside of the rock and she was now supplying them with air.

Every now and then the globule would overflow and a large bubble would rise to the top ; she however kept on bringing down more air with the idea, I suppose, of keeping the supply fresh.

I have already mentioned that these fish seem capable of actually breathing atmospheric air, but what the eggs should want with air, and compressed air at that, I leave others better versed in fishlore to explain. The eggs could hardly have been less safe had the parents put them on the top of a floating leaf, as one or other had to remain constantly on guard to keep away the other fish.

Another point struck me, which was the great self-denial exhibited by the pair, and more especially by the male ; these eggs seemed to be regarded by the other fish as great delicacies, and I could quite imagine a bad husband (and I suppose there are such things amongst fish as amongst other animals) bolting his mouthful of eggs and explaining the contretemps and excusing himself on the grounds of a sudden inclination to cough.

I was very much disappointed when I received the impression that the pair were destroying their own eggs, as it seemed to me that the Gourami, which attains to a weight of 20lbs., showed a most wonderful adaptability to circumstances in coming to maturity at three or four pennyweights, and I was naturally anxious to prove that they were really mature in every sense of the word. I had then to go into camp and leave the female still watching and aerating her eggs. When I returned after a short absence the globule was gone and all the fish were of the ordinary hue, and I searched in vain for any fry. Very soon after another pair, or it might have been the same, took up their quarters under the rock and went through the same process.

I am unable to remember how many times this happened, but one day I noticed several tiny pairs of eyes looking at me through the glass ; behind these eyes was a gelatinous tail and what appeared to be a pendulous sac or stomach.

These were evidently very young Gourami, but I could only see them when they came close to the glass as the Aquarium was very dark. Mr. Thomas

had warned me that they could not stand much cold, and for this reason they were kept permanently in my office as being rather warmer at night than the verandah. These young fish did not appear to thrive, and as the cold season approached they gradually disappeared until one only was visible. This one eventually grew to about ¾" in length, but was always very shadowy in appearance and difficult to see at any distance from the glass. All the others got sluggish and a few died, and as I was transferred during the cold weather, I returned the surviving ones into the lake.

The pond into which I had put the majority was emptied, but only a solitary Murrel was found and no trace whatever of the Gourami. I have no doubt that those put directly into the large lake also perished, but any way it dried up completely a year or so ago, so there can be none there now. I reported the results of my observations at the time to Mr. Thomas, and he started a larger aquarium in order to check them, which I believe he was able to do with satisfaction to himself.

CHARLES F. GILBERT, M.I.C.E.

No. VIII.—THE KOL-BHALU.

I have spelt the above name as it is pronounced, and as I have before seen it spelt, but I am not at all sure that it is correct. I have never succeeded in finding out what the name is derived from, and am ignorant as to what language it is. I have heard it in Guzerat, the Konkan, and Kanara, and pronounced, as far as I could judge, exactly the same in all three Provinces.

The Kol-Bhalu is, I think, generally described by natives in the Bombay Presidency as a jackal, either old and toothless, mad, or in attendance on a tiger or some other large animal. I have also heard it positively asserted by some villagers that it is an old and toothless jackal which has developed horns. The idea that the animal is an old and toothless jackal has, in my experience, the widest credence, and on examination of two Kol-Bhalus which I killed at different periods, whilst in the very act of uttering their peculiar weird-like cry, may perhaps be worth recording as bearing out this theory. Both were female jackals and bore the appearance of being extremely old, with short and almost hairless tails. The elder of the two had only a little short hair in patches on her body, and but one tooth in her head, a canine in the lower jaw worn down level with the gum. The other had more hair, but it was very short and of a dirty appearance, and in her mouth were five or six teeth much broken and worn. I found nothing to indicate that either of them was mad, nor did I kill them in places where there would be any likelihood of finding any other animal more formidable than an hyæna.

It seems possible that the peculiar cry which earns for the jackal the name of *Kol-Bhalu*, may be caused by the absence of teeth, and to this cause I have

frequently heard it attributed by villagers. I have never observed the *Kol-Bhalu's* cry and the ordinary jackal's cry uttered by the same animal.

On one occasion, in the evening whilst returning to my camp, I saw a jackal at a short distance off, and having dogs with me I set them after him, but to my astonishment the jackal made no great efforts to escape, but ran into a small bush a few yards away, and as soon as the dogs came up, the Kol-Bhalu cry was uttered ; the dogs stopped and after sniffing round the bush for a short time came back to me. I never saw these dogs behave in this manner before ; they had always been very keen in attacking jackals and had killed many. I can form no reason why this jackal which, from the cry uttered, must be called a Kol-Bhalu, was left in peace. Being pressed for time, I was unable to go up to the bush and make investigations.

F. A. HILL.

BOMBAY, 30*th September*, 1893.

No. IX.—THE FLOWERING OF *GRAMMATOPHYLLUM BROMHEADII.*

I am sending you a photograph of an enormous orchid, *Grammatophyllum bromheadii*, which flowered during these rains in Rangoon, and as this is, I believe, the first instance of its flowering in captivity to perfection, I think the circumstance is worth recording. It has, I believe, flowered twice at Kew, but on neither occasion was it successful. The habitat is Mergui and the plant looks not unlike a sugar-cane. The owner of this plant, Mr. E. S. Symes, Secretary to the Chief Commissioner, has had it for three years, and it has never shown any symptoms of flowering before. No special care was taken with the plant this season. Mr. Symes describes the spike as 7 feet in length, with from 60 to 70 flowers.

F. E. DEMPSTER.

RANGOON, *October*, 1893.

No. X.—NOTE ON THE THAMIN.

I have just come across Capt. St. John Richardson's interesting note on this animal, published in No. 2, Vol. VII of the Society's Journal, and as his observations and conclusions regarding the Thamin in Lower Burma differ so essentially from mine, made on the Chindwin, I should like to add a modest contribution to what is known of this animal.

I do not quite understand how the "points" on a Thamin head are to be counted ; the horn is one continuous sweep from the point of the brow-antler to the highest point of the horn, and this part is slightly palmated.

Small excrescences occur on all parts of the horn, very often two or three on the brow antler itself, but there only appears to be one regular tine growing out of the main horn.

If these excrescences are to be counted as points, it will be very difficult to distinguish where they end and the natural corrugations begin ; I have just measured a horn which has certainly 11 and possibly 12 points on the left, and 7 on the right, and I daresay, a very careful scrutiny might give a total of 20 points for the pair.

For this reason and on account of the peculiar formation noticed above I would suggest that all measurements be made right round outside the curve from the tip of the brow antler to the extreme end of the main horn, that points be not considered, and that this dimension together with the extreme span be regarded as all that is necessary.

I give below the measurements of three heads taken in this manner :—

Measurement of Lower Chindwin Thamin Horns.

Right Horn tip to tip...	53″	50″	49″
Left Horn, do.	52″	51″	49″
Greatest width across	29½″	33″	29″
Circumference above skull	6½″	5″	5½″

As regards the varying colour I do not feel at all sure that age only is the cause of this, though it would be quite natural to expect to find very old stags with darker coats than comparatively young ones.

In this district we have full-grown stags and does of a bright yellowish-brown, much the same colour as the barking deer, and we have also the Sambur-coloured stags and does.

All the villagers that I have ever consulted agree that there are certainly two kinds, Thamin Wan (yellow), and Thamin Wet (pig), the latter term being referable to the brown Thamin, and there seem to be three possible solutions of the puzzle of the varying colour—

(1). Age only ; in which case the herds would be mixed, all large stags would be brown, and the cause of the change would be so evident that villagers would scarcely fail to notice it.

I have seen some hundreds of yellow Thamin in herds, but on no single occasion have I found a brown one with them. I have also shot a yellow stag with a much better head than that of a brown one shot a short time previously.

(2). Actual difference of species : this will be the only remaining solution if (1) and (3) are erroneous.

(3). That the darker coat is only the winter coat.

I am led to believe that this may turn out to be the true explanation owing to my failing to find brown Thamin during the hot season.

I have shot brown fawns, but only in the winter, and in a place where I was unable to find a single brown deer during the hot season.

Captain Richardson mentions that " the young are often spotted, but this soon disappears " ; in this district all the yellow deer are spotted very dis-

tinctly, and I have never shot one which was not. Further, the villagers declare there is a third species, the Thamin Pyouktan (spotted) which is larger than any of the others.

I never heard of Thamin in this district going into the hills, or even into thick jungle; in the cold season they live amongst the long grass—spear grass for choice—and thin jungle, and later they may be seen quite in the open much the same as black buck. Just now they lie in the growing crops.

As regards the shedding of horns I saw many good heads up to August 15, but could find none on the 25th, though I heard of some being seen much later.

The span of head No. 1 given by Captain Richardson (39½″) seems to me unusually wide considering the length of the horn itself, and this is even more marked in No. 7 where the two horns totalling about 54″ diverge no less than 36″. The heads obtainable here are not nearly so flat as these.

There must be several members of the Society who have shot, or otherwise come into the possession of, heads, and some more measurements of such would prove of interest.

CHARLES F. GILBERT, M.I.C.E.

MONYWA, 28*th October*, 1893.

P. S.—Since writing the above I have got a couple of so-called Thamin Wet, one with the primary (or it may be secondary) scimitar-shaped horn, and one with ten points.

Both had decided brown coats very different to the yellow of the Thamin Wan, but neither of them approched blackness in the least degree.

Natives, here as well as in India, have a habit of saying what they believe you wish them to say, and it took a great deal of cross-examination before I could obtain the admission that in the cold weather Thamin Wan were not exactly plentiful, and in fact they could not say for certain that they had ever seen them during that season, but I have now not the smallest doubt that the Thamin Wet of the cold season develops into the Thaman Wan of the hot weather, and further that the blackness has little to do with age, being merely due to the full development of the winter coat.

I have noted the differences between the Wet and Wan as thicker horns and longer hair for the former, and the former difference is at once explained by the fact that before he sheds his winter coat, he has begun to rub the corrugations off his horns.

I have one head with smooth horns which must have become so by constant rubbing, as the corrugations are ducts through which the upper portions are developed after the lower is formed.

On this subject the remark made by Captain Richardson that "the horns are perfect in March" is not quite clear; I got a head last March, and though the

horns were good, they were rubbed to a certain extent, and it seems certain that the horns are at their best directly the velvet comes off; this date I should fix at the end of December or early in January.

I do not know if the stag "bells" or makes any other sound during the rutting season. I have never heard one, but the other morning I came on some Thamin before daylight, and they made a sharp clucking noise not unlike a pea-hen.

CHARLES F. GILBERT, M.I.C.E.

1*st December*, 1893.

No. XI.—A BRAVE WOMAN AND A COWARDLY TIGER.

The following account of a woman's encounter with a tiger may interest some readers of the *Journal*. The scene of the adventure was a jungle at Deusú, a village at the foot of the Amboli Ghát. At about 5 P.M. on the 7th July last, a young Mahrata woman named Parvatti was tending some cattle, when suddenly a tiger made his appearance with the intention of making his supper off one of the bullocks, as he had done more than once before under similar circumstances. The woman, however, not wishing to lose one of her precious cattle, very pluckily placed herself between it and the tiger; upon which the animal, resenting such interference, walked slowly forward and seized the poor woman by the left shoulder, and crunched the upper part of the arm bone into bits. Notwithstanding this, the brave woman gave the animal several blows on the head with a bamboo she had in her right hand which had the effect of making him let go; he then retired into the jungle to seek his supper elsewhere, leaving the herd unmolested. The poor woman was removed the next day to the nearest hospital, where she had to undergo an amputation at the shoulder joint. She suffered a great deal from blood-poisoning, but was quite well after two months. As a reward for her great pluck, and in consideration of her long and painful suffering, the State authorities gave her a present of Rs. 50. The story, as related by the poor and unsophisticated woman, bears every evidence of truth.

D. G. DALGADO, M.D.

SAVANTVADI, 4*th December*, 1893.

No. XII.—ODD NOTES.

HAS any one noticed how late the spotted-bill duck breeds? No doubt it is recorded somewhere. I have now more than once shot their flappers as late as the end of December; in the N.-W. P. and in Mysore I have come across them several times in November.

Quite recently, when on the march, I saw a harrier (I failed to identify him) stoop on a quail who had just settled in a tussock of long grass. He missed

his mark, and the quail—a grey one—rose, and a pretty bit of aërial coursing ensued. But to my surprise the quail had six to four the best of it and got away by sheer speed. It upset all one's theories of make and shape to see a heavy-bodied, short, round-winged bird like this easily distance the lithe, long-pointed, winged harrier in a fair run. One could only say "they run in all shapes."

I have several times, during the last few years, seen snipe on the ground. On one occasion I found two on the edge of a dirty village pond, between 9 and 10 A.M., running about and pecking in the mud with sand-pipers, pond herons, and other low company. I shot them both, and on examination they proved to be fantails. Is this not rather against Hume's account of their habits ?

The snipe up here have contracted a perfectly pestiferous habit of lying out in the middle of jhils on the rushes and weeds and coming in to feed on the cut rice stubble, etc., after dusk, when you cannot see to shoot them. The other day I walked up a likely bit of ground on the edge of a jhil :and put up three birds only. Returning to camp just before six, I crossed the same bit of rice field, and the birds got up all round me in sixes and sevens. There were at least twenty couple of them.

I had an opportunity lately of seeing some wild cattle, or more properly speaking, cattle whose progenitors ran wild. They inhabited a swampy jungle, from the fastnesses of which they sallied forth morning and evening to harry the adjacent fields. In colour the bulk of the herd were white or grey, and far superior in size to anything one sees in the villages of the N. W. P. I rode up to within 40 yards of a solitary bull and inspected him. He was a remarkably fine animal, and would have passed for an unusually good specimen of the wandering bull turned loose as a calf by some pious Hindu but for one peculiarity. His general colour was grey, but over the hump, shoulders, posterior portion of the neck, running down almost to the edge of the dewlap, he had a jet black mantle, giving him a peculiar, not to say weird, appearance. The same morning I came across a second bachelor, a well-known budmash, who charged any one who approached him. He was a really magnificent beast, and wore the same sombre mantle as the first. I did not see the bull who led the herd, but the villagers reported him as "burra jungi" and said he also had the same black marking. I should like to know if others have noticed this curious black mantle in cattle that have run wild. It is certainly unlike anything I have ever seen in domesticated bovines.

I have several times, in the last few years, coursed and killed the desert fox in the Meerut district. Speaking from memory, Jerdon notes its occurrence in Hissar and near Umballa, but I have seen no record of any being found in

Meerut.* He is far and away a gamer, speedier animal than his relative, the ordinary fox. He may be readily distinguished by the white tip to his tail.

I put up a couple of Houbaras (tilur) some time ago about 25 miles from Meerut. Surely this is far out of their usual range.

G. F. RAYMENT, VET. MAJ., C. V. D.

CAMP FATEHGARH, 6*th December* 1893.

No. XIII.—THE *BHAKHA PLANT* (*INDIGOFERA CORDIFOLIA*) AND ITS EFFECTS ON CATTLE.

At the recommendation of the Hon'ble Mr. Justice (now Councillor) H. M. Birdwood and Mr. Chester Macnaghten, Principal of Rajkumar College, Rajkote, I was appointed in the year 1886 Curator of Gardens and Forests in Porbandar State, when Mr. F. S. P. Lely of the Indian Civil Service was Administrator.

Accordingly, in conjunction with the Revenue Mamlatdar, I had to attend to the grazing of cattle. I had thus an opportunity of observing what kind of grazing was available in particular places in the different seasons of the year, and what effect it had on cattle throughout the State.

The grazing land of the State is divisible into three parts—namely, (*a*) the land along and near the sea-coast, (*b*) the hilly tract, (*c*) the plateaux and cultivated areas lying between the coast and the hills.

These three areas afford different kinds of grazing. On the first area there is very little grass if any, but there are various annual herbaceous plants cropping up at different times. On the hills there are to be found many species of the larger grasses, and on the intervening area, which is very largely cultivated by the agricultural classes, there are different kinds of smaller grasses which afford excellent fodder.

Before the introduction of the British administration into the State, the *Rabaries* (professional graziers) used to feed their cattle at all times of the year in any place they chose. The result of this practice was that the cattle found their way into the cultivated areas of the villagers and spoilt the crops. There were no restrictions as to public grazing grounds, nor any control over the depredations thus caused on private cultivated grounds. The British Administrator, having heard several complaints with regard to the losses thus caused to private cultivators, issued orders setting aside the coastal area for the express use of the *Rabaries*, where alone sheep and goats were to graze ; on the hilly area cows and buffaloes were allowed to graze ; and the intervening area was reserved for the cultivators and their own private cattle.

In the year 1888 it so happened that 20 or 25 days after the first fall of rain several sheep grazing on the coastal area died suddenly of diarrhœa. The

* Blanford states that the Indert Desert Fox, *Vulpes leucopus*, inhabits the dry and semi-desert regions of Western India, Sind, Cutch, Rajputana, the Punjab, and the North-Western Provinces as far east as Fatigarh.—ED

graziers therefore applied for permission to remove their sheep to the hilly and cultivated areas for two months. The permission was granted.

But the question with me was, why there were so many sudden deaths from *diarrhœa* among the sheep grazing on the coastal area. On inquiry the *Rabaries* informed me of what they thought to be the cause of such sudden mortality. They appeared to think that the *diarrhœa* was due to the sheep having eaten immature grass, and that the jinjvo-grass [(Gujrati જીંજવો) *Ischæmum pilosum*, Dalz., Bomb. Flo., page 305] growing around the cultivated areas and on the hilly tracts was harmless. If at all the sheep suffered (but as a matter of reality they do not suffer from *diarrhœa* after eating jinjvo-grass), that *diarrhœa* was amenable to treatment.

This explanation of theirs for a time satisfied me, but at the same time I was carrying on inquiries as to the real cause of the mortality. I discovered that although several cows and buffaloes which happened to be grazing at that time on the same coastal area had not suffered from *diarrhœa*, the sheep had. I thought therefore that there was some special reason why the sheep should suffer, and that there was some special herb which caused the *diarrhœa* among the sheep. I therefore made out a list* of all the plants growing on the coastal area. Among these plants I found that the *Bhákhà* plant [(Gujrati ભાખો) *Indigofera cordifolia*, Heyne, Hooker's Flo. Br. Ind., Vol. II, page 93] was the most predominant. I suspected that feeding on it was the cause of *diarrhœa* among the sheep. But as the rainy season was then over, I was unable to make any further investigations in the matter. One fact, however, was noticeable at this time—namely, that although the sheep and goats had returned to the coastal area for grazing, they did not suffer from *diarrhœa*.

A few days after, I heard of the sudden death of two healthy bullocks in a village. I was told that they had fed freely on *Bhákhá*. After three or four days more a cow and a bullock belonging to a villager died after feeding on *Bhákhá*. It appeared that these two animals had wandered from their master's yard and fed freely on *Bhákhà* during the whole night and in consequence died in the early morning after a copious drink of water with their abdomens tumid.

It is commonly believed by graziers and villagers that excessive feeding on the *Bhákhá* plant is productive of death among horned cattle. They are therefore not allowed to feed for any length of time on ground where the *Bhákhá* plant grows wild.

Having noticed that these deaths had occurred among the horned cattle *after* the rains, I ordered that they should not be allowed to graze after the rains on the coastal area wherever *Bhàkhá* grew. Thereupon several buffalo-graziers and the men in charge of the State camels represented that the coastal area was a proper feeding ground for their animals and that the *Bhàkhà* plant did them no harm. On such representation I countermanded my orders and allowed buffaloes and camels to graze on the coastal area. I could observe no injurious effects following such grazing.

* This list I propose to place before the Society on some future occasion with my notes.

In the rainy season of 1889, when the first rain fell, I found that the *Bhàkhá* plant had again shown predominance over other newly-grown plants on the coastal area. Being then quite young and not much raised above the ground, the *Bhakhá* plant could not be got at by the horned cattle, as it was beyond the reach of their large mouths and thick lips. But it was within easy reach of the smaller and thinner lips of sheep and goats; they therefore fed largely on it and suffered in consequence. I therefore decided that it was the *Bhákhá* plant alone that caused the *diarrhœa* among sheep.

I give below a description of the plant :—

Indigofera cordifolia (Heyne), Hooker's Flo. Br. Ind., Vol. II., p. 93 ; W. and A. Pro. Flo. Ind., Vol. I., p. 199 ; Dalz. and Gibs. Bomb. Flo., p. 58. Gujrati—Bhákhá, Dàriá (ભાખો, ઢારીયો).

(Natural Order *Leguminosæ*).

Description.—A diffuse annual plant covered all over with soft white hair except corolla and seeds.

Root.—Long and tapering, sometimes slightly branched at the base and giving off here and there a few minute fibres ; it is 3 to 8 inches long and as thick as a crow-quill ; of a pale brown colour, and longitudinally fissured ; on section it has a dull white resinous appearance.

Stems.— Suppressed. Branches radiating from a point immediately above roots, which grow to the length of from six to eighteen inches, giving off branchlets which are generally disposed of in secund. These branchlets give off still smaller branchlets in secund, but in the opposite directions.

Leaves.—Simple, alternate, thickish, very shortly petioled, slightly cordate, ovate, with a strong mucro, from $\frac{1}{2}$ to $\frac{3}{4}$ inches long ; soaked in water if dry, they are dotted with pellucid glands ; the mid-ribs are only perceptible on the under surfaces.

Stipules.—Minute and setaceous.

Flowers.—Racemes capituliform, sessile, flowers 4 to 8 ; calyx segments setaceous and longer than the bright red corolla.

Pods.—$\frac{1}{4}$ inch long, slightly curved and pointed with the remains of the style, distinctly one to two seeded ; the valves are adorned inside with brownish-red specks.

Seeds.—Small, ovate, of a brownish-red colour, pitted and minutely tubercled.

Remarks.—I present with these notes two dried specimens of Bhákhá I have in my collection. I attempted to collect a fresh specimen of it near the Wodehouse bridge in Bombay, but I only found a dried plant as this is not the season for collecting green samples of the plant. The plant grows in the rains and dries up after the rains. The plant has been described in Hooker's Flora of British India, Wight and Arnott's Prodromus Floræ Indiæ, and in Dalzell and Gibson's Bombay Flora. Dalzell and Gibson's merely copies the description of Wight and Arnott. Hooker's description is short, but gives the measurements of the different parts of the plant fairly well. I have supplemented the descriptions

of these well-known botanists by a few observations of my own, and it is to be hoped that they will be of some help in the identification of this plant.

My thanks are due to Surgeon-Major K. R. Kirtikar for his having helped me in putting my original Gujrati notes into the English form.

JAIKRISHNA INDRAJI.

Porebandar, Kathiawar.

No. XIV.—MEASUREMENT OF TIGER SKULLS.

It would be very interesting if such of our members as have in their possession tigers' skulls of considerable size would send the measurements of the same to the Secretary of this Society, as I notice that in Rowland Ward's book on the *Great Game of the World* he places at the top of the list a tiger's skull, in his own collection, which measures $14\frac{1}{2}'' \times 10''$. These are the exact measurements of the best specimen in our Society's rooms.

Mr. C. R. Cleveland, I.C.S., recently wrote to the Secretary of our Society stating that he had carefully measured a large tiger's skull in the possession of Col. T. W. Hogg, Deputy Commissioner at Saugor, C. P., which was exactly $14\frac{5}{8}'' \times 10\frac{5}{8}''$, and that he himself had one which was $14\frac{3}{4}'' \times 9\frac{3}{8}''$.

Sterndale speaks of an enormous skull (*Mammalia of India, page* 165,) which measured $15\frac{1}{4}'' \times 10\frac{1}{2}''$ and which he says was presented to the Calcutta Museum by Mr. J. Shillingford of Purneah, but according to the *Catalogue of the Mammalia in the Indian Museum*, by Sclater, the largest specimen now in the Museum measures $15'' \times 10{\cdot}3''$ and is stated to have been presented by Mr. Shillingford. This is no doubt the same skull which Sterndale wrote of in 1884, but it appears to have shrunk somewhat with age.

I need hardly say that the measurements should be taken between uprights.

W. S. MILLARD.

BOMBAY, *December*, 1893.

No. XV.—FOOD OF THE WILD BOAR.

As very little has been written on the subject of the food of the Indian Wild Boar (*Sus cristatus*), it is, I think, worth recording that, when I visited Matheran Hill in August last during the south-west monsoon, I was told by the jungle people (Thakors) that a large number of wild pigs came up on to the hill every year during the rains in order to feed on the snails which are very plentiful there at that time of the year. I verified this statement by carefully examining all the pigs' droppings I came across and found that they consisted almost entirely of snail shells.

J. M. MASON,
Custodian, Bo. Nat. Hist. Soc. Museum.

BOMBAY, *November*, 1893.

PROCEEDINGS

OF THE MEETING HELD ON 6TH SEPTEMBER, 1893.

The usual monthly meeting of the members of the Society was held on Wednesday, the 6th September, 1893, Mr. J. Wallace, C.E., presiding.

NEW MEMBERS.

The following gentlemen were elected members of the Society :—

Mr. C. H. F. Binsteed (Secunderabad), Mr. P. Berry (Madras), Mr. J. E. Berkley (Secunderabad), Lieutenant T. E. Madden (Agra), Captain A. Fraser (Secunderabad), Mr. H. S. Elworthy (Bombay), Mr. Dayabhoy Jaduram (Bombay), and Mr. Framjee R. Vikajee (Bombay).

CONTRIBUTIONS.

Mr. H. M. Phipson acknowledged the following contributions which had been received since the previous meeting :—

Contribution.	Description.	Contributor.
1 Kingfisher	Alcedo bengalensis	Mr. W. F. Sinclair, I.C.S.
A Collection of Birds' Eggs	.....	Mr. C. Crommelin.
2 Phoorsas	Echis carinata	Col. MacRae.
2 Rain Quail (alive)	Coturnix coromandelica	Mr. D. Bennett.
2 Rock Bush Quail (alive)	Perdicula argondah	Do.
1 Short-toed Eagle	Circactus gallicus	Major L. Fenton.
1 Photograph of a Rampur Hound	From Jhansi	Mr. W. H. Traill.
1 Snake	Coluber helena	Mr. W. E. Major.
50 Species of Birds' Eggs	New to the Society's collection	Mr. E. C. S. Baker.
1 Sambhar horn	Cervus unicolor	Mr. J. F. Snuggs.
1 Large Centipede (alive)	Scolopendra gigantea	Capt. Thorburn.
1 Dhaman	Ptyas mucosus	Mr. D. MacLaughlan Slater.
1 Wooden Caterpillar	Hepialus virescens	Capt. Stewart (s.s. Oceana).
1 Phoorsa	Echis carinata	Mr. J. A. Betham.
2 Snakes	Trimeresures animalensis	Do.
1 Krait	Bungarus arcuatus	Do.
2 Snakes	Lycodon aulicus	Do.
1 Do.	Tropidonotus stolatus	Do.
2 Do.	Onycocephalus acutus	Do.
2 Do.	Coluber helena	Do.
3 Large Scorpions	Scorpio swammerdami	Do.
1 Large Sole	Cynoglossus quinquelineatus	Mr. N. S. Symons.
1 Green Pigeon (alive)	Osmotreron Sp.	Purchased.
2 Nests of Stewart's Wren Warbler	Prinia stewarti	Mr. G. Vidal, I.C.S.

Minor contributions from Mrs. Godfrey and Miss A. Prentice.

CONTRIBUTIONS TO THE LIBRARY.

Les Formicides de Madagascar, par M. Forel	Presented by the author.
Memoirs of the Geological Survey of India, Vol. II, Part I.	In exchange.
North American Fauna, No. 7	In exchange.
Proceedings of the New Zealand Institute, Vol. XXV ...	In exchange.
Proceedings of the Linnæan Society of New South Wales, Vol. VIII, Part I.	In exchange.
Index and Appendix to the Pharmacographica Indica (Dymock.)	
Journal of the Asiatic Society of Bengal, No. 2, 1893 ...	In exchange.
The Destructive Insects of Victoria, Part II	In exchange.
Manual of the New Zealand Coleoptera	In exchange.
Proceedings of the Royal Society of Victoria, Vol. IV, Part 2.	In exchange.

PAPERS READ.

Mr. A. Abercrombie read extracts from a paper he had written for the Society's Journal on the Common Marine Shells of the Bombay Coast, and illustrated his remarks with specimens from a collection made by him in the immediate vicinity of Bombay. This local collection consists of 320 distinct species, all of which had been identified by Mr. Abercrombie with the assistance of the authorities at the British Museum.

The following miscellaneous notes were also read :—

(*a*) Notes on Indian Dogs, F. E. Dempster ; (*b*) Shooting Notes, Major E. F. Becher ; (*c*) Birds observed breeding in Kharagora, H. Bulkley ; (*d*) The habits of the Coppersmith, E. H. Aitken ; (*e*) Where do Swallows sleep ? E. H. Aitken.

PROCEEDINGS

OF THE MEETING HELD ON 13TH NOVEMBER, 1893.

A meeting of the members took place on Monday the 13th November, at the Society's room, Brigade-Surgeon-Lieutenant-Colonel G. A. Maconachie presiding.

NEW MEMBERS.

The following gentlemen were duly elected members of the Society :—The Honorary Secretary, Government Museum and Public Gardens (Trivandrum), Mr. C. C. Philpott (Rangoon), Mr. C. D. Twopenny (Cashmere), Mr. E. C. Ryland (Calcutta), Mr. E. Bryden (Cachar), the Honorary Secretary, Tenasserim Agri-Horticultural Society (Moulmein), Dr. C. C. Caleb (Lahore), Lieutenant B. Buchanan, R. A. (Bombay), Surgeon-Major Henry J. Barnes (Ahmednagar), Mr. S. L. Batchelor, I.C.S. (Bijapur), Mr. C. P. Fox, C. E. (Bellary), Mr. C. Greatheed (Tanna), Mr. R. Giles, M. A. (Sukkur), Mr. A. Lancaster (Betul), Captain W. D. Gunn, A. V. D. (Dum Dum), Mr. G. C. Sturrock, R. A.

(Quetta), Surgeon-Major E. P. Frenchman (Bassein, Burma), Mr. W. F. Loftus-Tottenham (Pegu), Mr. Charles W. A. Bruce (Upper Burma), Surgeon-Lieutenant Colonel H. J. W. Barrow (Ahmednugger), Captain R. M. Poore (Mhow), Mr. Naranjee Dwarkadas (Bombay), Mr. A. J. A. Jardine (Bassein, Burma).

The Honorary Secretary drew attention to the fact that according to Rule IV the first annual subscription of members elected during the months of October, November, and December shall be considered to extend to the 31st of December in the following year.

CONTRIBUTIONS TO THE MUSEUM.

Mr. H. Phipson, the Honorary Secretary, acknowledged having received the following contributions since the last meeting :—

Contribution.	Description.	Contributor.
1 Albino Dove	Turtur suratensis	H. H. the Maharaja of Kolhapore.
2 Cobras (alive)	Naga tripudians	The Principal of the Grant Medical College.
1 Malabar Civet Cat (alive)	Viverra civettina	Mr. Wasey.
1 Snake	Tropidonotus piscator	Surg.-Capt. M. Knaggs.
1 Daboiu	Daboia russellii	Surg.-Major H. Martin.
Specimens of Gold Quartz	From Mysore	Mr. E. C. Tooth.
1 Cobra	Naga tripudians	Col. D. Robertson.
Nest and Eggs of the Tailor Bird	Orthotomus sutorius	Mr. H. Hepworth.
Photographs of	Scindi Hounds	H. H. the Rao Sahib of Cutch.
Do.	Rampur Hounds	Mr. W. H. Traill.
Do.	Shan Dog	Mr. F. E. Dempster.
1 Indian Pipistrelle	Vesperugo abramus	Mr. W. F. Sinclair, C. S.
1 Snake (alive)	Tropidonotus punctulatus	Miss. A. Prentice.
2 Chameleons (alive)	Chameleo calcaratus	Mr. James Kenyon,
1 Scylla	From Aden	Capt. E. Shopland.
1 Cobra	Naga tripudians	Capt. F. T. C. Hughes.
1 Yellow-breasted ground Thrush	Pitta brachyura	Mr. F. A. Little.
A Number of Scorpions, Lizards, &c.	From Aden	Capt. E. Shopland, R. I.M.
1 Snake	Typhlops brahminus	Major H. C. Harford.
1 Sea Snake	Hydrophis nigrocinctus	Miss S. Baird.
2 Snakes	Tropidonotus stolatus	Dr.H. E. Drake-Brockman.
1 Snake	Zaminus mucosus	Do. do.
3 Tortoises' Eggs	Testudo elegans	Do. do.
1 Spotted Crake	Peyzana maruetta	Hon. W. T. O'Brien.
1 Red-headed Pochard	Fuligula ferina	Do. do.
1 Large Blue Heron	Ardea cinerea	Do. do.
1 Snake	Gongylophis conicus	Mr. E. H. Aitken.
2 Snakes	Tropidonotus plumbicolor	Do.
1 Snake	Crysopelea ornata	Do.
1 Kingfisher	Alcedo bengalensis	Miss A. Waller.
A Collection of Birds' Eggs	From Aden	Capt. Finny, R. I. M.
1 Cobra (alive)	Naga tripudians	Mr. A. Leslie.
12 Birds' Eggs	From Rutnagherry	Mr. J. H. Dickinson.

Contribution.	Description.	Contributor.
1 Persian Gazelle (alive) ...	Gazella subgutturosa	Capt. Gimblett.
1 Yellow-breasted Ground Thrush (alive).	Pitta brachyura	Mr. Douglas Bennett.
1 Snake	Simotes russellii	Mr. A. C. Walker.
1 Do.	Tropidonotus piscator.....	Surg.-Capt. Knaggs.
2 Snakes	Chersyurus granulatus	Mr. H. W. Barrow.
1 Snake.....	Tropidonotus stolatus.....	Do.
1 Emu's Egg	Dromœus irroratus	Mr. P. Churchward.
1 Osprey	Pandion haliætus	Mr. H. Bulkley.
1 Golden-backed Woodpecker.	Brachypternis aurantius.....	Do.
1 Crested Cuckoo	Coccystes jacobinus	Do.
1 Shikra	Astur badius	Do.
1 Marsh Harrier	Circus æruginosus	Do.
1 Indian Night-Jar.....	Caprimulgus asiaticus.....	Mrs. Pearson.
1 Snake	Lycodon striatus	Mr. W. H. Traill.
1 Flying Fox (alive)	Pteropus medius	Mr. E. James.
1 White-breasted Water Hen (alive).	Erythra phœnicura	Mr. P. E. Myer.
1 Albino Jack Snipe	Gallinage gallinula	Mr. C. H. B. Forbes.
A Number of Sea Shells	From Karachi	Mr. G. Elton.
A Collection of Sea Shells ...	From Madras	Mr. P. Berry.
2 Daboias (alive)	Daboia elegans.....	Mr. P. R. Mehta.
1 Snake (alive).....	Silybura macrelepis.....	Mr. E. W. Scott.

MINOR CONTRIBUTIONS FROM

Miss Ida Prager, Mr. Aston, Mr. Brandenburg, Mr. W. Jackson, Mr. J. Stiven, Mr. G. de Bildt, Major W. P. Kennedy, Mr. V. Cabral, Mr. A. L. Pilleau, and Mr. F. Chard.

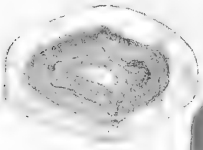
CONTRIBUTIONS TO THE LIBRARY.

Field and Garden Crops of the N.-W. P. and Oudh (Duthie)	From Mr. A. P. Young.
Proceedings of the Zoological Society of London, Parts II and III	From Mr. W. F. Sinclair, C.S.
The Prairie Ground Squirrels	From Mr. Vernon Bayley.
The Dictionary of Economic Products of India (Vol. VI)	From Government.

PAPERS READ.

The following papers were then read :—

1, Notes on Sambar and Sambar Shooting, by J. D. Inverarity. 2, Notes on some of the Butterflies of Matheran, by J. A. Betham. 3, Miscellaneous Notes—(*a*) O Pao da Cobra, or "Serpent's Wood," by Dr. D. G. Dalgado ; (*b*) The Nest of Stewart's Wren Warbler, by G. W. Vidal, I.C.S. ; (*c*) The Kol Bhalu, by F. J. A. Hill ; (*d*), Symptoms of Snake-bite, the result of fright, by Mr. S. M. Fraser, I.C.S. ; (*e*) The Breeding of the Gourami, by Charles F. Gilbert, M.I.C.E. ; (*f*) The flowering of "*Grammatophyllum bromheadii*," by F. E. Dempster.



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Isaac Benjamin del.

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THE POISONOUS PLANTS OF BOMBAY.

Cerbera thevetia. Nat. Ord. Apocynaceæ.

1. Horizontal Section of Fruit. 2. Vertical Section of Fruit.

½ Natural Size.

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THE POISONOUS PLANTS OF BOMBAY.

By Surgeon-Major K. R. Kirtikar, I.M.S., F.L.S.

PART VIII.

(*With Plate J.*)

(*Continued from page* 334.)

CERBERA THEVETIA—(*Willd.*).

(Natural Order—Apocynaceæ.)

Marathi— पिवळी कण्हेर.

Synonym, Thevetia Nerifolia (Juss).—It is known in England as the Exile tree. In this country it is known as the Yellow Oleander.

A handsome, ornamental, ever-green, spreading shrub, 12—15 ft. high. It may also be classed as a tree. Every part of it contains abundantly a thick acrid milky juice. The pith of the young branches is particularly rich in this juice.

STEM.—Rough, rugose, branching irregularly. Wood soft, whitish, and bitter.

Branches.—Rounded, often rising in clusters; sometimes springing from the ground separately.

Bark.—1—2 lines in thickness. The fresh bark of young wood is smooth, bright green, and covered by a thin grey rough epidermis. The epidermis can be readily scraped off; abundant milky juice escapes from the exposed green bark.

The wood becomes more compact as it grows older, and is then brownish, occasionally streaked black here and there. The pith becomes absorbed as the wood gets older, and leaves an irregular central canal, often large enough to admit of a crow-quill. The bark at this time has a brown suberous coating, much cracked here and there.

STIPULES.—Absent; there are several glands in the axilla of the leaf instead.

LEAVES.—Alternate, linear to narrow-linear ; 2—5 inches long, $\frac{1}{4}$ inch at the broadest part, glabrous, coriaceous, glossy ; usually veinless ; in some, the primary veins which arise from the mid-rib are faintly prominent ; acuminate at both ends, decurrent in a very short petiole, or almost sessile ; margin revolute, entire.

FLOWERS.—Large, bright yellow, 2—3 inches long, streaked on the dorsum, with lanceolate twisted greenish stripes from the tube to the distal end of the corolla, terminating in a point.

INFLORESCENCE.—Terminal or lateral cymes. Peduncles much shorter than the leaves, rounded, glabrous, about a line in thickness.

ÆSTIVATION.—Contorto-imbricate, the twist being to the right.

CALYX.—5-parted; sepals distinct and persistent ; lanceolate or ovate-lanceolate ; glabrous, deep green externally, yellowish or light green internally ; acuminate ; $\frac{1}{3}$ the length of the corolla-tube, or about 3 lines long.

COROLLA.—Deciduous, falling off the day after the opening of the flower ; glabrous externally throughout, and internally as far as the throat of the tube, below which it is thickly covered with fine white hairs. The tubular portion is darker yellow inside, greener outside.

The form of the corolla is said to be hypocrateriform by De Candolle, as also by Mr. A. Smith in his article on this plant in "Lindley and Moore's Treasury of Botany." But the tube in this flower is neither long nor slender, nor is the limb, that is, the terminal lobes of the corolla, flat. The form of the flower is more campanulate than anything else. The corolla may be divided into three parts :— (1) a tube about $\frac{1}{2}$—$\frac{3}{4}$ inch long, widest at its insertion on the calyx ; about 2 lines in diameter, narrowest at its mid-part, and

contracted at the throat ; (2) beyond the throat is the bell-like central portion, ¾—1 inch in length ; (3) from the distal part of this bell-like mid-portion five lobes twist in a spiral manner to the right, ¾—1 inch in length. The tube is all but closed in above the anthers by ovate acute-bilobate "*scales*" at the throat. These "*scales*" are covered with soft white shining hairs. They leave just a small opening enough to show the pointed apex of the stigma.

STAMENS.—5, alternating with the lobes of the corolla.

Filaments—Hardly perceptible.

Anthers—2-celled, included within the tube by the "*scales*" mentioned above ; inserted on the throat of the tube ; erect, introrse, subsessile, lanceolate ; enclosing the stigma at its base by their inferior pointed extremities, almost adhering to the stigma.

Pollen—Granular.

PISTIL—

OVARY—Superior, free, single ; 2-celled. The entire ovary is surrounded by a bright yellow ring-like five-notched disk, the notches alternating with the lobes of the calyx.

STYLE—Filiform, included ; each cell of the ovary sends up a distinct thread which unites with its fellow about a line away from the point of its exit from the cell.

STIGMA—Conically capitate ; faintly 2-lobed ; the apex of the cone finely pointing at the distal end.

OVULES—2 in each ovary ; amphitropous ; round, compressed from base to apex ; equi-distant from the ovary.

FRUIT.—Globose or ovately-globose, or half-orbicular ; truncated at the apex ; smooth, glossy ; light green when immature, yellow externally when mature ; slightly fleshy ; flesh white ; longest diameter 1½—2 inches horizontally ; dilated at mid-portion transversely, with a hard brown stone or putamen which contains the seed. The putamen is of a peculiar triangular shape, resembling the "cocked-hat." It is divided by a deep groove into two cells along the edge, corresponding to the base of the triangle. Each cell is generally described as having a distinct seed within it, but very often one of the cells seems to remain undeveloped. In such cases the seed in such a cell is abortive.

SEEDS.—Two, often only one, slightly winged near the situation of the embryo ; pale yellow ; the tegmen of the seed is friable.

ALBUMEN.—Absent.

EMBRYO.—Erect, small, fleshy.

RADICLE.—Short, eccentric, cylindrical.

COTYLEDONS.—Rotundate ; convex externally, plane internally ; fleshy ; varying in size from a two-anna silver-piece to a four-anna silver-piece. The substance of the cotyledons is intensely bitter.

REMARKS.

The shrub is a native of South America and the West Indies. It was introduced into England in 1735. It is not known when it was introduced into this country and whether it came here direct from its native soil or from England. It is, however, perfectly naturalized in India in the different parts of the country. It has been figured and described by Royle in his "Illustrations of the Himalayan Plants" published in 1839. The flower is considered by some writers to have a sickly odour. It has the faint odour of *Nerium oleander*, which is by no means disagreeable. But that is a mere matter of taste or opinion ; and, as such, knows no definite law. The wood also, as has been already observed, is credited by some writers of note, such as Lindley, with a repulsive odour ("Veget. Kingdom," p. 559, 1847). It does not possess any such odour, so far as I can judge from the examination of several specimens, fresh or dried, growing in Bombay, Thana, and Bandra, where the plant is much appreciated as a garden beauty of hardy growth.

Kurz, describing the plant as it grows in Burma, gives its height as from fifteen to twenty feet. It seldom grows as high as that on this side of India. The length of the clear stem is given by him as between six to ten feet, but very often here there appears to be no clear stem, as fresh branches are given off, even when the stem is old the branches keep sprouting out even down to the root. The flowering time in England, as given by Loudon, is from January to July ("Encyclopœdia of Plants," p. 148, 1829). Kurz gives the flowering time in Burma as between November and March, where the fruit is ready in the cold season. The plant seems to flower and mature fruit on this side of India at all times of the year. Here it is quite possible to see a full-formed fruit, while fresh flowers are being thrown out in succession.

The latest example in proof of this may be given from the specimens I examined in January last in the Victoria Gardens, Bombay, through the kindness of Mr. C. D. Mahaluxmeewalla,the well-informed and energetic Superintendent of the Gardens. In one of these specimens on a single branch, there was a mature fruit on one branchlet, on another a half-developed fruit, on the third a full-blown flower. In the Bandra specimens which I examined through the good offices of Mr. E. M. Pratt, I.C.S., in July and August, 1892, and in January last, there were flowers and fruits in all stages of development on one and the same tree.

The plant is said to require rich mould when grown as a stove-plant in cold countries. In India it grows in red soil, as well as in sandy or clayey soil.

With regard to the question of stipules, Alph. De Candolle has the following important observation in his monograph on the *Apocynaceæ* in "Annales des Sc. Nat." (3rd Series, Vol. I., Bot., pp. 235—263) :— "In *C. thevetia* there are axillary fasciculated glands, that is to say, accumulated in large numbers, between the stem and the petiole. Considering their situation, number, and smallness, one cannot in any way take these glands for stipules." (J. Mittra.)

Dr. Norman Chevers says in his celebrated work on Indian Medical Jurisprudence that the oil obtained by expression from the seed of *Cerbera thevetia* is amber-coloured and slightly viscid, and that it is recommended as a cathartic by natives ; "but," he adds on the authority of Dr. Shortt, "it produces violent vomiting and hypercatharsis." Col. Drury observes in his "Useful Plants of India" that the oil is of a bright yellow colour, but that its uses and properties are yet undetermined. Dr. Dymock and his colleagues in their "Pharmacographia Indica" (Vol. III, pp. 406—410), as our latest authorities on the subject, say that the oil when pure is as inert as olive oil. The oil, according to the researches of De Vrij, has an agreeable mild taste like that of fresh almonds. DeVrij says that the oil is limpid and almost colourless. The quantity that can be obtained by expression is 35—41 per cent., and 57 per cent. with benzol.

POISONOUS PROPERTIES.

The plants of the order *Apocynaceæ* abound in milky juice containing various acrid principles. The acrid principles isolated from

Cerbera thevetia, according to the most recent researches, are known as Thevetin and Theveresin. These active principles render the plant highly dangerous. It must not, however, be supposed that all the plants of the order *Apocynaceæ* are of such a nature. Owing to the absence of one or other of the acrid principles, the milky juice of a plant belonging to this order may be perfectly innocuous. Royle mentions, on the authority of Lindley, a plant of this order which is perfectly harmless. It is the milk-tree or *Hya-hya* of Demerara, called by Mr. Arnott *Tabernæmontana utilis*. Royle mentions other harmless plants, such as the *Melodinus monogynus*, which is a native of Northern and Eastern India, and the orange-like fruits of which have a sweet edible pulp ; the *Carissa edulis* of Nubia ; and the Cream fruit of Sierra Leone ; all these yield edible fruit. The *Willoughbia edulis* growing in India and the *Carissa carandas* growing wild all over the Thana District, are instances of plants bearing perfectly harmless fruit. There are, on the other hand, other plants of the same order, such as *Cerbera Manghas* and *Cerbera Tanghin*, which are highly dangerous. The seeds of *Cerbera Manghas* are narcotic. The seeds of *Cerbera Tanghin* (the Tanghin tree of Madagascar) are said to be so powerfully poisonous that a single seed may be sufficient to destroy *twenty* persons (Royle).

The bark of the plant, administered internally, has been, since the days of Lindley, considered to be a powerful febrifuge, 2 grains of it only being considered to be equal to a dose of cinchona. It is used in countries where it grows wild for poisoning fish.

I must not omit to mention here the observations of Mr. A. Smith in the "Treasury of Botany," which are as follows :—"Its fruit is regarded as noxious, though, according to Dr. Seeman, a gentleman ate four of them, when a boy, without injury." Possibly this was due to idiosyncrasy, by virtue of which the boy's constitution withstood the effects of the poison, or that he ate the quantity of the fruit on a loaded stomach, which possibly diluted the poisonous element to such an extent as to render it inert. Again, we are told that it was the fruit that was eaten. We are not aware to what extent the fruit, *i.e.*, the pulpy part, contains the poisonous element, nor do we know that the pulp is ever used for extracting the poisonous principles. Perhaps

the poisonous principles exist in much less proportions in the fruit-pulp than in the seeds, which latter is the part of the plant generally used for the extraction of the active principles. We have clear instances in recorded cases of how deleteriously the active principles of the plant may sometimes act on certain individuals. It is the milk of the tree that is considered *highly venomous*. Its bitter bark and leaves are cathartic.

Dr. Norman Chevers, on the authority of Dr. Waring, of unrivalled therapeutic repute as regards Indian plants, observes in his Medical Jurisprudence that the kernels of the plant are exceedingly bitter. I know it by personal experience, for I have tasted them and found them so to my disgust. "They produce," says Dr. Norman Chevers, "a slight feeling of numbness, very slight indeed, in the tongue;" but I did not notice any heat whatsoever which Dr. Waring says is experienced.

From a case published by Dr. J. Balfour ("Madras Journ. of Lit. and Sc.," 1857, Vol. III., N. S., p. 140), it appears that the swallowing of one kernel of the fruit produced acro-narcotic symptoms, similar to those of aconite. In a case quoted by Dr. Chevers, as mentioned to him by Babu Kannya Lall Dey, a case which occurred in the practice of a physician whom the latter knew, it appears that on the eating of a single seed, the following symptoms occurred :—In a short time after swallowing, vomiting commenced, but there was no purging : within half an hour the boy, who had swallowed it, was covered with cold clammy sweat; the countenance was pale, and the eyes sunken deeply, and within two hours he died convulsed.

Let us now consider the active principles of the plant under notice. They are Thevetin and Theveresin. Dr. Dymock and his colleagues, in their "Pharmacographia Indica," elaborately quote the experiments of T. Husemann on the lower animals, such as frogs, dogs and rabbits. Our concern is more with regard to man, and it will, therefore, be more useful to summarize the researches of a leading Pharmacologist like Schmiedeberg, so far as they could be determined on the mammalian genus *Homo*, with regard to the action of the poisonous group to which Thevetin belongs.

Schmiedeberg classes Thevetin with the Digitaline Group. The active principles of the various plants, classed under this group, act

upon all sorts of animals in so uniform a manner that each of the substances seems, as regards its individual action, a true copy of any one of the others. The most important of this group is the one which gives it its distinguishing name in pharmacology, namely, Digitalin, which, together with Digitalein and Digitoxin, form the active principles of Foxglove. Next to these comes the active principle of Squills, named Scillain. Next come Helleborin, the active principle of Hellebore, and Oleandrin, otherwise called Nerein, to which the Common Oleander owes its poisonous properties. Then there is Apocyanein. Finally, belonging to this group are Adonis, the active principle of Adonis, Vernalis and Convallamarin, the active principle of *Convallaria Majalias* (Lilly of the Valley).

Scillain, Helleborin, Adonis, and Oleandrin or Nerein are not crystalline and are almost insoluble in water. Digitalin, Apocyanein and Convallamarin are glucosides which form frothy solution with water like Saponin, a glucoside contained in the bark of Quillaia of Chili (*Quillaia saponaria*). Thevetin, Antiarin and Strophanthin, belonging to the Digitaline Group, are considered by Schmiedeberg as rarities.

The action of these active principles included in the digitaline group consists almost exclusively in the fact that they alter in a peculiar way the elasticity of the cardiac muscle without at first modifying the contractility of it. There are three stages distinctly, from their preliminary action to their most potent final effect :—(I)—*In the first stage*, there is a rise of blood-pressure and consequent slowing of the pulse, larger quantities of blood being thrown into the aorta and thence into the arteries. This effect can be kept up by small doses of the substances of this group. (II)—*In the second stage*, there is continuous high blood-pressure with irregularity both in the action of the heart and in the frequency of the pulse. (III)—*In the third stage*, there is sudden arrest of the action of the heart from the paralysis of that organ as indicated by a rapid fall of the blood-pressure.

It is as such that Thevetin is supposed to act, especially producing the phenomena characteristic of the second and third stages. The subcutaneous injections of this substance, Schmiedeberg observes, "cause phlegmonous inflammations more or less readily." Closely connected with this, is its action on the stomach and intestines which causes gastric disturbance, diarrhœa and other symptoms, well known

to have been observed during the use of digitaline. The action of Thevetin appears, from the recorded cases of poisoning, to be more rapid than in cases where digitalin is administered medicinally.

These views of Schmiedeberg are corroborated by Cerna. His experiments show that Thevetin produces death by asphyxia and cardiac paralysis. Applied to the skin, says he, it produces irritation and a sensation of burning. It produces also convulsions of cerebral and paralysis of spinal origin. It increases intestinal peristalsis, lowers the temperature, and, locally applied, it increases salivation, and contracts the pupils. Warden has confirmed the statement as to the production of convulsions. (Dymock.)

As against what Schmiedeberg has said—namely, that Thevetin is non-crystalline—De Vrij says that Thevetin is obtained at the rate of four per cent. from the cake left after the oil is expressed from the seed. It consists of a "beautiful white crystallized glucoside." This question is well worthy of the study and further research on the part of the Indian pharmacologist. De Vrij was able to find Thevetin in the bark also of *Cerbera thevetia*. Pure Thevetin, says Dr. Warden of Calcutta, is white and *crystalline* ("Pharma. Journal," Vol. XIII, 3rd Series, p. 43). Warden has discovered a second poisonous principle in the seeds of *Cerbera thevetia*, to which he gives no name, but it is one which appears to him to possess greater activity than Thevetin. Pure Thevetin, he says is only faintly bitter, whereas the newly discovered poisonous principle is persistently bitter and *non-crystalline*. The latter was obtained by precipitating the mother-liquor left after the crystallization of Thevetin by aqueous tannic acid and decomposing the precipitate by lime. In his work on Medical Jurisprudence, Dr. Lyon observes that in India cases of poisoning by *Cerbera thevetia* in the human subject are seldom met with. But Dr. K. L. Dey says that he has lately found it employed in Bengal for homicidal purposes without raising any suspicion. Two cases of homicidal poisoning came under his observation in the course of a month. Nine cases of cattle poisoning by the seeds of this plant came under the observation of Dr. Lyon in 1886. Dr. Dumortier records a fatal case in a child three years old after swallowing one seed.

I may observe here that Dr. K. L. Dey considers the oil obtained from the seeds of *Cerbera thevetia* to be a cardiac poison. He says that "the acrid oil contained in the kernels is a powerful acro-narcotic poison allied to Nux Vomica, and its effects as a poison are very rapid" (Pharmaceutical Journal, Vol. XII, 3rd Series, p. 397).

CONTRIBUTION A LA CONNAISSANCE DES MUTILLES DE L'INDE.

Par Earnest Andre'.

(*Read before the Bombay Natural History Society*, 13*th February*, 1894.)

La petite collection de *Mutilles* qui fait l'objet du présent travail a été recueillie dans diverses localités de la Présidence de Bombay par Mr. R. C. Wroughton, Indian Forest Service, et par quelques-uns de ses amis qui ont bien voulu, sur sa demande, joindre leurs recherches aux siennes pour arriver à un resultat plus complet.

La totalité des espèces recueillies s'élève à 31, sur lesquelles 15 sont nouvelles pour la science, ce qui donne une idée de la richesse de ses regions priviligiées.

Pour faciliter la reconnaissance de ces insectes je commencerai par résumer en un tableau synoptique les caractères des 31 espèces que j'ai pu étudier et qui toutes appartiennent au sexe femelle.

Puis je donnerai le catalogue raisonné des captures, avec les renseignements géographiques nécessaires et la description des espèces nouvelles.

Mais, avant d'entrer en matière, je tiens à remercier ici Mr. Wroughton de son extrême obligeance et à lui exprimer toute ma reconnaissance pour la générosité avec laquelle il m'a abondonné le fruit de ses diverses explorations.

Gray, 10 Juillet, 1893.

Tableau Synoptique.

des *Mutilles* ♀ comprises dans le present travail.

1. Thorax quadrangulaire, á côtés parallèles, rectilignes ou légèrement concaves ; abdomen toujours sessile, sans étranglement entre son premier et son second segments 2

   Thorax allongé, sensiblement rétréci en arrière, à côtés rarement rectilignes ; mais plus ou moins en arc convexe, parfois dilatès en dents ou tubercules. Abdomen tantôt sessile, tantôt distinctement pétiolé 24

2. Premier segment de l'abdomen sans tache distincte de pubescence claire, parfois cilié de poils formant une bande peu fournie á son bord postérieur 3

Premier segment de l'abdomen avec une tache distincte, isolée, de pubescence blanche ou jaune 22

3. Second segment de l'abdomen pourvu d'une bande de pubescence blanche ou jaune, mais sans tache isolée 4

Second segment de l'abdomen avec ou sans bande, mais pourvu d'une ou plusieurs taches isolées. (Parfois les taches sont plus ou moins confluentes et simulent une bande, mais on les reconnait toujours en ce qu'elles n'atteignent pas le bord externe du segment) 5

4. Taille très petite (3 à $3\frac{1}{4}$ mill.) ; second segment avec une bande de poils blanchâtres à son bord postérieur ; les segments suivants presque glabres ; tête et thorax rouges, sans revêtement de pubescence dorée ..... *M. atomus*, n. sp.

Taille grande (11 à 15 mill.); tête densèment revêtue de pubescence d'un fauve doré ; thorax rouge ; second segment abdominal avec une large bande de poils d'un fauve doré à son bord postérieur ; troisième segment recouvert en entier de semblable pubescence ..... *M. kauarœ* (Cam.)

5. Partie antérieure du second segment abdominal avec une seule tache médiane 6

Partie antérieure du second segment abdominal avec deux taches latérales 11

6. Bord postérieur du second segment abdominal soit simplement avec une bande, dilatée ou non en son milieu, soit avec une tache médiane reliée á une bande apicale 7

Bord postérieur du second segment abdominal portant une tache médiane, isolée, de pubescence blanche, non reliée á une bande apicale 10

7. Troisième segment abdominal sans bande de pubescence blanche ou jaune 8

Troisième segment abdominal avec une bande de pubescence d'un blanc jaunâtre ; second segment avec une tache basale et une bande apicale de même couleur ; tête noire, thorax rouge. Long : 5 á 6 mill .....*M. rufipes* (Latr.)

8. Tache et bande du second segment abdominal d'un jaune d'or ; tête noire, thorax rouge. Long: 5 mill.....*M. pulla*, n. sp.

Tache et bande du second segment abdominal d'un blanc d'argent 9

9. Tête entièrement noire, un peu plus large que le thorax, luisante, peu densément ponctuée ; thorax arrondi en arrière ; segment anal non strié en dessus. Long : 4 mill .....*M. subglabra*, n. sp.

Front et vertex rouges ; tête pas plus large que le thorax, fortement ponctuée-réticulée ; thorax verticalement tronqué en arriére ; segment anal longitudinalement strié en dessus. Long : 3½ á 5 mill .....*M. nigrigena*, n. sp.

10. Tête noire ; thorax rouge, arrondi en arrière ; une tache blanche au milieu du quatrième segment abdominal. Long : 5 mill .....*M, trimaculata* (Cam.)

Tête et thorax rouges, ce dernier nettement tronqué en arriére ; une tache blanche au milieu du cinquième segment abdominal. Long : 6 à 7 mill.....*M. ocellata* (Sauss.)

11. Taches abdominales formées de pubescence blanches 12

Taches abdominales formées de pubescence d'un fauve doré.....17

12. Second segment abdominal avec seulement deux taches sur sa moitié basale 13

Second segment abdominal avec deux taches allongées près de sa base et deux autres arrondies à son bord apical ; deux taches semblables se voient sur le troisième segment, ce qui forme en tout six taches sur deux rangées verticales. Tête noire, dos du thorax rouge. Long: 14 à 15 mill.....*M. sexmaculata* (Swed.)

13. Premier segment abdominal longuement et assez densément cilié de poils fauves; tout le corps noir, sauf le dos du thorax qui est ferrugineux ; second segment abdominal avec deux taches blanches allongées, troisiéme segment avec deux taches carrées de même couleur. Long: 10 mill. .....*M. niveosignata*, n. sp.

Premier segment abdominal non cilié de poils fauves 14

14. Bord postéro-supérieur du thorax armé d'une rangée d'épines courtes, mais bien accentuées. Tête rouge ou noire, thorax rouge; troisiéme et quatrième segments avec des bandes blanchâtres plus ou moins obsolétes. Long: 5 à 7 mill .....*M. pectinospinata* (Magretti)

Bord postéro-supérieur du thorax inerme.....15

15. Vertex avec une tache médiane de pubescence blanche ; tête noire, thorax rouge ; second et troisième segments avec chacun deux taches de pubescence argentée. Long: 6 mill .....*M. kolabensis*, n. sp.

Tête noire, sans tache blanche ; thorax rouge.....16

16. Second, troisiéme, et quatrième segments de l'abdomen avec chacun deux taches de pubescence blanche. Long: 5 á 9 mill.....*M. hexaops* (Sauss.)

Second segment abdominal avec deux taches blanches ; troisième segment avec une bande interrompue au milieu de semblable pubescence. Long: 9 à 10 mill.....*M. vicina* (Rad. et Sich.)

17. Second segment abdominal avec deux grandes taches basales très rapprochées et souvent confluentes. Taille plus grande 18

Second segment abdominal avec deux taches rondes, plus petites et non confluentes ; son bord postérieur ainsi que le troisième segment sont ornés de larges bandes d'un fauve-doré. Tête noire, revêtue de pubescence dorée ; thorax rouge. Long: 3 mill. .....*M. lilliputiana*, n. sp.

18. Troisième, quatrième, et cinquième segments couverts d'une épaisse pubescence d'un fauve-doré.....19

Cinquième segment abdominal non revêtu d'une épaisse pubescence dorée 20

19. Tête noire, recouverte de pubescence dorée ; thorax rouge. Long: 7 à 12 mill .....*M. agnata*, n. sp.

Tête et thorax rouges ; tête non recouverte de pubescence dorée. Long : 9 à 12 mill .....*M. nudiceps*, n. sp.

20. Tête noire, recouverte de pubescence dorée ; thorax rouge ; troisième et quatrième segments de l'abdomen revêtus d'une épaisse pubescence d'un fauve-doré. Long : 8 à 15 mill.....*M. pulchriceps* (Cam.)

Tête rouge, sans pubescence dorée ; thorax rouge.....21

21. Troisième et quatrième segments abdominaux couverts de pubescence dorée ; second segment ventral sans dépressions ni saillies bien accentuées. Long : 8 mill .....*M. erythrocera* (Cam)

Troisième segment abdominal seul couvert de pubescence dorée; second segment ventral avec des dépressions et saillies très accentuées, en forme de cicatrice. Long : 11 mill .....*M. cicatricifera*, n. sp.

22. Tache du premier segment abdominal d'un fauve doré; second et troisième segments portant chacun une bande apicale, semi-circulairement élargie au milieu, rétrécie sur les côtés, de pubescence fauve. Tête et thorax rouges. Long : 7 mill. .....*M. lunarifasciata*, n. sp.

Tache du premier segment abdominal blanche; second et troisième segments portant chacun, à leur bord apical, une tache semicirculaire de pubescence blanche. Tête et thorax rouges.....23

23 Tête quadrangulaire, distinctement plus large que le thorax, à sculpture superficielle ; thorax arrondi en arrière. Long : 4 à 6½ mill. .....*M. ruficeps* (Smith).

Tête de la largeur du thorax, plus grossièrement sculptée; thorax brusquement tronqué en arrière ; bord supérieur de la troncature formant une arête nette, denticulée. Long: 5 mill. ..... *M taylori*, n. sp.

24. Abdomen à couleur foncière d'un bleu d'acier ou d'un violet métallique. Tête et thorax rouges ; une tache sur le pronotum, une autre allongée à la base du second segment abdominal, une troisième arrondie au milieu de son bord apical, et parfois aussi une tache médiane moins distincte sur les quatrième et cinquième segments, de pubescence blanche. Long : 6 à 8 mill..... *M. regia* (Smith).

Abdomen à couleur noire, rarement avec un très faible reflet bleuâtre 25

25. Thorax à bords latéraux simples ou légèrement crénelés, mais non élargis en un fort tubercule dentiforme un peu avant leur milieu 26

Thorax à bords latéraux élargis en un fort tubercule dentiforme un peu avant leur milieu 28

26. Tête et moitié antérieure du thorax très densément revêtues d'une pubescence d'un beau jaune d'or pale qui cache entièrement la couleur rouge du tégument. Abdomen pétiolé, son premier segment rouge, petit et nodiforme, second segment avec une tache basale et trois autres à son bord apical, de pubescence blanche. Long : 8½ mill ..... *M. auropalliata*, n. sp.

Tête et thorax non revêtus de pubescence dorée, abdomen sessile 27

27. Tête et thorax rouges ; abdomen noir avec un très faible reflet bleuâtre ; son premier segment rouge, second segment avec une petite tache au milieu de sa base, et une bande apicale parfois interrompue au milieu de pubescence d'un blanc d'argent. Long : 4 à 5½ mill ..... *M. poonaensis* (Cam.)

Tout le corps noir, disque du thorax ferrugineux, une tache sur le vertex, deux à la base du second segment abdominal, deux autres à son bord apical et deux sur le troisième segment, de pubescence blanche. Long : 7 mill ..... *M. maculiceps*, n. sp.

28. Abdomen distinctement pétiolé, son premier segment nodiforme. Tête noire, marquée d'une grande tache blanche ou jaunâtre sur le vertex 29

Abdomen non pétiolé, son premier segment large et court. Tête rouge, sans tache 30

29. Les deux premiers tiers du second segment de l'abdomen recouverts, ainsi que le disque du thorax, de pubescence fauve ; une tache sur le premier segment abdominal, trois autres au bord apical du second segment et une au milieu des quatrième et cinquième segments, de pubescence blanchâtre. Long : 10 à 14 mill ..... *M. argentipes* (Smith).

Disque du thorax et premier segment de l'abdomen seuls revêtus de pubescence fauve ; une tache médiane à la base du second segment abdominal, trois autres à son bord apical et une dernière au milieu du cinquième segment, de pubescence d'un blanc jaunâtre. Long: 12 à 15 mill. *M. argenteo-maculata* (Smith).

30. Tête et thorax d'un rouge sombre ; une bande interrompue au bord apical du second segment abdominal et une autre couvrant tout le troisième segment, de pubescence d'un jaune d'or. Long : 13 mill ..... *M. trichocondyla*, n. sp.

31. Tête et thorax d'un rouge vif ; une tache médiane sur le premier segment abdominal, une large bande deux fois échancrée à la base du second, et deux autres, plus ou moins échancrées ou interrompues au milieu, couvrant les troisième et quatrième segments, de pubescence d'un fauve-doré. Long: 15 à 16 mill..... *M. pulchrina* (Smith).

CATALOGUE RAISONNÉ

ET

DESCRIPTIONS DES ESPÈCES NOUVELLES.

1. *Mutilla ruficeps* (Sm.) [= *rufiventris* (Sm.)]

Mes exemplaires s'écartent de la description de Smith en ce que le dessous de l'abdomen n'est ferrugineux qu'à l'extrémité et est brunâtre sur le reste de sa surface. La tête, rouge chez certains individus, se rembrunit chez d'autres, surtout sur les côtés, de façon à ne presenter de rouge que le vertex ou même à devenir entièrement brune.

Kanara et Kolaba (Mr. Wroughton).

2. *Mutilla taylori*, nov. sp.

♀ :—Tête brune, front et vertex d'un rouge sombre, thorax ferrugineux, scape des antennes, base du funicule, et pattes rougeâtres, le reste du funicule d'un brun noir, abdomen noir, une tache ovale au milieu du premier segment, une tache semicirculaire à l'extrémité du second et une autre plus petite à l'extrémité du troisième, formées de pubescence d'un blanc sale. Tout le corps et les pattes hérissés de poils blanchâtres ; sur la tête ainsi que sur le dos du thorax et de l'abdomen les poils sont bruns. Tête arrondie, assez convexe, un peu plus large que longue et à peine plus large que le thorax, grossièrement ponctuée-réticuleé ; troisième article des antennes presque deux fois aussi long que le quatrième ; yeux grands ovales, un peu plus longs que l'espace occupé derrière eux par le vertex. Thorax rectangulaire, ses bords latéraux parallèles, irrégulièrement denticulés ; il est tronqué en arrière et muni, au bord supérieur de cette troncature, de denticules spiniformes dont le médian est le plus allongé ; le dos du thorax est assez fortement et densément ridé-ponctué, les mésopleures sont à peu près lisses, les métapleures sont luisantes et marquées de gros points mediocrement serrés. Premier segment de l'abdomen large, peu allongé, non séparé du second, par un étranglement ; ce dernier assez densément ponctué ; segment anal couvert de poils blanchâtres qui en cachent la sculpture. Tibias postérieurs armés de 4 à 5 épines ; éperons pales. Long : 5 mill.

Ressemble à la *M. ruficeps* (Sm.) par la disposition des couleurs, mais, chez *M. ruficeps*, la tête est plus quadrangulaire, moins convexe, distinctement plus large que le thorax ; sa surface est luisante avec une ponctuation médiocre et assez éparse, les yeux sont plus petits, plus éloignés de l'occiput, le thorax n'est pas brusquement tronqué en arrière, sa face dorsale passe insensiblement à sa face déclive sans former d'arête nette et sans dents spiniformes au point de jonction ; enfin les bords latéraux du thorax ne sont pas distinctement denticulés.

Orissa (Mr. James Taylor) un seul exemplaire.

3. *Mutilla lunarifasciata*, nov. sp.

♀ :—Tête et thorax d'un rouge ferrugineux, scape des antennes d'un rouge brun, funicule noirâtre ; pattes d'un ferrugineux pale, sommet des cuisses et des tibias noir. Abdomen noir, assez densément revêtu de pubescence noire ; premier segment avec une grande tache triangulaire de pubescence d'un fauve-doré qui couvre presque toute sa largeur et dont la pointe s'étend sur le segment suivant ; second segment portant à son bord postérieur une bande de semblable pubescence, très étroite latéralement, très élargie au milieu en forme de demi lune ; troisième segment avec une bande semblable mais moins large, segment anal avec l'extrémité couverte de poils d'un jaune pale luisant ; en dessous, les segments deux et trois sont ciliés de poils jaunâtres. Quelques soies brunes sont éparses sur le dessus du corps et d'autres d'un jaune pale se voient sur sa face inférieure et ses côtés ainsi que sur les pattes où elles sont plus abondantes. Tête assez convexe, en rectangle arrondi, transverse, un peu plus large que le thorax, densément ponctuée-réticulée ; troisième article des antennes une fois et demie aussi long que le quatrième ; yeux de grandeur moyenne, ovales, un peu moins longs que l'espace occupé derrière eux par le vertex. Thorax peu allongé, quadrangulaire, à côtés parallèles et très faiblement concaves en leur milieu, assez fortement ridé-ponctué sur le dos, presque lisse et luisant sur les flancs, à l'exception des métapleures qui sont superficiellement ponctuées-réticulées ; il est assez verticalement tronqué en arrière avec quelques denticules au point de jonction de ses faces dorsale et postérieure, le denticule médian étant assez long et spiniforme. Abdomen ovale, peu rétréci en avant ; son premier segment large et court s'adapte régulièrement au segment suivant, sans

étranglement ; second segment densément et assez finement ponctué-réticulé en dessus, luisant et éparsement pointillé en dessous ; segment anal assez fortement ridé-ponctué à la base, très finement chagriné à l'extrémité, sans aire médiane distincte. Tibias avec de nombreuses et fortes épines d'un rouge brun ; éperons pales. Long : 7 mill.

Kolaba (Mr. Wroughton) un seul exemplaire.

4. *Mutilla rufipes* (Latr.)

Les individus que je rapporte à cette espèce sont semblables sous tous rapports aux exemplaires Européens et présentent comme eux les mêmes variations dans la couleur des pattes et des antennes qui passent du rougeâtre clair au brun noir foncé. M. Magretti (Ann. mus. civ. de Genova, 1892, p. 214) a décrit une *M. tenasserimica* qui, d'après lui, se distingue de la *M. rufipes* par la sculpture différente de la tête et du thorax. Les exemplaires de l'Inde que je possède ne présentent à cet régard aucune difference avec ceux de l'Europe, et je ne suis pas certain de la validité de la *M. tenasserimica* comme espèce distincte. J'ajoutera enfin que le pygidium régulièrement et longitudinalement strié sépare notre *M. rufipes* de la *M. ellipsifera* (Gribodo) dont l'aire pygidiale est couverte de stries en ellipses concentriques.

5. *Mutilla nigrigena*, nov. sp.

♀ :—Tête brune, rouge sur le front et le vertex ; thorax rouge ; scape des antennes et pattes d'un brun rougeâtre, funicule tantôt brun tantôt rougeâtre. Abdomen noir, revêtu d'une pubescence noire ; second segment avec une petite tache arrondie, d'un blanc d'argent, à sa base, et une autre plus grande et semicirculaire à son extrémité qui est bordeé d'une mince frange de poils également d'un blanc d'argent ; une tache incertaine et mal définie de poils de même couleur s'observe aussi au milieu des quatrième et cinquième segments. Dessus du corps parsemé de poils noirs ; en dessous et sur les côtés, ainsi que sur les pattes, se voit une éparse pilosité blanchâtre. Tête arrondie, de la largeur du thorax, fortement et densément ponctuée-réticulée ; antennes avec le troisième article seulement un peu plus long que le quatrième ; yeux grands, ovales, bien plus long que l'espace occupé derrière eux par le vertex. Thorax rectangulaire, à côtés parallèles, verticalement tronquè en arrière avec le bord de la troncature légèrement crénelé ; un peu avant ce bord se voit un onglet scutellaire peu saillant mais

distinct. Le dos du thorax est grossièrement ponctué-réticulé, ses flancs sont plus éparsement ponctués. Premier segment de l'abdomen court, s'adaptant exactement au segment suivant, sans étranglement ; second segment longitudinalement ridé-ponctué ; segment anal longitudinalement strié. Une carène courte, assez saillante et un peu bilobée en dessous du premier segment. Tibias intermédiaires et postérieurs avec de fortes épines rougeâtres ; éperons pales. Long : 3½ à 5 mill.

Cette espèce ressemble à *M. montana* (Panz) d'Europe, mais en est bien distincte par son front et son vertex rouges, par l'absence de bande blanche sur le troisième segment et par les stries longitudinales de son pygidium.

Kanara (Mr. Wroughton).

6. *Mutilla subglabra*, nov. sp.

♀ :—Tête noire, tubercules antennaires rouges, gros et très saillants; mandibules rougeâtres avec l'extrémité noire ; antennes noires, sauf l'extrémité du scape et le premier article du funicule qui sont rougeâtres. Thorax rouge ; pattes brunes, tarses testacés. Abdomen noir, presque sans pubescence, avec un reflet légèrement violacé ; second segment marqué à sa base d'une petite tache ovale d'un blanc d'argent et à son extrémité d'une bande étroite de même couleur, fortement élargie au milieu en triangle arrondi. Dessus du corps hérissé de poils noirs, plus abondants sur la tête et le thorax, plus épars sur l'abdomen ; en dessous sur les côtés et sur les pattes il existe une pilosité éparse, d'un blanc jaunâtre. Tête arrondie, assez convexe, un peu plus large que le thorax, fortement mais peu densément ponctuée, luisante. Antennes courtes et épaisses, leur troisième article à peu près de la longueur du quatrième. Yeux grands, ovales, plus longs que l'espace occupé derrière eux par le vertex. Thorax assez étroit, à côtés parallèles, arrondi en avant et en arrière, sa face postérieure oblique rejoignant la face dorsale par une surface arquée, sans arête ; il est assez fortement ponctué-réticulé sur le dos, presque lisse sur les flancs. Abdomen en ovale allongé, assez rétréci en avant et plus encore en arrière ; son premier segment court et étroit, mais s'adaptant régulièrement au segment suivant, sans étranglement ; second segment luisant, peu densément et peu profondément ponctué ; segment anal non strié. Epines des tibias brunes, éperons pales. Long : 4 mill.

