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EDITED BY

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

BY

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

(Continued from page 3)

19. The Northern Indian Rufous Turtle-Dove.

Streptopelia orientalis ferrago (Eversman)

This bird is the palest of the three subspecies. The chin and throat are albescent and the abdomen is white or nearly so. The under tail-coverts are white and the feathers under the wing are of a lighter grey than in the preceding bird. The sexes are alike.

The wing measures approximately from 65/8 to nearly 8 inches.

The white under tail-coverts are the easiest means of distinguishing this bird from the other two subspecies.

With regard to distribution Stuart Baker writes:— "through the lower levels to Sikkim up to 8,000 feet above which the preceding bird takes its place. Stevens records this form down to 4,500 feet in "early summer" but not then breeding, whilst birds shot by him at about 7000 feet were all intermediate between this and the last race." This statement does not agree with what Stevens wrote in his article on the "Birds of the Sikkim Himalayas". In it he wrote "So far, I have failed to locate this form from the Sikkim Himalayas." Those he got at 4590 feet in the early summer were the typical race *S. o orientalis*. Some birds intermediate between *S. o. orientalis* and *S. o. ferrago* were got by

in such a large snake. It is our largest, except the Python, but the fangs are practically no larger than an ordinary Cobra's and not as long as a Viper's. They grow to about three tenths of an inch and, as the writer of a very widely circulated article said, a little while ago—nearly three inches. Why the fangs of a Viper should be so much longer is not known, apparently it is more necessary for its venom to be injected deeply to take full and rapid effect.

The King-Cobra feeds mostly on other snakes but will not disdain small mammals. One in the London Zoo ate 82 snakes one winter, and cases of this Snake swallowing others nearly as large as itself have been frequently reported. Colonel Wall cites one where a twelve foot King-Cobra was caught after swallowing part of a Python 9 ft. 2 inches long.

Capt. K. L. W. Mackenzie told Col. Wall that in 1908 a sepoy in the Buxa Dooars shot a King Cobra 9 ft. 11½ in. long that contained a large monitar lizard, probably *Varanus bengalensis* measuring 3 ft 9 in.

Eggs (21 to 33) are laid during April and May or about then in a kind of nest of leaves and jungle rubbish and the female stays with them for some time, probably not coiled over them continuously but not much is known of this or whether she stays till they hatch. The male is said to stay near by. Hatchlings are about 20 inches long.

Its occasional ferocity under incalculable conditions is well known. It is assumed that, as with other animals, the breeding season accounts for it but some account of this and other habits has been given in our *Journal Vol. II. No. 2 page 30, October 1927.*

The poison causes gradual paralysis throughout the body, death taking place from interference with the respiratory apparatus just as with the Cobra. It also breaks up the red corpuscles and prevents clotting. There are however, minor differences from the effects of Cobra poison and the antivenine serum prepared for Cobra bites is of no use for the King-Cobra. It delays death but cannot ward it off.

There is always uncertainity about the amont of venom that has been injected so that the patient should be kept warm and drink hot soup or coffee in the hope that the dose has been below a lethal one. A ligature too should be put on to slow down the effect as much

as possible. However the King-Cobra strikes hard and maintains his hold generally and can inject ten times the amount of poison necessary to kill a man. Death may then take place in 15 or 20 minutes.

Costal scales 19 or 17. 15. 15. Ventrals 225-262. Subcaudals 76-117.

Length. Rarely exceeds 10 feet but the record is 15 ft. 5 ins.

67. Naia naia. (Linne) formerly *Naia tripudians.* The Cobra. Poisonous.

Both the names *Naia* and Cobra really only mean snake. *Naia* modified from the Sanskrit and Cobra from the Portuguese, and the fact that this particular snake has appropriated these names to itself indicates its importance. It is the best known and the most deadly snake in the world and this last fact may be better appreciated when it is realised that deaths from snake bites in India alone, amount to over 19,000 yearly. The Cobra accounts for more of these than any other snake though its venom may not be so powerful as that of some others, for instance the Sea-snake which very rarely indeed accounts for any deaths at all. Every one knows how it can raise the front of its body from the ground and expand its neck into a hood. For a long time it was always called "Cobra de capello" merely the Portuguese for the hooded snake; and most people have an impression that on the back of the hood is a spectacle mark, two circles united by a central loop. This is only true of one form, the universal form in the southern parts of India though some may be found all over the North and East of Peninsula India, in the Dooars for instance. But there are two other forms, one has a single circle on the hood and that is our variety while the third has no marking at all. This last form is found chiefly in the Central Provinces, but occurs in the plains of Bengal as well. Boulanger has attempted to classify the Cobras in this way calling our monocellate variety *fasciata*, the one without a ring *caeca*, and the one with the full spectacle marking *typica* and he tried to correlate with this the great variation in the number of rows of costal scales. But apparently the latter variations wont agree with the markings and neither will agree properly with the distribution, so that studies of variation in the Cobra are at a standstill.

Our variety is of a uniform light dull brown colour with the black ring on the back of its neck double, the narrow space between the two circles a lighter brown. Below the neck it is ochreous-brown in colour. The tail is nearly cylindrical but the rest of the body rather triangular and flattened. The head does not appear to be very distinct from the neck because of the loose skin that, when distended, forms the hood. The scales on the top of the head and along the back are highly polished and the body remarkably even in girth throughout its length. When the hood is not expanded and especially after the snakes' death when it would appear to be impossible to stretch out a large hood, it is not too easy to make out at once whether the snake is a Cobra or not. Many a time mistakes have been made by the unscientific. The chevron pattern of the scales (*shown in Fig. F of Plate 2*) is distinctive, and a safe criterion is the presence of small wedge-shaped extra scales between the tops of the 4th and 5th. infralabials or lower lip scales. It is small and the mouth should be opened when looking for it. Colonel Wall says that it occurs in no other land snake but is seen in a few species of sea-snakes. The Cobra is said to ascend the hills to 8000 feet but we have never found one above 4000 feet.

Food. Like most other snakes of its size it will eat lizards, frogs, toads, small mammals such as rats and mice, and squirrels, other snakes, birds and eggs. It has sometimes taken chickens from hen houses and quite often accounts have been sent to journals of Cobras swallowing hen's eggs entire. Several times, after the Cobra has been killed, the eggs have been recovered and hatched. There can be no doubt about this, it has been vouched for by various people.

In Fyzabad a fish hook that would have held a mugger was baited with a frog to catch a Cobra that had eaten chickens from a native hut. At 5 o'clock in the morning the Cobra came again and swallowed the frog. It was despatched and taken to Colonel Wall who tells the story.

It is really very timid but easily tamed and that is why snake charmers use it in preference to other poisonous snakes. They never carry young ones about this is because these are much more easily excited, more irritable and more active.

Even the adult, when suddenly alarmed or when brought to bay, will go for one. It first erects the front part of its body, hisses and sways and looks for an opportunity to strike. It can raise itself up to one third of the length of its body and only strike that distance from where it rests on the ground. I have seen two strange accounts of its tenacity of life and pluck when cut in two by shot. In 1895 a snake described as a black Cobra had been shot into two pieces and the head portion disappeared into a hole. A beater tried to dig it out, with the result that it came up and pursued him with hood expanded. In 1907 Colonel Biggs told of a Cobra cut in two by shot that afterwards put up a good fight, the head half being only 3 or 4 inches longer than the tail half.

The expansion of the neck to form the hood is due to the action of muscles on the ribs there. These, from vertebra No. 3 to about No. 30, have the ribs normally directed backwards, outwards and downwards and in the erect pose the muscles pull them outwards and completely transverse, at the same time straightening them. The loose skin is enormously stretched and the scales are widely separated. The markings are seen then to be almost entirely confined to the skin and practically not on the scales at all. Some of the plains people have the strange idea that all Cobras are female and the Dhaman (*Ptyas mucosus*) is the male and state in support that the Dhaman is proof against the poison of the Cobra. This of course is not the case and the only reason for this libel must be that the Dhaman and the Cobra prefer the same kind of haunt and food and therefore are found in the same places. The Cobra lays from 12 to 20 eggs at a time; they take about 50 days to hatch, and the young are venomous from birth. They are 10 or 11 inches long when they emerge from the egg and continue to grow in length for a time even without feeding.

Often when the snake has struck at something but failed to reach its object drops of venom, or a spray are ejected and in the Bombay Journal a case is recorded of such a spray entering a man's eye. Much pain and swelling followed. Some South African snakes seem to make a habit of this spitting. Apparently they actually blow the accumulated poison forward by a blast of air. The Cobra's poison acts directly on the

central nervous system. An animal becomes lethargic, then one observes that the hind legs have become paralysed. Paralysis spreads forwards and involves the forelegs. Gasping for air becomes marked and then total cessation. The heart, however, goes on beating. The poison has also an action on the blood, it breaks up the red corpuscles and hinders clotting.

In man, as a rule, at the beginning there is sickness and lethargy. Severe pain near the wound, swelling, and oozing away of bloody serum. Should the patient recover the tissues round the bite die, a black slough forms and on separating leaves a deep hole. General symptoms as a rule do not set in for an hour or two and on an average death occurs three to six hours later.

Various remedies have been at various times reputed to be certain cures for this and other snake bites, but it is now recognised that only one is of any use at all—Antivenin Serum. Even the permanganate of potash treatment is of no use. A ligature above the scar of the bite will prevent the poison being too rapidly absorbed but the serum must be injected very soon after the bite. It is unfortunate that serum is not always available and, so far as we know, it is only prepared for the Cobra and for Russells' Viper.

68. Calliophis macclellandi. (Reinhardt). McClelland's Coral Snake. Piosonous

Here again we have a snake appearing in three varieties only one of which is to be had in our district. Ours is called *univirgatus* and is distinguished by a narrow black line along the vertebrals It is a beautiful red snake with a wide white band over the very rounded black head, which cannot possibly be mistaken for any other snake. The sides are coral-red but the back is a little darker. About every inch, wide black transverse bands cross the ventrals and ascend a varying distance up the sides, with a light edging round them, none of them meet on top till the tail is reached and then three of them form complete rings. This is a most unusual arrangement, for incomplete rings in other snakes go over the top stopping short at the ventrals, just the reverse of this. The ventrals are yellowish and the black bands are widened on them often covering three scales at the centre. Colour patterns in snakes are,

however, far from uniform and I have seen specimens in which only short remnants of the black rings were left and many of these displaced

Pupil round. This Snake belongs to the same family as the Cobra and its venom is just as powerful yet we have never heard of a man being bitten by one, and even when of teased it never seems to dream of striking, but only getting away.

Its food is said to be principally snakes. We found one that had just swallowed a Blind Snake, and it is said to be particularly fond these. It is only found in jungle country in the hills. Costals 13 all along the body.

Ventrals 201-230 but very more than this in other parts of India. Subcaudals 26-32. Length to 32 inches.

69 Anblycephalus monticola. Cantor. Common Slug Snake or Cantor s Slug Snake. Also called Snail Snake but there are very few snails for it to eat in India. Not poisonous.

This is a brownish snake with a markedly vertically compressed body. Most easily recognised by the absence of the groove along the chin from throat to centre of under lip that all other snakes have. Feeding on slugs and other small creatures it has no need for much separation of the two sides of the lower jaw and the median fold is not required. The teeth too are few and small. Head very distinct from neck nearly black above, with a brown band from eye to neck and black lines above and below it. Eye large with vertical pupil; snout short and broad. Along the body are a series of vertical black bars, one or two scales wide, zizagging down the sides, rather, indistinct posteriorly. Ventrals whitish speckled slightly with brown and black. Anal entire.

Costals 15 all along the body. Ventrals 181-198. Subcaudals 67-87. Length to 27 ¾ inches.

[Wall gives prevailing ground colour as " dull orange, much the shade of dried orange peel " and says " the iris is profusely speckled with mustard-yellow.

This is a hill spiecies but Wall records one from Diburgarh in the plains of Assam. Editor].

(To be continued).

Where do Elephants go to die ?

This is a subject about which there are few facts and it still remains unknown as to where old Elephants go when they feel old age creeping upon them or indeed if they go anywhere or just die wherever they may happen to be. The only two cases of the carcase of an old Elephant having been found, so far as I know, is the one mentioned and photographed by Mr. F. W. Champion in his book "*With a Camera in Tigerland*" *pp 161 to 165* and that mentioned later on which was found by Sir William Gowers.

The author saw this Elephant a week after it had died and wrote as follows :—"It was lying on its side, in open grass forest containing a few scattered trees, and was only about 400 yards from the huts of some graziers.....Decomposition had already set in.. .....It was a large female in a very emaciated condition, and the general appearance suggested advanced age..... The graziers.....had known this Elephant for the last year.....and that she was so old and weak that she could not run away.....It is to be noted that, unless death overtook her suddenly, which seems unlikely under the circumstances, no attempt was made to seek seclusion in the very dense and mountainous Reserved Forests which border on the site of death."

Mr. Champion is inclined to believe that, as Elephants are very long-lived, Sanderson is of opinion that they live to be at least 150 years, and as they inhabit large tracks of forest, it is likely that deaths occur at long intervals and that the carcases disappear through natural agencies such as scavengers, fungi &c. and that whatever may remain over is hidden by the rich and rank growth of vegetation during the monsoon.

The author, in the same work, mentions three instances of bodies of dead Elephants being found in the United Provinces, but all these, as well as a couple recorded by the late Lt. Col Faunthorpe were not of particularly old animals.

The first case is that of a tusker found by his brother on a fire-line and it was supposed he had been dead for two days. The nearest water to the place where he died was about half a mile distant and there were no signs of external injury.

Arsenic had been used to kill some *rohini* trees, but the author says Elephants neither eat the leaves nor bark of this tree so it is unlikely that poison was the cause of death.

The second is that of a female found three or four days after death. She showed wounds on the throat and neck and the author considers it possible that she had been killed by a tiger.

The third case is that of a tusker recorded by Mr. Smythies He was found with his legs "embedded in the ground about 2½ ft. to 3 ft. deep and he was half squatting, half lying, on his left side." This animal had been dead about a month and had died in swampy ground but he had not apparently been caught in a quicksand. Mr. Champion thinks he may have been sick and unable to extricate himself or may have been bitten by a hamadryad.

Sanderson only saw the remains of one female Elephant, known to have died in calving and of "one drowned Elephant brought down by a mountain torrent." He never saw the remains of any Elephant which had died from old age. He wrote "In Chittagong.....I found a portion of a large tusk in a morass, much eaten by exposure.....Another was found in Tipperah almost fossilised....." He says the Sholagas believe Elephants never die and that the Kurrabas "believe that there is a place, unseen by human eye, to which they retire to end their days." According to Sir Emerson Tennent the Cingalese believe that Elephants retire to some secluded valley to die.

In "East Africa" of April 10th 1930, there is a photograph of an Elephant trapped in a bog. It was actually seen and photographed by Mr. Fliegner who also shot it as it couldn't possibly get out; shortly afterwards the whole animal disappeared.

The Editor in a footnote says:—".....a week or two ago we published a quotation from Mr. D. D. Lyell's look on African game spoor in which he says. "When an aged or badly wounded Elephant instinctively feels his days are numbered, he will naturally go away alone; and the animal will certainly make for water in fairly flat country, for some rivers can only be reached by going down steep banks. Therefore, marshy low land will likely be chosen, and there the

Elephant will likely be bogged, and being two weak to struggle out will eventually go under and disappear completely.

"Sir William Gowers (*East Africa* August 1, 1929) has expressed the same opinion; and on the left bank of the Victoria Nile about six miles above the junction with Lake Albert he actually came on a dead Elephant—a huge, very old tuskless bull—which had died while crossing the river. "To this animal," he wrote "it may have seemed easy to cross the Nile where he did, but the effort to get himself through the muddy bottom and then making the last effort of hoisting himself up to about six feet to get from the bottom of the shallow water on to the bank proved to be too much for him and he collapsed and peacefully died.....He seemed dignified even in death."

The Editor then remarks upon a specimen of a Mammoth, in perfect preservation, even the flesh being still on the body, which apparently had died while trying to climb out of a river bed. Selous also related having seen and herd of Elephants bogged; so it is proved that even such a careful animal as an Elephant, who tests each step over soft ground, before he treads on it, does get bogged. It appears to me to be probable that a certain number of old animals may end their lives in this way but it is still more probable that they just die in whatever kind of country they happen to be when extreme old age or disease strikes them and that their carcases decompose and skeletons get covered up as suggested by Mr. Champion.

I should be glad to hear of any cases that may have come to the knowledge of any of our members or any theories they may have on the subject.

CHAS. M. INGLIS, F. Z. S., F. E. S., E. M. B. O. U.

Darjeeling,
17th June 1930.

THE LEAF INSECT.

Phyllium Scythe. Gr.

(*With a coloured plate.*)

The Leaf and Stick insects belong to the family *Phasmidæ* of the Order *Orthoptera* and are closely related to the Preying Mantises belonging to the family *Mantidæ* of the same Order. The *Phasmidae*

PHYLLIUM SCYTHE Gr.
THE LEAF INSECT
NAT SIZE.

differ from the *Mantidæ* by having the prothorax very short and the fore legs are not formed for catching prey, all of that family being vegetarian, whereas the Mantises feed on insects.

Leaf insects derive their name from their resemblance to leaves, this resemblance even extending to the legs. This similarity is so remarkable that at one time they were supposed to be partly animal and partly vegetable. There is no necessity of describing the insect in detail as it is well represented in our coloured plate taken from a photograph by Mr. T. A Baldry. If one looks at the plate one can see that even the veins of the leaf are represented as also the cellular portion between the veins. The male has short forewings (*tegmina*) and well developed hind ones: whereas in the female the former are large and leaf-like almost covering the broad, flat abdomen and the hind wings are rudimentary. The colouration is cryptic and designed to make them so resemble a living leaf that they can escape from any insectivorous bird etc. which might prey on them. A remarkable thing about them is that the green colour of these insects is due to a pigment similar in nature to chlorophyll which forms the green colouring matter of plants.

The eggs are carried by the female in a process of the seventh abdominal half ring for some time before being laid; they are laid singly and are dropped on the ground The young, which resemble the adult, take a considerable time in developing.

The insects have a wide range but are only found in forest areas. In the Darjeeling district Mr. Shaw, who has kept several in confinement, could only get them to eat the leaves of our Common Chestnut (*Castonopsis hystrix*, A. De.) which is locally known to the Nepalese as *Dalne Katus*. At Mainimukh in the Chittagong Hill Tracts Mr. F. J. A. Hart found it on *Bischafia javanica*, Blume, known in the vernacular as *Kainjal*. The only one I have ever seen in life dropped on to my arm while walking down from Mangpu to Riyang. They appear to keep wholly to trees and are seldom seen.

These insects are one of the most wonderful examples of protective colouration.

Darjeeling.
26th May 1930.

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

THE FERTILISATION OF FLOWERS.

By Ida Colthurst.

An address at the Forest School, Kurseong on July 2nd 1929.

At the outset I wish to disclaim all pretensions whatsoever to being a botanical expert, for, although I have had a life-long love of trees and plants and all lore concerning them, I am merely a *dilettante* in Nature's marvellous workshops and fully realise that there are many here with what I may term a botanical, ballast far heavier than mine for I imagine, that theoretically at least, every forester should be a botanist even though there are different points of view as to what constitutes each. As regards the former, he will be found to consider his trees either in a purely commercial spirit with an eye to the revenues he might gather in, or in an aesthetic one. The commercial consideration is expressed in Dumbiedyke's advice to Jock: "Jock when ye hae nothing else to do, ye're may be aye sticking in a tree, it will be growing Jock, when ye're sleeping". The opposite view will be found among those who regard the beauties of nature as one of the greatest pleasures of life; those who find

"Tongues in trees, books in running brooks, sermons in stones."

And he who strikes the happy medium between these two types is I imagine, the true forester.

As regards the true botanist, is he merely a finder and recorder of new species? One to whom

"A primrose by the river's brim
A dicotyledon is to him
And it is nothing more"?

One who will know at sight and be capable of naming and classifying every scrap of vegetation he may came across? I think not—Such knowledge is doubtless most desirable and necessary, but after all the value of values *per se* is very small, they are only necessary symbols; and the individual who stores his mind with them is like him who commits a vocabulary to heart and thinks that he has mastered a language. A knowledge of botany goes further than this and the real botanist is he who

"In the blossom and the leaf
Seeks for the secret cause"

That is one who considers a knowledge of characteristics and relations as of bigger importance than the capability of naming every flower and plant.

A little over a hundred years ago, flowers were believed to be absolutely passive beings, meant only for man's enjoyment and use and it was deemed sheer heresy when in 1787.....Spregnal first introduced what has been termed a "new philosophy of flowers"—consequently, his research lay unheeded for 70 years, when Darwin proved definetly that in the quick vegetable world life also operates, and *that* almost visibly ! Geology too helped in this revolution of ideas, by showing that types of vegetation, now extinct, lived and died before the advent of man. Also, some of the loveliest and prost profuse Flora exists and blooms in uninhabited islands, by the icy edges of Himalayan and Alpine glaciers and in Siberian wastes where no human eye can behold them, and in lands where the intellectual development of the people is so low that they care as little as animals, for the floral loveliness so lavishly displayed around.

No, the usefulness of vegetable life to man is but secondary in the real design of their creation ; and all the qualities they are possessed of, flowering or flowerless, are of the greatest importance to themselves. A flower is a sentient being, impelled to act through the same strong desires that animate us, and is endowed with certain powers not differing from those of the Animal Kingdom. The desire to create rules all life and the further we investigate the wherefore of things, the more are we convinced that the perfume of the lily, the colours of tropical blooms, the thorns of the thistle are all gifts beneficial to the plants themselves and for the propagation of the species to which they belong.

This propagation of species is effected either by self-pollination or cross-pollination: in the former there is a transference of the pollen from the anthers to the stigma or stigmas of the same flower ; in the latter they are carried in various ways to other flowers. The great majority of the flowering plants are hermaphrodite and one would naturally expect therefore, that self-pollination is more frequent. But nature everywhere forbids the banns of inter-marriage, and always favours cross-pollination, the seeds resulting from which

are more numerous, heavier and give rise to a stronger offspring. This is especially the case where the pollen is transferred, not simply from one flower to another on the same plant, but from one plant to another. Cross-pollination is effected by various agencies, wind, water, insects, birds and animals; and flowers present many arrangements, mechanisms, colours, and perfumes which can only be interpreted as means to the important end. Some plants as the Rushes, Hibiscus etc. ensure a cross service by being self-sterile *i. e* the anthers and stigmas ripen at different times.

Wind fertilised flowers occur generally on our tall forest trees, especially the deciduous ones; so that the vast showers of pollen grain, sent flying before the wind are not impeded in any way in reaching a suitable destination. Also the bloom is simultaneous with the time of gales when they can be carried strongly and far. When the flowers and leaves appear together, the flowers are on long stalks exposed as fully as possible to every breeze, the stamens are long and pendent and thus easily shaken, and they produce an abundance of pollen, dry, smooth, flat or round so that the wind may be fully charged with it, since much must of necessity be wasted. This great secretion and discharge of pollen is well known, as it gives rise to that troublesome condition known as 'hay-fever'. Nor have such flowers the desirable attractions of colour and perfume, for if in the floral world we meet with profuse prodigality we are often surprised too by extreme economy, and these attributes of beauty and sweet scent would be wasted on an inorganic force like the wind which possesses no appreciation of quality. Among insect and bird fertilised flowers we have a much greater variety of adaptations, colours, perfumes etc. and the pollen is sticky, has roughened surfaces, so that it is easily attached to the hairy or feathered bodies of the visitors. This visiting is a reciprocal arrangement: the animal does not go from a love of the aesthetic, it is far too practical and goes in search of food in return for the important services it renders; and the plant sacrifices a part of its nutritive substances in providing this food, and makes a further sacrifice in developing certain attractive structures. Thus the facilities which Nature accords plants—through the track of the air and by means of animals, (to correspond so intimately) yield man numerous, beautiful varieties of flowers.

But observation alone is perhaps not considered sufficient argument in the support of this interdependence theory and others are necessary. The strongest is found in the parallel development of insects and flowers during geological time. The records of the rocks is indisputable and they show that of the vegetable world the earliest was the age of ferns, next the age of conifers followed by the age of true seeding plants, the monocotyledons preceeding the dicotyledons, and the wind fertilised varieties of the latter before the insect fertilised. The general order or succession of insects is this *Orthoptera* and *Neuroptera i. e.* Crickets and Dragon-flies in the Devonian epoch; *Coleoptera* or Beetles during the carboniferous; *Hymenoptera*, Bees, and *Diptera* Flies during the Oolite periods, *Lepidoptera* Butterflies and Moths, not until Tertiary times *i. e.* Bees and Butterflies, the most useful in cross fertilisation of flowers were not evolved until the true flower bearing plants first appeared, the earliest undoubtedly blooming more for bees than butterflies since those were of the compositae type and not long-bellied which is a formation suitable only to insects with probosces long enough to be thrust down to the low-lying nectaries.

Again, the change in the fauna of a country or locality certainly affects the propagation of certain plants; or to put it otherwise certain plants are mess-mated with certain insects and cannot be produced unless both are distributed together. The fertilisation of the aloe, *Yucca gloriosa* furnishes a splendid example and forms one of the romances of Natural History. It is effected by a tiny, silvery, night flying moth, *Pronuba yuccasella*, whose young live only on the tender young ovules of the plant. It is a ground burrowing insect and its first flight strangely enough coincides with the opening of the *Yucca* bells. The female does all the work, for the first thing she seeks are the young pistils in which to desposit her eggs. Then by means of a specially long maxillary palp, she *brushes* off the pollen, rolls it into a ball quite three times the size of her tiny head and holding it under her jaw, flies off to another bell around which she flirts for a while, then sprawling *over* the filaments, again inserts her eggs in the pistil and also stuffs in some of the pollen she has collected and so she goes on alternating egg laying and pistil stuffing as long as her short, busy life lasts. On the

fourth or fifth day, the grubs hatch out in the pistils and find food ready at hand in the young ovules; after devouring these, they bite their way through the corollas and letting themselves down by a narrow thread which they spin, burrow into the soil below and remain there until the flowering of the *Yucca* the next year. Thus does Nature arrange a mutual benefit between insect and flower.

Another instance of a special fertiliser for a flower is furnished by an orchid of Peru, *Coryanthes* and a small, metallic bee *Euglossa aurata* and another more common one in the fertilisation of the Bee Orchis which bears a superficial resemblance to another tiny burrowing bee, *Colpa aurea*. Here the male is the useful agent, for he emerges quite a fortnight before the female and during his time of waiting for her appearance flies about restlessly, and, struck by the appearance of the orchis, finds distraction by wandering over the flower thus transferring the pollen from bloom to bloom. Drainage and the smoke and chemical odours of large towns send the little bee further afield and as he disappears so does the plant.

Again in certain islands of the Pacific, entire orders of vegetable life are absent because the insect agents which serve them are driven off and destroyed by the prevailing violent winds; in others such as Fiji etc. which are more sheltered there is a wonderful variety of showy plants and insects. Sometimes, we come across a startling exception *i. e.* in conjunction with entomological poverty there is both floral variety and abundance of bright blooms, but this is at once explained by the presence of humming birds, whose heavier bodies can withstand the winds.

Fertilisation also occurs through insects, (especially small beetles) utilising flowers as a safe and cosy hiding place. The Evening Primrose *Œnothera biennis*, whose nocturnal temperature within is higher than that of its environment, is a wonderful asylum for belated beetles; and in the early morning it is very common to come across a small bee lodged in the slipper of our *Cypripedium* orchids, drowsy and satiated with his feast. Both beetle and bee goes off with a vitalising freight for other blooms.

Almost all waterside plants are served by flies and wee midges, which are creatures of no fine taste.

The *Arisœma* of our jungles carries a spadix of florets, staminal or male on the upper part and pistillate or female or hermaphrodite on the lower. Midges and flies enter the flower from above and crawling downwards effect fertilisation. The abominable smell exhaled by the blooms of *Sterculia fœtida*, *Careya arborea*, *Kigelia pinnata* prove irresistible to bottle-flies as deceptive advertisements for the accommodation of their eggs, and so are rendered a service which would certainly be withheld by more aesthetic insects. Therefore we arrive at this, that the chief nature-ordained animal flower fertilising agents are beetles, flies, wasps, butterflies, moths and birds and in this connection the most important differences to notice between them are the size of the body, the length of the tongue, the time of the year each is most plentiful, also their habits *i. e.* whether they collect pollen and honey, or only one and not the other and whether they are day or night flying. And by the careful study of the structure of flowers by noting the flowering time, the order in which the anthers and stigmas ripen, their relative positions, we can frequently tell what particular insect is suitable for the cross-pollination of each; and so we may arrange them in various biological groups according to their adaptations for such visits. The first thing to strike one is that the flowers' welcome for their guests is in exact proportion to the length of their visitors' tongues, and so they may be divided thus:—

1. Those, such as *Galium*, *Saxifrage* etc which present their honey on their surface or in very shallow chalices, are adapted for short-tongued creatures such as flies and some beetles.

2. Flowers with honey only partially concealed either by a ring of closely set stamens, as in *Potentella*; or by erect, stiff sepals as in the smaller *Cruciferæ;* or by the formation of a fairly shallow calyx as in our small *compositæ*, can only be reached by insects with tongues not extending beyond ⅛ of an inch, *i. e.* the longer tongued beetles and flies.

3. Flowers which differ in degree only from the last and can be despoiled by insects with tongues ¼ of an inch long, *i. e.* the longest tongued flies and the shortest tongued bees and wasps. Such are the *Geranium* and the small *Scrophularia*. The latter are attended to chiefly by wasps, and observation of Nature's contrivance

to avoid self-fertilisation will prove most interesting. The stigma matures first and is thrust forward to the mouth of the flower, the immature stamens lying curved and out of the way in the corolla tube. A wasp or bee alights on the lip and leaves the pollen it carries on the stigma as it seeks to rob the nectary lying further in. As soon as fertilisation is effected the stigma is withdrawn by a withering style and the stamens are elevated and ready to shower their gold on the backs of intruding creatures. Some of the *Scrophulariaceæ* have what is termed a "loose-pollen" mechanism, the powdery pollen lying in a box formed by the anthers, which have spiny projections that may be jostled by an insect entering the flower and cause him to receive a shower of the pollen on his head. Sometimes bees and wasps work together at the same spike of flowers, and it is interesting to see how, in the pursuit of their industry, they follow opposite routes, the bees below, the wasps above.

4. Long-tubed flowers reserve their sweets for butterflies, moths and the very largest bees. The lilies avoid the horror of self-fertilisation by the sticky stigma turning their backs to the anthers, but holding up their faces to receive the pollen brought by carriers. Flowers of the tea species (*Papillion aceæ*) are reserved for big bumble bees, but sometimes little hive bees painfully squeeze in between the tightly closed lips. Bumble bees must turn upside down in these blooms to reach the nectar and the pollen is thus distributed over their backs by the pressure of their bodies against the pointed anthers, *i. e.* Nature makes over the freight when the bee is in the right position to receive it and in her providence, so that the insect may not fall in this reversed position supplies hairy footholds on the filaments for it to cling to.

5. Are the purely butterfly and moth flowers, where the honey is more than ½ an inch deep. This is beyond the reach of bees, though they may visit for the pollen which they require as food for their broods and for the freight of which they have the most perfect mechanisms on their hind legs.

Butterflies frequent upright flowers for their legs are too fragile to stand the strain of an inverted position and their tongues can only bend when directed beneath their bodies. Moths attend upright or pendent

flowers since they have very long tongues especially the varieties of *Sphinx* in which it is several times as long as the body, forming a spiral tube of 2 separate pieces in its length, so that it can be drawn apart and cleaned if there is any danger of its becoming clogged, though sometimes in very sticky flowers it is liable to become fixed and broken—when flying the tongue is coiled up under the head.

Moth pollinated flowers are white or pale coloured, only sweetly scented in the evening at which time they open, remaining closed in the sunlight. Moths are the chief agents for orchids and work over them very diligently. In seeking the nectar, one or both of their large projecting eyes are pressed against the sticky disks of the column to which the pollen cases are attached. As they raise their heads, whether from habit or in irritation at the gluey mass, they jerk their heads, with the result that the cases cling to their eyes and they fly off carrying them with them. But now for another of Nature's marvellous arrangements. During their flight, in the very short time of going from one flower to another, the attached pollen cases change their position and lie so that the stalks bend downwards and only just far enough to require the moth, in thrusting his head again into another blossom, to strike the sticky stigma and leave there the pollen cases he has brought with him. Sometimes, one may be seen with the cases attached to the side of his mouth instead of the eyes. This occurs when he does not enter the flower from the exact centre. But the fertilisation of Orchids is a marvel of Nature and a very wide subject in itself. Various flowers find birds necessary to their cross-fertilisation. *Bombax malabaricum* is a positive tavern for mynas, drongos etc. who seek the intoxicating nectar either for itself or for the insects which are also attracted. In America Humming Birds serve all the large showy flowers; in India Sun Birds take their place and this may be seen any day when the *Erythrina* is in bloom or among the trumpets of the *Datura* and the *Bignonias*. In the Malayan Archipelago is a third and remarkably specialised fertilising agent, the Brush-tongued Parakeet, and in Australia the Honey-eaters. Wallace is of opinion that the last two are the latest products of ornithological evolution adapted to the new and specialised types of flowers in

Malayan and Australian vegetation just as the *Lepidoptera* are the newest outcome of the insect tribes.

Vallisneria, that small weed which clothes the bottom of Bengal ponds, puts forth most elaborate means of securing pollination. In mid-winter it sends up hosts of male and female flowers to the surface of the water. The females laboriously climb upwards by means of developing and uncoiling a long spiral stack, while the males are simply detached from the plants and floating up gather into rafts which drift over the surface applying their loads of snow white pollen to the stigmas which they meet in their voyages. Had the flowers of *Vallisneria* remained submerged, the pollen would have proved useless, for it is destroyed by water, but Nature has overcome this difficulty by the ascent of the stigmas and the coincident separation of the male flowers to float up and mature near by, one of Nature's marvellous ingenuities for accomplishing Life's great purpose. Most of the water plants are perennial and are either pollinated by the wind or by certain vegetative methods.

Of all the fertilising animal agents, bees may be considered the most useful; they depend absolutely on flowers, not only for their own food but for that of future generations for whom they labour; also, they are the most diligent workers, working all through the sunny day and rarely diverted from one species to another while on their collecting rounds. They chiefly visit blue and purple blooms and their steady work may be best seen when *Strobilanthes*, which forms one of our characteristic mountain flora (forming a close undergrowth) blooms. It grows without flowering for years (generally speaking), then after an interval of 8 to 12 years there is a gregarious flowering, the forests become a sea of blue flowers with crowds and crowds of bees working over them; later the seeds ripen and the forest is full of jungle fowl feeding on them and then they all die down. Red and pink flowers attract butterflies, white and pale-coloured ones moths. But there is no general rule and I feel sure that a study of the fertilisation of our Sikkim flora, or the Orchids alone which provide so wide a field for investigation, will afford a rich harvest of results, to those who are interested and have the opportunity and patience to labour in it.

Plate 1.

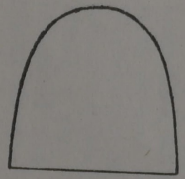

Fig. I. Straight front and curved back.

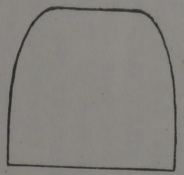

Fig. II. Straight front and back, curved sides.

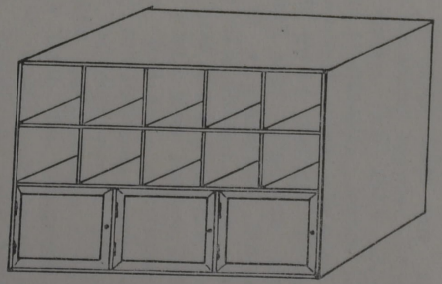

Fig. III. Case for 10 groups in front and 10 behind, with cabinets with wooden doors below.

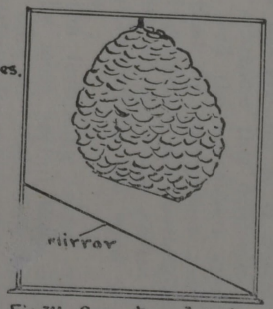

Fig. IV. Case to exhibit wasps' & ants' nests.

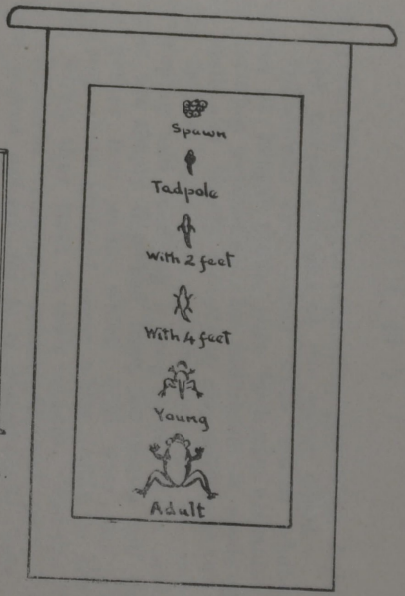

Fig. V. Exhibit showing metamorphosis of a frog.

EDITORIAL.

On a visit to some Museums in Europe.

While at home last year I visited about twenty Museums both at home and abroad and possibly a short account of the methods used for display and storage may be of interest to our members I will divide this article into two parts one "methods and cabinets used for exhibition" and "methods and cabinets used for study." Naturally it was the smaller local Museums which were of more interest to me as they more nearly approximate our own. Many of the latter are wholely kept up by the town in which they are situated, even some of large National ones are kept up in the same way such as that at Geneva. Mons. Pierre Revellion the Director, who most kindly showed me round, told me that it was wholly kept up by that town and that they had no trouble about funds. Some, though not all, have their own taxidermists who are really artists. The one at Geneva spoke English fluently and was trained in Denmark and had visited England, Germany and America. I had the privilege of seeing him and the taxidermist at Edinburgh at their work. I should like to say that I met with the greatest courtesy from everybody I met and they spared many hours of their valuable time showing me round and explaining all I wished to know.

Methods and Cabinets used for Exhibition.

Before starting on this subject I should like to say something about the colour of the walls. This is a feature that should not be disregarded. What is required is a colour restful to the eyes. In some Museums the colour scheme is such as suits the exhibits but as we have only one hall we do not require to go into this. A very suitable colour for our purpose is either a grey or a pale sea green, both most restful colours. I have spoken to the Executive Engineer about this and he has kindly promised to have this done this cold weather. It will be a very great improvement to the present glaring white.

Exhibition Cases :—Large heavy framed cases are now out of date, especially such horrible contrivances

as our large centre one. One reason for this is that a huge centre case like ours does not lend itself to any scheme of arrangement, artistic or otherwise and it also obstructs the view. An ideal arrangement is that of cases let in to the walls of the building and so taking up no floor space, the latter being occupied by not too high and narrow framed cases of varying sizes to suit the shape of the hall. In the Paris Museum there are some small octagonal glass show cases, containing small birds on glass shelves along the sides, these take up very little room and fit into any spare corner. With regard to wall cases I rather liked the colour of the backs of some of these in the Royal Scottish Museum at Edinburgh which was pale sea green and the bottoms of the cases were deep moss green. This colour was very restful to the eyes. In other wall cases there, in which the specimens were fixed on the backs of the cases, the backs and bottoms were covered with drab cloth which also gives quite a good effect. This method of fixing the exhibit on to the back of the case by means of brackets allows for a less stiff arrangement and a better means of using the available space. This method is being employed in the Prince of Wales Museum, Bombay.

In the Natural History Museum at Geneva a number of groups of small birds are being executed; the groups being arranged in cartons with straight fronts and curved back (*Plate I. Fig I*). In some Museums instead of the back being completely curved only the sides are curved and the back straight (*Plate I. Fig II*). These cartons are 20″ high 21″ broad and 20″ deep. When completed each carton slips in to one of the compartments of the case (*Plate I. Fiy III*). Each case holds 10 of these groups in front and 10 behind. The front of each compartment is a glazed door and in the top inside of the door electric light is fixed, a space being cut in the carton to fit it, the light is the whole breadth of each division. The bottom of the case is a wooden cabinet with shelves inside and doors for storing specimens.

The Dublin Museum has some very neat little cases $2' \times 1\frac{1}{2}' \times 2'$ in which are shown nesting groups and there are some larger ones $6' \times 2\frac{1}{2}' \times 2\frac{1}{2}'$ for groups of mammals such as foxes, otters &c.

In the Castle Museum, Norwich there is a very useful size case $2\frac{1}{2}' \times 2' \times 14''$ in which is exhibited a pair of Common Teal showing the drake flying and a duck just starting to fly with reeds and grass and a bit of water in one corner.

The idea of the curved background is that the painted scene blends with the ground work and shows no sharp edges. When lit up with electric light on the inside the effect is very fine.

Cases like our sloping desk ones should have solid bases instead of legs so that the space can be utilized for storing specimens. The same applies to the cases which exhibit our collections of snakes, fish etc.

In St. John's Rooms, Winchester I noticed quite a good idea for exhibiting wasps and ants nests. The exhibit is suspended from the top of the case of which the two sides and front are glass. At the bottom of the case a mirror is fixed at an angle which reflects the bottom of the nest, which is cut away to show the inside structure. (*Plate I, Fig IV.*)

Exhibits:—Nowadays Museums try to show their exhibits in as pleasing and artistic a form as possible; even the smallest local museums do this as far as possible as by this means the exhibits, besides being pleasanter to the eye, give an idea of the natural surroundings amongst which the mammals or birds are found. The background of the cases is painted and the ground work made to represent as closely as possible the natural habitat of the species concerned. Expense and space wont allow of this being done for all exhibits unless the museum caters for a very circumscribed area, in that case attempts are made to show all the local Fauna amidst their natural surroundings. This can be successfully done at home where the number of species is small but is out of the question in India. Still attempts should be made to show as much as possible in that way. We hope to be able to do something in this line and have already got two small cases, one showing a pair of Woodcock with their young and eggs and the other a pair of Fantail Snipe both in natural surroundings. These were executed by Mr. Williams of Dublin and the case of Snipe we owe to the generosity of Mr. J. T. Donovan I. C. S.

In Museums which deal with species outside their own area, a general collection is shown mounted on

ordinary stands on shelves in wall cases or fastened to the back of small cases as already described and only British or local groups of animals and birds are shown in their habitat. These groups are generally very good. In the Dublin Museum there is a fine group of two full grown otters, one emerging from the water with a trout in its month; three young ones are also shown one of which is eating a fish. The surroundings and water are beautifully reproduced. In the same Museum, among other fine groups, there is one of a pair of Kingfishers, one hovering and the other seated on a stone amongst reeds and over water. Below the surface of the water is a small frog which, when the case is slightly shaken, moves its legs.

These groups were executed by Mr. Williams who mounted most of the cats I took home with me.

With regard to reptiles most of those seen were either spirit specimens or else stuffed; there were few plaster-of-paris casts. The Taxidermist of the Royal Scottish Museum, Edinburgh told me that he found stuffing far more satisfactory than casts but that the measurements had to be very carefully taken otherwise the white skin at the edges of the scales became visible. He is an excellent artist and had executed a fine group of adders, old and young, amongst rocks and heather. In some cases, in spirit specimens, the snakes are fixed to their porcelain slabs inside long specimen jars. In some frogs exhibited in the same museum the whole metamorphosis was shown, the specimens being fixed to porcelain slabs. (*Plate I. Fig V.*)

In the Castle Museum, Norwich there are a couple of most interesting and instructive cases. The first one, a desk case divided into 4 parts, shows an "Introduction to Birds." In Part I there is a general description of a bird illustrated by skins of a woodpecker to show the terms generally used in describing a bird. To the right of this is a description of "Feathers," with a feather to illustrate the parts of a typical one. There is also a diagram of a section through two barbs of a feather with a description of the web. The down is described and examples given. "Feather tracts" are shown on the skin of a Skylark stripped of feathers, the various tracts painted red and named. Below this is "Growth" illustrated by a wing of a young bird showing growing feathers and also a completely formed feather. "Other

kinds of feathers" are illustrated by filo-plumes at base of a large feather and a powden-down patch from the breast of a small Heron In Part II "Wings" are described and illustrated by the wing of a duck. "Legs" are next described and illustrated showing the different parts of a leg and examples given of legs of a Pigeon and Plover and feet of a Snowy Owl, Gull, Redshank and Kestrel. "Beaks" are then described, a skull being shown to illustrate this as also heads of a Godwit and Summer Duck. The "Tail" is next described and one shown as also the oil gland of a duck. In Part III the "Anatomy" is given. First the skeleton is described and one of a duck shown, also the humerus of a goose to show the aeration of the bone; other parts of the skeleton are also shown and described. Next the "Digestive System" is gone into; the digestive organs of a Pigeon are shown in spirits, also *caeca* and stones from a pigeons' gizzard. In Part IV the "Respiratory System" is described. The air sacs are illustrated by a diagram and the skin of a Gannet. The trachea and *bulla ossea*, that peculiar bony or partly bony and partly membranous dilatation of the lower tracheal rings of drakes, are also exhibited. "Voice" is next described and illustrated "Sense Organs" such as vision and hearing are illustrated and described, a head of an Owl to show the parts of an eye and the peculiar nictitating membrane found in Eagles and Owls; the ear is also described. "Reproduction" ends this interesting case and under it the diagram of an egg showing the different parts is given and explained; also the egg-tooth of a chick and embryo bird showing the yolk sac are illustrated and different types of young birds shown in spirits to show those that are active at birth and those that are helpless.

The other case is about "Eggs" and describes number, form, size, colour and texture. Examples of these are also shown.

The Fish seen were mostly stuffed and coloured either mounted on wooden slabs or else suspended. Formalin and spirits specimens were also seen. One fish in spirits in the Dublin Museum has some natural weeds and a few small shell fish in the jar which gives it a very natural appearance. In the Edinburgh Museum, I was informed, they found stuffing more satisfactory than plaster-of-paris casts. Some other Museums however went in for the latter method. Mr. O'Mahoney,

the Assistant Curator of the Dublin Museum told me that he found a 7% solution of formalin injected into the fish before placing it in formalin solution was very effective.

In the Edinburgh Museum there is a 107 lbs. mahseer from the Cauvery exhibited. Some prawns and shrimps exhibited in specimen jars in the Paris Museum have a piece of dark material stuck to the back of the jar which shows up the specimens very well.

(*To be continued*)