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An Appeal to all Members.

This copy of the journal marks a milestone in our progress, as it contains the first of a series of coloured plates reproduced in England from paintings from life made by our Editor and Curator. It is hoped to include one such coloured plate in each future issue of the Journal; but this is an expensive undertaking and it will only be possible to continue it if our membership is largely increased in number.

The cost of reproducing and printing an economical number of copies comes to about 13 guineas for each plate, so all the help we can get is required to continue the good work. One of our members has most generously offered to defray the cost of reproducing a few of these coloured plates. Another member has, during the past few months, succeeded in enrolling no fewer than 12 new members. With these noble examples before us we look forward to a bright future and if each member can succeed in bringing in even one or two new members the continued success of our Journal is assured.

Darjeeling.

“One of the Committee.”

We hope all our members will read, mark and not only inwardly digest the above stirring appeal from “one of the Committee” but will also act up to it.

The subscription is only Rs. 10 a year and most people can easily afford that small amount. Will members send for a few membership postcards and try to get them signed by new members and duly returned to us? We would also ask those members, who are not already having the April issue sent to them by V. P. P. for the amount of the annual subscription, to sign the postcards which will be found in this issue. It is an easy means of paying the subscription, incurring no trouble to the member and saves the Editor much time in correspondence and reminders. Most of our members, we are glad to say, have already done this.

We will have a certain number of loose copies of the coloured plates for sale; the price for those has not been fixed as yet by the Committee but it won't be more than -12- each to members and Re. 1 each to non-members. We have already booked sets for some members. Should we be able to dispose of most of these sets, it will help us a lot towards defraying the cost of future plates.

There is another most important matter we would like to bring before our members, that is the sending in of notes and papers for the Journal. If you will glance through the past issues you will find that contributions of this nature are received from only a few members. All may not be able to send in papers of a scientific nature but *all* can send in notes, which perhaps may not seem important to the writer, but which are of interest to other members. Long papers are of course *desiderata* but it is to the short article or Miscellaneous note that we look to for the ultimate success of our Journal. The size of the Journal is not at all what we would like it to be but the remedy for this lies greatly with our members themselves. We hope they will take this to heart and all assist us to their utmost to increase the bulk of our Journal.

Editor.

Journal
OF THE
Darjeeling Natural History Society.

No. 4.

Game Birds of Sikkim, including the Darjeeling District,
and of Jalpaiguri District, Bengal.

BY

C. M. Inglis, F. Z. S., F. E. S., E. M. B. O. U.

(Continued from page 52)

22. The Indian Ring-Dove.

Streptopelia decaocto decaocto (Frivaldszky).

Head and neck grey, tinged with lilac; a black collar round the hind-neck, narrowly edged with white; remainder of upper parts light brown, passing into ashy grey on the wings; pinion quills dark brown; middle tail feathers light brown, the remainder grey to blackish-brown, with from narrow to broad white tips; breast pale lilac, passing into ashy-grey on the abdomen and slatey-grey on the under tail-coverts.

The sexes are alike.

The length of this bird is about 13 inches. The bill is black; iris crimson, and the skin round the eye whitish; the legs are dark purplish-red,

This Dove may easily be recognized by its largish size, and light grey and brown appearance with a black collar round the hind-neck. The only one with which it might be confused is the hen of the Sikkim Red Turtle-Dove but its much larger size easily separates them.

This species is resident in the Duars but does not seem to ascend the hills, although in the North West Himalayas it occurs as high as 11,000 feet. Stevens never came across it.

This, like the preceding species, is a bird of open country, eschewing forest areas. It is, often, just as confiding as the Spotted Dove, frequenting roads, gardens and also, like that species, entering verandahs. They are generally seen in pairs, but sometimes quite large numbers may be seen together especially when flying. Their flight is stronger than that of the Spotted Dove and they are, if anything, fonder of perching than that bird.

Their food consists, principally, of seed and grain but they are also said to eat fruit and berries. Their "coo", expressed by Whistler as a "dreamy how-do-do", is quite sweet. They do well in captivity.

We have no record as to when they breed in the Duars but in Bihar we took nests during every month of the year except February. Stuart Baker says they never build in buildings but this is a mistake, as nearly every year a pair nested on a pillar of the verandah of my brother's house. As a rule, however, they generally build on trees, bushes, bamboos, etc., and one was once found on the bare sand of a sandy down.

The eggs, two in number, are of course white, and sixty measured by Stuart Baker averaged 30.1×23.2 mm.

23. The Sikkim Red Turtle-Dove.

Enopopelia tranquebarica mурmensis (Hartert).

Our birds belong to this race, which is intermediate in colour between the Indian Red Turtle-Dove (*Æ. t. tranquebarica*) and the Burmese Red Turtle-Dove (*Æ. t. humilis*). It does not appear to be a very strong sub-species. Hartert's description of it is:—"Under wing-coverts whiter than in *Æ. t. humilis* but darker grey than in *Æ. t. tranquebarica*. Female intermediate between them both. Male often to be identified with certainty." Apparently they cannot always be identified with certainty.

In these Doves the sexes differ, which is unusual, the only other of our Doves in which this is the case being the next species, the Bar-tailed Cuckoo-Dove.

The cock has the head and neck dark ashy-grey, with quite a broad black collar round the hind neck; remainder of upper plumage rather deep vinous-red, some feathers almost brick-red, down to the back, with lower back slatey-grey; central tail feathers brown, next two pairs dark grey at base, with terminal portion grey; the remainder slatey at base, with the terminal third white: the two outer pairs have the outer web white; lower plumage vinous-red but not as red as the back; wing lining grey. Finn had a cream-coloured cock of the Indian species.

The hen is pale brown, darker above than below and with the head greyish; she has also got the black collar round the hind-neck as in the cock; the wing-lining is also grey.

The bill is black, iris dark brown with the eyelids plumbeous, and the legs and feet brownish-lake.

These are small Doves, only measuring about 9 inches.

I had an opportunity of comparing specimens of this Dove with some in Lord Rothschild's Museum at Tring and found them indetical.

The distribution of this Dove within our area is given as "Eastern Nepal, Sikkim....." Stevens never came across it in Sikkim nor have we. In the Duars it seems to arrive about the middle of February and leaves some time during the rains.

This exceedingly handsome little bird is not as confiding as the other Doves and, though not coming on to one's verandah, they may often be seen in gardens and not far away from houses. We had them nesting quite close to the bungalow in Bihar and they used often to settle on trees in the compound. We found them common in parts of the forest, especially at Gorumara in the Duars, and numbers were seen in the rice stubble at Kuntimari, the barer portions resembling, in a small scale, what G. R. S. Pitman says about these birds in the Central Provinces—"the dry bare paddy fields, shorn of their crops, looked a rich magenta-colour in patches from the number of male Red Turtle-Doves which were feeding there." As a rule, these Doves are seen in pairs, and feed wholly on the ground on various seeds and grain.

The first primary quill is very long and the flight is therefore very fast; it also gets off the ground well and goes straight away. They are excellent for the table.

Their note is more of a croak than a "coo." Whistler describes it well as "a rather deep *cru-u-u-u-w* repeated four or five times quickly without pause, and with the emphasis on the first syllable." Finn writes about it:—"It can only express its amorous feelings by muttering, which may not be romantic, but is not annoying to a third party!"

Stuart Baker, writing of the Sikkim bird, says "Apparently breeds from March to May, but quite possibly over a much wider season also." The Indian bird seems to breed pretty well all the year round.

They make a very flimsy nest and invariably build on trees.

The eggs are two or three, ivory white or pure white in colour. The average of forty-nine of the Indian bird, measured by Stuart Baker, was 25.9×19.9 mm. The few eggs he has seen of our sub-species varied in size between 25.7×20.5 and 28.9×21.8 mm.

With regard to a sub-species of this bird in captivity, Finn writes:—"I introduce it here as a particularly desirable aviary bird. The unique colouring of the cock makes him most ornamental.....The Red species is a particularly fine breeder; we had a pair in the Calcutta Zoological Garden, which bred successfully in a large cage much less than six feet square, which they shared with other Doves of the same and other species, and a lot of other birds! It has also bred in the London Zoological Garden....." He also wrote:—"This beautiful Dove has a very gentle, innocent appearance, its eyes being large and intensely dark."

(To be continued)

BIRDS' NESTING IN DARJEELING.

BY

Satya Churn Law, M. A., B. L., Ph. D., F. Z. S., M. B. O. U.

Written primarily for self-delectation during the leisured moments of a brief stay in Darjeeling, it disclaims any ambitious outlook of an elaborate survey of the nesting season of the birds of this hill station. Far too small has been my opportunity of making acquaintance with the avi-fauna of the District, and this precludes all pretensions of recording anything that might serve as a guide for other people.

The bird-life of the city chiefly I am concerned with, as my observations radiate from my cottage down below the West Birch Hill Road. It is the third week of May (1930) when I have reached Darjeeling. The smaller birds, almost all, which are resident of this place, are busy feeding their young ones. The flutter and animation which mark their period of courtship is just gone by. Their song has lost much of its impetuosity, acquiring a tenor which is at once subdued and infrequent. Their behaviour is on the whole not so intolerant of company, though the idea of territory is not given up, and any encroachment by its neighbour on the breeding area of any individual bird is strongly resented. Nature herself solves the problem of food supply of the young ones. Warmth and moisture contribute to the abundance of organic growth, and insect life does not now happen to be in its low ebb. Perching high on a protruding branch is a bird that sits for hours wagging its tail or bending its neck from side to side and sometimes uttering a syllable of sweet notes. This picture is an infallible sign of a nest near by. The mother bird seldom falls to our notice; her life now is one continual search for food for her young ones, and she wonderfully regulates her movements consistent with her safety and that of her nursery. The bird on the topmost branch is evidently the male, which sits on guard on a position of vantage. Conscious of his responsibility, he now and then displays his paternal instinct by sallying forth from his perch after a winged insect and carrying it in his beak back to his seat. He sits for a while, eyeing possible sources of danger, and suddenly in a moment of safety flies to the nest. Out he comes

in a minute, carrying in his bill a tiny bag of filth or excretion, which he throws away in a distance. An urge for sanitation, commensurate with the safety of the nursery, is a never-failing attribute of almost all birds; it seems at once inherent and instinctive. To the discerning eye of a person initiated into the mysteries of bird behaviour, the whereabouts of the bird in question do not take long to stand revealed. A queer relationship thrives in some instances between bird and man, and this is thrown into bold relief at no other time than this, when the security of the birds' progeny derives some measure of guarantee from the proximity of human abodes. The Verditer Blue Flycatcher becomes peculiarly attached to our houses and bungalows during its nesting season. At other times it is given to considerable wanderings, haunting forests and jungles and wildernesses amidst villages far, far away from human dwellings. Its breeding season brings it back to the hill stations as near the habitations of man as is compatible with its safety and that of its progeny. The bird we have been watching from the verandah of our cottage is in nine cases out of ten no other than this Verditer Blue Flycatcher, *Eumyias t. thalassina* (Swains). The hill boys, little urchins with a devilish propensity for stealing nests and young, will tell you its name. *Harini* they call it and a little tip is all that is necessary to induce them to fetch a dozen fledgelings at your feet. It is a pretty bird, with confiding habits and attributes admirably fitted for cage-life. Its nest is invariably placed on eaves, cornices or rafters near the ceiling of our bungalows. It is a cup-shaped receptacle, cleverly built with fine stems and fibres with an outer coating of moss. Two, three and even five young ones may be usually looked for in this nest. It is remarkable that moss is the main nest-material in the case of these hill birds, its use by the birds of the plains being very negligible, and in fact scarcely found except invariably in the case of *Parus major cinereus* (Vieill). Another peculiarity I have marked of many hill birds of Darjeeling is that the chicks are left alone at night by the parent birds, which evidently sleep out the night elsewhere, without coming to the nest to sit on their young. The Verditer Blue Flycatcher is, as I have said, a bird of attractive colour, and never shy of man. Winged insects form its main food, which it is noticed to secure mostly on the wing

by sallying forth from a vantage point into the air. This is why one finds this bird so nimble and alert, and prone to constant gyrations and aerial somersaults. Molestation at the hands of hill boys sometimes leads it to nest in a jungle environment, where exposed roots of a tree in a hollow or cavity of the hill side afford shelter to its nursery. The Green-backed Tit, *Parus monticolus* (Vig) is another common and familiar bird, which is equally attached to human habitations. *Chichin-koti* is the name given to it by the local hill people—a name which obviously derives its origin from the peculiar notes of the bird. A crack, crevice or hole in our houses is invariably looked upon as a good situation for this bird's nursery. Sometimes a tree-hole or a hole in the hill side within our compound will contain its nest. It is noteworthy that cow or horse-hair is in the case of this bird a principal material for its nest equally with moss. I could tempt almost all the little urchins of a village near Sidrapong to pull out one or two nests from underneath the tin-roofing of their houses. As many as six fledgelings could be found from a single nest, though four or rather five is the usual number. It is rather difficult to hand-rear these young Tits even with the aid of insect food. "*Dyire*" is another bird commonly seen and sometimes very numerous in the city, which chooses the situation of a hole or crevice in the boundary slopes of our compound for raising its brood. This is the Dark Grey Bush-Chat, *Rhodophila f. ferrea* (Gray). The male bird is of striking deep grey, almost black and white colour, the female being attired in drab dusky tint, which is considered protective. Its brood consists of two to five in number, reddish brown and mottled in coloration. Insectivorous in habit, the bird is noticed often to carry ripe raspberry in its bill for the young ones. It is very striking that the raspberry plants yield a crop of plenty at this season in Darjeeling, and as the ripening time advances, most of the hill birds of the district are busy rearing their brood. The hill people appear to be fully conscious of this fact. The ripe berries enter into the composition of the dietary of a large number of the local breeding birds. The *Dyire* has its predilection for open lands and clearances amidst jungles, affecting tea plantations and the vicinity of towns and villages. Two other birds markedly attached to the company of man are what are locally known as the *Bhangera* and *Rupi*. The latter

is the Common Myna, the ubiquitous *Acridotheres tristis tristis* (Linn), which is omnivorous in its food habits. The former bird is the Tree-sparrow, *Passer montanus malaccensis* (Dubois). Its peculiarity is that, in colouring, the male and female are alike. But by habit and temperament it is so much akin to the House-sparrows of the plains that the name Tree-sparrow is almost a misnomer. The main characteristics of the Tree-sparrow are its attachment to human dwellings, and its omnivorous food habits. In the nesting season one must look for its nest below the tin-roofing of our bungalows. Nesting prominently before our eyes, not in pairs but in parties and congregations, the Striated Swallow, *Hirundo daurica nipalensis* (Hodgs.) vies with the House Swift, *Micropus affinis nipalensis* (Hodgs) in its zeal for evincing its attachment to man, under whose aegis each of them finds it safe to rear its brood. The Swift is far ahead at the moment in its nidificatory task, for within a week after my arrival at the station, I find many full-fledged young in the company of their parents: while the Swallow is busy erecting its mud nests. The *Bhangera* moves now in family parties, while the young of the Common Myna are noticed on tree tops, crying with half-stretched wings before their parents for food. The Dark Grey Bush-Chat leads a silent life, engaged as it is with the responsible task of incubating its eggs. It is on the female bird that most of the burden falls. The raspberry shrubs are hunting grounds of many breeding birds of the locality. The south verandah of my bungalow, commanding, as it does, an unobstructed view of a large portion of the town, affords a happy position for my observation of bird life. Three isolated patches of raspberry with their ripe bumper crop stand on the south-west boundary of my compound, attracting a horde of birds, which in their engrossing search for food do not seem to mind my intrusion and close scrutiny. *Char-bari*, or what is familiarly known to the aviculturists as the Pekin Robin, is the nimblest individual amidst this horde, which in its search for food disdains our prying eyes and fights shy of man. Yet it builds its nest hidden and unseen in the thickets or amidst bamboo clumps in a remote and untrodden part of our compound. Once while off its guard, I could detect it pilfering raspberry and carrying it in its bill to its nest. The latter was a cup-shaped structure of dry leaves and fibres, surrounded by an outer coating of dry moss

imbedded into the roots of a bamboo clump as near the ground, thick with vegetation and grass, as possible. There were four young, partially fledged, and with feathers showing growth in accordance with their age and priority of birth. Their feet are rather long and active, so that when least startled or handled they would descend or slip down into the thickets and be lost to the eye of the intruder. This Robin or rather Red-billed Liothrix, *Liothrix lutea callipyga* (Hodgs.) is insectivorous, but also partakes of berries and fruits, which also constitute the principal diet of its young ones. Possessed of exuberance of vigour and activity, the Liothrix is much sought after for its qualities as a cage bird. Its body-colour is principally green and yellow, with patches of crimson and black on its bill, wings and tail. Its notes are varied and lively, and uttered forth with a gusto, which somewhat resemble the words *Char-bari*. Noisiness is its principal characteristic; nay it is a trait peculiar to all members of the Family Timaliidae. A few other members of this numerous Family are noticeable in Darjeeling, the commonest of which is the Black-headed Sibia, *Leioptila capistrata capistrata* (Vig.). It is a pretty bird with black head and rufous body. Its notes are piercing and melodious. It is known to the hill boys as *Char-chari*—a name which evidently has some connection with its noisy and over-active habits. It is a bolder bird than the Red-billed Liothrix, tolerant of man, though wary enough to avoid his clutches. It nests often in the higher branches of *Cryptomeria* and other tall trees. Mainly frugivorous, it is more easily amenable to captivity, and one can safely feed its young ones, whenever captured, without any risk of mortality. The Blue-winged Siva and the Silver-eared Mesia frequent solitary and rather out-of-the-way places, and sometimes visit our compounds in the city. In the Lloyd Botanic Garden one finds them common enough and in numbers. I did not come across their nest, but in one or two instances I imagine, from their manner of collecting food and carrying it in their bill, that they must have been breeding at this time. A near relative of the Blue-winged Siva fell to my notice. It is called the Stripe-throated Siva, *Siva strigula strigula* (Hodgs.)—mostly identical in habits and temperament, but mainly keeping to jungle areas. The Birch Hill is a resort of most of these birds, and here also one finds the

Shrike Babbler and the Red-tailed Minla—two other near allies of the Liothrix. By habit they are gregarious and arboreal; their local habitat is the wilds and forests of Darjeeling. I came across young ones of the Red-tailed Minla—three fledgelings out of the nest. Unhappily they were not amenable to treatment for the cage, notwithstanding the great care I bestowed on them. The Nepal Barwing, *Actinodura cyrtone cyrtone* (Gould), another frequenter of the Birch Hill forests, appears to have just finished its nesting operations, as the specimen in my hand was undergoing moult. *Fista* denotes, according to the hill boys, birds which are diminutive in size, noisy and gregarious. Small Flycatchers, Warblers, Flower-peckers, and Ixulus, etc, form a heterogeneous group to which this name is applied. Their presence is always felt if one takes a stroll within the Birch Hill Park, but they are hardly visible to the ordinary eye in the gathering gloom attendant on the mist that envelops the region at this season. Their insect-like notes are audible from afar. These are all breeding birds of the place, and many a nest I have seen, built within the mosses overhanging hollows in the hill side. *Ixulus flavicollis flavicollis* (Hodgs.) falls in this category; it has also a different name *Gyrabi* given to it, probably from its crest or erectile feathers on its head. The Bulbuls go by a similar designation, as they possess crest; for instance, the Black Bulbul, *Molpastes cafer bengalensis* (Blyth) is called *Kali gyrali*. The yellow-headed Ixulus is very common in the town of Darjeeling, frequenting our gardens and nesting within our compounds. I got at a nest with a clutch of three young ones—a flimsy structure of fine fibres and dry stems cleverly inserted in live mosses sticking to, and overhanging, a boulder which protruded out of the line of boundary of my compound. It was almost at my very nose, and from a seat in my verandah I could watch the movements of the parent birds. Each of them would by rotation carry for the young ones ripe raspberries, which appear to form exclusively their staple diet. The parents' attachment for their young abates not the least should there be, by some unforeseen circumstances, a break or interruption for a short period, say 4 or 5 days at a stretch, in the performance of their parental duties, by sudden removal of the nest and young and their

subsequent restoration by man. The pilferer in the present case was no other than myself. Taking advantage of the temporary absence of both the parents, I quietly removed the nest with three growing chicks into my bed-room, and took care always, and especially while handfeeding these chicks with raspberries, to keep all the sashes closed so that their voices might not be heard outside. At first the unsuspecting parents appeared quietly to resign themselves to the lot which befell them, and after hanging about the spot for a very short while, went about their usual way. Very little could be seen of them for two or three days. Meanwhile the chicks grew into robust fledgelings, capable of indulging in short flights accompanied with occasional snatches of warbles and loud cheeps. Suddenly one morning (four or five days afterwards) I was surprised at the appearance of one of the parent birds peeping through the fanlight of my bed-room. It carried a raspberry in its bill and was greatly agitated at the sight and incessant chirrups of the young, which evidently rekindled in its bosom all the former instincts of the breeding parent. It was so eager to come to the young ones to feed them. With food in its beak it moved round and round the closed sashes calling all the while and fluttering its feathers.

(To be continued).

The Atlas Moth

(*Attacus atlas* Linn.)

(with a coloured plate.)

The following information is taken from "*The Wild Silk Insects of India*" by E. C. Cotes, published in "*Indian Museum Notes Vol II, No. 2, page 71.*"

This moth is well known on account of its great size, some of the specimens in the Indian Museum being more than ten inches across, from tip to tip of wings. It is common on the slopes of hill ranges all over India and Burma; and, according to Gosse, ranges in South-Eastern Asia over 35° of latitude and 55° of longitude, being abundant in China and scattered over the whole of the Malay Archipelago.

The life history of the insect has been fully described by Gosse (*Entomologist XII, p. 291*), and by Brownlow (*Journ. Agri. Hort. Soc. Ind. N. S. Vol. V, p. 183*). According to Manuel, the insect spins once a year in its natural state, though, in domestication in Burma, it will spin twice and even three times, once at the commencement of the rains, once during the rains, and again at the close of the rains, the best cocoons being those formed towards the beginning of the cold weather. The female is very sluggish, and seldom flies; the male, which has a powerful flight, usually seeking her out and fertilizing her as she clings to the cocoon from which she has emerged; for this purpose the male is furnished with some sense, probably of smell, which enables him to find the female unerringly, however thick the foliage in which she is concealed. After fertilization, the female lays about 300 eggs in masses, which are firmly gummed on to the under surface of the leaves upon which the caterpillars afterwards feed. The food plants are very numerous; in Almorah the caterpillar has been found upon a bush belonging to the genus *Berberis*; in the hills about Mussoorie upon *Falconeria insignis* (Hutton); in Assam on *Vangueria spinosa* (Stack); in Sikkim upon *Teucrium macrostachyum*, a species which grows abundantly from an elevation of 6,000 feet upwards (Otto Moller); in Bangalore upon a species of *Ocimum* (Cameron); in Burma upon *Ardisia* sp., *Clerodendron infortunatum*, *Dillenia pentagynia*, *Lagerstroemia indica*, *Nauclea rotundifolia*, *Phyllanthus emblica*, and *Schleichera trijuga* (Manuel); while Gosse succeeded in

rearing it upon apple, and in Ceylon the form described by Moore as *Attacus taprobanus*, which is said to be very common about Colombo, feeds upon cinnamon (Thwaites).

The eggs are oval in shape, about 0.08 of an inch in diameter, in color greenish white, with brownish purple clouding, which readily washes off. They hatch about a week after being laid and the caterpillars which emerge are generally sluggish and solitary in their habits, seldom wandering to any distance from their birthplace unless driven by scarcity of food. When first hatched they are little, dark coloured creatures, about a third of an inch in length, and covered with hairy tubercles; they grow rapidly, however, and after the first moult become lighter in color and are soon covered with a dense white flour-like secretion, which accumulates upon them after each moult. After passing some twenty days as caterpillars, and moulting about five times, they are full grown and ready to spin themselves up into their cocoons; a very large proportion of them, however, fall victims, before they reach this stage, to the ants, wasps, and other foes which are always on the look-out for them. When the caterpillars leave off feeding, preparatory to spinning, they are sometimes as much as five inches in length by an inch in diameter, but they contract considerably before actually commencing their cocoons. The cocoon is spun in the usual manner and is so closely enveloped in the leaves of the food plant that, when it is torn away, permanent impressions, showing the shape and venation of the leaves, are left upon the silk. The cocoon is generally drab coloured, and from two to three inches long by an inch in diameter; it is irregular in shape, with thin, firm walls, which are scarcely at all silky in appearance except at the upper extremity, where there is a natural orifice for the exit of the moth. The orifice is formed, as in the cocoons of other Saturniidae, by the convergence of a great number of silken fibres which are left ungummed and are therefore soft and flossy, opposing an almost impenetrable hedge to any animal which tries to force its way into the cocoon, but opening readily when pushed aside by the moth which emerges from within. The moth thus effects its escape with hardly any perceptible disarrangement of the fibres, which close together again behind it. The stiff gummed parchment-like wall of the cocoon passes upon one side of the orifice, so as

to form a cord, which is firmly wrapped around the twig from which the cocoon hangs, thus securing it from mishap in case the leaves, in which it is wrapped, become detached. The cocoon contains a large amount of thick strong silk, which cannot indeed be reeled easily enough to make it worth doing, but which would have a considerable market value for carding and spinning purposes if large quantities could be obtained; it is said that some of these cocoons have been collected in Burma and exported to England for this purpose, while attempts have also been made to domesticate the insect in China: but upon the whole, experts seem to be agreed that there is no chance of the *Atlas* silk competing successfully with that of such species as the *tusser*, which can be obtained so much more easily."

We obtained a cocoon of this species in the Duars on the 6th February 1931.

The coloured plate is drawn from life and reduced to half the natural size. It shows the insect still on its cocoon after having fully expanded and dried its wings.

Notes on the Natural History and Shikar of Indian Deer.

BY

Colonel H. S. Wood, I. M. S.

(Continued from page 68).

2, The Cheetul or Spotted Deer

(With a plate).

This is the handsomest of all our Indian deer. Its form is so graceful, everything being in proportion—the beautiful colouring and the shape of the horns, the royals forming at their termination a handsome forking. One of the most splendid sights is to see in the early morning a herd of these animals grazing on the rich grass on the bank of some crystal forest stream, with a background of bamboos and sal forest, the sun shining on their dappled hides. Such scenes I have often seen in the Jaggar Valley in the Mysore district. In this beautiful valley I might have bagged many but my brother and I had decided not to shoot anything



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THE SPOTTED DEER OR CHITAL.
Axis axis Desl.

F. W. CHAMPON.

except Bison, unless we got anything close to the camp. This valley lies not very far from Kadur and was a sportsman's paradise; Bison, Cheetul, Sambhur and Spur Fowl simply swarmed. I was lucky to get a pass from the present Maharajah's father and we had the time of our lives in that glorious country. It is very difficult to get a pass now, as it is reserved for the Maharajah and high officials. In my time the Cheetul simply swarmed here and we must have seen herds of 60 or 80 animals. During the three weeks we were here, I only fired at two; one was a stag, which through bad luck I missed, my bullet striking a ringal bamboo, in a clump of which he was standing; the other was unfortunately a doe, as I could not see the entire animal. I shall however never forget that doe. My brother and I were about three miles from our camp when I bagged her. We got a bamboo, slung her up and carried her the three miles. It was hard work and our shoulders chafed and stiff muscles were in evidence for some time.

The other place where I saw many was in the Chunderbunnee forest in the Doon Siwaliks. Those were no days of luxurious camps. My uncle, who was as hard as nails and expected everyone else to be like him, used to give us boys an annual shikar at Lachiwalla or at Fultapore in the Mahar pass. We proceeded in *elckas* huddled up and nothing in the way of luxuries were taken. I think tea, flour, rice, dal, curry powder and other condiments were our only provisions and we had tin mugs and enamel plates.

When we reached the camp, we had to build our own shelters with the help of the servants, as we generally placed our camps far away from villages. We had two coolie blankets apiece with a pillow, no camp beds and only grass for a mattress. Each morning we proceeded in different directions; some of us went off to fish in the Sone river close by, and we practically lived on game the whole time. These outings made men of us and we did get as hard as nails and learnt much about tracking. All this experience came very useful to me in after years. It would be a good thing for the youth of to-day to do some of that roughing. Everything, with the advance of years, tends to luxury and this to physical deterioration and laziness. I think the greatest pleasure in shikar is to "swank" for it and am no believer in shoots made easy, where everything is done for the hunter with the minimum of exertion. The real shikari

should know all about the habits and tracks of an animal, know all the names of the trees and shrubs he meets with in jungles, the forest cries of bird and animal. He should also be able to track any animal independently of a native tracker. He will then find that his days are full of interest and that he will become observant and nothing will escape his eye. Let me here give a tip to younger sportsmen about learning the "spoor" of different animals. Books, most excellent ones, on "spoor" are of no practical value; two or three days spent at a salt lick or a tramp along the sandy bank of some secluded river, where all sorts of animals abound, such as the Dibingi or Dihong in Assam, will be a good practical lesson to the budding shikari. When I have had nothing to do, a stroll along the river near my camps has always proved interesting.

After this diversion let us return to the Cheetal.

The Cheetal loves sal forest and somehow I have always associated it with peafowl. The Cheetal at times utters a most weird noise; it beats the howl of the Hyæna. I heard this only in the Jaggar Valley and it was certainly an eerie sound and quite undescrivable. Whether it is the sound of alarm or a challenge, I am unable to say.

Many years ago, as I have said, the Siwaliks afforded splendid hunting grounds but before I left India in 1927 I was told game had sadly diminished, like everywhere else in India. This, I was told, was due to indiscriminate shooting by native shikaris. The chief damage, however, was done by Gurkha sepoy, who belonged to the regiments usually stationed in the Doon. These men get leave on the pretext of going to their homes but actually go hunting. Of course, everything is shot and the surplus meat dried on *machans* over a slow fire and afterwards sold. I hope my remarks will catch the eye of Commanding Officers and Forest Officers of the district concerned. There is no doubt, in my mind, that a sanctuary for game should be made in the Siwaliks to protect the fauna from further annihilation. Years ago the Cheetal was found in Assam, and I believe also the Black buck. Alas! the latter is no longer to be found there but a heap of the former still exists but only in one place. Hill, of Orangajuli, and myself have seen this herd of about fifteen animals twice in the sal forests N. E. of Orangajuli in the Darrang District, very close to the Bhutan hills. We could never

get near them, they were terribly shy and their dappled hides disappeared like a flash through the forest. I fancy the Cheetul and Black buck have been wiped out by heavy floods, which are notorious in Assam, the rivers rising many feet and the beds changing in the space of a few hours. In flood time, too, the animals would be easy prey to the hunters in dug-outs and armed with spears.

The forests between Dhubri and Gauhati, along the railway, are ideal ground for Cheetul and I do not see why a few animals are not introduced there and protected.

[There are two species of Spotted Deer, the one found in India being called *Axis axis axis*, Erxl, and that of Ceylon *Axis axis ceylonensis*, Fitz. The differences are according to the Summary of the Indian Mammal Survey :—

- A. Antlers stouter ; spots larger ;
forehead usually with a dark
chevron and a few white spots ... 1 *a axis*, Erxl.
- B. Antlers lighter ; spots smaller ;
forehead uniformly brown ... 2 *a ceylonensis*, Fitz.

The type locality of the former is "Peninsular India" and localities given are Berars; Central Provinces; Kanara; Oudh; Rohilkund; Kumaon; Bengal; Nepal; Mysore; Coorg, and base of the Himalayas from the neighbourhood of the Sutlej to Nepal. The type locality of the latter is Ceylon and it appears to be only found there.

The horns, well described by Dunbar Brander, "are reddish brown. The beam, which curves backwards and outwards in a lyre-shaped formation, is usually about 32 inches long and produces a tine on the inside about two-thirds of the way up. The brow tine comes off at approximately a right angle. In old animals one or more "sprags" are generally developed on the brow tine close to the axil.....Lydekker gives the record length as 38¼ ins., with a girth of 4¾ ins; Major Stockley has mentioned a head of 39 in.; it is probably correct to say that the 40 in. head has yet to be killed." Rowland Ward's record is of a stag shot in the Kumaon Terai, the owner being J. V. Collier. The measurements are :—

- 40" Length on outside curve.
- 4¼" Circumference above the first point.
- 23¾" Tip to tip.
- 4+3 Points.

The general colour of the Chital is rufous-fawn, with a dark dorsal stripe from the nape to the tail, bordered by a row of white spots. The body is also marked with white spots running in lines longitudinally along the body; those on the lower line sometimes coalesce, forming a continuous line. Below the chin, the throat, inside the limbs and under surface of the body and tail, are white and the head is brownish. The hide is usually beautifully glossy as if groomed and, with the sun shining on it, is a magnificent sight.

Chital are fond of more or less open forest, such as that in which *Siris* trees and cotton (*Eomlax*) trees grow, with clear pellucid streams meandering through. They must have water and in Bengal, at any rate, don't seem to care for heavy forest. They are not shy animals and, where their haunts are near villages, they do considerable damage to the villagers' crops. They also do some damage to young plantations as do other deer. Their food consists of grass, leaves, fruit as well as crops and they may often be found below trees on which there are troops of monkeys picking up any fruit, etc, dropped by them. They are less nocturnal than other deer and may be seen grazing till quite late in the morning and long before evening. Chital are very sociable animals and besides congregating in herds, they may be seen in the company of other wild creatures. With regard to their calls, Dunbar Brander writes:—"In addition to a death scream, Chital possess two calls. The commonest is the shrill whistle they utter when alarmed. In addition, stags when roaring make a somewhat kindred sound, *i. e.*, of the nature of a whistle, but louder and longer than the cry of alarm." Their senses appear to be rather moderate than acute and many fall a prey to leopards, tigers and wild dogs but especially the former. Dunbar Brander says that many also are killed by crocodiles; this is probably the case in the Sundarbunds, when the herds are on the sea shore.

Kinloch considers them to be not at all conspicuous, the skin harmonizing with the dead leaves and grass and the spots resembling specks of light. Those we have seen were usually in open glades and there they certainly were conspicuous.

With regard to Chital shedding their horns, we pillage Dunbar Brander. That interesting observer writes:—"Stags will be met with in full horn at all

seasons of the year, but, nevertheless, they have a regular period, and I have never seen a stag without horns in April or May.

"The great majority of animals drop their horns in August, begin to grow them towards the end of the rains, and are in velvet up to December, when they commence to clean their horns by rubbing on a bush or small tree. Most stags are in full horn by March. It has been suggested that the irregularity with regard to the period during which they carry horns is correlated with the date of birth. Newly born animals, as well as stags in horn, are found at all seasons, and it seems to me that the two phenomena may have simply been associated without any evidence of there being any connection between the two. There is a distinct rut in the end of April and the beginning of May, when most of the breeding takes place, and during this period it is rare indeed for a fully mature animal not to be in full horn. Most of the animals found in velvet or in horn at irregular times have not reached full maturity, and it is probable that the stags do not develop regular habits until they have attained this stage of development. It would seem, therefore, that the age of the animal is an important factor, and that animals which have been irregular, in the course of time, drop this habit." This is most interesting and appears to be very sound reasoning. We have seen stags in the velvet during a Xmas shoot, whilst others, at the same time, have been in full horn, and could never understand the reason for this. We should like to hear our members' views on the subject. We were under the impression that, with us, the rut took place in the cold weather. Chital are very prolific breeders and Dunbar Brander writes:—"One to three fawns are born at a time, two being a common number." The fawns are spotted, as are those of most other deer.

We are indebted to Mr. F. W. Champion for the excellent photograph. It was taken from the back of an elephant, in daylight, at a range of only 5 or 6 yards. He writes:—"It is interesting as showing how near it is possible to approach Chital (and sambar) on a well-trained tame elephant in wild elephant country." It also shows well how Chital blend with their surroundings. *Editor*].

The Life of the Darjeeling Land Leech.

BY J. PERCY MOORE.

In a recent number of this Journal (Vol. III, No. I) Mr. G. E. Shaw gave a brief account of the leeches known to have been found in the Darjeeling District. Of the five species listed, all belong to the single family Hirudidae and four are land leeches. Since then, Mr. Shaw himself has added a species of fish leech (*Piscicola*) of the family Ichthyobdellidae and the so-called buffalo leech or tank leech (*Hirudinaria manillensis*) fairly belongs to the district, though only in the deep river valleys and at the foot of the hills. This total of three species of aquatic leeches belonging to two families and four species of land leeches, compared with 44 known species of aquatic leeches belonging to four families and eight species of land leeches for India as a whole, brings into sharp relief the outstanding peculiarity of the leech fauna of Darjeeling. It is exceedingly poor in aquatic types and relatively very rich in terrestrial forms. This follows from the marked physical and meteorological features of Darjeeling, the turbulence of its streams and the paucity of natural bodies of still water, on the one hand, and the heavy rainfall, dripping ravines, mist-bathed ridges and water-saturated atmosphere, coupled with an abundance of domestic animals and bare-footed men, whose mountain-nurtured blood should be peculiarly rich in nourishing haemoglobins, on the other.

There is no need to repeat what Mr. Shaw has already reported so well and this article will be limited to an account of some aspects of the natural history of this common land leech of the hills. All of the land leeches of India belong to the typical genus *Haemadipsa* (takers of blood) and the little dark-colored leech, so abundant throughout the district, is a subspecies of *zeylanica* named *montivindicis*, or defender of the mountains, for quite obvious reasons. As all Darjeelings know, its stronghold is in the highly humid zone between about 4000 to 6500 ft. but it is found far beyond these levels to 1800 ft. and 9500 ft. at least.

Although so ubiquitous, the life history of this leech is by no means fully known. Of their birth little more is known than that during the early rains,

from the end of May to sometime in July, eggs, capsules or cocoons, each containing 10 to 20 eggs or young, are found partly buried in the wet earth beneath stones, wood and similar objects. These capsules are nearly spherical and about $\frac{1}{2}$ in. in diameter. They are composed of a pale brown substance of horny consistency, secreted by the skin glands of the clitellum and consist of an inner capsule which contains the eggs immersed in an albuminous mucus, and an outer protecting layer of about 35 coarse, polyhedral vesicles shaped like small soap bubbles in contact. The newly hatched young are about $\frac{1}{4}$ in. long but resemble the adults in form, color and behavior. The mode of formation of the capsule, the number of capsules and the number of young produced by each worm have not been reported for the land leeches nor how many seasons they will reproduce. Analogy with other leeches and their grouping into three sizes would indicate a life of three years and as many periods of reproduction. If the newly-hatched leeches secure a meal of blood early, they probably grow rapidly but no exact observations on the rate of growth of land leeches have been made. What is known of related leeches suggests, however, that normally they mature and breed at the end of their first year. All leeches are hermaphrodites and act first as males and then as females but the exact process of impregnation in the land leeches has not been described.

As is well-known, the period of activity of land leeches is during the rains, when a superabundance of moisture permits them to move about freely and widely with safety from drying. After the rains, hungry and unfed leeches will come into the open if stimulated, especially at night or on cloudy days or when the grass is still wet with dew. Even when the grass is quite dry and the sun shining, very hungry leeches will appear if one walks through their haunts but they remain out for only a short time and, if unsuccessful in attaching to a host, will quickly drop or retire to the ground and seek shelter and moisture at the bases of the stems of grass and other herbage. When exposed to dry air, it will be noticed that a thin glistening film of fluid quickly spreads over the body. This is a special adaptation to keep the surface moist. If denied this protection on a clear day, they quickly dry and succumb. It arises partly from mucous glands scattered abundantly throughout the skin and partly from the openings of the

nephridia or kidney tubules, a pair of which open at the margins of the body on each of most of the complete segments. Each nephridium is provided with a vesicle or bladder for the storage of the very watery secretion which is very carefully conserved and voided in small quantities when the need for more moisture is indicated by the drying of the surface, over which it is spread uniformly by an elaborate system of furrows like irrigation ditches. The first pair opens on the margin of the head sucker and the last pair beneath a bush-like spreader (auricle) at the base of the caudal sucker. These special arrangements serve to keep the margins of the organs of attachment and prehension moist and pliable, which is necessary for the efficient performance of their functions.

How do these leeches become aware of the presence and position of their prey? This is a matter of some complexity and the exact mechanism and procedure varies with conditions and circumstances. If one can succeed, without disturbing it, in placing a living and alert leech under a strong magnifying glass, many interesting and beautiful structures will be revealed. Among these are various sense organs, of touch, light, perception and smell-taste, at least. Most numerous and wide-spread are the organs of touch and pressure which stud the whole surface of the body as little conical papillae, reminding one of the "goose-flesh" effect on the chilled human skin but relatively more numerous and prominent. They are provided with circular muscles for retraction. On the middle ring of each segment (or group of five rings, except at the ends of the body) will appear among the conical papillae a transverse row of several colorless or whitish dots, which often stand up and sparkle like clear crystal beads. These are primarily light-perceiving organs or sensillae and with some variations there are six pairs above and six below, symmetrically arranged, on each segment. On the head five pairs of these, disposed in a regular arch, have become highly developed and specialized as the so-called eyes, characterized by the great increase in size and number of the clear visual cells, the development of an enclosing pigment cup to confine the stimulating pencil of light to a central axis, the development of retinal nerves, etc. On excited leeches, they often stand out so prominently as to justify the appellation "pop-eyed". The taste-smell organs, or organs of chemical sense, are

small goblet-shaped cells which thickly stud the margin of the lip and anterior sucker but are found sparingly elsewhere. Some other sense-cells are found but little is known of their functions.

Now if one walks in the grass along a leech-infested path but where no leeches are actually visible and pauses for a few moments to watch, it will be seen that after a perceptible interval leeches will come looping hurriedly up the plant stems to reach high points of vantage. Most of these leeches were lying on the ground at the bases of the plants and were stimulated to action either by the direct contact and movement of the herbage or more frequently by the vibration of the ground caused by the foot-falls. In either case the universally distributed touch organs were stimulated, setting in action the crawling or looping reflex, which in a hungry leech is directed upward away from the center of the earth (negative geotropism) and to a limited extent toward brighter light (positive heliotropism). The leech is impelled to climb any plant or object with which it comes into contact. When a high point at the top of a blade of grass or plant is reached, the leech usually pauses. With the caudal sucker fixed, the body is extended to the utmost and more or less violent reaching movements are made in all directions. Evidently these are quite random and exploratory and their general effect is to bring the leech into a wider and more varied field of sensory stimulation. Now any of one of three or four or possibly more things may happen according to the nature and strength of the stimulate received and the state of the leech itself. By its climb the leech has been placed in an advantageous position, where our shadow may be more readily perceived, and in a less confined space more accessible to air currents bearing our odoriferous particles. Or the leech may be so fortunate as to come into direct actual contact with one's body, in which case it immediately shifts to us and, guided by its sense of smell, quickly finds a spot where a meal can be enjoyed in seclusion.

More often, however, no sensory clue to the position of the passer-by reaches the leech immediately and most likely it will move to another position and repeat the exploratory movements, or it may extend itself in an attitude of rigid "attention" and remain so for a long time. This is not a condition of rest, as is often supposed, but, on the contrary, one of great excitation and

high nervous tension, comparable in that respect to the state of a hunter who, having heard a rustle of leaves, stands with gun poised awaiting the expected appearance of his game. This has been proved by many experiments. If one remains in the vicinity, the leech is almost certain sooner or later to catch one's odor, upon which it makes many excited exploratory movements, then orients itself in the general direction of increasing smell intensity (much like a dog pointing a bird) and starts looping as rapidly as possible towards its victim. But this movement is neither so precise in direction nor so rapid as some descriptions would lead one to believe; at least it is not in these small mountain leeches at the close of the rainy season. Until the leech gets within a few inches of its prey, its movements are marked by much uncertainty and indirection, with many pauses for random exploration, of feeling the way, as it were. It is a course of trial and error but always in the correct general direction. If, when the leech has nearly reached its objective, one, being careful not to throw a shadow on it or to jar the ground, steps carefully to another position, the leech, after some moments of hesitation and exploration, will correctly alter its direction of travel. A variety of experiments and observations many times repeated makes it quite clear that while touch is the principal sensation to start the leech into activity, it is smell, and only exceptionally light perception, that is chiefly effective in directing them to their prey. And once the victim is reached, it is smell that directs them to a suitable point of attack. One cannot observe the behavior just described without realizing that of all animals leeches are the most perfect exemplars of adherence to that admirable principle on conduct laid down in the prophet's admonition to "Prove all things; Hold fast to that which is good."

During the rainy season the first stage is frequently omitted by reason of the fact that many of the leeches are already in elevated positions on plants, etc. The chain of reflexes evidently differs under those circumstances but the mechanism has not yet been worked out fully. The feeding of a leech is in itself a matter of some interest. After selecting a spot where the skin is thin and vascular or where it is already abraded or inflamed, the leech attaches its oral sucker firmly. Immediately behind this are three radiating compressed semi-circular muscular ridges or jaws, each bearing

on its sharp ridge about seventy minute, acute teeth. By means of a powerful and complex musculature, arranged somewhat like that of our tongue, these jaws are brought to an exact center, pressed firmly against the skin and rotated back and forth, each along its own axis. The result is that the teeth cut into the skin three delicate slits meeting at a common center and separating three triangular flaps. On the jaws open numerous ducts of salivary glands which secrete a substance known as hirudin, which prevents coagulation of the blood. This is poured into the wound, causing the blood from the numerous cut capillaries and arterioles to remain fluid and free-flowing. This is why the bleeding from such an insignificant wound as a leech bite is so copious and sometimes so difficult to check. The incisions having been made, the bulb-like muscular pharynx immediately following the jaws begins to pump, lifting the points of the flaps of skin, drawing the blood through the central passage between the jaws and forcing it through a membranous valve into the storage stomach or crop. This, by far the largest portion of the digestive tract, occupies the entire middle region of the body and its capacity is enormously increased by eleven pairs of lateral extensions or caeca which reach far among the other organs. When empty it contracts and occupies but little space and the leech is slender, but under the vigorous pumping action of the pharynx, it may become so enormously distended that the skin is tightly stretched like a tick's and the body becomes thick and flask-shaped. Some actually weighed before and after feeding had imbibed nearly eleven times their own weight of blood. About thirty minutes of undisturbed feeding are required to complete such a meal, after which the leech drops off and seeks concealment.

It is most interesting to observe that after a full meal certain of the leech's reactions are completely reversed. Instead of crawling upwards and into the light, they now move downward and away from the light. This leads them to shelter and concealment and possibly to other ends that will be discussed below. It may be noted in passing that again the conduct of land leeches closely parallels that of our own species. A full stomach or a plethoric bank account, which ensures the continuation of a full stomach, tends to retirement, complacency and settling-down.

If a fed land leech be closely watched, it will be noted that a little drop of clear fluid appears at each of the nephridial openings and spreads over the skin. It appears that as the blood is imbibed, a considerable portion of the watery serum is excreted and drawn off by the kidney tubules and that this fluid is utilized to moisten the skin during the critical period of feeding, when the animal is likely to be exposed to the air and possible drying for a relatively long period. The stored blood is thus concentrated, with a great relative increase in its solid nutritive constituents. Furthermore, the saliva not only possesses anti-coagulant but also preservative properties and the stored blood remains fluid and undecomposed for an indefinite period. This is important, for a leech's meal will serve it for several months or even for an entire year until the next rainy season offers another opportunity or perhaps even for life. Digestion takes place very slowly. From time to time a small amount of blood is admitted to the small compact digestive stomach which follows the storage stomach, is acted upon by the juices therein secreted and passed on to the short intestine with its four pairs of lateral caeca to increase its surface, absorbed, and the small amount of undigested waste passed through the rectum to be eliminated by the pore-like anus. If the leech is not fully satiated, it may feed again within a short time and herein lies a possibility of the transmission of skin or blood infections.

The two questions most frequently asked about land leeches are Upon what do these subsist that fail to secure a meal of blood? and, what becomes of them during the dry season? Neither of these can be answered fully from present knowledge, so far at least as the mountain leeches are concerned, but the available data permit partial answers to both.

The first question is prompted by the enormous numbers in which these leeches appear in certain favored localities during favourable seasons—numbers described as so incredibly great that it seems impossible that more than a very small percentage should be able to obtain a meal of blood. It is often suggested that they may feed on plant juices or on such small animals as earthworms, snails and various insect larvae with which they are associated. But apparently no one has ever seen them partaking of such food. The direct examination of the stomachs of a large number of active hunting individuals

has invariably proved negative. Their stomachs are empty. If they have taken plant juice, it must have been very sparingly and it must have been rapidly absorbed. Certainly it is not stored in large quantities as is blood. No traces of other animal food have been found. Leeches have been kept captive for weeks at a time with earthworms and insect larvae without attacking them or showing toward them the slightest interest. All positive evidence is that vertebrate blood alone constitutes their sole diet but, while mammalian blood is preferred, they are known upon occasion to attack birds, snakes and frogs and it seems probable that when opportunity offers they will attack any other vertebrate. There is no evidence that they are cannibalistic. The percentage of leeches that secure blood is probably much greater than is commonly supposed. Hundreds may feed during the course of a day upon a single cow or a coolie exposed to their attacks and when one considers the large aggregate number of men and domestic animals, together with all the wild animals subject to their attacks at all times, it can readily be seen that during the entire season the total number that feed on blood must be very great indeed.

This brings us naturally to a consideration of the second question, which is closely bound up with the first. Most testimony is that these leeches reach their maximum abundance very early in the rains and shortly after their first appearance and that this maximum is in general first attained at the lower levels and spreads to the higher ridges, its progress being much complicated by local differences in topography, rainfall, temperature, plant cover, etc. From the maximum the numbers gradually decrease through the season, the largest individuals on the whole disappearing first and being later replaced by a swarm of very small ones that must be the new-hatched young. At the end of the season, when the rains have ceased, the residue, at the higher levels at least, consists almost exclusively of leeches of small and medium size and these are all unfed, hungry and active. Large, full-grown leeches or those gorged with blood are practically never found at this season at the higher levels (above about 5,500 ft.). This is all quite consistent with the facts already mentioned and with the results of the writer's own limited observations and experiments. It appears to indicate: first, that the chief mortality occurs in the oldest generation at the close of the egg-

laying in the early rains, and second, that during the course of the rainy season a large number of all sizes have fed and retired, thereby reducing the visible supply progressively. The diminution in numbers, of course, cannot be attributed solely to feeding. Many leeches must fall a prey to birds and other animals, become victims of accidents of various kinds or succumb to parasites and disease. But there are practically no data on these subjects and present information indicates that by far the most important factor in the great reduction in number of these leeches after the early post-generative mortality is retirement after feeding.

Two explanations of the cold weather disappearance of the leeches are commonly offered. One is that they die and that the species is preserved through the winter months by eggs from which the crop of the following year is produced. There is abundant evidence to disprove this view and it need not be considered further. The other is that they spend the dry months beneath stones, sticks, leaves and similar objects or penetrate a short distance into the ground. This hypothesis is largely supported by evidence. It can be fully established for the big striped land leech of the plains. During the winter months the fed adults of this species may always be found locally thus ensconced. It receives strong support for the mountain leeches also at the lower levels. From around about 5,000 ft. downward, the larger fed leeches have been found under the edges of sunken stones in ravines, along dry jhoras and similar somewhat moist spots long after the rains have ceased and, according to statements of some residents, throughout the winter. But at the higher levels, on the ridges and spurs of Darjeeling Town, for example, and on dry hillsides with southern exposures at lower levels, the problem remains unsolved. A careful search about West Point, Jalapahar, Senehal grazing ground and other points where leeches were reputed to have been abundant during the rains, under flower pots, boxes, boards, stones, etc. and among the roots of grass and herbage and in the superficial 2 or 3 inches of soil, failed to disclose any torpid leeches up to the middle of November. Neither is there any direct evidence that at these levels they gather at wet spots to pass the winter. A number of such spots which seemed specially favorable were examined but, although

earthworms in abundance were found, there were no leeches. If they hibernate in the very places where they are so ubiquitous during the rains, it seems strange that the malis and sweepers who work about the gardens and compounds or the coolies who are doing ground construction work fail to find them. Yet in spite of frequent inquiry none were produced. While such negative evidence is by no means conclusive, it does justify the examination of alternative hypotheses.

The only one worthy of serious consideration is that of migration. Do these leeches seek especially favored localities in which to spend the winter months? Do they leave the more open grass lands and grazing areas, the paths with many passers-by and the vicinity of human habitations and without materially changing their altitude gather at permanently moist spots or those where the remnants of the forest and jungle remain? If so, it would seem that in an area such as the town of Darjeeling some such congregating places must inevitably have been found. The writer has been unsuccessful in learning of any such. Do they then undertake a vertical migration, moving down the khud to the vicinity of the larger and permanent streams during and toward the close of the rains, and returning upwards to spread over the ridges and higher spurs when the rains again insure more uniform and favorable conditions of moisture? Residents of Darjeeling, whose long experience with land leeches entitles their opinions to the greatest respect, seem generally to look upon this suggestion with scepticism. However, it is worthy of examination, for while no direct evidence of such a movement is available, it would explain the disappearance of the leeches from the higher, drier and colder areas; it is not inconsistent with the known facts of their seasonable distribution and abundance, and it harmonizes with the known reactions of fed leeches, which move downward and enter water more readily than do unfed leeches. And it is precisely the fed leeches that disappear, whereas the leeches that reappear at the beginning of the rains are all lean and hungry and ambitious. They are moved by the urge to climb and might well bear the "banner with that strange device, Excelsior". Much collateral evidence bearing on this question might be presented but what becomes of mountain land leeches in winter is not to be settled by argument or the marshalling of opinion, but by the

gathering of precise, continued and extended observations which can best be made by those whose lives bring them into daily contact with the leeches. To those to whom land leeches appear solely as pests, (and this means practically all permanent and summer residents of Darjeeling), this question is not without interest, for, should it prove that the mountain leeches really do migrate, or even concentrate, a very promising means for their local control will be offered.

But why should one come half-away round the world to study land leeches? Are there no leeches in America? Can you find a means of getting rid of them? are questions frequently asked. All may be answered together. Land leeches are peculiarly creatures of the Orient. Their center of distribution and probably of origin lies along the southern slopes of the Himalayas. They are of particular interest to the Zoologist, not because they affect human comfort, but because, departing from the customs of their ancestors, they have cut out a new evolutionary pathway for themselves by leaving the water for the land. The measure of their success is their "incredible profusion" and their wide distribution from Japan to Australia and Madagascar. The means of its attainment are found in the many modifications of structure and behavior (a few of which are described above) which they exhibit in adaptation to terrestrial life. That this adaptation is not perfect is shown by their dependance upon moisture and a highly saturated atmosphere, which limits their activities both seasonably and specially. There is evidence that they are gradually overcoming this handicap that they are in process of further evolution and among the "winners in life's race." It is the means by which this success is being reached that are most worthy of study. If, because their interests clash with ours, they are to be restrained, the surest way of accomplishing that end is to learn everything possible of their ways of life and behavior. When our knowledge of their life histories and relationships to their environment approach completeness and exactness, we may feel confident that points of control will become obvious and measures of application readily devised.

[I am sure all our readers are very grateful to Professor J. Percy Moore, of the University of Pennsylvania, U. S. A., for this most interesting article on our common land leech. He is an authority on the subject

and is responsible for a large part of the Fauna of British India Volume on *Hirudinea* published in 1927. In a covering letter he writes:—"In writing this article I had largely in mind the possibility of arousing some of your readers who know a great deal about these leeches to write of their observations. I should be glad to correspond with any who have some facts to contribute." There is still a good deal to be learnt about these pests and we hope any of our members who are in a position to help with observations will communicate with Professor Moore. *Editor*].

Darjeeling Shooting and Fishing Club.

Minutes of a Meeting of the Terai Sub-Committee held at Bengdubi Club on January, 22nd 1931.

Present.

Mr. A. C. Ricketts, *in the Chair*. Mr. A. Robertson, Mr. D. Malcolm, Mr. W. C. Donnellan, Mr. A. W. Fullerton, Mr. C. G. Baron, Mr. D. C. Filose. Mr. R. R. Kirby.

(1) It was proposed that a new member joining during currency of season be only asked to pay a proportionate subscription, and thereafter a full subscription for the following season.

(2) A case has been reported where a Club Patrol was dismissed by a Forest Ranger for an offence which was not against any Forest or Club Regulations. We want it to be understood that the Club sub-district member in charge of that particular section is the only person authorised to appoint or dismiss the patrol of that section. (Note: The patrol has since been reinstated.)

(3) It is proposed that no member of the Club be permitted to tie up more than two baits for tiger at one and the same time.

(4) It is proposed that the Committee be approached not to allot any further sums towards the Trout Experiments, and that the matter be put on the Agenda for the next General Meeting.

(5) Complaints have been received by members from Patrols of not having received their pay regularly. We consider that all Patrols be paid regularly monthly.

(6) We consider that no Club Patrol be utilised by any member for tying up baits or any other duty not connected with his work.

(7) We propose that Sambhur be closed for one year.

A. C. RICKETTS,
Chairman.

Darjeeling Shooting & Fishing Club.

*Minutes of a Committee Meeting held at Bengdubi club,
Darjeeling Terai, on January the 25th at 6 p. m.*

Present.

Mr. W. H. Matthews, *in the chair*. Mr. E. G. Birch, Mr. R. R. Kirby, Mr. A. C. Ricketts, Mr. D. G. Smyth-Osbourne, Mr. D. A. G. Davidson, D. F. O., Kurseong. Mr. R. M. Wright, Superintendent of Police, Darjeeling.

(1) The Minutes of the last meeting held on the 29th October, 1930, were read and confirmed with the following provisos.—

Re. para 4. As the Secretary had not sent a letter to Col. Webb, the President would write himself asking for the necessary permission. If this was obtained Mr. Birch and Mr. Smyth-Osbourne agreed to discuss the matter further with Col. Webb, and to make an estimate of the cost of the work and the annual recurring expenditure, which would be submitted to the Committee.

Re. para 7. The Committee were of opinion that the action taken by the Forest Department be upheld, but that the fine of Rs. 50 imposed by the Club should be rescinded, and if already paid should be refunded. In this connection sub-district members should note that all the offences which are committed on land over which the Club has no jurisdiction, and which are therefore non-compoundable by the Forest Department but which come under the "Wild Birds and Animal Protection Act" should be reported the Magistrate having jurisdiction.

Re. para 9. The Club has no jurisdiction to grant the licence applied for.

(2) Proposed by Mr. Birch and seconded by Mr. Ricketts that the Club Patrols be enlisted as Forest Guards and wear Forest Patrol badges. Resolved that the matter being one of great importance in the matter of Club policy, the matter be brought before a General Meeting to be held in March. Meanwhile the D. F. O., Kurseong be asked to report on the cost of uniforms etc.

(3) Proposed by Mr. Smyth-Osbourne and seconded by Mr. Matthews that when the new boundaries of the Senchal Sanctuary are defined, the D. F. O., Kurseong

be asked to have notices put up in suitable places, and that a map be sent to the Club for information. Passed unanimously.

(4) The Minutes of the Sub-district Meeting of the Terai held at Bengdubi Club on the 22nd instant (attached herewith) were discussed at length and the following resolutions were passed:—

Item. 1. That no proportionate subscriptions were allowable.

Item. 2. That the Sub-district representative deal with the matter himself.

Item. 3. That the number of baits for tiger be limited to three per member at any one time.

Item. 4. That the matter had already been settled under para 1 of this meeting.

Item. 5. That the Secretary be instructed to remit the pay of all patrols and trout keepers regularly every month to the Sub-district members concerned.

Item. 6. That the resolution be confirmed.

Item. 7. That the matter be included in the Agenda of the General Meeting vide para 2 of these minutes.

(5) With a vote of thanks to the Chair the meeting terminated.

W. H. MATTHEWS,

President & Acting Honorary Secretary.

NOTICE.

Mr. F. C. Riches of Rydak T. E. and P. O. has asked us to insert a notice to the effect that he is now the Honorary Secretary and Treasurer of the Toorsa-Sankos Fishing and Shooting Association. All communications should be addressed to him at the above address.

Editor.