Ressemble à *M. nigrigena*, mais s'en distingue par sa tête entièrement noire, plus large que le thorax, moins fortement sculptée, par ses tubercules antennaires saillants, par son thorax plus grêle, non tronqué en arrière, mais insensiblement arrondi, par son abdomen presque glabre avec le segment anal non strié.

Kanara (Mr. Wroughton) un seul exemplaire.

7. *Mutilla atomus*, nov. sp.

♀ :—Tête, thorax, antennes et pattes ferrugineux, abdomen noir, avec un reflet bleuâtre, presque glabre ; second segment portant à son bord postérieur une bande, élargie au milieu, de poils blanchâtres très peu serrés et parfois peu distincts ; les autres segments avec une pubescence de même nature, très clairsemée et ne formant pas de bandes bien distinctes. Dessus de la tête, du thorax et de l'abdomen éparsement hérissés de poils bruns ; côtés et dessous du corps hérissés de poils blanchâtres ainsi que les pattes. Tête arrondie, assez épaisse, à peu près de la largeur du thorax, éparsement ponctuée et luisante. Antennes épaisses, leur troisième article seulement un peu plus long que le quatrième. Yeux assez petits, ovales, moins longs que la distance qui les sépare du bord postérieur de l'occiput. Thorax un peu étranglé en son milieu, sa déclivité postérieure oblique et rejoignant la face dorsale par une surface arrondie, sans arête ; il est à peu près aussi large en avant qu'en arrière, assez densément ponctué-réticulé sur le dos, la sculpture plus effacée sur les flancs. Premier segment de l'abdomen court, peu densément ponctué, aussi large que la base du segment suivant qui est rétréci en avant et en arrière, éparsement ponctué et luisant ; les autres segments sont trés finement pointillès et luisants ; segment anal non strié, rougeâtre à l'extrémité. Le premier segment porte en dessous une carène courte et assez saillante. Tibias avec quelques épines, éperons pales. Long : 3 à $3\frac{1}{4}$ mill.

Kanara (Mr. Wroughton).

8. *Mutilla pulla*, nov. sp.

♀ :—Tête noire, tubercules antennaires peu saillants, épistome, mandibules, scape et premier article du funicule testacès ; sommet des mandibules et le reste du funicule bruns. Thorax ferrugineux, pattes testacées, sommet des cuisses et des tibias rembrunis. Abdomen noir,

peu densément revêtu de pubescence noire ; second segment portant à sa base une tache allongée, assez grande, de pubescence d'un jaune d'or luisant et, à son extrémité, une bande de même couleur, très étroite sur les côtés, fortement et semicirculairement élargie au milieu. Vertex revêtu d'une pubescence dorée assez éparse. Quelques soies noires, obliques, sur le dos du thorax et sur l'abdomen ; face déclive du métathorax, dessous du corps et pattes parsemés de rares soies blanchâtres. Tête arrondié, assez convexe, un peu plus large que le thorax, fortement mais peu densément ponctuée, assez luisante ; troisième article des antennes un peu plus long que le quatrième. Yeux grands, ovales, plus longs que l'espace occupé derrière eux par le vertex. Thorax à côtés parallèles, arrondi en avant et en arrière ; sa face postérieure oblique, regagnant la face dorsale par une surface fortement arrondie, sans limite distincte entre les deux faces ; il est fortement ponctué-réticulé sur le dos, bien plus superficiellement et très éparsement ponctué sur les flancs qui sont presque lisses par places. Abdomen en ovale allongé ; premier segment court et étroit, mais s'adaptant régulièrement au segment suivant sans étranglement ; second segment peu densément ponctué, luisant ; segment anal lisse, non strié. Tibias avec quelques èpines testacées, éperons plus pales. Long : 5 mill.

Par la forme générale et la disposition du dessin cette espèce ressemble beaucoup à la *M. subglabra*, mais elle s'en distingue par ses tubercules antennaires bien plus petits, par la couleur de ses antennes et de ses pattes, ainsi que par la tache et la bande de son second segment qui sont plus developpées et d'un jaune d'or au lieu d'être d'un blanc d'argent.

Kanara (Mr. Wroughton) un seul exemplaire.

9. *Mutilla ocellata* (Saussure).

Kanara (Mr. Wroughton).

10. *Mutilla trimaculata* (Cameron).

Poona (Mr. Wroughton).

11. *Mutilla hexaops* (Saussure).

Cette espèce parait repandue dans la majeure partie de l'Inde et à Ceylan. La couleur des pattes et des antennes est très variable,

passant du rouge ferrugineux au brun noir, mais ces légères différences ne peuvent constituer des caractères spécifiques. J'en connais des exemplaires de Pondichéry et de Gingi ; Mr. Wroughton me l'a envoyée de Kanara et de Kolaba.

12. *Mutilla pectinospinata* (Magretti).

L'un des deux exemplaires que je possède a la tête rouge comme le thorax, mais ne se distingue pas d'ailleurs d'un autre exemplaire à tête noire, conforme à la description de Magretti. Les troisième et quatrième segments portent des bandes de poils jaunâtres très peu accentuées, non à cause du mauvais état des exemplaires, comme le pense M. Magretti, mais par suite du peu de densité des poils qui les forment.

Kanara, Poona (Mr. Wroughton).

13. *Mutilla kolabensis*, nov. sp.

♀ :—Tête noire, avec une tache ovale de pubescence d'un blanc d'argent sur le vertex ; antennes, mandibules et pattes d'un brun noir. Thorax d'un rouge sombre sur son disque, d'un brun noir sur le reste de sa surface. Abdomen noir, revêtu d'une pubescence noire assez abondante ; second segment orné, près de sa base, de deux petites taches ovales, assez distantes l'une de l'autre, d'un blanc d'argent ; troisième segment avec deux taches quadrangulaires situées respectivement au dessous de celles du second segment. Dessus de la tête, du thorax et de l'abdomen hérissé de longues soies noires peu abondantes ; côtés et devant de la tête, dessous du corps et pattes avec une pilosité blanche, fine et éparse. Tête arrondie, assez épaisse, un peu plus large que le thorax, grossièrement ponctuée-réticulée ; troisième article des antennes une fois et demie aussi long que le quatriéme ; yeux médiocres, allongés, à peu près aussi longs que l'espace occupé derrière eux par le vertex. Thorax à côtés parallèles ; son profil dorsal assez convexe, ses faces dorsale et postérieure réunies par une surface largement arquée, sans limite précise ; il est grossièrement réticulé-fossulé en dessus, avec les propleures et les mésopleures presque lisses, et les métapleures grossièrement et très superficiellement rugueuses. Premier segment abdominal médiocrement large, s'adaptant régulièrement au segment suivant ; second segment peu densément ponctué en dessus, plus éparsement ponctué et luisant en dessous ; pygidium finement ponctué. Epines des tibias noirâtres ; éperons pales. Long : 6 mill.

Voisine de *M. aulica* (Smith) mais les côtés du thorax ne portent pas de tache argentée, les pattes sont noires, les deux taches blanches du second segment ne touchent pas sa base et le quatrième segment est dépourvu de taches.

Kolaba (Mr. Wroughton) un seul exemplaire.

14. *Mutilla vicina* (Rad. et Sich).

Dehra Dun (Mr. C. G. Rogers).

15. *Mutilla lilliputiana*, nov. sp.

♀ :—Tête noire, revêtue de pubescence peu serrée d'un jaune d'or ; scape des antennes, premier article du funicule et pattes d'un testacé un peu rougeâtre ; thorax ferrugineux. Abdomen noir, médiocrement revêtu de pubescence noire ; second segment portant, à sa base, deux taches ovales assez grandes et, à son extrémité, une bande assez large de pubescence fauve-doré ; le troisième segment est entiérement couvert de pubescence semblable ; en dessous, les bords des segments 2, 3 et 4 sont décolorés et d'un jaune rougeâtre. Le corps est hérissé d'une pilosité éparse et noirâtre en dessus, blanchâtre en dessous et sur les pattes. Tête un peu plus large que le thorax en trapèze arrondi, plus étroite en avant qu'en arrière, assez fortement ponctuée-réticulée ; troisième article des antennes assez court, un peu plus long que le quatrième ; yeux grands, en ovale court, situés assez en arrière des bords latéraux, bien plus longs que l'espace occupé derrière eux par le vertex. Thorax quadrangulaire, à bords assez parallèles et très légèrement sinueux, assez fortement ponctué réticulé sur le dos, presque lisse sur les flancs qui sont un peu luisants ; il est obliquement tronqué en arrière. Abdomen ovale, attenué en arrière ; son premier segment assez étroit s'adapte régulièrement au segment suivant, sans étranglement ; second segment couvert en dessus de gros points peu serrés, plus éparsement ponctué et très luisant en dessous ; segment anal convexe, lisse et luisant, sans aire médiane. Tibias peu épineux, éperons pales. Long : 3 mill.

Kolaba (Mr. Wroughton) un seul exemplaire.

16. *Mutilla kauarœ* (Cameron).

Les exemplaires que j'ai sous les yeux répondent à la description de M. Cameron, sauf de petites divergences. Ainsi, l'abdomen ne porte de veritables bandes d'un fauve-doré que sur le troisiéme segment et

au bord apical du second ; les quatrième et cinquième segments sont revêtus de pubescence noire entremêlée de quelques poils fauves ; le segment anal est cilié de fauve sur les côtés ainsi que le bord apical de tous les segments ventraux. Le second segment ventral porte à la base une courte carène longitudinale. Enfin, le thorax, légèrement en arc concave sur les côtés, me semble de même largeur en avant et en arrière ; la suture méso-métanotale est légèrement distincte et montre en son milieu un onglet scutellaire peu saillant mais distinct. Je ne crois pas que ces particularités soient suffisantes pour caractériser une espèce nouvelle, surtout en l'absence de confrontation directe avec les exemplaires typiques de *M. kauaræ*.

Kanara (Mr. Wroughton).

17. *Mutilla pulchriceps* (Cameron).

Var. *pulchricoma*, nov. var.

♀ :—S'écarte du type de Cameron par sa taille beaucoup plus grande (15 mill), par les pattes et les antennes d'un brun noir, par le scape et les deux premiers articles du funicule revêtus de pubescence fauve comme la tête, et par les flancs du thorax entièrement couverts d'une pubescence fine et assez serrée, d'un jaune d'or. Ces caractères ne me paraissent pas suffisants pour constituer une espèce distincte et je la rattache comme variété à la *M. pulchriceps*.

Poona (Mr. Wroughton) un seul exemplaire.

18. *Mutilla cicatricifera*, nov. sp.

♀ :—Tête et thorax d'un rouge ferrugineux, antennes et pattes d'un ferrugineux plus pale. Abdomen noir, peu densément revêtu d'une pubescence noire ; second segment portant à sa base une large bande triangulairement échancrée au milieu et paraissant formée de la réunion de deux grandes taches transversales de pubescence fauve-doré luisant ; le sommet du même segment est cilié de semblable pubescence et une bande de même nature et de même couleur couvre le troisième segment ; les segments suivants sont seulement ciliés de poils fauves en dessus et en dessous et le segment anal en est plus abondamment pourvu. Quelques soies dressées, brunâtres et éparses, se voient sur le vertex, sur le dos du thorax et sur les deux premiers segments abdominaux ; en dessous et sur les côtés ainsi

que sur les pattes, la pilosite est plus abondante et d'un jaune d'or. Tête arrondie, de la largeur du thorax, trés fortement ridée-réticulée ; troisième article des antennes presque deux fois aussi long que le quatrième ; yeux petits, ovales, moins long que l'espace occupé derrière eux par le vertex. Thorax court, quadrangulaire, à côtés parallèles, grossièrement ridé-réticulé ; mesopleures lisses et luisantes ; il est tronqué verticalement en arrière, mais sans former d'arête vive à la jonction de ses faces dorsale et postérieure ; ses bords latéraux sont légèrement crenelés sur toute leur longueur et il n'existe pas d'onglet scutellaire distinct. Abdomen ovale ; son premier segment, court et assez large, s'adapte régulièrement au segment suivant sans étranglement ; en dessous il est muni d'une carène ordinaire ; second segment abdominal marqué de fossettes allongées, profondes en avant, superficielles en arrière, et dont les intervalles portent quelques points épars ; en dessous, ce même segment, qui est irrégulièrement ponctué, porte sur ses deux tiers antérieurs une dépression quadrangulaire partagée par une petite carène longitudinale et limitée, en arrière et de chaque côte, par des saillies tuberculeuses et caréniformes, irrégulières comme les bords d'une cicatrice ; segment anal très superficiellement chagriné, non strié. Tibias avec de fortes épines d'un brun rougeâtre, éperous testacés. Long : 11 mill.

Cette espèce parait voisine de *M. humbertiana* (Sauss.), mais s'en écarte par la disposition différente des bandes abdominales et surtout par les dépressions et saillies particulières de son second segment ventral.

Kanara (Mr. Wroughton) un seul exemplaire.

19. *Mutilla erythrocera* (Cameron).

Une femelle de Kolaba (Mr. Wroughton) s'accorde tout à fait avec la description de Cameron, mais une autre de Kanara (Mr. Wroughton) s'écarte du type par les taches du second segment abdominal qui sont confluentes, par le bord postérieur de ce même segment cilié de poils dorés, par le quatrième segment sans bande dorée mais seulement cilié sur les côtés de même que les suivants, et par la couleur d'un jaune d'or et non d'un fauve-doré des taches et bandes abdominales. Malgré ces différences, la forme générale, la sculpture et les proportions sont si exactement semblables à *M. erythocera* que je ne puis considérer cet exemplaire que comme une variété.

20. *Mutilla agnata*, nov. sp.

♀ :—Tête noire, couverte de pubescence d'un fauve-doré ; scape des antennes, les deux premiers articles du funicule, les tubercules antennaires, les mandibules et les pattes ferrugineux, le reste du funicule brun, genoux et sommet des mandibules noirs. Thorax d'un rouge ferrugineux. Abdomen noir, abondamment recouvert de pubescence noire ; second segment portant à sa base deux grandes taches, très rapprochées et parfois réunies, de pubescence fauve-doré, qui forment une large bande peu ou pas interrompue et occupant la moitié basale du segment ; l'extrémité de ce même segment peut être concolore ou bordé d'une mince bande de pubescence fauve-doré ; les segments 3, 4 et 5 sont entièrement recouverts de pubescence de même couleur et le segment anal est abondamment cilié sur les côtés de longs poils fauves ; en dessous les segments sont plus ou moins ciliés de poils d'un fauve clair. Les pattes sont éparsement hérissées de poils jaunes. Tête convexe, arrondie, de la largeur du thorax, fortement ponctuée-réticulée ; tubercules antennaires gros et arrondis ; troisième article des antennes deux fois aussi longs que le quatrième ; yeux très grand, en ovale court, beaucoup plus longs que l'espace occupé derrière eux par le vertex. Thorax quadrangulaire, à côtés parallèles, fortement ponctué-réticulé sur le dos, presque lisse sur les flancs qui sont comme dépolis et peu luisants ; il est presque verticalement tronqué en arrière, mais arrondi au point de jonction de ses faces dorsale et postérieure, avec un onglet scutellaire peu saillant mais distinct. Abdomen ovale, son premier segment, court et médiocrement large, s'adapte régulièrement au segment suivant sans étranglement ; second segment assez fortement et peu densément ponctué en dessus, très luisant, et éparsement ponctué en dessous ; segment anal assez plan, couvert en dessus de rides longitudinales sinueuses et irregulières. Tibias avec de fortes épines d'un rouge brun, éperons pales. Long : 7 à 12 mill.

Ressemble à *M. soror* (Sauss.) et à *M. nereis* (Kohl.), mais la tête est couverte de poils dorés et le cinquième segment abdominal porte une bande dorée comme les deux précédents. Parait se rapprocher aussi beaucoup de *M. pulchriceps* (Cameron), mais s'en écarte par son thorax à bords latéraux rectilignes ou indistinctement concaves, par les taches du second segment abdominal plus grandes et confluentes et par la présence d'une bande dorée sur le cinquième segment.

Kanara (Mr. Wroughton).

21. *Mutilla nudiceps*, nov. sp.

♀ :—Ressemble extrèmement à la précédente, mais la tête est rouge comme le thorax, sans pubescence dorée, les yeux sont un peu moins grands, le thorax est plus robuste, un peu plus large en arrière qu'en avant, le premier segment abdominal est nu, non recouvert de pubescence noire, éparsement ponctué et luisant, le pygidium est nettement, fortement et longitudinalement strié sur toute sa surface, tandis que chez *M. agnata* il est plus irrégulièrement ridé. Elle diffère aussi de *M. soror* et *M. nereis* par la tête rouge et par la présence d'une bande dorée sur le cinquième segment. Long : 9 à 12 mill.

Poona, Kanara (Mr. Wroughton).

22. *Mutilla sexmaculata* (Sweder).

Jabalpur (Mr. J. A. Betham).

23. *Mutilla niveosignata*, nov. sp.

♀ :—Tête, antennes et pattes noires ; thorax noir, sauf la majeure partie de sa face dorsale qui est d'un rouge ferrugineux et revêtue d'une pubescence très éparse d'un fauve clair. Abdomen noir, densèment revêtu de pubescence noire; premier segment presque nu en avant, cilié sur son bord postérieur de poils fauves formant une bande peu fournie qui s'étend sur le segment suivant ; second segment avec deux taches ovales, horizontales, de pubescence d'un blanc d'argent, assez éloignées de son bord antérieur ; troisième segment avec deux taches carrées de même pubescence, plus larges que les précédentes en dessous desquelles elles sont respectivement situées. Dessus du corps hérissé de soies fauves ; une pilosite blanche en dessous et sur les pattes. Tête arrondie, de la largeur du thorax, très grossièrement ridée-réticulée ; troisième article des antennes au moins deux fois aussi long qui le quatrième ; yeux ovales, de grandeur moyenne, à peu près de la même longueur que l'espace occupé derrière eux par le vertex. Thorax quadrangulaire, assez court, un peu plus large en arrière qu'en avant, ses bords latéraux très légèrement concaves ; il est verticalement tronqué en arrière avec le bord supérieur de la troncature un peu arrondi ; sa face dorsale est grossièrement ridée-réticulée ainsi que ses faces latérales, sauf les mésopleures qui sont lisses et luisantes et garnies de pubescence blanche sur leur moitié inférieure. Abdomen ovale, son premier segment large, s'adaptant régulièrement au segment suivant ;

second segment grossièrement ridé-réticulé en dessus, plus faiblement en dessous ou il est pourvu de trois carènes longitudinales, une médiane raccourcie et deux latérales plus longues mais n'atteignant pas le bord postérieur ; pygidium presque lisse, non strié. Epines des tibias brunes ; éperons pales. Long : 10 mill.

Cette espèce est très voisine de *M. sexmaculata* (Swed.) ; mais elle est plus petite, son premier segment abdominal est frangé de poils fauves, et le second ne porte que deux taches blanches au lieu de quatre.

Poona (Mr. Wroughton).

Orissa (Mr. James Taylor).

24. *Mutilla maculiceps*, nov. sp.

♀ :—Tête noire, avec une grande tache quadrangulaire sur le vertex de pubescence d'un blanc d'argent ; scape des antennes et pattes d'un brun noir, funicule et tarses rougeâtres. Thorax d'un rouge sombre sur son disque, noir sur le reste de sa surface ; la partie rouge revêtue de pubescence peu serrée d'un jaune d'or. Abdomen noir, abondamment revêtu de pubescence noire, sauf sur son premier segment qui est à peu près glabre ; second segment avec quatre taches de pubescence argentée, les deux supérieures allongées dans le sens longitudinal, obliquement divergentes en arrière, touchant la base du segment et assez distante l'une de l'autre, les deux inférieures plus petites, arrondies et situées au bord apical du segment ; troisième segment avec deux taches de semblable pubescence, de même grandeur que les précédentes. Les six taches de l'abdomen sont placées trois par trois sur la même ligne verticale. Dessus de la tête, du thorax et de l'abdomen hérissé d'assez longues soies brunes ; le devant de la tête, le dessous du corps et les pattes éparsement hérissés de poils blancs. Tête arrondie, un peu plus large que le thorax, grossièrement ridée-reticulée, chaque maille du réseau portant dans son intérieur un ou plusieurs gros points enfoncés ; troisième article des antennes deux fois aussi long que le quatriéme ; yeux grands, ovales, convexes, plus long que l'espace occupé derrière eux par le vertex. Thorax allongé, un peu rétréci en avant, plus rétréci en arrière, ses bords latéraux très faiblement arqués en dehors ; sa face postérieure oblique rejoint sa face dorsale par une large courbe, sans former de limite précise entre les deux faces ; il est grossièrement ridé-réticulé en dessus, mais sans gros points au fond des

mailles ; son flancs sont presque lisses et luisants, sauf les métapleures qui portent de grosses rides superficielles. Abdomen ovale, rétréci en avant et plus encore en arrière ; son premier segment, médiocrement large, s'adapte au segment suivant sans étranglement et est marqué de gros points irréguliers et épars ; la sculpture du second segment est indistincte par suite de l'épaisseur de la pubescence noire qui le recouvre ; en dessous il est éparsement ponctué, luisant et rouge sur la plus grande partie de sa surface ; pygidium éparsement ponctué ; épines des tibias d'un brun noir, éperons pales. Long : 7 mill.

Par la disposition des taches de son abdomen, cette espèce se rapproche de *M. sexmaculata* (Swed.), mais sa taille est beaucoup moindre et la forme de son thorax est toute différente. Elle parait aussi avoir quelque analogie avec la *M. aulica* (Smith), mais son second segment abdominal offre quatre taches blanches au lieu de deux, et le quatrième segment est sans tache ; elle s'éloigne enfin de *M. kolabensis* par son second segment marqué de quatre taches blanches et par la forme toute differente de son thorax.

Poona (Mr. Wroughton), un seul exemplaire.

25. *Mutilla regia* (Smith).

Répond tout á fait á la description de Smith, mais les quatrième et cinquième segments, portent en leur milieu de petites taches mal definies de pubescence blanchâtre, qui ne sont pas mentionnées par Smith, probablement à cause de l'usure de ses exemplaires.

Kanara (Mr. Wroughton).

26. *Mutilla poonaensis* (Cameron).

Mes exemplaires se rapportent parfaitement à la description de Cameron, sauf que la bande blanche du sommet du second segment est très légèrement interrompue au milieu.

Kanara (Mr. Wroughton).

Orissa (Mr. Jas. Taylor).

27. *Mutilla auropalliata*, nov. sp.

♀ :—Tête, thorax, antennes, pattes et premier segment de l'abdomen d'un rouge de sang ; dessus de la tête et des deux tiers antérieurs du thorax couvert d'une épaisse pubescence d'un beau jaune d'or pale, luisant, qui cache entièrement la couleur foncière ; le reste de l'abdomen

d'un rouge sombre sur la moitié du second segment et noir à partir de cet endroit, mais il parait noir en entier par suite de l'épaisse pubescence noire qui recouvre toute sa surface ; second segment orné de quatre petites taches d'un blanc d'argent luisant, l'une médiane près de sa base et les trois autres placées transversalement près de son bord apical ; tête et thorax hérissés de quelques longues soies noirâtres entremélées d'autres d'un jaune d'or ; des soies noires, également longues et plus abondantes se voient sur le dos de l'abdomen ; en dessous du corps les soies blanches prédominent et les pattes sont elles-mêmes hérissées de soies noires mélangées à d'autres d'un jaune pale. Tête un peu plus large que longue, moins large que le thorax, a sculpture cachée par la vestiture ; troisième article des antennes court, à peine aussi long que le quatrième ; yeux ovales, assez grands, plus longs que l'espace occupé derrière eux par le vertex. Thorax court, peu rétréci en avant, très rétréci en arriére, ses bords latèraux en arc convexe ou même légèrement anguleux a la partie la plus large de sa face dorsale ; il est obliquement tronqué en arrière, mais le bord supérieur de la troncature est arrondi et porte en son milieu un onglet scutellaire peu saillant ; la sculpture, visible seulement dans la partie nue, offre une réticulation grossière ; ces flancs sont eux-mêmes ridés-réticulés, sauf les mésopleures qui sont lisses et luisantes. Abdomen pétiolé, son premier segment nodiforme en arrière et beaucoup plus étroit que le segment suivant dont il est séparé par un étranglement très sensible ; il est presque lisse en avant, grossièrement réticulé en arrière. Second segment paraissant fossulé-réticulé en dessus, autant que permet d'en juger son épaisse pubescence ; en dessous il est éparsement marquè de grosses fossettes ; pygidium finement et longitudinalement strié. Epines des tibias brunes, éperons jaunâtres. Long : 8½ mill.

Cette remarquable espèce parait avoir été figurée par M. Cameron, Plate I, fig. 13, de ses *Hymenoptera Orientalis*, Part IV, 1892, mais n'a été ni nommée ni décrite dans le texte.

Poona (Mr. Wroughton), un seul exemplaire.

28. *Mutilla trichocondyla*, nov. sp.

♀ :—Tête et thorax d'un rouge de sang foncé, scape des antennes et pattes d'un brun rougeâtré, funicule ferrugineux. Abdomen noir, médiocrement revêtu de poils noirs couchés ; second segment orné à

son extrémité d'une bande, légèrement interrompue au milieu, de pubescence d'un jaune d'or ; troisième segment entièrement couvert de pubescence semblable ; en dessous et sur les côtés les segments 2 à 5 sont abondamment ciliés de poils d'un jaune d'or, le segment anal en est assez densément pourvu. De longues soies de même couleur, insérées á la base du métathorax et du premier segment abdominal, donnent une apparence très hérissée à l'intervalle qui sépare le thorax de l'abdomen. Le dessus de la tête, du thorax et des segments abdominaux, à l'exception du troisième et du dernier, est parsemé de soies noires et courtes ; les pattes et les flancs du thorax sont hérissés de poils d'un jaune d'or. Téte aussi longue que large, un peu plus étroite que le thorax, très grossiérement ponctuée-réticulée ; troisième article des antennes environ une fois et demie aussi long que le quatrième ; yeux médiocres, en ovale court, à peu près aussi long que l'espace occupé derrière eux par le vertex. Thorax trapézoidal, plus large en avant qu'en arrière, dilaté de chaque côté, vers son tiers antérieur, en une forte dent mousse, en arrière et à quelque distance de laquel se voit un tubercule arrondi beaucoup moins saillant. Le métathorax est assez brusquement tronqué en arrière, mais sans arrête distincte entre ses faces dorsale et postérieure ; il est grossièrement ponctué-réticulé sur le dos, trés finement chagriné sur les flancs, sauf dans les parties saillantes qui séparent les pleures et qui sont assez grossièrement ponctuées. Abdomen en ovale assez allongé ; son premier segment assez court et un peu moins large que le segment suivant auquel il ne s'adapte pas tout à fait régulièrement mais avec un leger ressaut ; second segment fortement fossulé-réticulé en dessus, un peu plus superficiellement en dessous ; segment anal avec des élévations caréniformes à sa base, finement rugueux à l'extrémité. Tibias médiocrement épineux, les épines ainsi que les éperons d'un rougeâtre pale. Long : 13 mill.

Kanara (Mr. Wroughton), un seul exemplaire.

29. *Mutilla pulchrina* (Smith).

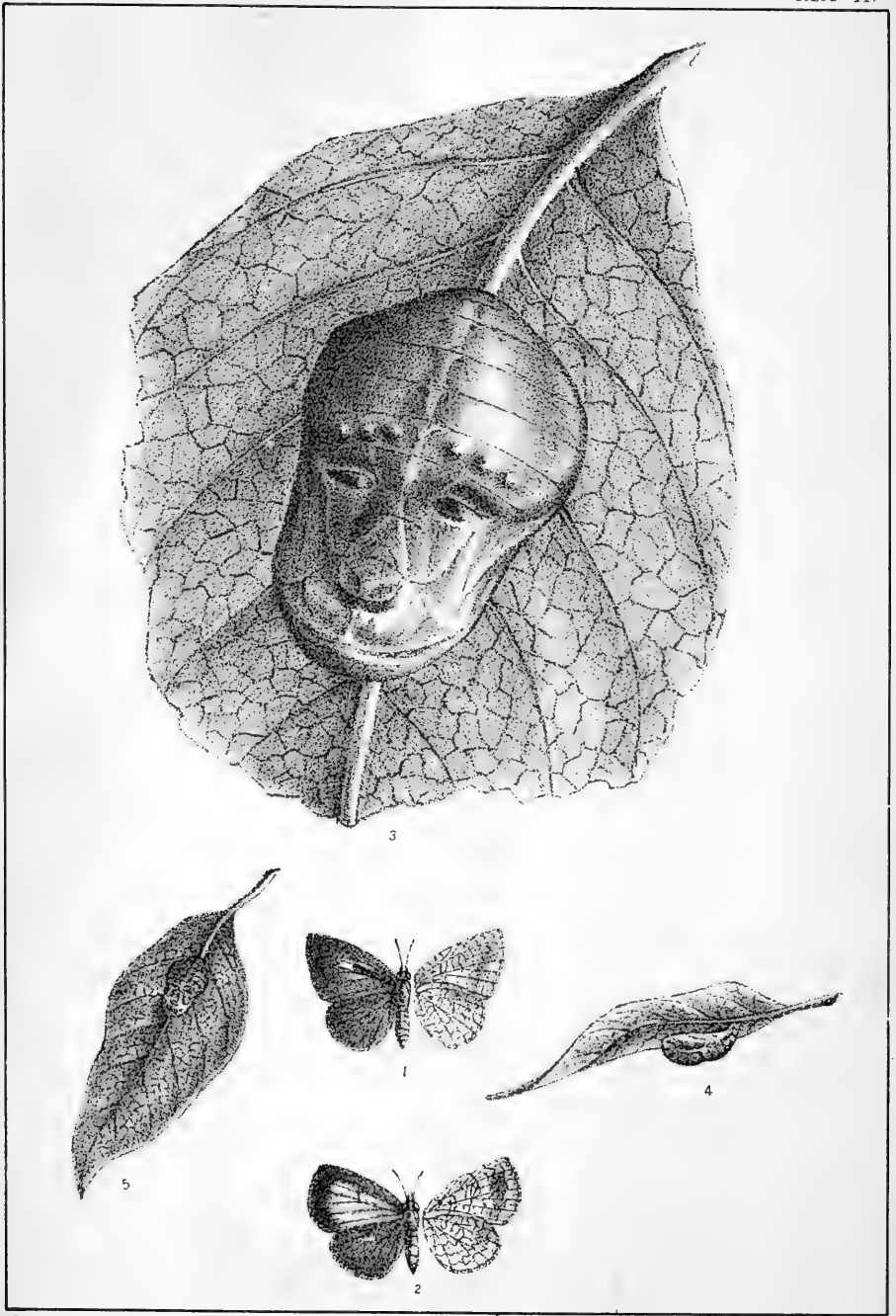
Kanara (Mr. Wroughton).

30. *Mutilla argentipes* (Smith).

Kanara (Mr. Wroughton).

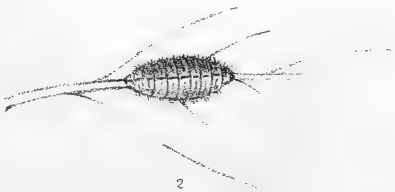
31. *Mutilla argenteo-maculata* (Smith).

Poona, Kanara (Mr. Wroughton).



Behari Lal Das. Del. & Lith. Calcutta

SPALGIS EPIUS, *Westwood, from S. India.*



1891

SPALGIS S-SIGNATA, *Holland, from W. Africa.*

THE LARVA AND PUPA OF *SPALGIS EPIUS*, *WESTWOOD.*

By E. H. Aitken.

(*With Plates A and B.*)

(*Read before the Bombay Natural History Society on* 10*th March* 1894.)

Spalgis epius, Westwood, is a small butterfly of the family *Lycænidæ*, not handsome or brightly coloured, but so curiously marked that there is little difficulty in distinguishing it from all our other "Blues." The upperside is brown, with a quadrangular whitish spot, or patch, in the middle of the forewing. But when the butterfly is resting, with wings closed, it is the underside we see, and this is of a clear French-grey colour, covered with a tracery of very fine, dark, zig-zag lines. In the centre of each wing there is a small, oval, whitish spot, and the peculiarity of the butterfly's appearance is completed by the very short antennæ and bright green eyes. The forewing of the male is sharply pointed, that of the female more rounded. It is found, I believe, throughout India, and, though not exactly a rare butterfly, does not seem to be plentiful anywhere. Mr. Moore, in his great book on the Lepidoptera of Ceylon, gave a figure of a curious object, green and red, with long processes on its back, as the larva of *Spalgis epius*, and said that it fed on *Euphorbiaceæ*. Afterwards Mr. E. E. Green, of Ceylon, wrote to Mr. de Nicéville that he had reared the larvæ of *Spalgis epius*, or some butterfly indistinguishable from it, and that they were carnivorous, feeding upon the white, fluffy, plant-louse known to gardeners as the "mealy bug." Mr. de Nicéville published Mr. Green's observations in his book, and evidently leaned to the view that he was right and Mr. Moore wrong ; but I had not seen the passage when, in December, 1891, I saw a female *Spalgis epius* flying suspiciously about a bush and thought it might be laying its eggs. This led me to examine the plant, and almost at once I found an unmistakeable lycænid pupa. Then I instituted a regular search, but not a larva could I find, nor any trace of one. The leaves of the plant were nowhere eaten, and it was too much infested with "mealy bug" to afford fresh, wholesome food to delicate insects. I had almost given up the search when I noticed that some of the bugs were enormously large. I brushed the white, woolly secretion off these, and they were uncommonly like lycænid larvæ. They were of the wood-louse form so common among the larvæ of that family, of a dark

greenish-brown colour, with a few hairs scattered over the back, and a fringe of bristles running along the side and round the front, where the second segment conceals the head. With this fringe I saw them shovel a quantity of the white stuff on to their backs and clothe their nakedness after I had denuded them. Watching them with a lens, I soon saw that they were feeding among the "mealy bugs." They would pass over the larger individuals and bury their heads in the downy covering of a little one, and though I could not say I actually saw that they devoured it, I was quite satisfied that this was what they did. So I secured a number and put them into a pill-box, with a supply of their prey, and in a few days the prey had disappeared and the larvæ had become pupæ. In a fortnight (exactly twice the time required by the smaller *Lycænidæ* generally) fine specimens of *Spalgis epius* emerged. I was very much surprised at my discovery, for I did not then know that any butterfly larvæ were carnivorous, except when they indulged in cannibalism and ate each other, as *Lycænidæ* often do. I wrote at once to Mr. de Nicéville, who replied, drawing my attention to the passage in his book and saying he was glad I had confirmed Mr. Green's observations. I mention all this to show that my observations were not biassed by any previous notion of what my eyes ought to see. Afterwards Mr. de Nicéville sent me a paper, published in "Psyche," on *Spalgis s-signata*, an African species of the same genus, the larvæ of which are also carnivorous. The most remarkable thing in this paper was a figure of the pupa, which, when magnified, exhibits a resemblance to the face of an ape, or chimpansee, so striking and so detailed that it is more than ludicrous, and deserves to be called mysterious. Unfortunately, when I found my specimens, I was travelling in haste through a very wild part of the country, so I put away the pupæ without examining them closely, and I never saw another until last month (September), when Mr. J. Davidson, I.C.S., found two in Karwar. On examining them with a lens, what was my astonishment to find a face totally different from that presented by the African species, but even more life-like and expressive. Ears were wanting, but every other feature was there. The abdominal portion of the pupa formed the forehead, two gleaming black spots, exactly in the right place, made a most malignant pair of eyes, the arched thorax was the nose, the effect of which was heightened by its being almost black at the muzzle, and the head, with its attachment to the thorax, formed the chin and lips. No description can convey any idea of the way in which the contour, features, and

expression are worked out, and I am afraid that the plate will be regarded as overdone. To this I can only reply that it is underdone. Drawing an object under a strong lens is difficult and the artist has failed to bring out the peculiarly expressive moulding of the lips and the malignant gleam of the eyes. In order to make it easier to understand the figure, the pupa has been shown nearly life-size in two positions. It is attached by the anal end to a leaf, usually, I think, on the upperside, so rigidly that it remains in a position parallel to the surface of the leaf. There is no band.

This almost perfect and yet wholly unaccountable representation of animal physiognomy in the pupæ of two allied butterflies should make us cautious of explaining every fancied resemblance by "protective mimicry." The likeness of the "Leaf Butterfly" to a withered leaf and of certain *Phasmidæ* to green leaves or sticks does undoubtedly often save their lives, but in none of them does the likeness approach this one, for which it seems impossible to suggest cause or reason. For what advantage can it be to an object the size of a grain of wheat that it looks just like a baboon? Verily we are not better than our fathers. It is a *lusus naturæ*.

Explanation of the Plates.

Plate A.

Fig. 1. Imago of *Spalgis epius*, Westwood, male, from South India, natural size.

Fig. 2. Ditto, female.

„ 3. Dorsal view of the pupa of the same, highly magnified.

„ 4. Side view of ditto, slightly enlarged.

„ 5. Dorsal view of ditto, slightly enlarged.

Plate B.

This plate, with some slight alterations only—*i.e.*, a front or dorsal view of the pupa of the natural size has been added, and the sides of the imago have been reversed, the left-hand side now showing the upperside, the right-hand the underside—has been copied from the original Plate IV of "Psyche," vol. VI (1892), p. 201, drawn by the Rev. W. J. Holland, Ph.D.

Fig. 1. Imago of *Spalgis s-signata*, Holland, from West Africa.

„ 2. Larva of ditto, dorsal view.

„ 3. Dorsal view of the pupa of the same, highly magnified.

„ 4. Side view of ditto, probably natural size.

„ 5. Dorsal view of ditto, also probably natural size.

BOTANY OF THE LACCADIVES, BEING NATURAL HISTORY NOTES FROM H. M. I. M. SURVEY STEAMER "INVESTIGATOR," COMMANDER R. F. HOSKYN, R.N., COMMANDING.

Series II, No. 5. By D. PRAIN.

Additional Note.

Since this paper was published, the writer has learned that while it is true that in Sir Wm. Robinson's day the Southern Laccadive islands belonged to the Cannanore *raj*, and though this arrangement was still in force at the time of Mr. A. O. Hume's visit in 1875, very shortly after this date they were, owing to revenue arrears, placed directly under British rule.*

The name given in this paper to the excavated areas under cultivation is wrong. Sir Wm. Robinson gives two names—the *tot* or *kat*, and the writer, following what has become the more usual custom, has unfortunately employed the latter only. But it is the word *tot*, which is a form of the Malayalam word for garden, that should alone be used; the word *kat* is a form of a Malayalam word for forest or jungle and is altogether inapplicable. The writer is indebted to Mr. Winterbotham, Collector of Tanjore, for kindly pointing out this error to him.

Mr. Winterbotham informs him also that on Suhelipar reef there is an island, Suheli; and that it has coco-nut trees.†

In addition to the species enumerated in the list of plants should be inserted after n. 163, 163b. ALOCASIA INDICA, Linn., which, as well as *Colocasia antiquorum*, is cultivated in Kalpéni, and perhaps in some of the other islands.

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* It is characteristic of the inexactness of the information contained in the *Imperial Gazetteer of India* that even its second edition (1886) makes no mention of this not unimportant fact.

What would happen were these arrears to be paid up, it is very hard to predict. The inhabitants of the southern islands, after nearly twenty years' experience of settled British administration, declare that they will resist by force any attempt on the part of the Cannanore *raj* to re-impose on them a native domination.

† It is not unlikely that, as in Bitrapar, these coco-nut trees have been planted. The island has a particularly fine lagoon and is often visited for its nuts and coir; doubtless it would be permanently inhabited were it not that, again exactly as in Bitrapar, when wells are dug only brackish and undrinkable water is obtained. One of the special features of Suheli is the presence of a large Banyan tree, clearly a planted species.

NOTES ON THE SYNONYMY OF SOME SPECIES OF INDIAN *PIERINÆ*.

By E. Y. Watson, Indian Staff Corps.

(*With Plates I and II.*)

While on leave in England a year or so ago, I endeavoured to name my collection of *Pierinæ*, and to ascertain the difference between the numerous "species" described, especially in the genera *Terias* and *Ixias*. From the descriptions alone it is absolutely impossible to identify specimens, and I found that, even with the type specimens before me, the question to which named form any particular specimen was referable, was a matter of the greatest uncertainty. In either of the above quoted genera for example, we see in the British Museum collection a series of specimens arranged above each name, the type specimen being frequently included; but on further examination of the series it is found that the specimens contained in it are not absolutely identical the one with the other or with the type, and that in many cases some of the specimens might equally well be arranged under the succeeding series, or, in fact, under one several rows distant. If we find this the case in the National Collection, which is arranged by experts, how can the ordinary individual ever hope to name his collection? The true explanation of course is, that many of the so-called "species" simply represent some of the numberless seasonal forms which occur in *Terias* and *Ixias*, in which genera, especially in the dry-season forms, it is almost impossible to obtain two specimens which agree with one another in every minute particular, and it must be remembered that the "species" in these genera have in the majority of cases been differentiated on the minutest details. The result has been that when collections arrive at the British Museum it has been found necessary either to describe and name every individual or else to assign the specimens to that form to which they bear the closest resemblance; since this latter alternative has been adopted in the majority of cases, the natural consequence has been that, under each "species," numberless links to other "species" have been arranged, one series in some cases running into four or five other series according to whether the acquisitions are incorporated on the markings of the fore- or hindwing or upper- or underside respectively, all of which are eminently variable.

However, my object was not so much to ascertain the species to which my specimens belonged, as to find out which particular names were referable to which particular forms of which particular species, and as with the type specimens before me it has been possible to ascertain what is impossible from descriptions and figures alone, I have thought it would be some assistance to working entomologists in India if I published the conclusions arrived at. In cases where the type of any particular species is not in the National Collection, the identifications of the British Museum have been accepted.

There is no group of butterflies which has been so hardly dealt with by the species-maker as the *Pierinæ*, or in which so much ingenuity has been wasted in the attempt to make species out of the many seasonal varieties which occur in almost every genus. The naming of these various forms is no doubt largely due to the fact that individuals of most species occur in great numbers, and in any collection which arrives in England many of the slight varieties will be found to occur, to the great delight of the worker-out of the said collection, who immediately sits down and describes them wholesale. That the above statement is very near the truth is borne out by the fact, that of fifteen forms of what I consider to be *Terias hecabe*, Linnæus, which have been described within the last ten years, no less than fourteen were described from the dry plains of Western and North-Western India, from districts where vegetation is comparatively sparse and the species of butterflies much more limited in number than in the wet heavy forest districts of North-Eastern India, or Burma, or even the hill-ranges of Southern India, so that when a collection is sent home from the above-mentioned plains districts, if the worker-out wishes to describe new species, he has to fall back on the *Pierinæ* for his purpose, as the other families would be represented only by well-known species presenting comparatively little variation, while, on the other hand, a collection from a richer district would afford new species from other families, and would not therefore offer the same temptation to describe slight varieties. These remarks though applying in greatest force to the *Pierinæ*, where slight varieties are innumerable, will also be found to apply in many other cases, as for instance in the genera *Catochrysops*, *Tarucus* and *Zizera* in the *Lycænidæ*.

There seems to be some confusion in the minds of naturalists at home as to what is meant by dry- and wet-season broods. Mr. Butler speaks of them quite wrongly as Spring and Autumn broods, and seems to be under the impression that there are only two broods annually, as he considers that an instance of the eggs of typical *Terias hecabe* producing typical *T. hecabe* proves that *T. excavata* or any other similar form cannot be the dry-season form of *T. hecabe*. He is however working on a wrong basis: *T. hecabe* has at least four and probably more broods annually, of which those individuals which emerge during the rainy-season would be typical *T. hecabe*, but those which emerge during the dry-season would be *T. excavata* or some other dry-season form, while there is no doubt that in some cases the eggs laid by one female would produce more than one form, according to the state of the atmosphere shortly before the emergence of each individual, which is the period at which it would be chiefly affected. Also the descendants of the first of the rainy-season broods would themselves be of the rainy-season form, and similarly the descendants of the first of the dry-season broods would be also of the dry-season form, and only the last of the wet- or dry-season broods would produce forms differing from themselves. To put down the broods of *T. hecabe* at four annually is a very moderate estimate, it is in fact probable that in the warmer regions there may be ten or even twelve broods a year, one brood following another without any break and in rapid succession.

Another difficulty with which naturalists at home have to contend is that in different parts of the Indian region the seasons vary to a certain extent, so that it cannot be laid down as a fixed rule that specimens captured in any particular month will belong to any particular form ; besides which allowance has to be made for breaks in the rains or showers in the dry-season; roughly however the rainy-season may be said to extend from the middle of May to the middle of November, and the dry-season for the rest of the year, and it will be found that the *very large majority* of the specimens obtained during these periods will be wet- and dry-season forms respectively. It will be seen from this how misleading are the terms Spring and Autumn forms, while the terms hot- and cold-season forms are equally inappropriate. The limitations given above are approximately those of the seasons in Burma, but they are liable to vary a fortnight either way, while in

the hilly districts of that country the rains sometimes continue till well into December. The same limitations would also apply fairly well to the whole of Eastern and Southern India, but in the dry tracts of the North-west the rains are of shorter duration and are less continuous ; consequently, rainy-season forms are scarce, and dry-season ones are much more pronounced.

It must also be borne in mind that these seasonal races are not confined to two clearly defined forms, *i.e.*, a rainy-season, and a dry-season form, but that in most species there are not only two very distinct-looking forms which represent the extremes of the two seasonal races, and which prevail in the rainy and dry-seasons respectively, but also numerous intermediates linking these extremes together, many of these intermediates having received names. A further point to be noticed is that these forms themselves vary according to the vegetation and rainfall, so that the extreme of the rainy-season form from a district where the rainfall is great and the vegetation dense is much more pronounced than the extreme of the rainy-season form from a district with slight rainfall and sparse vegetation ; and these differences are even more marked in the dry-season forms ; while in all genera the dry-season forms are as a rule smaller than the rainy-season forms. It is therefore an extremely difficult matter for home naturalists to work out correctly questions of seasonal variation, more especially as it is their usual practice to ignore the observations of working collectors who see the species in life and note the forms changing month by month from one extreme to the other.

The question as to what forms should be granted specific rank is one which is continually under dispute, and it is impossible to lay down any hard or fast rule which could be applied to all families and genera of butterflies, as in some genera we find absolutely fixed types which are constant throughout their range, while in other genera the difficulty is to find two individuals which are absolutely identical. The most obvious way out of the difficulty is to give sub-specific names to forms which appear to be constant but nevertheless to be too closely allied to some other form to be considered a distinct species, and this practice has been adopted to a limited extent by Mr. Scudder in his "Butterflies of the Eastern United States," and I consider it very probable that it will be found necessary hereafter to adopt some similar

method with the Asiatic *Pierinæ*. In this paper, where a form appears to be fairly constant in a fairly defined area, it has been treated as a local race, reference being made to the species of which it is, in all probability, a modification. But I think the practice of naming seasonal forms cannot be too strongly deprecated, this being done frequently without any reference to the other forms of the same species, so that the study of the variation of species, which, I take it, is one of the chief aims of entomology as a science, is not in any way furthered, but is, on the contrary, rather retarded. Further, in groups, such as the *hecabe* group of *Terias*, where it is extremely difficult to find two individuals of the dry-season form absolutely identical in markings, each specimen might be named and described as reasonably as many of the so-called "species."

The extraordinary extent to which this splitting of species may be carried is well exemplified in the arrangement of the collection at the British Museum, a most noteworthy point being that though practically every named form of *Terias* and *Ixias* is represented in the collection, yet there are almost as many unnamed forms separated off as distinct species and only awaiting a sufficiently bold describer to name them. Yet in spite of these many "species" I found, on trying to name my collection, mostly from Burma and Southern India, and containing several hundred specimens of *Ixias* and *Terias*, that though many specimens could be matched approximately, yet a very large residue could not be assigned to any (named or unnamed) species in th British Museum collection, and consequently represented many "new species." As my collection was obtained at all periods of the year, and as every specimen is dated, I was able to work it out to my own satisfaction, and to assign the different seasonal forms to the species to which in my opinion they belong, and though of course I do not for a moment anticipate that my conclusions will be accepted by the describers, yet I do not think I shall be far wrong in saying that there is hardly a single working entomologist in India who has not arrived at similar conclusions.

As Mr. Butler is the custodian of the butterfly collection at the British Museum and is therefore responsible for its arrangement as well as for the naming of many of the seasonal forms, I trust that both he and others will bear in mind that the Butler referred to is one of

many years ago and not the present reformed character who has relinquished butterflies in favour of moths, and whose views on variation have in consequence undergone considerable modification. This latter gentleman, while I was at home, treated me with the greatest kindness and gave me much assistance, though we differed on many points, and I should be the last to criticize his views from any personal animosity, and only do so that something like order may be produced from the chaos of the splitter. I consider the above remarks necessary, as I noticed when at home that some entomologists seemed to consider any criticism on their work, even when just, must have emanated from personal animosity, though one would have thought their opinions were published for the benefit of science in general, and that they should therefore be grateful if any points on which they had gone astray were put straight by others who had greater opportunities for observation.

The genera of the *Pierinæ*, which present the greatest variation and with which alone it is proposed to deal in this paper, are *Huphina*, *Appias*, *Ixias*, *Terias*, and *Teracolus*. In the remaining genera of the *Pierinæ* the species present for the most part comparatively little variation, and the synonymy is consequently not so voluminous.

Huphina.

In this genus seasonal variation is shown in the greater prominence of all the dark markings on the upperside and in the much richer coloration of the underside in the rainy-season forms, the general tone of the underside in the dry-season forms being, in most species, of a much greyer shade. The difference in size referred to above is also very marked.

The numerous named forms in this genus, from the Indian region, if local races be excluded, may be reduced to three species only, the males of which may be compared as below :—

A.—Hindwing broadly orange towards the anal angle.

H. lea, Doubleday.

B.—Hindwing not orange towards the anal angle ; a more or less prominent spot in the upper median interspace of the forewing on the upperside.

H. phryne, Fabricius.

C.—Hindwing not orange towards the anal angle ; no black spot in the upper median interspace of the forewing on the upperside.

H. NAMA, Moore.

H. lea is a common species in Southern Burma and usually stands under the name of *H. amalia*, Vollenhoven, as Burmese (and Malay) specimens generally differ from typical *H. lea* from Borneo in having a narrower dark margin to the hindwing on the underside, and a greater extent of yellow suffusion on the same wing, but Mr. de Nicéville informs me that he finds these differences are not constant and that he sees no point on which the males of *H. lea* and *H. amalia* can be separated.

H. phryne occurs typically throughout the whole of peninsular India ; east of Calcutta it is replaced by a geographical race, *H. dapha*, Moore, and in the Andamans by a second race, *H. lichenosa*, Moore.

The males of these three forms may be compared as below:—

A.—Spot in upper median interspace on upperside of forewing clearly defined ; underside, hindwing yellow, the veins fuscous.

H. PHRYNE, Fabricius.

B.—Spot in upper median interspace on upperside of forewing clearly defined ; underside, hindwing white, the veins fuscous.

H. DAPHA, Moore.

C.—Spot in upper median interspace on upperside of forewing almost merged in marginal border ; underside, hindwing almost entirely suffused with greenish-yellow, the veins concolorous.

H. LICHENOSA, Moore.

The form which is referred to here as *H. dapha* stands under that name in the British Museum, and the writer has not been able to find out for certain under what name the local race should stand, but probably *H. nerissa*, Fabricius, will be found to be the oldest name. This form is very common throughout Burma and extends as far west as Sikkim, being replaced by *H. phryne* in the rest of the Indian region. It may be distinguished from typical *H. phryne* in all its forms by the ground-colour of the underside being white (tinged with greyish-ochreous in the dry-season form), whereas in *H. phryne* the

ground-colour is invariably some shade of yellow. The dry-season form of *H. phryne* is the *H. cassida* of Fabricius, and is also the *H. pallida* of Swinhoe.

H. lichenosa is a very well-marked local race from the Andamans.

H. nama, with its dry-season form, *H. amba*, Wallace, occurs fairly commonly throughout North-Eastern India and Burma, and also in the Andamans, the race occurring there having been named *H. andamana* by Swinhoe, but the only difference between specimens of *H. nama* and *H. andamana*, Swinhoe, is the locality-label on the pin.

H. nama is replaced in the Nilgiris by a good local race, *H. remba*, Moore, the dry-season form of which is probably the "species" recently described by Col. Swinhoe as *H. liquida*. Seasonal forms of *Huphina* from my collection are figured on Plate I, figures 1 to 12 and Plate II, figures 6 and 7. Figures 1 and 2 on Plate I are from a pair of the extreme rainy-season form of *H. dapha* taken *in coitû* at Thayetmyo, Lower Burma, in August; figures 3 and 4 are from a pair of an intermediate seasonal form of *H. dapha* taken *in coitû* at Pokoko, Upper Burma, in October; figures 5 and 6 are from a pair of the extreme dry-season form of *H. dapha* taken *in coitû* at Toungoo, Lower Burma, in January. Similarly figures 7 to 12, represent males and females of the extreme rainy-season form, an intermediate form, and the extreme dry-season form of *H. phryne*; figures 7 and 8 from a pair taken *in coitû* at Berhampore, Ganjam, in July; figures 9 and 10 from a male taken at Madras on the 2nd April and a female taken at Madras on the 31st March; and figures 11 and 12 from a pair taken *in coitû* at Berhampore, Ganjam, in February. Figures 6 and 7 on Plate II show the underside of males of the rainy-season and dry-season form respectively of *H. nama*, the former from a specimen taken in the North Chin Hills, Upper Burma, in the end of April, and the latter from a specimen taken in the Yaw District, Upper Burma, in December.

Other named forms of the genus, which are either not represented in the national collection or are doubtfully identified, are *H. amasene*, Cramer; *H. evagete*, Cramer; *H. zeuxippe*, Cramer; *H. hira*, Moore; *H. coronis*, Cramer; and *H. copia*, Wallace. Mr. de Nicéville informs me that *H. amasene* was described from China, and that he fails to recognise it as Indian; that *H. evagete* represents a male of the richly-

coloured rains-form of *H. phryne*, that the figure of *H. zeuxippe* shows a dry-season female of *H. phryne*, that *H. hira* represents the extreme of the dry-season form of *H. phryne* from districts where vegetation is scanty, that *H. coronis* is figured from the very darkest female rains-form of *H. phryne*, and that *H. copia* is usually given as a synonym of *H. zeuxippe*.

Appias.

This genus is usually divided into two sections, *viz.*, *Appias* and *Catophaga*, the latter differing from typical *Appias* in the forewing being more produced apically and the outer margin excavated below the apex instead of straight. These seem to form two very natural sections, the two Indian species of the first section being very closely allied, in fact merely geographical representatives of one another, while they differ from the species of *Catophaga* in being very numerous in individuals, and being most abundant in comparatively arid tracts, while the species of *Catophaga* appear to prefer denser jungle and being also much less numerous in individuals are consequently not so well represented in collections.

Section Appias.

Seasonal variation is shown much as in *Huphina*, the rainy-season forms being larger and more profusely marked than the dry-season ones; the latter also having the ground-colour of the underside tinged with ochreous instead of being pure white. *A. libythea*, Fabricius, and *A. zelmira*, Cramer, are the only two species which occur within Indian limits, the latter being the Eastern representative of the former. Both these species show considerable seasonal variation, and four of the seasonal forms have been named by Colonel Swinhoe, three of them in the "Annals and Magazine of Natural History" for 1890 (pages 358 *et seq.*) Of these four named forms, *A. ares* and *A. retexta* are respectively the extremes of the dry- and wet-season forms of *A. libythea*, the typical form of which is intermediate between the two. The other two named forms, *A. irvinii*, and *A. olferna*, are respectively the extreme of the dry-season form and an intermediate between the two extreme forms of *A. zelmira*, which is itself the extreme of the wet-season form.

A. zelmira is a species which shows the transition from the extreme of one form to the extreme of the other more clearly than any other species known to me, and it is by no means difficult to obtain a series

of males showing every stage from one extreme, with all the veins on the underside of the hindwing broadly black, to the other extreme, in which the whole hindwing is of a uniform, slightly ochreous tint, the only marking being a few greyish scales across the end of the cell. Five forms from my collection are figured on Plate II. Figure 1 from a specimen taken at Pokoko, Upper Burma, in October ; figure 2 from a specimen taken in the Upper Chindwin District, Upper Burma, in May; figure 3 from a specimen taken at the same time and place ; figure 4 from a specimen taken in the Yaw District, Upper Burma, in January ; and figure 5 from a specimen taken at Toungoo, Lower Burma, in January.

It is curious that Colonel Swinhoe has failed to recognise the fact of the above forms being seasonal, for though he has never met with *A. zelmira* in life, yet *A. libythea* is a common species in Western India, where he has spent the best part of his life, and though the males of the latter species do not vary to the same extent as do the males of *A. zelmira*, yet the females show a complete transition from one extreme to the other. Col. Swinhoe also states he has a long series of all three species (i.e., *A. libythea*, *A. ares* and *A. retexta*), but makes no mention of intermediates, though my experience is, that if a large series be collected, month by month, there are very numerous specimens which cannot definitely be assigned to any one particular named form.

In nearly all its forms, the male of *A. zelmira* can be distinguished from that of *A. libythea* by the black venation of the underside of the hindwing as well as by the much larger extent and white spotting of the apical patch on the forewing ; the dry-season forms, however, are not so easily separated, as not only is the black venation of the underside entirely absent in *A. zelmira*, but the white spotting of the apical patch on the forewing is also obsolescent ; however, the greater extent of the apical patch in *A. zelmira* appears to be a good and constant character, as in dry-season *A. libythea* this apical patch is almost entirely wanting.

The females are similarly easily enough separated in the rainy-season forms, the female of *A. zelmira* being much more richly marked with yellow and green on the underside of both wings, though these tints are not entirely absent from the extreme rainy-season female of *A. libythea*

as stated by Swinhoe in his description of *A. retexta*, nor are the apical white spots of the female of *A. zelmira* at all constant or invariably present as implied by Swinhoe in his description above quoted. The females of the dry-season forms of the two species approach each other very closely, but even in these the underside of the female of *A. zelmira* appears to be invariably more richly marked than that of *A. libythea*.

Section Catophaga.

There are some fifteen named forms of *Catophaga* from the Indian region in the national collection, which may be compared as below :—

A. Male, upperside red.

C. galba, Wallace. In the B. M. from Manipur and Sylhet.

B. Male, upperside white ; underside, hindwing with no black marginal band.

a. Male, base of forewing broadly irrorated with bluish-grey.

a^1. No large black spot in upper median interspace in the male.

a^2. Male, apical border of forewing black extending broadly to outer angle, enclosing a curved series of well-defined apical white spots. Underside, male, pale yellow ; female, pearly-white.

C. wardi, Moore. In the B. M. from the Nilgiris.

b^2. Male, apex of forewing irrorated with greyish, enclosing a row of ill-defined whitish spots. Underside, male, pale yellow ; female, pearly-white.

C. neombo, Boisduval. In the B. M. from the Nilgiris.

b^1. A large black spot in upper median interspace in the male.

C. alope, Wallace.

b. Male, base of forewing slightly or not at all irrorated with bluish-grey.

a^1. Male with a black spot in upper median interspace of the forewing on the underside.

C. roepstorffii, Moore. In the B. M. from Camorta.

b^1. Male with no black spot in upper median interspace of the forewing on the underside.

a^2. Male, apex of forewing broadly irrorated with greyish, enclosing no white spots. Underside, male and female, hindwing and apex of forewing deep ochreous-yellow.

C. LANKAPURA, Moore. In the B. M. from Ceylon and the North-West Provinces.

b^2. Male, apex of forewing narrowly irrorated with greyish. Underside, male, pale ochreous ; female, pearly-white.

a^3. Male, grey apical patch of forewing, extending for a short distance along costa. Female, bluish irrorations at base of forewing on upperside extending up to or beyond the forking of the lower median branch.

a^4. Male, a few apical black spots on margin of hindwing. Female, white portion of forewing extending across the end of the cell to the upper discoidal nervule ; apical patch containing four white spots (the uppermost one of the possible five being absent), the two upper prominent, the two lower minute. Underside, forewing strongly suffused with orange-yellow from the base to more than two-thirds the length of cell.

C. DARADA, Felder. In the B. M. from Darjeeling.

b^4. Male, upperside, hindwing unmarked at apex. Female, white portion of forewing extending across lower end of cell, only reaching the lower discoidal nervule. Three apical white spots all prominent (the uppermost and lowermost of the possible five wanting). Underside, forewing suffused with pale yellow from the base to the first median branch.

C. GALENA, Felder. In the B. M. from Ceylon.

b^3. Male, greyish irroration at apex of forewing not extending along costa. Female, bluish irroration at base of forewing on upperside not extending as far as forking of lower median branch. White portion of wing extending across the end of the cell to the upper discoidal nervule. Three to five apical white spots, the uppermost and lowermost always minute, occasionally wanting, the other three always prominent ; faintly suffused with pale yellow at base of forewing on underside.

C. VENUSTA, Moore. In the B. M. from Ceylon.

c^3. Male, greyish irroration at apex of forewing very slight, or entirely wanting. Female, grey irroration at base of forewing on upperside extending to forking of lower median branch. Five apical white spots, the lowest alone being minute, the other four prominent. Underside, forewing, strongly suffused with lemon-yellow from the base to two-thirds the length of the cell.

C. PAULINA, Cramer. In the B. M. from Java, Penang, and Celebes.

C. Male, upperside white; underside, hindwing with a black marginal band.

a. Male, upperside, hindwing, marginal band broad and diffused inwardly. Female, the cell entirely or almost entirely suffused with dark brown.

a^1. Male, underside, hindwing, subcostal vein black.

C. TAPROBANA, Moore (rainy-season form). In the B.M. from Ceylon.

C. APERTA, Moore (dry-season form). In the B. M. from Ceylon.

C. LATIFASCIATA, Moore (dry-season form). In the B. M. from the Nilgiris and Trevandrum.

b^1. Male, underside, hindwing, subcostal vein concolorous with rest of wing.

C. HIPPOIDES, Moore. In the B. M. from Manipur, Pegu, and Tenasserim.

b. Male, upperside hindwing marginal band narrow. Female, the cell almost entirely white.

C. VACANS, Moore. In the B. M. from Pegu and Modah (Irrawaddy).

C. EPICÆNA, Swinhoe. In the B. M. from Maldah.

I am unable to say how *C. epicœna* is supposed to differ from *C. vacans*. In addition to the specimens in the collection at the British Museum, from the localities quoted above, there are in my collection specimens of *C. wardi* from the Nilgiris in June; *C. neombo* from the Nilgiris in January, and Mysore in November; *C. alope* from Tenasserim in March; *C. lankapura* from Madras in June; *C. darada* from Tenasserim in March, and the North Chin Hills, Burma, in June; *C. galena* from Madras in August; *C. venusta* from the Nilgiris in October and January, Madras in July and August, and Tenasserim

in March ; *C. paulina* from the South Chin Hills in May and the North Chin Hills in the same month ; *C. hippoides* from Toungoo, Burma, in March, and Tenasserim in January and February ; and *C. vacans* from Toungoo, Burma, in January, February and March, from Myingyan, Burma, in December, and from Mysore also in December.

The differences given above are in most cases of a very slight nature, and though fairly constant in the specimens I have been able to examine, it is most unlikely that they would be found to hold good in a larger series. There can be little doubt that *C. wardi* and *C. neombo* are forms of one and the same species, and it seems very probable that *C. darada*, *C. venusta*, *C. galena*, *C. paulina* and probably *C. lankapura* as well do not represent more than one species ; *C. alope* is according to Distant the male of *C. leis* of Hübner and should stand under that name.

Other named forms recorded from the Indian region are *C. hippo*, Cramer, *C. eleonora*, Boisduval, and *C. nero*, Fabricius.

Ixias.

In this genus seasonal variation is shown on the upperside by the black markings being broader and more prominent, and on the underside in the ocelli and other markings tending to become obsolete in the rainy-season forms. In the dry-season forms the marginal band on the upperside of the hindwing is frequently entirely obsolete, while the markings on the underside are always more or less prominent. The tone of the underside in the dry-season forms of the yellow group is also much more ochreous than in the wet-season forms. The females of the yellow forms also further differ in the coloration of the apical patch, which is deep orange in the dry-season forms, but usually more or less tinged with yellow in the rainy-season forms, being sometimes entirely yellow and even in some cases white. Some thirty forms of *Ixias* have been recorded from Indian limits as distinct species, though the correct number probably does not exceed four, if local races are excluded.

Mr. Butler (Ann. and Mag. of Nat. Hist., March, 1888, p. 201), in speaking of the species of *Ixias* in the collection of the British Museum, says that a complete gradation can be traced from one extreme to the other, *i. e.*, from *I. reinwardtii* to *I. depalpura*, and his

inference is that the whole genus must be treated either as containing one variable species, or else as containing numerous species differing from one another only in very minute particulars. If his first statement were literally correct, his inference would undoubtedly be so as well; but, unfortunately, his statement is only correct with certain limitations.

The series in the British Museum collection commences with *I. reinwardtii* from Lombock, which is succeeded by three or four more island forms which run into *I. venatrix* from Moulmain. This species is succeeded by *I. kausala* from Depalpur, and here we come to an enormous gap, as there is no species linking *I. venatrix* to *I. kausala*, which differ very widely, and undoubtedly represent two quite distinct species. *I. kausala* is followed by the remainder of the forms of yellow *Ixias*, and the series runs through *I. pygmæa*, *I. pyrene*, *I. pyrenassa*, *I. watti*, *I. colaba*, &c., ending with the pale yellow forms *I. citrina*, *I. verna* and *I. andamana*, and there is no doubt that a very fairly complete gradation can be shown from *I. kausala* to *I. andamana*, and that all the forms included in the collection between them represent one and the same species, though several of the forms are sufficiently localized and defined to deserve naming. After *I. andamana* there is another big jump to *I. marianne*, and there is no connecting link between these two forms, which undoubtedly belong to two distinct species. The remaining species mentioned by Mr. Butler, *viz.*, *I. meridionalis*, *I. agniverna*, and *I. depalpura* are nothing more than seasonal forms of *I. marianne*, so that, at the time Mr. Butler wrote, the British Museum collection contained three distinct species of *Ixias* from the Indian region all quite distinct and not running into one another. Since that time a fourth species, *I. nola*, has been discovered at Mahableshwar in the Bombay Ghâts.

The males of these four species may be compared as below :—

A.—Upperside yellow, apical orange patch of forewing occupying more than half of cell.

I. VENATRIX, Wallace.

B.—Upperside yellow, apical orange patch of forewing not occupying more than outer fifth of cell.

I. PYRENE, Linnæus.

C.—Upperside white, apical orange patch of forewing broad, extending into submedian interspace.

I. MARIANNE, Cramer.

D.—Upperside white, apical orange patch of forewing narrow, not extending into submedian interspace.

I. NOLA, Swinhoe.

I. venatrix, of which there is a single specimen in the British Museum from Moulmain, has no near ally from the Indian region, but is closely allied to several species from the Malay Archipelago. It is more than probable, I think, that the recorded locality for this species is incorrect, unless the specimen be a "sport."

I. pyrene is very subject to both climatic and seasonal variation, and many forms have been named. Of these some are fairly distinct, and the males can be compared as below:—

A.—Forewing, upperside, yellow of ground-colour not entering upper median interspace.

a.—Apical orange patch extending across whole breadth of cell.

I. EVIPPE, Drury.

b.—Apical orange patch entering cell both above and below black spot on disco-cellulars.

a^1.—Upperside deep lemon-yellow.

I. PYRENE, Moore.

b^1.—Upperside pale lemon-yellow.

I. CITRINA, Moore.

c.—Apical orange patch entering cell only above black spot on disco-cellulars.

a^1.—Upperside, deep lemon-yellow.

I. PYRENASSA, Wallace.

b^1.—Upperside, pale lemon-yellow.

a^2.—Apical patch orange-yellow.

I. VERNA, Druce.

b^2.—Apical patch orange-red.

I. ANDAMANA, Moore.

B.—Forewing, upperside, yellow of ground-colour entering upper median interspace and filling angle at origin of second median branch.

I. CINGALENSIS, Moore.

Typical *I. evippe* is a very large form, in which the orange of the apical patch enters largely into the cell and extends across its whole breadth. This form appears to be confined to the north-east of the Indian region, and is in the British Museum from Nepal, Darjeeling, and Manipur. The figures of the dry- (fig. 28) and rainy-season (fig. 27) forms on Plate II are taken from two specimens in my collection from Assam.

Typical *I. pyrene* differs from *I. evippe* in being smaller, and in the orange apical patch on the forewing entering the cell both above and below the black spot on the disco-cellulars, but not, or hardly, entirely surrounding the black spot.

I. moulmeinensis, Moore, only differs in the apical orange patch entering the cell to a rather less extent below the black spot. Both typical *I. pyrene* and typical *I. moulmeinensis* occur commonly throughout Burma, but apparently do not extend west of Assam. The two forms run into one another, and are not separable. The dry- and rainy-season forms are figured on Plate II, figs. 28 and 25, the former from a male taken in the Yaw District, Upper Burma, in January, and the latter from a male taken in the same locality in September.

I. pyrenassa is a form in which the apical orange patch only extends into the cell above the black spot on the disco-cellulars ; this is the common yellow *Ixias* which occurs throughout the Indian region wherever yellow forms of *Ixias* are found (except in the Andamans and Ceylon). It would, therefore, appear to be the parent form, other yellow forms being local modifications of it. It has received numerous names, having been called *I. dharmsalæ*, *I. frequens*, and *I. watti* by Butler, *I. colaba* and *I. alana* by Swinhoe, and the extreme of the dry-season form having been named *I. pygmæa* by Moore. I am quite unable to say how the first four of these forms are supposed to differ from typical *I. pyrenassa*, but am quite certain if the specimens arranged above each name in the National Collection were mixed up and the labels removed, that no one would be able to re-arrange them as they are now arranged. *I. alana* I have not seen, but there is not the faintest doubt that it is a form of *I. pyrenassa*, occurring in a more rainy time of year than *I. colaba*, with which it is compared by its describer.

I. pygmæa, which represents the extreme of the dry-season form, is only represented in the British Museum from North-western India (October, November, December) ; but there are perfectly typical examples of it in my collection from several localities in Burma, taken in January, besides numerous intermediates between typical *I. pygmæa* and typical *I. pyrenassa*.

I. pyrenassa is in the British Museum Collection from Dharmsala, Bombay, Barrackpore, Darjeeling, Bengal, the Nilgiris, Campbellpore, Attock and Kangra ; and in my collection, from Madras, the Nilgiris, Mysore, Ganjam, and numerous localities in Burma. I have not found this form so common in Burma as typical *I. pyrene*, and some specimens are distinctly intermediate with *I. moulmeinensis*, having a few specks of orange in the cell below the disco-cellular spot on one wing and none on the other. These puzzling specimens apparently do not occur out of Burma, where they show a distinct transition to *I. moulmeinensis* and thus to *I. pyrene* and *I. evippe*.

The figures on Plate II represent a male of the rainy-season form taken in Upper Tenasserim in May (fig. 21), a male of the ordinary dry-season form taken in the Karen Hills, Burma, in December (fig. 20), and a male of the extreme dry-season form, *i.e.*, *I. pygmæa*, taken in the Yaw District, Upper Burma, in February (fig. 22). This latter is the ordinary dry-season form in dry districts, where the rainy-season form is, on the other hand, not so pronounced ; the specimen figured is absolutely typical even in size, though, as has been pointed out by Mr. Butler, the small size of this form is by no means constant.

I regret I took no notes about *I. latifasciatus* when at home, but it represents the utmost extreme of the rainy-season form of either *I. pyrene* or *I. pyrenassa*, probably the former.

I. citrina, which I am unable to distinguish from *I. pallida*, Moore, is in the British Museum from Tenasserim and High Island, Mergui, and in my collection from Tenasserim. It appears to be a pale form of *I. pyrene* and is probably insular, its head-quarters being in the Mergui Archipelago, while it straggles occasionally on to the adjacent continent.

I. verna, which is in the British Museum from High Island, Mergui, and is in my collection from Tenasserim, bears exactly the same relation to *I. pyrenassa* that *I. citrina* does to *I. pyrene*.

I. andamana, the dry-season form of which has recently* been named *I. lena* by Swinhoe, can only be separated from *I. verna* by the redder tinge of the apical patch on the forewing.

I. cingalensis is a very well-marked local race, and occurs commonly in Southern India and Ceylon. It can be separated at once from all other forms of yellow *Ixias* by the greater extent of the basal yellow of the forewing, which spreads into the upper median interspace ; the British Museum has specimens of typical *I. cingalensis* from Ceylon alone, and of the dry-season form *I. kausala*, Moore (which is inseparable from *I. jhoda*, Swinhoe), only from the Bombay Presidency. Both forms, however, occur in the utmost profusion throughout the whole of Southern India, and I have numerous specimens from the Nilgiris, Madras, and Ganjam ; some of these specimens are distinctly intermediate to *I. pyrenassa*, but nothing approaching *I. pyrene* or *I. evippe* occurs in Southern India.

A form rather intermediate between the dry-season and wet-season forms, but nearer the latter, is figured on Plate II (fig. 23) from a male taken at Madras at the end of April, and the extreme of the dry-season form (*I. kausala*) at fig. 24 from a male taken at Surada, Ganjam, in January.

My conclusions on the *pyrene* group of *Ixias* are that, as far as the Indian region is concerned, the parent form is represented by *I. pyrenassa*, which occurs typically wherever yellow *Ixias* are found, with the exception of the Andamans and Ceylon ; that the forms *I. cingalensis*, *I. pyrene*, and *I. evippe* are fairly well-marked local races, not yet fully established; and that *I. citrina*, *I. verna*, and *I. andamana* are paler island forms, the two former of which extend to the adjacent mainland.

I. marianne of Cramer is the common white *Ixias* which occurs throughout Southern and Western India. Typical *I. marianne*, which has been re-named *I. cumballa* by Swinhoe, represents the extreme of the rainy-season form. The dry-season form has been named *I. agniverna* by Moore, and re-named *I. depalpura* by Butler. An intermediate form has been named *I. meridionalis* by Swinhoe. The males of these three forms differ comparatively slightly ; in fact, males of *I. marianne* and *I. meridionalis* are hardly distinguishable. The

* Ann. and Mag. of Nat. Hist., sixth series, Vol. V, p. 357, n. 7 (1890).

females, however, differ more conspicuously, though all the forms run into one another.

The figures on Plate II represent a typical female of *I. marianne* taken at Berhampore, Ganjam, in July (fig. 17), a typical female of *I. meridionalis* taken in Mysore in November (fig. 18), and a typical female of *I. agniverna* taken at Berhampore, Ganjam, in February (fig. 19), all from specimens taken by myself.

I. nola has as yet only been recorded from Mahableshwar. It appears to be a quite distinct species. Both seasonal forms are represented in the collection at the British Museum. Other named forms of *Ixias* recorded from the Indian region, which are either not named in the British Museum, or about which I neglected to take notes, are *I. bebryce*, Hübner, *I. anexibia*, Hübner, *I. sesia*, Fabricius, *I. rhexia*, Fabricius, *I. pirithous*, Fabricius, *I. meipona*, Grose-Smith, *I. birdi*, Distant, *I. ganduca*, Moore, *I. familiaris*, Butler, and *I. satadra*, Moore.

TERIAS.

The genus *Terias* has been more hardly dealt with than any other in the matter of bad species, chiefly owing to the fact that seasonal variation is very much developed in the species of the *T. hecabe* group, of which there are twenty-two named forms in the collection at the British Museum and almost as many unnamed ; how many of these will turn out to be good species when they have been bred is rather doubtful, but probably it will be found that not more than four species of this group occur within Indian limits.

The Indian species of *Terias* fall naturally into four groups which can be readily separated. The chief point of separation is the presence, absence, or form of the glandular streak in the male—a point to which attention was first drawn by Mr. de Nicéville in a paper on the Butterflies of Calcutta, published in the Journal of the Asiatic Society of Bengal for 1885. Apparently no mention of these characters has been made by subsequent authors, though their presence or absence is a point of great systematic importance.

The four groups referred to above may be compared as follows :—

A.—Male, with a greyish glandular streak on either side of submedian nervure at base of forewing on underside. No male-mark on hindwing. A reniform spot on disco-cellulars of forewing on underside.

T. HECABE group.

B.—Male, with an oval patch of closely-set salmon-coloured scales on underside of forewing below submedian nervure, and a similarly coloured patch on upperside of hindwing below costal nervure. A single spot on disco-cellulars of forewing on underside.

T. LÆTA group.

C.—No secondary sexual characters on wings of male. Underside more or less irrorated with fuscous scales. Two small dots on disco-cellulars of forewing on underside.

T. LIBYTHEA group.

D.—No secondary sexual characters on wings of male. Underside absolutely fleckless.

T. HARINA group.

In the *hecabe* group of *Terias* seasonal variation is shown by the greater breadth of the black markings on the upperside, and also by the deeper shade of the yellow in the rainy-season forms, and by the underside in the dry-season forms being more or less marked with brown, especially towards the apex of the forewing.

The named forms of this group represented in the National Collection may be compared as below :—

A. With three dark streaks or spots in cell on underside of forewing in addition to the reniform spot on disco-cellulars (*T. silhetana*).

a. Apex of forewing on underside more or less marked with brown. (Dry-season forms.)

T. SILHETANA, Wallace.
T. UNIFORMIS, Moore.
T. HELIOPHILA, Butler.

b. Apex of forewing on underside unmarked with brown. (Rainy-season forms.)

T. MERGUIANA, Moore.
T. MOOREI, Butler.

B. With never more than two streaks or spots in cell on underside of forewing in addition to the reniform spot on disco-cellulars (*T. hecabe*).

a. No apical brown patch on underside of forewing. (Rainy-season forms.)

a^1. Upperside, forewing, marginal band dilated into a large square spot at outer angle.

T. HECABE, Linnæus.
T. HECABEOIDES, Ménétriés.
T. NICOBARENSIS, Felder.

b^1. Upperside, forewing, marginal band only slightly dilated at outer angle.

T. TEMPLETONII, Moore.

c^1. Upperside, forewing, marginal band uniformly broad throughout.

T. CURIOSA, Swinhoe.

b. Apex of forewing on underside with a more or less strongly pronounced brown patch. (Dry-season forms.)

a^1. Upperside, forewing, marginal band sharply angled at upper median branch, and dilated into a large square spot at outer angle.

a^2. Upperside, hindwing, marginal band narrow.

T. EXCAVATA, Moore.
T. SIMULATA, Moore.

b^2. Upperside, hindwing, marginal band obsolete.

T. FRATERNA, Moore.

b_1. Upperside, forewing, marginal band not sharply angled at upper median branch, and only slightly dilated at outer angle.

a^2. Upperside, hindwing, marginal band narrow.

T. SWINHOEI, Butler.
T. PATRUELIS, Moore.

b^2. Upperside, hindwing, marginal band obsolete.

T. PURREEA, Moore.

c^1. Upperside, forewing, marginal band uniformly narrow from upper median to outer angle.

a^2. Marginal band sharply angled on upper radial.

T. SIMPLEX, Butler.

b^2. Marginal band not sharply angled on upper radial.

T. FIMBRIATA, Wallace.
T. IRREGULARIS, Moore.
T. NARCISSUS, Butler.
T. ASPHODELUS, Butler.

d[1]. Upperside, forewing, marginal band obsolete from lower radial to outer angle, appearing only as dots at the extremities of the nervules.

T. APICALIS, Moore.

The minor characteristics given above for separating the different forms are taken almost entirely from the type specimens of the respective "species." It is needless to say that the specimens arranged under each name in the British Museum are not true to the type, but show every gradation from one form to another, if one judges by the characters taken above. These characters (the apical marking on the underside of the forewing and the shape of the marginal band of the forewing on the upperside) have been taken as they are the ones on which the describers of the forms have based their "species," but they are eminently variable and unreliable, nor have I been able to find a single constant character to separate the forms shown under Section B; and until some constant character is shown, these forms should, in my opinion, be all classed under the name *T. hecabe*.

The distinctions between Sections A and B may appear trivial, but they appear to be absolutely *constant*. The three markings in the cell of the forewing of *T. silhetana* are all confined to the basal half of the cell, and consist of a highly zigzag, somewhat 3-shaped, marking, slightly nearer to the base than to the end of the cell, inside of which is a somewhat similar but shorter streak, and at the extreme base of the cell there is a small rounded spot. These three markings are absolutely constant in *T. silhetana* in all its forms, and of the large number of this species which I have taken *in copulâ*, the males and females *invariably* presented the same markings in the cell, while the apical markings differed from typical *T. silhetana* to typical *T. merguiana*. In no form of *T. hecabe* are there more than two markings in the cell, and in the extremes of the wet-season form one or both are frequently absent, though they appear to be invariably present in the dry-season forms. When present, these markings consist of a streak inwardly concave, somewhat variable in size and shape, situated in the same place as the 3-shaped marking in *T. silhetana*, and a second small spot, either linear or rounded, similarly situated to the second streak in *T. silhetana*, while

the spot at the base of the cell is *invariably* wanting. I have taken typical *T. hecabe in copulâ* with typical *T. hecabeoides*, *T. excavata*, *T. swinhoei*, and *T. purreea*, but never with either *T. silhetana* or *T. merguiana*; the circumstance of specimens of the dry- and rainy-season being taken *in copulâ* is accounted for by their having been taken during a break in the rains, or else either at the commencement or conclusion of the rainy-season, when both forms can be obtained on the wing together.

To take all the named forms in detail:—

T. uniformis differs from *T. silhetana* only in having a slightly more prominent apical brown patch on the underside of the forewing, but in pairs of *T. silhetana* taken *in coitâ*, where the male has been typical *T. silhetana* the female has been typical *T. uniformis*; in fact the brown patch invariably seems more developed in the female than in the male.

T. moorei differs from *T. merguiana* only in having the marginal band of forewing rather less dilated at the anal angle.

This species, *i. e.*, *T. silhetana*, occurs in Burma more commonly than *T. hecabe*, and also occurs throughout Southern India though less commonly than *T. hecabe*. I have it in my collection from numerous localities in Burma and S. India, and also from Assam and Sikkim. The dry-season form taken from October to February, and the wet-season form from July to September, with a few odd ones at other dates.

T. heliophila was originally described by Mr. Butler from three *males*, "only one in good condition," taken by Dr. Watt "near Assam," one of these males is now in the British Museum and must be taken as the type of the "species." This male represents an intermediate seasonal form of *T. silhetana*, and is very closely matched by the specimen figured here on Plate II, fig. 9. This form was described in 1885, but in 1886 Mr. Butler apparently repented of his sexing of his type specimen above referred to, as he in that year incorporated into the Museum collection a male of *T. excavata* from Durbunga as male *T. heliophila*, this specimen now standing in the British Museum as "*T. heliophila*, male, type," the original Assam specimen, which is also a male, standing as "*T. heliophila*, female, type." These two specimens are the only ones which are arranged over the name *T. heliophila*.

Mr. Butler's oversight is due to the fact that his original specimen like most other forms of *T. silhetana* is pale yellow, and therefore rather similar to females of the *hecabe* group, while the second specimen is of the usual darker yellow of *T. excavata*, and, as the apical markings on the underside of the two specimens are very similar, they being the corresponding forms of two different species, he was led to believe they were the same species. As these apical markings on the underside are the distinctive characters on which so many described forms have been based, and as it has not been generally recognised that these markings are purely seasonal, no doubt the mistake was a very natural one; it is, however, unfortunate that he overlooked the sexual glandular streak on the underside of the forewing, which is present in both specimens. It will therefore be seen that the Durbunga specimen, which is not absolutely typical *T. excavata*, *has no name.* Will Colonel Swinhoe oblige?

The next three forms, *T. hecabe*, *T. hecabeoides*, and *T. nicobarensis*, are absolutely identical, and there is no doubt that if the specimens of the three forms in the British Museum were mixed together no one would be able to re-separate them as at present arranged.

T. templetonii has the marginal band of the forewing rather less dilated at the outer angle than in typical *T. hecabe*, but otherwise does not differ from it.

T. curiosa, of which the type is the sole known specimen, appears to be a "sport" of *T. hecabe.*

T. simulata is inseparable from *T. excavata*, which is the ordinary dry-season form of *T. hecabe.*

T. fraterna differs in the marginal border to the hindwing being obsolete, which is probably due to its dry habitat.

T. swinhoei, *T. patruelis*, and *T. purreea* are slight varieties of *T. excavata*, and occur with it throughout its range. The first two are inseparable the one from the other, and the third is hardly more distinct.

Of the next five forms, *T. irregularis* is an exact synonym of *T. fimbriata*, and *T. asphodelus* of *T. narcissus*, which is slightly smaller than *T. irregularis*; while *T. simplex* differs slightly in the shape of the marginal band of the forewing. They are all almost certainly only extremes of the dry-season form of *T. hecabe.*

T. apicalis appears fairly distinct, it is represented in the British Museum, as far as I remember, by two specimens only, both dry-season forms.

T. sari, Horsfield, is possibly a distinct species. Mr. Butler speaks of it as "purely Malayan," but I took a perfectly typical specimen in the Nilgiris in January. It occurs fairly commonly in Burma, and seems very constant. The shape of the marginal band on the forewing and the entirely brown apical patch on the underside are very distinctive, but before the species can be considered established, some character should be pointed out which is not found to vary in other species of the genus, and the rainy-season form should also be designated.

Of *T. kana*, Moore, I have only seen two specimens, both from Burma, and both rainy-season forms; this may turn out to be the rainy-season form of *T. sari*, although it does not agree with it at all in the shape of the marginal band of the forewing.

Of the species referred to above I have examined the type specimens of *T. moorei*, *T. templetonii*, *T. curiosa*, *T. heliophila*, *T. fraterna*, *T. swinhoei*, *T. purreea*, *T. excavata*, *T. irregularis*, *T. narcissus*, *T. asphodelus*, *T. simplex*, *T. apicalis*, and *T. kana*. Figs. 8 to 11 on Plate II represent the undersides of four seasonal forms of *T. silhetana*; figs. 8, 9, 10 from three males taken at Thayetmyo, Lower Burma, the first in August and the others in September, and fig. 11 from a male, taken in the Yaw District, Upper Burma, in December. Figs. 12 to 16 represent the undersides of five seasonal forms of *T. hecabe*; figs. 12 and 13 from two males taken at Thayetmyo in August; fig. 14 from a male taken in Mysore in October; fig. 15 from a male taken at Madras in March, and fig. 16 from a male taken in the Yaw District in December.

The species of the *T. læta* group may be compared as follows :—

A. Apex of forewing very acuminate, marginal band of forewing extending scarcely beyond the lower median branch (*T. læta*).

a. Underside, hindwing reddish.

T. LÆTA, Boisduval.

b. Underside, hindwing flesh-coloured.

T. JÆGERI, Ménétriés.

c. Underside, hindwing yellow.

T. VAGANS, Wallace.

B. Apex of forewing less acuminate, marginal band of forewing extending to outer angle (*T. venata*).

a. Marginal band of hindwing narrow.

T. VENATA, Moore.
T. RAMA, Moore.
T. PALLITANA, Moore.

b. Marginal band of hindwing broad.

T. CINGALA, Moore.

T. jægeri has the underside more flesh-coloured than *T. læta*, of which it is probably the dry-season form.

T. vagans, which is possibly wrongly identified in the British Museum, has no reddish tinge on the underside, and is apparently without the salmon-coloured patch on the upperside of the hindwing in the male, though the similar patch on the underside of the forewing is present.

Of the next four forms the British Museum possesses nine males of *T. venata*, from Bombay, the Punjab, Mhow, and the N.-W. Himalayas; one male and one female of *T. cingala*, both from Ceylon; two males of *T. rama* from the Nilgiris; and two females of *T. pallitana* from Kutch. As identified in the British Museum, *T. pallitana* represents the ordinary female of *T. rama*. *T. venata* is slightly smaller than *T. rama*, but does not appear to differ otherwise. *T. cingala* may represent a distinct species. It is not at all certain that the above four forms are correctly identified in the British Museum.

The *T. libythea* group is represented in the British Museum by four named forms, of which three are separable. They may be compared as below :—

A. Marginal band of hindwing evenly broad throughout.

T. SENNA, Felder.

B. Marginal band of hindwing evenly narrow throughout.

T. DRONA, Horsfield.

C. Marginal band of hindwing broad at apex and narrow at anal angle.

T. LIBYTHEA, Fabricius.
T. RUBELLA, Wallace.

T. senna is in the British Museum from the N.-W. Himalayas, Mhow, and Camorta, and in my collection from the Nilgiris, Ganjam, Madras, Mysore, and Burma.

T. drona is in the British Museum from Java only, and I have never met with it in India or Burma, but it is recorded from Ceylon by Moore, though probably the insect referred to by him is not the same as that identified in the British Museum as *T. drona*.

T. libythea, from which, as identified in the British Museum, *T. rubella* is inseparable, is in the British Museum from Poona and Sheemagar, Upper Burma, and in my collection from the Nilgiris, Ganjam, Mysore, Tenasserim, and the Shan States. I am inclined to believe that *T. libythea* is the female of *T. senna*.

The *T. harina* group is represented in India by one species alone, which varies slightly seasonably in the breadth of the black margins of both wings. The more heavily-marked or wet-season form has been named *T. formosa* by Wallace.

Mr. Butler has given it as his opinion that the only true species is a local race, but in this I do not see my way to agree with him, nor does the British Museum collection arranged with his own hands bear him out. For in it we see forms such as *T. fimbriata*, *T. narcissus*, and *T. asphodelus* arranged as three distinct species, *i.e.*, as three "local races;" but specimens of these three "local races" are all in the British Museum from the one locality of Campbellpore, and the only conclusion to which we can come is that the variation between the three forms is due to the different local influences of three adjoining compounds or gardens, a conclusion which is certainly justified by the extent of the variation, but in spite of that I question very much whether such is Mr. Butler's contention. But if on the other hand we conclude that these three forms are simply modifications of one species due to slight atmospheric changes shortly before their emergence from the pupa, in my opinion we should be much nearer the mark; as it is evident to any one who has taken the trouble to catch numbers of *Terias* from month to month that this genus is pre-eminently affected by the state of the atmosphere. A similar *reductio ad absurdum* could be made in the case of almost every "species" of the *T. hecabe* group, many of the "local races" of which will be found together in the same spot, while at the same time *T. excavata* is in the British Museum from Bombay and Pegu, *T. purreea* from Kangra and Kyoukmyoung in Burma, *T. patruelis* from the North-West Himalayas and Christmas Island, *T. irregularis* from Campbellpore and Assam,

T. hecabeoides from Mhow, N.-W. Himalayas, Cachar, Malacca, and Australia, and *T. hecabe* from Mhow, Campbellpore, Cachar, the Andamans, the Nicobars, Formosa, China, Aru, and N.-W. Australia—all rather extensive ranges for local races.

Other forms of *Terias*, which have been recorded from the Indian region, but which were either not represented in the collection at the British Museum or about which I neglected to take notes at the time, are *T. rotundularis*, Moore, *T. contubernalis*, Moore, *T. andersonii*, Moore, *T. citrina*, Moore, *T. sodalis*, Moore, *T. suava*, Boisduval, and *T. œsiope*, Ménétriés; all these will almost certainly be found to be merely forms of *T. hecabe* or *T. silhetana*.

Teracolus.

This genus may be divided into several well-marked groups or sections, which are all more or less affected by seasonal variation, but in different ways.

Section A.—Of moderate size; upperside salmon-coloured, male with a glandular patch of scales above submedian vein near base of forewing, the inner margin of forewing prominently lobed.

Of this group there are eight named forms in the British Museum collection, which probably represent at most two species; but how far the variation is seasonal and how far geographical I am unable to form an opinion without more personal experience of the group, only three forms of which I have met with, while the specimens in the British Museum are for the most part undated.

The males of these eight forms may be compared as follows:—

A. Submarginal fuscous band of forewing not coalescing with marginal band towards outer angle.

a. Upperside, forewing, costa not irrorated with greyish.

a[1]. Underside, hindwing, not dusted with brown; markings faint and brownish.

T. faustus, Olivier. In the B. M. from Europe, Turkey, and Kandahar.

b[1]. Underside, hindwing, densely irrorated with brown; markings prominent and reddish.

T. faustinus, Felder. In the B. M. from Campbellpore and Rawal Pindi.

c^1. Underside, hindwing, not irrorated with brown; markings prominent and reddish.

T. ORIENS, Butler. In the B. M. from Kalka (foot of W. Himalaya).

b. Upperside, forewing, costa strongly suffused with greyish from base to apical markings.

T. SOLARIS, Butler. In the B. M. from Deesa.

B. Submarginal fuscous band of forewing coalescing with marginal band towards outer angle, thus forming an apical patch enclosing spots of the ground-colour.

a. Apical fuscous patch not reaching outer angle.

T. FULVIUS, Wallace. In the B. M. from Khandesh.

T. PALLISERI, Butler. In the B. M. from Khandesh.

b. Apical fuscous patch continued to outer angle.

a^1. With three spots of ground-colour in apical patch.

T. TRIPUNCTATUS, Butler. In the B. M. from Bombay and the Nilgiris.

b^1. With more than three spots of the ground-colour enclosed in apical patch.

T. SURYA, Moore. In the B. M. from Ganjam.

T. faustus, *T. faustinus*, *T. oriens*, and *T. solaris* grade into one another, and are probably not separable; *T. rosaceus*, Butler, which is not represented in the British Museum, is apparently identical with *T. oriens*. As far as known the females of all the above forms are similar to the males, but are of a deeper shade.

T. palliseri is slightly smaller and more suffused with red beneath than *T. fulvius*, but is otherwise identical. The distinction between *T. surya* and *T. tripunctatus* is very slight, and is not true to locality. I have specimens of typical *T. tripunctatus* from Ganjam, and of typical *T. surya* from the Nilgiris. *T. fulvius*, which is in my collection from Southern India, is in my opinion the dry-season form of *T. tripunctatus*, and it is almost certain that *T. fulvius*, *T. palliseri*, *T. tripunctatus*, and *T. surya* represent a single species. The females of these four forms as far as known are white, sometimes slightly tinged with salmon-colour towards the margin.

Section B.—Of small size. Upperside salmon-coloured; male with a patch of specialized black scales on upperside of hindwing extending from subcostal vein to costal margin. No glandular patch on forewing, but the inner margin slightly convex.

The described forms of this group may be compared as below :—

A. Upperside, forewing, submarginal spot in submedian interspace prominent and squared; apical spots conspicuous.

a. Underside, forewing, base prominently suffused with orange in both sexes.

T. CALAIS, Cramer. In the B. M. from Aden and Kilimanjaro.

T. CARNIFER, Butler. In the B. M. from the N.-W. Himalayas and Karachi.

b. Underside, forewing, base faintly suffused with orange in male, more prominently so in female.

T. DYNAMENE, Klug. In the B. M. from Aden, Somali, N. India, and Karachi.

c. Underside, forewing, base not suffused with orange in either sex.

T. CYPRÆUS, Fabricius. In the B. M. from Bombay.

B. Upperside, forewing, submarginal spot in submedian interspace linear; apical spots comparatively inconspicuous; no orange suffusion on underside of forewing in either sex.

a. Male, hindwing, marginal band narrow, more or less obsolete towards anal angle, and prominently spotted with the ground-colour.

T. AMATUS, Fabricius,
T. KENNEDII, Swinhoe } In the B. M. from the Deccan and Coromandel.

b. Male, hindwing, marginal band broad, continuous, almost unspotted.

T. MODESTUS, Butler. In the B. M. from Ceylon.

In this section there are at most two species, which will stand as *T. calais* and *T. amatus* respectively, *T. kennedii* being identical with and *T. modestus* a good geographical race of the latter, while *T. dynamene* and *T. cyprœus* are inconstant varieties of the former.

These two species are themselves not much better than geographical races, *T. amatus* being confined to Southern India, where it occurs commonly, and is replaced by *T. calais* in the drier climate of Western and North-Western India.

T. kennedii, Swinhoe, does not appear to differ from *T. amatus*, or *T. carnifer* from *T. calais*. The females of *T. calais*, *T. amatus*, and *T. dynamene* are very similar to the males. The females of *T. modestus* are either white or salmon-colour, while of *T. cyprœus* there is only a single pair in the British Museum, the male being a largish long-winged insect, and the female white.

Section C.—Similar to Section B but the male with a minute glandular patch on upperside of forewing above the submedian nervure.

The only species of this section occurring within Indian limits is *T. protractus* of Butler, which is in the British Museum from the Punjab, Kutch, Campbellpore and the Hubb River (Biluchistan); there are two well-marked seasonal forms which differ in the tone of the underside, which in the dry-season form, obtained in November, is pale reddish-yellow, and in the wet-season form, obtained in June, July and August, is bright yellow.

There are two other closely allied species of this group in the British Museum. *T. ocellatus* from Somali and *T. phisadia*, Godart, (*T. arne* Klüg), from Senegal, Abyssinia and Aden.

Section D.—Of moderate size. Upperside, white or lemon-yellow with broad black margins, that on the forewing spotted with white; the male with a minute glandular patch on the forewing exactly as in Section C.

In this group there are at most two species, though there are many named forms. The seasonal broods differ in the colour of the underside, which is reddish-buff in the dry-season form and yellow in the wet-season form.

The two species may be compared as follows :—

A. Underside, forewing, the lowest of the three black spots near the outer angle not extending below the submedian nervure.

T. VESTALIS, Butler.
T. DUBIUS, Swinhoe.
T. INTERMISSUS, Butler.
T. PEELUS, Swinhoe.

B. Underside, forewing, the lowest of the three black spots near the outer angle extending to the inner margin.

T. PUELLARIS, Butler.
T. OCHREIPENNIS, Butler.
T. RORUS, Swinhoe.

Of the above forms, *T. dubius* is an exact synonym of *T. vestalis*, and *T. rorus* of *T. ochreipennis*. *T. vestalis* and *T. puellaris* are wet-season forms and *T. intermissus* and *T. ochreipennis* dry-season forms. *T. peelus* is a lemon-yellow variety of the female of *T. intermissus*.

Section E.—Of moderate size. Forewing with a crimson apical patch. No glands on wings of male.

In the British Museum the following eight forms are separated :—

T. DANAË, Fabricius. Ceylon, Coimbatore and Bombay.
T. SANGUINALIS, Butler. Ceylon and Khandesh.
T. DIRUS, Butler. } Karachi.
T. EBOREOIDES, Butler. }
T. IMMACULATUS, Swinhoe. }
T. DULCIS, Butler. }
T. SUBROSEUS, Swinhoe. }
T. TAPLINI, Swinhoe. Poona and Bombay.

The above undoubtedly represent only one species.

T. danaë is the rainy-season form in Southern India with a broadish black margin to the hindwing, and is replaced in the dry-season by *T. sanguinalis*, which differs in being slightly smaller, and in having less black on the hindwing. *T. dirus*, *T. eboreoides* and *T. immaculatus* run one into the other and represent the extreme of the dry-season form from a dry-climate, and as a rainy-season is practically unknown in Sind, the heavily marked rainy-season form is not found there. *T. dirus*, which is the most heavily marked form of the three, is hardly separable from *T. sanguinalis*. *T. dulcis* is inseparable from *T. dirus* in the male, but differs in the female in having no discal spots on the upperside of the hindwing, an eminently variable character, and in any long series of females, typical specimens of *T. dulcis* would be obtained. *T. taplini* and *T. subroseus* are slight varieties of *T. dirus*, the underside in both being more or less suffused with pink, *T. subroseus*, differing from *T. taplini* only in having a rather narrower inner black margin to the apical patch. There are very few

specimens of these last two forms in the British Museum, and like the female *T. dulcis*, they consist of slight aberrations picked out of long series, *T. taplini*, as might be expected, being as near to the Southern *T. sanguinalis* as to *T. dirus*. *T. albertus* of Swinhoe I have not seen, but judging from the description it is only a form of *T. danaë*. *T. phœnius* of Butler originally described from Abyssinia but since recorded from Karachi has been sunk by Swinhoe as a synonym of *T. dulcis* (P. Z. S., 1884).

Section F.—Upperside white, with an orange apical patch. No sexual glands on wings of male.

This group is represented in the Indian region by two species, *I. etrida* and *T. eucharis*, the former of which has a well marked local race (*T. limbatus*), in Ceylon.

The three forms may be compared as below :—

A. Upperside, forewing, the fuscous inner border of apical orange patch more or less obsolete.

T. EUCHARIS, Fabricius.
T. PSEUDEVANTHE, Butler.
T. TITEA, Godart.

B. Upperside, forewing, the apical orange patch entirely surrounded with dark brown.

a. Hindwing with a border of separated spots.

T. ETRIDA, Boisduval.
T. FARRINUS, Butler.
T. PERNOTATUS, Butler.
T. PURUS, Butler.
T. BIMBURA, Butler.

b. Hindwing with a continuous border.

T. LIMBATUS, Butler.

Of the first species, *T. pseudevanthe* is the wet-season form, *T. eucharis* the dry-season form, and *T. titea* intermediate. This species occurs throughout Western and Southern India, and in Ceylon.

The first four named forms of the second species are practically inseparable ; *T. bimbura*, which is in the British Museum only from North-West India, differs in having a reddish-brown underside, but this is a character which is found in specimens from Southern India and is merely varietal, probably more or less seasonal.

T. etrida occurs commonly throughout Southern, Western and North-Western India, and is replaced in Ceylon by the local race *T. limbatus*.

T. casimirus of Butler, which I have not seen, appears from the description to be a form of *T. etrida*; another named form probably identical with *T. etrida* is the *T. pallens* of Moore.

In this genus I have received great assistance from Mr. Butler, who has in many cases pointed out the characters on which several of the forms were originally supposed to differ, and which have since been found to be inconstant, and I think I am not far wrong in saying that the views expressed above do not differ materially from those held at the present time by Mr. Butler himself.

The conclusions arrived at in the foregoing paper may be summarised as under, what I consider to be true species or well defined local races being shown in ordinary type and numbered, while mere varieties and synonyms are shown in italics.

HUPHINA.

1. H. LEA.
2. H. PHRYNE, rainy-season form.
   H. pallida, extreme of dry-season form of *H. phryne*.
   H. cassida, synonym of *H. pallida*.
   H. hira, synonym of *H. pallida*.
   H. evagete, extreme of rainy-season form of *H. phryne*.
   H. zeuxippe, dry-season form of *H. phryne*.
   H. copia, synonym of *H. zeuxippe*.
   H. coronis, synonym of *H. evagete*.
3. H. DAPHA, well defined local race of *H. phryne*.
   [*H. nerissa*, ? oldest name for *H. dapha*.]
4. H. LICHENOSA, well defined local race of *H. phryne*.
5. H. NAMA, rainy-season form.
   H. amba, dry-season form of *H. nama*.
   H. andamana, synonym of *H. nama*.
6. H. REMBA, well defined local race of *H. nama*.
   H. liquida, ? dry-season form of *H. remba*.

APPIAS.

1. A. LIBYTHEA, intermediate form.
   A. ares, dry-season form. } Extremes.
   A. retexta, rainy-season form. }
2. A. ZELMIRA, rainy-season form. } Extremes.
   A. irvinii, dry-season form. }
   A. olferna, intermediate form.

Ixias.

1. I. VENATRIX.
2. I. PYRENE, local race of *I. pyrenassa.*
   I. moulmeinensis, inconstant variety of *I. pyrene.*
3. I. CITRINA, insular race of *I. pyrene.*
   I. pallida, synonym of *I. citrina.*
4. I. EVIPPE, local race of *I. pyrenassa.*
5. I. PYRENASSA, parent form of this group.
   I. dharmsalæ, *I. frequens*, *I. watti*, *I. colaba*, *I. alana*, } synonyms of *I. pyrenassa*, ranging from the extreme of the rainy-season form to the normal dry-season form.
   I. pygmæa, extreme dry-season form of *I. pyrenassa.*
6. I. VERNA, insular race of *I. pyrenassa.*
7. I. ANDAMANA, insular race of *I. pyrenassa.*
   I. lena, dry-season form of *I. andamana.*
8. I. CINGALENSIS, local race of *I. pyrenassa.*
   I. kausala, dry-season form of *I. cingalensis.*
   I. jhoda, synonym of *I. kausala.*
9. I. MARIANNE, rainy-season form.
   I. agniverna, dry-season form. } Extremes.
   I. depalpura, synonym of *I. agniverna.*
   I. meridionalis, intermediate form.
10. I. NOLA.

Terias.

1. T. SILHETANA, dry-season form.
   T. uniformis, synonym of *T. silhetana.*
   T. heliophila, synonym of *T. silhetana*, slightly intermediate.
   T. merguiana, rainy-season form.
   T. moorei, slight variety of *T. merguiana.*
2. T. HECABE, rainy-season form.
   T. hecabeoides, *T. nicobarensis*, } synonyms of *T. hecabe.*
   T. templetonii, slight variety of *T. hecabe.*
   T. curiosa, "sport" of *T. hecabe.*
   T. excavata, dry-season form of *T. hecabe.*

T. simulata, synonym of *T. excavata*.

T. fraterna, *T. purreea*, *T. swinhoei*, } slight varieties of *T. excavata*.

T. patruelis, synonym of *T. swinhoei*.

T. simplex, *T. fimbriata*, *T. narcissus*, } varieties of the extreme dry-season form of *T. hecabe* from districts with little rainfall.

T. irregularis, synonym of *T. fimbriata*.

T. asphodelus, synonym of *T. narcissus*.

3. T. APICALIS, dry-season form only known.
4. T. SARI, do. do.
5. T. KANA, rainy-season form only known.

} These are possibly identical with *T. hecabe*, but are probably distinct.

6. T. LÆTA.

T. jægeri, dry-season form of *T. læta*.

7. T. VAGANS, identification doubtful.
8. T. VENATA.

T. rama, synonym of *T. venata*.

T. pallitana, synonym of *T. venata*.

9. T. CINGALA, local race of *T. venata*.
10. T. SENNA.
11. T. DRONA, doubtfully Indian.
12. T. LIBYTHEA, ? ♀ of *T. senna*

T. rubella, synonym of *T. libythea*.

} The identification of these eight named forms is doubtful.

13. T. HARINA.

T. formosa, rainy-season form of *T. harina*.

TERACOLUS.

1. T. FAUSTUS, *T. faustinus*, *T. oriens*, *T. rosaceus*, *T. solaris*, } forms running into one another and not separable. Variation probably more climatic than seasonal.
2. T. FULVIUS, dry-season form.

T. palliseri, slight variety of *T. fulvius*.

T. tripunctatus, rainy-season form.

T. surya, inconstant variety inseparable from *T. tripunctatus*.

3. T. CALAIS.
   T. carnifer, synonym of *T. calais*.
   T. dynamene, *T. cyprœus*, } inconstant varieties of *T. calais*.
4. T. AMATUS.
   T. kennedii, synonym of *T. amatus*.
5. T. MODESTUS, local race of *T. amatus*.
6. T. PROTRACTUS.
7. T. VESTALIS, rainy-season form.
   T. dubius, synonym of *T. vestalis*.
   T. intermissus, dry-season form.
   T. peelus, inconstant variety of ♀ of *T. intermissus*.
8. T. PUELLARIS, rainy-season form.
   T. rorus, synonym of *T. puellaris*.
   T. ochreipennis, dry-season form.
9. T. DANAË, rainy-season form.
   T. sanguinalis, dry-season form from districts with normal rainfall.
   T. dirus, *T. eboreoides*, *T. immaculatus*, } forms from an exceptionally dry climate, all running into one another and not separable.
   T. dulcis, slight variety of ♀ of *T. dirus*.
   T. subroseus, *T. taplini*, *T. albertus*, } slight and inconstant varieties of *T. dirus*.
10. T. EUCHARIS, dry-season form.
    T. titea, intermediate form.
    T. pseudevanthe, rainy-season form.
11. T. ETRIDA.
    T. farrinus, *T. pernotatus*, *T. purus*, } synonyms of *T. etrida*.
    T. bimbura, slight variety of *T. etrida* probably seasonal.
12. T. LIMBATUS, local race of *T. etrida*.

Reckoning well defined local races as species, the number of Indian species in the above genera would be :—*Huphina*, 6 ; *Appias*, 2 ; *Ixias*, 10 ; *Terias*, 13 ; and *Teracolus*, 12. If on the other hand local races are excluded, the number of species would be :—*Huphina*, 3 ; *Appias*, 1 ; *Ixias*, 4 ; *Terias*, 12 ; and *Teracolus*, 10.

EXPLANATION OF THE PLATES.*

Plate I.

Fig. 1. *Huphina dapha*, Moore, ♂, extreme of rainy-season form.
„ 2. „ „ „ ♀, „ „
„ 3. „ „ „ ♂, intermediate form.
„ 4. „ „ „ ♀, „ „
„ 5. „ „ „ ♂, extreme of dry-season form.
„ 6. „ „ „ ♀, „ „
„ 7. *Huphina phryne*, Fabricius, ♂, extreme of rainy-season form.
„ 8. „ „ „ ♀, „ „
„ 9. „ „ „ ♂, intermediate form.
„ 10. „ „ „ ♂, „ „
„ 11. „ „ „ ♂, extreme of dry-season form.
„ 12. „ „ „ ♀, „ „

Plate II.

Fig 1. *Appias zelmira*, Cramer, ♂, extreme of rainy-season form..
„ 2. „ „ „ ♂, intermediate form.
„ 3. „ „ „ ♂, „ „
„ 4. „ „ „ ♂, „ „
„ 5. „ „ „ ♂, extreme of dry-season form.
„ 6. *Huphina nama*, Moore, ♂, rainy-season form.
„ 7. „ „ „ ♂, dry-season form.
„ 8. *Terias silhetana*, Wallace, ♂, extreme of rainy-season form.
„ 9. „ „ „ ♂, intermediate form.
„ 10. „ „ „ ♂, „ „
„ 11. „ „ „ ♂, extreme of dry-season form.
„ 12. „ *hecabe*, Linnæus, ♂, extreme of rainy-season form.
„ 13. „ „ „ ♂, intermediate form.
„ 14. „ „ „ ♂, „ „
„ 15. „ „ „ ♂, „ „
„ 16. „ „ „ ♂, extreme of dry-season form.
„ 17. *Ixias marianne*, Cramer, ♀, extreme of rainy-season form.
„ 18. „ „ „ ♀, intermediate form.
„ 19. „ „ „ ♀, extreme of dry-season form.
„ 20. „ *pyrenassa*, Wallace, ♂, ordinary dry-season form.
„ 21. „ „ „ ♂, rainy-season form.
„ 22. „ „ „ ♂, extreme dry-season form.
„ 23. „ *cingalensis*, Moore, ♂, rainy-season form (rather intermediate).
„ 24. „ „ „ ♂, dry-season form.
„ 25. „ *pyrene*, (*moulmeinensis*) Linnæus, ♂, rainy-season form.
„ 26. „ „ („) „ ♂, dry-season form.
„ 27. „ *evippe*, Drury, ♂, rainy-season form.
„ 28. „ „ „ ♂, dry-season form.

* These plates, Nos. I, II, of Indian *Pierinæ* will be issued with a subsequent number of the Journal.—Editor.

DESCRIPTION OF A NEW SNAKE FOUND IN TRAVANCORE, BY Mr. S. DIGHTON. PIRMAAD.

By G. A. Boulenger (Brit. Museum, Natural History).

(*With a Plate.*)

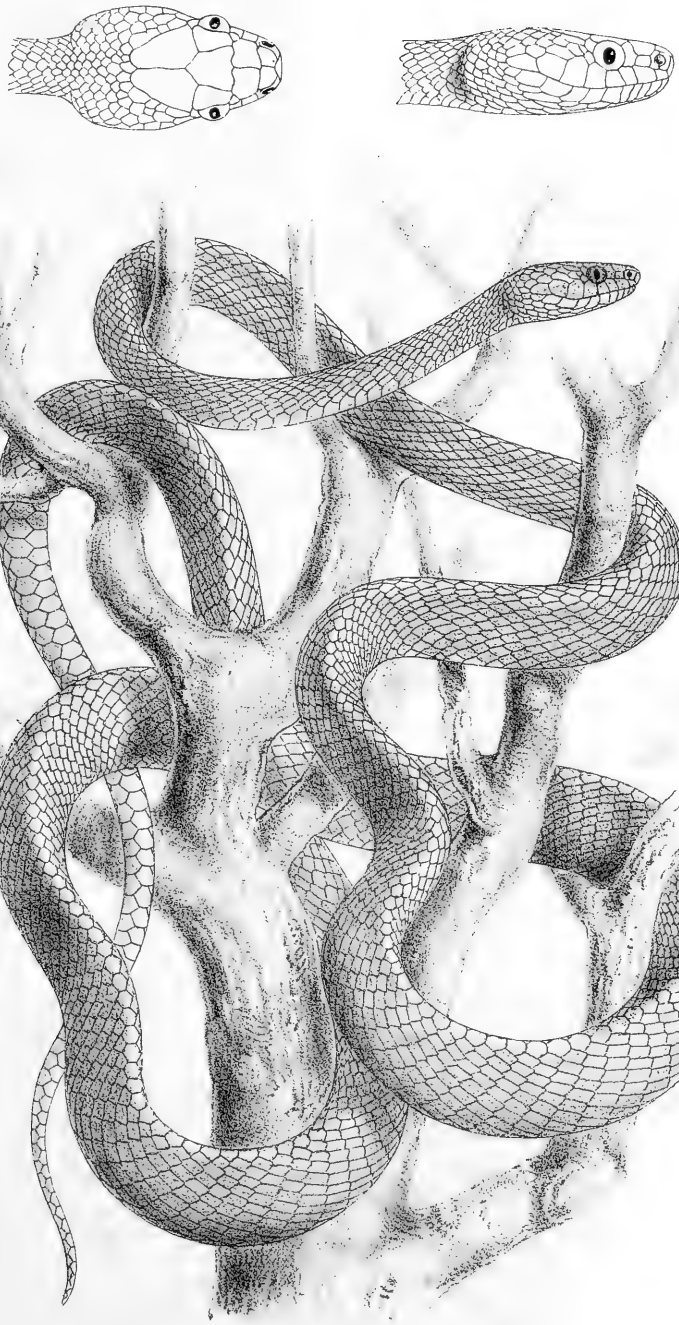
(*Read before the Bombay Natural History Society on* 13*th Feb.*, 1894.)

Dipsas dightoni.

Anterior platine and mandibular teeth enlarged; eye shorter than the snout. Prostral broader than deep, just visible from above; internasals broader than long, shorter than the præfrontals; frontal as long as broad, as long as its distance from the end of the snout, shorter than the parietals; lonal longer than deep; a single præocular reaching the upper surface of the head; two postoculars: temporals small, scale-like, 2 and 3; eight upper labials, third, fourth, and fifth entering the eye; four lower labials in contact with the anterior thin shields, which are as long as the posterior. Body strongly compressed; scales in 23 rows, not very oblique, the vertebral scales scarcely enlarged on the anterior half of the body, longer than broad on the posterior half. Ventrals 241; anal entire; subcaudals 95. Pale reddish-brown above, without any dark markings; a series of salmon-coloured blotches along the back; head pale brown, with minute blackish dots; lower parts yellowish, finely dotted with brown; the outer ends of the ventrals salmon-pink.

Total length 1,100 millimetres (3 feet, 8 inches); tail 220 millimetres (8½ inches).

I am indebted to Mr. H. S. Ferguson for a single example, a female, of this fine new snake, which was obtained by Mr. S. Dighton at Pirmaad, at an altitude of 3,300 feet, in January, 1893.



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Mintern Bros. del et lith. London.

DIPSAS DIGHTONI, Boulenger.

A new species of Tree Snake found in N. Travancore, by Mr. S. Dighton.

"SMALL DEER."

By W. F. Sinclair, I.C.S.

(*Read before the Bombay Natural History Society*, 13th *February*, 1894.)

The phrase of my heading is familiar, and brief enough to suit our notice cards. But of three animals before us to-night, the first is an antelope, the second an aberrant deer, and the third neither.

If one of us send out a shikari from Bombay to any jungle within our horizon, his report of game will commonly include "bakris." He may mean one or other of two very different animals. The first, and commonest in the lower and thinner forests, is the four-horned antelope—*Tetraceros quadricornis*. This animal has really, in perfect male specimens, two pairs of short hollow horns. Nothing else of the sort is now known above ground. The Giant *Sivatherium* of the Indian tertiary rocks seems to have had four horns, and to have had a contemporary poor relation assigned to the very genus that we are now dealing with. Some American monsters seem to have had even three pair of horns.

But that sort of thing is out of fashion amongst modern ruminants, and even our own species seems to have had nearly enough of it. The development of the anterior horns varies greatly, often without apparent relation to age or place, and some have believed in a second species, having only rudimentary or trivial cores for the anterior horns, without any true horn upon them. A somewhat deformed head of this type is on the table. But it happens that I know the owner when he wore it, with two tiny, but true, horns on the cores, which were lost by the carelessness of my own servants.

Again, the finest head before us, from the Central Provinces, shows horns curving backwards, though the usual curve of the posterior and larger pair is forward, like the Blue Bull's. The section, indeed, is nearly circular, and does not show the three-sided figure often visible in the horns of *Portax*; nor is there any tendency at all towards a spiral form in the specimens that I have seen. These have been all in Western India, mostly in Khandesh and the Konkan. In the latter province there is a half-tame herd at Tanna, which belongs to Mr. Wellis, of the Tanna Jail. His observations, and mine, of that herd will be of some use to us to-night. A full-grown buck weighs three stone: a doe in good condition little less. The colour

is a dull dun-brown, something that of most Sambar. The hair is long (for a Peninsular Antelope), harsh and rather scanty. The under-parts have a somewhat softer and shorter hair; pale-brown or whitish, almost white in some specimens. The dun and white colours are curiously and irregularly mixed upon the legs; and in perfect specimens there are two white spots above the fetlock joints, forming an almost complete ring. The fetlock below these is black, as are the coronet and back of the pasterns. But these carry on each toe so large a white spot that a casual observer may easily suppose the whole pastern white. It is only in good specimens that these markings can be fully decried or described. The colours, like the horns, seem to be very variable, and not dependent on age nor on locality.

Many of you may have noticed similar foot-markings on the Blue Bull, and I shall have more to say about them later on.

The four-horned Antelope is not very polygamous nor gregarious. Five or six is an unusually large herd. Four is a common number, as the female of a virtuous couple usually bears twins of the same sex in the cold or early hot weather, and at six months' notice. A female nursing twins readily adopted an orphan fawn.

These Antelopes are tameable little beasts, and often petted by natives. But the bucks are sometimes dangerous. One at Tanna wounded a woman severely, and a female nursing attacked a man four or five times her weight.

They drop their "fewmets" in a common place, like many other forest ruminants. Probably this habit is of much use to animals so little gregarious when the time comes for pairing. It lets each know what there are others about; and, amongst animals so keen of scent, the buck may well find, at such places, the means of following up a solitary doe in season. There is no accident in nature.

The four-horned Antelope occurs in all our true Bombay forests, except the densest highland thickets of the hills, where it is replaced by the next species. It is not known on any of our plains, even when covered with "babul kurans" (that is, *Acacia* plantations), as far as I am aware. But I have not been in those countries for some years. It is good meat, but dry; wants to be well larded with mutton fat or bacon. It makes excellent "hare soup," as my cook says, describing the haunch further as bakri-ka "leg-mutton."

The second of our small deer is truly a deer, having solid bony antlers. This is *Cervulus aureus*, the "barking deer." I have chosen the two most descriptive of its names from amongst many inappropriate or barbarous.

It is *Cervulus*, a little deer; it is *aureus*, or golden (a very fine chestnut in good specimens); and it does bark just like a little dog. The antlers are small and have but two points as a rule, though a third, or even fourth, subordinate point may be occasionally met with. The main "beam" stands up straight from the burr for about three-fifths of its length; then curves lightly backward, and ends in one point imperfectly hooked. At its base is a tiny brow-antler.

The burr rests upon a bony stalk, which in Indian specimens is commonly as long as the antler, or longer. I have seen a Javan collection in which the antlers were far finer than this; but the species are now considered identical. The animal is lower on its legs than the four-horned Antelope, and perhaps a little less in weight; but I have no weights before me. It is more thick-set, indeed, and puts on more fat. The colour, as I have said above, is a fine chestnut; the lower parts white or whitish, especially under the tail, which it has a way of cocking up in flight, as a rabbit does his "fud," and probably for the same reason—as a "danger signal."

It is an inhabitant of the thickest thickets, such as are, with us, chiefly on the higher hills; and into these it dives, as a rabbit into furze, when it finds itself driven out by force, or surprised at forage. Another point in the colour is the presence, in this very different animal, of foot-markings, very like those of our last beast and of the Nilghai. I shall probably have more to say about this hereafter.

The barking deer is pretty monogamous, often solitary, and never found in anything worth calling herds. I should say seldom four are together. For, although its period of gestation is reported the same as that of the four-horned Antelope (six months), it seems seldom to produce twins. It seems, too, to breed rather later in this region, as I have found pregnant females well into the hot weather on the ghâts.

There is one curious point about this deer, marking it off to any eye from the true *Cervidæ* and associating it with our next (though very different) beast. This is the presence in bucks of long, sharp, upper canine teeth, capable of inflicting a very severe wound on a rival,

or (as I have known) on a dog, and therefore presumably upon a jackal or wild cat. The feeble recurved horns can hardly be looked upon as serious weapons.

It is good meat and, in the ghâts, not so dry as our last beast, or most of our other venison. The evergreen thickets which it loves give it more perennial green food than our other horned game get; and it probably browses more, and grazes less, than even the four-horned Antelope, itself a browser for choice.

Both are habitually called "bekad" and "bekri" by natives, and sometimes "jungle sheep" by both natives and Europeans.

I have mentioned already the curious foot-markings of these two very different creatures and of the Blue Bull, not very closely related to either.

The reason of these has puzzled me long, until I found that I was looking at the matter through the eyes of a man, and not of a beast—wanting in sympathy in short.

Most wild animals when they find themselves in presence of foes or prey, but suppose themselves unobserved, have the habit of standing like statues for a short time, as, indeed, have the best human hunters. In the ruminants we call this "gaze"; in the *Carnivora* "point" or "set." But the object is the same in both cases—to observe without attracting attention by motion.

Now, during much of the tropical year the grasses and herbs of the forest are dead and dry, perhaps burnt up by forest fires.

The bushes have a much more perennial foliage.

Therefore, the *Carnivora*, none of them animals of lofty stature, and mostly given to crouching, more or less get a clearer view of the *legs* of ruminants below the bushes than of their bodies behind, or heads over them. We, indeed, commonly see the heads or bodies first, but our point of view is different.

All old shikaris know how seldom a tiger or panther looks *up* if men keep quiet in a tree, and that the eyesight of these creatures, though good, is not unerring.

Now, if we suppose a ruminant animal standing "at gaze" in the neighbourhood of a foraging panther, with the advantage of the wind, and standing quite still (as he has commonly the sense to do until he knows himself discovered), the advantage of the foot and leg markings is clear; they break the outline of the leg and make it more resemble a bush-stem with lichens, or a bamboo-stem with its white foot-markings—signs of age and approaching decay, which I have been to-day noting for the purpose of this paper.

Above, the outline is again broken by the whitish under-parts, always difficult to observe against light; and higher up, the darker body is lost amongst the foliage.

Not always will such protection avail the prey against the terrible hunting power of the *Carnivora*, itself sharpened on the wheel of natural selection. But if it avails five times in a hundred of such occurrences, which is little to suppose, the race of ruminants concerned is most likely to be continued by those members with motley "stockings," other things being equal.

The lateral position of spots on the toes, and more nearly annular or vertical disposition of those on or above the fetlock joint, we can conceive to be not altogether unrelated to the present and past osteology of those parts. It is a difficult question for an amateur naturalist; but we do constantly see that certain colours and forms of colour do hold their place over certain parts of the skeleton, even in such variable domestic species as horses and dogs. No man ever saw a horse with a blaze or star on the shoulder, nor an ass with a cross on its belly and thighs.

Our third beast is the so-called "mouse-deer"—*Tragulus memimna*. There is much confusion about its names. I adopt Mr. Blanford's assignment to the genus *Tragulus*, but suspect a printer's error in either his last book or Jerdon's Mammals of India (the reprint, p. 269), where the spelling is consistently as I have given it. Mr. Blanford not only spells "*Meminna*" (with double *n*) himself, but quotes Jerdon as doing so, giving the page above quoted, and each of them quotes the same or other authorities as using his own spelling. These are not here for me to examine.

As regards the trivial name, Jerdon and Blanford both call it "mouse-deer," the latter also giving the name "chevrotain," a good deal used by European writers. In some of our gazetteers it has been called a "hog-deer," and identified with "*Cervus porcinus*." I took some trouble to trace this error to its source; and the President's special reference to the matter, when the substance of this paper was spoken, induces me, preparing it for the press, to go fully into it. "Hog-deer" is the Bengal name for *Cervus porcinus*, which is not a "small deer" at all, the bucks often exceeding a hundredweight fresh killed and untouched by the knife, except to cut their throats.

This deer is not found in the Peninsular provinces of Bombay at all. It is abundant in parts of Sind. But the Anglo-Sindian sportsmen seldom call it "hog-deer," preferring the more elegant native

name "Para." One at least (if not more) of the last generation of Bombay sportsmen had contracted the habit of calling our present beast a "hog-deer," and so it spread to the early gazetteer lists. The writers, turning up the name in Jerdon and identifying by name and not by nature, added the Latin name he gives, *viz.*, *Axis porcinus*, and so the thing got into print.

On the mere merits, *Cervus porcinus* has less right to its not very elegant trivial name than our beast. For there is nothing hoggish about it, except a certain failure in the beauty of colour and form, and poetry of motion, that distinguish its nearest ally, the spotted deer.

Now the mouse-deer has several very porcine points about him. He is hornless ; he has (the male) tusks in the upper jaw, and his feet are "pettitoes," like a pig's ; whereas those of *Cervus porcinus* are, like those of all the horned ruminants, "cloots."

The difference is not very obvious at a glance ; and although many of us have anatomised cow-heel and pettitoes, it has seldom been with scientific intent. Opportunities of dissecting the foot of *Tragulus* are not common, though we have a specimen in spirit in our collection. But if any one will take any text-book of natural history, or Mr. Blanford's own book (page 480), he will see the difference between a pig's foot and a deer's plainly illustrated. The figure and action of *Tragulus memimna* are clumsy and ungraceful, and it squats on the ground in a pig-like way. But it is not very much observed. It is a small animal, seldom exceeding two feet long or half a stone in weight ; the colour is olive-gray, almost green ; whitish below, and along the sides it has the marks which naturalists call "menillings" ; longitudinal rows of long whitish spots. These are almost continuous stripes in young animals, but the chain gets broken up as they grow older ; the oldest males seem to get almost reddish, especially about the head, as may be seen by our fine mounted head on the table. It haunts the thickest forests, and even holes in rocks, so that beaters, without dogs, go over or past it. European sportsmen in such places are apt to be reserving their fire for something better, and if they espy it at all, or hear it move in the thicket, take it for a hare.

Natives, hunting with dogs, know a good deal more about it, and know it well throughout the Ghâts and the Konkan. The Maratha name is "*Pisarwa.*" The female usually produces twins in the early cold weather after a gestation of four or five months. It may be presumed that the males fight with their tusks. The natives say that it is well to handle a netted male carefully ; and this is likely.

THE NILGIRI GAME AND FISH PRESERVATION ASSOCIATION.

[*Extracts from the Annual Report for the year ending 30th June*, 1893.]

Increase of Game and Results of Protection.

Sambhur.—There is still a great scarcity of good stags, and such scarcity must continue so long as license-holders and others butcher small brockets. In the deer forests of Scotland, on Exmoor, in Germany, Newfoundland and many other places, none but "warrantable" stags are allowed to be shot. On these hills, there is nothing whatever to restrain any one but his own feelings of humanity and sport.

For the Mudumalai Forest, however, special rules have been published, which prohibit the shooting of brockets. These rules have been in force from 1st July, 1892, and have worked satisfactorily.

Ibex.—The Association has to announce, with great regret, that the small herd of 5 ibex which existed in Tarnad Burray has totally disappeared, and the only buck left on Konabettu was killed by a landslip last February. It is to be hoped that one of the 2 kids born last year may be a buck; otherwise this small herd of 7 (including the kids) must become extinct.

Elsewhere on the Kundahs and at Pakasuramalai the ibex are slowly increasing. As already remarked, ibex are much preyed on by panthers, and a small herd cannot make head against their depredations: a larger herd of 20 or 30 may continue to increase in spite of such losses.

Bison.—A few young bulls are still with the herds in the Mudumalai Forest. Though there were 6 sportsmen shooting in these forests during the year and every inch of the ground was gone over by them, only one black bull was seen. The herds, too, have decreased in number since last year.

Spotted deer.—The wild dogs have done much damage to these deer during the year. A pack of over 40 dogs appeared in the Sigur Forests and killed deer every day for some months, when the pack suddenly broke up into twos and threes. Nine dogs were found lying dead in the forests. Mr. Liebenrood also reports that he found 3 wild dogs lying dead in the forests near Nellakotta. The presumption is that distemper or some other disease broke out in the pack. Some such cause must operate in keeping wild dogs in check, or they would rapidly increase and overrun the whole country.

Antelope.—These will increase, no doubt, in time with efficient protection. There are 3 or 4 small herds of 5 or 6 in each in the Sigur forests.

Small Game.—Woodcock have been scarce. Hares fairly plentiful, except in places where jackals are abundant. There is a satisfactory increase in jungle-fowl in all the large sholas, but in the small sholas they are shot down every season and have but a poor chance of breeding.

Exotic and Introduced Game.

Chikore.—Single birds are occasionally seen, and a covey of 15 was reported in the neighbourhood of Billikal.

Pheasants.—Those turned out in Lovedale are occasionally seen; others have been seen in Governor's shola, Marliamund plantation, Tudor valley and elsewhere. The birds have apparently scattered widely, as is their habit. Of the 12 pheasants originally imported, there are 8 alive; also 3 chickens hatched out. The eggs do not appear to be fertile in the hot climate of Kartéri, and the chickens do not live long when hatched. Mr. G. Oakes, who spent over a thousand rupees in importing pheasants from England at his own expense, came to the same conclusion and removed his birds to Ootacamund, where, to his great disappointment and the lasting regret of all sportsmen, they were destroyed to a bird by a marauding jackal, which gained entrance into the pen at night.

Rabbits.—The game-watcher reports that he occasionally sees rabbits, but they have probably scattered and are not likely to increase very fast in such a vermin-infested district as Kartéri.

Peafowl.—The Honorary Secretary has not relaxed his efforts to obtain *pardees* to capture peafowl. After sending men over the Mysore District, a gang was found, but they declined to enter the Government forests even though offered an advance of Rs. 10, as they imagined it was only a ruse to entice them away and put them in jail! The Forest Department hunted them out of the forests before, and this is really the reason why it is so difficult to get hold of them now. However, it is to be hoped that when the season commences for capturing peafowl, the Association will be able to obtain the assistance of these men.

Partridges.—The Association is under great obligations to those gentlemen who have, at their own expense, endeavoured to further sport and benefit the district by the introduction of game and fish or who have assisted the Association by donations for the furtherance of the same good objects.

Mr. H. P. Hodgson has been instrumental in introducing partridges at his own expense at Kartéri, where they have bred successfully.

Guineafowl.—The Honorary Secretary obtained 6 guineafowl, a peahen, and 2 partridges at his own expense, which are doing well. The guineafowl have increased to 13.

Mr. Naher of Kartéri has also introduced guineafowl, and he is getting black partridges from Northern India at his own expense.

In former years many sportsmen spent considerable sums of money in introducing guineafowl, partridges, peafowl, Himalayan pheasants, &c., and letting them loose; but, as no protection was then afforded by the law, the birds let loose were all either shot down or trapped within a few months.

Imported and Indigenous Fish.

Trout.—The four large fish at Dodabetta were transferred to the Snowdon troutponds. The two females spawned in February, but, as the male were in milt in November, the ova could not be fertilised. 40,000 ova were obtained

from Mr. Silk (Marquis of Exter's Manager). They were put into the ice-house and were, of course, at once frozen to death. The money spent and trouble taken about the matter were wasted. A telegram was despatched to Mr. Silk to send out 20,000 more ova, and, instead of sending them *at once* on receipt of the telegram, Mr. Silk delayed a whole month and then sent out the ova. They arrived on the 4th March, the hottest time of the year. The high temperature of the water destroyed the fry as fast as they were hatched out, and only 83 of the strongest survived. These were put into the frypond at Snowdon and are now fine strong young fish 3″ in length. Out of the fry, 10 were retained in the large hatching box ; of these, 6 survived and are quite equal in size to the fry put out in the pond. All the fry have been daily fed with sheep's brains and chopped earth worms and young white ants.

Stockponds.—A stockpond of 1,000 cubic yards capacity and a fry pond of smaller dimensions have been excavated in Marliamund plantation, with two silt pits, the whole surrounded with wire netting. The adjoining ground has been tastefully laid out with flowers, ferns, &c., at a total cost of Rs. 279.

A site has been chosen on the banks of the Pykara river for a stock pond for breeding fish, where a natural depression in the soil has lent itself to the formation of an artificial dam. The surrounding soil has been excavated to a depth of 3 feet, and the earth thus obtained thrown up across the neck of the depression. The dam is 54 yards in length by 51 feet in diameter, with a puddlewall of clay 4 feet wide in the centre. The total length of the pond is 93 yards and the average width 30 yards. The depth varies from 12 feet near the dam to 3 feet near the upper end of the pond. The capacity of the pond is 5,800 cubic yards. About 700 tons of granite have been collected for facing the dam, lining the calingula and building a wall round the pond. The necessary iron standards, galvanised wire fencing, cement and other necessary materials have been purchased. From 20 to 40 laborers are daily employed by the contractor, and the work will probably be finished by October. The pond will be capable of holding 500 trout, which, in so limited a body of water, must necessarily be daily fed with chopped crabs, earth worms, &c. Mahamed Cassim is in charge of the pond and, as he lives within 50 yards of it and as he takes great interest in the work, may be entrusted to look after the place properly. An artificial waterfall will be constructed 12 feet high, the water (diverted from a neighbouring stream) will fall on to a gravel redd, with a trapdoor 14 feet from the fall. The trout will ascend the redd to spawn, when the door will be let down, the fish stripped of their ova, which will be fertilised and then despatched to the hatching boxes in Snowdon, which are most excellently situated for the purpose and in charge of Mahamed Gouse, who has been taught and thoroughly understands everything connected with the management of ova. He deserves great credit for the manner in which he has supervised and carried out the last experiments.

Trout turned out in the Pykara and other Rivers.—The Association is indebted to Mr. Marsh for the first successful attempt made to introduce trout ova and hatch them out on these hills. Encouraged by the success of Mr. Marsh's experiment (which cost him some Rs. 200 and much personal trouble) the Association imported ova, which Mr. Edmiston kindly took charge of on the voyage out and which proved a success. The fry were introduced into the Emerald Valley Stream, the Pycara River, the Ootacamund Lake, Dodabetta and Marliamund reservoirs, and Dr. Ross's Lake.

Mr. Wapshare also went to considerable private expense, amounting to several hundred rupees, in importing ova, which he placed in the Pykara River. Mr. M. A. Lawson aided the Association with his personal assistance and a donation, and the Association is not a little indebted to him for the successful results attained. Trout have been seen in the Dodabetta reservoir, the Emerald Valley Stream and the Pykara River, but, unless the Association systematically hatches out ova and turns the fry into the streams and rivers, no real success can be hoped for, as all ova are devoured by the legions of crabs infesting the rivers as soon as they are laid. Natural reproduction is not therefore to be expected, but the fish kept in the Association ponds must be annually stripped and the ova artificially hatched in boxes and the fry turned out. Three men have already been well trained for the work.

The troutponds at Pykara will probably cost Rs. 1,200 when properly completed, but this will be very cheap compared to the cost of similar work executed at home.

Perch fry.—Mr. Silk has kindly promised to present the Association with some perch fry, which Mr. H. P. Hodgson will probably bring out with him on his return shortly.

Carnatic Carp, Tench, Mahseer, &c.—Though the Honorary Secretary proposed that some attention should be devoted to the introduction of valuable indigenous fish, more especially Mahseer, the Committee did not sanction his proposals. There is no doubt, however, that some of the reservoirs might be stocked with *Barilius bola* (the Indian Trout), *Barilius bakeri* (Striped Mountain Carp), Mahseer, Rosyperch, Labeos, Rohus, &c., instead of being, as they are now, full of the worthless golden carp, which afford no sport and are worthless for food on account of their numberless bones. The Honorary Secretary (at his own expense) introduced during the year 28 Mahseer, 2 Mountain Carp, 1 Labeo, 24 Carnatic Carp and 16 common *Barilius*. All these fish are doing well and promise to succeed, but the *Barilius*, which were only caught last year, have already increased to about two or three thousand, and the fry are now nearly full-grown. Some Mountain Carp were obtained from the Kollimalais by the Honorary Secretary in 1872 and successfully brought up to the hills, but an otter managed to get into the pond where they were kept and destroyed them all. These and other experiments connected with pisciculture cost the Honorary Secretary nearly

Rs. 900, and Mr. Wapshare and other gentlemen have also spent money freely on similar experiments, which on the whole have been sufficiently encouraging to warrant further perseverance.

Enemies of fish.—Horned owls, Water-snakes, Otters, Crabs, the larvæ of the dragonfly and mildew (*Suproligneus ferox*) are the most deadly enemies to fish on these hills. The owls hook the fish out with their talons when they come into shallow water at night and are exceedingly destructive. The Honorary Secretary trapped several owls that had become confirmed depredators with gins. No doubt the two male trout which died were injured by owls seizing them. Water-snakes, fortunately, are not found above 6,000 feet, but they swarm at a lower elevation, and it is impossible to keep fish in any small pond if they once obtain entrance.

Twenty-eight Black spots, which the Honorary Secretary brought all the way from Tellicherry, were eaten in a week by 5 snakes, all of which were shot as they appeared. Each snake had 2 or 3 fish in it. They do not hesitate to attack and kill fish of even half a pound in weight.

Otters kill large quantities of crabs and dragonfly larvæ, but very rarely kill fish, unless they find them in a confined pond. Crabs and dragonfly larvæ are so destructive to fish ova that it is hopeless to expect trout to increase where these pests are abundant.

General Remarks.

Other Societies.—The Dehra Dún Fishing Association has been very unfortunate. After the expenditure of Rs. 900 and infinite trouble, only 4 fry out of 10,000 ova were put out into the Re Nadi. May they have greater success next time!

In Ceylon the trout fry put out into the Newara Eliya streams seem to have thriven, but do not increase. These fish are of considerable size and come into the runs to spawn on the gravel, when it is found necessary to have guards put on to prevent them being netted and stolen. No trout fry has been seen in the streams. This is doubtless due to the crabs devouring the ova at night. If the fish are stripped and the fertilised ova put into the hatching boxes, those interested ought to have no reason for complaint.

Messrs. Crossley and MacTaggart on the Pulneys have collected Rs. 700 already, and are making active preparations to introduce trout into the pretty lake at Kodaikanal, in which spirited endeavour all must heartily wish them success.

ON A STAG, *CERVUS THOROLDI*, FROM TIBET, AND ON THE MAMMALS OF THE TIBETAN PLATEAU.

By W. T. Blanford, F.R.S.

(*With a Plate.*)

[*From the Proceedings of the Zoological Society of London, 2nd May*, 1893.]

In the course of Captain Bower and Dr. W. G. Thorold's adventurous journey across the Tibetan plateau from west to east, two specimens of a stag were shot by the latter at a spot about 200 miles N.E. of Lhassa [1]. These animals were killed in the snow amongst brushwood just above the forest, at an elevation of about 13,500 feet above the sea. Of one individual a complete skin, skull, and horns have been brought to England, and are now in the Natural History Museum ; of the other, the head with the skin and horns has been preserved and has been left by Dr. Thorold in London, so that I have been able to examine both.

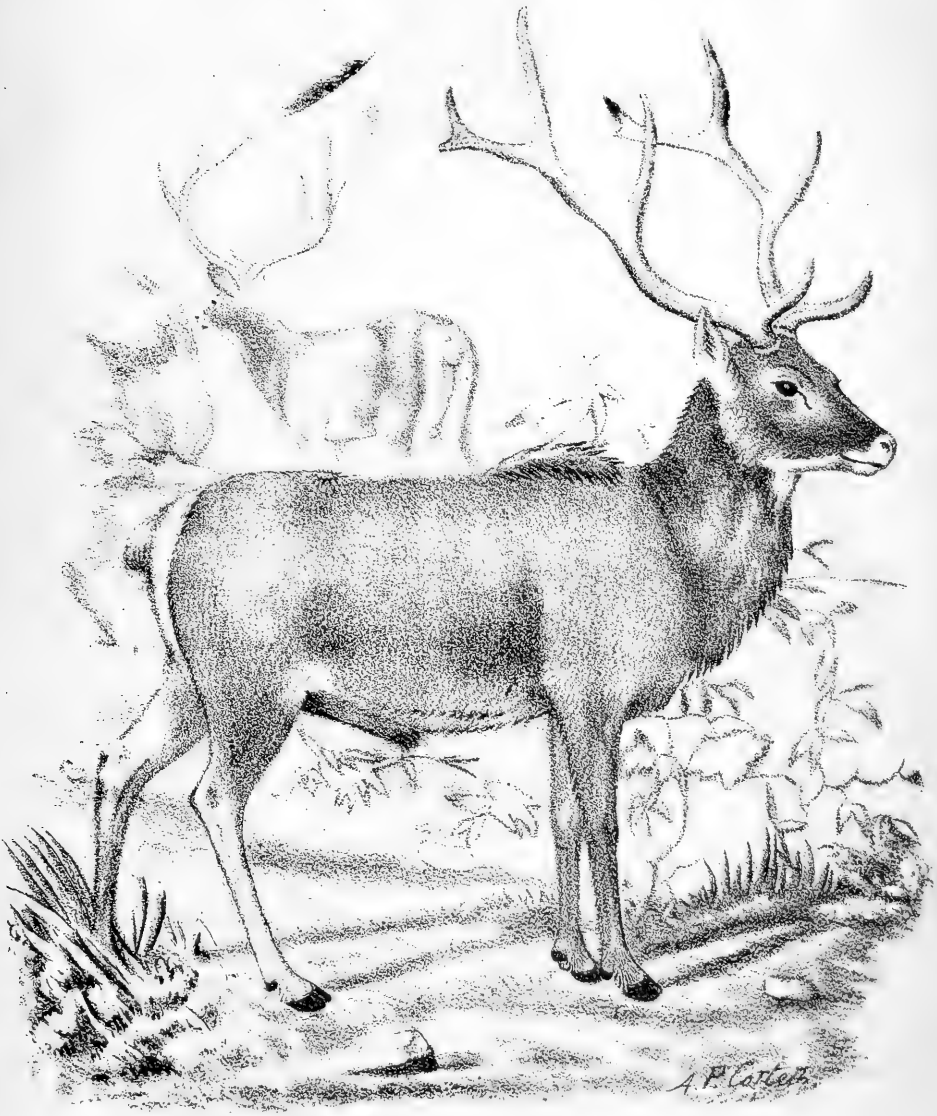
Last February I received a letter from Dr. Thorold, in which he asked me to look at the specimens and let him know to what species I thought they belonged, Some time before this I had heard from Mr. Oldfield Thomas that the complete specimen had been received by the Museum, but had been sent away to be stuffed. I, however, saw the head which had been mounted, and although I did not like to come to any decided conclusion without having an opportunity of seeing the skin also, I was disposed to believe that the deer was probably the same as that of an immature horn of which the name of *Cervus nariyanus* was given by Hodgson in 1851, and was clearly identical with the species, of which the head was described and figured by Mr. W. L. Sclater in 1889 (J. A. S. B., lviii., pt. 2, p. 186, pl. xi.), and which was shown to be allied to the Mantchurian *C. dybowskii*.

For the last two months the skin has been in the hands of the taxidermists, but I have at length, by permission of Dr. Gunther, been able to examine it ; and I have now no hesitation in saying that I believe the stag obtained by Dr. Thorold must be regarded as an additional peculiar species of the extraordinarily specialized mammalian fauna inhabiting the Tibetan plateau. The following are the principal characters :—

The animal is about the size of a Red Deer, *C. elaphus*. The height at the shoulder must have been about 4 feet, that measurement on the body over the curves to the withers having been recorded by Dr. Thorold as 4 ft. 5 in., and the length from the insertion of the tail to the nose 6 ft. 1½ in. The tail (with hair probably) measured only 4 inches. The ears are of moderate size and pointed, and measure outside in the mounted skin 9½ inches from the head.

The horns are distinguished at once by the want of the bez tine characteristic of the Elaphine group and found in the other Tibetan stag, *C. affinis*. There are five points on each horn (except one, which has only 4), and there can be

[1] I am indebted to Captain Bower for several of the details. The approximate position is in lat. 31° 40′ N., and long 93° 30′ E.



CERVUS THOROLDI

A NEW STAG FOUND IN THIBET.

DESCRIBED BY Mr. W.T BLANFORD F.Z.S. 1893.

very little doubt that this is the number characteristic of the adult. The beam is angularly bent at the insertion of the second tine (corresponding in position to the tres tine of *C. elaphus*), and above this is gradually curved back and presents the peculiarity that the upper four points and the upper part of the beam are nearly in a flat plane. Another conspicuous character is that (except in one horn which is slightly abnormal) the third tine exceeds all the others in length. The corresponding tine (4th) is generally the longest in the Wapiti, and the upper part of each horn in the present animal much resembles that of *C. canadensis* in shape.

Each horn measures round the curve outside 38 inches, none of the four differing more than a quarter of an inch more or less. The girth above the burr is 5·25. The following are the measurements of the different tines on one horn in inches :—

Lowest or brow tine	7·5
2nd (= tres)	10·25
3rd	11
4th	4
5th	2·5

The coloration of the skin is very uniform brown, minutely speckled, scarcely paler on the lower parts, but much paler and ochreous-buff on the small pygal disk which completely surrounds the tail, this latter being also pale rufous throughout. Ear whitish within. The muzzle, chin, and under surface of lower jaw white. The hairs of the body are stiff, long, and very coarse, and somewhat resemble those of the Musk-deer, being filled inside with a cellular pithlike tissue and having very small roots.[1] The hair of the body is long, dark brown, except at the base which is whitish, and at the tips which are buff. The pale tips are wanting around the caudal disk, so that the latter appears to be surrounded by a dark band. The hair along the spine is directed forward from above the hips as far as the wither, where the anterior direction ceases abruptly. This character is quite peculiar.

The muffle or rhinarium occupies the whole area between the nostrils, and a rather narrower portion extends to the upper lip.

The skull presents a few peculiar characters, the most important of which have been already noticed by Mr. W. L. Sclater. As a whole, the skull is short when compared with other skulls of Elaphine Deer; the muzzle is especially short, but broad. The hinder part of the skull is distinctly lower and flatter than that of *C. elaphus*, the forehead continuing the line formed by the nasals and not curving upwards into a ridge between the horns. In this respect the present specimen shows some resemblance to Rusine and Pseudaxine skulls, but the evidence of affinity is small. The termination of the bony palate in the middle above the opening of the posterior nares is between the last molars,

[1] I am indebted to Mr. E. Gerrard for calling my attention to the very peculiar structure of the hair.

whereas in all other deer of which I have examined the skull, the opening is farther back.

But by far the most peculiar character, as already noticed by Mr. Sclater, is the form of the nasals. These, a little way from the posterior termination, are fully twice as broad as they are in front, each bearing on the outer side a large rounded lobe-like expansion, so as to cover over the greater part of the lachrymal vacuity, which is much narrower than in Elaphine or Rusine deer.

The following are measurements in inches :—

Basal length of skull, from anterior border of foramen magnum to anterior end of premaxillaries	13·4
Length from posterior border of occipital condyles to ditto	14·3
Breadth across posterior edges of orbits	6·8
Breadth across premaxillaries just above canines	2·9
Length of nasal bones	5·85
Greatest breadth of nasals between lachrymal vacuities	3·0
Breadth of nasals in front at suture between maxillary and premaxillary	1·45
Length of row of upper molars and premolars	4·3
Length of upper three molars alone	2·6

On the whole, I can see no very close affinity between this and any known species of *Cervus* ; the present species approaches some forms of the Elaphine group quite as much as any other Cervine type, perhaps more. I can see no evidence of Pseudasine affinity, such as the horns might perhaps suggest. On the whole, the species is probably as near to *C. cashmirianus* and *C. affinis* as to any other, though perfectly distinct from both.

As regards the name of the present species, some little difficulty arises. As already mentioned, it is most probable that the horn to which the name *Cervus nariyanus* was given by Hodgson (J. A. S. B., xx., 1851, p. 292, pl. viii.) belonged to a younger individual of the same species. This horn was said to have been brought from Ladák ; it was 34 inches in length, and had four points, the two lower being more than 4 inches apart, so there was no bez tine. Judging by the figure,[1] the horn was more massive than would be expected in a young specimen of Thorold's Stag. Mr. Hodgson remarked that "the Bhotiahs who brought this horn say it belonged to a very young animal, and that the species, which is proper to Gnári or Western Tibet, is larger than the Shou" (*C. affinis*). The stag obtained by Dr. Thorold is considerably smaller than the Shou ; there is, so far as is known, no stag in Western Tibet, *C. cashmirianus* being limited to the Kashmir valley, at all events on the north and east of its range, and, as is well known, young examples of *C. elaphus*, and I believe of the

[1] The original specimen cannot be found in the British Museum, though Mr. Oldfield Thomas has searched for it. As no mention of it is to be found in the published catalogue of Mr. Hodgson's collections, it was perhaps not included in them.

Wapiti also, frequently want the bez tine ; so that it is by no means impossible that the Ladák horn may have belonged to a young *C. cashmirianus* from Kashmir, to *C. yarkandensis* from Eastern Turkestan, or even to *C. eustephanus* (*C. canadensis*, var.) from the Thian Shan, Ladák being connected with all these regions by trade routes. The Bhotiah story was probably pure fiction.

There is, moreover, one very strong reason for not using the name *C. nariyanus* for the present animal even if, as is highly probable, it was the species that furnished the horn described and figured by Hodgson. The name was taken from Nári, the Western (or rather perhaps the South-Western) province of Tibet, often called Gnári or Nári-Khorsum, a tract, as represented on maps, of no great breadth from north to south, but extending along the north of the Himalayas from the western extremity of Tibet proper near Rudok to between long. 80° and 85° E. This region, part of which is known as Hundes, is on the frontier of our own territory, and has been visited at several points by British sportsmen. If any stag inhabited the region, it is incredible that nothing should have been heard of it ; moreover, the whole of the upper valleys of the Sutlej and Yârotsánpo or Brahmaputra, of which the area consists, is a barren, treeless almost bushless waste, differing essentially from the country inhabited, so far as is known, by any species of *Cervus*. I think it extremely improbable that any stag inhabits Nári ; and, under these circumstances, it is not desirable to apply the name *nariyanus* to a species which does not occur there.

Whilst Mr. Sclater pointed out the similarity of the head which had been purchased in the Darjiling bazaar, and was described by him, to that of *Cervus dybowskii*, he was careful to avoid identifying the two. It is clear that he was perfectly right in supposing that the head, the skin of which was dried on, had come from Tibet. Now that we have the whole skin and dimensions, it is evident that the species is distinct from *C. dybowskii* (P. Z. S. 1876, p. 123, woodcut of head and horns, p. 124), which is a much smaller form, spotted at all seasons, although the spots in winter are described as indistinct and confined to the posterior part of the body. So far as is known, the horns in the adult of *C. dybowskii* only bear 4 points each, and the shape of the beam is different, being more regularly curved.

As, therefore, the Tibetan species requires a name, I think it impossible to do better than to call it *Cervus thoroldi*, after its discoverer. The following are the principal characters :—

Cervus magnitudine ad C. elaphum *proxime accedens ; fuscus, immaculatus, areâ pygali circum caudam porrectâ pallide rufâ ornatus ; pilis hirtis crassis longiusculis, in medio dorso ab uropygio usque ad humeros antice versis, indutus ; cornibus singulis valde curvatis, ramos ad quinque gerentibus ; ramo secundo a primo vel basali multo distante, tertio longiusculo.*

Plate XXXIV. represents the stuffed specimen in the British Museum, the type of the species ; the cut (p. 445) is taken from the head of the other specimen, still belonging to Dr. Thorold.

About a year ago, when discussing the geological age of the Central Asiatic highlands,[1] I had occasion to call attention to the remarkable specialization of the mammalian fauna inhabiting the Tibetan plateau. The stag now described adds another to the species peculiar to this tract of elevated country, and the list of these mammals as amended may be of interest to zoologists. It is, therefore, added here.

MAMMALIA OF THE TIBETAN PLATEAU.

INSECTIVORA.

Crocidura aranea.
†*Nectogale elegans.*

CARNIVORA.

Felis manul.
F. lynx.
F. uncia.
**Paradoxurus laniger.*
Canis lupus, var. *laniger.*
Vulpes alopex, var. *flavescens.*
**V. ferrilatus.*
Cyon deccanensis, var.
Mustela foina, var.
**Putorius larvatus.*
**P. canigula.*
P. alpinus, var. *temon.*
P. erminia.
**Meles leucura.*
**M. albogularis?*
†*Æluropus melanoleucus.*
**Ursus pruinosus.*

RODENTIA.

†*Eupetaurus cinereus.*
**Arctomys himalayanus.*
**A. robustus.*
**Mus sublimis.*
**Microtus (Arvicola) blythi.*
**M. strauchi.*
**M. (Eremiomys) przevalskii.*
Siphneus fontanieri.
**Lagomys curzoniæ.*
**L. rutilus.*
**L. erythrotis.*
**L. melanostomus.*
**L. ladacensis.*
**Lepus oiostolus.*
**L. hypsibius.*

RODENTIA—*continued.*

UNGULATA.

Equus hemionus, var. *kiang.*
**Bos grunniens.*
**Ovis hodgsoni.*
O. vignei, var.
**O. nahura.*
Capra sibirica.
†*Pantholops hodgsoni.*
†*Budorcas taxicolor?*
**Gazella picticaudata.*
**Cervus affinis.*
**C. thoroldi.*
Moschus moschiferus.

In this list * signifies a peculiar species, † a peculiar genus; that is, a species or genus not known to exist out of Tibet.

This is a list of the mammals known to inhabit the plateau north of the Himalayas and south of the Kuenlun, Altyn Tag, and Nanshan, at elevations exceeding 12,000 feet. Many of the forms named only inhabit small portions of the area, and whilst *Bos grunniens*, *Ovis hodgsoni*, *Pantholops hodgsoni* and *Gazella picticaudata*, with several rodents, appear to be peculiar to the high plateaus above 14,000 feet, the two species of *Cervus* are probably found in brushwood at a rather lower elevation in the more broken regions of Eastern Tibet, where the rainfall is heavier and the vegetation more abundant.

As was pointed out in the paper in the "Geological Magazine," there is, so far as I am aware, no equally peculiar mammalian fauna to be found in any continental area of equal extent, and for a parallel it is necessary to turn to some island like Celebes, that has long been isolated from all surrounding lands.

[1] Geological Magazine, April, 1892 (iii.), ix., p. 164.

DEEP SEA LIFE IN THE BAY OF BENGAL.

[*Extracts from a paper read before the Microscopical Society of Calcutta, on 11th September*, 1893, *by Dr. A. W. Alcock.*]

In a previous lecture, which I had the honour last year of delivering before this Society, I gave an account of the physical geography of the sea basins and seas of the Indian region, and of the various technical methods by which the facts of marine physiography, or hydrography, have been elucidated. To-day I have before me the much simpler task of exhibiting a few of the inhabitants of these deep sea basins, of explaining some of the more obvious peculiarities of their structure, and of offering a few suggestions as to the relations which these peculiarities of structure bear to the peculiarities of the habitat in which the animals are found.

It is hardly necessary for me to remind you that peculiarities in the form of animals are largely the outcome of peculiarities in their environment or habitat. We express this fact by saying that such or such an animal is exactly adapted to its environment. In the case, for instance, of animals that live in dark caves—such as the Mammoth Cave of Kentucky—we find that the eyes are wanting. Here is a cray fish (*Cambarus pellucidus*) from the Mammoth Cave: it has eye-stalks just like other cray fish, which proves that it is descended from a well-eyed form, but there are no eyes at the end of the eye-stalks. Other species of *Cambarus* which do not live in the dark possess eyes. Now why should *Cambarus pellucidus* have lost its eyes? Because eyes are no longer necessary; they have fallen into disuse. Being of no service to their possessors they are not acted upon by natural selection, for in the dark an animal with eyes has no better chance of surviving than an animal without eyes. Furthermore, eyes are delicate organs and extremely liable to injury: moreover they are large and vascular structures, and require a large amount of blood. Now, so long as the eyes are highly useful to their possessor, it so to speak "pays" to protect them from injury, and to keep them supplied with blood; but when they become useless it is in the highest degree wasteful to expend upon them the nourishment and care that might be much more advantageously bestowed upon some organ more useful to an animal living in the dark,—such as an organ of smell or an organ of touch: under such conditions we may expect an eyeless species to be gradually developed—such as this *Cambarus*, and the blind fish and the blind amphibian, along with which it lives. *Cambarus*, then, is an excellent and extreme illustration of the truth of the fact, that peculiarities in the environment of an animal are largely answerable for peculiarities in the structure of that animal.

Beside peculiarities in the inorganic environment there are other powerful factors that influence the shapes and structure of animals. One of the principal of these is the necessity for getting food to eat in the face of a multitude of hostile competitors of the same and of other species.

Another of the principal of these factors is the effort for preservation of the type—in other words, the desire to win a mate and generate offspring amid a crowd of competitors of the same species. If this statement of the case seems somewhat unromantic, let me bring before you some extreme illustrations in its support. Here is a specimen of a peculiar crustacean known as *Sacculina*, which, as you see, is a shapeless mass of tissue firmly fixed to the tail of this crab. In its early larval stages, *Sacculina* resembles not perhaps the crab, since the crab's earlier larval stages are somewhat different from those of other crustacea, but the prawn; so that it has—for a crustacean—noble relatives and a high ancestry. Both *Sacculina* and the prawn have at first the form of small free-swimming larvæ with a pair of antennæ, two pairs of biramous legs, a mouth, a single median eye, &c., known as *Nauplius*. Now the necessity for self-preservation has led *Sacculina* to attach itself as a parasite to some other animal. Being a parasite and entirely dependent on this other animal, or host, it no longer requires organs of sense to see its prey or escape its enemies; it no longer wants legs to swim about in search of prey, and its existence being assured as a parasite, it loses all resemblance to its nobler relatives and becomes nothing but a large stomach encapsuled, along with its reproductive organs, in a bag of skin. *Sacculina* then exhibits in an extreme degree the truth of the proposition, that the form of an animal is very very largely determined by the manner in which it gets its living.

Again, let this *Gelasimus* crab be a witness of the truth of the fact, that the aim of preserving the type—in other words of winning a mate and leaving offspring—has a great effect in shaping an animal. Here are two specimens of *Gelasimus annulipes*—a male and a female. Now the females of this *Gelasimus* are relatively scarce, while the males are relatively very numerous, so that it is a difficult thing for the male *Gelasimus* to win a wife. To obtain a wife he must fight with his fellows, and this necessity of existence has led to the wonderful development of one of his chelipeds as a fighting weapon—a development so extraordinary, as to make the animal a rather ridiculous appendage to his own claw. That this claw is not otherwise necessary for existence is proved by the fact that the female does not possess it.

In a nexus of animal life the necessity to get a living—*i. e.*, the necessity to eat—involves and implies a necessity to escape being eaten, and this necessity to avoid falling a victim becomes a third factor of great importance in determining the forms of animals. As an extreme illustration of the influence of this third factor, let me show you this beautiful specimen of *Oreophorus*—a small, timid, inoffensive crab which, for the purpose of concealment from its enemies, has become so modified in form as to resemble a piece of eroded coral shingle, rather than an animal.

To recapitulate then, we find one, or all, of four principal factors at work in determining the peculiarities of form of animals—*viz.*, (1) peculiarities in the

inorganic environment; (2) the necessity to kill and eat; (3) the necessity to avoid being killed and eaten, and (4) the necessity to obtain a mate.

Before proceeding to consider the play of these four factors in the depths of the sea, we must briefly explore these depths and discover the nature of the first factor. Comparing the subaqueous surface of the sea bottom with the subaërial surface of the dry land, we find a great contrast between the two. The surface of the dry land is sculptured and diversified in multitudinous ways by all those forces classed by geologists as 'epigene—*i.e.*, by rain, by runnels and streams and rivers, by alternating periods of moisture and drought, and of heat and cold, by ice, by winds, by movements of the sea itself, even by plants. On the floor of the ocean none of those epigene forces are present, and in consequence there is very little diversity of surface. We find, it is true, great plains and great valleys and great mountain-chains—the Bay of Bengal for instance is a vast plain nearly 1,000 miles in greatest breadth, broken only by the one long narrow mountain-chain, which at places rises above the surface of the sea as the Andaman Islands—but everything is on a vast and monotonous scale, without diversity because there are no sculpturing forces at work, no inequalities of temperature, no alternating periods of heat and cold, no winds, no movements of the water (for waves are quite superficial, and even great currents, such as the Gulf Stream, do not extend to any great depth below the surface), no plants.

Another great difference between the surface of the land and the bottom of the depths of the ocean is that the bottom of the ocean is entirely screened from the heat and light of the sun by the intervening mass of water. Every one here is familiar with the fact that the intervention of clouds, which are simply finely divided masses of water, between the sun and the earth's surface results in gloom and in a reduction of temperature. Now apply this familiar phenomenon with thousandfold intensity to the bottom of the ocean, between which and the sun there is interposed, not for a day or two a layer of cloud, but for ever a volume of water often several miles thick. Even in 15 fathoms depth, as seen by the water-glass on a fine sunshiny day, the light that reaches the bottom is much subdued, giving more the appearance of moonlight than of direct sunlight. Experiments by Messrs. Fol and Sarasin in the clear waters of the Lake of Geneva, in winter time, proved that sunlight there does not penetrate to a greater depth than 155 fathoms. They sunk photographic plates, suspended from a buoy, to various depths by night, and left them exposed all the following day, with the result that at about 155 fathoms the plates were unaffected. In the open ocean, where there is absolutely no sediment, and in the tropics, where the sun's light is fiercest, it is generally allowed that no light whatever penetrates to a greater depth than 200 fathoms. Below that depth all is eternally dark.

Not only is the sun's light cut off. We know how clouds shield us from the sun's heat rays, and similarly at the bottom of the ocean the sun's heat is

completely cut off by the overlying water. Even in the Bay of Bengal, at a depth of 20 to 30 fathoms, there is a fall of temperature, compared with the temperature at the surface, of 2° to 3°. At 200 fathoms in the Bay of Bengal the thermometer would stand all the year round at about 55° Fahr., at 2,000 fathoms it stands all the year round at about 35° Fahr.

To get an idea, then, of what the ocean-bed is like, we must imagine great plains, thousands of miles in extent, broken here and there by great valleys with very gently sloping sides, and by great mountain chains rising here and there into land. Minor inequalities of surface there are none, for the good reason that none of those forces which wear and sculpture the surface of continents are in action. All is absolutely still, the darkness must be something that we can hardly conceive, and the temperature is near the freezing point.

Plant life is of course absent, for plants can grow only in the presence of sunlight, so that we must imagine these vast dark silent plains and valleys to be absolutely bare. It is difficult to conceive that life can be found in the midst of such desolation ; and yet the researches of the last 20 years have proved that these cold, dark abysses teem with animal life, and are quite as well inhabited as the warm tropical reefs. Another factor has to be considered. At the surface of the sea we are accustomed to the presence of the superincumbent atmosphere only, a pressure which amounts to 14·7 lbs. on every square inch of the surface of our bodies ; but water is infinitely heavier than air, and the animals which live at the bottom of the sea are subjected to the enormous pressure of the superincumbent ocean. Now, a column of water 33·7 feet high exercises the same pressure as the whole column of the atmosphere. Let us say in round numbers that a column of water 5½ fathoms high exercises the pressure of one atmosphere ; then a column of water 2,000 fathoms deep exercises a pressure of 363 atmospheres—a pressure that is of 363 times 14·7 lbs, or in round numbers of 2 tons 8 cwt. That is to say an animal placed at a depth of 2,000 fathoms has to support a pressure of 2 tons 8 cwt. on every square inch of the surface of its body. We now know the conditions under which animals live at the bottom of the ocean : (1) they are subjected to an enormous pressure ; (2) they are absolutely deprived of sunlight ; (3) they live in a medium, the temperature of which is only slightly above the freezing point ; (4) as there are no plants for them to eat they are carnivorous, and therefore highly rapacious.

At the outset of this lecture we realized the fact that the forms of animals are profoundly modified by the direct action of the conditions of their inorganic environment ; and by means of these specimens I propose to illustrate some of the ways in which deep sea animals are modified by the peculiar circumstances of their inorganic environment. Here I hand you a specimen of a deep sea fish, *Tauredophidium hextii*. *Tauredophidium* is closely allied to the blind fish that inhabits the underground waters of the great Mammoth Cave of Kentucky. You observe that it is quite blind. Underneath the skin, in the posi-

tion where eyes ought to be, there are indeed the rudiments of eyes, showing that it is descended from ancestors that had eyes, but it itself, living in darkness, is quite blind ; it has no need for eyes, eyes would be liable to be injured, and are therefore a disadvantage, and so they have been gradually eliminated by natural selection. These crustaceans, *Polycheles*, *Nophropeis*, and *Lyreidus*, are also blind. They have eye-stalks, like their close relatives the lobsters, but the eye-stalks, like those of *Cambarus*, carry no eyes. It commonly happens that the absence of eyes is compensated by the development of organs of touch—just as a blind man feels his way about with a stick. This beautiful specimen of *Bathypterois* illustrates this compensatory development: its eyes are not quite lost, but they are quite rudimentary, and in compensation the fin-rays are enormously prolonged, and are abundantly supplied with nerves. On the other hand there may occur, and there actually does occur, another line of development equally interesting, and perhaps even more wonderful. Animals may become adapted to darkness by becoming blind—surrendering at once, so to speak, to the irresistible force of their environment like *Tauredophidium*, &c., &c. Other forms, however, when deprived of sunlight, may meet the difficulty by manufacturing their own light, just as man when deprived of sunlight by the daily rotation of the earth manufactures fire sticks and candles. There is nothing really out of the way in animals thus developing light by the combustion of their own tissues. The familiar fire-fly is a daily illustration of this common physiological phenomenon. In the fire-fly certain cells situated on a certain part of the abdomen undergo chemical changes which result in phosphorescence—the albumen of these cells is burnt or oxidized, it is converted into uric acid, and urates, with the evolution of light, just as the muscles of other animals are burnt and converted into urates and urea, &c., with the evolution of heat and mechanical motion. Again it is well known to all voyagers by sea that most marine animals are at times luminous. Now in certain deep sea animals living in constant darkness, this luminosity is very highly developed. Cells in particular regions of the body become aggregated to form glands, the secretion of which is brilliantly luminous. These fishes, *Thaumastormias*, *Gonostoma*, and *Leptoderma*, illustrate this, as also do these crustaceans, *Nephrops*, *Aristaeus*, and *Heterocarpus*. In this case the eyes, instead of aborting, are very singularly developed, being of enormous size, like those of owls, to catch all the comparatively feeble light of their own manufacture. These illustrations, then, must suffice to show some of the modifications of structure imposed by the peculiar conditions of life at the bottom of the ocean.

Let us next consider some of the modifications which follow from the action of the law "kill and eat," a law which acts with peculiar rigour in the depths of the sea, because there are no plants there, and carnivorism is a universal rule. If there are no plants, how is the cycle of life carried on? On dry land we know that plants are the great manufactures manufacturing

food for the consumption of animals—all animals either living directly on vegetable food, or being dependent on it indirectly, as in the case of the carnivora which eat the herbivora. Animals in turn furnish carbonic acid to the plants for food, and when they die, are ultimately converted into salts and gases which may serve as food for plants. Thus we get a cycle, a constant succession, of changes of life ending in death, and of death ending in life. But in the deep sea this series seems to want a link, for we have no plants to manufacture food out of inorganic substances. The wanting link, however, is only apparently wanting. Whence then the ultimate food supply? It is supposed that it all comes from the surface. The surface of the sea is crowded with organisms, both animal and plant, and there appears to be an incessant rain of small food from the surface. Great rivers also carry into the sea a large amount of water-logged matter that finds its way to the bottom. On food derived from these sources, the smaller and lowlier forms feed, and the larger and higher forms feed in turn on the lowlier forms. This necessity for catching prey impresses a very distinct mark upon many deep sea animals, which are horribly rapacious. This is best seen in certain fishes which have the teeth enormously magnified, and the mouth capable of even greater distention than that of a serpent. In this specimen of *Thaumastomias*, the lower jaw is practically a great rat-trap attached to the head simply by a long elastic muscular band, and capable of being turned completely over the head. In *Ponerodon* we have a somewhat similar mouth with large hinged teeth : from the stomach of this specimen of *Ponerodon* I removed the remains of a fish weighing more than the *Ponerodon* itself, the animal being a mere appendage of its own abdomen. In *Polycheles*, again, observe the long chelipeds, and that all the " feet " end in chelæ.

The third factor we may now consider is, that which covers the modifications due to the action of the law, " avoid being killed and eaten." " Protective resemblances" for the purpose of deceiving enemies appear to be rare in deep sea animals, and we can easily understand that it must be so, seeing that there is no light. Coloration, which is so largely developed in land animals for purposes of protective resemblance, cannot come within the scope of natural selection where light is wanting. Hence deep sea animals are commonly sombrely and uniformly coloured in harmony with the uniform sombre gloom of their habitat, deep black being common, and deep purple shading off to red and pink.

The action of the fourth factor—sexual selection—appears also to be much hampered by the want of light. However, our knowledge of the deep sea fauna is not yet comprehensive enough to allow us to make any definite statements on this subject. So far the only case of difference in form between the male and female which has come to my notice, is in this specimen of a male of *Neobythites pterotus*, which has the pectoral fin-rays much prolonged, perhaps for the purpose of feeling for the female. At any rate, in the female the rays are of the ordinary length.

MISCELLANEOUS NOTES.

No. I.—QUAILS BREEDING IN CAPTIVITY.

In June or July, 1891, I bought a large cage with 20 or 30 birds in it; among them 3 bush-quail cocks: one died soon after. In August or September, 1891, I rescued a hen bush-quail from the hands of my cook, who was about to slay her, and I put her into the cage. Soon afterwards she began to lay, and up to this (January, 1894,) she cannot have laid less than 60 eggs. One of the cocks died last November. At the beginning of December I put a "sod" of grass into the cage; the hen almost immediately made a nest,—that is, she pressed down a small circular portion of the grass,—and laid five eggs. I let her sit. Three weeks afterwards I broke one of the eggs; there was a partly developed chick in it, alive. A few days afterwards I broke another egg: contents bad. Then, as I thought it best to make the bird cease from sitting, I broke the other three eggs; one was bad, but in the other two were fully-formed chicks, dead. I believe that if the other (many) birds in the cage had not disturbed the sitting quail, she would have hatched her eggs.

R. P. BRUNTON.

15*th January*, 1894.

No. II.—*SAUROMATUM GUTTATUM*, SCHOTT.

In the "Flora of British India," Vol. IV, page 509, it is stated *S. guttatum* is confined to N.-W. India, except Schott's specimens should prove to be from the Concan, of which there is no evidence.

A root collected at Tulsi near Bombay has flowered in the Botanical Garden of this College during the last few days and proves to be this species. The description in "Flora of British India" is good, and the figure in Wight's *Icones Plant.*, n. 800, is unmistakable.

G. MARSHALL WOODROW.

College of Science,
Poona, 28*th January*, 1894.

No. III.—NOTES ON *CALLEREBIA NIRMALA*, MOORE, A SATYRID BUTTERFLY.

On the 5th of July, 1893, I caught at Mussoorie, a hill-station in the Western Himalayas, a female example of *Callerebia nirmala*, Moore, which the same day laid eight eggs on grass.

The eggs are pearly-white, irregularly globular, slightly flattened at the top and bottom like an orange, and resemble seed-pearls both in colour and shape. They are about the size of very fine grains of sago. They were laid on the blades of grass, but fell off at once when the grass was touched. On the 16th the eggs turned yellow and remained so till the 20th, when a slight dark mark

was visible on the top of the egg, in shape like a crescent. On the 21st this mark had enlarged, and the head of the caterpillar was distinctly visible, the rest of the egg being of a dirty pink shade.

July 22nd.—Five larvæ emerged by eating away the top of the shell. The rest of the shell is left untouched. The larva, when newly hatched, is a little over $\frac{1}{8}''$ long, white, with a few fine white hairs or down. It resembles a flat white maggot more than anything else. Head black, very large for the body, heart-shaped. The body tapers a little towards the tail.

July 28th.—Larvæ nearly $\frac{1}{4}''$ long, of a blue-green colour, fading to yellowish at the tail. The body is thicker at the head, and tapers regularly to the tail. It is covered with minute white hairs. Scarcely perceptible lines of a brownish tint extend from the head to the tail.

August 12th.—The body is very much thicker in the middle, tapering towards the tail. The larvæ were now $\frac{5}{16}''$ long, and very pretty. Head flat, rising to two little points at the top. By degrees spots and lines made their appearance, and on the 27th of August I described the nearly full-grown larva as follows:—Length $\frac{1}{2}''$; fusiform; from the front the head looks like that of a cat with ears erect. The body tapers more from the middle to the tail than from the middle towards the head, and terminates in two little pointed tails. Head and body fawn-colour, with the following markings :—two ear-like projections on the head, and a line on each side of the head, dark brown. Minute brown lines forming a square on the face. A narrow dorsal dark brown stripe, much darker from the middle of the body to the tails, bifurcated anally. The sides are ornamented by five narrow yellowish-white lines, the two upper ones undulating, the three lower ones straight. Two minute subdorsal dark brown spines on the 3rd segment, two on the 4th, and one dorsal one on the 13th. An irregular subdorsal series of dark brown spots, one on each of the 6th, 7th, 8th, and 9th segments. A narrow spiracular dark brown line. Legs, claspers, and abdomen, fawn-colour. The whole body presents the appearance of a piece of very finely woven repp. On the 31st of October I brought the larvæ from Mussoorie, in the hills, to Bankipore, in the plains, and fed them on various kinds of grass.

The larva, when full grown, is $1\frac{1}{4}''$ long. The markings are the same as described above, only more spread out.

December 24th.—One larva suspended itself by the tail, and remained in that position for two days. I found it changed to a chrysalis on the morning of the 27th. The chrysalis is brown, wing-cases paler and more of a reddish-golden-brown. Shape, much the same as *Lethe sidonis*, Hewitson.

January 19th, 1894.—Butterfly emerged.

February 7th.—A second imago appeared to-day. These, like their parents, are distinctly *C. nirmala*. It would appear, therefore, that this is a distinct

species, and not a seasonal form either of *C. annada*, Moore, of *C. hybrida*, Butler, or of *C. scanda*, Kollar.

MRS. S. ROBSON.

BANKIPORE, *7th February*, 1894.

NOTE BY MR. DE NICEVILLE.

Mrs. Robson is to be congratulated on her discovery for the first time of the egg, larva, and pupa of a species of *Callerebia*. Until now no one had succeeded in doing so. From her account of the life-history of *C. nirmala*, it is evident that, like nearly all the temperate species of *Satyrinæ*, the species of *Callerebia* occurring in the Himalayas are only single-brooded; so with them there can be no question of seasonal forms. It is further obvious that they hybernate in the larva state, as, but for the fact that Mrs. Robson brought her living larvæ in the autumn from the cold Himalayas to the hot plains and thus forced them to premature perfection, there is no doubt that the butterflies, instead of emerging from the pupa in February, would have done so in June, thus completing the full cycle of a year, the larvæ in a state of nature attaining their full size and pupating in the spring after the winter hybernation.

No. IV.—*PSAMMOPHIS LONGIFRONS.*

On page 406 of Vol. VII of our journal there is an interesting account of a fine specimen of the above secured by Father Dreckmann. I am glad to be able to present the society with a specimen new to the collection. The snake was caught by myself in the Umargaon Taluka of Thanna, a few miles from the coast and from the Damanganga River, in April, 1891. It was found in grass on a dry and rocky little hill, and tried to escape by taking refuge in the ground. It was very agile, and nearly succeeded. Father Dreckmann has the credit of discovering the arboreal habits of this snake, but it is probably as much at home on the ground. More information is needed, but in any case it is most interesting that a snake of so desert a type as *Psammophis* should be found in forest trees in the moist climate of Kalyan.

F. GLEADOW.

POONA, *February*, 1894.

No. V.—THE FLAMINGO BREEDING IN INDIA.

I send you a letter which I received some time ago from the Rao Sahib of Cutch together with several eggs of the Flamingo (*Phœnicopterus antiquorum*).

BHUJ, 5th October, 1893.

MY DEAR MR. LESTER,

I have caused a letter to be sent to Khadir to inquire the name of the spot where the Flamingo's eggs were found and shall let you know when an answer is received. In the meantime I have looked up the letter which came with the eggs sent last year by the official at Khadir. This letter is dated 23rd October, and I received with it about 20 eggs and two recently hatched flamingoes. The eggs were easy to blow, as the young ones were not formed inside. From this it seems safe to conclude that the flamingoes lay in September and

October. The letter further says that the men who picked up the eggs found numerous nests in one place on the Runn.

Yours sincerely,
RAO KHENGARJI.

I think His Highness can claim to be the first who has discovered for certain that *Phœnicopterus antiquorum* does breed in India.

C. D. LESTER, Lieut.,
17th Bombay Infantry.

Cutch, 1*st March*, 1894.

No. VI.—MEASUREMENTS OF TIGERS' SKULLS.

Referring to the note by Mr. W. S. Millard in the last number of the Journal, I beg to send you the measurements of two tigers shot by me this year in the Central Provinces. They were both carefully measured as they lay on the ground before being skinned. Tiger No. 1 measured 9′ 10″ from nose to tip of tail ; length of tail 3′ ; the skull measures $13\frac{1}{2}'' \times 9\frac{1}{4}''$. Tiger No. 2 measured 9′ $10\frac{1}{2}''$ from nose to tip of tail ; length of tail 3′ $3\frac{1}{2}''$; the skull measures $14'' \times 10''$.

H. F. CLEVELAND, Surg.-Capt.,
5th Bombay Light Infantry.

Bombay, 1*st March*, 1894.

No. VII.—MUSCULAR ACTION AFTER DEATH.

While dealing with a big cobra the other morning, the quiver of his dying tail recalled to my mind an incident, connected with one of his race, that occurred to me several years ago. The narrative may be of interest to members of the Society, although the curious circumstance described is possible of explanation as a mere accident.

I was out quail-shooting one morning with a friend at Dharwar when we put up a cobra. A charge of small shot failed to stop him, and he escaped to his hole on the maidan and was nearly in when another shot stopped him, and he lay with his tail outside the hole.

Wishing to examine him, we pulled gently and then firmly at that tail, but could not stir him. Resolving to put on more power, we took a rumal from one of the beaters and tied the tail to a stick and put on two men to pull. The result was that the snake came in half, and with the jerk the tail portion was unloosened from the stick and fell to the ground at a short distance from the hole.

Then the marvel followed. This piece of tail, about two feet in length, proceeded to act as if endowed with sense. It wriggled towards the hole, but, missing it went a foot or two beyond. Then it stopped and, as if it knew it had gone wrong, wriggled back again, and this time struck the hole and went down it and disappeared.

I remember that we all stood aghast, and that my friend and I found little encouragement to repeat our story in the station.

I mentioned the incident in a letter home at the time, and in reply was informed, on the authority of the Parish Clerk, that it was a well-known fact that, if you cut an adder in two, the tail will follow the head.

Also I found something like it in Lucretius, but the poet describes the head as going in search of the tail, and not the tail of the head.

The experiment is easy of repetition, but one does not often get the opportunity of pulling a lively snake in half, and there are obvious objections not only on the score of cruelty.

It would be interesting if some of our naturalists have any lore on the subject to communicate.

E. J. EBDEN, I.C.S.

CAMP, AHMEDNAGAR DISTRICT,

1*st March*, 1894.

No. VIII.—FERTILIZATION OF THE VANILLA FLOWER BY BEES.

"Autrefois l'élevage des abeilles constituait une industrie importante ; Cuba exportait alors de grandes quantités de miel et de cire. Délaissé dans ce dernières années, ce genre d'exploitation, encouragé par les demandes croissantes des consommateurs américains, reprend à nouveau et c'est par millions que se chiffre l'exportation aux Etats-Unis."

"Ce résultat en amène un autre. La reprise de l'apiculture à Cuba donne une impulsion vigoureuse à la culture du vanillier, *Duranta plumiere*, la fécondation artificielle devenant inutile, affirme-t-on, et les abeilles y suppléant. On s'est souvent demandé comment il se fait, alors que des capitaux immenses sont engagés, en Chine et aux Indes, dans la culture du thé, que celle de la vanille, bien autrement lucrative, quoique d'une consommation autrement restreinte, attire si peu l'attention des planteurs. En gens pratiques, les Américains ont compris les grands bénéfices qu'elle pouvait donner aux Antilles, où le sol et le climat sont des plus favorables à cette liane originaire du Mexique."

VII.—Le monde Antilien. II.—Cuba, Puerto-rico, par M. C. de Varigny. *Revue des Deux Mondes*, 1st January, 1894, p. 185.

For the benefit of members that do not happen to read French, I may say that the pith of the passage quoted from the *Revue des Deux Mondes* is as follows :—

Formerly the Cubans, like other Vanilla cultivators in many tropical countries, had to fertilize their Vanilla flowers by hand, because the plant, an exotic orchid, depends in its native country for fertilization on an insect that no one had managed to induce to follow the plant across seas.

Now the Cuban bees, whether themselves indigenous, or, as is more probable, naturalized European bees, have learnt to do the fertilizing for their masters, and given a great impulse to the cultivation. The other countries which have been producing vanilla by artificial fertilization must, if this is the case, either use bees too—or be undersold.

W. F. SINCLAIR, I.C.S.

TANNA, 1*st March*, 1894.

No. IX.—THE BUTTERFLIES OF MATHERAN.

I notice in the last number of the Society's Journal a list of the butterflies of Matheran. It is some years since I have been there, and I do not remember accurately all I have caught there. I, however, certainly have caught there both *Lethe europa*, Fabricius, and *Apatura camiba*, Moore. These might, therefore, be added to the Matheran list.

J. DAVIDSON, I.C.S.

KANARA DISTRICT, 7*th March*, 1894.

No. X.—BREEDING SEASON OF THE SPOTTED-BILLED DUCK.

Vet.-Maj. G. F. Rayment asks on p. 442 of the Society's Journal (Vol. VIII, No. 3) if any one has noticed how late the spotted-billed duck, *Anas Pœcilorhyncha*, breeds. I have shot flappers of this species in the Kod taluka of the Dharwar district, about ten miles from the northern frontier of Mysore, in the middle of November. They were very nearly full-grown; but the *remiges*, or flight-feathers (quills), had not developed.

C. HUDSON, I.C.S.

CAMP BASSEIN, 14*th March*, 1894.

No. XI.—COLD-WEATHER SHOOTING IN RAIPUR.

When I saw the Honorary Secretary in October last and told him that I was going to pass the cold weather in camp in the Raipur jungles, he said, "You will have lots to tell us for the Magazine;" the result has not come up to the anticipation; in the first place I have have had to contend with much bad luck and much fever. As I have been in camp, with the exception of about fifteen days, in Raipur from the 1st November to the 1st March, I may consider this period as the cold weather.

A correspondent in the *Pioneer* lately said that tigers jostled each other in Raipur; this is theory; from the 7th November to the 20th December I had garahs out in every direction; I did not have a single kill from a tiger, and only one from a panther; I left my garahs down for several days, and I did not shift camp very frequently, to show on what sort of lines I worked; lately a friend (whose camp was about 8 miles from mine) and myself had about

fifteen garahs out between us for three days and eleven for six days; the amount of ground covered can be imagined; result—one kill by a panther; there was no lack of fresh pugs, but in the cold weather a place where there are fresh pugs is the most unlikely spot for a kill as a rule. Twice I should have got a certain kill if it had not been for the obstinacy of my shikaris in this matter: native shikaris have two articles of faith—one is that it is no use tying up unless there are fresh pugs, and another that, if there is no blood, it is a miss; I am glad to say that I converted mine on both these points. I found the greatest difficulty in getting information of village animals killed by tigers, it was quite the exception for information to be volunteered. I saw a full-grown buffalo which had a narrow escape from a tiger, who must have sadly miscalculated his spring, as the buffalo was clawed at the back of its hind quarters, one very bad wound involving the anus: I am surprised at the tiger attacking a full-grown buffalo, especially as the tiger (which I shot) was only a young one.

This tiger must at one time have had an encounter with a porcupine in which the former did not have all the honours, for, on skinning him, I found pieces of porcupine quill, some nearly three inches in length, in his foot, head and body; these had evidently been in a long time, as there was no trace of any external wound, and the quills were very much discoloured and worn; they were between the inner layers of the skin.

Panthers I also found decidedly scarce; one was the smallest one I have ever seen and seemed all tail (I missed it sitting over the kill). I was surprised at finding it on the kill when I went to inspect it between one and two o'clock in the day. It was a long time before I could make myself understood when I wished to enquire about panthers and chital, when neither tendwa or chital was understood; however I at last got hold of the difference, *viz.*, *Chitwa* for the former and *Chita* for the latter; this, however, does not seem to work everywhere.

There was a custom in the case of a tiger being shot which was new to me, or at least which I do not remember, *viz.*, when the dead tiger was being brought in, the women of the village used to put a rope across the road and refuse to let it pass until they received *backsheesh*; it would be interesting to know when this originated; I am afraid that they never get any thing out of me.

There is a deal of latent pluck and folly combined about a native; how frequently do we hear of a herd driving off a tiger which has attacked one of his cattle with no more formidable weapon than a stick; a case occurred near here only last week; the tiger, however, resented the interference and made for the man, who died of his wounds.

Bears were fairly numerous. I was having a beat for a tiger on one occasion; behind me was an open space about 300 yards across, then grass; during the beat two bears at different times came close to me; they both behaved in

exactly the same way, they would not face the little bit of open; they went a little way on it, then back they came and sat down close to me (to consider I suppose); there was jungle all round the open, so they might have cut across, but they appeared not to be able to see that there was, which no doubt was the case, on the other side of the open their sanctuary. I shot a she-bear and her cub, which was nearly as big as his mother, but was still being suckled. Bears frequently take a lot of killing on account of the difficulty in placing one's shot in a mass of fur; I was rather surprised at one I shot in the shoulder, breaking it, but not injuring any internal organs, it was up on its hind legs facing me, it went off quick enough, but did not go far before I heard it grizzling; I went to the sound, about 200 yards, and found him lying down bemoaning his luck; he was off again as soon as he saw me, but I knocked him over. My experience is that bears are easily knocked over, but they very quickly recover sufficiently from a most severe wound to get clear away.

I made two small excursions into the buffalo country and saw a fair number, but did not bag a bull; I could not make out that there was a bull in the small herds of six and under which I pursued; if there was a bull, he must have been quite young and with very small horns. A buffalo which I killed was an object-lesson for those gentlemen who are advocating small-bore rifles for big game; I wounded it and had to follow up in thick jungle with much foliage. I could never get a fair shoulder-shot, but put four more bullets into its body without stopping it; my sixth shot at the root of the tail brought it down, and I finished it with a ·500 Express behind the horns; all the other six shots were from an 8 bore with 6 drams powder; if I had not made the lucky shot at the root of the tail, the buffalo might have "eaten" more bullets; all my shots were within less than 15 yards; I kept coming on the buffalo amongst the thick foliage, and as it was off as soon as it saw me, all my shots had to be snap, but, as I said before, they were all in the body; this shot behind the head I found a capital one for finishing off wounded animals. I killed one of my garahs to put it out of its misery—it was in an awful state—and a sambhur instantaneously with my Rook rifle with this shot.

As regards deer, I was woefully disappointed; I only saw one sambhur, male or female, and very few chital; of the latter I saw three stags, but with very poor horns; discounting the grass and the foliage, I am sure they are both remarkably scarce, I have beaten hills for the former, where the natives said there were "*bahut, bahut*," without seeing anything; I think the cause of chital being scarce is the native shikari, as the part of Raipur I have been in (south of Sambalpur road) has many villages and much cultivation, so they really have not a chance; in fact in a few years to come Raipur will be played out as a shooting ground. New villages are constantly being settled. As an instance I will take Sankra on the Sambalpur road; a very few years

back you could find buffalo within a mile of the dâk bungalow I am told ; it is necessary to go a good many miles now before you would see one ; I walked one evening about four or five miles up the river, the Jonk Nadi, without seeing anything whatever except fresh clearings. I neither saw nor heard a barking deer. I saw a few four-horned antelope without horns—they are called universally "*Kotri*"—a few nielghai, and that is all. This scarcity of deer quite spoils the pleasure of a shooting expedition, as it is always pleasant to see some life in the morning or evening walk : I nearly always was out in the early morning and always in the evening, and as a rule saw absolutely nothing ; in fact latterly my shikar diary nearly daily contains the following entry : "Morning stroll, usual result ; evening walk, as usual." My beats also were so deplorably lifeless ; I have beaten lovely hills and jungle ; perhaps I might see two or three peafowl, but generally not that, nor even a monkey ; not a single jungle or spur foul did I ever see.

Of miscellaneous animals I was annoyed by wild dogs once or twice ; natives call them "*Kog*" (*g* hard) ; on one occasion I had *kubber* of a panther kill, so rode out 6 or 7 miles to arrange about a *machan* being made, only to find out that about ten or eleven o'clock a pack of wild dogs had come down the nullah and eaten up every bit of the kill. Wild dogs seem to be later on the prowl than other animals ; whether they turn out at a corresponding later hour in the evening I do not know, but I have come across them when every other predatory animal would be ensconced for the day.

Porcupines I saw two in beats.

The universal pig, of course, was common enough. One evening sitting up over a kill I was interested by their behaviour, they went all round the kill and remained in its neighbourhood all the evening ; they apparently devoured the droppings of the vultures, but never offered to touch the kill ; one pig came under my *machan* and evidently winded something as he sniffed about for some considerable time, but appeared satisfied at last ; the panther did not come to the kill, nor would this be accounted for by it not daring to face the pig, or ought the panther to be master of the situation ? I cannot imagine a cat-sized panther, which I have referred to above, being able to frighten off a number of full-grown pig ; at last, as it was too dark to see to shoot, I decided to give up, but as a pig was under my *machan* and several close to it, I decided to try the effects of the sound of a whistle to see if it would alarm them ; I had with me what is known as a policeman's whistle ; I blew this as hard as I could ; not one of the pig took the slightest notice. I have mentioned that the pig did not touch the kill ; at another place I had a kill from a tiger (which I shot) ; the next morning my shikari reported that pig had eaten up all the kill. Why should they have done so in this case and taken no notice of the kill in the other ?

Jackals, of course, were present in body and in voice ; as we know, they are not usually of a particularly timid nature, and I was very much amused—at

least as much as one can be amused with one's temperature about 104° F.—one evening sitting over a kill to see the scared way in which a jackal tried to snatch a little meat from the kill ; however he unfortunately did not remain until the panther came, which it did very shortly and gave me a shot on which I would stake my life, but I was so weak and shaky that I missed.

A common jungle cat (*F. chaus*) annoyed me at one camp ; why it should have such confidence in man I cannot imagine ; in this case it was misplaced ; it sat at the corner of my servants' tent one night and let me, without any stalking, walk up and shoot it—range 5 yards.

When I was sitting up on one of the occasions above mentioned, an animal which I take to be the long-tailed mongoose (*H. jerdoni*) with great circumspection came up to the kill, sitting up every now and then to have a look round ; though it sniffed all round the carcass, yet it did not touch it ; it, I fancy, smelt our foot-steps and was afraid.

I yesterday found a musk-rat in my bath, but as this is Sambalpur, it cannot count. At one of my camps a wolf was reported to have jogged slowly through my camp ; I was out for my evening walk at the time, so did not myself see it.

I think that with the hyæna, of which I saw two, and the hare, of which I came across about six, I have closed my list of quadrupeds.

As regards man himself, the country I was in was too civilized for jungle tribes, such as Gonds and Bheels ; I came across one or two individuals who were not cultivators, and that is all. The Europeanized shikari is also developing ; I even saw one of my shikaris—a well-known one to those who have shot in these parts—walking about in the sun in December with an umbrella of the bazaar type opened, in addition to being covered up more or less with cast-off Europe clothes.

It must be remembered in cold weather shooting that in November, on account of the rice harvest, there are difficulties in getting beaters together. Again in the grass districts, in the latter half of February grass-cutting is going on, which disturbs the whole place. The language of the country is Hindi.

I will now turn to the birds. I must first state that on account of more than two years' absence from the country my ornithology has grown rusty, and killing a bird merely for the sake of putting a name to it is now rather repugnant to me. Raipur is what is called a tank district ; do not imagine that this means it resembles Guzerat ; on the contrary it means that water is very scarce and that the inhabitants draw their water-supply from tanks ; at one village I was at, the water of the universal tank already stank ; what it will be like in the hot weather can be imagined. In Raipur I did not shoot a single duck with the exception of one teal ; I saw a few duck on one tank ; on suitable tanks there are generally whistling teal and cotton teal. The flock of common teal, out of which I shot one, were the only teal I saw. Snipe were exceedingly scarce ; I am told it is a very bad year in this district for both duck and teal ; I saw two painted snipe and no jack. Her (Bosna, which is *maidan*) there are one

or two tanks with sufficient duck on to amuse one, but in no great quantities; nukta, red-crested pochard (*F. rufina*), and ganganey teal are what I have bagged.

Peacock in suitable places are in fair numbers. I have seen and shot a few painted partridges and two florican; there are no grey partridges. I was told that there was no quail in the district, but the common quail at all events this year is generally distributed; I have also shot a rain quail or two, and some small quail which I did not identify; the crop of the country is rice; when that is cut, except here and there, where there is an odd patch or two of irrigated cultivation, the fields remain bare; so the only place to find quail is in the grassy "*bands*" between the rice fields. This is taken advantage of by the native bird-catcher who walks along the "*bands*" with a large oblong net over his head, beating the grass as he goes along. As regards species of water-birds which I saw, I could count them on my fingers, probably on one hand; even the common pied kingfisher was scarce. *Hurrial* are generally to be found about villages, and the common grey hornbill, locally called *danêis*, is not uncommon; both make a welcome addition to the bill of fare. I saw five wild pigeons near Bosna; in fact it seems to me that I am better situated as far as ornithology and entomology are concerned in Sambalpur than in Raipur, but as I have seen so very little of the former, I can say nothing for certain.

Before I came out I received a commission to catch pretty butterflies, but I have seen none but the commonest kinds; but as none have English names and my Indian nomenclature has lapsed, I can say no more.

I have mentioned before that the principal crop is rice; here and there, however, there is a small crop of sugarcane of indifferent growth, some few patches of miserable-looking castor oil, a field or two of wretched cotton and gram, and a fair amount of bad "till"; on the other hand the linseed does not look at all bad. I was desirous of photographing some Indian crops as they stood in the field. I have not seen anything worthy of exposing a plate on (I do not allude to rice).

The jungles seem composed for the most part of various more or less useless timber, principally *saj*. I have often, on the march through jungle, asked my shikari the name and use of every sort of tree I passed, and the reply to the latter query was in nearly every case "Of no use." My other botanical observations were principally practical. Various villages have weekly their market-days or bazaar-days; at most of them tomatoes, brinjals, a green equivalent to spinach, onions, etc., can be obtained. A most important discovery I made at Bosna (Sambalpur road) is that potatoes can be obtained in quantity; they are brought from Raipur. I find native tobacco—the dark and mild sort—very good when smoked in a leaf-pipe after the native fashion; the light-coloured leaf is too strong.

The only poisonous snake I saw was one very large cobra, which suddenly appeared out of a white-ants' nest at the foot of a tree, round which a number of men were sitting ; luckily it was slain before any harm was done. It seems strange to me that so many natives cannot discriminate between a harmless and poisonous snake ; they seem to know as little about what must be an only too common object as if they had never seen a snake before. Having now descended from unavoidable and constantly regretted circumstances to the status of a globe-troter, I have committed my three months' experiences to paper. I, however, have not investigated the drink question except when my shikari has got drunk, nor the currency question except in one particular, which is that, when you pay your beaters two annas each, this two annas cannot be converted into food, drink, or raiment except at the rate of one anna three pies ; in fact the current coin of the realm in Raipur and in most other places is copper.

I was asked to notice any particular breed of dogs which I might come across, but I have not seen anything except the ordinary "Pie." By the way, what is the meaning of "Pie"? I have, however, been puzzling over the reason that so many of them have tails curled round like a pug or a Chinese dog, &c. I should have thought that, semi-wild creatures that they are, their tails would droop. The colour of pies as a rule seems to be for the many yellow, for the few black and tan. I saw about three black "Pies." I came across a very good black and tan dog of sporting proclivities, and evidently, from the sleekness of his coat, well looked after, but still unmistakeably a pie.

E. F. BECHER.

BOSNA, *March*, 1894.

No. XII.—ANNELIDE REEFS.

I am forwarding to you a couple of specimens of the Annelide Reefs of Kelve Mahim in the Tanna District.

All along the west coast, north of the Waitarna River, the coarse debris brought down by numerous local streams and torrents, with the sand of the Arabian Sea, and the finer silts and sands washed out of the Gulf of Cambay, are forming recent deposits over the (probably) Tertiary basalt, of very various quality.

The muddy character of the water is probably unfavourable for the growth of corals. But the place of these seems to some extent to be taken by tubicolous Annelides, probably of, or allied to, the genus *Serpula*, which are really here reef builders, though not to be compared in degree with the masons of the "massive corals."

The specimens forwarded will easily enable you to understand that their productions are here used in construction and have even, in Portuguese times, been used in fortification.

W. F. SINCLAIR, I.C.S.

TANNA DISTRICT, *March*, 1894.

No. XIII.—STALKING SAMBAR.

In the interesting account of Sambar Shooting which Mr. Inverarity gives in the last number of the Journal, he begins by stating that there is no deer-stalking in India: but India is rather large and few sportsmen have shot on all its hill ranges. I think it may interest some of your readers to know that there is at least one place where stalking sambar may be had, and where a good telescope is *absolutely* necessary. I refer to the Koondha range in the Nilgiri district, some 20 miles west of Ootacamund. The height is about 6,500 feet, a perfect climate at times, with delightful scenery of open grassy hills, with woods of rhododendron scattered here and there. Stag shooting is obtainable from November to April, but a license is required, which costs Rs. 30.

As the district shot over is comparatively small, large heads are now rare, but I believe there are several other hill ranges south of the Nilgiris where sambar can be obtained by stalking. I send you a photograph I took during a recent shooting trip among the Koondhas, which I hope will give you and Mr. Inverarity an idea of the country.

G. S. RODON, MAJOR,
The Royal Scots.

BELGAUM, 23*rd March*, 1894.

No. XIV.—WOLF CUBS.

I shall be glad to know whether the Indian wolf has ever been successfully trained to hunt with dogs, in a "bobbery" pack, as I hope to try the experiment before long.

Last month I came on the lair of a pair of wolves on the borders of the Runn of Cutch, containing 5 cubs (2 males and 3 females). I removed three of the cubs and left the others so as to tempt the parents back to their lair, hoping to be able to run them down with my greyhounds in the morning, but when I visited the place the next day before dawn, the old wolves had removed the two young ones during the night and had left their lair.

The three cubs, which I had taken, were successfully suckled by means of a village dog. Their foster-mother objected to them considerably at first, but soon became very fond of them, and will not leave them now. They are perfectly tame, come to call, and lick my hand, but they appear to be rather stupid, although exceedingly keen and plucky. All my dogs have taken a great fancy to the young wolves and play with them, but the wild parentage of the little cubs is especially noticeable at meal time when they bolt their food in the most ravenous manner imaginable. When they were only about three weeks old, they showed their hunting instinct by flying at the throat of a tame Chinkara fawn. Should they become unmanageable and dangerous, I shall send them to you for the Zoological Gardens in Bombay, but I still hope to train them to hunt with my "bobbery pack." They went out with me yesterday with the terriers and followed very fairly.

G. B. O'DONNELL, *Captain.*

MALIA, KATHIAWAR, 26*th March*, 1894.

No. XV.—HORNS AND SKULL MEASUREMENTS, &c.

I agree with Mr. Gilbert's remarks in your latest number of the journal that it would be of great assistance if some of our members, who must be acquainted with the Brow-Antlered Deer, would give us the benefit of some additional notes on the subject. In reckoning the points on the heads of stags, it was the custom, I believe, to count as a point anything on which a powder flask could be hung. If Mr. Gilbert bears this in mind, I do not think he will find any difficulty in determining the points of a "Thamin's" head any more than of the heads of its consin, the Swamp Deer (*Cervus duvauceli*). The Thamin's head, with the exception of the peculiar direction of the Brow Antler, is not unlike the head of the Swamp Deer—that is, they generally have a small point on each brow antler and four or five "on top." The beam at the top, where it gives out a number of points, is sometimes thickened, as in the Swamp Deer, but I think the horns are never palmated as is the case with the Fallow Deer (*Cervus dema*) found in Persia. As regards the last paragraph but one in Mr. Gilbert's paper, I may mention that all the measurements quoted were carefully made by myself.

With regard to Mr. Millard's article on Tigers' Skulls, there is or was in the collection of the Society the skull of a tiger presented by Mr. Shillingford, the measurements of which are precisely the same as Mr. Rowland Ward's, *viz.*, $14\frac{1}{2}'' \times 10''$. Mr. Cecil Gray in 1888 shot a tiger, I believe, over 10 feet; the skull measurements were $13\frac{11}{16}'' \times 9\frac{1}{16}''$: for comparison I will put one of my own (a good-sized male 9′ 5″) $13\frac{1}{4}'' \times 9\frac{1}{8}''$, and I think we may safely conclude that a skull over 14″ must have belonged to an animal longer than 10 feet.

The other day I was out stalking not far from here amongst some rocks. I came across a Muntjac (Rib-faced Deer) quite freshly killed by a panther ; its head and forequarters were mostly eaten, but what struck me as most singular was that the hairs on the rest of the body had been licked clean off with his tongue, just as if a razor had been used. It was quite easy to see where each sweep of the tongue had gone, and there on the ground were the hairs exactly as he had put them off his tongue. This was new to me, for I never knew a panther or tiger ever to take any trouble about hair on an animal, certainly they do not seem to usually, in the case of a calf or buffalo ; but I suppose the long and somewhat erect hair was too much for this gentleman's palate. I picked up the other day a fine Swamp Deer's head ; it has only ten points, but it is a good head. It had lain in the jungle some years, and I was going to send it to the collection in Bombay as an instance of deer eating their horns, for to my eye the chisel-shaped marks of the teeth are conclusive. In the jungle, however, I met an old friend (of about thirty years' shikar experience) and he pooh-poohed it, saying "Oh, rats and squirrels, even our prickly friend *Hystrix leucura*." It was a shock, but it was only too true ; the teeth-marks bear a great resemblance to those of rodents.

W. ST. JOHN RICHARDSON, CAPTAIN.

TOPLA, 23*rd March*, 1894.

No. XVI.—THE RUSSELL'S VIPER.

I think it may be worth putting on record that on the 4th January, 1888, two very large specimens (male and female) of the *Daboia russellii* were killed in my garden at Cuddalore, North Arcot. The male measured 5′ 6″ and the female 5′ 3″. Again, at Vellore, in November, 1890, I killed a specimen of the same snake in my verandah, which measured 5′ 6″.

F. G. BROOK-FOX,
Executive Engineer.

MULTAN, 25*th March*, 1894.

[Dr. Günther, in his "Reptiles of British India," states that the *Daboia* attains the length of 50″, and Mr. Boulenger in the " Fauna of British India " gives 48″ as a full measurement, but it is evident that both of these excellent authorities have considerably understated the maximum length of this snake. We have a specimen in the Bombay Natural History Society's Collection killed at Hurda in the Central Provinces by Mr. J. C. Anderson, which measured 62″. —EDITOR.]

No. XVII.—THE NUX-VOMICA TREE.

All lovers of Natural History will be grateful to " Eha " for the many valuable and interesting observations published from time to time in the columns of the *Times of India*. In his latest article of March 23rd—" Leaves from a Naturalist's Scrap Book "—he criticises Dr. Kirtikar's paper, published in the Journal of the Bombay Natural History Society on the nux-vomica tree, or, by-the-bye, plant, for anything vegetable from a microscopic yeast cell to a giant eucalypt is a plant in botanical language, but " Eha" is a facetious writer, and my correction is perhaps hardly apt. It is to be regretted that Dr. Kirtikar has not availed himself of the latest and most valuable literature on the subject, especially as all the recent researches are summarized or noted in a Bombay work, *Pharmacographia Indica*, by one of his distinguished *confrères* of the I. M. S., and a past President of the Bombay Natural History Society, the late Dr. William Dymock. I refer chiefly to the laborious researches of Dunstan and Short. These writers, after describing the statements of leading Indian botanical authorities as to the harmlessness of the pulp of the fruit, say that these statements are rendered quite unintelligible by the experiments of Fluckiger and Hanbury, who found both the fresh and inspissated pulp contained strychnia. In view of these conflicting statements the following physiological experiments were made by Dr. Ondaatje at the Hambaulota Hospital, Ceylon :—

Experiment I.—The pulp of a large fruit mixed with about half an ounce of water was given to a large cat. In five minutes tetanic convulsions set in, and the animal died within ten minutes of the administration of the pulp.

Experiment II.—5·6 grammes of the fresh pulp mixed with half an ounce of water was given to a dog about two months old. After eight minutes the posterior extremities became stiff, tetanic convulsions supervened, and the dog died eighteen minutes after the administration of the pulp. In both these cases the toxic action of the pulp was proved, the animals exhibiting the usual symptoms of poisoning by strychnine. *Post mortem* and other details are given in the paper, but it is not necessary to reproduce them here. As, however, the pulp was stated to have no poisonous action on birds, further experiments were made.

Experiment III.—Some fresh pulp mixed with a little water was given to a pigeon without any result.

Experiment IV.—The pulp given to a pigeon as in Experiment III without any effect.

Experiment V.—0·3 gramme of the inspissated pulp was administered to a frog and produced no effect. As the quantity of alkaloid contained in the amount of inspissated pulp administered to the frog was extremely small, and considering the fact that in the first pulp which was administered to pigeons there would be still less owing to the large quantity of water present, Dr. Ondaatje repeated the two last experiments, using larger and weighed quantities of the pulp.

Experiment VI.—2·6 grammes of the inspissated pulp was dissolved in water and given to a frog and no effect followed, but on administering twenty grains more, convulsions speedily came on, commencing at the lower extremities, and death resulted in forty minutes.

Experiment VII.—2·0 grammes of the inspissated pulp mixed with water was given to a pigeon. Almost immediately after violent tetanic convulsions set in, and the bird died in twelve minutes.

These experiments conclusively demonstrate the poisonous nature of the pulp, and show that its action is mainly, if not entirely, due to the strychnia which it contains. Birds can no doubt consume a certain quantity of the fresh pulp with no fatal effects, for the proportion of strychnine present in the semi-liquid mass is not large as subsequent analysis shows. Obviously, if eaten to more than this extent, fatal results will ensue. With regard to the action of strychnine on monkeys, it appears that some species possess immunity, while others are susceptible to the poison. From some experiments undertaken about twenty years ago and published in the *Indian Medical Gazette*, it seems that the "lungoor" may be said to be proof against strychnia, that the "pouch-cheek" is susceptible, but not so readily as a human being, and that the popular saying that a monkey will never eat anything that is poisonous is borne out by the "lungoor" readily eating and relishing the strychnia which produced no ill effect upon him, whilst the "pouch-cheek" refused the same and fell a victim to the poison. The story related by "Eha" that two horses were killed by eating the leaves is very likely correct. The leaves have been recently analysed by my friend, Mr. David Hooper, Quinologist to the Government of Madras, who found them to contain brucine ; hence they are poisonous. Horses and cattle, possibly through long years of domestication, do not readily distinguish between poisonous and non-poisonous plants. Horses are occasionally killed in Europe by eating the leaves of the yew tree, which are poisonous. Dr. Kirtikar writes: "Brandis says that the pulp in the fruit is orange-coloured. It is not so ; it is white. It is difficult to understand how such a careful observer as Brandis says so. It is evidently a misprint or slip of the pen." Dunstan writes :—"The fruit contains the seeds imbedded in a white gelutinous pulp . . . . . The ripe fruit has a deep orange colour"—and again in another place—"The pulp when fresh has a very bitter taste and is white, but on drying becomes dark brown."

27th March, 1894. J. G. PREBBLE.

(The above appeared in the *Times of India* on 2nd April, 1894.)

PROCEEDINGS

OF THE MEETING HELD ON 10TH JANUARY, 1894.

The usual monthly meeting of the members of this Society took place on Wednesday, the 10th of January, Mr. G. W. Vidal, I.C.S., presiding.

NEW MEMBERS.

The following gentlemen were elected members of the Society :—

Mr. H. E. Chappel (Calcutta), Mr. J. Harrington (Bikaneer), Mr. G. Battie (Ganjam), Mr. R. E. S. Thomas (Calcutta), Mr. E. Pemberton (Mormugoa), Mr. Jugmohandas V. Bhaisett (Bombay), Mr. C. M. Hodgson (Belgaum), Mr. F. G. H. Anderson, I.C.S. (Dharwar), Mr. Jivaji Dinshaw Ghandy (Bombay), Mr. Edward Comber (Bombay), Surgeon-Lieutenant C. E. Williams (Agra), Mr. Charles M. Inglis (Cachar), Surgeon-Lieutenant P. P. Kilkelly and Captain H. V. Biggs, R.E. (Secunderabad), the Secretary, Colombo Museum (Colombo), Mr. G. R. Long (Moulmein), Surgeon-Lieutenant-Colonel D. M. Martin (Saugor), Rev. S. Leigh Lye (Bombay), Mr. H. Mainwaring (Bijapur), Mr. W. Trood (Sirispore), and Mr. G. R. Duxbury (Tanna).

Mr. H. M. Phipson, the Honorary Secretary, acknowledged the following contributions which had been received since the last meeting :—

CONTRIBUTIONS DURING DECEMBER.

Contribution.	Description.	Contributor.
1 Indian Oriol (alive)	Oriolus kundoo	Mr. Douglas Bennett.
A collection of Sea Shells, from Kurrachee	.....	Capt. F. W. Townsend.
1 Common Yellow Bat	Nycticejus kuhli	Mr. W. F. Sinclair, C.S.
4 Cobras	Naga tripudians	Mr. C. E. Kane.
A collection of 140 Birds' Skins from Behar	.....	Mr. F. J. R. Field.
1 Green Tree Snake (alive)	Dryophis mycterizans	Mr. A. D. Stewart.
1 Horned Owl	Bubo bengalensis	Mr. W. Shipp.
1 Red-headed Merlin	Falco chiquera	Mr. A. C. Walker.
1 Cobra	Naga tripudians	Mr. H. S. Symons.
A number of Corals, from Arabian Gulf	.....	Dr. N. V. Gokhale.
1 Albino Snipe	Gallinago gallinaria	Capt. A. E. Hatch.
1 Snake	Lycedon aulicus	Mr. F. Graham.
1 Bustard's Egg	Eupodotus edwardsii	Mr. H. Gibbs.
1 Dhaman (alive)	Zamenis mucosus	Mr. W. Thacker.
1 Black-winged Kite (alive)	Elanus cœruleus	Mr. H. Bulkley.
1 Sind Hare (alive)	Lepus dayanus	Do.
1 Snake	Dipsas trigonata	Do.
1 Kingfisher (alive)	Halcon emyrensis	Mr. J. F. Snuggs.
1 Tanned Crocodile Skin	Crocodilus palustris	Do.
1 Pintail Duck	Dafila acuta	Capt. A. Newnham.
1 Red-crested Pochard	Fuligula rufina	Do.
1 Common Teal	Querquedula crecca	Do.
1 Koklass	Pucrasia macrolopha	Do.
1 Cheer	Phasianus wallachi	Do.
1 Curlew	Numenius arquata	Do.
1 Shaheen Falcon	Falco peregrinator	Do.

Contributions.	Description.	Contributor.
1 Porcupine, Stuffed	Diodon hystrix	Mr. Esoofali Hiptoola.
2 Painted Snipe	Rhynchæa bengalensis	Hon. W. T. O'Brien.
1 Blue Heron	Ardea cinerea	Do.
1 White-eyed Pochard	Fuligula nyroca	Mr. N. S. Simons.
1 Purple Coot	Porphyrio poliocephalus	Do.
1 Snake	Lycodon aulicus	Mr. R. T. Gibbs.
1 Spotted Owlet	Carine brama	Mr. W. E. Major.
2 Long-tailed Tree Mice (alive)	Vanueleuria cleracea	Mr. Page.
1 Albino Squirrel	Sciurus palmarum	Mr. M. Meling.
4 Eggs of White Scavenger Vulture	Neophron ginginianus	Lieut. H. E. Barnes.
2 Eggs of White-tailed Sea Eagle	Polioætus ichthyætus	Do.
1 Starling (alive)	Sturnus vulgaris	Mr. M. C. Turner.
2 Jedbos (alive)	Alactaga indica	Do.
The Bones of the great Indian Fin Whale	Baloenoptera indica	Mr. W. F. Sinclair, C.S.
2 Fishing Cats (alive)	Felis viverrina	Mr. T. S. Brumby.
1 Civet Cat (alive)	Viverra civettina	Mr. G. K. Wasey.
12 Snakes (alive)	Silybura macrolepis, Cylindrophis rufus	Mr. C. E. Kane.
A Collection of Birds' Skins, from Mysore	.....	Mr. P. H. Lee.
1 Snake	Callophis trimaculatus	Dr. K. R. Kirtikar.
1 Leopard's Skin	Felis pardus	Mr. E. G. Farquharson, R.E.
1 Wigeon (alive)	Mareca penelope	Mr. B. G. Buchanan, R.A.
1 Black Ibis	Inocotis papillosus	Mr. A. C. Walker.
1 Snake	Zamenis fasciatus	Mr. C. E. Kane.

CONTRIBUTIONS TO THE LIBRARY.

Illustrations of the Botany of the Himayalan Mountains and of the Flora of Cashmere (Royle), from Colonel Kenneth Mackenzie.

Illustrations of the Forest Flora of the North-West Provinces and Central India (Brandis), from Colonel Kenneth Mackenzie.

Stray Sport, Vols. I and II (J. Moray Browne), from the author.

A number of back parts of the Society's Journal, Major Selby, R.E.

Proceedings of the Royal Society of Victoria, Vol. V, in exchange.

PAPERS READ.

The following papers were then read:—(1) On new and little-known Hymenoptera, from India, Burma, and Ceylon, by Major C. T. Bingham, F.Z.S.; (2) The genus *Psilotum Sw*, in India, by Dr. D. Prain; (3) On the Brow-antlered Deer or Thamin, by Charles F. Gilbert, C. E.; (4) Odd Notes, by Vet.-Major G. F. Rayment, C.V.D.

PROCEEDINGS

OF THE ANNUAL GENERAL MEETING HELD ON 13TH FEBRUARY, 1894.

The annual general meeting of this Society took place on Tuesday, the 13th February, Mr. G. W. Vidal, I.C.S., presiding.

NEW MEMBERS.

The following gentlemen were duly elected members of the Society :—

Mr. D. Rutherford, C.E. (Sholapore), Captain John Charles Watson (Kathiawar), the Superintendent of the Government Central Museum (Calcutta), Mr. Allen McF. Chalmers (Cachar), Mr. J. E. O'Conor, C.I.E. (Calcutta), Mr. G. Jacob, I.C.S. (Shikarpur), Mr. A. M. Caccia (Hoshungabad), the Curator, Central Museum (Nagpore), Mr. G. Trevithick (Bombay), Mr. H. B. Thurburn (Bombay), and the Superintendent, Government Central Museum (Madras).

CONTRIBUTIONS TO THE MUSEUM.

Mr. H. M. Phipson acknowledged the following contributions to the Society's Museum since the last meeting :—

Contribution.	Description.	Contributor.
1 Antelope's Head, mounted	Antilope cervicapra	Mr. J. F. Snuggs.
1 Cobra	Naga tripudians	Dr. T. S. Weir.
1 Sea Snake	Enhydrina valakadien	Mr. W. S. Turnbull.
1 Snake	Lycodon aulicus	Mr. A. F. Ferguson.
1 Albino Sand-piper	Actitis sp.	Major Mason.
Land shells, from Aden		Capt. E. L. Shopland.
1 Snake	Cynophis malabaricus	Dr. F. E. Davar.
1 Phoorsa	Echis carinata	Mr. W. Thacker.
Fossil Bones, from Jubbulpore		Mr. R. Dale.
A Coppersmith's Nest	Xanthoæma hæmacephala	Do.
2 Kites' Eggs	Milvus govinda	Mr. W. George.
1 Teal	Querquedula crecca	Miss N. Otto.
29 Species of Bombay Fish		Mr. A. Corrodi.
1 Darman	Zamenis mucosus	Mr. H. Godfrey.
1 Snake	Psammophis longifrons	Mr. F. Gleadow.
1 Parrot Fish	Tetrodon reticularis	Capt. Nantes.
1 Paradise Fly-Catcher	Muscipeta paradisi	Mr. D. Campbell.
1 Snake	Dryophis pulverulentus	Mr. J. Davidson, C.S.
1 Snake (alive)	Dipsas trigonata	Mr. C. E. G. Crawford, C.S.
1 Indian Pipistrelle	Vesperugo abramus	Mr. J. A. Betham.
11 Snakes	Lycodon aulicus, 2; Eryx johnii; Tropidonotus stolatus; Echis carinata; Naga tripudians, 2; Bungarus arcuatus; Trimeresurus anamalensis; Dipsas trigonata; Onychocephalus acutus.	Do.

CONTRIBUTIONS TO THE LIBRARY.

Indian Snakes, Part I (Chiplonker), from the author.

Indian Museum Notes, Vol. 2, No. 7, from Government.

Annals of the Royal Botanic Gardens, Calcutta, Vol. IV, from Dr. G. King.

Records of the Geological Survey of India, Vol. XXVI, Part II, in exchange.

EXHIBITS.

Mr. Gambier Bolton, F.R.G.S., exhibited some splendid photographs of animals in the Zoological Society's Gardens, London, and explained the process by which they had been taken. The pictures, which measured 36″ by 48″, were greatly admired. Mr. N. S. Symons exhibited a beautifully-made net used by Bengal trappers for catching snipe. It measured 120′ by 4½′, but only weighed 5¾ ozs.

THE ACCOUNTS FOR 1893.

Mr. E. M. Slater, the Honorary Treasurer, read a statement of the accounts of the Society for the year ending 31st December, 1893, showing a balance carried forward of Rs. 2,182, with a Reserve Fund of Rs. 2,000. It was decided that the accounts be passed subject to the usual audit.

ALTERATION OF RULE No. 3.

It was resolved that Rule No. 3 be cancelled and that the following words be substituted :—

"The election of Members shall be vested in the Committee, subject to such by-laws as they shall from time to time make. A majority of two-thirds of those who vote shall be required to secure election."

ELECTION OF OFFICE-BEARERS.

It was further resolved that the following be elected office-bearers for the current year :—

PRESIDENT.

H. E. Lord Harris.

VICE-PRESIDENTS.

Dr. D. MacDonald, M.D., the Hon'ble Mr. H. M. Birdwood, and Dr. G. A. Maconachie, M.D.

MANAGING COMMITTEE.

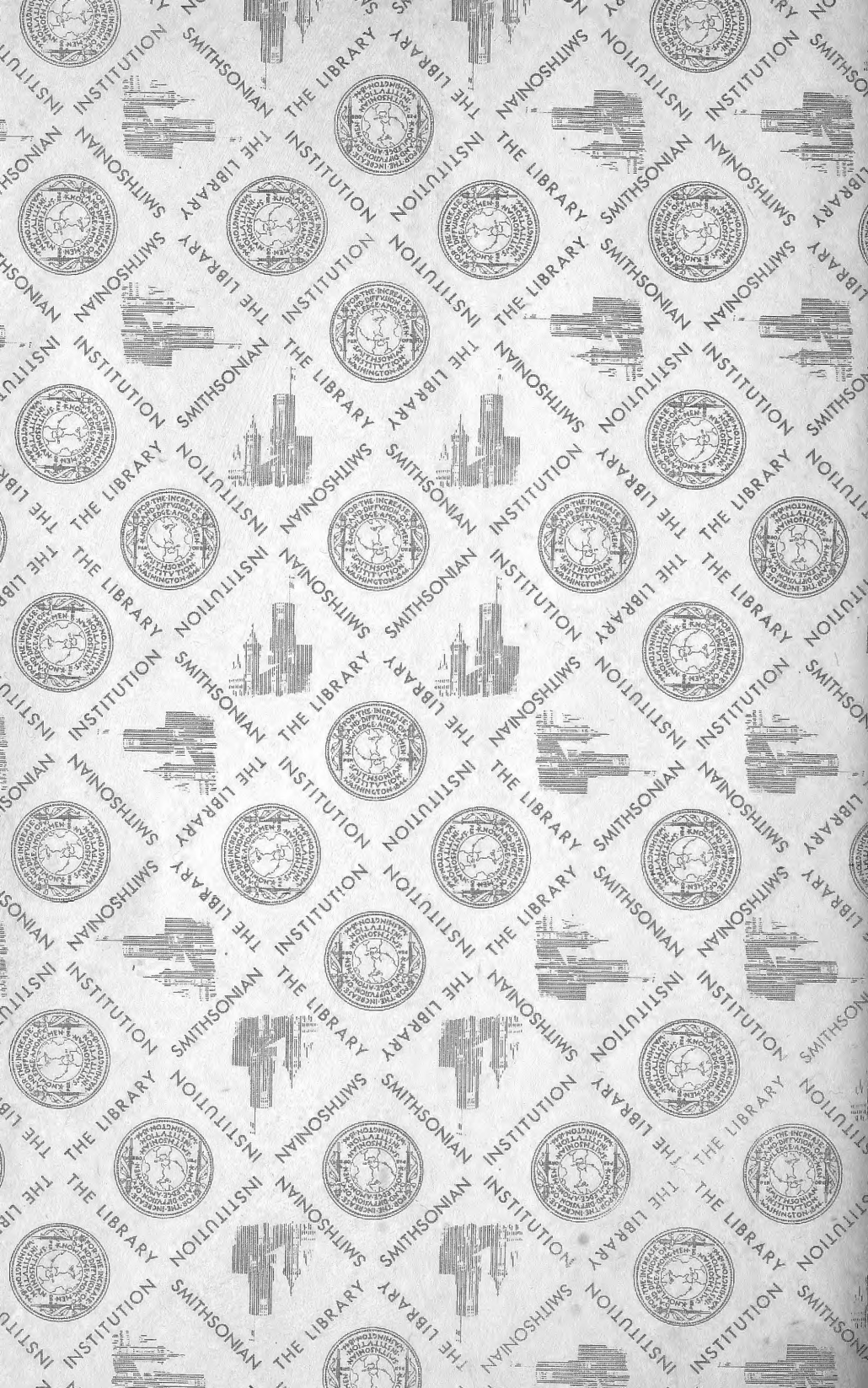
The Hon'ble Mr. H. M. Birdwood, Dr. G. A. Maconachie, Dr. D. MacDonald, Mr. G. W. Vidal, C.S., Rev. F. Dreckmann, S.J., Dr. T. S. Weir, Dr. Kirtikar, Mr. J. D. Inverarity, Mr. W. S. Millard, Mr. W. F. Sinclair, C.S., Mr. M. C. Turner, Col. W. S. Bisset, R.E., Lieut. H. E. Barnes, Mr. J. C. Anderson, Mr. E. L. Barton, Mr. Reginald Gilbert, Mr. R. M. Branson, Mr. N. S. Symons, Dr. J. C. Lisboa, Mr. E. M. Slater (*ex officio*), and Mr. H. M. Phipson (*ex officio*).

SMALL DEER.

Mr. W. F. Sincair, I.C.S., read an interesting paper on three small deer found in the neighbourhood of Bombay, *viz.*, the Four-horned Antelope (*Tetracerus quadricornis*) ; the Rib-faced or Barking Deer (*Cervulus muntjac*) ; and the Mouse Deer (*Tragulus meminna*), illustrating his remarks by means of specimens from the Society's Museums. An excellent photograph, taken by Mr. J. D. Inverarity, of a specimen of the first-named species was also exhibited.

A NEW SNAKE.

The Honorary Secretary read a description, by Mr. G. A. Boulanger, of the British Museum, of a new snake which had been found by Mr. S. Dighton of Piermaad, Travancore. The snake has been named *Dipsas dightoni* after its discoverer.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