Journal of the Bombay Natural History Society

Vol. 58, No. 2

Editors
H. SANTAPAU, S.J., & HUMAYUN ABDULALI

AUGUST 1961

Rs. 15

CONTENTS OF VOLUME 58, NO. 2

CORRIGENDA

Vol. 58, No. 1—April 1961

In the paper entitled 'The Moss Flora of the Palni Hills', the following names should have been printed in bold face capitals :

Page 29 : **TRIGONODICTYON**

Page 34 : **HOMALIOPSIS**

Page 41 : **NANOTHECIUM**

Page 42 : **FOREAUELLA**

Vide explanation on page 14 of the same *Journal*.

JOURNAL
OF THE
BOMBAY NATURAL
HISTORY SOCIETY

1961 AUGUST Vol. 58 No. 2

The White Rhino of Hluhluwe

BY

O. H. DE ST. CROIX

(With two plates)

Mention of a game reserve in the Union (now Republic) of South Africa usually turns the mind to the world-famous Kruger National Park in eastern Transvaal, with its vast area and great range of wild life. It may not be generally known that there are a number of much smaller game reserves in different parts of the Union, some of them for the protection of a particular species in its former habitat. The province of Natal has been especially forward in establishing smaller game reserves of this kind, most of which are in the Zululand area. Among these are the two White Rhinoceros reserves at Hluhluwe and Umfolosi, of which the former appears at present to be much the better organised for casual visitors.

The Zulu language, though melodious to the ear, presents some formidable problems to the foreign tongue, with its register of clicks and other pitfalls of pronunciation. At first sight the word Hluhluwe seems to be one of them. But if the two 'hl' sounds are pronounced as rough aspirates and the ending is made to rhyme with 'Hooey' the result will be understandable to the local inhabitants.

This Reserve (estimated at 57,000 acres or 89 sq. miles) lies in the northern part of Zululand about 180 miles north of Durban and is easily accessible by motor road. For a start the way lies along the new Natal north coast national road and one might be travelling through the south of India so thick is the Tamil population of the towns and villages along the first 30 miles or so of the route. Then, after passing the modern town of Stanger, once the site of Shaka

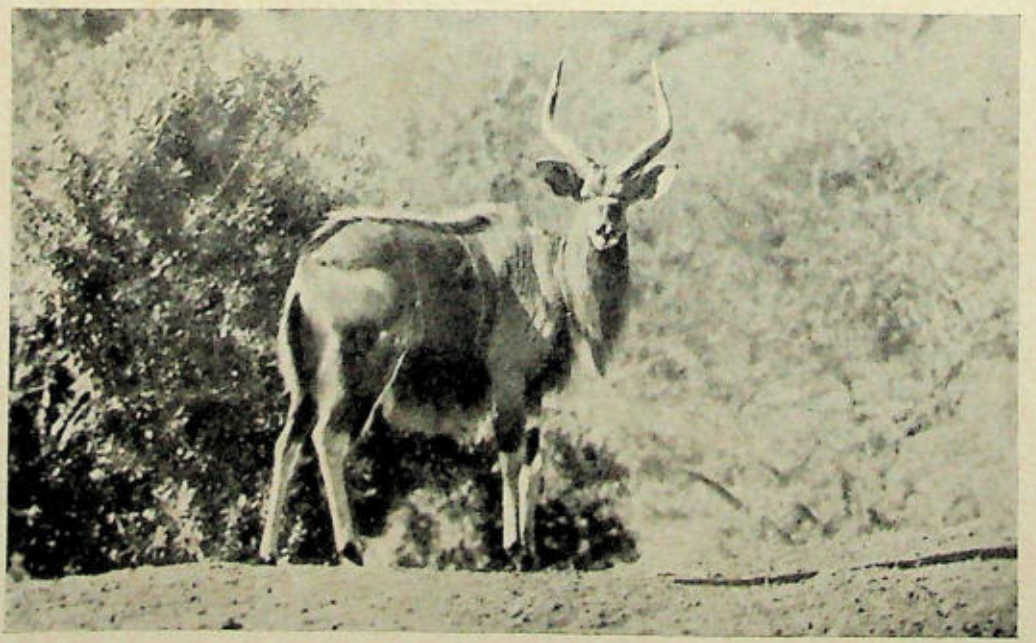
Zulu's royal kraal a fine new bridge carries the road over the historic Tugela River into what is now the heart of Zululand. There is ample evidence hereabouts that sugar is king, for on either side of the road as far as the eye can see stretches an apparently limitless sea of sugar cane. It is not grown here in small patches as in India but in mass, sometimes extending unbroken over many acres. The result is that the pastoral scenery typical of Zululand, with its gently undulating down-like hills and occasional patches of bushveld, has been transformed.

On reaching Mtubatuba some 150 miles from Durban there are signs that the modern way of life is being left behind. From here the road stretches away, metalled but not asphalted, to Swaziland and the Mozambique border. The way to the Reserve shortly takes a turning off inland and almost at once one is in a much wilder environment. It is now a landscape of steeper undulations, extensive stretches of bushveld, and occasional rocky outcrops. It is not a thickly populated region and only small bee-hive kraals are to be seen dotted about sparsely. There are not many signs of cultivation but cattle of many sorts abound and there is every appearance of overgrazing.

Soon another turning branches off and thence the way is over little more than a rough track. In a few miles this reaches the fenced and gated boundary of the Reserve. Here visitors have to check in with their reservations at the gate lodge and are also given comprehensive information and instructions covering their stay. The road then runs for several miles through the Reserve itself. At first it is past open savannah and park-like country. Presently thick bush closes in on both sides and, although a fair speed is being kept up, quite a variety of wild life is to be seen in fleeting glimpses. A troupe of baboons, a party of guinea fowl, several wart hog and Impala antelope, a solitary Nyala buck are all visible by the roadside and scarcely heeding. Then of a sudden the road starts twisting and climbing through picturesque scenery up to the ultimate destination.

The camp site is ideally located along the flat top of a narrow ridge at an altitude of about 1500 feet (460 m.) above sea-level. Coolness is thus assured at all times of the year and an absence of insect pests. There are delightful views on either side over grass-covered hills and deep wooded valleys. Thick forest lines the valley floors wherever perennial watercourses run and, where the hillsides have been sharply weather-carved, rocky cliffs and peaks protrude to vary the scene. Sometimes through binoculars wild life can be watched without even moving from the camp itself.

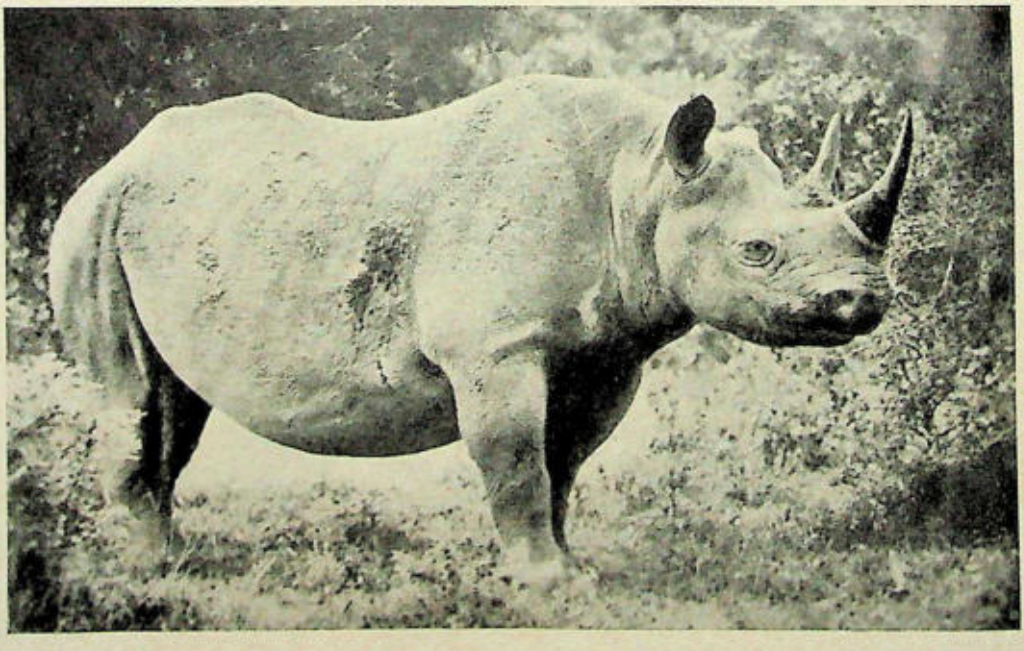
Visitors' Rest Camp at Hluhluwe Reserve



Nyala Buck in Hluhluwe Reserve

Courtesy : Natal Parks, Game & Fish Preservation Board

Square-lipped ('White') Rhinoceros



The Common, or Black Rhinoceros in Hluhluwe Reserve

Courtesy : Natal Parks, Game & Fish Preservation Board

Accommodation in the camp is of two kinds. There are cottages (not shown in the illustration) each absolutely self-contained and designed to house under one roof a party of up to six people if necessary, but four more comfortably. The suite consists of 2 large bedrooms, a sitting room, a dining room, a bath-room and a fully-equipped kitchen with store-room. The rondavels (which are as shown in the illustration) are bed-sitting rooms for two with washing and eating facilities centralised externally. In either case the accommodation is fully and comfortably equipped and spotlessly clean. Literally, all the visitor has to bring are his food and drinks, except drinking water. All one has to do on arrival is to hand over one's supplies to the well-trained Zulu staff and the rest, with very little supervision, can be left to them. The camp has its own electric supply with current cut off between the hours of 10 p.m. and 5 a.m., running hot and cold water, with flush sanitation, and a limited petrol supply; telephone and telegraph facilities are also available. For all this the inclusive cost of occupation (excluding food and drink) should average between 15 shillings and 25 shillings per head per day only, according to the type of accommodation used.

Other items of administrative interest are: no dogs are allowed, bookings may not be made for more than 5 nights or more than 3 months in advance, there is a vehicular speed limit throughout of 25 miles (40 km.) per hour, and visitors are strictly confined to camp between sunset and sunrise, no one may camp out or sleep in a vehicle within the Reserve, no one may tour the Reserve without an authorised Game Guard or get out of a car while touring unless accompanied by him. It does not need much imagination to appreciate that these regulations are framed for very good reasons in the best interests of the visitors themselves.

Our arrival coincided conveniently with tea-time and, once the essentials of registering at the camp office, unloading gear, and onloading some tea are complete, we are ready to make the most of an evening excursion. A Zulu guide is allotted to us without delay, a strapping young man in smart khaki uniform and obviously capable of dealing effectively with even the most tiresome visitor. His knowledge of English is limited but one of the party is fortunately fluent (though clickless) in the Zulu language which adds very greatly to the interest of everything. These Zulu guides are also guards vested with certain powers, the tangible evidence of which is a pair of handcuffs fixed to their belts. They seem to be men carefully picked, not only for their physique and intelligence, but also

for their knowledge of and interest in wild life. They are certainly an impressive body of men who would be a credit to any organisation.

So, fully imbued with confidence in our guide now installed in the car, we set off not long after arrival down-hill in the opposite direction to that from which we came. It is the dry season and dusty, but the grass is short, visibility good, and the animals concentrated where there is good grazing. Almost at once we are in sight of Wildebeest (Gnu), Zebra, and Impala, the last named in some numbers. Presently, as the road descends into thicker bush, we begin to see Nyala in ones and twos but quite frequently. This is a species which is not so well known as most, being shy and a lover of dense cover. But it is quite a speciality in this Reserve, where it can be seen at very close quarters and to good advantage. It is not very spectacular as antelope go, yet the illustration will show that it has a distinctive beauty, a good deal of which is unfortunately lost without the colouring. The adult buck is a deep chocolate-brown with irregular, cream-coloured, vertical stripes, and quite modest horns with a single backward-sweeping twist. The doe and the young are a vivid chestnut and always seem to be in the sleekest of condition.

The next animal to come on view is a patriarch among male baboons sitting with a bored, proprietary air on a rocky eminence quite close to the road. But he is allowing no familiarities, for as soon as the car stops he turns his back rudely and ambles away. He utters a grunting signal call to his troupe as he goes and the swaying of trees all over the hillside shows that they are taking rapid but unseen evasive action. A little further on the guide suddenly jerks to the alert and says the word for which we have all been waiting—'Rhino'. But even with 2 pairs of binoculars trained on where he is pointing there appears to be nothing but the usual termite heaps and rocks protruding from the bushveld. Then one of them shifts and turns and the identification is obvious. It is a tribute to the guide's keenness of sight that he could pick out an object like this from a moving car about a quarter of a mile away. A quick appraisal of the situation now shows that we are up-wind, too far away and also that the light is wrong for photographs. So the car is turned and a long detour made to another road, which brings us down-wind and much closer to the objective.

We are now about 150 yards (140 m.) only from the nearest rhino and are able to see with some disappointment that it is one of the nearly related and much commoner 'Black' species. But the disappointment is partly offset by the prospect of possible excitement.

For the guide at once makes it clear that no liberties whatever are to be taken. We are allowed to get out of the car but only to move a few paces from it. The doors are all left wide open and the engine running, so that a very quick get-away can be made if necessary. As soon as the binoculars are focussed the reason for these precautions as also for most of the rules governing all conduct in the Reserve become obvious. The 'Black' Rhino is a most vicious and aggressive-looking animal. Though very heavily built his quarters give an impression of ponderous agility concealing a deceptive speed of movement, like an outsize all-in wrestler and just as ugly. His head is held high, tapered and fully armoured, the business-end of a powerful, self-activated battering ram. This one, the bull of the party, is evidently feeling his responsibilities and prepared to take on anything. He has detected the presence of humans but is unable to locate them precisely, which is exactly what our guide had planned. He shifts about, testing the air and snorting unpleasantly. We watch him closely through binoculars while photographs are taken, to the reassuring accompaniment of the car engine ticking over healthily. He is joined by a female of the species which appears to have a soothing effect; a third animal remains rummaging in the bush. But this interesting encounter has to be cut short since the position of the sun indicates a move homeward, somewhat to the guide's relief. He is under no delusion as to the Black Rhino's real character. The way back to camp is now by a wide circuit, touching the boundary of the Reserve, which has to be covered at fair speed. Yet there is something of wild life to see almost continuously. Unfortunately birds are not very plentiful in such dry weather. Guinea fowl are the most conspicuous and there are several glimpses of a small bustard, whose shyness makes exact identification impossible. A stop cannot be resisted when a herd of Buffalo is sighted, though some way off, grazing slowly along a steep, grassy slope. Except for the adult bulls they are not nearly such impressive animals as their Indian counterparts. Time has by now almost run out and the study of them has to be abandoned. As it is, the camp gate is reached only just before sunset.

When leaving us for the night our guide made it firmly but politely clear that a very early start was called for the following morning. So the whole party is up with the sun and witnesses a smart parade of the entire staff of Camp Guides. As soon as they are dismissed we are rejoined by our man and are soon on our way to a part of the Reserve not yet visited. At this early hour wild life is afoot in abundance. At first it is wart hog which steal the show, since they

are the quite unwitting comedians of the bushveld. Almost invariably they greet the visitor with a prolonged and searching stare. With snout held high and the formidable array of tusk well to the fore, there is a distinct resemblance to a senior army officer flaunting his traditional bristling, white moustache in highly truculent mood. The scrutiny complete, there is an abrupt about turn and the hog makes off at a smart trot, his whip-like tufted tail held rigidly vertical as an eloquent sign of extreme disapproval. His plump little hind-quarters seem to work overtime in keeping up with his more shapely forelegs and look like those of a squat scrum-half whose shorts are too tight for him.

Impala are on view in large numbers all along the road. A small herd composed entirely of bucks all with fully-developed horns shows what beautifully graceful creatures these antelopes in the adult male stage really can be. Elsewhere some does with fawns give an exhibition, for no apparent reason, of their well-known running-jumping act. In succession they literally soar through the air with a series of immense, leaping bounds as though impelled by hidden springs in their feet. If there were to be an animal Olympiad an Impala would surely be the hop-step-and-jump gold medallist. Further on a large herd of Wildebeest puts on for our benefit a sort of mass manoeuvre like a squadron of riderless cavalry on parade. They wheel and counter-march raggedly and then finish facing the car in a bunched, irregular line-abreast pawing the ground and snorting as though expecting applause.

Two new species now appear. A family of Waterbuck are seen standing close together in the open, frozen to inconspicuousness. Stocky and well built with heavy neutral-coloured coats, the buck has thick, corrugated, lyre-shaped horns and they all give an impression of extreme physical fitness and a capacity for endurance. Then there is a passing glimpse of two doe Kudu, rather unshapely and inelegant, with dowdy colouring and nervous, spinsterly temperament. They lack distinction but raise our hopes high of seeing a buck of the species, which certainly must share with the Sable (apparently not represented in this Reserve) a claim to being the most imposing and handsome of all the antelopes.

At a point where the road runs along the crest of a bare ridge commanding a good view the car is stopped, and the whole party deploys to bring binoculars into play. A long way off there is a herd of buffalo, aloof and grazing busily. But they are too far away to be watched with any interest. Somewhat nearer, on a steep open hill-side is a large object like an animated, earth-coloured tank-lorry,

shambling around evidently in urgent search of fodder which is not so plentiful in this very dry season. The guide confirms that it is a 'White' Rhino but it is too far off to approach closer on foot and judging by its restless movements it has no intention of staying put for very long. So we have to be content with this very distant view until in a few minutes the Rhino disappears in its strenuous search for an adequate meal to start the day.

We now turn homewards on a circuitous route but there is still one more interesting encounter to come. From the top of a tallish thorn tree protrudes a row of shapely heads and at first sight it looks as though some of the larger antelope population have been indulging in climbing exercises. But closer inspection reveals that we have met the Reserve's one family of Giraffes. We advance to meet them on foot and, since they do not move, stand staring at them at a few yards' range with the thorn tree in between. The Giraffes, a female with partly grown young, remain motionless and return the stare with gentle, melting eyes, looking down on us with a pitying expression on their faces. Soon tiring of this mutual admiration society, we retrace our steps leaving the Giraffes still in the same position as when we first saw them. On the way we meet the bull of the herd, a huge handsomely-marked animal, by now quite a well-known character in this Reserve. He appears overjoyed at seeing us and follows like a dog back to the car. Even when we get in and slam the doors he still stands close by as if expecting something. He is now so close as to be within touching distance and we see every detail of his markings, including large numbers of ticks clustered on his underside. But the limit is reached when, overcome by curiosity or impatience, he tries to push his enormous head in at one of the windows. We start off abruptly back to the camp for, however friendly his intentions, a Giraffe of this size might be quite capable of overturning the car.

Since we have still not had a proper view of the real object of our visit, our guide insists that there will be no siesta. As this is our last afternoon we are obliged to admit the force of his contention. So at about 2 p.m. we set off again. It is the hottest time of a not very hot day and, unlike us, most of the animals are by now enjoying their siesta. But whereas the majority of them find full concealment in so doing, the 'White' Rhino, as our guide well knows, has long since given up trying to hide his enormous bulk merely for the observance of a daily routine. Thus for one who knows where to look it must be the easiest time of day to locate this animal and

by the way our guide is looking out of the window he is obviously confident of success. Sure enough before long he makes an urgent signal to stop and leaps out while the car is still moving. We look in the direction he is pointing and there, about half a mile (800 m.) away under an acacia tree, lies a mountainous grey shape, so large as to make the tree look like a lady's parasol. Binoculars identify it at once as an enormous 'White' Rhino, lying fast asleep with his legs tucked under him and his snout resting on the ground as if tired of supporting the large, scimitar-like nose-horn. The guide explains that we are now to make a tactical approach on foot to within range for close-up photography, and off we go at a cracking pace. A Zulu's idea of a cross-country walk is austere to say the least. It takes no account of thorn bushes, rocks, dry water-courses, steep banks, and the like; nor does it make any allowance for the softness engendered by 'civilised' life. We follow as best we can and are soon past caring. Then of a sudden, before we are fully prepared for it, we find ourselves with nothing but about 40 yards of bare veld between us and the still slumbering Rhino. The guide obviously scornful of our sweating and breathless condition, whispers that the time for photography will be strictly limited. We try to steady ourselves by looking through binoculars and are fascinated by what we see at such close quarters. But the Rhino is not alone, for clambering about his body are two ox-peckers, drab-coloured birds of the starling family, with blood-red beaks and about the size of a myna. Their function is to relieve their host of ticks and other parasites and this they are now doing with tireless energy, not omitting the most intimate and impertinent inspections. By way of reciprocation they appoint themselves as watchmen and presently these two give the alarm. The Rhino springs to its feet with surprising agility and at once stands facing us, apparently having been warned of our exact position.

The first impression is of a creature of gigantic size, like a sizeable elephant on short legs. It is now evident that this is a fully adult male and one is told that these stand nearly 6 feet at the shoulder and can weigh up to 5 tons. Yet its whole bearing and attitude reflect a humble docility which dispels any feeling of fear at the proximity of so huge a wild animal.

It may here be explained that the designation 'White' as applied to this species is really a misnomer and that it should more properly be called the 'Square-lipped' Rhino from a physical attribute which the illustration does not show clearly (the illustration incidentally

is of a much smaller specimen than that described). For whereas the other species is a browser and, as we saw yesterday, stands with his head held aggressively high, the Square-lipped Rhino is so equipped for grazing, and stands ponderously with its head held low like a corpulent old man bowed at the shoulders.

There is something enthralling about standing within a stone's throw of one of the world's rarest and largest land animals. It does not take long to realise why this one so nearly suffered extinction. For despite its great size and potential strength it is ill-fitted either physically or by temperament to protect itself against man's incessant persecution. Its equipment requires a sheltered, inoffensive life in an environment governed solely by Nature's own checks and balances.

The Rhino returns our inquisitive stare with timid, puzzled eyes and turns from side to side as if uncertain what to do next. A cloud of flies and other insects rises from its body at each movement and hangs around it like a haze. Then, satisfied as to our harmlessness and evidently convinced that it is not worth while resuming the interrupted siesta, it ambles slowly away on an erratic course across the veld grazing at random as it goes. We watch it out of sight with mixed feelings, composed of sympathy for such a mountain of helplessness and of satisfaction that something substantial has been saved from the welter of 20th century destruction.

As a finale we are taken to a place where the track ends on the bare summit of a hill, whence a fine view is to be had. From here there is a panorama covering a large area of the Reserve and comprising almost every type of scenery to be found in the South African bushveld. With a few sweeps of the binoculars our now practised eyes can pick out most of the species which have been encountered at closer quarters. Zebra are present in numbers but it is surprising how such a dazzle-coated creature can make itself so inconspicuous in broad daylight merely by standing still in the shadow of a tree. On a grassy slope below us stands a solitary Secretary Bird, easily identified by his slate-grey plumage and lanky build, a characteristic but increasingly rare sight in this type of country. He is an eagle on stilts, the arrangement of whose head feathers gives him his name and makes him look like a lean and spindly individual who has not brushed his hair. As we watch he struts about with a rolling, nautical gait searching the ground for food in a most uneagle-like way. In some scrub jungle just beyond a rhino is moving around, but it is impossible to determine the species with only a rear view of its broad back. Overhead a pair of Bateleur Eagles soar

and wheel in widening circles. While so doing they display their curious propensity for side-slipping instability in flight as though indulging in a form of controlled aerobatics. Can this be due to their having been equipped by nature with most unusually short tails?

Then an excited comment from one of the party draws all binoculars to the point on which he is focussed. The glint of sun on a moving horn betrays the presence of a large animal. Can it be the one species we have so far missed seeing? A pair of binoculars is handed to the guide and without hesitation he confirms that it is what we hoped for. At last we have located a Kudu buck and a very fine one too. At first he is half concealed by the bush on which he is browsing. But soon, as if to oblige, he steps out into the open and stands in the full afternoon sunlight, showing to perfection what a superbly magnificent creature a male Kudu is in its prime. He is as large as a medium-sized pony and beautifully proportioned, with long, massive spiral horns flowing straight up from his head in perfect symmetry. The guide says there is a second buck present, having somehow spotted it with his naked eye. He points disdainfully to help out our fumbling efforts with the binoculars; at last we pick him out standing still in shadow, a marvel of protective coloration. He is every bit as fine a specimen as his companion, and it seems absurd that we could so easily have missed such a large animal in the open. But even in daylight the mouse-dun coat broken up with pale, irregular, vertical stripes provides a perfect camouflage when motionless. Now for several minutes we are able to enjoy an uninterrupted view, in a setting that could hardly be bettered, of a species which is certainly one of Nature's masterpieces. Then of a sudden they both appear to sense that they are under human observation and fade quietly into the bush.

We return to our base for the last time, reluctantly but with a feeling of deep satisfaction at having seen all we set out to see under such delightful conditions. There is a distinct atmosphere of depression the next morning at having to go back so soon to the 'civilised' way of life.

What lessons does the example of the Hluhluwe Reserve hold for the Indian conservationist? Local conditions and the type of wild life to be preserved do, of course, differ widely. But certain broad conclusions can undoubtedly be drawn.

Here in the first place is evidence that to be successful a Reserve need not necessarily be of enormous size, even if located in a settled agricultural region. For given good grazing with adequate perennial

water supply, both properly husbanded and conserved, and provided species suitable for the environment are selected for preservation, it is evidently possible to contain a large stock within a limited area without undue straying. In this context Hluhluwe maintains a very considerable stock of grazing and browsing animals without, so one is told, any predators. It would clearly be inadvisable to introduce lions in so restricted an area, but there appears no reason why leopard or cheetah could not be allowed. In the circumstances one wonders how the necessary checks are provided so as to prevent the usual consequences of overpopulation, which in the case of some species already appears to be in sight. Possibly judicious control is exercised by the wardens themselves or some of the lesser predators may in fact be present unseen in small numbers. It is an interesting question on which the writer unfortunately was unable to obtain any authoritative information.

Then again conditions at Hluhluwe give a satisfactory answer to the charge commonly made, and unhappily too often substantiated, that a game reserve merely creates a poacher's paradise. This will only be so if there is an inadequate staff or a staff insufficiently trained and of the wrong calibre or not vested with powers appropriate to the efficient discharge of their duties. The confiding behaviour of most of the animals in this Reserve bears eloquent enough witness to the very thorough control over human molestation which the staff is able to maintain.

Finally, and by no means least important, there is the practical demonstration that a well-stocked and intelligently-administered game reserve, backed by a soundly organised and comfortably (but not luxuriously) equipped rest camp can be an attraction to visitors from overseas in large numbers. 20,000 people visited the park in 1960, and it can hardly be denied that this represents a significant national asset.

Critical Notes on the Orchidaceae of Bombay State

VI. *NERVILIA* GAUD. & *MALAXIS* SW.

BY

H. SANTAPAU, S.J., F.N.I. AND Z. KAPADIA, PH.D.

(With three plates)

[*Continued from Vol.* 58 (1) : 67]

NERVILIA Comm. ex Gaud.

NERVILIA Comm. ex Gaud. Bot. Voy. Freycinet 421, 1826, nom. cons. ; Pfitz. in Engl. & Prantl, Pflanzenf. 2 (6) : 106, 1888 ; Schltr. Orchid. 101, 1927 ; Sprague & Fischer in Kew Bull. 1927 : 363 ; Holttum, Rev. Fl. Malaya 1 : 104, 1953. *Pogonia* Endl. Gen. Pl. 218, 1837, p. p. ; King & Pantl. in Ann. R. Bot. Gard. Calcutta 8 : 265, 1898, p.p. ; J. J. Smith, Fl. Buitenz. 6 : 53, 1905 ; Duthie in Ann. R. Bot. Gard. Calcutta 9 (2) : 157, 1906 (non Juss. 1769). *Pogonia* sect. *Nervilia* Benth. & Hook. f. Gen. Pl. 3 : 615, 1883 ; Hook. f. Fl. Br. India 6 : 118, 1890.

The name *Nervilia* is derived from the prominent veins in the leaves of several species.

Perennial, tuberous *herbs*, mostly coming into leaf after flowering. *Tubers* globose, usually with small warty root-knobs, generally dirty-white in colour. *Leaf* one, petiolate, broadly cordate or orbicular, plicate, glabrous or variously pubescent. *Inflorescence* erect, bearing 1, 2 or several flowers in racemes. *Flowers* erect, horizontal, nodding or drooping. *Sepals* and *petals* subequal, spreading, rather long and narrow. *Lip* inferior, adnate to the base of the column, sessile or subclawed, entire, or 3-lobed, often slightly saccate at the base, embracing the column in the basal region. *Column* elongate, straight or slightly curved, footless, broadening upwards to contain the stigmatic surface and the anther. *Anther* sub-stipitate, almost horizontal ; pollinia 2 bifid, or 4, granular, yellow, without caudicles or glands. *Stigmatic surface* oblong, or somewhat quadrate, broad.

Species about 40 to 50, distributed from Africa to India and China, and through Malaysia to Australia.

The Bombay species have been put under *Pogonia* Juss. by Cooke (in FL. PRES. BOMB. 2 : 706, 1907) ; in this he follows Hooker f. and Bentham & Hooker f.'s treatment of this genus, though the latter authors distinguish *Nervilia* Gaud. as a section of *Pogonia* Juss. We consider *Nervilia* Gaud. a distinct genus, differing primarily from *Pogonia* Juss. by the production of their flowers before the leaves, and by having a separate stem which bears no leaves but may have scales or scaly sheaths.

The generic name *Aplostellis* attributed in *Ind. Kew.* to Thouars, *Orch. Iles Austr. Afr.* t. 24, 1822, has been adopted by Ridley (FL. MALAY PENINS. 4 : 203, 1924) in place of *Nervilia* Gaud. (1826) on the ground of priority of publication. Sprague and Fischer have shown that *Aplostellis* Thouars is ' . . . not a generic name but the name of a species. A critical examination of Thouars's preliminary paper "Sur l'histoire des plantes orchidées des îles australes d'Afrique" (Nouv. Bull. Soc. Philom. Paris 1 : 314-319, 1809) and of his "Orch. Iles Austr. Afr." (1822) shows that he attempted to introduce two innovations into the nomenclature of Mascarene Orchids : (1) that all generic names of *Orchidaceae* should end in *orkis* (orchis) ; and (2) that each Mascarene species of that family should be known by a single name instead of a binary combination. These innovations were not accepted by other botanists and when Thouars published his plates of *Mascarene Orchidaceae* in 1822 he employed a double system of nomenclature in the tables and plates, the names of these genera and species according to his own peculiar method being followed by corresponding names in accordance with the established system. Thus *Aplostellis* Thou. was the uninomial name of a new species from Mauritius, which he placed under the new genus *Stellorkis* (*Stellorchis*) ; he appended the new binary combination *Arethusa simplex* for those who preferred to follow the generally accepted methods of nomenclature. The mode of formation of the uninomial names of the species was explained in Thouars's preliminary paper. The first half was an abbreviation or Greek translation of the trivial name ; and the second half was composed of the first part of the generic name with the suffix *-is*. Thus *Aplostellis* is a portmanteau word composed of *Aplo-*, the Greek equivalent of *simplex*, and *stellis* a contraction of *Stellorkis*.

' *Aplostellis* as a generic name was proposed by A. Richard in 1828, but this is antedated by *Stellorkis* Thou. (1809) and *Nervilia* Comm. ex Gaud. (1826) '. The name *Nervilia* Comm. ex Gaud. has been conserved for the genus.

The following is the synonymy of *Nervilia* (*Aplostellis*) as given by Sprague and Fischer (loc. cit.) :

Nervilia Commerson ex Gaud. in Bot. Voy. Freycinet 421, t. 35, 1826, *nomen conservandum*. *Stellorkis* Thou. in Nouv. Bull. Soc.

Philom. Paris 1 : 317, 1809. *Stellorchis* Thou. Orch. Iles Austr. Afr., Tabl. Genres, 8, t. 24, 1822. *Cordyla* Blume, Bijdr. 416, 1825 (non Lour. 1790). *Aplostellis* A. Rich. in Mem. Soc. Hist. Nat. Par. 4 : 36, 1828. *Roprostemon* Blume, Fl. Jav. vi, 1828, sub nomine *Cordyla*. *Haplostellis* Endl. Gen. Pl. 219, n. 1603, 1837. *Rephostemon* Endl. loc. cit. 216, n. 1578, 1837. *Haplostellis* Reichb. Nomencl. 1 : 56, 1841.

Most species of *Nervilia* are found in a definite ecological habitat. In open fields they are often found under the shade of hedges of cultivated fields. Very often one or more rows of the orchid in leaf or in flower may run parallel to the hedge. In forests these species are found growing in spots with plenty of rotting leaves. The tuber produces an inflorescence ; one leaf per plant appears after the wilting of flowers ; each plant gives usually 2 slender horizontal, underground stolons, which produce new tubers at their end. The latter at first produce leaves, but in subsequent years flowers are first produced, then leaves. Thus vegetative propagation is quite prolific in this genus. We have observed that flowering in *Nervilia* strictly coincides with the very first showers of the monsoon ; in N. Kanara, where the monsoon sets in early, often by the last week of May, flowering is practically over by the first week of June ; in Salsette Island the monsoon generally does not begin till about the middle of June, and the flowers of these plants usually come about the third week of June.

Type species : *N. aragoana* Gaud.

KEY TO THE SPECIES OF *NERVILIA* OF BOMBAY

BASED ON LEAF CHARACTERS

1. Petioles 2-5 cm. long ; leaf-blade lying more or less flat on the ground :
   2. Leaf-blade glabrous, green with 5-7 broad chocolate-coloured bands along the nerves .. .. *infundibulifolia*
   2. Leaf-blade pubescent, green or purple :
      3. Leaf-blade pure green, with pale green or somewhat white hairs :
         4. Leaf-blade 2-12 cm. in diam., orbicular-cordate, subreniform, subplicate, hairy on the upper surface, glabrous or glabrescent below .. *monantha*
         4. Leaf-blade 4-16 cm. in diam., ovate-cordate, acute or subacute, plicate, hairy on both surfaces .. .. *discolor*

3. Leaf-blade deep purple or green-purple to rusty-brown with stiff pale or deep purple hairs in regular rows on both the surfaces .. .. *discolor*

1. Petioles 8-20 cm. long ; leaf-blade not lying flat on the ground .. .. *juliana*
aragoana
carinata

BASED ON FLOWERS

1. Scape 1-flowered :
2. Sepals and petals 13-15 mm. long ; lip 3-lobed; midlobe glabrous, entire, obovate or obovate-oblong, rounded, midnerve prominent and callus-like *infundibulifolia*
2. Sepals and petals 17-25 mm. long ; lip scarcely lobed ; midlobe or its apical portion much wrinkled. subfimbriate, somewhat 3-4-lobulate, hairy on the nerves .. .. *monantha*
2. Sepals and petals 25-35 mm. long ; lip 3-lobed ; midlobe rhomboid or rhomboid-ovate to rhomboid-lanceolate, acute or subacuminate, hairy within .. .. *juliana*

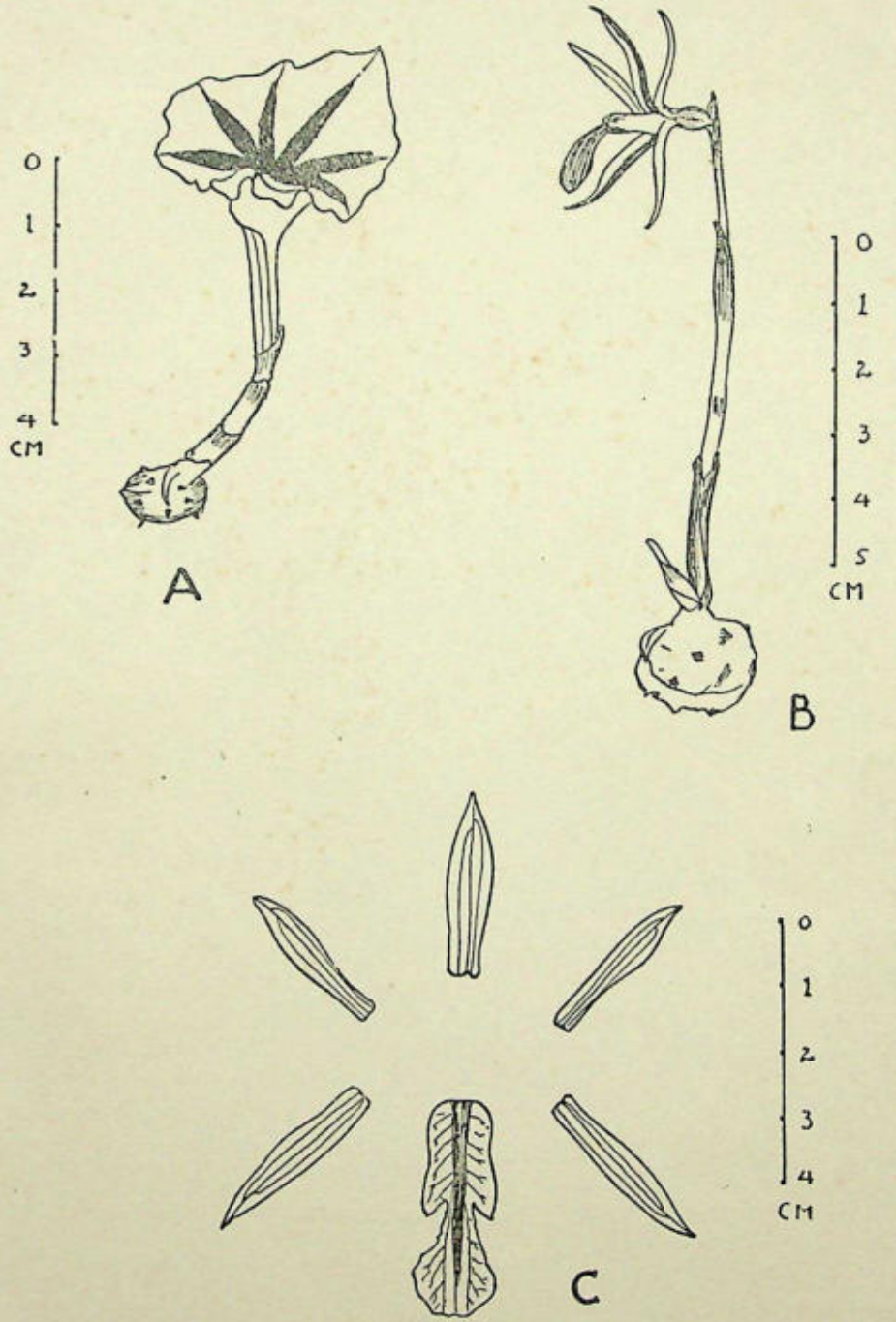
1. Scape 2-flowered ; flowers at right angles to the scape ; lip scarcely lobed, the apex somewhat retuse .. .. *discolor*

1. Scape several- to many-flowered ; flowers drooping ; lip 3-lobed :
2. Floral bracts deflexed ; lip slightly saccate at the base ; midlobe not constricted at the base, ovate or ovate-oblong, rarely suborbicular, rounded with incurved, erect edges ; column rounded on the dorsal side, flat in front .. .. *aragoana*
2. Floral bracts erect ; lip not saccate at the base ; midlobe somewhat constricted at the base, straight, ovate or rhomboid-ovate, tapered to an acute or subacuminate apex ; column with a strong keel on the dorsal side, making it 3-angled .. .. *carinata*

ENUMERATION OF THE SPECIES OF *NERVILIA* OF BOMBAY STATE

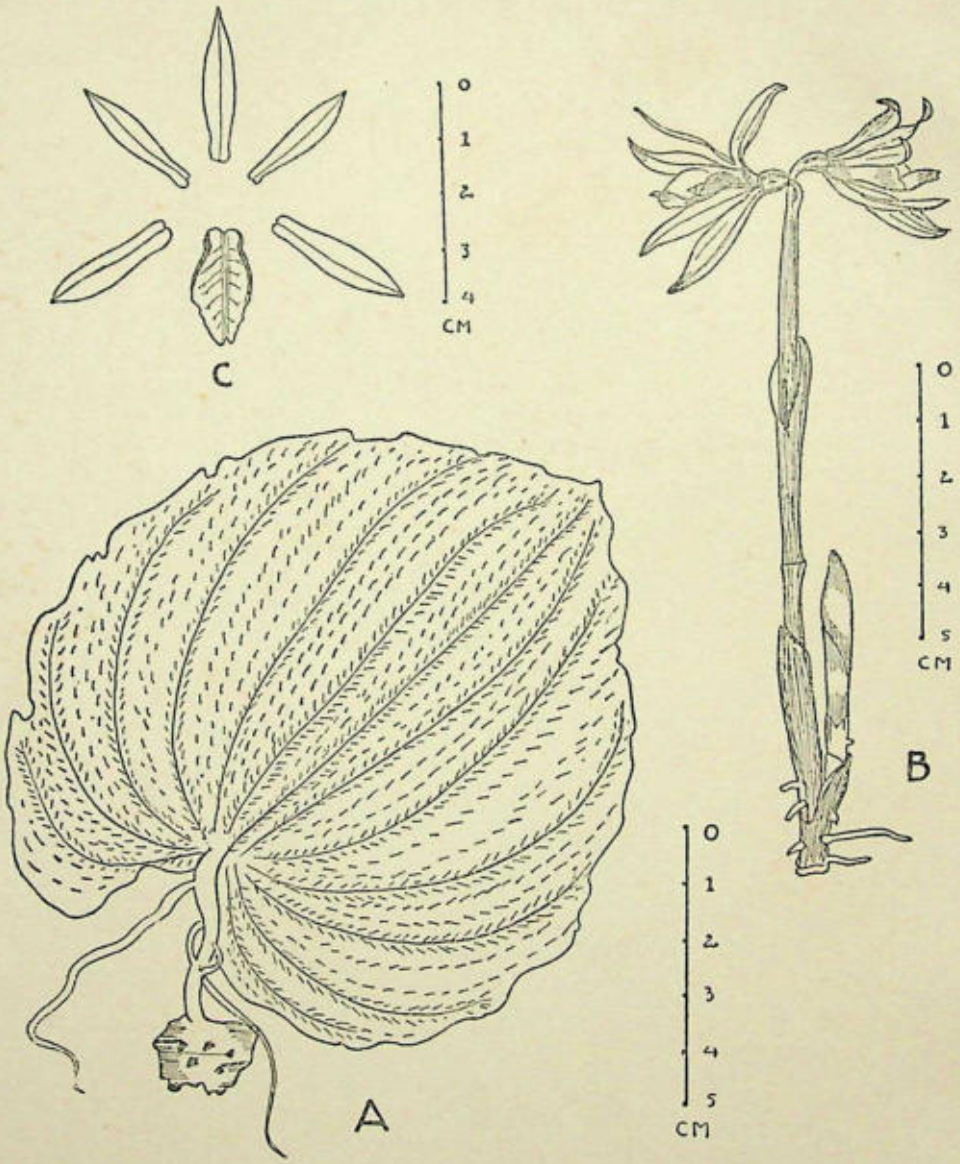
1. **Nervilia infundibulifolia** Blatt. & McC. in Journ. Bombay nat. Hist. Soc. 35 : 725, t. 3, 1932 ; Santapau in Rec. Bot. Surv. Ind. 16 (1) : 304, 1953. *N. hallbergii* Blatt. & McC. ibid. 726, 1932 ; Santapau 304. (See Plate XXXI).

Tubers 6-12 mm. in diam., subspherical, slightly flattened above and below, sparsely covered with small root-knobs. *Leaf* flat on the ground or slightly above the surface ; sheaths about 1-2 cm. long, light brown, translucent, oblong, acute to subacuminate, entire, purple-nerved ; petioles 2-4 cm. long, dark-brown purple above, turning lighter below, terete, grooved, ridged, opening into a slightly enlarged funnel-shaped mouth at the base of the lamina ; lamina 2-3 × 3-4 cm. glabrous, broadly ovate, cordate to suborbicular, subacute, obtuse or slightly retuse at the apex ; margins brown-maroon, crimped, irregularly and minutely dentate-crenulate ; nerves 5-7, rarely 9 pairs, the last pair generally thin ; upper surface dark grass-green with broad chocolate-coloured bands along the nerves, broadening in the middle but not reaching the margin ; lower surface light green with prominent dark-brown nerves, corresponding to the depressed ones above. *Inflorescence* one-flowered ; scape 6-15 cm. (often reaching 27 cm. in fruit) tall, terete, pale maroon, of 2 internodes ; sheaths linear-oblong, obtuse, entire, 5-nerved ; the upper sheath about 3-3.5 cm. long, wide-mouthed, the lower much shorter, closely appressed. *Flower* at about right angles to the scape or nodding, greenish purple. *Bract* 3-7 × 2-3 mm., subconcave, ovate, or ovate-oblong, acute, entire, 3-nerved, maroon, the nerves deeper in colour. *Pedicel* 1-1.5 mm. long, curved, pale purple. *Sepals* and *petals* similar, slightly concave, light maroon-green with maroon veins, linear-lanceolate, broader in the middle, acute, entire, glabrous. *Sepals* 13-15 × 3-4 mm., 3-nerved. *Petals* 12-14 × 2-2.5 mm., sparsely or not at all gland-dotted, 3-nerved, the midnerve more prominent. *Lip* 16-17 × 5-6 mm., saccate at the base, gland-dotted, 3-lobed ; lateral lobes 8 × 2 mm., pale apple green, acute or subobtuse, entire, more or less embracing the column to form a tube, the latter about 3 mm. broad at the mouth, narrower behind ; midlobe 9-10 × 6-7 mm., broadly obovate to even suborbicular, rounded (rarely subretuse) at the apex, the margin somewhat wavy, deflexed on the sides, minutely denticulate ; the midlobe white or pink suffused irregularly all over with more or less deep patches of rose-maroon, the midnerve callus-like, white. *Column* 8 mm. long, 2 mm. broad at the top, 1 mm. below, straight, flat in front, rounded behind, pale apple green with at times faint red-maroon narrow longitudinal streaks. *Anther* 3 × 2 mm. white or faintly tinged with purple-maroon in front ; pollinia 2, in the shape of a broad exclamation mark. *Stigmatic surface* large, longer



Nervilia infundibulifolia Blatt. & McC.

A. Plant in leaf; B. Plant in flower; C. Sepals and petals dissected.



Nervilia discolor Schltr.

A. Plant in leaf; B. Plant in flower; C. Sepals and petals dissected.

than broad, occupying the whole of the enlarged top portion of the column. *Ovary* 4-5 × 3 mm., maroon, 6-keeled with alternate low and high ridges. *Capsules* 18 × 6 mm., elliptic, maroon.

Flowering : May to June. *Leaves* : July to November.

Occurrence in Bombay State : W. GHATS : Khandala, *Blatter* 35235 ; *Cooke* ; *Santapau* 634, 643, 824, 2036-2037, 2060, 4510, 4515, 6812, 9140, 18843 ; *Kapadia* 520, 582, 1228-1230 ; Lonavla, *Kapadia*. N. KANARA : Yellapur, *Santapau* 18709 ; *Sedgwick* 6066 *A*.

Distribution : Konkan, W. Ghats, N. Kanara.

Notes : Blatter & McCann described this species but did not cite any specimens actually examined by them. In the circumstances a *neotype* must be selected for the taxon [Art. 7 (3), *Int. Code Bot. Nomencl.* edit. 1956]. There are two old specimens in Blatter Herbarium ; one is *Blatter* 35235 (from Khandala), the other is a flowering plant, *Sedgwick* 6066 *A* (from Yellapur). These might possibly be counted among the original collections, but were not cited as such by the authors. We select, then, *Sedgwick* 6066 *A* as the *neotype* for *Nervilia infundibulifolia* Blatt. & McC.

As Santapau has pointed out, there is no distinctive feature which can separate *N. hallbergii* Blatt. & McC. from *N. infundibulifolia* Blatt. & McC. After a very careful study of the descriptions of the two species, we have come to the conclusion that they are identical. Since the latter species is much more fully described and also figured, we adopt *infundibulifolia* Blatt. & McC. as the epithet for this species, in accordance with Art. 57 of the Code.

This species is usually found under dense shade, in loose, moist soil.

2. **Nervilia monantha** Blatt. & McC. in Journ. Bombay nat. Hist. Soc. 35 : 724, 1932.

Tubers 12-22 mm. in diam., subglobose with several root-knobs. *Leaf* broadly funnel-shaped on opening, later spreading on the ground, appearing after the flowers ; petiole 2-4 cm. long ; lamina 2-12 cm. in diam., orbicular-cordate or subreniform, uniformly green, subplicate and velvety with short, glandular, greenish-white hairs on the upper surface, glabrous below ; the hairiness is more prominent when the leaf is freshly expanded. *Scape* 5-10 cm. long in flower, up to 25 cm. in fruit, 1-flowered, pale pink with 2-3 acute or subacuminate pale-pink, wide-mouthed sheaths. *Flowers* erect on opening, becoming suberect, then at maturity nodding and deflexed. *Bracts* small, triangular, acute, about 2 mm. long. *Sepals* and *petals* similar, greenish white, often rose tinted, linear-oblanceolate, broader above the middle, tapering to the base, entire, acute ; midnerve subcarinate below, with 1-2 pairs of faint lateral nerves. *Sepals* 17-22 × 3-5 mm., sub-concave. *Petals* slightly shorter and narrower. *Lip* 18-20 mm. long, scarcely saccate, more or

less tubular, obscurely 3-lobed ; lateral lobes connivent around the column, narrow-oblong, entire; midlobe 3-4-lobulate, lateral lobules entire or subentire, slightly divergent, the middle one obscurely 2-lobed or entire, much wrinkled, subfimbriate in the sinuses between the lateral lobules. *Lip* pale pink, white at the base with 3 main nerves at the centre giving off papillate, purplish, hairy outgrowths on the midlobe, the lateral nerves on the midlobe also somewhat hairy. *Column* 7-9 × 2 mm., broad and clavate, flat in front, rounded behind, glabrous, walls of the clinandrium denticulate. *Anther* 2 × 1.5 mm., squarish. *Ovary* 5 × 2 mm. long, oblong-ovoid ; pedicel 2 mm. long, curved. *Capsules* 21 × 7 mm., decurved, broadly fusiform, 6-ribbed ; beak 5-7 mm. long.

Flowering : June. *Leaves :* July to December.

Occurrence in Bombay State : N. KANARA : *Bell* 4073; Dandeli, *Kapadia* 1690; Yellapur, *Bell* ; *J. Fernandes* 1627 ; *V. Patel* 1845; *Kapadia* 1967, 1987, 2010-2015, 2213, 2242, 2344-2345; Nagargali, *Sedgwick ;* Karwar, *Bell.*

Distribution : Apparently endemic in N. Kanara.

3. **Nervilia juliana** (Roxb.) Schltr. in Bot. Jahrb. 45 : 402, 1911 ; Blatt. & McC. 726. *Epipactis juliana* Roxb. Fl. Ind. 3 : 453, 1832. *Pogonia juliana* Wall. Cat. 7399, 1832, nom. nud. ; Hook. f. 119.

Tuber 10-15 mm. in diam., orbicular, warted with 2 or 3 transverse bands. *Scape* 1-flowered, 7-9 cm. tall, erect ; sheaths 2-3, oblong, acute, the uppermost much dilated. *Flower* 30-35 mm. long, bracteate, very shortly pedicellate. *Bracts* 12-15 mm. long, erect, oblong, acute, somewhat cymbiform, longer than the ovary. *Sepals* 28-33× 3 mm., straight (rarely curved), lanceolate, acute, entire, 5-nerved ; midnerve keeled below. *Petals* 25-28 × 2-3 mm., lanceolate, acute, 3-nerved. *Lip* 30-32 mm. long, very slightly saccate at the base, 3-lobed ; lateral lobes 15 × 2 mm., falcate, subacute, connivent with the column and concealing it, only the anther projecting beyond ; midlobe 13-15 × 7 mm., rhomboid or rhomboid-obovate, acute, entire or rarely subundulate, pubescent within.

The leaf and the colour of flowers are given by Blatter & McCann as follows : 'Leaf solitary, developing after the flowering of the scape, petioled, broadly ovate-cordate, acute, about 5 cm. in diameter, membranous, plicate with 5-7 veins radiating from the top of the petiole, green or purplish beneath ; . . . sepals and petals green ; lateral lobes white ; terminal white mottled with pink . . .'

Flowering : March (Assam).

Occurrence in Bombay State : N. KANARA : *Bell.*

Distribution : India : Assam, Lower Bengal, N. Kanara. *World :* Ceylon, India, Burma.

Notes : The description has been drawn up from *Collect* 199, from

the Naga Hills ; the specimen was kindly loaned by the National Herbarium, Calcutta.

4. **Nervilia discolor** (Bl.) Schltr. in Bot. Jahrb. 45 : 403, 1911 ; Holttum 105, f. 16e ; Santapau in Proc. nat. Inst. Sci. India 24B : 139. *Cordyla discolor* Bl. Bijdr. 417, 1825. *Pogonia discolor* Blume, Mus. Bot. Lugd.-Bat. 1 : 32, 1849, & 128, t. 57, 1858 ; J. J. Smith 54, f. 33. *P. biflora* Wight, Icon. 5(1) : 22, t. 1758, 1851 ; Hook. f. 119. *Nervilia biflora* (Wight) Schltr. in Bot. Jahrb. 45 : 403, 1911 ; Fischer 1459 ; Blatt. & McC. 726. (See Plate XXXII).

Tubers 1-3 cm. in diam., globose to oval, with a few rootlet knobs and 2-4 transversely circular bands. *Leaf* appearing just after the flowers, flat on ground and spreading; petiole 3-4 cm. long, arising from one end of the tuber, and giving rise to 2 stolons just below the lamina ; lamina 4-16×5-16 cm., ovate-cordate, rounded, acute or subacuminate, plicate ; margins with stiff hairs ; upper surface pale green to dark green-purple with many prominent purple or green nerves and an equal number of depressed ones in between, hairy all over; hairs 1-2 mm. long, purple or pale green, stiff, in rows parallel to and on the nerves; lower surface pale green to light mauve-purple with smaller and fewer hairs similar to the ones above. *Scape* 4.5-17 cm. long, up to 30 cm. in fruit, brownish mauve, longitudinally striated with deeper colour, greenish white below, sheathed, sparsely tubercled, sheaths 2-3, the lowermost subterranean and colourless, enclosing part of the foliar bud at the base; the upper ones 2.5-3.5 cm. long, brown-mauve tinged with green, about 9-nerved, oblong acute, glabrous. *Flowers* 2 at the apex of the scape, one slightly below the other, nodding, 20-25 mm. long. *Bracts* 3-8×1-4 mm., ovate-lanceolate to subulate, acute, entire or very slightly toothed at the apex, faintly 1-3-nerved, glabrous, brown-maroon tinged with green. *Pedicels* 5×1 mm. pale purple, faintly ribbed. *Sepals* and *petals* spreading, brown-mauve, oblong-lanceolate, acute, entire, glabrous, sparsely gland-dotted; sepals 20-27×4-5 mm., midnerve prominent below. *Petals* 23-24×3-4 mm., 7-nerved. *Lip* 18-20×11 mm., obovate-oblong or nearly elliptical, shallowly 3-lobed, slightly saccate at the base, convolute round the column, the tube narrowest a little above the base, widening outwards, opening just beyond the column; lateral lobes very small, entire, obtuse, purple-veined; midlobe 6×6 mm., oblong or oblong-ovate, obtuse, narrowly emarginate, faintly crisped and crenulate ; midnerve swollen and prominent, impressed on the underside. Colour of lip rose-mauve with deeper lateral veins, the midnerve on the midlobe much paler or white. *Column* 10-12×4-5 mm., erect, pale rose-pink, sigmoidally curved, clavate at the apex, shallowly grooved in front. *Anther* rose-pink, red in front, somewhat square; pollinia oval, in 2 masses. *Stigmatic surface* 3×2 mm., broadly funnel-shaped. *Ovary*

5×3 mm., oblong-orbicular, brownish maroon, with 3 strong and 3 shallow ridges. *Capsules* fusiform, 10-16×6-8 mm., ribbed, winged along the ribs; generally only 1 fruit develops.

Flowering : May to June. *Leaves :* June to November.

Occurrence in Bombay State : DANGS : Waghai, *Santapau* 19136-19140, 19206-19207; *Kapadia* 671, 1254-1259, 1409-1411; Pimpri, *Santapau*; *Kapadia*. DECCAN: Bhimashankar, *Kapadia* 1464-1467. N. KANARA : Yellapur, *Bell* 6066 (excluding A); *Kapadia* 2017-2018; Sirsi, *Bell*; *Santapau* 18660.

Distribution : India : Dangs, Deccan, N. Kanara, S. India. *World*: India, Malaya, Java.

Notes : From the literature, *N. biflora* Schltr. and *N. discolor* Schltr. seem to be identical; the only point of difference seems to lie in the raised, median band of lip (the midnerve) which is yellow in the latter and white or pale rose-coloured in the former species; the basic floral structure (including the position of the individual floral parts) is identical, and, therefore, we have fused the two species under the earlier specific epithet, *discolor* of Blume.

The colour scheme of this species is strikingly variable. In dense undergrowth, where little light reaches the forest floor, leaves are deep purple to almost black in colour with deep purple stiff hairs. With an increase of light, leaves turn brownish, often somewhat rusty-brown in colour. We collected tubers from dense forest in the Dangs (where the leaves were purple) and planted them in St. Xavier's College garden ; they gave pure green leaves with pale green hairs. Leaves collected from Bhimashankar in a rather open habitat were also green. It would seem, then, as if the deep colour of our Dangs plants was intimately connected with light intensity; as to the colour of the flowers themselves, we have noted sepals and petals in the Dangs as brownish mauve; Blatter & McCann recorded that in Yellapur they were brownish yellow with a green shade. Malayan plants have them pale olive-green to dull purplish, the veins of the lip being yellow to brown or purplish, the midnerve itself being yellow.

This species is locally known as *Dukkarkand* in the Dangs Dist., and is used to promote lactation in women.

5. **Nervilia aragoana** Gaud. in Bot. Voy. Freycinet 422, t. 36, 1826 ; Fischer 1459 ; Blatt. & McC. 729 ; Holttum 105, f. 16 d ; Santapau in Fl. Purandh. 128. *Pogonia flabelliformis* Lindl. [in Wall. Cat. 7400, 1832, nom. nud.; et] Gen. Sp. Orchid. 415, 1840 ; Hook. f. 121 ; Prain 1026; J. J. Smith 57, f. 36 ; Duthie 158, t. 125 ; Haines, Bot. Bih. Or. 1163, 1924. *P. nervilia* Bl. Mus. Bot. Lugd.-Bat. 1 : 32, 1849 ; & 130, t. 56, 1858. *P. carinata* Wight, Icon. 5 (1) : 15, t. 1720, 1851. *P. scottii* Reichb. f. in Flora 276, 1872 ; Hook. f. 120, et in Ann. R. Bot. Gard.

Calcutta 5 : 62, t. 93, 1895 ; King & Pantl. 269, t. 360 ; Prain 1026. *Nervilia scottii* (Reichb. f.) Schltr. in Bot. Jahrb. 45 : 404, 1911.

Tuber 1.5-2 cm. in diam., subglobose, white, with parallel lines along the circumference dividing into obscure lobes. *Leaf* appearing after the flowers, erect, petiolate. *Petiole* 8-20 cm. long, purple turning light green with purple lines ; generally 2 stolons arise on opposite sides from the petiole just above the tuber. *Lamina* 9-12 × 8-11 cm., cordate, broadly ovate to almost orbicular, acute, acuminate or apiculate, glabrous, dark green above, pale green below ; nerves up to 18 in number. *Scape* 10-25 cm. tall, 2-sheathed, green above, light purple below ; lower sheath 2 cm. long, white with brown streaks, loose, acute ; upper sheath about 2 cm. long, closely fitting round the peduncle, similar to the lower one. *Raceme* few- to many-flowered, lax. *Flowers* drooping, green, shortly stalked, about 20-25 mm. long. *Bracts* 14 × 2 mm., decurved, linear-lanceolate, subacuminate, glabrous, light green, faintly tinged with purple. *Pedicels* 3 mm. long, green, curved. *Sepals* 17-25×2-4 mm., green or yellowish green, oblanceolate, acute or subacute, entire, glabrous, often the midnerve subcarinate below, the lateral pair of nerves fainter. *Petals* 14-25×2-5 mm., green, similar to sepals, often narrower at the base. *Lip* 17-24 mm. long, subsaccate and subclawed at the base, obovate in outline, 3-lobed, lateral lobes erect, 1-3 mm. broad, parallel and embracing the column; narrowly oblong, acute or obtuse, pale green ; midlobe 4-6 × 5-7 mm., variable in shape, not constricted or deflexed, obtuse or subacute, irregularly crenulate, somewhat crimped with incurved edges, pale yellowish green, nerves red-pink, parallel, subwavy along the midlobe. The 3 central prominent nerves along the entire length of the lip are yellowish green, minutely hairy, the pubescence extending to some of the lateral nerves also. *Column* pale green, 7-10 mm. long, dilated above, placed at an angle to the ovary. *Anther* posticous, white above, reddish towards the base ; midnerve red-purple. *Stigmatic surface* fairly broad, circular trapezoid. *Ovary* 4-5 mm. long, drooping, green often flushed with pink, the ridges often winged.

Occurrence in Bombay State: DANGS : Waghai, *Santapau* 19141 ; Dungarda, *Santapau* 19280. KONKAN : Bombay, cultivated, *Kapadia* 1357, 1917-1920 ; Neral, *Blatter* ; Tansa, *Santapau* 2706 ; Borivli, *Santapau* 2343-2344, 15026 ; *R. Fernandez* 1287, 1816-1817, 1838-1839, 1862 ; *Herbert* 2348 ; *Kapadia* 1244-1247 ; Wajreshwari, *Kapadia* 1293-1294 ; Mumbra, *Shenoy* 3462, 3641-3642, 3656, 3667 ; Badlapur, *Kapadia* 1284, 1288 ; Karjat, *Irani* 90 ; *Kapadia* 1217-1218, 1239. DECCAN : Purandhar, *Santapau* 7130, 7246, 7248, 7254, 7263 ; *Kapadia* 1316. N. KANARA : Yellapur, *Kapadia* 2233-2235 ; Sampkhand, *Sedgwick & Bell* ; Guddehalli, near Karwar, *Kapadia* 2127.

Distribution : India : Tropical Himalayas from Garhwal (1400 to 1600 m.) eastwards to Kumaon, Bengal, southwards to Saurashtra, Dangs, Konkan, Deccan, N. Kanara, Mysore, Rampa and Pulney hills, and Travancore. *World :* India, Malaya, and Java.

Notes : This species is often found under clumps of *Euphorbia neriifolia* Linn. in open fields and around bamboo clumps in forests.

From the descriptions and plates of Hooker f. (in *Ann. R. Bot. Gard. Calcutta* 5 : 62, t. 93, 1895) and King and Pantling, *Pogonia scottii* Reichb. f. seems to be identical with *N. aragoana* Gaud. The latter is a very variable species with respect to the shape of the lip. Duthie mentions that the leaves, at least the younger ones, are hairy on the margins, and the midlobe, as figured in his t. 125 and described in the text, is supposed to be deflexed from the general upward rising of the lip. These characters are not in agreement with our observations and those of others. The leaves are completely glabrous and the midlobe is not deflexed.

6. **Nervilia carinata** (Roxb.) Schltr. in Bot. Jahrb. 45 : 406, 1911 ; Fischer 1459 ; Blatt. & McC. 729. *Epipactis carinata* Roxb. Fl. Ind. 3 : 454, 1832 ; Graham, Cat. Bomb. Pl. 205, 1839. *Pogonia carinata* Lindl. Gen. Sp. Orchid. 414, 1840 ; Dalz. & Gibs. Bomb. Fl. 270, 1861 ; Hook. f. 121, et in Ann. R. Bot. Gard. Calcutta 5 : 62, t. 94, 1895 ; Prain 1026 ; Duthie 159, t. 124, et Fl. Upp. Gang. Pl. 3 : 217, 1920 ; Cooke, Fl. Pres. Bomb. 2 : 707, 1907.

Leaves similar to those of *N. aragoana* Gaud. ; authors do not seem to be in agreement about the characters of the leaves of this species ; Hooker f., Duthie, etc., give the leaves as 7-9-nerved, and this number is said to be distinctive of the species ; Hooker f., however, in *Ann. R. Bot. Gard. Calcutta* states that the number of nerves is 7-9-12. As for size, leaves are said to be 3.8-6.4 cm. wide ; but these figures seem rather low and probably refer to young, not yet fully developed leaves. *Scape* 10-17 cm. long, 2-sheathed, bearing a terminal lax raceme of few flowers ; sheaths 2-4 cm. broad, oblong, obtuse. *Flowers* 18-22 mm. long, drooping. *Bracts* 6-8 mm. long narrowly linear-lanceolate, acute, somewhat erect ; *pedicels* 3-4 mm. long. *Sepals* and *petals* 19-21 × 3-4.5 mm., oblanceolate, acute, entire, the midnerve prominent below with a pair of fainter lateral nerves ; petals slightly shorter than sepals, narrower in the lower third portion. *Lip* 20-21 mm. long, 3-lobed, not saccate, subclawed at the base, rhomboid in outline ; lateral lobes 2-2.5 mm. broad, subacute, narrowly oblong ; midlobe ovate or rhomboid-ovate, slightly constricted at the base, tapering to an acute or subacuminate apex, irregularly crenulate ; disc 3-nerved, sparsely pubescent. *Column* 9 mm. long, subclavate and slightly curved at the apex, strongly carinate along the back, the column being trigonous. *Ovary* 5 mm. long, strongly ridged, ovoid.

Flowering : June.

Occurrence in Bombay State: W. GHATS : Khandala, *Santapau* 4501-4502. N. KANARA : Dharwar, *Law* ; Kulgi, *Bell.*

Distribution : India : Sub-Himalayan tracts of Rohilkhand and N. Oudh, Kumaon, Bengal, Konkan, W. Ghats, N. Kanara, Mysore, Pulneys, Cochin. *World :* India, Burma.

Notes : Very similar to, if at all distinct from, *N. aragoana* Gaud. Duthie stresses the number of nerves on the leaf, the erect bracts and the shape of the midlobe of lip as typically distinguishing this species from *N. carinata* ; these points appear far from clear on examination of the actual specimens.

Prain separates the two species thus : Midlobe ovate, acute, crenate, white with red or purple veins = *carinata* ; Midlobe ovate, acute, pure white = *aragoana.* All our specimens show a white or greenish-white, rarely yellowish lip, with various shades of red or purple or brown on the veins.

In our opinion, the only more or less constant features on which *N. carinata* Schltr. can be separated from *N. aragoana* Gaud. are : in *carinata* the floral bracts are erect, the lip is neither saccate nor gibbous ; the midlobe of the lip is narrow at the base, ovate and acute to acuminate. To judge from the descriptions of this plant, the diagram of Hooker f. in *Ann. R. Bot. Gard. Calcutta* 5 : t. 94, seems to represent the present plant correctly ; our Khandala plants are very close to Hooker's plant.

Nevertheless, the position of *N. carinata* Schltr. remains rather doubtful.

Imperfectly known Species

1. **Nervilia hispida** Blatt. & McC. in Journ. Bombay nat. Hist. Soc. 35 : 728, 1932.

This species was described from T. R. Bell's manuscript notes.

According to Blatter & McCann, the species is distinguished from *N. aragoana* Gaud. by its leaf being much smaller and densely hispid, the hairs being minute, white and tubercular ; the scape is shorter and the flowers several, smaller and appearing with the leaves ; the base of the lip is somewhat saccate. From *N. carinata* Schltr. it is distinguished by the much longer petiole, and the hispid, many-nerved leaf.

Flowering and *Fruiting :* June.

Occurrence in Bombay State: N. KANARA : Yellapur, *Bell.*

2. **Nervilia plicata** (Andr.) Schltr. in Bot. Jahrb. 45 : 403, 1911 ; Blatt. & McC. 727 ; Santapau 304. *Arethusa plicata* Andr. Bot. Rep. t. 321, 1803. *Epipactis plicata* Roxb. Fl. Ind. 3 : 454, 1832. *Pogonia plicata* Lindl. Gen. Sp. Orchid. 415, 1840 ; Hook. f. 119 ; King & Pantl. 268, t. 358 ; Cooke 707.

We have not seen any specimen which may, with certainty, be said to belong to this species ; hence we give the original description of Andrews :

'*Generic Character.* Calyx sheath leafy. Cup none. *Blossom* gaping. Five petals oblong, nearly equal, 2 outer, all converging into a helmet. *Honey-cup* one leaved, tubular at the base, within the bottom of the blossom two-parted ; lower lip reflexed, broad, wrinkled, the length of the petals, hanging down forwards, upper lip linear, very delicate, fixed to the shaft, lobed at the top. *Stamens* 2 threads, very short, fitting on the top of the pointal (pistil). Tips egg-shaped, flattened covered by the folding of the inner lip of the honey-cup. *Pointal* (pistil) seedbud oblong, beneath. Shaft oblong, incurved, clothed by the inner lip of the honey-cup. *Stigma* funnel-shaped. *Seed-vessel* capsule oblong, egg-shaped, one celled, 3-valved, splitting at the angles. *Seeds* numerous, chaffy. *Specific Character.* Arethusa with a globular root ; leaf heart-shaped, hairy.'

Flowering : July.

Occurrence in Bombay State : KONKAN : Bombay, *Millard.*

Distribution : India : Konkan (?), W. Ghats (?), Bengal (?), Sikkim (?). *World :* India, Philippines.

Notes : N. plicata Schltr. (= *Pogonia plicata* Lindl.) as described in our provincial floras seems to be quite a different plant from *Arethusa plicata* Andr., which is the basionym of both Schlechter and Lindley ; the descriptions seem to agree with *N. discolor* Schltr. We feel quite sure about the characteristics of the latter plant, but are rather doubtful about those of *N. plicata.* To add to these doubts, we have studied Cooke's specimens in Kew Herbarium and in Poona, collected from Khandala; such specimens do not agree with the description and diagram of *Arethusa plicata* Andr., but with *N. infundibulifolia* listed above. The plant mentioned as *N. plicata* in our floras is *N. discolor* Schltr. and not *N. plicata* Schltr. nor *Arethusa plicata* Andr.

MALAXIS Soland. ex Sw.

MALAXIS Soland. ex Sw. Prodr. Veg. Ind. Occ. 119, 1788, non Swartz 1789 nec auct. ; O. Kuntze, Rev. Gen. Pl. 2 : 672, 1891 ; Correl, Nat. Orch. N. America 255, 1950 ; Holttum, Rev. Fl. Malaya 1 : 191, 1953. *Achroanthes* Rafin. in Amer. Monthly Mag. Crit. Rev. 4 : 195, 1819. *Microstylis* (Nutt.) Eaton, Man. Bot. North Am. (ed. 3) 115, 347, 353, 1822 ; Lindl. Orchid. Scel. n. 18, 1826 ; Endl. Gen. Pl. 189, 1837 ; Benth & Hook. f. Gen. Pl. 3 : 494, 1883 ; Ridley in Journ. Linn. Soc. (Bot.) 24 : 308 ; Pfitz. in Engl. & Prantl, Pflanzenf. 2 (6) : 130, 1880 ; Hook. f. Fl. Brit. Ind. 5 : 686, 1890 ; King & Pantl. in Ann. R.

Bot. Gard. Calcutta 8 : 14, 1898 ; Duthie, ibid. 9 (2) : 87, 1906 ; J. J. Smith, Fl. Buitenz. 6 : 247, 1905 ; Schltr. Orchid. 155, 1927.

The generic name *Malaxis* is a Greek word meaning *softness* or *tenderness*, probably in allusion to the soft texture of the leaves, or may be with reference to the delicacy of the entire plant.

Terrestrial, rarely epiphytic or lithophytic *herbs*. *Stems* creeping, with erect leafy apex ; or short, fleshy and close together, bearing few to many leaves. *Leaves* broad, often unequal-sided at the base, thin, more or less plicate, inarticulate, sheathing at the base. *Inflorescence* terminal, in few- to many-flowered subumbellate racemes, or in an elongated raceme of small flowers. *Sepals* free, or the lateral ones more or less connate, spreading. *Petals* ovate-lanceolate to narrowly linear or filiform, often strongly coiled. *Lip* sessile, superior, erect or spreading, entire or 3-lobed, concave to saccate, often with a hollow near the base, usually with 2 large lobes (called auricles) close to the sides of the column and extending downwards below it, the apex often toothed. *Column* very short, terete, hollowed on top, often toothed at the apex, with or without fleshy arms. *Anther* terminal, sessile, erect on the back of the column, its tip pointing upwards ; pollinia 4, waxy, ovoid, free or cohering in pairs to a viscid mass. *Capsule* small ovoid, ellipsoid.

This genus consists of about 250 species distributed in the warmer parts of the World, extending into North Temperate regions. It attains its maximum development in Asia and Oceania ; it is also widely distributed in the Western Hemisphere.

Bentham & Hooker f. attribute the name *Malaxis* to Swartz in *K. Vet. Acad. Nya Handl.* 21 : 233, 1800, where Swartz published the species *M. paludosa* (L.) Sw. ; O. Kuntze, however, has pointed the existence of an earlier homonym, *Malaxis* Swartz, *Prodr. Veg. Ind. Occ.* 119, 1788, with two species *M. spicata* and *umbellifera* Sw. In the opinion of O. Kuntze, *Malaxis* Sw. 1800 is the same as *Malaxis* of Bentham & Hooker f., but is different from *Malaxis* Sw. 1788. The name *Hammarbya* was proposed by O. Kuntze for *Malaxis* Sw. 1800; and this has been accepted by Summerhayes (in *Wild Orch. Britain* 315, 1951) and other recent authors, with *H. paludosa* O. Kuntze as the only species.

In most of the earlier works the generic name *Microstylis* is attributed to Nuttal, 1818 ; this is not correct, for Nuttal made *Microstylis* a section of *Malaxis*. The first author to treat *Microstylis* as a generic name is undoubtedly Eaton (1822), and not Lindley (1826) as stated by O. Kuntze.

KEY TO THE SPECIES OF *MALAXIS* OF BOMBAY

1. Leaves flat and spreading on the ground, sub-coriaceous and subplicate ; inflorescence lax ; petals involute behind the large lip, hardly visible ; side lobes of lip produced upwards into acute or obtuse auricles, the apex bilobed .. .. *mackinnonii*
1. Leaves erect, not flat on the ground, membranous, much plicate ; inflorescence dense ; petals not involute, clearly visible in flower ; sidelobes of lip not produced upwards into auricles, the lip somewhat suborbicular, reniform, pectinate :
   2. Stem stout, not pseudobulbous at base ; leaves 5-18 cm. long, with a petiole 2-6 cm. long .. .. .. *versicolor*
   2. Stem slender, much swollen and distinctly pseudobulbous at base ; leaves 2.5-7 cm. long, sessile or nearly so .. *densiflora*

ENUMERATION OF THE SPECIES OF *MALAXIS* OF BOMBAY STATE

1. **Malaxis mackinnonii** (Duthie) Ames in Orchid. 6 : 289, 1920. *Microstylis mackinnonii* Duthie in Journ. As. Soc. Bengal, II. 71 : 37, 1902, et in Ann. R. Bot. Gard. Calcutta 9 (2) : 88, t. 95, et Fl. Upp. Gang. Pl. 3 : 184, 1920. *Microstylis cardonii* Prain, Beng. Pl. 1004, 1903, et in Journ. As. Soc. Bengal, II, 73 : 189, 1904 ; Haines, Bot. Bih. Or. 1165, 1924 ; Mooney, Suppl. Bot. Bih. Or. 210, 1950.

Terrestrial *herbs*. *Tuber* small, corm-like, 7-10 mm. in diam., whitish. *Leaves* 1-3, clustered and spreading on the ground, subfleshy, subplicate, green or purplish on the under surface, continued below the ground level into a sheath which is more or less rigid, greyish, 1-4 cm. long ; lamina 3-13 × 1.3-7 cm., variable in shape, oblong-lanceolate, elliptic, oblong, ovate-lanceolate, or broadly ovate to rarely suborbicular, acute or obtuse, entire, about 5-9-nerved, the nerves often purplish below. *Scape* together with the raceme 12-40 cm. long, erect, subflexuose, yellowish green, angled, often slightly winged, rarely much thickened towards apex. *Flowers* 3-4 mm. across, pale yellow or yellowish green. *Bracts* 4 × 1-1.5 mm., deflexed, pale yellowish green, narrowly subulate, subacuminate or acute, entire, 1-nerved. *Sepals* 2.5 × 1.5 mm., narrowly oblong, obtuse with the entire margins folded backwards, 3-nerved, pale yellowish green to yellow. *Petals* 1.5-2 mm. long, very narrowly linear to filiform, obtuse, twisted and much reflexed, normally not

visible in the flower, 1-nerved, pale yellow. *Lip* 5-5.5 mm. long, pale yellow, superior, ovate-oblong in outline, somewhat constricted just beyond the middle ; basal portion 3.5 × 3 mm., suborbicular with the auricles about 1.5 mm. long, obtuse or acute, concave in the middle about the attachment of the column, again convex on the sides outwards ; the apical part 2 × 2 mm., broadly ovate-oblong, slightly curved forwards, somewhat hooded, bilobed at the apex with a narrow sinus in between, the lobes obtuse. *Column* about 1 mm. long, pale yellow, with fleshy rounded arms. *Anther* minute, broader than long or suborbicular ; pollinia 4, in pairs, ovoid-pyriform. *Pedicel* with the *ovary* 2-3 mm. long, pale greenish yellow, ribbed. *Capsules* 10 × 4 mm., erect, obovoid, ridged, greenish yellow ; stalk 2-3 mm. long.

Flowering : August to September. *Fruiting :* September to November.

Occurrence in Bombay State : DANGS : Waghai, *Santapau* 19088, 19142, 20000 ; *Kapadia* 688, 1421-1428.

This orchid has been recorded for the first time in Bombay State.

Distribution : N. W. Himalaya 1800 to 2000 m., Upper Gangetic Plain, Bengal, Chota Nagpur, southwards to the Dangs District.

Notes: This species is locally abundant in open patches of forest, usually around bamboo clumps.

We have checked our specimens with Mackinnon's specimens in the National Herbarium, Calcutta, on which Duthie based his *Microstylis mackinnonii*. Except for the absence of the slight purple coloration in the flowers, our specimens are identical with the ones in Calcutta.

Microstylis cardonii Prain seems to be identical with *Malaxis mackinnonii* (Duthie) Ames. Further, both Duthie and Prain point out the similarities in the floral structure of their plants to *Microstylis wallichii* Lindl. ; but the structure and position of the leaves at once distinguish these two plants.

2. **Malaxis versicolor** (Lindl.) Sant. & Kapadia, comb. nov. *Microstylis versicolor* Lindl. Gen. Sp. Orchid. 21, 1830 (non Wight 1844-45); Ridley 343 (excl. syn. *Malaxis rheedii* Sw.); Cooke 678 ; Haines 1165, 1924; Fischer 1408 ; Blatt. & McC. 259. *Malaxis rheedii* Heyne ex Wall. Cat. 1939, 1828, nom. nud.; Graham, Cat. Bomb. Pl. 202, 1839. *Microstylis rheedii* Wight, Icon. 3 (2): 9, t. 902, 1844-1845; Dalz. & Gib. Bomb. Fl. 260, 1861 (excl. syn.); Hook. f. Icon. Pl. t. 1883, et Fl. Brit. Ind. 5: 690, 1890 ; Prain 1004 ; Gammie 565 ; Fyson, Fl. Nilg. Puln. Hill-Tops 384, 1915, et t. 510, 1920. *Liparis intermedia* A. Rich. in Ann. Sc. nat. ser. 2, 15: 17, 1841 (?). (See Plate XXXIII).

Terrestrial, lithophytic or rarely epiphytic *herbs*. *Stem* erect, 3-25 cm. tall, slightly swollen at the base, sheathed greenish-purple ; sheaths 2-5 × 1-1.5 cm., ovate-lanceolate, acute or acuminate, green-purple with 3-5 prominent purple nerves. *Leaves* 3-5, petiolate, sheathing

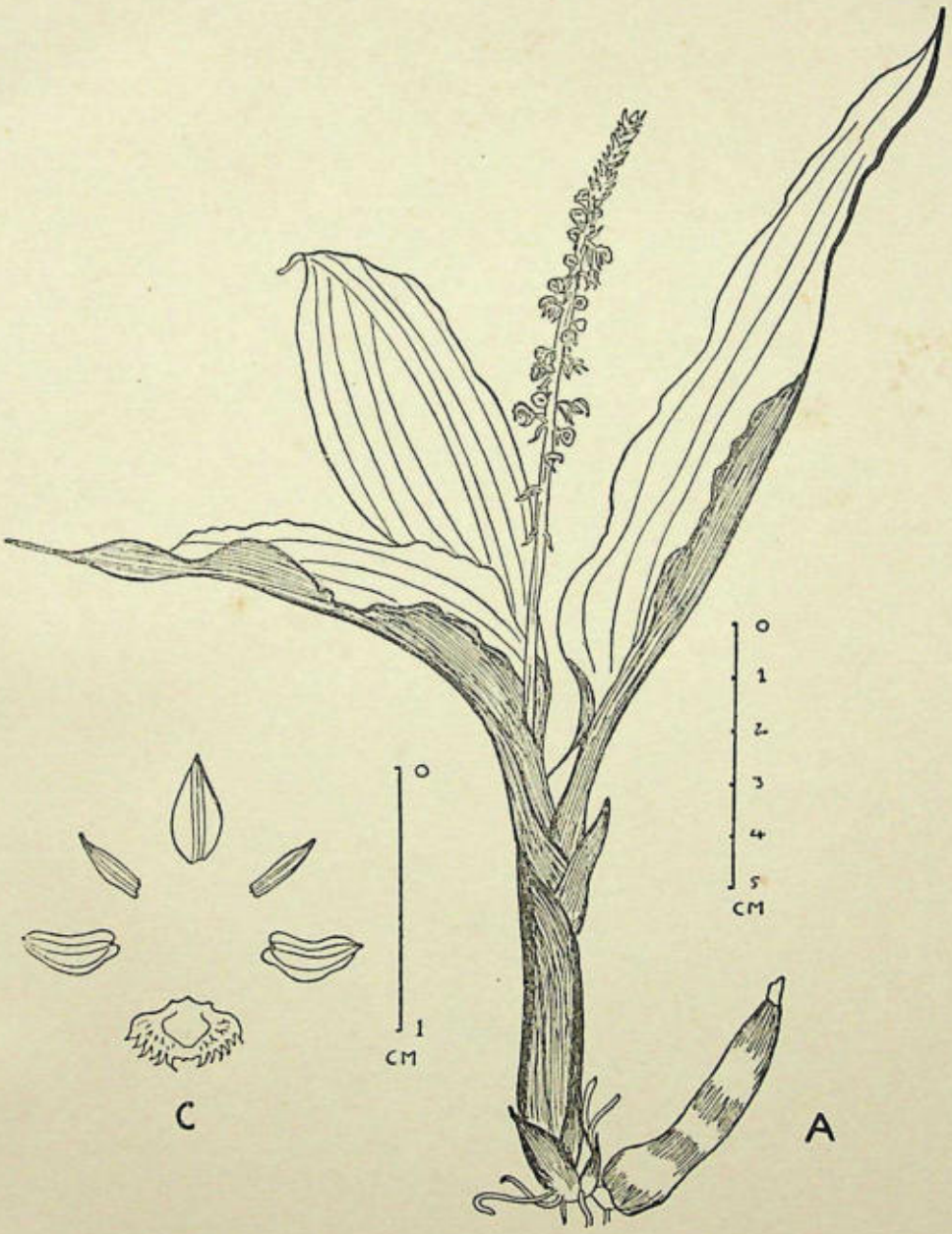
plicate ; petioles 2-6 cm. long, amplexicaul, green-purple with a few purple nerves; lamina 5-18×2.5-11 cm., ovate-lanceolate or broadly ovate or elliptic-lanceolate, acute, glabrous, 8-10-nerved ; margins slightly crimped, denticulate ; nerves depressed above, prominent below, purple-green. *Inflorescence* 8-35 cm. high, dense or lax; peduncles 3-10 cm. long, angled, purple with a few bracts at the top. *Buds* green when young, turning yellowish to purple at maturity, ovate, obtuse, slightly curved. *Flowers* 4×4 mm., yellow with a pale purple tinge when young, becoming deep reddish purple with age, and again somewhat yellow on fading, pedicellate. *Bracts* 3.5×1-1.5 mm., erect and green in bud, deflexed and slightly purple at the base after anthesis, lanceolate, acuminate, entire. *Sepals* unequal, purple, obtuse, entire, 3-nerved; the dorsal one 4 mm. long, linear and reduplicate with a broad base; the lateral ones 3×1 mm., broadly ovate and conduplicate with a broad back, subfalcate. *Petals* 3.5 mm. long, purple, slightly curved, acute, entire and reduplicate. *Lip* superior through a twist of 180 degrees, 2.5×4 mm., purple, rounded, reniform and somewhat fan-shaped, pectinate except for a small portion in the middle ; teeth usually about 8-11, curved, pointing towards the centre; the claw small, concave, just opposite the column. *Column* about 1.5×1 mm., yellow, footless, somewhat constricted in the middle with 2 very short arms. *Anther* whitish, globose ; pollinia 4, waxy, in pairs, broadly ovoid. *Stigmatic surface* yellow, oblong-truncate. *Pedicel* with *ovary* 2-5 mm. long, deep brown-maroon, strongly ridged. *Capsules* 10× 6 mm. obovate, pyriform.

Flowering : July to August. *Fruiting :* September to March.

Occurrence in Bombay State: KONKAN: *Law*; *Stocks*; Bombay, cultivated, *Kapadia* 1358; Hills west of Mulund, *McCann*; Matheran, *Chibber*. W. GHATS : Khandala, *Cooke* ; *Hallberg* ; *Blatter* 35233 ; *Blatter & McCann* ; *Kapadia* 640-641; Lonavla, *Garade*; Panchgani, *Blatter*; Mahableshwar, *Cooke*; *McCann*; *Santapau* 11804-11805, 13197-13199, 13201, 13240; *Kapadia* 2086-2093. DECCAN: Koina nagar, *Kapadia* 2880-2883, 2902. N. KANARA : *Sedgwick* ; Yellapur, *Santapau* 18710 ; *Kapadia* 1983-1986, 2241 ; Castle Rock, *Kapadia* 2851-2853 ; Guddehalli, near Karwar, *Bell* ; *Kapadia* 2143-2144.

Distribution : India : Chota Nagpur, Konkan, W. Ghats of Bombay State and S. India, Deccan, N. Kanara. *World :* India, Ceylon.

Notes: The colour of the plant bears a striking relation to the kind of light under which it grows. The Khandala plants were green tinged with purple, with very deep purple prominent nerves, and the plant as a whole looked purplish. These plants were cultivated in St. Xavier's College garden, more or less under the open sky ; the new shoots given off from old stumps did not have the slightest trace of purple, leaves being pure green. Thus the purple coloration seems to be inversely



Malaxis versicolor Sant. & Kapad.

A. Plant in flower; C. Sepals and petals dissected.

proportional to the light intensity. This effect of light has been more clearly observed in the variations in the colour of the flowers. A number of plants were collected from spots with varying light intensity, from Mahableshwar : (1) In dense forest undergrowth ; (2) at the edges of dense forest ; and (3) along the road among shrubs. At (1) the spikes of flowers were deep purple ; at (2) the flowers were purplish tinged with greenish yellow ; at (3) the lowermost flowers, which were practically hidden in the shade,were of a deep purple colour, the middle ones, receiving some light, were yellowish ; the uppermost, receiving the full sunlight, were pure green.

It is probably due to these variations in colour that Lindley gave the specific epithet *versicolor* to this species.

The nomenclature of this plant is complicated by the fact that two different plants have often been considered identical. O. Kuntze gives the following plants as specifically identical : *Malaxis resupinata* (Forst.) O. Kuntze (1891); *Malaxis rheedii* Sw.; *Epidendrum resupinatum* Forst.; *Microstylis versicolor* Lindl.

Hooker f. in *Icon. Pl.* t. 1883, distinguishes two plants : (a) *Microstylis rheedii* Wt. (= *Malaxis rheedii* Heyne ex Wall., non Sw. ; Rheede, *Hort. Mal.* 12 : t. 27), which is our Indian plant, and (b) *Microstylis plantaginea* (= *Malaxis rheedii* Sw., non Heyne ex Wall., *Epidendrum resupinatum* Forst.) ; this is a Javanese and Pacific Islands plant, not found in India.

It would seem, therefore, that if these 2 species are accepted as distinct, the oldest legitimate name for our plant is *Microstylis versicolor* Lindl. (non Wt.) and for this reason we herewith propose the new combination, *Malaxis versicolor* Sant. & Kapadia.

3. **Malaxis densiflora** (A. Rich.) O. Kuntze, Rev. Gen. Pl. 2 : 673, 1891. *Liparis densiflora* A. Rich. in Ann. Sc. nat. ser. 2, 15 : 18, t. 1 B, 1841. *Microstylis versicolor* Wight, Icon. 3 (2) : 9, t. 901, 1844-1845 (non Lindl. 1830) ; Hook. f. 691. *M. luteola* Wight, Icon. 5 (1) : 4, t. 1632, 1851 ; Ridley 345. *M. pratensis* Ridley in Journ. Linn. Soc. 24 : 344, 1888. *M. densiflora* (A. Rich.) Fischer in Gamble, Fl. Pres. Madr. 1409, 1928.

We have been unable to collect fresh flowers for detailed examination ; the following is the translation of A. Richard's original description : 'Pseudobulbs ovoid, sheathed ; leaves often in pairs, ovate, acute, sheathing at the base, 7-nerved, plicate, glabrous ; scape longer than the leaves, many-angled ; the spike many-flowered, very dense, 2-3 inches long ; the bracts lanceolate, acute, as long as the flowers ; the lip foveolate at the base, flabellate, its margins reflexed and fimbriate into narrow linear strips. Grows among grasses on the hills near Ootacamund and Dodabetta. Flowers from July to December.

Note : This species has rather small flowers, which are purple, at times very deep purple. It approaches near many species, which are already known, and, like the present one, native of India, among others *Liparis atropurpurea, L. nepalensis* ; from all these the present species is clearly distinguished by the beautiful spike and the lip that is concave in its lower part, the margins of which are reflexed and cut into deep, linear and narrow segments. Its flowers are very numerous and form a very dense spike.'

Fruiting : October.

Occurrence in Bombay State: N. KANARA : Sirsi, *Hallberg* & *McCann* 34975.

This species is not mentioned by Blatter & McCann in their Revision. It constitutes a new record for Bombay State.

Distribution : India : N. Kanara, W. Ghats of Madras State at high elevations. *World :* India, Ceylon.

Notes : This species is similar to *M. versicolor* Sant. & Kapad. from which it differs in being much smaller and more slender, and the base of the stem is swollen into a more or less distinct pseudobulb.

Notes on the Tuna and Frigate Mackerel from Ratnagiri[1]

BY

M. R. RANADE

Marine Biological Research Station, Ratnagiri

(*With one plate*)

Tuna fishery is being well exploited in countries like the United States of America, Japan, and Australia. Although potentialities exist for similar exploitation in India, our tuna fishing is conducted on a comparatively small scale. Six species of tuna have so far been recorded from the Indian Ocean: three by Day (1886), viz. *Euthynnus alletteratus affinis* (=*Thynnus thunnina*), *Katsuwonus pelamis* (=*Thynnus pelamis*), and *Neothunnus macropterus* (=*Thynnus macropterus*) ; one by de Beaufort (1951), viz. *Kishinoella tonggol* ; and two by Jones (1958), viz. *Auxis thazard* and *Auxis tapeinosoma*.

Ratnagiri, on the coast of Maharashtra State, is singularly fortunate in having a good tuna fishery which is of considerable importance to the local fishermen. During the course of investigation on this fishery off Ratnagiri, the following four species have, so far, been recorded :

Scientific Name	Common English Name	Vernacular Name
Euthynnus alletteratus affinis (Cantor)	Little Tuna	Bibya Gedar
Auxis thazard (Lacépède)	Frigate Mackerel	Gedari
Kishinoella tonggol (Bleeker)	Blue-fin Tuna	Khavalya Gedar
Neothunnus macropterus (Temminck & Schlegel)	Yellow-fin Tuna	Pimp

Of these four species nearly equal quantities of two species, viz. *Euthynnus alletteratus affinis* and *Kishinoella tonggol*, form more than nine-tenths of the total catch of tuna landed at Ratnagiri. It is reported by fishermen that specimens of Oceanic Skipjack, *Katsuwonus pelamis* (Linnaeus), are also occasionally found in Ratnagiri, but I have so far not come across any specimen of this species.

[1] Communicated by Dr. C. V. Kulkarni, Director of Fisheries, State of Maharashtra.

As there is some confusion with regard to the identification of tuna fish, (Serventy, 1956), a field key is presented for the identification of different species of tuna found in the Indian Ocean, along with some notes on the variation in the number of gill-rakers in *Auxis thazard* and *Kishinoella tonggol*.

KEY TO THE IDENTIFICATION OF INDIAN TUNA (cf. Plate)

1. Scales confined to the fore part of the body (the corselet) and along the lateral line. Base of the first dorsal fin equal or longer than head .. .. ..

Fam. : KATSUWONIDAE

2. Body completely covered with scales and the base of the first dorsal fin shorter than head.. .. ..

Fam. : THUNNIDAE

Fam. : KATSUWONIDAE

3. Wide interspace between the first and second dorsal fins .. .. Genus : *Auxis* 5

4. The first and the second dorsal fins close together .. 7

5. Corselet having not more than four rows of scales in the band below the position of the second dorsal fin ..

Auxis thazard (Lacépède)

6. Corselet having 7 to 12 rows of scales in the band below the position of the second dorsal fin .. ..

Auxis tapeinosoma Bleeker

7. Four or five dark stripes along the sides and belly ..

Katsuwonus pelamis (Linnaeus)

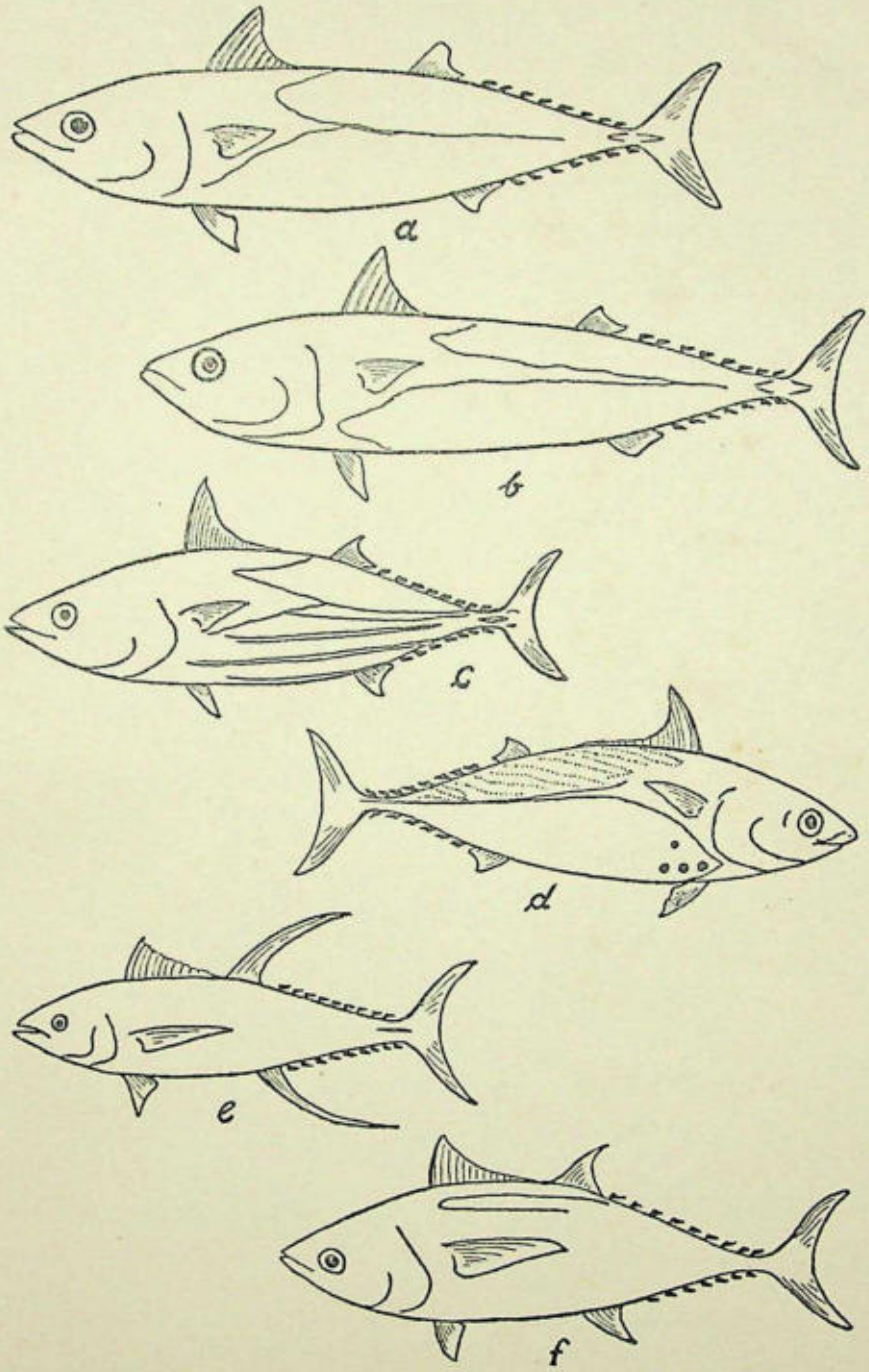
8. Three to five black spots below the pectoral base ..

Euthynnus alletteratus affinis (Cantor)

Fam. : THUNNIDAE

9. Pectorals long, extending beyond the origin of the second dorsal fin. Air bladder present. Second dorsal and anal fin and finlets yellow .. .. ..

Neothunnus macropterus (Temminck & Schlegel)



a. *Auxis thazard* (Lacépède) ; b. *Auxis tapeinosoma* Bleeker; c. *Katsuwonus pelamis* (Linnaeus) ; d. *Ethynnus alletteratus affinis* (Cantor); e. *Neothunnus macropterus* (Temminck & Schlegel) ; f. *Kishinoella tonggol* (Bleeker)

10. Pectorals short, reaching end of the first dorsal fin. Air bladder absent. Finlets yellow with grey edges .. *Kishinoella tonggol* (Bleeker)

Auxis thazard (Lacépède)

This species has a wide distribution in the warm seas of the Atlantic and Pacific Oceans. Previous records of this fish from the Indian Ocean are from Java and adjacent islands in Indonesia (de Beaufort, 1951), coasts of Natal and Cape Province in South Africa (Smith, 1949), and from the Ceylon coast (Munro, 1955). Jones (1958) recorded its occurrence in the Arabian Sea from Minicoy Islands, Malpe in South Kanara, Colachel in South Travancore, and Mandapam Camp on the Gulf of Mannar. The occurrence of *Auxis thazard* in Ratnagiri, therefore, extends its known distribution in the Arabian Sea a little further north. It would be interesting to see if it also occurs in the Gulf of Kutch where tuna fish is reported by the Superintendent of Fisheries, Kutch, to be available.

Wade (1949), describing this species in detail, has recorded the number of gill rakers on the first gill arch as 37-43. Jones (1958), who has described *Auxis thazard* from a single specimen, records the number of gill rakers as 40. I had an opportunity to examine a number of specimens in September 1960. The gill raker counts made in 21 specimens showed the following variations :

Upper arch :	Number of rakers	..	9	10	11		
	Number of specimens	..	4	14	3		
Lower arch :	Number of rakers	..	29	30	31	32	
	Number of specimens	..	1	9	6	5	
Total rakers :	Number of rakers	..	39	40	41	42	43
	Number of specimens	..	4	6	5	5	1

The gill raker formula is, therefore, 9-11/29-32=39-43. The modal formula is 10/30=40. This range of variation in the number of gill rakers is quite within the range given by Wade (1949).

Kishinoella tonggol (Bleeker)

This species is recorded from Singapore, Java Sea, Sulu Sea, Celebes Sea, Moluccas, and from Japan to Australia ; in the Indian Ocean from the Gulf of Aden, Maldive Islands, and the coast of Ceylon (de Beaufort, 1951). Munro (1955) has also recorded this species from Ceylon. The detailed distribution of *Kishinoella tonggol* in Australian waters is given by Serventy (1942, 1956). This is the first record of occurrence of *Kishinoella tonggol* in the Arabian Sea on the west coast of India. The species

can be easily identified by the extension of the pectoral fin up to the end of the first dorsal fin, the absence of the air bladder, and the finlets being yellow with grey edges. The range of variation in the gill raker count as 5-8/13-18=19-25 with a modal formula 6/16=22 is given by Serventy (1956). However, the gill raker formula given by Nakamura (1949) from Japan is 6/17=23. I have had an opportunity of examining only six specimens so far and gill raker count of all the specimens was 8/18=26. In order to work out a raker formula, more specimens will have to be observed. It is possible that a distinct race occurs at Ratnagiri, but it is premature to say this.

ACKNOWLEDGEMENTS

The author is highly indebted to Dr. C. V. Kulkarni, Director of Fisheries, Maharashtra State, Bombay, and Dr. H. G. Kewalramani, Research Officer, for suggestions and necessary corrections.

REFERENCES

Day, F. (1886) : The Fishes of India. Vol. I & II. London.

de Beaufort, L. F. (1951) : The Fishes of the Indo-Australian Archipelago. (Leiden) 9.

Jones, S. (1958) : Notes on frigate mackerels, *Auxis thazard* (Lacépède) and *Auxis tapeinosoma* Bleeker, from Indian waters. *Indian J. Fish.* 5(1):189-194.

Munro, Ian S. R. (1955) : The Marine and Fresh Water Fishes of Ceylon.

Nakamura, Hiroshi (1949) : The Tunas and their Fisheries. Takeuchi Shobo, Tokyo. (In Japanese). Translated by W. C. Van Compen (1952). Special Scientific Report. Fisheries No. 82, U.S. Department of Interior, Fish and Wild Life Service.

Serventy, D. L. (1942) : The tuna *Kishinoella tonggol* Bleeker in Australia. *J. Coun. Sci. Industr. Res. Aust.* **15** : 101-112.

— — (1956) : Additional observations on the biology of the Northern Blue fin tuna *Kishinoella tonggol* Bleeker in Australia. *Aus. J. Mar. Fre. Res.* 7 (1) : 44-63.

*Smith, J. L. (1949) : Sea Fishes of Southern Africa, 298.

Wade, Charles B. (1949) : Notes on the Philippine frigate mackerels, Family Thunnidae, Genus *Auxis*. U.S. Department of the Interior, Fish and Wild Life Service, Bull. No. 46.

* Not referred to in original.

Notes on Indian Caecilians

BY

EDWARD H. TAYLOR

Department of Zoology, University of Kansas, Lawrence, Kansas, U.S.A.

(*With two text-figures*)

Peninsular India has one of the richest caecilian faunas in the world, with no less than five recognized genera occurring there. Some of these are known in northern and north-eastern India, but they are presumably absent from the drier areas of north-western India and Pakistan.

In August 1959, I visited the Bombay Natural History Society and the Honorary Secretary, Mr. Humayun Abdulali, permitted me to examine the specimens in their collection (including one live specimen). All the forms had been referred to their proper genera. As in most museums all striped forms of *Ichthyophis* were regarded as *I. glutinosus* (Linnaeus), and the uni-coloured forms as *I. monochrous*.

At the time of my visit, I had in press 2 papers dealing with the caecilians of south-eastern Asia and the Indo-Australian Archipelago, describing certain Asiatic species, including a new genus from India.

The collection was handed over to me for study. Among other forms, it contained representatives of two species I had recently described in the two papers which were at that time in press in America. It was too late to add data from these specimens to my papers. However, since they have now been published[1] Mr. Abdulali has suggested that I publish a short article in the Journal of the Society and, to the data taken from the Bombay collection, add pertinent information and keys for other recently described Indian forms, so as to make the article more useful to students in India. This I have done.

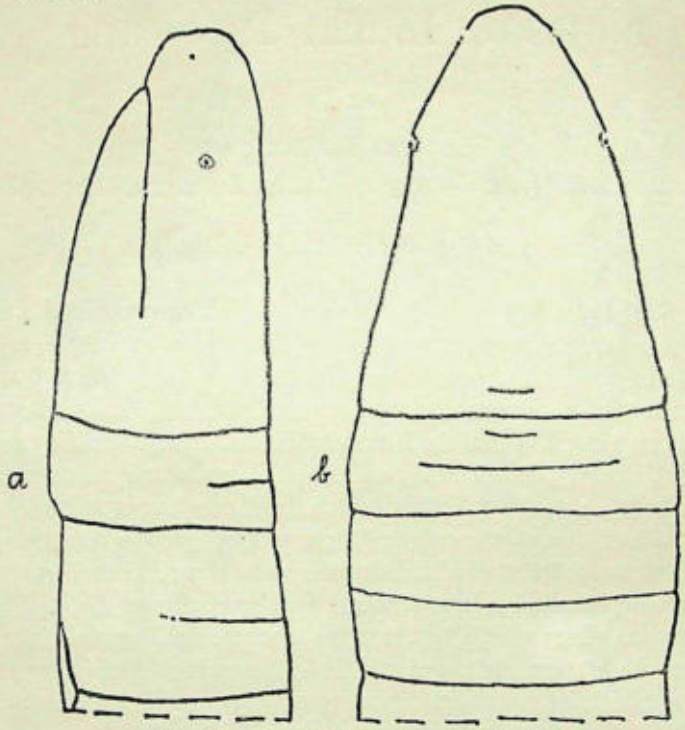
Indotyphlus battersbyi Taylor 1960

Indotyphlus battersbyi Taylor, *Univ. Kansas Sci. Bull.* **40** : 31-36, figs. 1-4, 1960 [type locality, Khandala, Poona District, *c.* 1800 ft. (550 m.), India. Type, No. 49974, American Museum of Natural History, New York].

Three preserved specimens are in the Bombay collection : No. 1121 from Lonavla (about three miles from Khandala), Poona District, and two, Nos. 1178 and 1179, from the type locality, Poona District. I have

[1] On the caecilian species *Ichthyophis monochrous* and *Ichthyophis glutinosus* and related species. Taylor (1960) : *Univ. Kansas Sci. Bull.* **40** : 37-120, figs. 1-38 ; A new caecilian genus in India, *Univ. Kansas Sci. Bull.* **40** : 31-36, figs. 1-4.

examined also a living specimen obtained by Mr. Humayun Abdulali, from under a stone near the type locality. These specimens are



Text-fig. 1. *Indotyphlus battersbyi*

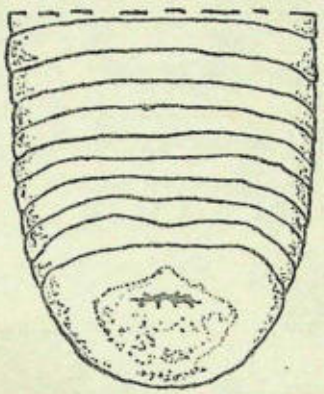
Head and anterior part of body, showing relative positions of nostril and tentacle (the eyes are not visible). *a*. side view, *b*. dorsal view. (From type, × 12)

presumably the only ones known, other than the type. Their variable characters are given below :

Specimen	AMNH type 49974	BNHS 1121	BNHS 1178	BNHS 1179
Total length (in mm.)	170	200	205	220
Head length (1st groove) (in mm.)	4.2	5.4	5.5	5.5
Head width (1st groove) (in mm.)	3	3.7	3.8	3.8
Body width (in mm.)	3.7	3.95	3.8	4.1
Width in length (times)	46	50	49	53
Primary folds	139	138	133	141
Secondary folds	29	17	22	21
Total folds	168	155	155	162
*Maxillary-premaxillary teeth	9-9	12-12	11-11	14-14
*Vomeropalatine teeth	12-12	13-14	13-14	17-17
*Mandibular teeth	9-9	11-11	9-10	11-11
Splenial teeth	2-2	2-2	2-2	2-2

*Number of teeth increases somewhat with age.

On each side of the tongue, near its anterior end, there is a somewhat elevated rounded area almost surrounded by a deep groove. These areas are blackish, and in strong contrast to the light colour of the rest of the tongue. Superficially *Indotyphlus battersbyi* resembles *Gegeneophis carnosus*, a form also occurring in southern India ; however,



Text-fig. 2. *Indotyphlus battersbyi*

End of body, showing the transverse vent and the absence of a tail. (From type, × 12)

the two species may be readily separated by examining the point of emergence of the tentacle. The position of the tentacular opening in *Indotyphlus* is directly anterior to the hidden eye, in line between the eye and nostril but much closer to the eye, whereas in *Gegeneophis* the opening is close behind the nostril and somewhat below it. The eye of *Gegeneophis* is hidden below the bones of the skull.

In my paper on caecilians (1960) in the key to the Indian genera I repeated Boulenger's error of stating that *Gegeneophis* lacks scales. I have since examined the type of the genus and scales are *certainly* present in the posterior part of the body where the secondary folds appear. The type of *Gegeneophis* has 114 primary folds and only six secondary, totalling 120.

In *Indotyphlus* the number of vertebrae in the type is 144, a number exceeding that of other known Asiatic caecilians. The number of vertebrae in *Gegeneophis carnosus* is not known.

The type of *Indotyphlus*, which does not bear the collector's name, may be one of the specimens collected by Charles McCann (1927) at Khandala, Poona District, and reported by him as *Ichthyophis monochrous* Boulenger, in the *J. Bombay nat. Hist. Soc.* **31** (4): 1039. McCann states : ' When at Khandala during the month of September, 1919, I secured several specimens of this batrachian. It lives under stones, during the rains, in burrows much after the fashion of the earthworm

which it also resembles in its movements. At first sight it might well be mistaken for one of these creatures as its body is also coated with slime. On the removal of the stone under which it lives the animal soon begins its descent into its burrow away from the light.'

In the *Journal* **42** (1) : 64, Mr. McCann (1940) writes : ' On the 6th September 1931 while collecting frogs I discovered another specimen [of *Ichthyophis monochrous*] living under a stone on the banks of the lake behind a range of hills locally called the "Sausages". I have repeatedly hunted for this animal since its first discovery at Khandala, but without much success. The 1931 specimen measured 232 mm.'

The species is named in honour of Mr. J.C. Battersby of the British Museum of Natural History.

Uraeotyphlus malabaricus (Beddome)

Caecilia malabarica Beddome, *Madras Month. Journ. Med. Soc.* **2** : 176, 1870, (type locality, Malabar).

Uraeotyphlus malabaricus Peters, *Monatsb. Akad. Wiss. Berlin*, 1879, p. 933 ; Boulenger, Catalogue of the Batrachia Gradientia *s.* Caudata and Batrachia Apoda in the collection of the British Museum, Ed. 2, 1882, p. 92, pl. V., fig. 3.

A single specimen in the Bombay collection, No. 222, from Ootacamund, Nilgiris, south India, is referable to this species. The secondary folds cannot be distinguished from the primaries by their appearance. The secondaries begin suddenly and at once have almost the same dimensions as the primaries : that is, they do not alternate longer and shorter as is typical of certain species of the genus. The total number of folds is approximately 242 (difficult to count because of injury to the specimen). The grooves lack the light lines that are typical of certain other species of the genus. Seven folds are confined to the tail. Scales are absent or rare in the anterior third of the body ; they form an incomplete row at the 64th fold, and extend practically around the body at the 100th fold. Posteriorly there are two complete rows in each fold and occasionally part of another row may be present.

The teeth have the following formula :

Maxillary-premaxillary, 16-17 ; vomeropalatine, 17-19 ; mandibular, 19-20 ; splenial, 8-9.

The total body length is 157 mm. The body width, 7.6 mm.

Ichthyophis subterrestris Taylor 1960

Ichthyophis subterrestris Taylor, *Univ. Kansas Sci. Bull.* **40** : 65-67, 1960 (type locality, Kottayam, Travancore, India. Type, No. 73927 "Travancore-Cochin", Chicago Nat. Hist. Museum.)

Two specimens in the collection of the Bombay Natural History Society belong to this species :

No. 217, from Injiparai Estate, Anamalai Hills, agrees well with the type in most characters. Only nine transverse folds can be counted on the injured tail : the expected number is 16 to 18. The count of 355 for the folds is probably low, and should be 364, if allowance is made for the missing caudal folds. The tooth formula is :

Maxillary-premaxillary, 23-23 ; vomeropalatine, 23-23 ; mandibular, 20-20 ; splenial, 13-13.

No. 223, from Alibag, Kolaba Dist., Bombay, is a small specimen, probably recently transformed, that has been broken into several pieces. No attempt has been made to count the folds.

This species is seemingly distinguished from other species of the Indian peninsula by the following combination of characters : the shape and position of the tentacular opening ; the elongate tail with the high number of transverse folds ; the tail length being contained in total length only 22.2 times ; and the enlarged mandibular teeth. The colour of the venter (dark) separates it from *peninsularis* and the body proportions of the two species seem to be somewhat different.

Ichthyophis peninsularis Taylor 1960

Ichthyophis peninsularis Taylor, *Univ. Kansas Sci. Bull.* **40** : 61-65, figs. 9, 10, 11, 1960 (type locality, Malabar, India. Type, B.M. No. 82, 12-12-6.)

Diagnosis : A large species with a broad, relatively short head ; the eye invisible covered by a raised circular white spot ; the tentacle nearer the eye-spot than to nostril ; body width in length 22 times ; tail long, its length in total length nearly 22 times ; transverse folds 363-366 ; folds on tail, 18 ; vertebrae, 116. Splenial teeth 3-4 on each side ; mandibular teeth large. Ventral surface very light, probably yellow or cream colour in life. A well-defined cream spot at vent.

The increased number of vertebrae, the coloration of the venter, and reduction in size of the vomeropalatine teeth seem to separate this species from other Indian species. Other differences are evident on a comparison of the type descriptions.

Ichthyophis malabarensis Taylor 1960

Ichthyophis malabarensis Taylor, *Univ. Kansas Sci. Bull.* **40** : 80-84, figs. 20, 21, 22, 1960 (type locality, Maduvangard, Travancore, India. Type B.M. 94. 3. 15. 3).

Diagnosis : Large, reaching a length of approximately half a metre, and the largest Oriental species. Tail proportionally long, its length in total length 23.5 times ; transverse primary and secondary folds 360,

14 confined to tail; vertebrae 111; splenial teeth, 10-10; tentacular opening near edge of lip, closer to eye than to nostril. Scales four to five in each fold except the most anterior ones.

Remarks : It would appear that this species is rare in its range or that it burrows to a considerable distance below the surface of the earth. A creature so conspicuous would otherwise be better known. Despite the fact that it is the largest caecilian reported from Asia, it has a relatively low number of vertebrae (111). The number of folds on the tail is 14, a lower number than occurs in certain other Indian forms.

The specimen is a female containing many large eggs (5.6 mm. in diameter), the number estimated to be more than 60.

Ichthyophis bombayensis Taylor 1960

Ichthyophis bombayensis Taylor, *Univ. Kansas Sci. Bull.* 40 : 67-69, fig. 12, 1960 (type locality, Waghai Surat, Bombay, India. Type, B.M. No. 86. 6. 11. 1.)

Diagnosis : A large species (390 mm.) having 386 transverse folds, 14 confined to tail ; splenial teeth, 9-9 ; body width in length, 26 times ; vertebrae, 121 ; colour in preservative, dark brown above, somewhat lighter brown below ; tail relatively long contained in total length about 25 times ; tongue tending to cover the splenial teeth ; mandibular teeth much larger than maxillary-premaxillary series ; vomeropalatine teeth relatively small, scarcely extending through the thick gums.

Remarks : The increased number of vertebrae, the coloration, the enlarged mandibular teeth and the reduction of the size of the vomeropalatine teeth seem to separate this from southern Indian forms. The specimen is a male.

Ichthyophis sikkimensis Taylor 1960

Ichthyophis sikkimensis Taylor, *Univ. Kansas Sci. Bull.* **40** : 91-95, figs. 28-30, 1960 (type locality, Darjeeling, India. Type, No. 64216, Calif. Acad. Sciences.)

Diagnosis : A medium-sized species, characterized by 106-108 vertebrae ; primary and secondary transverse folds 276-292 ; series of splenial teeth (9-9 or 10-10) ; tail short, contained approximately 50 times in total length, bearing five or six folds from front of vent ; tentacle near lip, closer to eye than to nostril. Scales sparse or absent in anterior half of body ; two to four rows in each fold posteriorly.

Variation : No. 2685* has the pharyngeal region considerably thickened and widened. The eye area is milky white, the pupil not visible. The tongue seemingly is not completely developed. It is

*Museum of Comparative Zoology, Harvard.

very short, covering the splenial teeth, and its posterior limit is a ridge curving forward. This specimen agrees reasonably well with the others in tooth counts, vertebrae, and transverse folds. It is, judging from the tongue, a recently transformed specimen that has not attained all the adult characters.

No. 2574*, the other Sikkim specimen, is very light, almost white, on the venter and nearly white on the chin. I cannot be certain that this specimen has not been faded somewhat by light. The two Darjeeling specimens vary but little from each other. Nothing is known of the exact habitats except that No. 2685 comes from the Rungeet Valley.

Ichthyophis tricolor Annandale 1909

Ichthyophis glutinosus tricolor Annandale, *Rec. Ind. Mus.* 3 : 286, 1909 (type locality, Maddathori, India) ; ibid 9 (4) (19) : 346-347, 1915 (Western Ghats, Cochin).
Ichthyophis tricolor Taylor, *Univ. Kansas Sci. Bull.* 40 : 113-114, 1960.

Since I proposed the revival of the name *tricolor* for a species of *Ichthyophis* in India, I have been able to examine certain specimens of the species in the collection of the British Museum. These specimens agree with the extremely brief colour description by Annandale, who saw three specimens. He mentions one that measured 280 mm. in length, but gives no other anatomical data. Annandale regarded *tricolor* as a variety of *glutinosus*, but it is not known what form was called *glutinosus* by him.

The two British Museum specimens are No. 93. 4. 18. 26 from Peermed, Travancore, and No. 82. 12. 12. 5 from the ' Nilgiris'. The second specimen was presumably taken in the same general locality as four specimens of a different species that lacks the ventral white stripe. The counts of the teeth of the two specimens are respectively :

Maxillary-premaxillary, 19-19, 20-21 ; vomeropalatine, 23-24, 28-29 ; mandibular, 15-15, 19-19 ; splenial, 24-23, 25-26.

The mandibular teeth are the largest, while the splenials are relatively very small. The tentacle is nearly equidistant from the eye and the nostril (2.3 mm. and 2.45 mm. respectively). The number of transverse folds is low, 245 for the male, 275 for the female. The lateral yellow stripe extends from near the tip of the snout to the tip of the tail, dividing at the angle of the mouth. A broad white (or yellow) midventral stripe is separated from the yellow lateral stripe by a stripe of brownish lavender, with a rather indefinite edge. The jaw and part of the chin are cream with a slightly pigmented area near the centre of the chin.

---

*Berlin Museum.

Scales are present throughout the body, the first folds having three rows of rather large scales widened transversely, the posterior folds having seven rows in each fold.

Variable characters of *Ichthyophis tricolor* Annandale :

Specimen	BM 93.4.18.26	BM 82.12.12.5
Sex	Male	Female
Total length (in mm.)	226	296
Tail (in mm.)	4	4.85
Body width (in mm.)	12.8	12.8
Head width (1st groove) (in mm.)	8.1	9
Distance between eyes (in mm.)	5	5.5
Eye to tip of snout (in mm.)	4.65	5.6
Head length (to 1st groove) (in mm.)	11	13
Head length (to 3rd groove) (in mm.)	21	19.8
Eye to tentacle (in mm.)	2.3	2.5
Tentacle to nostril (in mm.)	2.5	2.6
Transverse folds	245	275

The male specimen came from an elevation of 3300 ft. (1005 m.).

Ichthyophis beddomii Peters 1879

Ichthyophis beddomii Peters, *Monatsb. Akad. Wiss. Berlin*, 1879, p. 931, pl.—figs. 1-3 (type locality, Nilgiris, India) ; Taylor, *Univ. Kansas Sci. Bull.* **40** : 113, 1960.

Ichthyophis glutinosus (part.) Boulenger, Catalogue of the Batrachia Gradientia *s.* Caudata and Batrachia Apoda in the collection of the British Museum, 1882, p. 90.

I have referred three specimens in the collection to *Ichthyophis beddomii* Peters. These are: Nos. 219 and 220 from Ootacamund, Nilgiri Hills, southern India, and No. 527 from near Gersoppa Falls, North Kanara, India (the last was taken on a laterite path by day, and was said ' to progress by a series of ripples reminiscent of a millipede ').

Peters distinguished this species by the following characters : tentacle near lip, nearly equidistant from the eye and the nostril ; the head small, pointed or acuminate ; a lateral stripe on the body, and low number of transverse folds on the body (240 in the type).

The type of this species, formerly No. 5545 in the Berlin Museum, was not to be found on my recent visit there, and Dr. Heinz Wermuth, the Curator, believed that the specimen had been lost.

It will be seen from the following table that the type has fewer transverse folds and the body is narrower in proportion to length than the other specimens listed.

Specimen	BNHS 220	BNHS 219	BNHS 527	Type
Total length (in mm.)	265	257	185	225
Head width (in mm.)	7	—	—	—
Head length (in mm.)	9.3	—	11	—
Body width (in mm.)	16	15	11	10
Width in length (times)	16.5	17	16.5	22.5
Transverse folds, total	293	284	281	240
Transverse folds on tail	5	5	—	5
Maxillary-premaxillary teeth	23-23	23-25	24-25	—
Vomeropalatine teeth	28-27	27-27	23-24	—
Mandibular teeth	25-26	22-22	24-24	—
Splenial teeth	26-25	24-25	25-26	—

Moreover the count of folds (240) is lower than in 15 other specimens of the species I have been able to examine, most of which are from the Nilgiri Hills. Three specimens in the British Museum from ' Wynaad, Nilgiris, India ' have counts of 255, 263, and 273. The number of maxillary teeth in these specimens is a little less than in the specimens listed above. Tail length in total length about 30 times.

In all, the lateral yellow stripe is widened anteriorly so that there is a suggestion of two yellow triangles joined to the lateral stripes on the throat. A fork from the stripe beginning at the mouth-angle extends anteriorly to the tip of the lower jaw.

Usually one or two rows of scales are present in the folds on the anterior part of the body (beginning on the first or second fold). Posteriorly there are usually four rows in each fold.

It is impossible to state now whether this variation in the number of folds is a result of sex, elevation, or individual variation.

Key to Genera of Gymnophiona in India

1. Tentacle closer to eye than to nostril (or tip of snout) or equal 2

   Tentacle closer to tip of snout than to eye.. 3

2. Anal opening transverse; the tentacle cone-shaped, on a level with a line between eye and nostril; no tail; 144 vertebrae; splenial teeth present.. .. .. *Indotyphlus*

   Anal opening longitudinal; tentacle near edge of lip below level of a line between eye and nostril; tail present; vertebrae not over 125; splenial teeth present or absent .. .. *Ichthyophis*

3. Squamosal and parietal bones of skull separated by a diastema. Tentacle flaplike situated almost directly below nostril near mouth; orbit circular enclosed; tail region wider than body .. .. .. *Uraeotyphlus*

   Squamosal and parietal bones forming a common suture 4

4. A single row of teeth in lower jaw. No splenials .. .. *Gegeneophis*

Two rows of teeth in lower jaw ; eye covered over by bone ; tentacle conical somewhat behind nostril but below its lower level .. .. *Herpele*

KEY TO INDIAN SPECIES OF *Ichthyophis*

1. A lateral stripe of cream or yellow on side of body from head to tail ; splenial teeth usually more than 20 on each side 2

No lateral stripe of cream or yellow on side of body ; usually less than 20 splenial teeth on each side 4

2. Venter uniform brown lavender, to plumbeous ; position of tentacle variable 3

Venter with a broad white or yellow mid-ventral stripe ; tentacle near lip and nearly equidistant from eye and nostril ; transverse folds 245-275 ; tail length in total length 56.5 times ♂, 60 times ♀ .. *tricolor*

3. Tentacle nearly equidistant from eye and nostril ; lateral yellow stripe widens in region of throat ; fewer transverse folds (240-293). . *beddomii*

Tentacle near lip, much closer to eye than to nostril ; higher count of ventral folds (300-400) lateral stripe not widening under throat .. .. ? *glutinosus* vars.

4. Number of folds on tail less than ten ; body folds less than 300 ; tail length in total length about 50 times ; splenial teeth 9 or 10 on each side ; vertebrae, 106, 108 ; scales sparse or absent anteriorly, two to four rows in posterior folds .. .. *sikkimensis*

Number of transverse folds on tail more than ten ; on body usually more than 300 ; tail length in total length less than 30 times 5

5. Splenial teeth four or less on each side ; 18 transverse folds on tail ; vertebrae 116 ; body width in body length, 20-22 times ; venter light coloured (perhaps cream or yellowish in life) ; total length, 330 mm. .. *peninsularis*

Splenial teeth five or more on each side in full-grown animals, transverse folds 356-386 ; tail folds, 14-18 6

6. Number of mandibular teeth high (28-28) ; tail in total length about 23.5 times ; body width in body length 27 times ; vertebrae 111 ; scales in anterior folds small sparse ; posteriorly four or five rows in each fold ; venter light (perhaps cream or yellow in life) ; total length 494 mm. .. .. *malabarensis*

Number of mandibular teeth reduced (17-20) 7

7. Mandibular teeth, 20-20 ; splenial, 9-9 ; transverse folds 386 ; 14 folds confined to tail ; width of body in total length 26 times ; tail length in total length 25.6 ; venter brown to lavender brown ; one row of scales in anterior folds, three in posterior ; total length, 390 mm. .. *bombayensis*

Mandibular teeth very large, 17-17; splenial, 10-10; transverse folds 356-364, 18 confined to tail; body width in total length 21 times; venter dark lavender brown; two rows of scales in anterior folds; four or five in posterior rows; total length 295 mm. .. .. *subterrestris*

A study is in progress of the forms of Indian caecilians hitherto confused with *Ichthyophis glutinosus*. The provenance of the type (still in existence) has not been yet satisfactorily determined, and these forms are not treated here.

Amphipnous indicus, a new synbranchoid eel from India, with a Redefinition of the genus and a Synopsis to the species of *Amphipnous* Müller[1]

BY

E. G. SILAS AND E. DAWSON

Central Marine Fisheries Research Institute, Mandapam Camp

(With two text-figures and two plates)

INTRODUCTION

On 28 July 1957 while collecting fish from a stream passing through Krishnagiri National Park, Bombay, one of us (E. G. Silas) came across a tiny eel-like fish 84 mm. in length. Subsequently a second specimen was obtained just above the main falls at Kanheri Caves about three miles further up. During the last week of September and early in October of the same year, it was once again possible, assisted by a party from the Natural History Section of the Prince of Wales Museum of Western India, Bombay, to collect several specimens of similar eel-like fishes from a streamlet passing through Robbers' Cave, Mahableshwar, Satara District, and one specimen from an adjacent stream at Mahableshwar. A note on the fishes collected on an earlier occasion from the Robbers' Cave together with some ecological observations has appeared elsewhere (Silas, 1953).

A close examination showed that all these eel-like fishes collected at Borivli (elevation between 30 and 75 metres above m.s.l.), and Mahableshwar (elevation about 1400 metres) are identical, belonging to a hitherto undescribed species of the synbranchoid family Amphipnoidae, known thus far from only two species, *A. cuchia* (Hamilton), said to be the most highly evolved air-breathing fish in India, and *A. fossorius* Nair. The new species is designated here as

[1] Published with the permission of the Director, Central Marine Fisheries Research Institute, Mandapam Camp.

Amphipnous indicus sp. nov., based on its systematic description given below. The anatomical details etc. will be dealt with separately.

Amphipnous indicus sp. nov.

Material:

Holotype: 1 specimen 412 mm. in total length.

Type locality: Robbers' Cave, Mahableshwar, Satara District, Maharashtra State, India.

Paratypes: 43 specimens from Robbers' Cave, Mahableshwar; 1 specimen from Dhobi Falls, Mahableshwar; 1 specimen from Davri R., Krishnagiri National Park, Borivli, Bombay; 1 specimen from above Kanheri Falls, Kanheri Caves, Bombay.

The type material will be deposited in the research collection of the Bombay Natural History Society.

Diagnosis:

Body elongate, eel-like, head relatively short, snout bluntly rounded, and occipital region dome-shaped and muscular; scales present in irregular rows on tail and in a narrow streak along dorsum in posterior part of trunk and occasionally in a small isolated patch midventrally in front of vent; palatine teeth anteriorly in three or four rows; branchiostegals five; gills greatly reduced to highly vascularised plate-like structures present on third and fourth branchial arches; suprabranchial accessory respiratory chamber well developed; preanal vertebrae 93 to 99.

DESCRIPTION

Body proportions:

In the following paragraph the body proportions are given in thousandths of the total length as follows. First that of the holotype is given followed in parenthesis by the range and mean for all the specimens examined. For additional details reference may be made to Table IV.

Head 76 (65-84 : 73); eye 5 (4-9 : 5); snout 21 (14-23 : 19); interorbital distance 19 (9-21 : 16); tip of snout to posterior nostril 19 (13-20 : 17); isthmus between gill openings 16 (12-21 : 16); width of gill opening 6 (2-9 : 6); gape of mouth 27 (16-27 : 22); snout to vent 794 (770-830 : 798); greatest height of body 36 (25-41 : 34); width of body 31 (22-35 : 27); snout to occiput 70 (57-78 : 68);

height at occiput 30 (26-38 : 31); distance between anterior nostrils 9 (5-14 : 10); distance between posterior nostrils 12 (7-15 : 12); snout to posterior nostril 19 (13-20 : 17); greatest width of upper lip 9 (4-11 : 8); width of lower lip 4 (3-7 : 5); height of head 38 (25-42 : 35); depth of body at vent 28 (18-32 : 27); depth of body midway between vent and caudal end 22 (16-32 : 24); width of body at vent 20 (16-25 : 21); end of maxilla to tip of snout 40 (26-45 : 37); end of maxilla to tip of lower jaw 34 (21-38 : 31); and length of preanal scaly patch along dorsum 252 (110-392 : 226) in total length.

Head:

The head is conspicuous from the rest of the body by the dome-shaped muscular occipital region and the bluntly rounded snout. A profuse secretion of mucus, mostly from the anterior part of the body was noticeable soon after the animals were caught and when preserved in formalin this formed into a thick opaque covering all over the body, especially on the head and scaleless part of the trunk. When the mucus layer is cleared, the glandular skin with the pitted surface, especially on the head and nape region is discernible (Plate I, figs. 10 & 11).

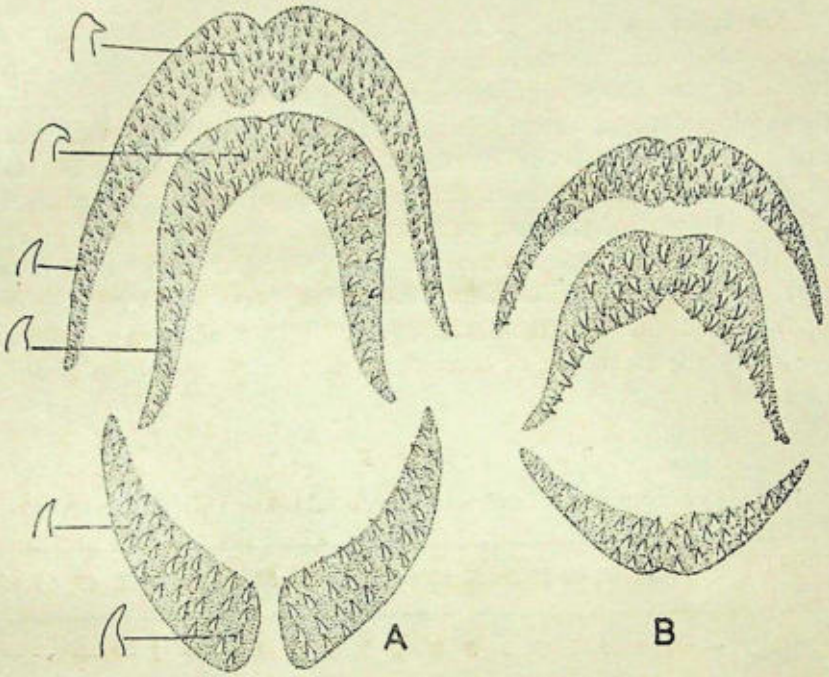
The eyes are greatly reduced and covered by skin. Usually, in preserved specimens the opaque mucus layer completely obliterates the eyes from view.

Part of the snout and upper jaw overhangs the ventrally positioned mouth. The upper lip is thick and overlaps part of the lower lip. Towards the extremity on either side of the symphysis the anterior nostrils appear as two holes. The post-labial groove is not continuous, being interrupted anteriorly at the symphysis of the lower jaw.

Dentition:

While the general pattern is the same both in the young and adults of *A. indicus*, there is a tendency in the larger specimens for an increase in the number of teeth on the maxillary, palatine, and mandibular bands (Text-fig. 1). In a specimen 425 mm. long the palatine band shows four rows of teeth anteriorly which progressively decrease to a single row in the posterior third of the band. The maxillary band has 5 to 6 rows of teeth near the symphysis, but laterally it shows three rows becoming uniserial at the posterior end. When the mouth is closed, in the larger specimens part of the maxillary band of teeth is seen exposed. The mandibular teeth are arranged in three or four rows at the symphysis. The shape of the teeth at different parts of the bands are indicated in Text-fig. 1.

The pattern of the dentition is another important feature distinguishing the new species from its congeners. In *A. cuchia* the palatine and mandibular teeth are uniserial. In the case of *A. fossorius* the maxillary teeth are arranged in two or three rows at the anterior end,



Text-fig. 1. Dentition of *Amphipnous indicus* sp. nov.
A. paratype 425 mm. long, and B. paratype 127 mm. long.

but uniserial in the posterior half and the palatine teeth are biserial anteriorly and uniserial posteriorly; further, the teeth in *A. fossorius* are more pointed and distinctly directed backwards than in *A. indicus*.

Caudal region:

The dorsal and anal 'fin folds' or ridges vary with age, being more conspicuous in the young. In the latter, the dorsal ridge commences about 0.25 length of head behind level of vent while it can be made out only in the posterior third of the post-anal distance in the adults. The anal ridge commences almost midway between the vent and the end of the caudal in the young, while in the adults it is seen only in the last fourth of the length of the post-anal distance. In *A. cuchia* the dorsal 'fin fold' is said to commence slightly ahead of a vertical line above the vent, while in *A. fossorius* the condition is

more or less as in *A. indicus*, but the anal fold in *A. fossorius* commences from the mid post-anal distance. The caudal tip in *A. indicus* is bluntly rounded.

Scales:

The scales are present in the post-anal part of the body. Anterior to and above the vent they occur as a narrow band along the dorsum extending to some distance in the front, but not surpassing the mid-point of total length. The sides above the vent and slightly behind it are devoid of scales (Pl. I, figs. 4 & 14, and Pl. II, figs. B & C). In a few specimens a small scaly patch is present in front of the vent midventrally.

Although the scales are not arranged in regular longitudinal rows, they are nevertheless countable. Where they completely encircle the body behind the vent there are on the average about 52 scales as shown by the frequency of their occurrence in 40 specimens detailed in Table I.

TABLE I

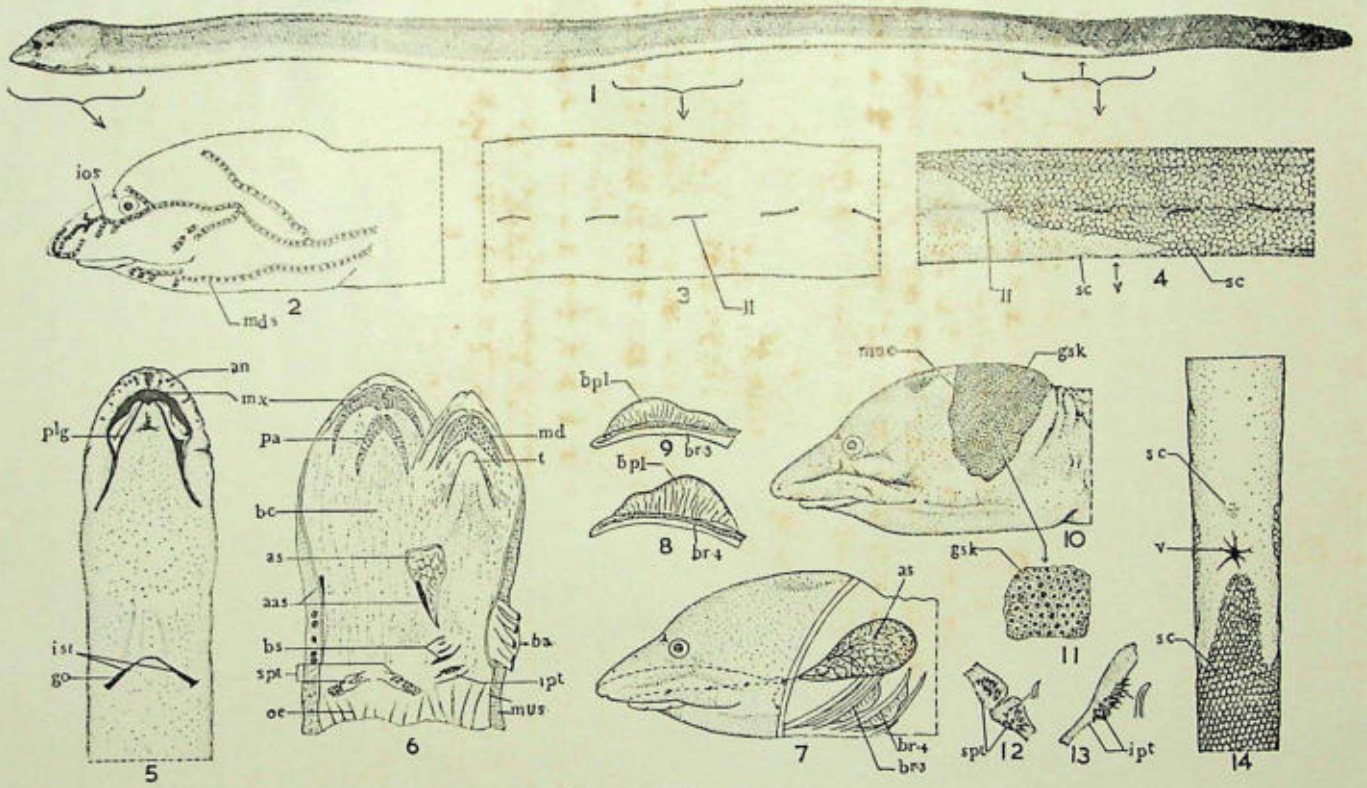
Frequency of occurrence of scales round body behind vent in *A. indicus* sp. nov.

No. of scales	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
No. of specimens	—	1	3	3	3	3	3	2	3	7	7	3	1	1	—	—	1	—	—	—	—

The scales are relatively much smaller when compared to those of *A. fossorius*. A typical scale from the side of the tail of a specimen 372 mm. long shows the basal nucleus extending to one-third the length of the scale. The radii are complete, there being 8 apically and 12 or 13 laterally on each side. The circuli are widely spaced apically, numbering 12 in this region. Laterally they are placed more close together and many terminate at the sides of the nuclear area, so much so that only 3 closely placed basal circuli are seen. Variations from this general pattern are seen in scales from different parts of the body and these will be dealt with elsewhere along with a comparative account of the scales of all the three species.

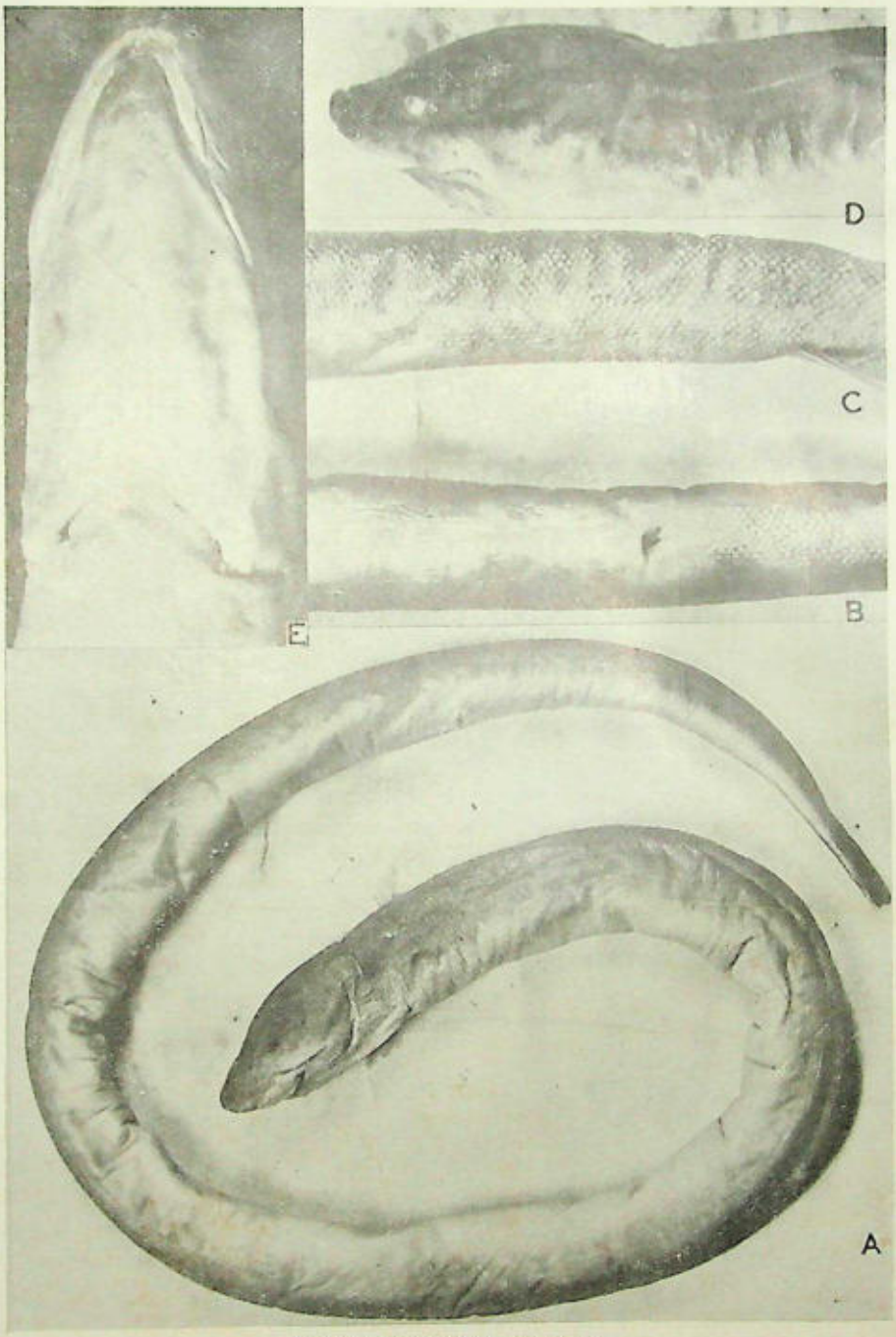
Lateral canal system:

In *A. indicus*, the lateral canal system is well developed and is clearly discernible even in the juveniles. The typical pattern as seen in the larger specimens is shown in Pl. I, figs. 2, 3, & 4. The canal



Amphipnous indicus sp. nova

For explanations see p. 378.



Amphipnous indica sp. nova

For explanations see p. 378.

system on the body appears discontinuous along the mid-lateral part of the body where it is present as short linear streaks each having a number of open pores. The lateral canal system is generally not visible unless the mucus over the body is cleared away.

The nature of the lateral canal system is not known in the case of *A. cuchia* and *A. fossorius*. However, the condition seen in the head region of *A. indicus* differs considerably from that of an allied synbranchoid fish *Monopterus javanensis* Lacépède as described by Yih (1948). The mandibular canal is present in both, but *A. indicus* shows a distinct infraorbital canal (Pl. I, fig. 2), which is absent in *M. javanensis*. The latter instead has the supraorbital canal well developed. It is likely that the nature of the lateral canal system may vary in the different species of the genus *Amphipnous*.

Vertebrae:

X-ray photographs of 32 specimens were taken for vertebral counts. From these, the pre-anal vertebrae could be clearly counted, while those towards the end of the tail were rather indistinct. However, two specimens cleared and stained with alazarin showed 95 and 99 pre-anal and 42 caudal vertebrae respectively.

TABLE II

Frequency of occurrence of pre-anal vertebrae in *A. indicus* sp. nov.

No. of pre-anal vertebrae	90	91	92	93	94	95	96	97	98	99	100
No. of specimens	—	—	—	3	8	10	11	1	—	1	—

The number of pre-anal vertebrae thus range from 93 to 99 (average about 95) while the total number of vertebrae for the species is about 137 to 144.

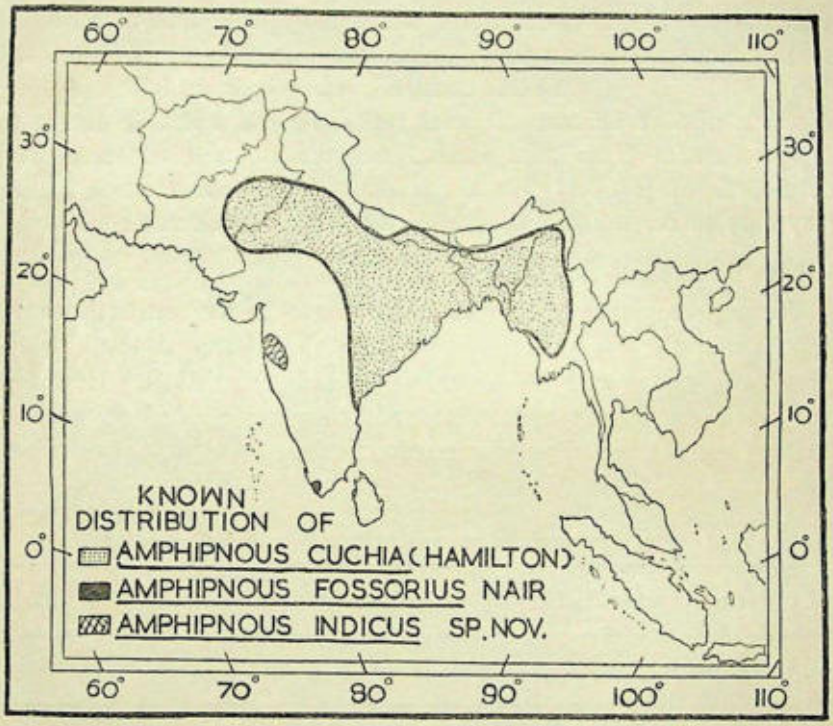
The number of vertebrae differ in the three species of *Amphipnous* as shown in Table III.

TABLE III

Characters	*A. indicus* sp. nov.	*A. cuchia* (Ham.) (after Günther, 1870)	*A. fossorius* Nair (after Nair, 1951)
No. of pre-anal vertebrae	93-99	106	73
No. of caudal vertebrae	42-45	65	53-56
Total No. of vertebrae	137-144	171	126-129

In this connection it is interesting to note that Nair (1951) found the pre-anal vertebrae in *A. fossorius* to be constant (73), while the

caudal vertebrae were found to vary in number. The range for *A. cuchia* is not known, but the figures given indicate a much higher count for that species. The vertebral counts in the three species also indicate another interesting trend of an increase from the southern to the northern latitudes as seen in the lowest counts in



Text-fig. 2. Map showing the distribution of species of the genus *Amphipnous* Müller

A. fossorius from the southernmost part of India to the highest counts in *A. cuchia* in the northernmost parts of India. Text-fig. 2 shows the natural distribution of the three species.

Branchial region:

The gill filaments of the third and fourth branchial arches are reduced and fused to form plate-like organs which are highly vascular. The first two branchial arches are placed close together, so much so that, instead of a branchial slit there is only a shallow blind pocket indicating the position in the wall of the bucco-pharyngeal cavity. Behind this are three narrow branchial slits, the posteriormost one being the broadest (Pl. I, fig. 6). The gill opening on either side is narrow and is separated by a wide isthmus. The gill membranes

unite with each other to form a slight ridge below the isthmus, but the latter can be distinctly made out.

The walls of the accessory air chamber are also highly vascular but, unlike *A. cuchia* where the accessory air chamber is much elongate and shown by Das (1927) as surpassing posteriorly a line above the gill opening, in *A. indicus* the chamber is relatively broader and falls short of a vertical above the gill opening. All three species show differences in the branchial region which will be dealt with elsewhere.

Sex:

There appears to be no noticeable difference externally between the two sexes. In some of the larger males the testicular lobes extend forwards to just below the posterior end of the liver. In mature females, the single-lobed ovary also extends to below the liver. Two of the specimens dissected showed fully gravid ovaries, while a few others showed spent ovaries.

Colour:

Almost all specimens when caught fresh were reddish or flesh-coloured. On preservation, with the mucus layer removed, dorsal surface is generally greyish or dusky and ventral side dirty white.

Weight and size:

The maximum weight of 72.1 gm. was noted for a specimen measuring 447 mm. in total length. The maximum length of a specimen in the collection is 480 mm.

Altitudinal distribution:

The collection of *A. indicus* from about 1400 metres above m.s.l., at Mahableshwar, is interesting, and shows the distribution of the species as occurring from just above sea-level to the colder waters of the hill streams of the Western Ghats of Bombay. The smallest specimen from Mahableshwar measures 82 mm. and this combined with the condition of the ripe ovaries of two of the specimens examined and the spent ovaries of a few others suggests the possibility of the fish breeding inside the cave or in the marshy areas in the vicinity of Robbers' Cave. That the fish could be a resident in the cooler waters at that altitude is also suggested by the recent discovery of its congener, *A. cuchia*, from the Kathmandu Valley, Nepal (DeWitt, 1960). In view of this, it will not be surprising if *A. fossorius*, at present known only from the

low-lying areas near Trivandrum, is also found to occur in marshy places along the courses of hill streams in the Western Ghats of Kerala. In any case, the spatial distribution of *A. indicus* and *A. cuchia* shows their adaptability to relatively cooler waters also.

TABLE IV

DETAILS OF BODY PROPORTIONS

(No. of specimens followed by range in thousandths of total length: the averages are given in parentheses)

Species	*A. indicus* sp. nov.					*A. fossorius* Nair
Total length	0 - 100 mm.	101 - 200 mm.	201 - 300 mm.	301 - 400 mm.	401 - 500 mm.	192 mm.
Head length	5 : 73-80 (76.5)	3 : 66-71 (68.5)	3 : 65-69 (66.6)	15 : 66-78 (72.8)	20 : 74-84 (78.4)	83
Diameter of eye	5 : 5-9 (6.8)	3 : 5-8 (7.0)	3 : 4-5 (4.6)	15 : 4-6 (4.8)	20 : 4-6 (5.0)	6
Length of snout	5 : 16-22 (18.8)	3 : 16-18 (17.0)	3 : 14-17 (15.3)	15 : 16-22 (19.3)	19 : 18-23 (20.4)	20
Height of body	5 : 28-33 (29.6)	3 : 25-37 (30.3)	3 : 31-34 (32.3)	15 : 31-40 (35.3)	20 : 30-41 (35.4)	29
Width of body	5 : 22-30 (25.2)	3 : 25-31 (28.0)	3 : 24-29 (27.0)	15 : 25-35 (27.8)	20 : 24-35 (29.0)	23
Height of head	4 : 26-29 (28.0)	3 : 25-31 (27.6)	3 : 30-34 (32.0)	15 : 33-39 (35.7)	20 : 33-42 (37.8)	33
Depth at vent	4 : 23-29 (26.2)	2 : 24-28 (26.0)	3 : 28 (28)	15 : 25-32 (28.3)	20 : 18-32 (26.4)	19
Angle of mouth to tip of snout	4 : 26-39 (33.0)	2 : 31-33 (32.0)	3 : 30-34 (32.6)	15 : 31-40 (36.1)	19 : 35-45 (41.6)	42
Dist. bet. upper angles of gill openings	5 : 18-24 (20.2)	2 : 20 (20.0)	3 : 20-21 (20.6)	15 : 19-21 (21.4)	20 : 18-23 (21.7)	13
Snout to vent	5 : 762-791 (776.2)	3 : 734-784 (768.3)	3 : 796-803 (800.3)	14 : 775-814 (811.1)	20 : 784-830 (810.0)	779
Length of pre-anal scaly patch	4 : 110-167 (148.5)	—	3 : 258-341 (286.1)	15 : 137-311 (244.4)	20 : 144-290 (208.5)	*167?

* In this specimen examined, the scales are absent in the anterior part of the trunk.

REDEFINITION OF THE GENUS *Amphipnous* MÜLLER 1839

The last definition of the genus *Amphipnous* Müller given by Day (1878) reads as follows:

'Branchiostegals six. Gill membranes almost entirely grown to the isthmus, and having a single transverse opening. Three branchial arches with the laminae rudimentary, divided by narrow slits. A respiratory air sac exists on the neck behind the head communicating with the gill cavity. Palatine teeth in a single well-developed row. Scales present and arranged in longitudinal rows.'

With the discovery of *A. fossorius* and *A. indicus* from peninsular India, a redefinition of the genus is necessary and this is given below:

Genus Amphipnous Müller

Amphipnous Müller, 1839, *Adh. Akad. Wiss. Berlin*, p. 244 (Orthotype: *Unibranchapertura cuchia* Hamilton).

Pneumobranchus McClelland, 1844, *Calcutta Journ. Nat. Hist.* 5 : 192 [Logotype: *P. striatus* McClelland = *A. cuchia* (Hamilton)].

Branchiostegals five or six; body elongate, cylindrical anteriorly and tail compressed laterally; body partly or wholly covered with small cycloid scales; posterior nostrils placed interorbitally; anterior nostrils placed near end of snout in upper lip; fins totally absent, but short dorsal and anal rayless folds of skin present on tail, confluent at tip; suprabranchial accessory respiratory chamber present on either side; gills greatly reduced and fused to form highly vascular plate-like structures on two or three branchial arches; two or three branchial slits leading from buccopharyngeal cavity to branchial chamber; a pair of gill openings partly or well concealed by the fold of the united gill membranes; teeth uniserial or multiserial on jaws and palate; vertebrae 121 to 171, pre-anal vertebrae numbering 73 to 106.

The genus is distributed along parts of India, Pakistan, Nepal, and Burma.

SYNOPSIS TO THE SPECIES OF THE GENUS *AMPHIPNOUS* MÜLLER

1. Palatine and mandibular teeth in two or more rows; vertebrae 126 to 144, pre-anal vertebrae being 73 to 99 3
2. Palatine and mandibular teeth uniserial; vertebrae about 171, pre-anal vertebrae 106 (longitudinally arranged scales present throughout body; branchiostegals 6) .. .. *Amphipnous cuchia* (Hamilton)

3. Snout pointed ; skin of branchial region of ventral side of head drawn out into longitudinal folds ; teeth on palate anteriorly biserial ; body covered with longitudinal rows of minute scales ; branchiostegals 6 ; pre-anal vertebrae 73 .. .. *Amphipnous fossorius* Nair

4. Snout bluntly rounded ; skin of branchial region of ventral side of head not drawn into longitudinal folds ; teeth on palate anteriorly tri- or quadri-serial ; scales present only on posterior half of body along dorsum in a narrow streak and on sides of tail and a small scaly patch may or may not be present midventrally in front of vent ; branchiostegals 5 ; pre-anal vertebrae 93 to 99. .. .. .. *Amphipnous indicus* sp. nov.

Synonymy and Notes on the Species

Amphipnous cuchia (Hamilton)

Muroena Russell, 1801, *Fish. Vizag.* **1** : 25, pl. 35 (named *Dondoo paum*). (Locality : a 1'11" specimen taken from Ankapalle Lake)

Unibranchapertura cuchia Hamilton, 1822, *Fish. Ganges* 16, 363, pl. 16, fig. 4. (Type locality : Rivers and ponds in south-east parts of Bengal); Hora, 1929, *Mem. Indian Mus.* **7** : 185 (reference only).

Cuchia Taylor, 1831, *Edinburgh J. Sci.* **5** : 42-50 (Anatomy) ibid. **5** : 33-42 (Respiratory organs) ; 1835, *Isis* (Oken) 307-10.

Ophichthys punctatus Swainson, 1839, *Nat. Hist. Classif. Fish.* **2** : 336.

Pneumobranchus striatus McClelland, 1844, *Calcutta Journ. Nat. Hist.* **5** : 192. (Type locality : Bengal)

Pneumobranchus leprosus McClelland, 1844, ibid. **5** : 195-96. (Type locality : Bengal)

Pneumobranchus albinus McClelland, 1844, ibid. **5** : 219. (Type locality : Bengal)

Amphipnous cuchia Müller, 1839, *Akad. Wiss. Berlin* 244 ; Cantor, 1850, *Cat.* : *Malayan Fish.* 338; Bleeker, 1853, *Verh. Bat. Gen.* **25** : 78; Kaup, 1856, *Apodal Fish.* 120; 1858, *Denks. K. Akad. Wiss. Wein.-Nat. Cl.* : 14; Günther, 1870, *Cat. Fish. Brit. Mus.* **8** : 14; Beaven, 1877, *Handbook Freshw. Fish. India* 157; Day : 1877, *Proc. Linn. Soc. London (Zoology)* : 205 (Respiration); 1878, *Fish. India* : 656, pl. clxvii, fig. 1; 1889, *Faun. Brit. India, Fish.* **1** : 69, fig. 27; Vinciguerra, 1889, *Ann. Mus. Civ. Stor. nat. Genova* (2) **9** : 355; Fea, 1897, ibid. (2) **17** : 490, 497; Regan, 1912, *Ann. Mag. Nat. Hist.* **9** : 387; *Annandale*, 1918, *Rec. Indian Mus.* **14** : 43; Das, 1927, *Phil. Trans. Roy. Soc.* (B) **216** : 197-200, figs. 3 a-d, pl. 10, figs. 38-42 (Respiration); Prashad & Mukerji, 1929, *Rec. Indian Mus.* **31** : 170; Ghosh, 1933, *J. & Proc. Asiat. Soc. Bengal* **29** (4) : 328; Hora, 1937, *Trans. Nat. Inst. Sci. India* **1** : 1-16; Shaw & Sheabbeare, 1937, *J. Roy. Asiat. Soc. Bengal* **3** : 128, fig. 130; Hora, 1939, *Proc. Nat. Hist. Inst. Sci. India* **5** (2) : 281-287; Das, 1947, *Proc. Indian Sci. Congr. Assoc.*, pt. 3, Abs. 42 : 11-12; Nair, 1952, *Proc. Indian Acad. Sci.* **34**(B) : 310 ; DeWitt, 1960. *Stanford Ichth. Bull.* 7(4) : 83.

Note:

No attempt has so far been made to study the variations in the vertebral counts of this species. Material from Burma should be specially examined in the context.

Amphipnous fossorius Nair

Amphipnous fossorius Nair, 1951, *Proc. Indian Acad. Sci.* 34(B) (6): 311-316, 321, 326-327, figs. 1,7. (Type locality : Marshy areas in the paddy fields and banana plantations adjoining Karamanai River, Karamanai, Trivandrum, Kerala State)

Note:

The single specimen of *A. fossorius* that we have examined is devoid of scales in the anterior part of the body; the scales are arranged in distinct longitudinal rows in the posterior half. The skin in the anterior part of the body is smooth without any indication of scale pockets. According to Nair (1951) 'the body is covered by very minute cycloid scales . . .'; we feel that this character needs rechecking in the type material also. Unlike in *A. indicus*, the gill openings and the crescent-like opening is greatly arched. The longitudinal furrows on the ventral side of the branchial region of the head as in some of the true eels (e.g. *Moringua* etc.) are very characteristic of this species.

ACKNOWLEDGEMENTS

We are very grateful to Dr. S. Jones, Director, Central Marine Fisheries Institute, Mandapam Camp, for the facilities given for carrying out this study; to Dr. M. Mathias, Nagercoil, for the X-ray photographs of the specimens. To Mr. C. T. Samuel we are indebted for making available for examination a specimen of *Amphipnous fossorius* Nair. The senior author wishes to specially thank Mr. V. K. Chari, Curator, Natural History Section, Prince of Wales Museum of Western India, Bombay, for help rendered in the field at Mahableshwar. The photographs of the new fish given on plate II were taken by Mr. K. G. Nambiar of this Institute, and the junior author assisted in the preparation of the figures given in Plate I. The material on which the paper is based was collected by the senior author while Registrar at the Bombay Natural History Society.

REFERENCES

(Only those not listed under the synonyms to the species are given below.)

Silas, E. G. (1953) : Notes on fishes from Mahableshwar and Wai, (Satara District, Bombay State). *J. Bombay. nat. Hist. Soc.* **51** (3) : 579-589.

Yih, P. L. (1948) : The lateral canal system of *Monopterus javanensis*. *Sinensia* **18** : 13-20.

EXPLANATION OF PLATES

PLATE I

Amphipnous indicus sp. nov.

1. Lateral view of holotype 412 mm. long; 2. Head region showing lateral sensory canal system; 3. Middle of body showing scaleless condition as well as discontinuous sensory canal system along the midlateral part of the body; 4. Part of trunk and tail showing disposition of scales and discontinuous lateral sensory canal system along midlateral part of body; 5. Ventral view of head and anterior part of body; 6. Dissection showing both roof and floor of buccal cavity and pharynx and indicating the position of the aperture to the air chamber and its relation to the branchial slits; 7. Lateral dissection showing the position of the accessory air chamber; 8. Fourth branchial arch and attached plate-like organ composed of fused gill filaments; 9. Third branchial arch showing same structure as 8; 10. Lateral view of head with part of mucus coating removed to show glandular skin; 11. Patch of skin of head magnified to show pitted glandular nature; 12. Suprapharyngeal bone and its teeth; 13. Infrapharyngeal bone and its teeth; 14. Ventral view of part of trunk and tail showing disposition of scales.

Abbreviations : *aas* aperture of accessory air chamber; *an* anterior nostril; *as* accessory air chamber; *ba* cut ends of branchial arches; *bc* buccal cavity; *bpl* gill filaments fused to form gill plates; *br* branchial arches; *bs* branchial slits; *go* gill opening on one side; *gsk* glandular skin; *ios* infraorbital sensory canal; *ipt* infrapharyngeal bone and teeth; *ist* isthmus between gill openings; *ll* discontinuous lateral canal system on side of body; *md* mandibular band of teeth; *mds* mandibular sensory canal; *muc* layer of mucus covering on head; *mus* muscular body wall cut across; *mx* maxillary band of teeth; *oe* oesophagus; *pa* palatine band of teeth; *plg* post labial groove; *sc* scales; *spt* suprapharyngeal bone and teeth; *t* tongue; *v* vent.

PLATE II

Amphipnous indicus sp. nov.

A. Holotype, 412 mm. long; B. Ventral view of part of trunk and tail showing arrangement of scales; C. Lateral view of same, but showing more of the tail portion and complete encirclement of scales in the posterior part; D. Lateral view of head of paratype showing characteristic dorsal profile; E. Ventral view of same, with the skin cut to enable counting of branchiostegal rays.

Notes on some Corvidae from Nepal, Pakistan, and India

BY

RAYMOND A. PAYNTER, JR.

Museum of Comparative Zoölogy, Harvard University, Cambridge, Massachusetts

The following observations were made during a study of the Corvidae collected by the Harvard-Yale Expedition (1957-59) in the region about Pokhara, central Nepal, in the vicinity of Darjeeling, India, in various localities throughout East Pakistan, and in northern West Pakistan.

ACKNOWLEDGEMENTS

For permission to collect and for assistance in many ways I am grateful to the Ministry of Foreign Affairs of Nepal and to the Zoological Surveys of Pakistan and of India. A. R. Ranjha and M. S. U. Siddiqi were of particular help in our work in Pakistan, as was H. Khajuria in India.

I am indebted to the following for lending specimens in their care: James D. Macdonald of the British Museum (Natural History), Robert W. Storer of the Museum of Zoology of the University of Michigan, Melvin Traylor of the Chicago Natural History Museum, and Charles Vaurie of the American Museum of Natural History.

Humayun Abdulali, Honorary Secretary of the Bombay Natural History Society, very generously provided me with descriptions and measurements of that institution's series of *Dendrocitta vagabunda*.

DENDROCITTA VAGABUNDA

Dendrocitta vagabunda exhibits much seasonal, individual, and geographical variation. In spite of the fact that it is a relatively common bird over much of the Indian sub-continent, it has not been collected systematically, either geographically or seasonally. Its patterns of variation are, therefore, difficult to analyse and the present study can only attempt to outline the trends and problems.

The following seems to be the general pattern of variation. The birds from Bengal, nominate *vagabunda*, are of moderate size and richly

coloured. North-westward in the lower ranges of the Himalayas the birds remain generally dark, but there is a cline toward larger size which reaches its extreme in the westernmost Himalayas. From Bengal westward in the plains there is a trend toward paler coloration and larger size, but the extreme size of the north-west Himalayas is nowhere reached. South-westward the cline is toward paler and smaller birds, with the smallest birds of the sub-continent (*D.v. parvula*)[1] occurring on the west coast from Mangalore to Cape Comorin.

Blyth (1846, p. 30), the first to be aware of geographical variation in the species, described *pallida* from a specimen in a collection of birds purchased in Calcutta and said to have come from the 'Western Himalaya'. The form was described as differing from '*rufa*' (now nominate *vagabunda*) in its paler colouring and 'considerably smaller size'. The wing length was given as five and one half inches (140 mm.) and the tail as eight and three-quarter inches (222 mm.).

Ticehurst (1922, p. 537), in examining a large series of Indian treepies, mainly from the north, concluded that while *pallida* is distinguished from *vagabunda* by its paler colour, it is not much smaller, as Blyth noted, but is 'considerably larger'. He named Simla as the type locality for *pallida* and Calcutta as the type locality for *vagabunda*.

Ticehurst's assumption that Blyth erred in describing *pallida* as a small bird, and his designation of Simla as the type locality, seem to be two unfortunate errors.

Although Blyth's bird was said to have come from the Himalayas, his description fits *D. v. parvula* of the south-west coast, or possibly *D. v. vernayi* of southern and south-eastern India. Both these races are paler than nominate *vagabunda* and are smaller, with their size range encompassing the measurements (wing 140 mm. ; tail 222 mm.) given in the original description of *pallida*.

Designating Simla as the type locality of *pallida* compounded the error, since this falls within the range of a large and dark Himalayan population which ranges from the vicinity of Hazara District, or possibly somewhat farther north-west, south-eastward roughly to Dehra Dun.

While it seems probable that the type of Blyth's *pallida* was a specimen of the race now known as *parvula*, or possibly of *vernayi*, some element of doubt remains since it is impossible to be certain that Blyth's bird did not come from the 'Western Himalaya'. It could, conceivably, have been an unusually small specimen from the western lower foothills. I am, therefore, reluctant to shift the name *pallida* from the population

---

[1] Whistler & Kinnear (1932) described *parvula* as being much smaller than *vagabunda* but similar to it in colour. However, Abdulali (*in litt.*) informs me that the three specimens of *parvula* in the Bombay Natural History Society's collection are considerably paler than the nominate form, and in fact are very close to *pallida*. I have seen no specimens of *parvula*.

of the north-western region of the sub-continent, where it has been applied for more than 100 years, to either of the races of the south. The best course would appear to be to designate a new type locality for *pallida* since Simla, within the range of a large dark form in no way resembling *pallida*, certainly could not have been the provenance of Blyth's specimen. I hereby designate Galkund, Surat Dangs, as the type locality of *pallida*. This locality falls within the range of a moderate size, pale population much more nearly approaching Blyth's description.

The large, dark birds of the north-western Himalayas lack a name and for these I propose :

Dendrocitta vagabunda bristoli subsp. nov.

Type : Adult male, No. 185, 365, Museum of Comparative Zoölogy, Harvard College, Cambridge, Massachusetts, collected at Jabri (*c.* 11 miles west of Murree), alt. 900 metres, Hazara District, West Pakistan, by Raymond A. Paynter, Jr., 17 December 1958.

Diagnosis : The largest of the races of *D. vagabunda*, nearest to *pallida*, but with a considerably longer tail and a somewhat longer wing ; richly coloured, but slightly paler than the nominate form.

Range : Lower ranges of the westernmost Himalayas from Hazara District, West Pakistan, south-east to the vicinity of Dehra Dun, India.

Measurements : The wing and tail measurements of the type are 177.0 and 363.0 mm. respectively ; these measurements for two adult male topotypes are 174.0 and 342.0 mm., and 179.0 and 334.0 mm. The wings of three adult female topotypes are 174.0, 166.0, and 163.0 mm. ; the tails of the former two are 349.0 and 312.0 mm.

Remarks : The characters of the race are most pronounced at the north-western limit of its range, which probably is also the limit of the distribution of the species. To the west, south, and south-east there are marked clines toward the contiguous races *D. v. pallida* and *D. v. vagabunda*.

The race is named for Melvin Lee Bristol who, with enthusiasm and industry, did much to make the Harvard-Yale Expedition a success.

Specimens Examined : bristoli : 12 ♂, 10 ♀, and 4 ? from Jabri, Hazara Dist. ; Rawalpindi Dist. ; Jhelum Dist.; Kangra ; Simla ; and Dehra Dun. *pallida* : 28 ♂, 19 ♀, and 13 ? from ' plains near Ambala ' ; Lahore ; Keshapur ; Ludhiana ; Ferozepore ; Sargodha ; Surat Dangs ; Sirohi ; Kathiawar ; Junagadh ; Hyderabad (Sind) ; Khinjar Lake (Sind) ; Soneri Lake (Sind) ; and Kohat. *vagabunda* : 5 ♂, 6 ♀, and 1 ? from vicinity of Pokhara (central Nepal) ; Bastar Dist. ; Cachar ; and Sylhet Dist.

In addition to the above series, Humayun Abdulali sent me descriptions and measurements of 16 males and ten females, representing all

TABLE I

Measurements of adults of the races of *Dendrocitta vagabunda* on the Indian Sub-continent

Character	Race	Sex	No. of specimens	Mean	$S_{\bar{x}}$	Range
Wing (flattened)	*bristoli*	♂	12	169.9 mm.	2.1	157.0—179.0 mm.
		♀	7	163.8	1.5	158.0—174.0
	pallida	♂	38	161.3	0.8	149.0—172.5
		♀	28	153.5	1.0	144.0—165.0
	vagabunda	♂	13	153.6	1.6	146.0—168.0
		♀	7	153.5	1.1	136.5—161.0
	vernayi	♂	2	147.5	—	146.0—149.0
		♀	3	144.3	3.1	138.0—149.0
	parvula	♂	2	139.5	—	136.0—143.0
		♀	2	136.0	—	131.0—141.0
Tail	*bristoli*	♂	11	312.6	9.4	265.0—363.0
		♀	5	304.5	14.0	269.0—349.0
	pallida	♂	36	262.3	3.1	217.5—297.0
		♁	27	243.7	3.1	219.0—279.0
	vagabunda	♂	12	237.9	4.2	216.0—263.0
		♀	5	224.6	7.1	207.0—240.0
	vernayi	♂	2	211.5	—	200.0—223.0
		♀	2	188.0	—	187.0—189.0
	parvula	♂	1	184.0	—	—
		♀	2	202.0	—	201.0—203.0
Weight	*bristoli* (type locality)	♂	3	143.5 gm.	1.6	140.6—146.2 gm.
		♀	3	132.0	6.8	119.5—143.0
	vagabunda	♂	3	119.0	4.9	112.0—128.3
		♀	3	107.0	5.8	98.3—117.8

five of the sub-continental races, contained in the collections of the Bombay Natural History Society.

NUCIFRAGA CARYOCATACTES

In a review of the Himalayan races of the Nutcracker, Biswas (1950) states that *N. c. yunnanensis*, now considered a synonym of *macella* (*vide* Vaurie, 1954), could be differentiated from *hemispila* by its darker colour, smaller spots, and heavier bill. Vaurie (1959) distinguished *macella* from *hemispila* by these same characters, noting also that the frequency of spotting was reduced ; he omitted mention of a difference in bill size.

I concur that *yunnanensis* should be merged with *macella*, but I find *macella* a relatively weak race, not nearly so distinct from *hemispila* as would seem to be indicated by earlier workers. No difference in bill size is apparent in the 35 specimens of both races examined by me. Colour is an extremely variable character, as noted by Sanford & Mayr (1940), with pronounced seasonal changes, as well as foxing, obscuring any differences which might exist between the races. There remain as characters only the size and frequency of the spots. I agree that the spotting is heavier and more numerous in *hemispila* than in *macella*, although even these characters are variable.

Biswas (1950) believed that birds from Nepal, Sikkim, Darjeeling, Bhutan, south-eastern Tibet, northern Assam, and northern Burma were referable to *yunnanensis* (now *macella*), rather than to *hemispila* which has long been considered to range from about Kashmir eastward through the Himalayas. Vaurie (1959) followed Biswas in listing *macella* as the form from Nepal eastward. My eastern Himalayan material is limited to five fresh specimens from Darjeeling District ; these are definitely *hemispila*. Rand & Fleming (1957) referred their series of nine birds from central Nepal to *hemispila* also. Thus it appears, contrary to Biswas (1950) and Vaurie (1959), that *hemispila* occurs east at least to Darjeeling.

CORVUS MACRORHYNCHOS

C. m. intermedius, the race extending from Afghanistan through the Himalayas to Nepal, differs from *levaillantii*, the form of Assam, West Bengal, East Pakistan, the Andamans, Burma, and northern Thailand, in having a distinctly longer tail and shorter, thicker bill, and a somewhat longer wing (Table II). This follows the usual pattern wherein most montane races have longer wings and tails, and shorter bills (Allen's rule), than their lowland counterparts.

It is generally assumed that any intraspecific differences in the linear dimensions of the wings and tail reflect differences in body size (=weight). In other words, a long-winged, long-tailed race is presumed to be a heavier-bodied form than a short-winged, short-tailed race. While this assumption is valid in the majority of instances, an increase in body mass is not necessarily always accompanied by an increase in the length

of the wings and tail, or vice versa. The linear measurements of these appendages may remain relatively constant while body weight varies. This has been documented by Amadon (1943).

TABLE II

Measurements of adults of *Corvus macrorhynchos levaillantii* and *C. m. intermedius*

Character	Race	Sex	No. of specimens	Mean	S$\bar{x}$	Range
Wing (flattened)	*levaillantii*	♂	3	326.1 mm.	8.7	308–335 mm.
		♀	9	307.1	5.3	280–329
	intermedius	♂	7	335.9	3.9	320–349
		♀	10	323.9	2.9	309–338
Tail	*levaillantii*	♂	3	190.0	5.2	181–190
		♀	8	178.7	3.7	165–192
	intermedius	♂	6	219.2	4.7	199–241
			10	204.9	3.0	185–215
Culmen (from base)	*levaillantii*	♂	3	68.0	.6	67–69
		♀	9	62.2	.5	60–65
	intermedius	♂	7	60.7	.6	58–63
		♀	10	55.0	.8	50–59
Weight	*levaillantii*	♂	3	602.2 gm.	23.7	554.8–625.6 gm.
		♀	9	502.0	16.4	419.3–565.7
	intermedius	♂	7	522.4	15.1	460.4–582.3
		♀	10	456.3	9.6	392.0–495.1

The next step beyond a positive relation between wing and tail length and the body mass, or stage where there is no change in appendicular measurements while there is variation in weight, is that of a negative relation between weight and the size of the wings and tail. This is clearly demonstrated by a series of *C. m. intermedius* from East Pakistan and a series of *C. m. levaillantii* from central Nepal and from Swat, Kurram Agency, and Hazara District, West Pakistan (Table II). Here the long-winged, long-tailed montane race is distinctly smaller in body mass than the short-winged, short-tailed lowland form. The significance of this phenomenon is obscure. I am not aware of it having been documented before, but similar situations undoubtedly will be found when the weights of birds are better known.

Weights of some Corvidae

There are few data available on the weights of Asiatic birds, although this is an area of research of considerable interest and potential importance. Future students may find the following compilation of use :

Table III

Weights of adults of some Corvidae from the Indian Sub-continent

	Sex	No. of specimens	Mean	$S_{\bar{x}}$	Range	Locality
Garrulus glandarius interstinctus	♂	1	gr. 128.8	—	gr. —	Darjeeling Dist., India.
Garrulus lanceolatus	♂	7	103.5	1.7	97.2–108.5	Pokhara, Nepal; Kaghan Valley, Kurram Agency, and Swat, W. Pak.
	♀	4	96.9	2.7	90.8–103.0	
Urocissa flavirostris cucullata	♂	2	163.4	—	162.6–164.2	Vicinity Pokhara, Nepal; Kaghan Valley, W. Pak.
	♀	2	153.1	—	143.7–162.5	
Urocissa flavirostris flavirostris	♀	2	137.4	—	131.8–143.0	Darjeeling Dist., India.
Urocissa erythrorhyncha occipitalis	♂	3	214.7	8.2	205.0–231.1	Pokhara and vicinity Nepal.
	♀	2	201.5	—	195.8–207.2	
Cissa chinensis chinensis	♂	2	132.7	—	132.0–133.4	Pokhara, Nepal; Kalimpong Dist., India.
	♀	3	122.3	1.2	120.0–124.0	
Dendrocitta formosae occidentalis	♀	1	104.4	—	—	Hazara Dist., W. Pak.
Dendrocitta formosae himalayensis	♂	22	106.4	1.5	90.3–121.0	Pokhara and vicinity Nepal; Chittagong Hill Tracts, E. Pak.; Kalimpong Dist., India.
	♀	12	99.3	2.0	89.0–105.9	
Pica pica bactriana	♂	1	248.7	—	—	Kurram Agency, W. Pak.
	♀	5	203.0	4.6	190.3–211.7	
Nucifraga caryocatactes multipunctata	♂	1	190.7	—	—	Kaghan Valley and Swat, W. Pak.
	♀	3	159.1	5.7	147.8–165.4	
Nucifraga caryocatactes hemispila	♂	2	209.6	—	205.6–213.7	Darjeeling Dist., India.
	♀	2	183.8	—	183.3–184.3	
Pyrrhocorax graculus digitatus	♂	1	243.7	—	—	Kaghan Valley, W. Pak.
	♀	1	208.1	—	—	
Corvus monedula soemmerringii	♂	1	265.0	—	—	Kaghan Valley, W. Pak.
	♀	1	235.0	—	—	
Corvus splendens splendens	♂	2	336.0	—	310.0–362.1	Pokhara and vicinity Nepal; Sundarbans, E. Pak.
	♀	5	277.8	8.7	252.0–304.5	

REFERENCES

Amadon, Dean (1943) : Bird Weights as an Aid in Taxonomy. *Wilson Bull.* **55** : 164-177.

Biswas, B. (1950) : The Himalayan Races of the Nutcracker, *Nucifraga caryocatactes* (Linné) [Aves]. *J. Zool. Soc. India* **2** (1 &2) : 26.

Blyth, E. (1846) : Notices and Descriptions of Various New or Little Known Species of Birds. *J. Asiatic Soc. Bengal* **15** : 1-54.

Rand, Austin L. & Fleming, Robert L. (1957) : Birds from Nepal. *Fieldiana, Zoology*, **41** (1) : 1-218.

Sanford, J. K. & Mayr, Ernst (1940) : The Vernay-Cutting Expedition to Northern Burma. *Ibis* : 679-711.

Ticehurst, Claud B. (1922) : The Birds of Sind (Part I). *Ibis* : 526-572.

Vaurie, Charles (1954) : Systematic Notes on Palearctic Birds. No. 5. Corvidae. *Amer. Mus. Novit.*, no. 1668 : 23 pp.

— — (1959) : The Birds of the Palearctic Fauna. Passeriformes. London.

Whistler, H. & Kinnear, N. B. (1932) : The Vernay Scientific Survey of the Eastern Ghats (Ornithological Section). *J. Bombay nat. Hist. Soc.* **35** : 505-524.

Entomological Survey of Himalaya

Part XXVI. A Contribution to our Knowledge of the Geography of the High Altitude Insects of the Nival Zones from the North-West Himalaya[1]

PART 1

BY

M. S. MANI, D.Sc., F.L.S. and SANTOKH SINGH, Ph.D., F.R.E.S.

(With eleven text-figures)

I. INTRODUCTION

The zoogeographical considerations of the nival insect fauna from the north-west Himalaya, outlined here, are based on our four years' work in the School of Entomology, St. John's College, Agra. The nival insects belong to an ecologically specialized, cold-adapted, mountain-autochthone fauna, inhabiting the montane tundra beyond the timber line (Fig. 1), above an elevation of 3000 metres and extending to over 6000 metres above m.s.l. We have recently described the field ecology of these insects (100).

The earliest collections of the high altitude insects from the region were probably made by von Hügel (72). His collections, comprising several hundred species, were described by various specialists in Europe, like Kollar and Redtenbacher (80). The next important attempt at collecting in the region was undoubtedly by the Yarkand Political Mission. To Col. Stoliczka, the renowned geologist and naturalist of the Yarkand Mission, should really go the chief credit for discovering the wealth of insect life in these inaccessible and extremely inhospitable regions. His collections were described by various eminent European specialists (12, 13, 28, 107, 108, 125, 143). Guy Babault, the celebrated French naturalist, who travelled through Kangra, Kulu, and Lahaul valleys, through Ladakh and parts of Kashmir in 1914, brought back fairly large collections of high altitude species. The Orthoptera from his collections were identified by Uvarov (151). The large collection of Carabidae was described by Andrewes (2). The Curculionidae were worked out by Hustache (73) and the Histeridae by Desbordes (24). In recent years the Yale University North-India Expedition has also made valuable

[1] For parts I-XXIII see References Nos. 8-10, 51, 56, 77, 90-99, 101, 130-133, 136-140; part XXIV is appearing in *Proc. National Acad. Sciences, India*, and XXV in *Proc. Zool. Soc.*

collections of the high altitude insects, mainly from Ladakh (3, 21, 23, 74). Some collections of these insects were also made by the Italian Karakorum Expedition (14, 47, 48, 111) and by the German Nanga Parbat Expedition (34). A special study of the high altitude insects of the NW. Himalaya was initiated some years ago by the first author in

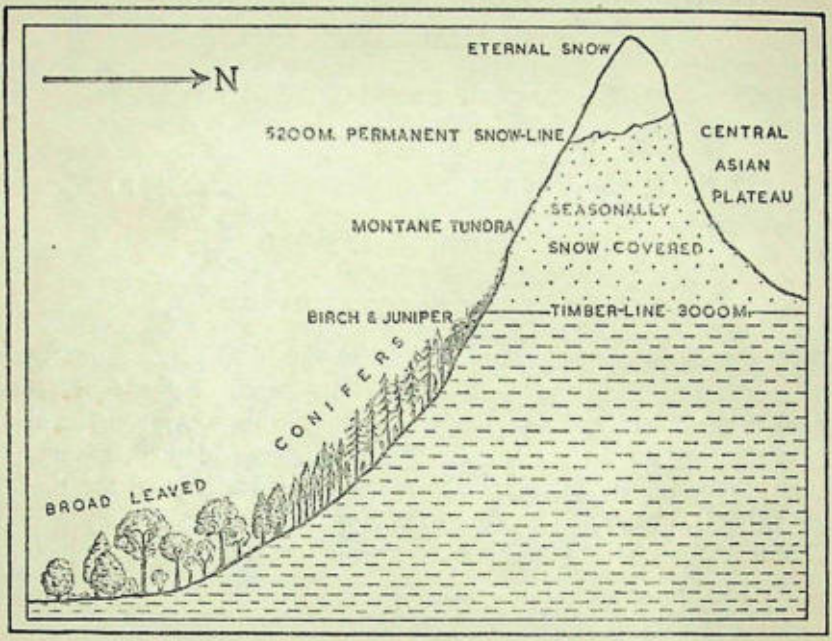


Fig. 1. A simplified diagram of the region of the north-west Himalaya, showing the zone of the montane tundra above an elevation of 3000 metres above mean sea level. This seasonally snow-covered zone is the home of the nival insect fauna. (*Not drawn to scale*).

the School of Entomology, St. John's College, Agra. The three entomological expeditions to the NW. Himalaya, organized and led by him, brought back over 15,000 specimens of large numbers of species of the nival insects. Some of the results of the work of the three expeditions have already been published (8, 9, 10, 51, 56, 77, 95-101, 130-140).

The localities from which the nival insects have so far been collected are listed below under the three natural drainage areas of the NW. Himalaya, viz. the Indus area, the Chenab-Beas area, and the Jhelum area (Fig. 2). In the following pages we have briefly discussed the known distribution of about 400 species so far found inhabiting the nival zones in the region. Although this represents a fraction of the total nival species still awaiting discovery, our account of the basic distributional patterns is not likely to be affected by future additions. The general pattern of distribution conforms to the known characters of high mountain fauna, but most of the peculiarities are more or less greatly

exaggerated in the case of the massive NW. Himalaya. Zoogeographical analysis shows a high degree of endemism and the great predominance of the Palaearctic faunal elements. Some of the limiting factors in the distribution of nival insects are briefly outlined. On the basis of the differences in the general species composition, the region is subdivided into three faunal provinces, which agree with the three natural drainage areas. The available evidence indicates mainly the Pliocene origin of endemism from an Angaran (central Asiatic) stock *pari passu* with the third major phase of the uplift of the NW. Himalaya and the Pleistocene survival of the nival species on nunataks. Some endemites have also risen during the Pleistocene and there are a few post-Pleistocene endemites also.

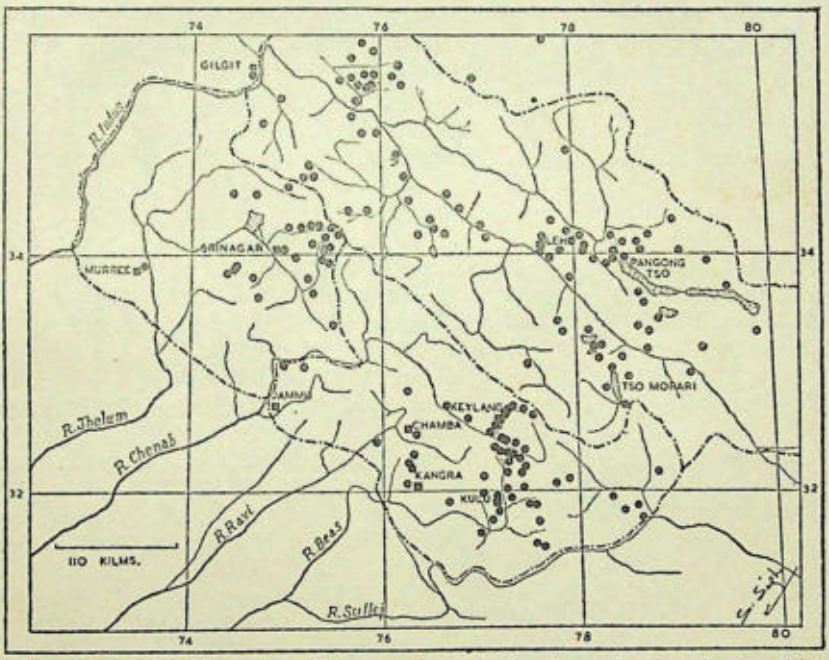


Fig. 2. Map of the region of the north-west Himalaya, showing the localities from which the nival insects have been collected so far.

ACKNOWLEDGEMENTS

We take this opportunity of expressing our cordial thanks to the members of the three entomological expeditions for their willing co-operation and team work. We are particularly indebted to the authorities of St. John's College, Agra, for facilities and encouragement. We are also grateful to the Agra University for part financial assistance for the expeditions. Our thanks are also due to various specialists for identification of the material. We are grateful to the authorities of the Carnegie Institution, Washington, U.S.A., for important literature.

LOCALITIES FROM WHICH NIVAL INSECTS HAVE BEEN COLLECTED

INDUS DRAINAGE AREA

1.	Alchori	.. Shigar Valley 75° 39′ E., 35° 32′ N.
2.	Anem La	.. Somewhat E. of NW. end of Pongong Tso, near 78° 45′ E., 34° N.
3.	Baltoro Glacier	.. 76° 15′ to 76° 30′ E., 35° 45′ N.
4.	Bao and Shaple	.. Near Shyok to NE. of Leh in Ladakh
5.	Bardumul	.. W. of Baltoro Glacier, 76° 1′ E., 35° 38′ N.
6.	Biaho Valley	.. Tributary of Shigar River flowing into Indus
7.	Boorgi Nulla	.. Tributary of R. Suru, S. of Skardu
8.	Braldo Valley (including Braldotal, Askole, Kro Brok and Dusu)	In Baltistan
9.	Burzil Chauki	.. In Deosi Plain, 75° 5′ E., 34° 50′ N.
10.	Chang Chenmo	.. Tributary of R. Shyok, N. of Pongong Tso
11.	Chang La	.. 77° 56′ E., 34° 3′ N.; E. of Leh in Ladakh
12.	Chhota Deosi	.. Between R. Dras and Boorgi Nulla
13.	Chongo Hot Spring	.. In Braldo Valley, 75° 48′ E., 35° 40′ N.
14.	Chusul	.. S. of Pongong Tso, 78° 40′ E., 33° 36′ N.
15.	Dakar	.. On Tibetan border in Ladakh
16.	Damb Guru	.. Somewhat to N. of E. end of Pongong Tso 78° 54′ E., 33° 58′ N.
17.	Daulad Begoldi	.. SE. of Karakorum Pass
18.	Deosi (Lalpani)	.. In R. Dras drainage area
19.	Digar Polu	.. On S. slope of Ladakh Range; NE. of Leh
20.	Doyan	.. Near Nanga Parbat on R. Astor, on route to .. Gilgit; 74° 48′ E., 35° 30′ N.
21.	Dumiltar	.. Glacier, E. of Punmah Valley and N. of Braldo Valley
22.	Dras	.. Between Zojila Pass and Kargil, on road to Leh in Ladakh; 75° 45′ E., 34° 25′ N.
23.	Ghulam Bagh	.. Near Chushod (also called Shushot), on left bank of R. Indus in Ladakh; 77° 44′ E. and somewhat north of 34° N.
24.	Gilgit	.. 74° 18′ E., 35° 58′ N.
25.	Igu	.. Right bank of R. Indus above Leh in Ladakh
26.	Kangral	.. About 13 km. E. of Mulbek
27.	Karbu	.. Near Mulbek in Indus Valley, Ladakh
28.	Kardong Pass	.. N. of Leh on Ladakh Range
29.	Kargil	.. On the left bank of R. Suru on road to Leh from Srinagar, in Ladakh
30.	Karpet	.. On S. shore of Pongong Tso, in Ladakh
31.	Kastet La	.. Between Mitpal Tso and Yaye Tso, in Ladakh; 78° 32′ E., 33° 23′ N.
32.	Kayann La	.. In Koh Lungpa Valley, between Leh and Shyok, Ladakh
33.	Khalatse	.. Between Kargil and Leh, right bank of R. Indus, .. Ladakh; 76° 53′ E., 35° 36′ N.
34.	Kushumul	.. Shigar Valley, 75° 35′ E., 35° 36′ N.
35.	Kutie Pass	.. N. of Karakorum Pass

36.	Kyam La and Kyam Hot Spring	Near E. of R. Chang Chenmo, N. of Tso Pongong
37.	Kyang La ..	SE. of the confluence of R. Chang Chenmo and R. Shyok, in Ladakh ; 78° 25′ E., 34° 9′ N.
38.	Kro Brok ..	Braldo Valley, about 8 km. E. of Chongo Hot Spring
39.	Lac Sale (Salt Lake), also called Tso Kar.	NW. of Tso Morari in Rupshu
40.	Leh ..	Capital of Ladakh on the right bank of R. Indus
41.	Lopsang Bransa ..	N. of the Baltoro Glacier ; 76° 18′ E., 35° 48′ N.
42.	Lukung ..	Somewhat N. of NW. end of Pongong Tso; 78° 23′ E., 34° N.
43.	Marsimik La ..	N. of NW. end of Pongong Tso ; 78° 40′ E., 34° 12′ N.
44.	Matyan ..	On road between Zojila Pass and Dras in Ladakh
45.	Mitpal Tso ..	S. of Pongong Tso, between Pangur Tso and Yaye Tso
46.	Mulbek ..	In Ladakh, 76° 25′ E., 34° 25′ N.
47.	Mundu ..	Mundu Glacier, S. of the Baltoro Glacier, near 76° 15′ E., 35° 45′ N.
48.	Mustag ..	N. of the Baltoro Glacier ; 76° 15′ E., 35° 50′ N.
49.	Nanga Parbat area, including Partabgarh and Chamura (German Nanga Parbat. Expedition Collections)	
50.	Nima Mud ..	On the right bank of R. Indus, below S. end of Pongong Tso in Ladakh
51.	Nurla ..	E. of Khalatse on the right bank of R. Indus ; 76° E., 35° 18′ N.
52.	Nyangtsu ..	Between Chang Chenmo and Pongong Tso ; 78° 50′ E., 34° 2′ N.
53.	Nyangri ..	78° 50′ E., 34° 2′ N.
54.	Olthingthang ..	Indus Valley, left bank of Suru tributary of R. Indus and near its confluence with the latter
55.	Ororotse Tso ..	S. of the confluence of Chang Chenmo and Shyok, in Ladakh ; 78° 28′ E., 34° 15′ N.
56.	Pango ..	Near to and somewhat W. of Mulbek in Ladakh
57.	Pongong Valley ..	NW. of Pongong Tso
58.	Parkutta ..	Indus Valley, E. of Skardu ; 75° 55′ E., 35° 5′ N.
59.	Peldo La ..	N. end of Tso Morari
60.	Phuga Hot Spring ..	N. end of Tso Morari ; 78° 20′ E., 33° 12′ N.
61.	Punmah Valley ..	Includes many localities like Shimtsa, Punmah Tal, Skiniltolmosa, Tsok, etc., N. of Braldo Valley
62.	Renka La ..	Between Mitpal Tso and Yaye Tso, S. of Pongong Tso.
63.	Saser La ..	Above Shyok, between and nearer to 78° than 77° E.
64.	Shaksgan Valley ..	N. of Karakorum Range
65.	Shakya La ..	Near Shyok, W. of Bao and to the N. of E. of Leh
66.	Shergol ..	About 8 km. W. of Mulbek
67.	Shera La ..	77° 88′ E., and 33° 55′ N.
68.	Shigar Valley ..	Opposite Skardu in Baltistan

69. Shimsha .. Suru Basin near Kargil
70. Skardu .. Indus Valley
71. Skoro La .. Baltistan, 75° 48′ E., 35° 33′ N.
72. Slope opposite Mulbe Gompa in Ladakh
73. Spitok (Pitok) .. Right bank of R. Indus and S. of Leh
74. Spring below Fotu La .. E. of Mulbek
75. Sta-rtsk-puk-Tso .. SE. Tso Kar.
76. Suru Basin .. Indus drainage area
77. Tagalang La .. 77° 45′ E., 33° 30′ N.
78. Tangyar .. NE. of Leh and S. of R. Shyok ; 77° 52′ E., 34° 15′ N.
79. Tankse to Chagra .. On R. Tankse, a feeder of R. Shyok, near Shyok ; 78° 10′ E., 34° 2′ N. and Chagra 78° 28′ E., 34° 5′ N.
80. Tankse to Mugleb .. About 10 km. E. of Tankse
81. Thla Brok .. Left bank of Braldo stream, 75° 52′ E., 35° 38′ N.
82. Thangman Tso .. East Ladakh
83. Tograma Tso .. Near Padam, 76° 52′ E., 33° 28′ N.
84. Tolti .. E. of Parkutta, 76° 5′ E., 34° 2′ N.
85. Tsak-shang and Tsak-ra .. On road from Tso Morari to Tso Kar in Rupshu
86. Tso Morari .. In Rupshu ; 78° 10′ E., 32° 30′ N.
87. Tso Nyak .. E. of Pongong Tso
88. Urdukas .. Near Baltoro Glacier ; 76° 17′ E., 35° 45′ N.
89. Widukas .. In Braldo Valley
90. Zarra .. S. of Tagalang La ; 77° 40′ E., 33° 15′ N.
91. Zaskar .. N. of main crest line of the Great Himalaya.

CHENAB-BEAS DRAINAGE AREA

1. Baijnath .. On road from Palampur to Jogendranagar on Dhauladhar Range, S. slope ; 76° 38′ E., 32° 2′ N.
2. Bahaura .. On right bank of R. Beas near and S. of Kulu (Sultanpur)
3. Baralacha La .. On Great Himalaya, main pass connecting Lahaul with Ladakh, with sources of Chandra on S. and Bhaga on N. ; 77° 27′ E., 32° 45′ N.
4. Batote .. On road from Jammu to Srinagar, S. of Banihal .. Pass ; 76° 15′ E., 33° 2′ N.
5. Bhabu Pass .. W. of Sultanpur (Kulu)
6. Chamba .. Upper R. Ravi Valley on N. slope of Dhauladhar Range
7. Chhatru .. Chandra Valley (Lahaul), opposite Hamta Gorge ; 77° 23′ E., 32° 20′ N.
8. Cimur .. Bhaga Valley (Lahaul) ; 77° 23′ E., 32° 20′ N.
9. Dalhousie .. On Dhauladhar Range ; 76° 8′ E., 32° 15′ N., in Gurdaspur Dt., Punjab
10. Dharamsala .. Kangra Dt., Punjab, on Dhauladhar Range ; 76° 20′ E., 32° 13′ N.
11. Dhauladhar .. N. of Dharamsala
12. Dhorni .. Upper Chandra Valley (Lahaul), between Koksar and Chhatru ; 77° 18′ E., 32° 22′ N.

13. Dibi Bokri and Runi Tach — In Spiti Valley
14. Gharry .. Parbati Valley (Punjab)
15. Gondhla .. Upper Chandra Valley (Lahaul), on road from Koksar to Keylang ; 77° 2′ E., 32° 30′ N.
16. Gramphu .. Upper Chandra Valley (Lahaul), below Rohtang Pass and in front of Kulti Nal ; 77° 15′ E., 32° 23′ N.
17. Hamta Gorge .. Upper Chandra Valley (Lahaul) after descent from Hamta Pass and E. of Chhatru, on Pir Panjal Range
18. Hamta Jot and Hamta Pass — Pir Panjal Range, on Manali-Kanzam La route, 77° 21′ E., 32° 17′ N.
19. Jalori Pass .. On route from Simla to Kulu, about 36 km. from the junction of Manali-Kulu road and Simla-Kulu road at Aut
20. Jibhi .. 6 km. from Jalori Pass toward Kulu
21. Kandi .. NE. of Mandi (a pass on way to Kulu)
22. Kangra .. Headquarters of Kangra District, Punjab (Kangra Valley)
23. Kareri Lake .. N. of Dharamsala on the S. slope of Dhauladhar Range
24. Keylang .. Capital of Lahaul Valley on R. Bhaga ; 77° 2′ E., 32° 35′ N.
25. Khoksar .. Upper Chandra Valley (Lahaul), below Rohtang Pass on road to Keylang
26. Kote .. Upper Beas Valley, on road from Manali to Rohtang Pass ; 77° 13′ E., 32° 20′ N.
27. Kulti Nal .. Chandra Valley (Lahaul), on Great Himalaya Range, N. slope, opposite Rohtang Pass, site of a large Pleistocene Valley Glacier, with the present Kulti Ice Fall or Seragru Ice Fall
28. Laka Pass .. On Dhauladhar Range N. of and above Dharamsala; 76° 23′ E., 32° 18′ N., on road to Chamba
29. Mandi .. On left bank of R. Beas on way to Kulu from Kangra
30. Manikaran .. Parbati Valley (Kulu Division), Hot Spring ; 77° 22′ E., 32° 2′ N.
31. Marhi .. Below Rohtang Pass on Pir Panjal
32. Naggar .. Beas Valley N. of Kulu on way to Manali
33. Namu .. On S. slope of Great Himalaya, in Upper Chenab Valley, below Baihali Jot Peak and near Triloknath ; 76° 53′ E., 32° 45′ N.
34. Nilang Pass .. Spiti
35. Pangi .. Sutlej Valley, N. of Chini on Hindustan Tibet road ; 78° 16′ E., 31° 36′ N.
36. Parbati Valley .. In Kulu Division, Punjab
37. Patseo .. Bhaga Valley (Lahaul) ; 77° 15′ E., 32° 45′ N.
38. Peak W. of Rohtang Pass (Beas Rikhi Peak) .. 77° 14′ E., 32° 22′ N.
39. Pir Panjal Range opposite Kulti Nal
40. Pulga .. At the end of the Parbati Valley

41.	Purana Khoksar Nal	.. In Great Himalaya, above Chhatru, Upper Chandra Valley, with Sonapani Glacier and Seri Ice Fall
42.	Ramban	.. River Chenab on way to Srinagar from Jammu.
43.	Rahla	.. Upper Beas Valley below Rohtang Pass; 77° 12′ E., 32° 20′ N.
44.	Rohtang Pass	.. On Pir Panjal Range on way to Lahaul and Keylang from Manali; 77° 15′ E., 32° 23′ N.
45.	Runang and Hungrung Pass	In Spiti drainage area
46.	Rohtang Valley	.. Upper Beas Valley; source of R. Beas; on the S. slope of Pir Panjal Range
47.	Seraj	.. Kulu area N. of Larji
48.	Sidu	.. Chandra Valley (Lahaul); 77° 8′ E., 32° 22′ N.
49.	Solang Valley	.. W. of Manali in Kulu Valley
50.	Sumdeo	.. Bhaga Valley (Lahaul); 77° 13′ E., and 32° 40′ N.
51.	Tandi	.. At the confluence of Bhaga and Chandra, in Lahaul Valley; 76° 58′ E., 32° 34′ N.
52.	Taulin Pass to Shipki Pass	.. In Spiti drainage area
53.	Tchary-Joni	.. End of the Parbati Valley in Kulu Division of Punjab.
54.	Thirot	.. Upper Chenab Valley; 76° 47′ E., 32° 39′ N.
55.	Tsho-Ti	.. End of Parbati Valley
56.	Zingzingbar	.. Bhaga Valley (Lahaul); 77° 20′ E., 32° 48′ N.

JHELUM DRAINAGE AREA

1.	Apharwat	.. S. of Khilanmarg, on Pir Panjal Range (Kashmir)
2.	Baltal	.. Near and somewhat E. of Sonemarg in the Sind Valley (Kashmir)
3.	Gagarbal	.. Between Kangan and Sonemarg in the Sind Valley
4.	Gond	.. Sind Valley; 75°-5′ E., 34° 18′ N.
5.	Goorai Valley	.. N. of Tragbal Pass (Kashmir)
6.	Gulmarg	.. Kashmir, 74° 55′ E., 34° N.
7.	Kangan	.. Sind Valley; 74° 55′ E., 34° 18′ N.
8.	Khilanmarg	.. On Pir Panjal Range near Gulmarg, Kashmir, approximately about 74 °25′ E., 34° N.
9.	Kolahoi Glacier	.. Kashmir; 75° 25′ E., 34° 10′ N.
10.	Lake Vishnshar	.. Near and N. of Avantipur, Kashmir, on route to Srinagar
11.	Liddar Valley	.. Kashmir, Liddar tributary of R. Jhelum
12.	Liddarwar	.. S. of Kolahoi Glacier
13.	Prang	.. Sind Valley, near Sonemarg
14.	Razdhingan	.. Near Sonemarg
15.	Sintan Pass	.. E. of Verinag; 75° 35′ E., 33° 30′ N.
16.	Sonemarg	.. 75° 18′ E., 34° 20′ N.
17.	Songam	.. Sind Valley
18.	Srinagar	.. Kashmir Valley; 74° 35′ E., 34° 2′ N.
19.	Tragbal Pass	.. 74° 40′ E., 34° 30′ N.
20.	Yusimarg	.. E. of Gulmarg on S. slope of Pir Panjal Range
21.	Zoji La	.. On road to Leh from Srinagar; 75° 30′ E., 34° 20′ N.

II. The Nival Insect Fauna

Nearly 400 species, belonging to 14 orders, occur above an elevation of 3000 metres. The number of species and their percentage abundance in different orders are summarized in Table I (Fig. 3).

Table I

Analysis of abundance of species of different Orders of the nival insect fauna

Serial No.	Order	Number of species	Percentage
1.	Plecoptera ..	5	1.27
2.	Odonata ..	4	1.01
3.	Orthoptera ..	14	3.30
4.	Dermaptera ..	3	0.76
5.	Heteroptera ..	17	4.50
6.	Homoptera ..	1	0.25
7.	Coleoptera ..	186	48.80
8.	Hymenoptera ..	36	8.10
9.	Neuroptera ..	1	0.25
10.	Trichoptera ..	11	2.50
11.	Lepidoptera ..	91	22.60
12.	Diptera ..	7	1.70
13.	Thysanura ..	3	0.76
14.	Collembola ..	15	3.80

Total number of nival species = 394

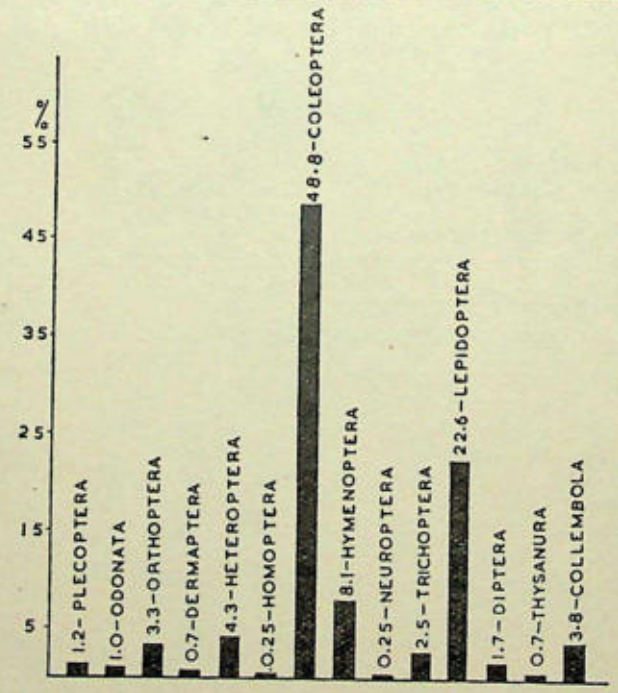


Fig. 3. The total nival insects from the north-west Himalaya.

About half the known nival species belong to Coleoptera and nearly one-fourth to Lepidoptera. Though the Diptera, so far described from the region, seem to constitute less than 2.0% of the total nival insects, the order is however extremely abundant, especially at extreme high altitudes. Recent experience of the three entomological expeditions (100) has shown that no less than 300 undescribed species exist above the timber line. Diptera should eventually surpass Coleoptera and prove to be the most abundant of nival insects. Except Collembola, the remaining orders represent minor taxonomic elements of the nival insect fauna.

The distribution and zoogeographical analysis of the different orders of nival insects are discussed below.

PLECOPTERA

Although several species of stoneflies are widely distributed, often at great elevations and close to the permanent snow line (100), throughout the NW. Himalaya, a relatively small number of species has so far been identified and described. Among the species listed below endemism is high, viz. 80%. They are localized in the drainage area of the Chenab-Beas system. The species belong to well-known Holarctic genera of Tertiary origin. We do not at present know anything about the Plecoptera of the mountain ranges drained by the Indus.

Nemouridae

*1. **Capnia manii** Jewett
Localities : Beas Valley, near Marhi 3352 m., Marhi 3657 m.

*2. **Nemoura (Nemoura) cordata** Jewett
Localities : Gramphu 3352 m., Chandra Valley 3352-3657 m.

*3. **Nemoura (Nemoura) punctata** Jewett
Localities : Gramphu 3657 m., Beas Valley near Marhi 3352 m.

*4. **Nemoura (Nemoura) punjabensis** Jewett
Localities : Chhatru 3352-3657 m., Rahla 2743 m., in Beas 3.5 km. below Rahla 3048-3352 m., Kulti Nal 3535 m., Gramphu 3657 m., Dhorni 3657 m., Pir Panjal Range opposite Kulti Nal 3657 m., Rohtang Pass 3962 m.

5. **Rhabdiopteryz lunata** Kimmins
Localities : Kulti Nal 3535 m., Chhatru 3500 m., Hamta Jot 4420 m., Kulu Valley.
Other Distribution : Rongbuk (Tibet) 5028 m., Everest Base Camp, Rongbuk Glacier.

---

*Throughout this paper the species marked with an asterisk are endemites.

ODONATA

Though our knowledge of this order occurring in the region is at present very incomplete, there seems to be little doubt that the dragonflies are unimportant minor elements in the nival insect fauna of the north-west Himalaya. As may be expected, endemism is rather very low. All the known species seem to be localized in the drainage areas of Jhelum and Chenab-Beas. Outside the NW. Himalaya, they are widely distributed in the Holarctic Realm (Fig. 4). As explained in our paper on the field ecology of the nival insects (100), the specializations of the Odonata do not seem to harmonize with the general ecologic conditions in the biome of the montane tundra of the NW. Himalaya.

Coenagriidae

1. Enallagama cyathegerum Charp.
   Localities : Kashmir 3000 m.
   Other Distribution : Central Asia, Tibet, Europe, N. America.

Libellulidae

2. Libellula quadrimaculata Linn.
   Localities : Yusmarg 3040 m., Gulmarg.
   Other Distribution : Lahsa, Europe, Central and N. Asia, Japan, N. America.

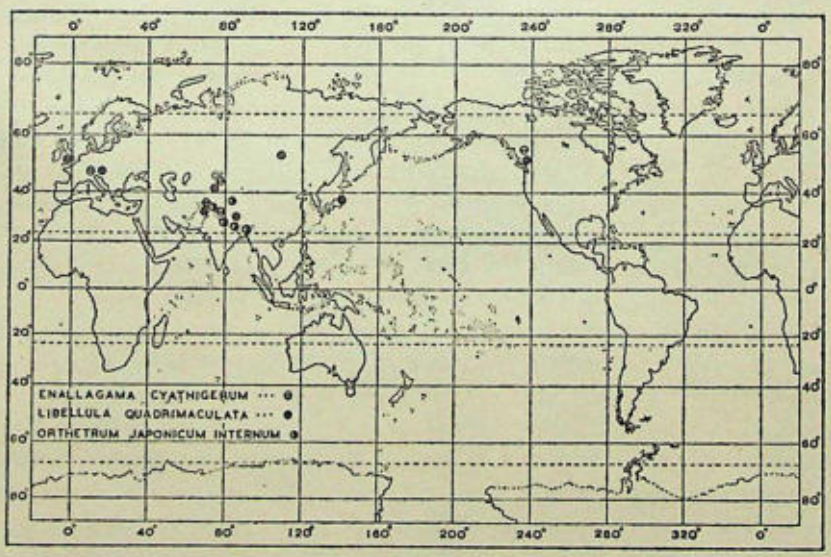


Fig. 4. The world distribution of the non-endemic nival Odonata from the north-west Himalaya.

3. **Orthetrum japonicum internum** MacLach.
Localities : Kashmir 3000 m.
Other Distribution : The Himalayan districts of Bengal, Nepal, Tibet, SW China, Assam.

*4. **Sympatrum tandicola** Santokh
Localities : Upper Chenab Valley near Tandi 3352 m.

ORTHOPTERA

This order constitutes about 3.3% of the total nival insect fauna (Table I, fig. 3) and comprises mostly Acrididae. Nearly 71% of the species are endemic. The Palaearctic elements constitute about 85.5% (Table X). There are several Mediterranean forms like *Sphingonotus* and *Oedipoda*. The central Asian elements are represented by four species of *Gomphomastax*, a genus which Uvarov (151) believes to have derived from ancient tropical and subtropical Eumastacinae. *Sphingonotus rubescens* (Walk.) (Fig. 5) is also known from Pamir, Persia, Baluchistan, Arabia, Palestine, Egypt, Lebanon, Sahara, Greece, Sardinia, and Canary Islands. Outside the NW. Himalaya, *Sphingonotus savignyi* Sauss. (Fig. 5) occurs also in Sind and N. Africa. The genus *Sphingonotus* does not seem to inhabit very high elevations. *Metrioptera* is also common in Pamir, Alai, and other Turkestan mountains. *Bryodema luctuosa* (Stoll.) is an endemic species, but the genus *Bryodema* is known from Mongol-Tibetan border mountains and represents the Manchurian or the east-Asian South Palaearctic component of the nival insects of the region. *Conophyma mitchelli* Uvarov is an extremely interesting endemite. The genus *Conophyma* is also a central Asian form, with 13 species from Pamir (106) and other neighbouring Turkestan mountains (Fig. 6). Two other endemic species, *Dicranophyma hingstoni* Uvarov and *D. babaulti* Uvarov, also often occur near the timber line on the north slopes of the Great Himalaya in the Nanga Parbat area and seem to represent ecologically transitional forms. It must be observed that the genus *Dicranophyma* is itself endemic. The Indo-Malayan element is represented by *Aularches punctatus* (Drury) (Fig. 5), which often occurs at elevations of nearly 4800 m. above m.s.l. Though the great bulk of the species of Orthoptera from the NW. Himalaya seem to be generally localized at elevations of about 3500 m., the maximum altitudinal record of 5000 m. above m.s.l. is reached by the Tettigonid *Hyphinomus fasciata* Uvarov. The majority of the Palaearctic species, especially the central Asian forms, are generally localized north of the main crest line of the Great Himalaya Range and the Mediterranean forms are similarly mostly localized in areas to the south of this crest line. The zoogeography of some of the more common high altitude Orthoptera from the NW. Himalaya has recently been discussed by Uvarov in a series of short papers (146-157).

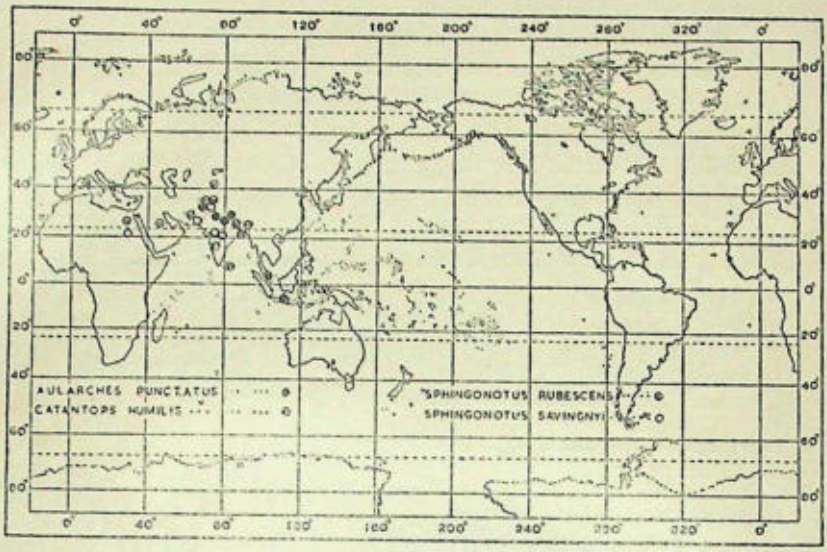


Fig. 5. The world distribution of the non-endemic nival Orthoptera from the north-west Himalaya.

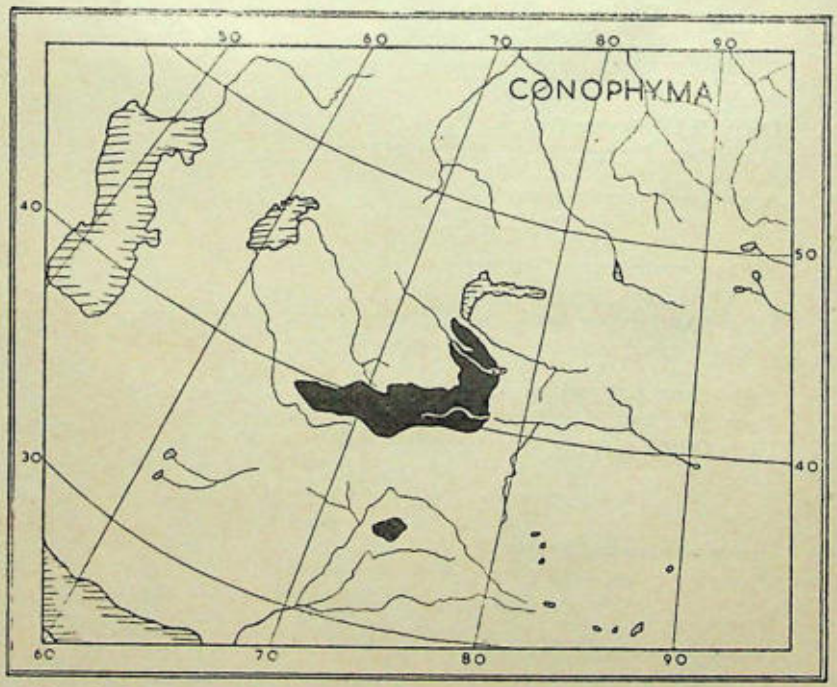


Fig. 6. The area of endemism (shaded black) of *Conophyma*, comprising central Asia and the north-west Himalaya.

Acrididae

1. **Aularches punctatus** (Drury)
   Localities : Kashmir, about 3000 m.
   Other Distribution : Tibet, Nepal, Garhwal, Malaya, Java.

*2. **Bryodema luctuosa** (Stoll.)[1]
   Localities : Tso-Morari 4520 m.

3. **Catantops humilis** (Serville)
   Localities : Spiti, Gharry, about 300 m.
   Other Distribution : Sikkim, Assam, Calcutta, Bombay, Ceylon.

*4. **Conophyma mitchelli** Uvarov
   Localities : Srinagar 3350-3960 m.

*5. **Dicranophyma hingstoni** Uvarov
   Localities : Astor District about 3000 m.

*6. **Dicranophyma babaulti** Uvarov
   Localities : Gond about 3000 m.

*7. **Gomphomastax bolivari** Uvarov
   Localities : Tragbal Pass 3200 m.

*8. **Gomphomastax antennatus** Brunner
   Localities : Tragbal Pass 3200 m.

*9. **Gomphomastax disparilis** Uvarov
   Localities : Tragbal Pass 3200 m.

*10. **Gomphomastax** sp.
   Localities : Tso-Morari 4540 m.

*11. **Oedipoda himalayana** Uvarov
   Localities : Doyan 2440 m., Mulbek 4420 m.

*12. **Spathosternum prasiniferum** (Walker)
   Localities : Tragbal Pass 3200 m.

13. **Sphingonotus rubescens** (Walker)
   Localities : Leh, 3440 m.
   Other Distribution : Baluchistan, Arabia, Persia, Palestine, Lebanon, Egypt, Sahara, Greece, Sardinia, Canary Is., and Pamir.

14. **Sphingonotus savingnyi** Sauss.
   Localities : Ladakh 3500 m.
   Other Distribution : Sind, central and western India, North Africa.

Tettigonidae

*15. **Hyphinomus fasciata** Uvarov
   Localities : Dakar (Ladakh-Tibet border) 4572-4876 m.

*16. **Metrioptera** sp.
   Localities : Tragbal Pass 3200 m.

---

[1] *Bryodema inda* Sauss. is recorded from Dakar on Tibet border. We have not seen specimens of this species and, in the absence of fuller data, we are not including this species here.

DERMAPTERA

This order is represented by three species of the typically Palaearctic genus *Anechura*, belonging to the mountain-inhabiting Anechurinae. The genus *Anechura* occurs in N. and central Asia and Europe. *Anechura zubovskii* Sem. occurs north of the main crest line of the Great Himalaya in the area drained by River Indus and the remaining two species seem to be localized in the areas south of the crest line in the Chenab-Beas drainage slopes. According to Burr (17), *Anechura zubovskii* Sem. is a local subspecies of *Anechura bipunctata* Sem., the typical form of which is known from Pyrenees, Alps, and the Balkan Mountains. In Crimea, Persia, and the Caucasus the subspecies *orientalis* seems to be common, *Anechura zubovskii* Sem. is also known from western parts of Tibet.

Forficulidae

*1. **Anechura bipunctata pirpunjalae** Santokh
Localities : Khoksar 3657 m., Marhi 3657 m., Kulti Nal 3530 m., Hamta Jot 4440 m.

*2. **Anechura himalayana** Santokh
Localities : Khoksar 3657 m., Marhi 3657 m., Rahla 2745 m.

*3. **Anechura zubovskii** Semenov
Localities : Ladakh, Kashmir, 3500 m., road from Srinagar to Gilgit.

HETEROPTERA

This order constitutes about 4.5% of the total nival insect fauna of the region (Table I, fig. 5) and comprises mostly Lygaeidae. The species endemism amounts to nearly 65% and there are also two endemic genera *Dolmacoris* Hutchinson and *Tibetocoris* Hutchinson. The Palaearctic elements constitute nearly 94% and are largely represented by central Asian and North Palaearctic forms (Table X). *Bianchiella adelungi* Reut. represents the Manchurian element of the nival Heteroptera from the region. *Lamprodema brevicollis* Fieb., known from Dalmatia (Europe), appears to contribute the Mediterranean element (Fig. 7). The distribution of *Microplax hissarensis* Kiritsch. is shown in Fig. 7. *Nysius ericae* (Schill.), found commonly in the high elevations of the NW. Himalaya, is also known to occur in Pamir, Alai mountains, Astrakhan, Turkestan mountains, Taurus mountains, central Russia, Algeria, mountains of Yugoslavia, Rumania, Hungary, Austria, Switzerland, Belgium, and Germany (Fig. 8). The genus *Nysius* is widely distributed (Fig. 9) in Pamir and other Turkestan mountains, central Asiatic mountains, Mongolia, Japan, Mt. Everest area of the Himalaya, Greenland, Alaska, Egypt, Caucasus, Alps, Pyrenees, Syria, Canary Islands, Germany, France, Belgium, Holland, Hungary, Lapland, and Leningrad area.

The pentatomid *Phimodera rupshuensis* Hutchinson, occurring at an elevation of 4520 m. above m.s.l., is an interesting endemic. The genus *Phimodera* is widely distributed (Fig. 10) in central and N. Asia and in Europe. *Chlamydatus pachycerus* Kiritsch. is an interesting species which has been reported from the Mt. Everest area in the E. Himalaya. The genus is distributed (Fig. 11) in Caucasus, Siberia, Mongolia, Alaska, Greenland, Canada, Europe, and Algeria. The only Indo-Malayan form is the apterous Aradidae *Brachyrhynchus tagalicus* (Stoll.), confined to the birch-juniper zone at the edge of the taiga on the Pir Panjal Range, in the area drained by Chenab-Beas system. This species is ecologically and geographically a transitional form.

Four of the species are confined to an elevation of 3500 m. above m.s.l. and five each above 4000 m. and 5000 m. *Nysius ericae* (Schill.) occurs from an elevation of 3500 m. to nearly 5200 m. and *Nysius ericae alticola* Hutchinson occurs as high as 5365 m., which at present represents the maximum altitude record for Heteroptera in the NW. Himalaya.

Nearly 94% of the known species are localized in the area drained by River Indus, north of the crest line of the Great Himalaya.

Some of the peculiarities of the distribution of the high altitude Heteroptera from the NW. Himalaya and the neighbouring regions are discussed by Hutchinson (74), Oshanin (114), Kiritschenko (78, 79), and Reinig (123).

Pentatomidae

*1. **Phimodera rupshuensis** Hutchinson
Localities : Peldo la near north end of Tso-Morari 4520 m.

Coreidae

*2. **Stictopleura** sp.
Localities: Tsak-Shang and Tsak-ra, road from Tso-Morari to Tso-Kar 4570 m.

Lygaeidae

3. **Bianchiella adelungi** Reuter
Localities : Igu in the Indus Valley above Leh, 3400 m.
Other Distribution : North China, Mongolia, Siberia.

*4. **Dolmacoris deterrana** Hutchinson
Localities : Nying-ri and Chungang La, 5120-5180 m.

*5. **Emblethis horvathiana** Hutchinson
Localities : Renka-la 5580 m., between Mitpal-Tso and Yaye Tso.

6. **Lamprodema brevicollis** Fieb.
Localities : Tanktze to Chagra, Pongong Valley 4270 m., Ladakh.
Other Distribution : Dalmatia (Europe).

7. **Nysius ericae** (Schill.)
Localities : Leh 3440 m., Tsak-shang north of Tso-Morari 4570 m., Kayam La 4880 m., Koh Lungpa Valley 4880 m., Renka La between Mitpal Tso and Naye Tso 5180 m., and Ororotse Tso.
Other Distribution : Central Asia, Pamir.

*8. **Nysius ericae alticola** Hutchinson
Localities : Ororotse Tso 5280 m., Kyang La 5000-5300 m.

9. **Microplax hissarensis** Kiritschenko
Localities : Between Tsak-shang and Tsak-ra, road from Mitpal Tso to Tso Kar 4572 m.
Other Distribution : North Bukhara.

Aradidae

10. **Brachyrhynchus tagalicus** (Stoll.)
Localities : Pir Panjal Range, Chandra Valley near Gramphu 3657 m.
Other Distribution : Burma, Java, Philippines.

Anthocoridae

*11. **Anthocoris gyalpo** Hutchinson
Localities : Leh 3500 m.

*12. **Ectemnus paradoxus** Hutchinson
Localities : Igu in Indus Valley above Leh 3500 m.

Miridae

*13. **Chlamydatus pachycerus** Kiritschenko
Localities : Shakya La 5180 m., Kyang La 5120-5330 m., Ororotse Tso 5300 m. Marsimik La 5300 m., Kyam La 4730 m., Nyangtzu 4660 m., Paldo La north of Tso Morari 4520 m., Tsak-Shang.
Other Distribution : Southern Tibet ; Mt. Everest area Eastern Himalaya 4110-5030 m.

*14. **Dicyphus physochlaenae** Hutchinson
Localities : Damb Guru 4620 m.

15. **Dicyphus senggae** Hutchinson
Localities : Between Tankse and Mugleb 4175 m.

*16. **Tibetocoris margaretae** Hutchinson
Localities : Chang Chenmo near Pamzal 5180-5270 m., Nying-ri 5120 m., Chungang La 5300 m., Kakstet La 5365 m.

Saldidae

*17. **Chiloxanthus alticola** Kiritschenko
Localities : Bulaki-Murghai between Depsang and Tshangtsha, Shyok 4255 m.

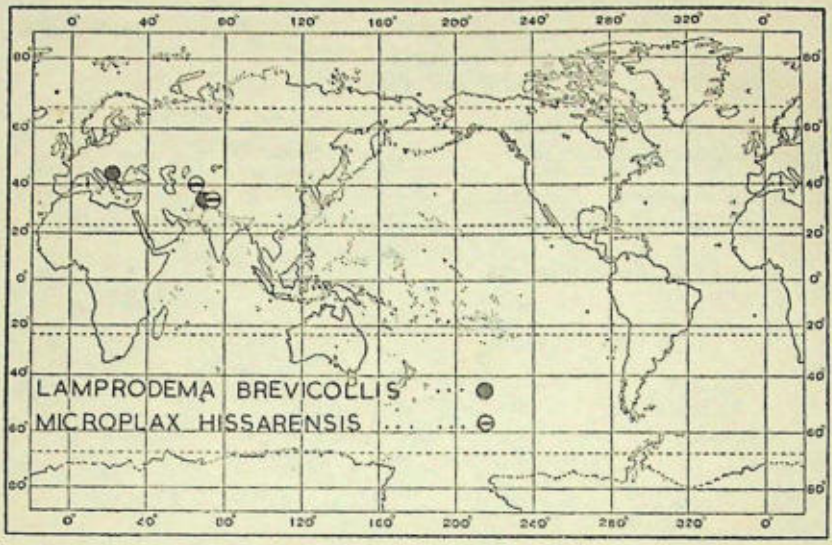


Fig. 7. The world distribution of two non-endemic nival species of Heteroptera from the north-west Himalaya.

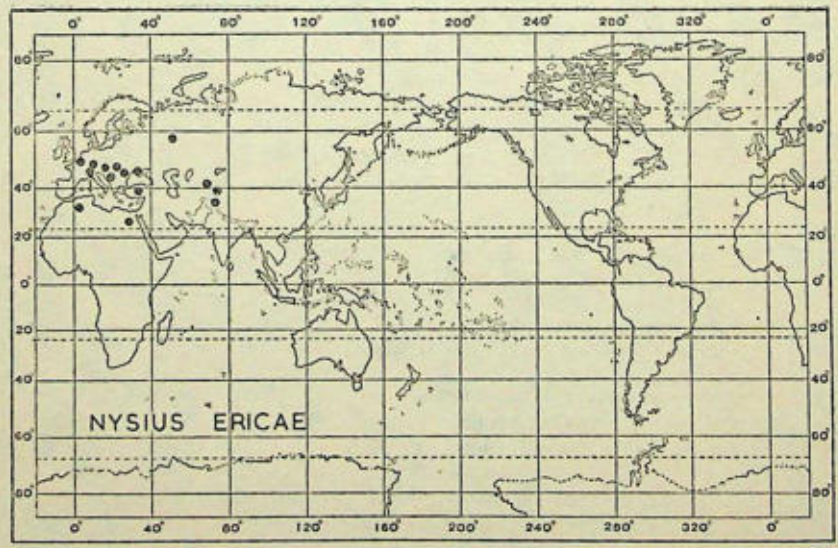


Fig. 8. The world distribution of *Nysius ericae* (Schill.)

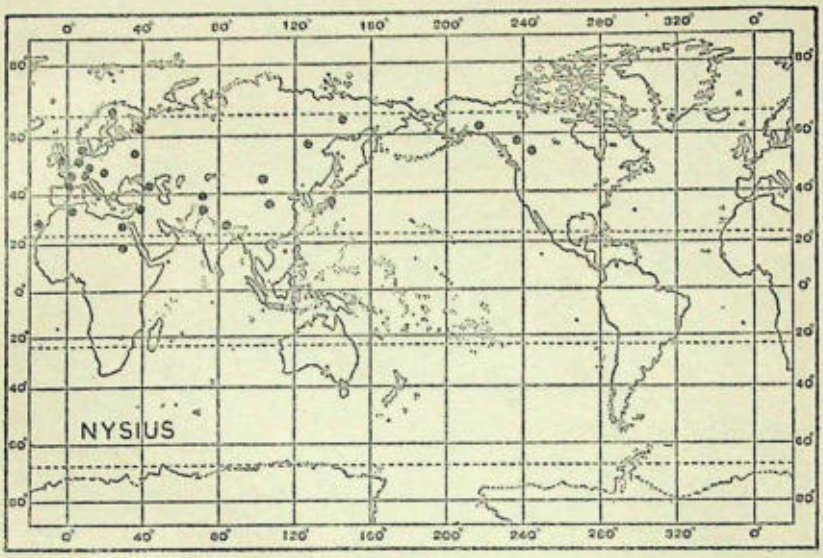


Fig. 9. The world distribution of the genus *Nysius*.

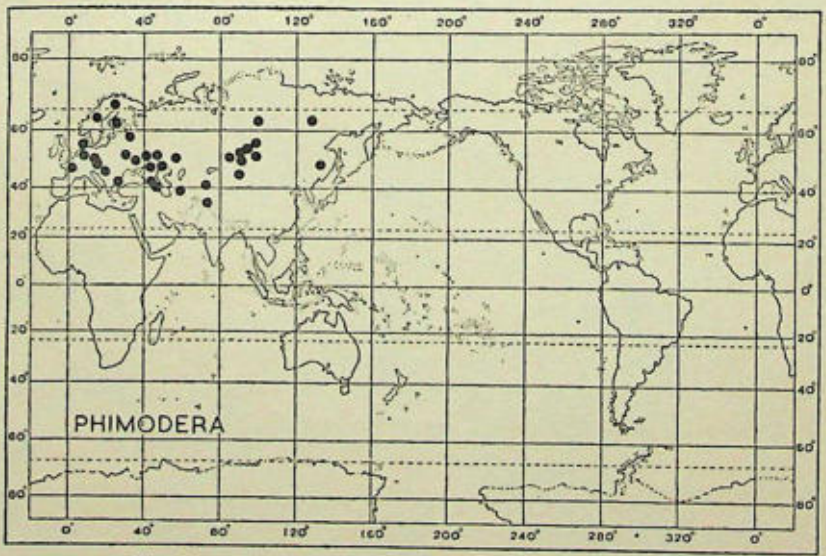


Fig. 10. The world distribution of the genus *Phimodera*.

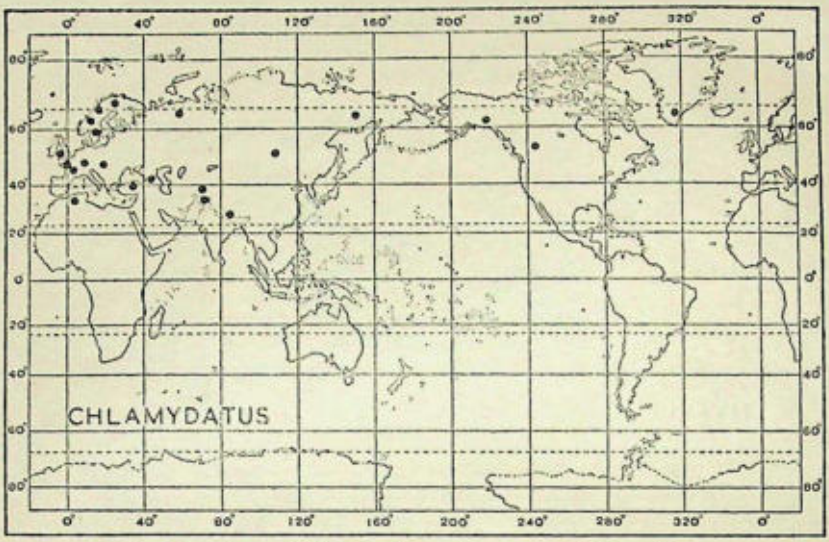


Fig. 11. The world distribution of the genus *Chlamydatus*.

HOMOPTERA

This order is represented by *Poophilus costalis* (Walk.) (Cercopidae). It is a widely distributed species found in other parts of Himalaya, Calcutta, Bombay, Karachi, Ceylon, Singapore, S. and W. Africa. In the NW. Himalaya the species has been collected from Dras 3100 m., Kargil 2740 m., and Leh 3440 m.

(*To be continued*)

The Flora of Parlakimedi and its immediate Neighbourhood

PART II

BY

K. S. SRINIVASAN AND G. V. SUBBA RAO
Industrial Section, Indian Museum, Calcutta

[*Continued from Vol.* 58 (1) : 170]

COMPOSITAE

Vernonia cinerea Less.
Parlakimedi.

Elephantopus scaber Linn.
Parlakimedi.

Grangea maderaspatana Poir.
Parlakimedi.

***Ifloga** sp. (Only one species reported by *Hooker* from Upper Gangetic Plains—*Ifloga fontanesii* Cass.)
Parlakimedi.

Blainvillea sp. (Only one species *rhomboidea* Cass. was reported by *Hooker & Gamble*)
Parlakimedi.

Bidens pilosa Linn.
Parlakimedi : in rocky jungles near the top of the hill. *Burkill, Grant & Candler* 20477, Sept. 1903.

Glossogyne pinnatifida DC.
Patapatnam : rare. *Burkill* 20500, Sept. 1903.

Tridax procumbens Linn.
Parlakimedi : very common.

CAMPANULACEAE

***Campanula canescens** Wall.
A weed in the crops of millets etc.
Devagiri, Parlakimedi. *Burkill* 17968, Dec. 1902.

PLUMBAGINACEAE

Plumbago zeylanica Linn.
Peddalogidi, *Burkill, Grant & Candler* 20587, Sept. 1903.

MYRSINACEAE

***Ardisia humilis** Vahl.

Vern. Bontu (S.)
Parlakimedi. *Corey* 20150, 1903.

SAPOTACEAE

Madhuca indica Gmel. (*Bassia latifolia* Roxb.)

Vern. Aba (S.) ; Ippa chettu (T.)
Parlakimedi. *Burkill, Grant & Candler* 20525, Sept. 1903. 610 m. *Corey & Ramamurthy* 20112, Sept. 1903.

EBENACEAE

Maba buxifolia Pers.

Parlakimedi : in sandy areas in low hill jungles. *Burkill, Grant & Candler* 20425, Sept. 1903.

Diospyros tomentosa Roxb.

Parlakimedi : in jungles in valleys. *Burkill, Grant & Candler* 20527, Sept. 1903.

APOCYNACEAE

Carissa spinarum A.DC.

Parlakimedi : on sandy strips. *Burkill, Grant & Candler* 20527, Sept. 1903.

Thevetia peruviana (Pers.) Schum. (*Thevetia nereifolia* Juss. ex Steud.)

Parlakimedi : planted.

***Rauvolfia canescens** Linn.

Parlakimedi : in jungles in the valleys. *Burkill, Grant & Candler* 20550, Sept. 1903.

***Alstonia neriifolia** Don.

Parlakimedi : in rocky jungles. *Burkill & Candler* 17986, Dec. 1902 ; *Burkill Grant & Candler* 20485, 20572, Sept. 1903.

Holarrhena antidysenterica Wall.

Parlakimedi : abundant in low jungles. *Burkill, Grant & Candler* 20493, 20566, 20567, Sept. 1903.

ASCLEPIADACEAE

Hemidesmus indicus R. Br.

Vern. Eriji (S.) ; Sugandhu chettu (T.)
Parlakimedi : 915 m. *Burkill* 20132, Sept. 1903.

***Cryptolepis grandiflora** Wight

Parlakimedi. *Burkill & Candler* 17987, Dec. 1902.

Cryptolepis elegans Wall.

Parlakimedi. *Burkill, Grant & Candler* 20430, Sept. 1903.

Calotropis procera Br.

Parlakimedi. *Burkill, Grant & Candler* 20554, Sept. 1903.

Pergularia daemia (Forsk.) Chiov. (*Daemia extensa* R. Br.)

Parlakimedi : common in the valleys. *Burkill, Grant & Candler* 20546, Sept. 1903.

***Tylophora pauciflora** W. & A.

Ramasagaram : on the bund. *Burkill, Grant & Candler* 20535, Sept. 1903.

Ceropegia tuberosa Roxb.

Parlakimedi : in low jungles. *Burkill & Candler* 20402. Sept. 1903.

Caralluma adscendens Br.

Parlakimedi : very common among rubble. *Burkill* 20499, Sept. 1903.

GENTIANACEAE

Canscora decussata Roem. & Sch.

Devagiri : in thin jungles. *Burkill & Candler* 17936, Dec. 1902.

BORAGINACEAE

* **Cordia myxa** Linn.

Vern. Bari (S.) ; Nakkare chettu (T.)
Parlakimedi. *Corey* 20173, 1903.

Ehretia microphylla Lamk. (*Ehretia buxifolia* Roxb.)

Parlakimedi : very common. *Burkill, Candler & Grant* 20495, Sept. 1903.

Trichodesma indicum Br.

Parlakimedi.

CONVOLVULACEAE

Evolvulus alsinoides Linn.

Parlakimedi : chiefly in sandy places at the foot of hills. *Burkill, Grant & Candler* 20419, Sept. 1903.

Erycibe paniculata Roxb.

Parlakimedi : in low jungles. *Burkill, Grant & Candler* 20433, Sept. 1903.

* **Merremia gemella** (Burm. f.) Hall. f. (*Ipomoea polyantha* Miq.)

Parlakimedi. *Burkill, Grant & Candler* 20474, Sept. 1903.

Merremia tridentata (Linn.) Hall. f. (*Ipomoea tridentata* Roth.)

Parlakimedi : at the bottom of valleys. *Burkill & Candler* 18106, Dec. 1902.

Operculina turpethum (Linn.) Silva-Manso. (*Ipomoea turpethum* Br.)

Vern. Tampatada (S.) ; Arategadi chettu (T.)
Parlakimedi : 30.m. *Corey & Ramamurthy* 20186, Sept. 1903.

* **Argyreia choisyana** Wight

Parlakimedi : in the Sal forests in the valleys and also in low jungles. *Burkill, Grant & Candler* 20514, Sept. 1903.

SOLANACEAE

* **Solanum indicum** Linn.

Vern. Jiddumunaga chettu (T.)
Parlakimedi. *Corey & Ramamurthy* 20135, Sept. 1903.

Solanum melongena Linn. (Wild form)

Vern. Andarai (S.) ; Kondavankaya chettu (T.)

Parlakimedi : in valleys at lower levels and roadsides. *Burkill* 18105, Dec. 1902 ; *Burkill, Grant & Candler* 20534, Sept. 1903 ; 915 m. *Corey & Ramamurthy* 20133, Sept. 1903.

Solanum xanthocarpum Schrad. & Wendl.

Parlakimedi. *Burkill, Grant & Candler* 20579, Sept. 1903.

***Capsicum minimum** Roxb.

Parlakimedi, Devagiri : in cultivated patches ; 915 m. *Burkill* 17981, Dec. 1902.

Datura metel Linn. (*Datura fastuosa* Linn.)

Parlakimedi : in valleys near dwellings. *Burkill, Grant & Candler* 20545, Sept. 1903.

SCROPHULARIACEAE

Mazus japonicus (Thunb.) Kuntze. (*Mazus rugosus* Lour.)

Parlakimedi.

***Lindenbergia indica** (Linn.) O. Kuntze. (*Lindenbergia polyantha* Royle)

Parlakimedi, Devagiri. *Burkill & Candler* 17956, Dec. 1902.

Scoparia dulcis Linn.

Parlakimedi : common on bunds in sandy soils and near river courses. *Burkill* 17999, Dec. 1902. *Burkill, Grant & Candler* 20504, Sept. 1903.

***Melasma arvense** (Benth.) Penneil. (*Alectra indica* Benth.)

Parlakimedi, Devagiri : a weed in millet fields. 915 m. *Burkill & Candler* 17970, Dec. 1902.

Centranthera humifusa Wall.

Parlakimedi : in boggy sandy places and edges of ragi fields, also in glades in valleys. *Burkill, Grant & Candler* 20521, Sept. 1903.

LENTIBULARIACEAE

Utricularia flexuosa Vahl.

Parlakimedi : in tanks with Nymphaeas. *Burkill, Grant & Candler* 20508, Oct. 1903.

BIGNONIACEAE

Kigelia pinnata DC.

Parlakimedi : planted.

***Tabebuia pentaphylla** Hemsl.

Parlakimedi : planted. *Burkill, Grant & Candler* 20557, Sept. 1903.

Oroxylum indicum Vent.

Vern. Pampena (S) ; Pampena chettu, Konda pampena chettu (T.)

Parlakimedi. *Corey & Ramamurthy* 20196, Sept. 1903.

PEDALIACEAE

Pedalium murex Linn.

Parlakimedi: in sandy roadsides. *Burkill, Grant & Candler* 20506, Sept. 1903.

Sesamum **indicum** DC.

Parlakimedi. *Burkill* 18104, Dec. 1902.

MARTYNIACEAE

Martynia **annua** Linn. (*Martynia diandra* Glox.)

Vern. Kinakarsi (S.); Puligoru chettu (T.)

Parlakimedi: at higher elevations up to 915 m. *Corey & Ramamurthy* 20122, Sept. 1903.

ACANTHACEAE

Elytraria acaulis (Linn. f.) Lindau. (*Elytraria crenata* Vahl.)

Parlakimedi.

Asteracantha **longifolia** Nees

Parlakimedi.

Dipteracanthus **prostratus** (Poir.) Nees. (*Ruellia prostrata* Poir.)

Parlakimedi: common everywhere. *Burkill & Candler* 20403, Sept. 1903.

***Hemigraphis elegans** Nees

Parlakimedi, Devagiri: in lower parts of jungles. *Burkill & Candler* 17935, 17943, Dec. 1902.

Blepharis maderaspatensis (Linn.) Heyne ex Roth. (*Blepharis boerhaviaefolia* Pers.)

Parlakimedi: in rocky hill jungles. *Burkill, Grant & Candler* 20476, Sept. 1903; *Burkill & Candler* 17994, Dec. 1902.

Blepharis molluginifolia Pers.

Parlakimedi: on dry rubble. *Burkill, Grant & Candler* 20494, Sept. 1903.

Barleria prionitis Linn.

Vern. Tamresa (S.); Mulugorinta chettu (T.)

Parlakimedi. *Burkill, Grant & Candler* 20552, 30 m. Sept. 1903; *Corey & Ramamurthy* 20162, 1903.

Barleria strigosa Willd.

Parlakimedi, Devagiri: in dense shade and by streams. *Burkill & Candler* 17973, Dec. 1902; *Burkill, Grant & Candler* 20461, Sept. 1903.

***Asystasia chelonoides** Nees var. **amoena** Kurz.

Parlakimedi. *Burkill & Candler* 17995, Dec. 1902.

Andrographis paniculata Nees

Vern. Resan (S.); Nelavembu chettu (T.)

Parlakimedi. *Burkill* 17926, Dec. 1902, 305 m. *Corey & Ramamurthy* 20141, Sept. 1903.

Lepidagathis fasciculata Nees

Parlakimedi. *Burkill & Candler* 17921, Dec. 1902.

Justicia betonica Linn.

Parlakimedi : among *Holarrhena* bushes. *Burkill, Grant & Candler* 20503, Sept. 1903.

Justicia glauca Rottl.

Parlakimedi : plenty in low jungles *Burkill, Grant & Candler* 20437, Sept. 1903.

Rungia repens (Linn.) Nees. (*Justicia repens* Linn.)

Parlakimedi.

***Dicliptera beddomei** Clarke

Parlakimedi : in hill jungles, plenty. *Burkill, Grant & Candler* 20467, Sept. 1903.

LABIATEAE

Orthosiphon pallidus Royle

Parlakimedi : on roadsides, sandy places and embankments. *Burkill, Grant & Candler* 20501, Oct. 1903.

Anisochilus carnosus Wall.

Parlakimedi. *Burkill, Grant & Candler* 20415, Sept. 1903.

Dysophylla quadrifolia Benth.

Parlakimedi. *Burkill & Candler* 17996, Dec. 1902; *Burkill, Grant & Candler* 20563, Sept. 1903.

***Leucas mollissima** Wall. var. **strigosa** Hook. f.

Parlakimedi : in low jungles. *Burkill, Grant & Candler* 20432, Sept. 1903.

Leucas cephalotes Spreng.

Parlakimedi : fairly common in sandy fields. *Burkill, Grant & Candler* 20558, Oct. 1903.

Leucas aspera Spreng.

Parlakimedi.

AMARANTHACEAE

Celosia argentea Linn.

Parlakimedi: in ragi fields and sandy roadsides. *Burkill, Grant & Candler* 20537, Sept. 1903.

Allmania nodiflora Br.

Parlakimedi. *Burkill, Grant & Candler* 20412, Sept. 1903.

***Allmania nodiflora** Br. var. **procumbens** Hook. f.

Parlakimedi. *Burkill, Candler & Grant* 20541, Sept. 1903.

Amaranthus spinosus Linn.

Parlakimedi.

Aerva javanica (Burm. f.) Spreng. (*Aerva javanica* Juss.)

Parlakimedi.

ARISTOLOCHIACEAE

Aristolochia indica Linn.

Vern. Son (S.); Nagasara (T.)
Parlakimedi: 30 m. *Corey* 20178, 1903.

PIPERACEAE

* **Peperomia pellucida** H.B.K.
Parlakimedi. *Burkill, Grant & Candler* 20580, Sept. 1903.

LAURACEAE

Litsaea glutinosa (Lour.) C. B. Robinson (*Litsaea sebifera* Pers.)
Parlakimedi: in hill jungles. *Burkill, Grant & Candler* 20441, Sept. 1903.

VERBENACEAE

Lantana camara Linn.
Parlakimedi.

Stachytarpheta sp.
Parlakimedi.

Tectona grandis Linn. f.
Parlakimedi: planted.

Premna latifolia Roxb.
Vern. Orbonda (S.); Peddanelli chettu (T.)
Parlakimedi: 915 m. *Burkill* 20131, 20139, Sept. 1903.

Gmelina asiatica Linn.
Vern. Nalla gummudu chettu (T.)
Parlakimedi: 30 m. *Corey* 20188, Sept. 1903.

Vitex trifolia Linn. f.
Vern. Vayila (S.); Vayitaku chettu (T.)
Parlakimedi: 30 m. *Corey* 20167, Sept. 1903.

Vitex pubescens Vahl
Parlakimedi. *Burkill, Grant & Candler* 20519, Sept. 1903.

LORANTHACEAE

Dendrophthöe falcata (Linn. f.) Ettingsh. (*Loranthus longiflorus* Desr.)
Host: *Zizyphus incurva* Roxb.
Devagiri. *Burkill & Candler* 17977, Dec. 1902.

* **Scurrula philippensis** (Cham. & Schlecht.) G. Don. Host: *Emblica officinalis* Gaertn. & *Randia brandisii* Gamble.
Devagiri: 183 m. *Burkill & Candler* 17931, Dec. 1902,
Parlakimedi. *Burkill, Candler & Grant* 20469, Sept. 1903.

Viscum orientale Willd. Host: *Pavetta indica* Linn.
Parlakimedi. *Burkill, Candler & Grant* 20442, Sept. 1903.

EUPHORBIACEAE

Euphorbia hirta Linn. (*Euphorbia pilulifera* Linn.)
Parlakimedi.

Bridelia retusa Spreng.
Parlakimedi ; in low jungles. *Burkill & Candler* 17992, Dec. 1902.

Bridelia tomentosa Bl.
Parlakimedi : common in low jungles. *Burkill, Grant & Candler* 20533, Sept. 1903 ; 20456, Sept. 1903.

Cleistanthus collinus Benth.
Vern. Karada (S.) ; Odise chettu (T.)
Parlakimedi : very common in the valleys in places where Sāl is not present. *Burkill & Candler* 17990, Dec. 1902 ; *Burkill, Grant & Candler* 20516, Sept. 1903 ; 609 m. *Corey & Ramamurthy* 20102, Sept. 1903.

Emblica officinalis Gaertn. (*Phyllanthus emblica* Linn.)
Vern. Ener (S.) ; Usirika chettu (T.)
Parlakimedi : 610 m. *Corey & Ramamurthy* 20117, Sept. 1903.

Phyllanthus maderaspatensis Linn.
Parlakimedi : on stony hill sides. *Burkill, Grant & Candler* 20561, Sept. 1903.

* **Glochidion montanum** Thw.
Vern. Kasakodi (S.) ; Torke chettu (T.)
Parlakimedi : 30 m. *Corey & Ramamurthy* 20161, Sept. 1903.

Securinega virosa (Roxb. ex Willd.) Pax & Hoffm. (*Flueggea microcarpa* