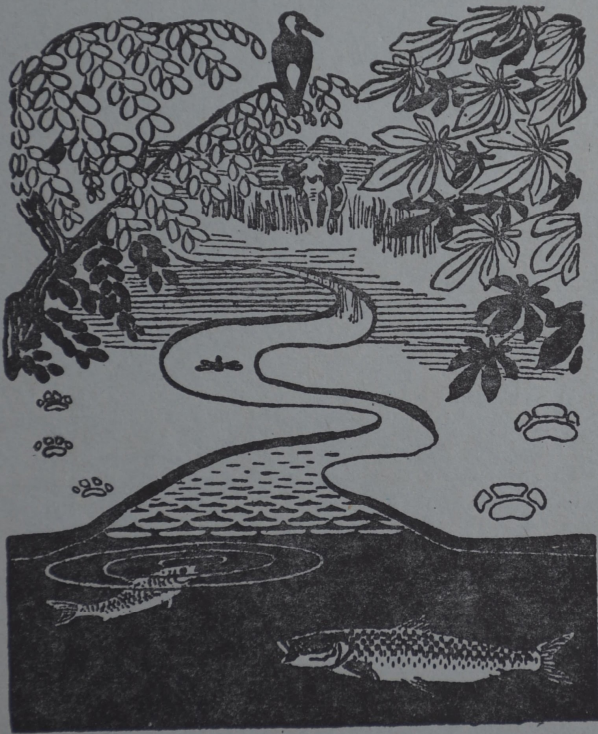


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JULY, 1970

NO. 2

JOURNAL OF THE BENGAL NATURAL HISTORY SOCIETY.



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ALCEDO HERCULES (Laubmann).
The Great Blue or Blyth's Kingfisher.
From a specimen from the base of Daphla Hills, Assam.
 $\frac{1}{2}$ Nat. Size

JOURNAL
OF THE
BENGAL NATURAL HISTORY SOCIETY

VOL. 36

JULY, 1970

No. 2

BIRDS OF THE DUARS

By

C. M. INGLIS

(Continued from page 14, Vol. 36, No. 1)

Suborder—*Coracii*

Family—*Coraciidae*

349. THE INDIAN ROLLER OR BLUE-JAY.

Coracias benghalensis benghalensis Linnaeus.

Fauna B. I. 2nd. ed. No. 1517.

Description .—Length 13 inches. Sexes alike. Forehead brownish-white ; top of head bluish-green ; hind-neck and sides of neck, deep vinous ; upper plumage greenish-brown ; rump blue ; central tail-feathers dull green, the others deep blue with broad, light-blue subterminal bands ; bend of wing deep bright blue ; wing quills Oxford-Cambridge blue ; sides of head and throat purplish-lilac with cream-coloured shaft-streaks ; breast vinous ; rest of lower plumage Cambridge blue ; feathers under the wings pale blue.

Bill dark brown ; iris grey-brown, eyelids yellow ; legs brownish yellow.

I once obtained an intermediate specimen between this and the next race in which the feathers under the wings were mixed pale blue and deep purple-blue.

Distribution and habits :—I have not found this Roller as common as the next race. My specimens were obtained at Hasimara and Jalpaiguri, the latter by G. E. Shaw. The Blue-Jay is a bird of open country, frequenting gardens, the proximity of villages and groves and is one of the birds commonly seen on telegraph wires. It is rather a sluggish bird remaining for a long time on some perch in the open and then pouncing on something on the ground which it swallows ; it will also sit on a clod of earth, or on the lawn, to look out for its prey. Its food consists mainly of insects, grasshoppers, crickets, beetles with an occasional small snake, lizard, toad, frog or small mouse. I once saw one swallow a Bloodsucker (*Caletes versicolor*) which it had great difficulty in getting down and there were many pauses between the efforts. It is not at all conspicuous when at rest with closed wings, in flight, however, the glorious beauty of the latter is displayed to perfection, as well as that of the tail. Most gardens have one, or a pair, of these birds, which during the breeding season become much more active and vociferous. One of them presumably the cock, flies straight up into the air and does a regular nosedive down to where its mate is seated, uttering its harsh screams.

The breeding season is from March to July and the nest is placed in a hole in a tree or a building ; it is just a conglomeration of grass, feathers, or old rags etc. but, sometimes, the eggs are laid on the bare wood. The number of eggs is 4 or 5 ; they are glossy white and measure about 1.30 by 1.05 inches.

350. THE BURMESE ROLLER.

Coracias benghalensis affinis, Mc Clelland.

Fauna B. I. 2nd. ed. No. 1519.

Description :—Length 13 inches. Sexes alike. It differs mostly from the last race in its much darker, and deeper, colour, the back being dark olive-brown ; the sides of the head, chin and throat are deep purplish-blue with shining violet-blue shaft-streaks ; the breast is darker being vinaceous-brown ; abdomen dark blue, passing into pale blue on the vent and below the tail ; feathers under the wing deep purplish-blue.

Bill nearly black ; iris brown, eyelids orange-yellow ; legs yellowish-brown.

Its much darker colour distinguishes it in the field.

Distribution and habits :—The Burmese Roller is common in the district and besides coming into gardens and villages it, also largely frequents forests, the outskirts of the dense forest and the more open deciduous and bamboo-jungle ; one commonly sees it on the shade-trees in the tea. Its habits resemble those of the last species ; grasshoppers and cicadæ are its principal food. Numbers may be seen during a jungle grass-fire hawking the escaping insects.

It breeds from March to May, laying its eggs in holes in trees but, not in buildings. The number of eggs is 4 but 3 or 5 are sometimes laid ; they are glossy white and measure about 1.37 by 1.09 inches.

351. THE INDIAN RED-BILLED ROLLER.

Eurystomus orientalis orientalis (Linnaeus).

Fauna B. I. 2nd. ed. No. 1520.

Description :—Length 12 inches. Sexes alike. Top and sides of head and neck dark brown tinged with olive ;

back greenish-brown, brighter on lower-back, rump and above the tail ; tail black washed with deep purple-blue, the central feathers with some greenish-blue at their base ; wing-coverts and inner flight-feathers crossed with a band of pale blue ; centre of chin, throat and fore-neck deep purple-blue, centred with small blue shaft-streaks ; sides of chin, throat and whole breast brownish-green ; rest of lower plumage brighter bluish-green.

Bill deep vermilion, tipped with black ; iris dark brown ; legs vermilion.

The bill is broad and short, the wing long and pointed.

Distribution and habits :—I have found this Roller rather a rare bird, but being, essentially, a forest bird it may not be as rare as it appears to be. I secured one specimen in the Raidak forest. It is a much quieter bird than the other Rollers and more crepuscular in its habits and having an unobtrusive colouration it may be overlooked. It passes the heat of the day seated on the top of some high tree, quite motionless, occasionally leaving its perch to catch some insect : it wakes up in the late afternoon. Its note has been variously described as a harsh croak or a whistle, resembling that of a Myna but, during the breeding season it is quite vociferous. Its food consists of wood-boring beetles, grasshoppers, mantids etc.

It is probably resident. The breeding season is from March to May and it makes its nest in the hole of some decayed tree or in some high tree like a Simul (*Bombax malabaricum*) often 60 to 100 feet from the ground though, sometimes, as low as 30 feet. The eggs are deposited on the bare wood. The eggs number 3 or 4 and are like those of the other Rollers. They measure about 1.38 by 1.15 inches.

Family *Meropidae*.

352. THE COMMON INDIAN GREEN BEE-EATER.

Merops orientalis orientalis Latham.

Fauna B. I. 2nd. ed. No. 1523.

Description :—Length 9 inches. Sexes alike. Bright green, with the crown to upper-back tinged with golden-rusty ; rump bluish ; flight-feathers rufous, with green on the outer webs ; a broad black streak through the eye and a narrow, crescent-shaped, one on the fore-neck ; chin, cheeks and sometimes the throat verditer-blue.

Bill black ; iris blood-red ; legs dark plumbeous.

The bill is long, slender, curved and pointed ; the legs are feeble and the central tail feathers are long and pointed. It is a slenderly-built bird.

Distribution and habits :—Very common everywhere, frequenting open country, gardens etc., avoiding heavy forest but occurring in lighter jungle. It is another of those birds so fond of resting on telegraph wires, but it settles on anything so long as it is able to obtain a clear view of its surroundings and from which it can hawk insects on the wing. The snap of its bill, as it secures its prey, is often audible ; if the insect is small it is allowed whole, otherwise, it is broken by beating it against the perch. Its flight is graceful and consists of some quick strokes of the wing, and glidings with outspread wings and tail, it is rather undulating and while flying it utters its pleasant note of *tree-tree-tree*. It feeds exclusively on insects, mostly taken on the wing ; the insects are largely bees and other *Hymenoptera*. Mason examined the stomach contents of 30 birds which contained 284 insects of which 202 were beneficial, 41 injurious and 41 neutral. Of the beneficial insects 200 were bees. This

shows that this pretty little Bee-Eater is harmful. At Pusa there were always half-a-dozen of these birds near the hives snapping up the bees, the queen bees often being snapped up on their marriage flight. In Bihar I watched one of these birds make 12 sallies after insects and on 9 of these only bees were taken, it also takes dragonflies.

The breeding season is from the middle of March to June. It excavates a tunnel in the ground, either in a bank or a ridge ; there is no nest, the eggs lying on the bare earth. The number of eggs is, usually, 3 to 5 but I once took a clutch of 7 in Bihar. They are almost spherical, glossy white. They measure about 0.75 by 0.7 inches.

353. THE JAVAN BLUE-TAILED BEE-EATER.

Merops superciliosus javanicus Horsfield.

Fauna B. I. 2nd ed. No. 1526.

Description :—Length 12 inches. Sexes alike. Upper plumage green tinged with rufous ; rump, above the tail and tail verditer-blue, the long central feathers of the latter tipped with black ; wings rufescent green tipped with blackish, inner flight-feathers bluish ; a broad black streak through the eye bordered above, and below, with verditer-blue ; chin and upper-throat yellow ; lower throat and upper breast rufous-chestnut, passing into rufous-tinged green and then into blue below the tail.

Bill black ; iris crimson ; legs dusky-plumbeous.

This is a large Bee-Eater easily recognized by the blue tail.

Distribution and habits :- H. Storrs found this fine Bee-Eater plentiful from the middle of April to the end of May and again in August but they occur right through June and July upto the beginning of October when O'Donel

secured a specimen on the 1st of that month, but they appear to be uncommon after August. It is oftenest seen in parties or flocks, hawking insects, especially during the evening, uttering its note *teerp-teerp* as it flies. Its flight is similar to that of the last bird. It also settles on exposed positions, such as telegraph wires or trees, from which it sallies after its prey and it is very partial to the vicinity of water. It is a harmful bird to agriculture largely feeding on beneficial insects such as bees, dragonflies etc. Of 83 insects taken by 13 birds Mason recorded 70 as beneficial, 9 injurious and 4 neutral ; they do some good however by feeding on certain wood-boring beetles.

There is no information about its breeding in the district but it is likely to do so as the breeding months are from April to June. It nests in colonies, tunnelling into the banks of rivers or even into mud walls. The number of eggs are 4 to 5 but I have found upto 7. They are white and very glossy and measure about 0.88 by 0.75 inches.

354. THE INDIAN CHESTNUT-HEADED BEE-EATER.

Merops leschenaulti leschenaulti Vieillot.

Fauna B. I. 2nd ed. No. 1528.

Description :- Length $8\frac{1}{2}$ inches. Sexes alike. Crown, to upper-back, chestnut-rufous ; lower back, rump and above the tail silvery-blue, greenish on the latter ; tail green, a black line in front of and behind the eye ; wings green, the flight-feathers rufous on the inner webs and tipped with black ; chin and throat saffron-yellow ; below this a chestnut-rufous gorget bordered first with black and then yellow ; rest of lower plumage pale green, more bluish on the abdomen and below the tail.

Bill and legs black ; iris crimson.

In this genus the central tail feathers are not prolonged beyond the others.

Distribution and habits :- Common in the forests of plains. I obtained specimens near Hasimara and in the Titi, Upper Tondu and Apalchand forests. It is what one might call a forest, or semi-forest, species, by the latter I mean visiting the outskirts of the forests. I have seen small parties of these birds but, they do sometimes, occur in considerable numbers. It feeds on any insects, mostly captured on the wing and several observers have noticed it picking small insects from the surface of water. Its habits are very similar to those of the preceding species. It is a tame bird, allowing close observation and utters a pleasant trill while on the wing.

It breeds towards the end of March, but April is the principal breeding month. I have seen many of their nest-tunnels in banks near, or inside, the forest and a pair used to nest on the edge of the, more or less, level path in front of the Gorumara Forest bungalow, which is quite open and within the compound, it also tunnels into the banks of forest streams. The eggs are laid at the bottom of tunnels, which may be as far into the bank as 10 feet, there is no nest. They number 4 to 8, are nearly spherical and glossy white in colour. They measure about 0.87 by 0.76 inches.

355. THE BLUE-BEARDED BEE-EATER.

Alcemerops (Nyctiornis) athertoni (Jardine and Selby)

Fauna B. I. 2nd ed. No. 1529.

Description :- Length 14 inches. Sexes alike. Fore-head, and a little above it, verditer-blue; rest of upper-plumage bright grass-green including the sides of the head, neck and throat; the elongated feathers of the chin, throat

and fore-neck, brilliant pale blue, centered with rich dark blue ; remainder of lower plumage ochrous-buff, boldly streaked with green on the breast, upper abdomen and flanks ; under-surface of wings and tail buffy-yellow.

Bill horny, transparent whitish at the base, lower mandible slaty, pale plumbeous at base, iris bright-brown ; legs purplish-green.

This is a large Bee-Eater with no prolonged feathers in the tail and a stronger and deeper bill. Easily recognized by its size and the blue, elongated, drooping feathers of the chin, throat and upper-breast.

Distribution and habits :—A common bird in the forests of the foothills and extending far into the plains. I have many specimens from the Moraghat forest and others from the Tondur and Apalchand forests, also from near Hasimara and Binaguri. It is a heavily built bird and sluggish both in flight and when on a tree with none of the graceful movements of the other Bee-Eaters. It is generally seen singly, or in pairs, and is fond of sitting motionless on the branch of a tree. Some of its food is captured on the wing, but according to Stuart Baker, it "searches the leaves and flowers for insects and honey". Deignan only found *Hymenoptera* in the stomachs of those he examined. He describes the note of this Bee Eater as follows "The song is composed of a series of notes that sound like the syllable *Kuk* ; it begins slowly but finishes with a rapid, rattling *Kuk-kuk-kuk-kuk-kuk*, during which the bird points its bill at the sky and erects the elongated feathers of the throat." I have observed it doing this.

The principal breeding months are April and May but, some breed earlier and later. It excavates a deep tunnel in the bank on the side of a forest road or in that of a stream.

The eggs number 4 to 6, are glossy white in colour and measure about 1.14 by 1.03 inches.

Family *Alcedinidae*.

356. THE INDIAN LESSER PIED KINGFISHER.

Cerylerudis leucomelanura Reichenbach.

Fauna B. I. 2nd ed. No. 1531.

Description --Length 12 inches. The only description necessary is that the male has the upper plumage barred and spotted with black and white ; lower plumage white with a double black gorget across the breast and some bold black spots on the flanks.

Female :--Differs in having only one black gorget ; generally interrupted in the middle.

Bill and legs black ; iris brown.

In this Kingfisher the bill is long, heavy and pointed and the feet very weak. The Lesser Kingfisher has a small nuchal crest.

Distribution and habits :--A very common Kingfisher frequenting streams and river in open country, also tanks, pools and even ditches which contain water. Its usual method of fishing is to fly over a stretch of water and on spying its prey below the surface, it hovers like a Kestrel and drops perpendicularly into the water like a stone emerging, if successful, with a tiny fish. It has, also been seen diving obliquely from an overhanging bank. It usually, eats its prey on a bank but I have seen it swallow it on the wing. In flight it, constantly, utters its rather shrill but pleasant call, syllabalized by Deignan as *peet-weet, peet-weet, peet-weet*. Its main diet is small fish but, it is said to eat small prawns,

very small frogs, tadpoles and water-insects, I have never known it do so.

The breeding season is roughly from November to March. It tunnels into the banks of rivers or tanks ; there is no nest but fish-scales etc. may be found in the egg-chamber. The eggs number 4 to 6 and are highly glossy and china-white in colour. They measure about 1.18 by 0.94 inches.

357. THE HIMALAYAN OR GREAT PIED KINGFISHER.

Ceryle lugubris guttulata Stajneger.

Fauna B. I. 2nd ed. No. 1532.

Description :—Length 16 inches. *Male* :—Upper part of the head black with elongated white spots ; a band of white from the base of the lower mandible, forming a broad semi-collar on the hind-neck ; upper plumage barred slaty-grey and white ; ear-coverts streaked black and white, a line of black spots down each side of the throat, merging into the broad gorget of rufous-brown and black spots ; lower plumage white ; flanks and patch below the tail, barred with grey and black, feathers under the wings white, streaked with black.

Female :—Differs in having the feathers under the wings rufous-brown and generally there is none of that colour on the gorget.

Bill horny-greenish-brown, blackish towards tip ; iris dark brown ; legs greenish-plumbeous.

This fine Kingfisher has a large crest.

Distribution and habits :—This is a bird of hilly-streams and rivers but, during the winter, it descends to the foothills and wanders a considerable distance into the plains as I have secured specimens as far away as the Murti

river, near Gorumara and in the Moraghat forest. It is never seen away from water and is found singly or in pairs, perching on bushes, or boulders on the banks. It does not hover as frequently as its smaller cousin and is not such a good fisher ; its usual method is to dive either perpendicularly or obliquely, from a perch, to secure its prey. It has a strong flight and can put on a great speed if necessary but, otherwise, it flies much slower, with flapping wings ; while in flight it utters a harsh, shrill call. It feeds entirely on fish,

358. THE COMMON INDIAN KINGFISHER.

Alcedo atthis bengalensis Gouclin.

Fauna B. I. 2nd ed. No. 1533.

Description :—Length 7 inches, Sexes alike. Fore-head to nape, transversely banded black and pale blue ; back to above the tail glistening smalt-blue ; in front of and behind the eye bright ferruginous ending in a white patch ; a deep blue, or greenish-blue, moustacheal streak ; chin and throat white ; rest of lower plumage ferruginous.

Bill black, orange-red at base in female ; iris dark brown ; legs coral-red.

Distribution and habits :—A common bird found wherever there is water be it river, stream, pool or ditch and it also perches anywhere on stump, stone, bush or telegraph wire. It, usually, dives obliquely, returning to its perch with its catch, which may be a small fish or water-insect. Its flight is swift and straight and it has a loud trilling note like *chee-chee-chee-chee*, or *ch'kee*, which it utters on the wing.

I do not know whether it is resident or not but it probably is. The breeding season is, generally March and April but nests have been found in Bengal during December and January. The nest is excavated in the bank of a stream or river, the tunnels may be from one to four feet in depth, there is often a mass of fish bones at the bottom of it. The number of eggs is 5 to 7; they are almost spherical and highly glossy, china-white in colour. They measure about 0.8 by 0.7 inches.

359. THE ASSAM DEEP-BLUE, OR BLUE-EARED,
KINGFISHER.

Alcedo meninting coltarti Stuart Baker.

Fauna B. I. 2nd. ed. No. 1540.

Description :—Length 6 inches. Sexes alike. It differs from the Common Indian Kingfisher in having the patch behind the eye deep blue instead of ferruginous, with a buff spot, partly white, behind this instead of a pure white one; it is also a deeper and more brilliant blue, the light blue being more brilliant too; the lower plumage is a much deeper ferruginous.

Bill black, reddish or orange red at base of lower mandible; iris dark brown; legs coral-red.

Distribution and habits :—Common in the forest streams of the district. I secured it at Rajabhatkhawa, Gorumara and in the Moraghat forest; one was collected at Hasimara on a stream outside the forest. It is a forest loving bird seldom wandering far from it and when it does happen to fly across an open stretch of forest, its glistening blue is a beautiful sight. It feeds, principally, on small fish but also captures some water-insects.

360. THE GREAT BLUE KINGFISHER.

Alcedo hercules Laubmann.

Fauna B. I. 2nd. ed. No. 1542. Plate.

Description :—Length 8 inches. Sexes alike. Top of the head to hind-neck blackish with well-defined bluish cross-bars ; middle of back, rump and above the tail, glistening pale blue, deeper on the latter ; tail blackish, suffused with blue-green ; shoulder feathers and wing-coverts dull green, most of the latter with brilliant blue shaft specks ; quills blackish, edged with dull green ; in front of eye blackish with a pale ferruginous spot next the bill ; another similar spot below the eye ; cheeks and ear coverts blackish, spotted and streaked with blue ; a pale ferruginous or white stripe on each side of the neck ; chin and throat pale rufescent or white ; rest of lower plumage deep ferruginous.

Bill black, inside of mouth blood-red, the female has the base of the lower mandible reddish ; iris blood-red ; feet coral-red.

In the coloured plate the glistening blue on the back is not bright enough ; in fact the reproduction of the blues is far too dull ; the buff patch on the side of the neck and the chin and throat are shown too deep in colour.

Distribution and habits :—I include this fine Kingfisher on the strength of a note by Hume in which he states that he, recently, received from Mandelli a specimen of this species "from the Bhutan Doars" (*Stray Feathers Vol. II, p 458, 1874*). I have not, nor has anyone else, so far as I know, even come across this Kingfisher in the district since then. It is a bird of deeply shaded forest streams and on the larger ones, keeps to the shadiest bank. Stuart Baker writes, "It perches also low down in the bushes overhanging the stream rather than on conspicuous posts....."

.....and when disturbed starts off with great rapidity, only uttering one cry as it starts." Its note is merely a vocal but soft replica of that of the Common Kingfisher and it has the same flight as that bird, swaying from side to side, gleaming should a sun-ray touch it but looking sombre and black in the shade. Stevens who knew this bird well in Assam wrote "It has an arrowy flight and in consequence is very difficult to procure on the wing and when it rests settles in the dense vegetation well out of observation". Stuart Baker also states that this Kingfisher always returns to its perch after attempting to catch a fish and that it is successful in catching one "not more than once in every six or seven times."

361. THE INDIAN THREE-TOED KINGFISHER.

Ceyx erithacus erithacus (Linnaeus).

Fauna B. I. 2nd. ed. No. 1544.

Description - - Length $5\frac{1}{2}$ inches. Sexes alike. A black spot at base of forehead, running up the centre of the crown, glossed with blue; crown, nape, hind-neck, lower back, rump and above the tail, orange-rufous, glossed with shining lilac, especially above the ear-coverts and above the tail; rest of upper plumage black, washed with deep ultramarine-blue; tail orange-rufous; wings brown, some of the feathers edged with blue; behind the ear-coverts a deep ultramarine spot; sides of the head and lower plumage orange-yellow, except on chin and upperthroat which are whitish.

Bill and feet bright vermilion; iris crimson.

In this tiny Kingfisher there are only three toes, the inner one is wanting and the tail is very short and rounded.

Distribution and habits—A rare forest species during the rains. In fact the only record for the district is one retrieved from J. J. Macphersons' cat, at Gairkata and given to O'Donel: this specimen was caught by the cat quite in the open and not far from the compound. It is usually, seen singly or in pairs in small streams running through evergreen forest where, when captured by a ray of sunshine as it darts along, it is like a veritable gem, shining vivid blue or lilac. It has a rapid, twisting flight and often cuts through the forest at some bend to join the stream further on. Its food consists of fish, shrimps, small spiders snatching these from their webs and snapping up floating grasshoppers, winged-ants and May-flies according to Robinson. Stuart Baker once found one of these beautiful Kingfishers in a spider's web and sucked dry, "a true case of retribution" he called it.

362. THE BROWN-HEADED STORK-BILLED
KINGFISHER.

Famphalcyon capensis gurali (Pearson).

Fauna B. I. 2nd. ed. No. 1548.

Description :—Length 15 inches. Sexes alike. Top and sides of head dark brown; neck, and lower plumage, deep buff; upper-back and wings, greenish-blue; lower back, rump and above the tail, glistening pale blue; tail rather bluer than upper-back.

Young birds have some dusky brown edges to the sides of neck, breast and flanks and these persist on the breast of, otherwise, adult birds.

Bill dark blood-red, blackish at tip; iris deep brown; legs coral-red.

The birds of this genus are very large and have strong, large bills.

Distribution and habits :—A common plains Kingfisher, found in both open country and wooded places ; in Bihar it, regularly, came to our garden. It, also frequents rivers, streams and even ditches, whether in the open or shaded by trees. I have not found it a shy bird but, some consider it to be so. It, certainly, is oftener heard than seen as its very loud cry, *peer-peer peer*, repeated several times, is constantly uttered when in flight or at rest ; its flight is straight and powerful. It fishes from a vantage point, such as the bare branch of a dead tree which has fallen into a river or some tree, or bush, on land. Its food is very varied, consisting of fish, frogs, lizards, grass-snakes, crabs, prawns, locusts and grasshoppers. Stuart Baker saw one take a young Myna from its nest and devour it.

363. THE NORTHERN WHITE-BREASTED KINGFISHER

Halcyon smyrnensis smyrnensis (Linnoeus).

Fauna B. I. 2nd. ed. No. 1551.

Description :—Length 11 inches. Sexes alike. Head, neck and lower plumage, chocolate-brown, except the chin, throat and centre of the breast which are white ; upper plumage greenish-blue ; bend of the wing chocolate brown, followed by a black band ; flight feathers black with a white patch at their base.

Bill deep red, purplish-brown on tip and edges of upper mandible, iris brown, coral-red.

Distribution and habits :—Very common in the plains, in fact our commonest Kingfisher. It is really a bird of open country, rivers, tanks etc. Stuart Baker says it keeps to forest and cover but I have not noticed this ; it is even found in large cities like Calcutta and Madras. It, frequently, visits gardens and has been known to visit a garden tub to have a plunge bath, it also often perches on telegraph wire. This

Kingfisher is found either singly or in pairs and where persecuted for its plumage, becomes very shy. Its flight is fast and direct and it utters its harsh cackling cry both on the wing and at rest. It is more a land than a water bird, a large proportion of its food is found on the ground and captured by flying down at it from a perch ; it is varied and mainly consists of locusts, grasshoppers and crickets ; it also consumes other insects, taking cicadae off the trunks of trees ; this diet is varied with lizard, crabs, frogs, tadpoles, shrimps, water-insects and fish. Aitken (EHA) said it swallowed small birds if kept with them in an aviary.

It breeds from March to July and usually, excavates a tunnel on the bank of a river but Hume took eggs from a well 100 feet below the ground from a mud bastion of a fort. The number of eggs is from 4 to 8 but 6 is the normal clutch. They are pure, very glossy, china-white and measure about 1.15 by 1.05 inches.

364. THE INDIAN RUDDY KINGFISHER

Halcyon (Entomothera) coromanda coromanda (Latham).

Funa B.I. 2nd. ed. No. 1555.

Description :—Length $10\frac{1}{2}$ inches. Sexes alike. Upper plumage rufous-chestnut, strongly glossed with violet, lower back and rump, glistening pale blue ; lower plumage rufous-ochraceous, palest on chin and throat.

Bill red, darker at the base ; iris dark brown ; legs coral-red.

Distribution and habits :—The only two records of this Kingfisher in the district are one captured by two children, beneath some flowers, in the Kumargram Tea Estate on the 9th September 1938 and recorded by Martin Hawes. The garden is about 4 miles from the foothills. The second

one was also found on a tea-garden, Mechpara, [by M. O. Stevenson on the 31st July 1939, it was suffering from a broken wing. J. S. Turner wrote to me "It was found a mile, as the crow flies, from the nearest jungle, the Raimatong river. There had been a heavy wind the night before which, probably, buffeted it about away from its usual haunts". I had long suspected that this beautiful Kingfisher would turn up in the Duars but it is extra-ordinary that the only ones to do so should have been found some distance away from the heavy forest to which this species normally keeps and more or less both under similar circumstances.

It is one of the shyest of Kingfishers and keeping as it does to streams and rivulets running through dense forest, it is seldom seen. In some localities it is found on the sea-coast. Its flight is fast and it has a high-pitched note, which Cripps likens to that of the Stork-billed Kingfisher and Stuart Baker to that of the Common Kingfisher. Its food consists of land-shells, small lizards, tadpoles; grasshoppers, beetles and fish. I dissected a stomach and found only insect remains inside, the only recognizable one was a Fulgorid bug.

THE NATURAL HISTORY MUSEUM AS A SOURCE OF
EDUCATION.

BY

KEDAR NATH RUI.

Indian Museum, Calcutta.

*“Acquisition and Systematization of positive
knowledge are the only human activities
which are truly progressive and cumulative.”*

—George Sarton.

If the function of the university is to discover and to interpret new knowledge for the advancement of learning and to pass it on to their students so as to equip and inspire them in research work, the functions of a modern natural history museum are of equal importance. The students of a museum are less sophisticated because they come from different walks of life.

The section of museum visitors which responds to the formal techniques includes school-children, students of higher secondary and pre-university or entrance classes of university at under-graduate level, graduate classes including honours standard, post-graduate classes and lastly a certain small but specialised section like naturalists and school-teachers. To use formal techniques effectively, the subject materials must strictly be tailored to fit the particular audience.

The nature and mode of teaching in a museum is related to materials in its collection and available facilities on which the degree of its success depends. There is a fundamental difference between a museum and other educational establishments such as schools, colleges and universities since, it has a permanent as well as a reserve collection of material. So the method of instruction also differs.

As a single object on display may convey different meanings to different sections of spectators the most modern museum adopts varied informal means of communication such as display, conducted tours, popular lectures, different activity centres etc. Owing to varied presentations of its materials, a museum is able to be of service to the community which is impossible for any other organisation to perform. The position of a museum is unparalleled and unique. A museum's education service should not reproduce or compete against the programme of any academic body. Its primary aim is to develop enthusiasm to stimulate thought, to arouse inquisitiveness, to light a spark, to create an interest, particularly among children. In this way, it becomes complementary to formal education.

The type of direct teaching with three-dimensional objects requires a specially trained teaching staff. Added to scientific knowledge and understanding of the displayed objects must be a psychological knowledge of the visitors to a museum, particularly the un-informed adults, teen-agers and children.

It is recommended in the UNESCO publication.....
"Museum Organisation...a practical advice"...that the best qualification for the staff of a museum education service is a combination of a university degree with a post-graduate teachers' training. Alternately, the museum personnel who is to come in close contact with museum visitors require a period of practical teaching experience in an academic institution, or teachers may be assisted in acquainting themselves with the museum exhibits displayed therein. The Government Museum of Madras adopted the last method.

Opinions differ as to how enthusiasm can be aroused by a museum among little children. Some feel that a carefully chosen object lesson of museum material will serve this purpose. Others however, feel that a few formal lessons should

be devoted to encouraging the child to return to the museum to take part in the free activity centre.

The former technique probably impresses a large number of children, but may give the impression that biology is a subject that can only really be dealt with by a museum, while the latter approach becomes successful if the activity centres are sufficiently attractive to encourage children to return to these by themselves.

In addition to stimulating the childrens' interest, curiosity and enthusiasm, museum lecturers have unique opportunities for giving direct help to the school teachers. By supplementing with specific knowledge the teachers' general knowledge of a subject, they serve as it were as living encyclopaedias answering questions from teachers and students alike.

There are very few children's museums or children's corners in a big museum in India, but those existing may play a vital role in the life of the community. The Sri Giridhari Bhai Sangrahalaya in Ameriali in the State of Gujarat with its notable collections of natural history specimens caters for the children of the locality. The Motilal Nehru Children's Museum at Lucknow is disseminating knowledge to school children appropriately through its free activity programmes on science, paintings, crafts, music, drama, etc. The National Children's Museum of New Delhi is still in the blue print stage. However, Bal Bhawan is serving this purpose to some extent. The Government Museum at Madras opened a special section for children in 1960.

A special programme of museum games of different educational value on the line of children's museums of the United States has been started. In comparison with the magnitude of the task, the achievement on the part of museums of national status is lamentably poor.

For physically handicapped children, the community has been much benefited through special museum education programmes and have claimed their success in the United States. This special problem requires a different treatment. A maiden venture has recently been made in the neighbourhood of the city of Calcutta by "The Society of the Experimental Medical Science" with the help of a band of young and experienced staff.

Secondary Education, including the Higher Secondary and Pre-University stages, presents to the museum a very different problem. At this stage, a museum should be a place of 'reference'. The present general trend of displaying biological objects in a museum is undoubtedly useful and stimulating, but emphasis in Secondary Education with particular reference to the changed curricula of Higher Secondary and Pre-University courses with biological subjects, due to the switch over from a two-year-degree course to a three-year-degree course, is still imparting the detailed factual knowledge which is used for examinations. Here the task of the museums' specialised staff is to use its collection to complement the work of schools for a wider and better understanding of a particular subject.

Through his lessons a student will realise that the museum is not merely a place of recreation, but a functioning scientific unit, and he will appreciate the museum as a source of information and a place of reference.

For the implementation of this task, the museum requires a co-ordinated effort with the authorities of schools like the Secondary Board, or the State Education Department. But it is a matter of deep regret that such co-operation is entirely lacking. In India, the medium of natural history museum as a teaching aid remains neglected, though there are signs of growing consciousness in this regard. For instance, The Bombay Natural History Society launched a Nature Education

a Programme in 1926 and is perhaps the pioneer in disseminating knowledge through

- (1) popular, lucid talks on simple natural history, topics for school children,
- (2) Establishment of Natural History Clubs both for students as well as teachers.
- (3) Arrangements for field trips for teachers and pupils.

The aim is to arouse enthusiasm and promote an interest in natural history subjects. The Lord Reay Maharashtra Museum undertakes the propagation of education in a planned manner through its Museum Education Service, the scheme of which covers solely the branches of the sciences related to agriculture and industry. The museum exhibition is based on and restricted to the practical material assistance in the form of a school loan service providing portable show cases of habit groups, charts, maps, etc. The Museum also arranges talks with the help of teachers. The Natural History Museum at Darjeeling in 1957 started a Nature Education Scheme,* for selected students of some local institutes. This scheme is claimed to be a successful one. Very recently, the authorities of the Indian Museum have launched a programme of conducted tours in different galleries followed by educational film shows, once a week; the said programme being restricted to a limited number of students only.

A newly created chain of Vijnan Mandirs in selected rural areas of India might play a vital role to diffuse scientific knowledge among the local primary as well as higher secondary schools or other institutions of equivalent standards. These facilities may be well utilised by the local Basic Training Centres for primary teachers. Recently, the

* In abeyance since 1967 for want of funds.—Ed.

administration of Vijnan Mandi's has been transferred to State Governments to enable better co-ordination among local academic institutions which are directly under the control of the Depts. of Education of the States.

Regional sub-stations of the Zoological Survey of India in different parts of the country have set up museums with collections representing mostly local fauna. Likewise the Botanical Survey of India maintains herbaria and botanical museums representing only regional flora in their sub-stations. It is pertinent to suggest, that, when developed fully, they may play an important role in formal education in natural sciences at different levels.

In the formal education of university undergraduates the complementary role of the scientific staff of the natural history museums and the university departments of biological sciences is self-evident. They both possess the same level of academic qualification but their enthusiasm and research interests in the same subject are different. In the present day of apparent dichotomy between the descriptive and experimental sciences, it would be most beneficial to students to experience different presentations of the same subject and to realise their interdependence.

Again instruction on principles and effects of animal and plant distributions in space and time, needs a large series of specimens for demonstration purposes. Normal university teaching departments of biological subjects cannot, as a rule, afford the assemblage and maintenance of such material, while museums do this in the course of their normal duties. A close co-operation between colleges and museums for the use of museum collections for undergraduate teaching is desirable, but there are valid objections to it. One objection is that students as untrained people may fail to appreciate the value of material of this kind which is

often irreplaceable and the loss of which may mean a loss to science itself. So, these must always be handled with a view to their use for many years to come. In the interest of education, the use of such materials may be allowed only under the supervision of the museum staff who are their custodians.

In the field of post-graduate and original research, the museum can also render to the university departments a valuable service. Research workers choose subjects which require the use of collections, particularly for taxonomic problems. Sometimes collections which are the outcome of research work would best be preserved in a museum. Any collection upon which the taxonomic work is based should be permanently preserved for future reference.

Natural History museums may help in identification of unknown and unnamed zoological and botanical specimens. They may develop and maintain the standard flora and fauna collections of the country. Recently the UNESCO has taken up a massive programme for a Union Catalogue for type specimens of zoological collections in South-East Asia. In such a programme the natural history museum may act as repository of Standard National Collections. These are studied systematically so that scientific names of fauna can be kept up-to-date in the light of recent researches and in accordance with the latest international Biological Nomenclature. A constant vigilance is needed to maintain them in a proper state of preservation.

The conception of the museum service is gradually changing as the word 'museum' is changing its import from a repository to a centre of education, entertainment and enrichment. The museum education service is a service to the community. But such service is conspicuous by its absence in our country. It is evident that the problem will

remain unsolved so long as the people in responsible positions remain unaware of the needs of schools and universities. In this context the much laudable efforts of the newly established Museum Education Service Bureau may be mentioned. This Bureau, since its inception in the year 1965, has already visited some twenty educational institutions in the city and suburbs, and it is known that their education officers give illustrated lectures on popular museum topics, which are appreciated by teachers as well as students. In this way they give the audience a short briefing for intended museum visits ; this briefing is very essential without which no visit can be a fruitful one.

Amongst some of the difficulties to be faced initially in our country, the *first* is the scanty number of science museums, not to speak of natural history museums. Language imposes a serious problem in a multilingual country like India and poses the *second* difficulty. The *third* is the lack of properly trained personnel. The prevailing service conditions of the museum staff come *next*. Lack of co-ordination between the museum education service and the academic institutions cannot be over-emphasised and is the *fifth* problem. It is pertinent to suggest that the number of natural history museums ought to be multiplied. In this context it may also be suggested that the regional sub-stations of the Botanical Survey of India and Zoological Survey of India may set up new museums. These ultimately would become centres of study of regional fauna and flora as well as places of reference for nearby schools and colleges including post-graduate institutions.

The Vijnan Mandirs established in different parts of India may be developed into local natural history museums. The patronage of local self-governing institutions are to be sought for their role as instruments for mass education to fight age-old superstitions.

The language problem can be solved by adopting a tri-lingual formula, (in addition to Latin) viz. the regional language, Hindi and English for labels of exhibits as well as for conducted tours by specially trained staff.

In the third problem the paucity of trained staff and their service conditions are inter-linked. The former is due to the lack of properly equipped training centres. Regarding the latter it may be suggested that the service conditions of museum staff should be at par with other Central Government Staff of equivalent status in respect of emoluments and other benefits so as to attract young talents of the nation. Both the problem should be dealt with at the highest Government level.

The lack of co-ordination could be met by action along the lines of the recommendations made by the UNESCO General Conference at its 11th. Session in Paris in 1960 which run as follows :—

- (a) Each museum might have on its staff educational specialists to organise, under the curator's supervision, the use of the museum for educational purpose.
- (b) Museums might set up educational departments which would call on the services of teachers ;
- (c) Joint committees of curators and teachers might be established at Local, Regional or State level to ensure that the best use is made of museums for educational purposes ;
- (d) Any other measures which would co-ordinate the demands of education and research at museums.

Taking it for granted that the museum is a powerful audio-visual instrument for mass education, the role of the

natural history museum in education merits special consideration in an under-developed country like India. In India there is a high percentage of illiteracy and superstitious beliefs about certain plants and animals. But the analysis of the nature of problems in India indicates the need for a well thought-out comprehensive educational programme with properly trained staff, for the whole country.

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A FURTHER DESCRIPTION OF *DASYPSOCUS*
JAPONICUS End. 1906 (Amphibsocidae) Pearman

BY

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A redescription of *Dasypsocus japonicus* End. is desirable owing to the incomplete nature of the existing descriptions. The present paper is supplemented by including the detailed coloration of various body characters and genitalia. This species is for the first time recorded from Shillong (alt. 1880m), Assam, India. In addition, the morphological findings on hypopharyngeal plate of *Psococerastis assamensis* Datta (J. Bengal Nat. Hist. Soc.) is noted here.

Female :—Coloration : Epicrænia plate white, frons reddish, sutures dark brown postclypeus creamy with pale brown converging stripes, anteclypeus paler ; labrum grey ; gena reddish ; antennal segments pale excepting 4th and rest of the segments which are greyish ; maxillary palpi greyish ; eyes black, ocellar space black.

Mesothorax : Antedorsum dark brown with a 'Y'-shaped creamy band posteriorly ; lateral dorsa darker anteriorly otherwise pale-grey, scutellum pale white ; axillary cord dark brown ; tergite with erect hairs.

Metathorax : Coloration as mesothorax, without 'Y'-shaped band. Legs : Tibia with pale band proximally ; first tarsal segment pale yellow, second segment dark grey, rest pale yellow.

Forewing (Fig. 1) : Transparent, margins with soft hairs ; veins lightly pigmented, with stout hairs arranged in two rows, $r1$, $r2+3$, $r4+5$. $m1$, $m2$, $m3$. $cu2$, $r+m$ at the

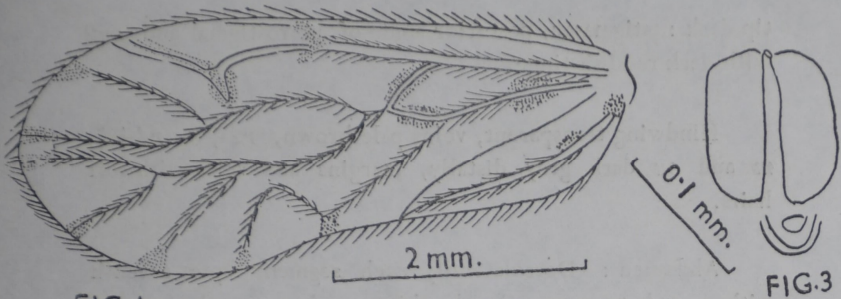


FIG. 1

FIG. 3

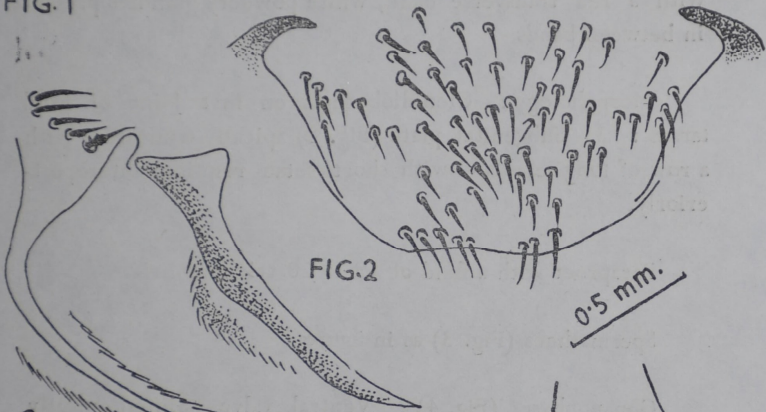


FIG. 2

0.5 mm.



FIG. 4

0.2 mm.

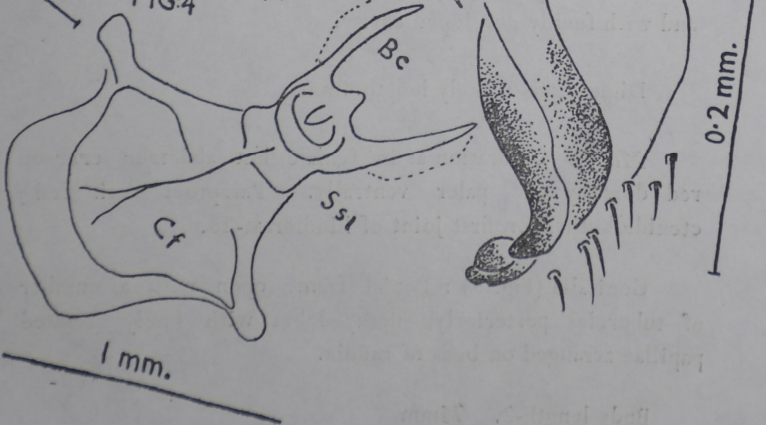


FIG. 5

0.2 mm.

FIG. 6

1 mm.

tip dark : stigmasac, posterior angle of pterostigma and *cu2* with dark reddish tinge.

Hindwing transparent, veins pale brown, *r2+3*, *r4+5*, *m* and *cu* dark grey distally, margins and veins with soft hairs.

Abdomen : Dorsolaterally each segment upto seventh with a red transverse band, white powdery granules present in between bands.

Morphology : Ctenidiobothria on first joint of hind tarsus : 23 Subgenital plate (Fig. 2) apically truncated, with a row of long setae and with short setae running anteroposteriorly.

Paraproct with a field of 19 to 20 trichobothria.

Spermatheca (Fig. 3) as in figure.

Gonapophyses (Fig. 4) : Ventral valve pointed apically membranous part slightly serrated with prominent condyle ; dorsal valve pointed apicad with its proximal plate triangular and with feebly developed cavity.

Dimensions : Body length-4mm.

Male : Coloration as in female but abdomen crimson red dorsally and paler ventrally. Paraproct dark red ; ctenidiobothria on first joint of hindtarsas-23.

Genitalia (Fig. 5) : Penial frame open with a number of tubercles posteriorly, fleshy lobes with finely serrated papillae arranged on beds of radula.

Body length-2. 75mm.

Measurements (mm) of taxonomic characters of

D. japonicus End.

(Number of specimens 3 ♀♀, 3 ♂♂)

	Female	Male
Width of head capsule	... 0. 960	0. 912
Interocular Distance (IOD)	... 0. 640	0. 320
Ratio IOD/Ed.	... 3. 90	1. 08
Length of forewing	... 5. 00	5. 00
Length of hindwing	... 3. 60	3. 50

Brief notes on hypopharynx of *P. assamensis* Datta.

The sitophore sclerite (mortar) (Fig. 6) ('Salivarium' of Cope 1940; 'oesophageal sclerite' of Noland 1924) is found highly sclerotised as a rectangular structure dorsal to the mandibular molar surface and when viewed from ventral surface, it appears most distinct. It has a pair of basal cornua between which lies a short, thick plate with pointed tip. Till halfway from their origin, the distal arms are welded by a plate-like structure and preapically these are incurved and terminate in a squarish plate which, according to Noland (1924), is a part of mentum. The sitophore sclerite is attached to two 'lingual sclerites' by a pair of connective filaments ('Salivary ducts' of Cope 1940) which, as in *Liposcelis* (Noland 1924), unite into a common duct before opening on sitophore sclerite and ('Brush' of Cope 1940) engulfs the common duct. The connective filaments

do not open separately on the sitophore sclerite as has been generalised for Psocoptera by Snodgrass (1944).

Bc=Basal cornua

Ssl=Sitophore sclerite

Cf=Connective filament

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Guru Sikkhar highest peak of Mt. Abu.

AN ECOLOGICAL STUDY OF BIRD LIFE AT MT.
ABU AND ARAVALLI RANGE.

BY

Indra Kumar Sharma, M. Sc.

Mt. Abu is the only hill station of Rajasthan and Guru Sikkhar is the highest peak (1727 meters above M. S. L.) between the Himalayas and the Nilgiris of South India. It is part of the detached Aravalli Range. Being the only evergreen mountain in Rajasthan, the bird fauna of this region is of special interest from an ecological point of view. Salim Ali has described the bird fauna of Mt Abu (Hill Birds of India, 1949) in a general way only. So, it was considered desirable to study the ecology of birds of this region which enjoys the distinction that it is an evergreen mountain in the desert area of Rajasthan, as well as the highest place between the Himalayas and the Nilgiris of South India. It was in this context that I studied the bird life of Mt Abu and other ranges of Arvalli.

Method :—Several typical habitats were selected at Mt. Abu in 18 × 22 kms and several places in the Aravalli range for ornithological ecological study of this region. A pair of 6 × 30 binoculars was used to study birds from afar without disturbing their natural activities by close approach.

Physical Conditions of Mt. Abu :—It is situated at 24.36 N. latitude and 72.43 E. longitude in south-west Rajasthan in India. It is a detached chain of the Aravalli Range on ancient igneous granite rocks. The valley of the mountain has an evergreen sub-tropical forest composed of *Mitranga parvifolia*, *Eugenia jambolana*, *Mangifera-indica*, *Salix babylonica*, *Anogeissus latifolia*, *Dendrocalamus strictus*, *Adina cordifolia*, *Bombax malabaricum*, *Grewia oppositifolia*, *Carrisa caranda*,

Lantana bouxii, *Ficus glomerata*, *F. bengalensis*, *F. religiosa* and several other trees and plants.

The annual rainfall is 1560 mm precipitated mainly during the rainy season, that is, from June to September. The temperature in June is 31 C. max and 22 C mini, in January it is 18 C max and 10 C mini ; the relative humidity at 8 a.m. is 40 % in May and 96 % in August.

TYPES OF HABITATS AT MT. ABU AND ARAVALLI RANGE AND THEIR FAUNA

Foot Hills

From the plains to 50 meters altitude towards the mountain the vegetation is scrub or small trees interspersed with large rocks on alluvial soil or gravelly ground.

Indian robin, bulbuls (red-vented and white-cheek), babblers and doves (brown and ring) are found in abundance : they feed on insects, seeds of herbs, shrubs and grasses according to their preference for food and use bushes and small trees for rest and roost. Redstart, Bush-chat, and Pied-chat are found in good numbers in winter and spring.

Low Hills

From 50 to 250 meters generally there is moderately thin deciduous forest having *Acacia catechu*, *Zizyphus jujuba*, *Butea monosperma*, and *Comiphora mukul* trees of small size.

Birds mentioned under foot-hills are also found here. In addition to those, Nuthatch (*Sitta castanea*), Golden wood pecker, Mahratha woodpecker, Tree pie (*Dendrocitta vagabunda*), Rose-ring parakeet, Little minivet, partridge, Red turtle-dove and other common doves, bulbuls and hill babbler are found here.

Valleys

The valleys have a thick forest of larger evergreen trees e.g. *Eugenia jambolana*, *Mitragyna parvifolia*, *Mangifera indica*, *Salix babylonica*, *Anogeissus latifolia*, *Adina cordifolia*, *Bombax malabaricum*, *Grewia oppositifolia*, *Ficus glomerata*, *Ficus bengalensis* and *Ficus religiosa*.

Red-cheek bulbul (*Pycononotus jocosus*), *P. cafer*, Wood shrike, Rose-ring parakeet, Blossom-head parakeet (*Psittacula haemocephala*), Magpie robin (*Copsychus saularis*), Cuckoo shrike, Hawk-cuckoo (*Cuculus varius*), Green pigeon (*Teron phoenicopterus*), Grey Jungle-fowl (*Gallus sonneratii*), Yellow tit (*Parus xanthogenys*), Rose-finch (*Carpodacus erythrinus*), Crested bunting, Grey horn-bill, Black-bird, Ground-thrush, White-eye and Oriole etc. are also found here in addition to the fauna of plains.

Ground-thrush, Rose finch, green pigeon, blossom-head parakeet, Hawk-cuckoo, Crested bunting are rarely observed in very green and humid areas.

Ravine

This is a part of the valleys having water in springs or pond; here most of the birds come to drink in summer. Egret, king-fishers (common and white-breast) are seen close to ponds; mynas are found near green grass-land.

Plateau

There are some plateaux where there are patches of fertile land, between hillocks, which is generally cultivated by local tribes. Here the birds found are the same as those found on cultivated lands in the plains. Mynas, babbler, doves, crow, house sparrow, lapwing and peafowl etc. are common here.

Lake

Reservoirs are formed when dams are constructed in the mountains for supply of water for irrigation and domestic use in hill stations. Birds found here are the same as those found in lakes in the plains, but they are less numerous ; large-size species and delicate natured birds are not found here. Here cormorant, darter, egret, king-fisher (common and white-breast) pond heron, moorhen and black-wing stilt etc are found in water ; wagtails are found close to water.

Hill Stations

Birds found in urban areas in the plains are generally found here, but the density is less as there is scarcity of food. Common birds are house sparrow, pigeon, mynas and crow. Bulbuls visit gardens of hill stations, as do some other forest birds.

Peak area

Mostly conical peak area, at high altitude of hill or mountain. From top to 100 or 200 meters below, the slope is devoid of thick vegetation, here desert type vegetation is found because of scarcity of water. It consists of *Euphorbia caudicifolia*, *Zizyphus nummularia*, *Barleria* and *Aspuragus* etc.

Birds found in deserts are found here as conditions are similar. Doves, Robin, and babblers are abundant. In caves pigeon, swallows, common and scavenger vulture are found. Vultures are seen gliding high above the peak. Grey-tit is sometimes observed in greener parts close to the peak.

ALTITUDE AND FAUNA

It is found that a little below the middle of the mountain there are green valleys bearing large trees. These have a

rich fauna of birds. At high altitudes and the foot of the hills the vegetation is poor and the fauna of birds is correspondingly poor. At Mount Abu mountain there is thick vegetation and a rich fauna of birds from 800 to 1350 meters ; below and above that zone the avifauna is poor.

MOST ABUNDANT BIRDS

Doves, babblers, bulbuls and robin are most abundant in the mountains as they subsist on little or poor food and survive under adverse conditions.

ADAPTATIONS OF BIRDS IN THE MOUNTAINS OF MT. ABU AND ARAVALLI

Rocks of this mountain are granite, so ground colour is mostly dark black. Therefore, the colour of birds e. g. bulbul, crow and other dark colour birds, is much darker than that of the birds living in the plains having yellowish brown soil. Here the temperature does not rise high and R. H. does not go too low so birds do not have to migrate due to variations in weather conditions with change of seasons. There is a profusion of date-palm (*Phoenix dactylifera*) growing in valleys and on hill-sides, where some birds (e. g. myna, sparrow and warblers) have adapted themselves to rest, roost and breed ; and find protection against predator animals. The bird population is more or less evenly distributed as this mountain is green enough over a wide area throughout the year, providing food and shelter.

USEFUL PLANTS FOR BIRDS

Lantana bouxi which grows here plentifully bears small drupes (fruits) providing food for bulbuls and other small and medium size birds. Insect larvae feeding on leaves of *Lantana* furnish food for insectivorous birds. *Ficus* trees are common and shelter large and medium size birds.

Their fruits are the favourite food of majority of the birds. Jamun trees (*Eugenia jambolana*) and mango trees are useful for shelter and their fruits are eaten with relish by many birds.

DAILY ROUTINE OF HILL-BIRDS

There is a wide area for rest, roost and acquiring food, hence, the birds need not travel far as birds of arid areas have to do. As the temperature does not rise high at noon birds are found active in the valley even at mid-day. Birds of small towns have to travel farther in search of food, e. g. crow and house sparrow. Some birds e. g. parrot, crow and mynas prefer to roost close to human habitation in the evening, again go to forest in the morning in search of food.

BIRDS FOUND IN THE ARVALLI MOUNTAIN AND NOT FOUND IN PLAINS

Hill babbler, Yellow tit, Red-cheek bulbul, White-eye, Large Parakeet, Iora, Blossom-head parakeet, Magpie robin, Tree-pie, Jungle fowl, Grey horn-bill, Crested bunting, Rose-finch, Spotted dove, Grey tit, Red turtle-dove, Black-bird, and Ground thrush.

SUGGESTIONS

Beautiful birds of the Himalayas, South America and Europe may be introduced here. These birds would survive and flourish as climate and vegetation of Mt. Abu is very mild and wholesome and great varieties of plants and environments are available here. I suggest introduction of Budgerigar, Gold finch, Shyama, Masked love-bird, Toucan, barbet, Peking robin, Zebra finch, Gouldian finch, and Golden pheasant etc.

SUMMARY

Mt. Abu valley has a rich fauna of birds ; the peak and foot hills have arid area fauna. Birds here have adapted to the environment in routine as well as appearance. Except in the green valleys the avi-fauna resembles that of plains. The birds are not concentrated at places as in oases in arid areas.

ACKNOWLEDGEMENT

I acknowledge my gratitude to my guide Dr. Iswar Prakash, Animal Ecologist, Central Arid Zone, Jodhpur for his guidance as well as supplying literature and meteoerological data. I am thankful to local gardeners and farmers for providing me all possible facilities in their gardens and farms for my observations.

I also acknowledge some worthy suggestions by my friend Shri S. S. Vyas.

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NEW RECORD OF TWO SNAKES, *ELAPHE HELENA*
(DAUDIN) AND *LYCODON TRAVANCORICUS*
(BEDDOME) (SERPENTES : COLUBRIDAE) FROM
ANDAMAN ISLANDS WITH A SHORT NOTE
ON THEM.

S. BISWAS

Zoological Survey of India, Calcutta.

INTRODUCTION

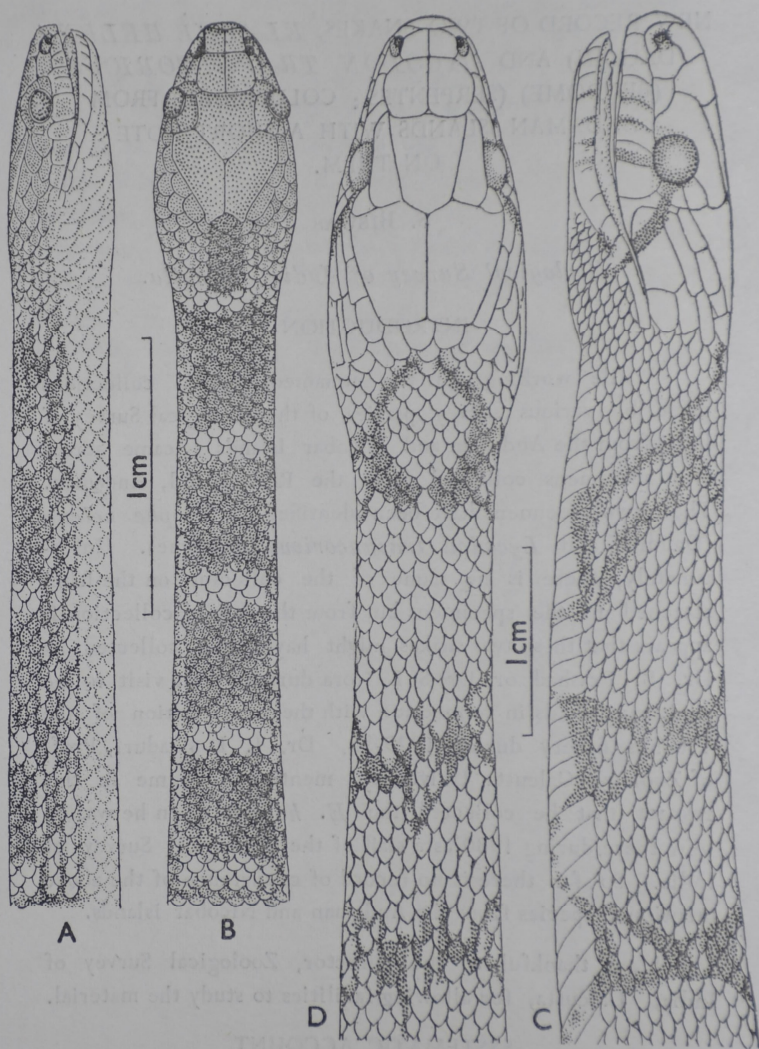
While working out the unnamed reptilia collections made by various survey parties of the Zoological Survey of India from the Andaman and Nicobar Islands I came across two specimens collected from the Ross Island, Andaman. These two specimens have been identified as *Elaphe helena* (Daudin) and *Lycodon travancoricus* (Beddome). Unfortunately, there is no name of the collector on the label attached to the specimens but from the date of collection it appears that these two snakes might have been collected by Dr. B. Prashad or Dr. S. L. Hora during their visit to the Andaman Islands in connection with the investigation of the Trochus fishery during 1929-32. Dr. J. L. Bhaduri, Prof. of Zoology, Calcutta University, mentioned to me in this respect that he collected the *E. helena* when he was on tour there during 1930 as a staff of the Zoological Survey of India. So far there is no record of occurrence of the above mentioned species from the Andaman and Nicobar Islands.

I am thankful to the Director, Zoological Survey of India, Calcutta, for allowing facilities to study the material.

SYSTEMATIC ACCOUNT

Elaphe helena (Daudin)

1803. *Coluber helena* Daudin, *Hist Nat. Rept.* vi,
p. 277 (based on Russell's plate) (Vizagapatnam).



Lycodon travancoricus (Beddome) A. lateral view ; B. dorsal view
Elaphe helena (Daudin), C. lateral view ; D. dorsal view.

1943. *Elaphe helena*. Smith, *Fauna Brit. India*
(Rept. & Amph.) III. pp. 149-50.

The specimen from Andaman referred to above agrees with both the colour patterns mentioned by Smith and Wall (1909) in their specimens that are supposed to be confined to the Western Ghats or Western India, South of Bombay. Smith recognised two distinct colour pattern groups by the marking on neck of specimens belonging to the species. The first one is with two longitudinal black stripes parallel to one another on the neck and the second one with a black-edged white collar interrupted in the middle line. The first pattern is common and occurs in the whole range of the species including Ceylon. The second pattern on the other hand is mostly restricted to the Western Ghats. According to Wall specimens confined to Western India, South of Bombay, have in their lower part a more or less distinct festooned marking. The same marking is present in the specimen and its colour patterns are still very prominent after such a long preservation in spirit.

Material : Zoological Survey of India Reg. No. 21696 ;
Ross Island, Andaman ; 30th January 1930.

Lepidosis : 9 supralabials on the right side and 10 on the left side ; 5th and 6th on the right and 5th to 7th on the left side touching the eye ; 7th and 8th on the right and 8th and 9th on the left touching the temporal ; V-245, C-80 ; Cos-25, 27, 21 ; A-1.

Total length : Head to vent 470 mm., vent to tip of tail 100 mm.

Range : So far this species was known to occur in Ceylon, Peninsular India to Sind in the north-west ; the Himalayas and Assam in the north-east. The present record of the species in Andaman Islands extends its distribution south-east to the islands of Bay of Bengal.

Lycodon travancoricus (Beddome)

1870. *Cercaspis travancoricus* Beddome, *Madras Month. J. Med. Sci.*, ii, p. 169 (Travancore Hills).

1943. *Lycodon travancoricus*, Smith, *Fauna Brit. India* (Rept. & Amph.) iii, p. 259.

The colour of the specimen under consideration is blackish above with whitish crossbars which bifurcate on the sides. The bifurcation is clear in case of anterior bars only. The first cross bar starts at the back of head and dorsally it is in the shape of U. The interval between crossbars decreases from the anterior to the posterior. In the present specimen prominent crossbars which are more in number signifies that it is a young one. The measurement also confirms this.

The ventrals are angled at sides and all subcaudals are entire, Dorsal scales are with apical pits or grooves.

Material : Zoological Survey of India Reg. No. 21697 ; Ross Island, Andaman ; 30th January 1939.

Lepidosis : 9 supralabials 1st and 2nd touching the nasal, 3rd, 4th and 5th touching eye, 6th and 7th touching the temporal ; V-185 ; C-64 ; Cos. 17, 17, 15 ; A-1.

Total length : Head to vent 135 mm., vent to tip of tail 83 mm.

Range : The species is recorded from Western Ghats, as far north as Mathern and on the north from M. P. The eastern range is Vizagapatnam and South Arcot and the southern limit is upto Kerala. The present record of the species extends its distribution farther east to the Islands of Bay of Bengal.

ZOOGEOGRAPHY

So far two species of the genus *Lycodon*, (*L. aulicus capucinus* Boie and *L. tiwarii* Biswas and Sanyal) have been found in the Andaman and Nicobar Islands. The distribution of the former species is Indochinese and Malaysian and the latter is indigenous while in case of *L. travancoricus* the distribution is mainly South Indian. Of the two species of the genus *Elaphe*, *E. oxycephala* (Boie) and *E. flavolineata* (Schegel) that are known from the Andaman and Nicobar Islands, the distribution of *E. oxycephala* is Indochinese and Malayan and *E. flavolineata* is Malayan reaching Indochinese region in its southern part but both are absent from the Indian fauna.

The zoogeographical distribution of species belonging to the Indo-Chinese and Malayan subregions in the Andaman and Nicobar Islands as well as in South India is an interesting question. In the present case whether migration took place from Indo-Chinese subregion to the Indian subregion or *vice versa* is first to be decided. Though *E. helena* is recorded from eastern India, both the present species are not known to occur in any other parts of Indo-Chinese subregion. Therefore, it may be highly probable that these two Indian species might have migrated from the Peninsular India to eastern India and Andamans or only to Andamans (the most western part of the Indo-Chinese subregion). If we accept the hypothesis that migration took place between these two regions through the ancient connecting landmass, called the Gondwanaland, then the alternative explanation for the distribution of these two species by the Satpura Hypothesis of Dr. S. L. Hora (1949) can be tested. But it still remains to be explained why *Elaphe helena* is found throughout India, Ceylon and now Andamans and *Lycodon travancoricus* occurs only in the hills of Indian Peninsula and Andamans but not in any other country of Indo-Chinese subregion, if

these two species originally migrated from that region to India. Another aspect of discontinuous distribution was observed by Smith (1930) while studying reptilia fauna of Malaya Peninsula which cannot be easily explained. He found many common species in northern Malaya and Malaya Archipelago but those were absent from southern Malaya. Sometimes this kind of discontinuous distribution have been explained in cases of species that have adapted themselves to similar but widely separated ecological conditions. Regarding these two species the ecological condition from which they have been recorded does not vary much from that of the other possible Indo-Chinese regions.

In conclusion all the above mentioned facts indicate that distribution of reptilia fauna took place not only from one direction, east to west, as is the usual presumption but also in some cases in the opposite direction.

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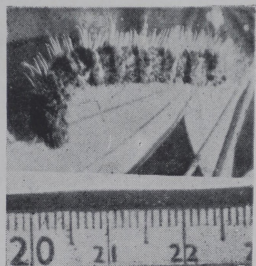


Fig. A



Fig. B



Fig. C

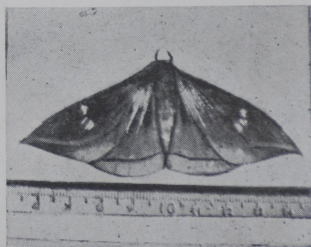


Fig. D

Fig. A. First stage larva of *Cricula trifenestrata* Helf.

Fig. B. Cocoon of the same.

Fig. C. Pupa of the same.

Fig. D. Adult of the same (female)

STUDIES ON THE BIOLOGY OF A NEW PEST, *CRICULA*
TRIFENESTRATA HELF. (SATURNIDAE :
LEPIDOPTERA) ON PLUM, *PRUNUS*
DOMESTICA IN SHILLONG.

By

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INTRODUCTION

The moth, *Cricula trifenestrata* Helf, is common in Shillong and its larvæ feed exclusively on the leaves of plum *Prunus domestica*, a common fruit of this locality.

Hampson (1892) in his Fauna of British India only described the morphology of this insect. Singh (1964) in his article Temperate Fruit Pests (pp. 213-226) in Entomology of India (1938-1963) recorded a number of insect pests from the leaves of temperate fruit plants including plum but he did not mention *Cricula trifenestrata* Helf, as a pest.

The authors are fortunate to record this moth as a pest on plum for the first time and here an attempt has been made to study the biology of this moth.

BIOLOGY

This moth completes three broods in a year. The first brood is completed in May—July, second brood in August—October and for completing the third brood it takes the maximum time i.e. November—April, because before winter they simply lay eggs and as such pass the winter, the larvæ are only found in March.

The female moth lays nearly 100 eggs. The moths do not show any marked preferences as to the host material for

laying eggs because sometimes it was found that they laid eggs on grasses near the host plant.

The incubation period is about 7-8 days and it varies on either side according to temperature. After hatching, the larvæ take nearly 4-5 weeks to build the cocoon and normally they remain 30-35 days in the pupal condition.

Eggs :—The eggs measure 1.9 mm in length and 1.0 mm in breadth. They are thick walled and oval in shape. The colour of the egg is white with a yellowish tinge.

First stage larva :—The tiny first stage larva measures 3.4 mm in length with a conspicuous black head and a pale brown body with a faint black mid-dorsal line which is extended upto the tip of the narrow posterior end.

The full grown larva :—The full grown larva (Fig. A) measures 6-8 cm in length. The head, the posteriormost portion of the body and the ventral side are black in colour. The black portion of the body is spotted with minute yellow dots, 2nd to 11th somites each with six setiferous tubercles ; 1st somite and anal clasper crimson ; a pale reddish sublateral stripe. Legs and prolegs brown.

Feeding Method :—The larva after hatching starts feeding but in the first two instars the feeding is very slow. The rate of feeding increases in the subsequent instars and in the final instar it becomes a voracious feeder. The larva feeds during day. It holds the slender branches by its prolegs and extends the whole body along the midribs. It starts feeding from the margin

of the leaves and ultimately consumes entire leaves except the petiole. It is not gregarious and usually one larva feeds on a small branch. It preferably takes the leaves from the lower portion of a branch leaving some leaves at the growing end.

Cocoon formation :—Prior to cocoon formation a larva moves towards the growing point of a branch and folding a few leaves together starts to build the cocoon (Fig. B Hampson (1885) described the cocoon as follows : Composed of bright golden yellow silk, firmly united into a net work.

The Pupa :—The Pupa (Fig. C) is typically of the obsect type. The fully formed pupa is pale yellow in colour with deeply stained yellow intersegment. Subsequently the colour becomes brownish. The pupa measures 26-28 mm in length and 10-12 mm in width. It is bluntly rounded at the head end and tapers posteriorly, by which the pupa remains attached to the cocoon. The period of pupation is from 30-35 days.

Description of the Moth :—(Fig. D ♀) ♂ Hampson (1892) described the Moth as follows—“Brown, ochreous, yellowish, or reddish. Forewing with a waved antemedial dark line, a small hyaline spot beyond the end of the cell, with one or two others above it, the upper one generally represented by a dark spot, an oblique line from the apex to the inner margin beyond the middle, the area beyond it suffused with grey. Hind wing with the oblique line continued to the inner margin before the middle ; a hyaline spot

beyond the cell, a submarginal waved line, underside with basal area suffused with purple.”

♀ Generally redder ; three large irregularly shaped hyaline spots beyond the cell of the forewing often with one or two small ones inside them.

Parasite :—In course of rearing the larvæ in the laboratory a small Hymenopterous parasite has been obtained from a large number of larvae. In every case of parasitism the larvae died after the immergence of the parasite. The Hymenopterous larvae just after emergence spun cocoons, the colour of which is white with a yellowish tinge. The pupation period of the parasite is 6-7 days.

Economic Status :—The insect is of considerable economic importance as it, in its larval condition, defoliates the plum trees every year.

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A NEW SPECIES OF THE GENUS *COILIA** GRAY
(PISCES : ENGRAULIDAE)
FROM HOOGHLY ESTUARY

BY

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During the course of a systematic study of *Coilia* spp. (Fam : *Engraulidae*) of the Hooghly estuary, three species could be distinguished. The first two were identified as *C. ramcarati* (Ham. Buch) and *C. dussumieri* Val. The third species did not agree with any of the described species. It is being reported as a new species and is named after Mr. P. J. P. Whitehead of the British Museum (Natural History) who has done so much towards the understanding of the systematics of the clupeoid fishes. A description of the new species and differences with the related species are presented in the following account.

Fam : *Engraulidae*

Sub-fam : *Coilinae*

Coilia whiteheadi, sp. nov.

Holotype : a fish of 120.5 mm, S. L. (129.0 mm. total length) (Fig. 1) collected from the fishermen's catches in the Hooghly estuary on 13.2. 1968.

Paratypes : 12 fishes of S. L. range, 98 mm.—124 mm. from the same sample as that of holotype, Four paratypes of S. L. 103 mm., 99 mm. 114 mm. and 110 mm.

*Bengali name—Banspata, বাঁশপাতা—Ed.

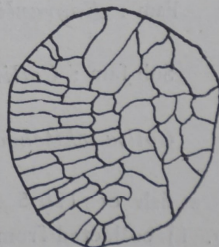
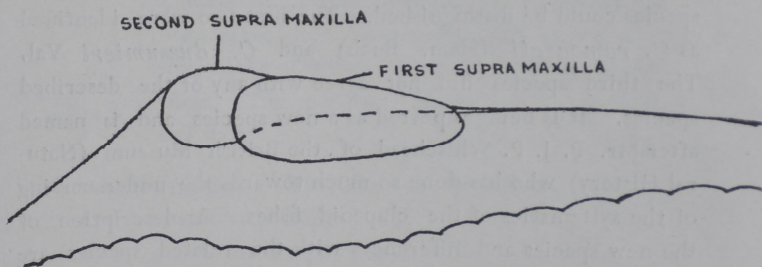


Fig. 1. *Coilia whiteheadi* Sp. nov.

Fig. 2. Upper : Maxilla showing orientation of first and second supra maxillae
Lower : Scale showing the reticulation

were sent to the British Museum ; other type material deposited with Z. S. I. collections.

Meristic data (figures for paratypes given in parantheses) : P. XI+6 (X-XII+6-8), V. 7 6-7), D. I iii 9 (I ii-iii 10-12). A. ii 105 (ii-iii 98-110). C. 10+10 (9-10 10-11), Sc. 9+10 (8-9+9-10), G. R. 24+32 (22-26+29-34).

In percentages of standard length : body depth 4.63 (4.29-5.00), head length 5.47 (5.02-5.76) snout length 5.50 (4.75-5.37), eye diameter 4.40 (4.00-4.75), length of maxilla 7.53 (6.86-7.93), length of lower jaw 8.31 (7.62-8.88), pectoral fin length (longest filament) 2.15 (1.87-2.36), pelvic fin length 1.35 (1.00-1.30), length of anal fin base 7.7 (6.2-8.1), prepectoral distance 5.73 (5.42-6.20), prepelvic distance 3.88 (3.67-4.27), predorsal distance 3.54 (3.21-3.67), preanal distance 2.56 (2.28-2.68) pectoral-pelvic interspace 1.1 (0.75-1.15), pelvic-anal interspace 1.75 (1.40-1.85).

Body compressed, its width about $2\frac{1}{2}$ times its depth, deepest at dorsal origin then tapering evenly to tail. Belly distinctly convex, from under pectoral base becoming compressed and keeled towards vent. Head dorso-ventrally compressed, shorter than body depth. Snout shorter than eye diameter. Lower jaw without high coronoid process. Maxilla reaching nearly to the posterior margin of preopercle, it is expanded opposite supramaxillae, tapering towards posterior end. The two supramaxillae (fig. 2) are similar in general shape and orientation to those found in *C. reynaldi* (Whitehead, 1967a, Fig. 15a) except that the first supramaxilla is bigger than in *C. reynaldi*. A single series of fine teeth along entire edge of maxilla. Few minute teeth-like projections on the lower jaw. Scutes present from before the origin of pectoral.

Gill rakers slender, long, about as long as eye diameter and twice the length of corresponding gill filaments. Muscular portion of isthmus reaching forward to hind margin of branchiostegal membrane.

Dorsal fin preceded by small scute-like spine. Pectorals originate just behind the posterior margin of opercle; longest free rays extending nearly to the middle of anal fin. Ventrals originate just before the dorsal origin and do not reach the origin of anal. Pelvic axillary scale present and is about $3/4$ th of the longest pelvic fin ray. Dorsal is situated more or less in the middle of the anterior half of the total length of the fish. Anal originates behind dorsal and is continuous with the caudal.

Scales more reticulated towards the exposed portion (Fig. 2).

Body silvery laterally in fresh condition, becoming golden during preservation. Black diffuse pigmentation on the dorsal side of body, head and edges of dorsal and anal fins. Pectorals and ventrals hyaline.

In the presence of pre-pelvic scutes and the number of pectoral filaments the new species can be grouped with *C. reynaldi* Val. and *C. coomansi* Hard. (Whitehead, 1967b, p. 30). However the scute counts distinguish it from the above two species. The first supramaxilla is distinctly larger than in *C. reynaldi*.

Whitehead's (1967b, p. 30) key of *Coilia* spp., can be modified, as follows, to include the new species.

1. No pearly spots (light organs) along flanks.

A. Pelvic rays i 8-9 ... *C. ramcarati* (Ham. - Buch., 1822)

B. Pelvic rays i 6

1. Maxilla short, not reaching beyond gill-opening

(a) No prepelvic scutes

(i) Pectoral filaments 19

... *C. rebentischii* Bleeker, 1859

(ii) Pectoral filaments 11

... *C. polyfilis* Volz.

(b) Prepelvic scutes present

(i) Pectoral filaments 6

(α) Scutes 5-6+9-11

... *C. neglecta*, Whitehead, 1967

(β) Scutes 17 + 35

... *C. rendahli* Jordan & Seale, 1926

(ii) Pectoral filaments 10-14

(α) Scutes 4 - 6 + 8 - 9

... *C. reynaldi* Valenciennes, 1848.

(β) Scutes 8-9 + 9-10

... *C. Whiteheadi* sp. nov.

(γ) Scutes 13-14+9-10 ... *C. coomansi*

Hardenberg, 1934.

2. Maxilla long, reaching to and beyond gill opening

(a) Lower gill rakers 25-30 ; total scutes 36-39

... *C. mystus* (Linnaeus, 1758)

(b) Lower gill rakers 21-24 ; total scutes 46-53

... *C. macrognathus* Bleeker, 1852

II. Pearly spots along flanks (luminous organs) ;

4-6 free pectoral filaments ; 4-6 6—8 scutes.

C. dussumieri. Valenciennes. 1848.

The authors are thankful to Drs. A. P. Kapur and B. S. Chauhan, Zoological Survey of India for their kind interest and encouragement in the preparation of this paper.

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ON A NEW MITE OF THE FAMILY TYDEIDAE
(GENUS : *TYDEUS*)

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INTRODUCTION

Although the mites of the family Tydeidae has a wide range of distribution throughout the whole world yet it has received little attention in oriental regions. However, Oudmans (1926, 1932) and Sig Thor (1932, 1933) have described a few oriental species of the family. The species described here is new to science and now may be added to the Tydeus mite fauna of India.

SYSTEMATIC ACCOUNT

Tydeus reerii sp. nov.

Female : Body elliptical, somewhat narrowed posteriorly with reticulate striations and truncated end. A curved furrow separating the propodosoma from the metapodosoma being well developed laterally. Body uniformly red with a few setæ. Chelicera triangular at the base. Pedipalp well developed, four segmented, coxa longest and stout ; tarsus ending in spinelike projection directed forward. Gnathosoma with pointed spinelike projection in front. Legs five-segmented ; coxa smallest and tarsus being longest with small pretarsus ending in claws and pulvillus. Leg I longer than II. Leg IV longer than III. Leg II shortest (Table). No genital sucker.

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Table showing length of leg segments in mm.

Species	Leg	Coxa	Trochanter	Femur	Tibia	Tarsus with pretarsus
	I	0.05	0.09	0.01	0.11	0.13
<i>T. reenii</i>	II	0.03	0.05	0.08	0.09	0.09
Sp. nov.	III	0.05	0.08	0.09	0.12	0.14
	IV	0.06	0.09	0.11	0.14	0.15

Measurement : Length of the body 0.22 mm.-0.25 mm, including rostrum 0.24 mm—0.27 mm. Maximum width of the body is 0.11 mm.

Male : It differs from the *female* in having an oval body with the posterior part emerginate and without any reticulate striations.

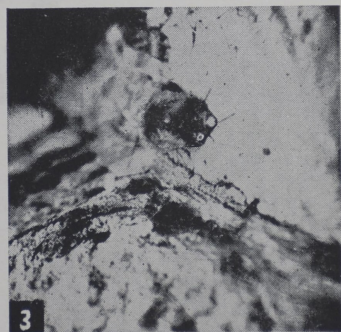
Holotype : Female, *allotype* one male, *paratype* one female. All the type materials are on slides.

Remarks : *T. reenii* agrees with *T. aberrana* in many characters but differs from it in having an oval body, no sensory setæ at the propodosomal region, and in the absence of the spine like projections given out from the gnathosoma.

Type locality : South Dum Dum Municipal Campus from the leaves of moss plants and in association with the mites mostly of the genus *Phytoptipalpus* (Family : *Eriophyidae*). *Collector* : B. D. Basu, *Date of collection* : 8. 8. 1962.

ACKNOWLEDGEMENT

The author is grateful to his teacher Dr. D. N. Ganguly and to Dr. D. N. Roy Chaudhury for their helpful criticism and to Dr. N. R. Bardhan and Principal K. C. Gupta of Raja Peary Mohan College for their manifold help.



- Fig. 1. Showing the shrew on the grassy field near the crevices.
Fig. 2. Showing the shrew in the act of digging the soil from cultivated field.
Fig. 3. Showing the mother eating the dead young ones.
Fig. 4. Showing the female busy for digging soil under the wooden floor.

NOTES ON THE BEHAVIOUR OF SZECHUAN BURROWING
SHREW *ANOURESOREX SQUAMIPES*
SQUAMIPES MILNE EDWARDS
FROM KHASI HILLS, ASSAM.

BY

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Little is known on the behaviour of Szechuan Burrowing Shrew. Authors like Anderson (1879) described in detail the anatomy of this animal, while Blanford (1888, 1891) and Allen (1938) contributed much regarding its morphology.

During our stay (1964-65) at Shillong, Khasi Hills, Assam, we had an opportunity to study the behaviour of this animal. Due to their nocturnal habit it was difficult to study them in their natural habitat. However, efforts were made to do the same.

Many shrews were caught during this study. A few areas were selected, both wooden and break-neck types of traps were placed with bread, potato and raw meat as baits. The wooden type of trap and the potato bait yielded the best results. The best time of trapping was from dusk (4.30 p.m. to 6.00 p.m.) to 7.30 p.m. Traps were placed throughout the year, the number of animals trapped was maximum during the month of August. The absolute lack of shrew in the traps set in any area in any month was a rarity.

This shrew is found at dusk in maximum number, with the onset of dusk their voice can be heard near kitchen, garden with grassy beds and in drains which are their favourite haunts (Fig. 1). They are also visible during the day,

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particularly just after a shower of rain or in winter when the sky is overcast, but never in bright sun-light.

They prefer moist, damp places such as those near drain, behind kitchen, under small bushes near a house, below a wooden house. They are never found to make their own holes. Blanford (1888, 1891), however, stated, (p. 245) "This is probably from its structure a burrower,....." They live in crevices or the holes of other animals, but Allen (1938) (p. 141) indicated "..... the only note on its habit is the remark of Milne-Edwards that it usually keeps in its underground tunnels . . .".

These animals cannot walk very fast, and while walking, the hind portion appears to move sidewise, which gives an impression that the animal's hinder part is heavier and requires a special device for balancing. On cemented floors their performance is very poor and the same is the case in climbing a vertical surface of any extent. They produce a distinct low pitched *chick chick* sound much quicker than the characteristic slower high pitched *chick chick* sound produced by the common house shrew, *Suncus murinus* Linnaeus—a neighbouring shrew available in a slightly different ecological condition, although their habitats often overlap with each other. One can easily differentiate the calls of the two shrews.

These animals are omnivorous, but prefer animal products. The refuse of the kitchen is at the top of their menu. Generally they take insects, insect larvae, earthworm. Just after a shower of rain, they are found to collect earthworm from the damp moist or just tilled soil near human habitation with the help of the snout (Fig. 2). They do not come out while it is raining but, when the rain subsides or is merely drizzling they are seen busy in search of food. Peter (1963) recently stated that the specimens from Bomdilla, Assam

were coprophagus in habit and fed on insects or human excreta.

In captivity, various types of food such as bread, rice, potato, raw meat were supplied to them and they took all but preferred potato. It is seen that in captivity, they generally survive for ten days even with sufficient care. Cannibalism is very common amongst them. They were never seen in groups, on the contrary, if two individuals came side by side, immediately fighting started. In captivity it was observed that a mother ate its dead young along with placenta (Fig. 3). In the field, the *Suncus* and *Anourosorex* were often seen to fight with each other and a retreat on the part of the latter resulted.

Young ones were observed once a year: May to September, copulation was observed in April. The process is intermittent with a total duration of 8-10 minutes. During the process, the hinder part of the female is pressed downwards and the hind feet appear pushed to the sides. The male presses for a few seconds and then gets down, takes a few long breaths marked by up and down movements of the lateral abdominal portions. The process is repeated. The male appears to have a constant watch over the female even during the intervals. The female looks very helpless moving her head in different directions and sometimes producing its sound at low pitch.

Usually four to six young ones are born in a blind and naked condition. The young ones are not laid inside the crevices but the mother removes the loose moist soil of the upper surface below the wooden floor of the house. She digs upto a depth of 8 to 10 cm. usually until the hard layer of the earth is exposed and afterwards gives birth to young ones inside (Pl. 1, Fig. 4).

The mother keeps a constant watch over them. Once she was found by the side of the young ones from 7 A.M. to 10 P.M. As the eyes are excessively small in these ani-

mals, it had become very difficult to mark the time of opening of the eyes, however, it takes approximately 7 to 10 days. Though blind, an infant can perceive a sound and appears active. The most remarkable character of this animal is the tail, which is rudimentary in adult (about one sixth the length of head and body). While studying the development it has been marked that the tail is longer in young ones in proportion to the head and body (H & B) length than in the adult.

	H & B(Head & Body) length	Total length	Tail length	% of Tail in relation to H & B length	% of Tail in relation to Total length	
Embryo probably 15-20 days.	(i) 25 mm.	33 mm.	8 mm.	32%	24.2%	
	(ii) 26 mm.	35 mm.	9 mm.	34.6%	25.7%	
	(iii) 25 mm.	33 mm.	8 mm.	32%	22.8%	
	(iv) 25 mm.	33 mm.	8 mm.	32%	24.2%	
Young ones 15-20 days after birth	(i) 48 mm.	60 mm.	12 mm.	25%	20%	
	(ii) 46 mm.	58 mm.	12 mm.	26.08%	20.7%	
	(iii) 46 mm.	59 mm.	13 mm.	28.28%	22.01%	
	(iv) 48 mm.	60 mm.	12 mm.	25.0%	20%	
Adult	♂	(i) 88 mm.	102 mm.	14 mm.	15.9%	13.7%
		(ii) 94 mm.	108 mm.	14 mm.	14.9%	13.05%
	♀	(iii) 85 mm.	97 mm.	12 mm.	14.11%	12.3%
		(iv) 98 mm.	113 mm.	15 mm.	15.3%	13.2%

The differences in the percentage of tail length in relation to the H & B length and total length of the embryo, young and adult (Table) is due to the differential growth rate of the tail with age i.e. the rate of growth of the tail is lesser than that of H & B length.

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NOTES ON INDIAN MAGNOLIALES (ILliciACEAE)

BY

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INTRODUCTION

Illiciaceae is a small family with the single genus *Illicium* which comprises 42 species distributed in both Old and New Worlds. Three species are found to occur in the south eastern United States while the rest are distributed in China, Japan, Malay Peninsula, Burma, India and the East Indies. Linnaeus (1759) described the genus *Illicium* Linn. based on a Japanese plant called "Star anise" which he named as *I. anisatum* Linn. Hooker and Thompson have described two species viz. *I. griffithii*, and *I. majus*, from the Indian region in their *Flora Indica* in 1855. Later King in *Ann. R. bot. gdn. Cal.* 3 : 199, 1891 treated 3 taxa including a new species viz. *I. manipurensis* Watt and *I. cambodianum* Hance and *I. simonsii* Maxim. Occurring in the Indo-Chinese region. Since then Merrill (1909) added 2 species from Philippines, 2 from Borneo and 2 from Indochina. Hayata (1912), Makino (1929) and Wilson (1927) have described one each from Formosa, Japan and Burma respectively, thus raising the total to about 23 for the whole world. A. C. Smith in *Sargentia*, 1947 described 19 more new species mostly from China except for one from Burma and another from Mexico.

Illicium was often linked with *Drymis* under the tribe *Wintereae* of *Magnoliaceae* sensu lato by Engler, Rendle, Bentham and Hooker while Hutchinson (1926), Ridley and others have placed it in *Winteraceae*. Bailey and Nast (1945) have rejected this disposition on the basis of

their studies on the anatomy, carpel morphology and karyology of *Illicium* and its allies. Spach (1839) was the first to set up a section for *Illicium* and *Cymbostemon* under the older concept *Magnoliaceae* tribe *Illicieae* DC. Van Tieghem in J. de Bot. 14 : 353, 1900 suggested the family "Illiciace" and the term was later used by Pilger and Hu (1906) circumscribing a note on the distribution but without any intention of proposing the new family. It remained only for Smith (1947) to erect *Illiciaceae* Smith following the rules of botanical nomenclature and publish his monograph "Families Illiciaceae and Schisandraceae" in Sargentia 7 :, 1947.

There are three species viz. *I. griffithii*, *I. simonsii* and *I. manipurensis* in the north eastern parts of India distributed in Assam, Assam-Bhutan border, Naga Hills and Manipur-Burma border. A synopsis of the family and taxonomic notes of Indian species are dealt with in the following text.

Illiciaceae Smith

In Sargentia 7 :, 1947 ; Lawrence Tax. Vasc. Pl. 505, 1951 ; Hutchinsonson Fam. Fl. Plants 1(2) : 125, 1959.

Tulipiferae Vent. Reg. Veg. Syst. Nat. 3 : 68, 1799.

Wintareae R. Br. ex DC. Reg. Veg. Syst. Nat. 1 : 548, 1817.

Magnoliaceae tribe *Illiciaceae* DC. Prodr. 1 : 77, 1824 ; G. Don, Gen.

Syst. 1 : 78, 1831 ; Torre & Gray, Fl. N. Am. 1 : 42, 1838 ; Walp. in.

Ann. Bot. 4 : 42, 1857 ; section *Illicineae* Spach in Hist. Nat. Veg. 7 ; 439, 1839.

Winteraceae Lindl. Nat. Syst. Bot. 2nd ed. 17, 1836 ;
Ridley, Fl. Mal. Peninsula 1 : 18, 1922.

Magnoliaceae tribe *Wintereae* R. B. ex Meissn. Pl.
Vasc. Gen. 3, 1836 ; Hook. f. & Thoms. Fl. Ind. 1 : 73,
1855 ; Benth. & Hook. f. Gen. Pl. 1 : 17, 1862 ; Hook.
f. & Thoms. in Fl. Brit. Ind. 1 : 39, 1872 ; King in Ann.
R. bot. Gdn. Cal. 3 : 199, 1891 ; Nakai, Fl. Sylv. Koreana
29 : 110, 1933.

Illiciaceae Van Tiegh. in J. de Bot. 14 : 353, 1900 ;
ex Pilger in Engl. & Prl. Nat. Pfl. 3 : 108, 1906 ; Hu in
Bull. Chin. Bot. Soc. 1 : 86, 1935 (Nom. subnud).

FAMILY CHARACTERS

The family characters are given under the generic description. *Illicium* Linn. is the only genus included in this family. *Illicium* Linn. Syst. Nat. ed. 10 : 1059, 1759, 1759 ; Gen. Pl. ed. 6, 144. 1764.

Plants *shrubs* or small *trees* ; bud scales present in the apices of young shoots, intricate, caducous ; *leaves* alternate, often pseudoverticillate, exstipulate, margins entire ; *Flowers* small to medium solitary or clustered 2 or 3, axillary or supra axillary, rarely below the leaves or on the trunk. Pedicels terete, bracteate, often 1-2 bracteoles present. Sepals and petals many, 7-33, free, imbricate, multiseriate, outermost few bracteole like, inner ones larger, ligulate, ovate to suborbicular ; *Stamens* few to many (4-50), one to many scriate, ligulate to subterete, ; filaments basifixed, tetrasporangiate, intorso-lateral, dehiscens longitudinal. *Carpels* c. 5-20, free in a single whorl, ovary unilocular, flattened, ovoid or ellipsoid with an attenuate base. *Fruit* a follicetum consisting of a single whorl of free follicles with persistent styles ; Seed ellipsoid or obovoid, laterally flattened, rounded on

dorsal edge, base obliquely truncate, rounded at apex : testa stramineous or brown ; endosperm copious, oily ; embryo minute.

KEY TO SECTIONS

- A. The inner perianth segments are thin, lax at anthesis, narrowly oblong or ligulate.—*Badiana* Spach Hist. Nat. Veg. 7 : 440, 1899. (13 sp.)
- AA. The inner perianth segments are fleshy to papyraceous, not lax at anthesis, usually ovate to suborbicular :—*Cymbostemon* (Spach) ex Smith in Sargentia 7 : 15, 1947. (29 sp.)

KEY TO THE INDIAN SPECIES

- A. Petals not lax at anthesis, ovate to suborbicular ;
I. griffithii.
- AA. Petals lax at anthesis, oblong-ligulate ;
- B. Flowers congested towards apices, Pedicels short, Carpels not more than c. 13.....*I. simonsii*
- BB. Flowers solitary in the axils, Pedicels slender, elongate, Carpels more than 13 (17-19).....
I. manipurensense.....

Illicium griffithii Hook. f. & Thoms. Fl. Ind. 74, 1855 ; Drury, Hand b. Ind. Fl. 1 : 15, 1864 ; Bail, Hist. Pl. 1 : 154, 1868 ; Hook. f. & Thoms. in Fl. Brit, Ind. 1 : 40 ; 1872 ; Thistleton Dyer in J. Linn. Soc. Bot. 13 : 331, 1873 ; Maxim. in Bull. Acad. Sci. St. Petersburg. 32 : 480, 1888 ; King in Ann. R. bot. Gdn. Cal. 3 : 201, 1891 ; Finet & Gagnep. in Bull. Soc. Bot. Fr. 53 : 30, 1906 ; Kanj. et al Fl. Assam 1 : 27, 1934 ; Smith in Sargentia 7 : 53, 1947.

A shrub or small tree, 4-6 m high; young branchlets subterete, strongly rugulose when old. *Leaves* irregularly alternate, or clustered distally; oblong-elliptic to narrowly obovate, 7-13 cm. long, 2-5.5 cm. wide, base acute apex shortly acuminate, veins 7-10 pairs, prominent on lower surface; petioles up to c. 15 mm long, terete. *Flowers* axillary or subterminal, solitary or in clusters of 2-3, bracteate; bracts few, fugacious; perianth segments dichlamydeous, c. 25, scantily pellucid glandular; *Sepals* 6, sparsely ciliolate; *Petals* 18 to 20, fleshy, eciliate, 3.5-4.5 mm long, 5.6 mm wide, broadly ovate or suborbicular, innermost few smaller. *Stamens* 30, biseriate; filaments c. 1.4 mm long, fleshy, ligulate; anthers as long as the filaments connective thickened, subtruncate. *Carpels* c. 12, ellipsoid, 1.5 mm long, style slender, 2.5-3 mm long, reflexed distally. Fruiting pedicel not thickened, 14-20 mm long. *Seeds* 7.5 2.5 mm.

Flowers : April-May ; Fruits : Nov-December.

Distribution : Assam and Bhutan at elevations between 1200-2000 m. and in dense wet forests.

BHOOTAN : Goomlibhaun Hill, *Wall. Cat.* 7121 : Without exact locality and date, *W. Griffith* s. n. ; ASSAM : Khasia Hills, *W. Griffith* 422, *Kurz* s. n. NAGA HILLS : Harikanni Nagahills, 2000 m. Dec. 1907, *A. Meebold* 9262.; NEFA ; Kameng Frontier division, Nyukmadang, May 1957, *B. S. Rao* 7573 : Seargaon, May 1958 *G. Panigrahi* 15815.

I. Simonsii Maxim, in Bull. Acad. Sc. St. Perersb. 32 : 480 1888 ; King in Ann. bot. Gdn. Cal. 3 : 201, 1891 ; Smith in Sargentia 7 : 22, 1947. *I. fargesii* Finet. & Gagnep. in Bull. Soc. Bot. Fr. 52 : 29, 19-05.

A shrub or small tree. up to 9 m high ; Branches slightly angled, bud scales present, 4-10 mm. long, lanceolate,

Leaves sub-opposite or alternate at distal nodes, lanceolate to elliptic or oblong-elliptic, 6-12.5 cm. long, 1.5-4.3 cm wide, base acute, apex cuspidate or shortly acuminate, margin slightly recurved; veins 6-10 pairs, sparsely conspicuous. Fedioles up to 1.5 cm. long, slender. *Flowers*: axillary, congested towards the apices of branchlets; bracts few, suborbicular to oblong, c. 6 × 6 mm.; *Sepals* 2-5, papyraceous, elliptic-oblong, 5-7 mm. long, 4-7 mm. wide, ciliate. *Petals* 12-18, oblong-lanceolate, or ligulate, 9-15 mm. long, 2-4 mm wide, membranous, ciliate at margins, pale yellow to creamy white or pinkish, fragrant. *Stamens* 16-18, free, 2-3 seriate, filaments ligulate, c. 2 mm. long, anthers 1.4-2.4 mm. long, oblong, connective rounded or cuspidate. *Carpels* 8-13, free at anthesis, c. 2 mm long, flattened, Style subulate, c. 1.5-2.5 mm. long. Seeds 6 × 4.5 × 3 mm.

Flowers: Feb.-May. Fruits; June.

Distribution: Western Szechuan to N. E. Assam at 1800-3200 m, in variety of habitats.

ASSAM: Khasi hills, 500 m., Aug. 1885, *S. Kurz S. n.*; MANIPUR: Kupra to Kunho near Mao, Feb. 1882, *G. Watt 6146.*; NEFA: Kameng division, Perila to Jabraang, April 1957, *G. panigrahi 6403, 6409.* Wang Basti 6941., Subansiri division: Bondila to Dirangjung, *G. panigrahi 6941. I. manipurensis* Watt ex King in *Ann. R. bot. Gdn. Cal. 3: 2000, 1891*; Finet & Gagnep. in *Bull. Soc. Bot. Fr. 53: 29, 1906*; Smith in *Sargent. 7: 27, 1947.*

A *shrub* up to 2 m. high; branchlets slender, bud scales oblong, papyraceous. *Leaves* alternate, ovate-elliptic or lanceolate, 7-11 cm. long 2-4.2 cm wide, base acute, apex mucronulate, veins 6-9 pairs. *Flowers*: axillary, bracteate; bracteopapyraceous, oblong, c. 6 mm. long; Perianth segments 22-24; *Sepaloid* segments 3,

oblong, 9-14 mm. long, c.5 mm wide ciliolate ; *Petals* : outermost 7-8 large, plicate, 1.3-1.5 cm. long, eciliate, innermost few subulate, yellow. *Stamens* c. 18, biseriate, thecae up to 1.5 mm. long, connective truncate or cuspidate ; *Carpels* : 7 or 8, free, 4-5 mm. long glabrous, stylesubulate, c.3 mm. long. Pedicels up to 2.5 cm. long, slender.

Flowers : April.

Distribution : MANIPUR, Keyong & Ching Sow on the Burmese border at 2500 m. April, 1882, *G. Watt 6585*. (Lectotype in CAL.)

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NOTES & NEWS

I. OBSERVATION ON THE BEHAVIOUR OF THE HOUSE
SHREW (*SUNCUS MURINUS CAERULESCENS*
SHAW)

(MAMMALIA : INSECTIVORA : SORICIDAE)

BY

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Except for small notes by Blanford (1888-91), Finn (1929), Jerdon (1874) and Prater (1965) very little information is available on the habits of the Indian Insectivores. In this connection, the following true account of a curious behaviour of two specimens of *Suncus murinus caerulescens* Shaw, based on my own observation may be of interest.

On July 14, 1965, two House Shrews (*S.m. caerulescens*) came out of a burrow at one corner of the courtyard of my residence in Calcutta. Of the two specimens, one was adult (*c.* 130 mm in head and body length) and the other a young (*c.* 70 mm in head and body length). The anterior portion of the mouth of the young one was between the hind legs of the adult and it was holding the adult's skin with its teeth near the base of the tail. The two animals came out of the burrow in this fashion, waited for a few seconds and started walking at a medium pace to the opposite side of the courtyard like two coupled railway compartments. Reaching the opposite side of the courtyard, they together entered another burrow situated at one corner. After a lapse of two to three minutes they came out of that burrow and marched in the same manner towards the first burrow and entered it finally. The distance between the two burrows was about

13 metres. While proceeding from one burrow to another, they went along the shadowy portions of the courtyard.

Writing on the habits of the 'Grey Musk Shrew', Prater (1965, 0.169) says : 'The young are most active and follow their mother on her excursions trailing behind, each holding with its jaws the tail of the one in front'. The above observation adds further information in the literature and corroborates Prater's statement.

An innate tendency of following their mother up to a certain stage of their development is commonly noticed among the young of mammals. In different species it is accomplished in different ways. The habit of trailing of the young behind the mother in the above stated fashion is well known in certain other insectivores such as the Bicolor White-toothed Shrew [*Crocidura leucodon* (Herman)] and hedgehogs etc. in other countries. For example, in *C. leucodon*, a number of young ones (five to six or more) remain firmly attached to their mother and trail her during the first three weeks after birth till they get their own nests (Wahlstrom, 1929). The young ones remain so firmly joined with each other that one can lift the whole group by raising the mother only. It is not certain if a similar phenomenon as in *C. leucodon* is also involved in *Suncus murinus caeruleus*.

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II. ON THE DISTRIBUTION OF *CROTALARIA*
TETRAGONA ROXB.,
IN THE PLAINS OF BENGAL.

BY

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CALCUTTA

The genus *Crotalaria* L. of the family Leguminosae consists of 350 species (Willis 1955) distributed in the tropical and sub-tropical regions of the world. Hooker (1875) reported the occurrence of *Crotalaria tetragona* Roxb., from Kumaon in India and its distribution is extended upto Sikkim and Assam. There were reports of cultivation of the plant in the Indian Botanic Garden by Roxburgh (1874) and Serampore Botanical Garden by Voigt (1845). Consultation of the Herbarium of the Central National Herbarium reveals the record of the species under study from Kurseong and its neighbourhood in 1903. The species was reported to have been distributed in the hill tracts of Chittagong by Prain (1903) but in his revision of flora of Hughli-Howrah-24 Parganas during the year 1905, he did not mention about the occurrence of the plant. Later workers like Biswas (1950), Culshaw (1950), Mazumder (1962) and very recently Dutta and Mazumder (1966) have not recorded the distribution of the plant.

In the present communication, the writers state that the species is found to be distributed in the outskirt villages situated near the Botanic Garden and the plant so distributed composes a constituent element among the flora of the district of Howrah which was previously reviewed by Prain (1905).

The plant is characterised by an erect and shrubby habit with a square stem bearing linear lanceolate leaves. The inflorescence is a terminal raceme carrying drooping yellow flowers.

The authors express their sincere gratitude to the Head of the Central National Herbarium, Howrah, Calcutta and Curator, Calcutta Herbarium of the Botany Department, Calcutta University for extending necessary help for consulting the herbarium sheets and lastly to the Librarian, Indian Botanic Garden for his kindly providing necessary literature.

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III. INCIDENCE OF HETEROSPORIUM DISEASE IN DARJEELING AREA *

BY

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In course of a survey of the disease of ornamental plants, a severe type of leaf spot disease—the heterosporium disease of garden nasturtium (*Tropaeolum majus* L.) was observed during May 1967 in Kalimpong, Manibhanjan and Darjeeling.

*This investigation was supported under U.S. PL. 480 research project No. (FG-In-194) (A7-CR-98).

Symptoms : Only the leaves have been found to be affected by the disease. Mature leaves are the most susceptible, whereas, the young leaves remain almost unaffected. The spots are widely distributed on both surface of the leaves. The spots appear first as minute carmine-red flecks which with maturity become rounded to elliptical having dimension 0.5 to 1.5 cm. A mature spot has distinct zonations. The centre of the spot on the upper surface (Fig. A) is light brown which is successively surrounded by whitish, deep green and finally with mixed yellowish green coloured zones. The spots on the lower surface (Fig. B) have deep brown centre surrounded by whitish and greyish zones from centre to periphery. The badly affected leaves become chlorotic and ultimately wither. In them, the centre of the spot dries up and cracks. The disease causes serious damage to the leaf and thereby makes the affected plants weak and ultimately the seed setting is affected.

The Causal Organism : Olive brown, septate mycelium was observed under dissecting microscope ramifying the affected host tissue. The mycelium produces conidiophores. The conidiophores pass out singly through the stomata on the lower surface of the leaf. They are septate, branched and uniformly thick throughout, geniculate and swollen at the tip, brownish in colour, ranging from 120—171.5 μ in length and 6.5—7 μ in breadth. The conidia are olive brown with verrucose wall (Fig. E), cylindric, 1 to 2-septate (Fig. C, D) but 3-septate conidia are not infrequent. Each conidium is with a broad-ended basal cell showing conspicuous scar and prominent constriction at the septa (Fig. C). The conidia are borne singly from the growing tip of the conidiophore, and measure 23.1—40.25 μ in length and 13.2—23 μ in breadth. The causal organism is *Heterosporium tropaeoli* Bond.

Microscopic study of the causal organism was made from scrapings and free-hand sections of the affected host tissue.

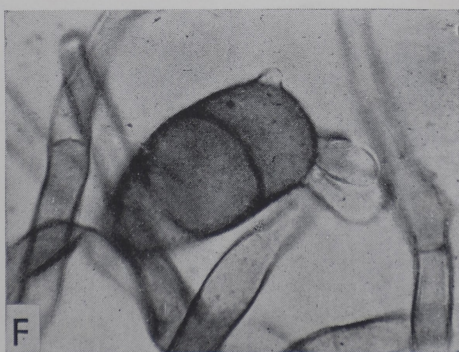
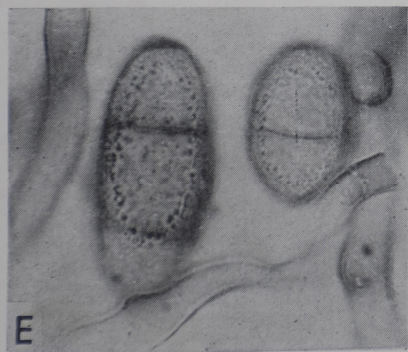
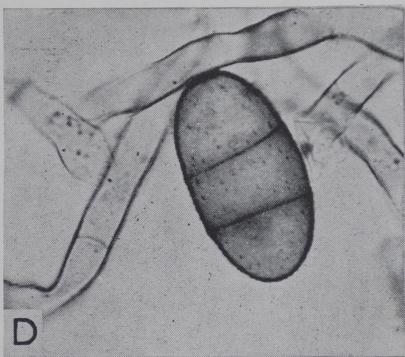
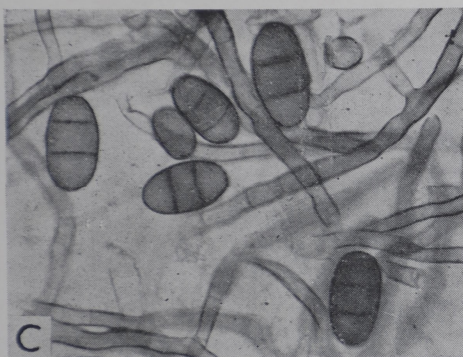
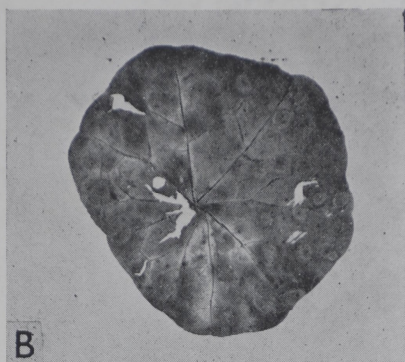


Fig. A—F. *Heterosporium tropaeoli*.

A. Spots on the upper surface of the leaf $\times \frac{1}{2}$ nat. size. B. Spots on the lower surface of the leaf $\times \frac{1}{2}$ nat. size. C. Conidia and septate mycelium $\times 378$. D. Conidium showing verrucose wall $\times 883$. E. Surface view of conidia showing verrucose wall $\times 883$. F. Germinating conidium $\times 883$.

All preparations were stained in lactophenol cotton blue and mounted in lactophenol.

Preliminary germination experiments reveal that the conidia germinate (Fig. F) under humid condition at a temperature range of 25 to 30°C.

This disease is for the first time observed in Darjeeling area at an altitude of 4500 to 6500 ft, and at an average temperature range of 20 to 30°C. in places like Kalimpong, Manibhanjan and Darjeeling.

In India, Chona and Kapoor (1956) reported the disease from Mussorie in the month of October, Bond (1947) observed this disease in Ceylon at an altitude of 4000 to 8000 ft. This disease was also reported from the United States.

From the study of literature and from the present report it appears that the disease is confined to higher elevation. So far there is no report of this disease from lower elevation.

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LEGEND

Fig. A.F. *Heterosporium trepaoli*. A. Spots on the upper surface of the leaf x $\frac{1}{2}$ nat. size. B. Spots on the lower surface of the leaf x $\frac{3}{4}$ nat. size. C. Conidia and septate mycelium x 378. D. Conidium showing verrucose wall x 883. E. Surface view of conidia showing verrucose wall x 883. F. Germinating conidium x 883.

IV. NOTES ON EGG-LAYING HABIT OF
*LISSEMYIS PUNCTATUS**

IN NATURE.

Lissemys punctatus (Bonnaterre), Family Trionychidae, (Reptilia), is found in abundance in ponds and tanks in East Bengal. This animal is very shy and timid (Smith, 1931); males are more so (Carr, 1952) and they very seldom come out of the water except in winter when they are noticed to come up to bask in the sun. But during the breeding period which ranges from August to October of the year, they shake off their shyness and come out to select compatible breeding places which include embankments of ponds and tanks or any other high place, namely roads, both sides of which are flooded during this season. In selecting the site the animal shows little sense as very open and exposed places may also be chosen without showing any preference to shady or grassy places as is done by reptiles generally (Carr. op. cit.).

The sexual behaviour of this animal is perhaps controlled by light, as in birds (Carr. op. cit.). The oviposition starts with the nightfall and finishes before the sun rises. The "mother" engages herself in making a considerably big pit expressly for the purpose of laying her eggs. Thus the animal shows some form of guardianship (Mertens, 1960). The pit is made by scraping aside the soft soil by powerful horny toes of hind feet, by moving the toes to and fro throughout the operation. The water of the bladder might have some effect in wetting the soil as that makes digging easier (Carr. op. cit.). It seems that this moistening of the excavated cavity by the bladder is not only to facilitate the mechanical

* The pond turtle. Ed.

state of the soil (Cunningham, 1923) but also to provide a moist environment for the eggs. This belief is further strengthened by the fact that the breeding hole is always chosen in the vicinity of water. One peculiarity of these breeding pits observed by the author is that the openings of the pits are usually smaller than basal portions. The average size of a pit is 7" to 8" inches deep, 4 to 5 inches in diameter at the opening and 4" to 6" inches at the base.

When the pit is well built, the "mother" sits over it keeping her face out, and lays her eggs. When egg laying is complete, the hole is sealed off. The covering operation is performed by the hind feet, which rake the soil from behind and from the sides. The 'mother' then slides over the hole with her hard plastron and thus exerts additional pressure for levelling the covering of the hole. When the pit has been filled up with a layer of soil the site is pressed and trodden with such skill that it is hardly possible to detect the presence of any pit. Snakes and crows are natural enemies of the eggs as these animals are predacious upon the eggs. And the covering of eggs with a layer of soil is a measure to protect the eggs from such unwelcome guests.

At the approach of day-light, the parent retires to her watery habitat but is frequently seen to visit the site ; and, in some cases, the parent is seen occasionally to visit the pit for long times as if for guarding the eggs. This activity continues till the eggs hatch out. The natural incubation period normally ranges from 30-40 days depending on humidity and temperature. Over-wintering of hatched eggs seems not practicable in this species. The emergence of the young from the nest is facilitated by heavy rain, which is the characteristic of this region in this season. The rain softens the roof of the nest, wears away the soil and frees the young ones. How the young ones find their watery habitat is yet to be investigated, But it seems likely that being attracted by

the intensity of the glare reflected from the surface-film of water, they migrate of their own accord and with ease (Mertens, 1960). Of course, only a small percentage of the eggs laid get an opportunity to mature because crows search out the pits and dig up the eggs, and, it is a very common scene to see emptied and broken egg-shells in the vicinity of the pits.

It is interesting to record in this connection that the number of eggs laid is always an odd number and varies from seven to eleven.

The shape of eggs is spherical like a tennis ball, they are white in colour (Cameron, 1923) measuring $1/4$ inch in diameter on an average : the shell is calcareous and brittle.

The above note is based upon the personal observation of the author as a naturalist, in more than 25 cases, at his native village, Rajapur.

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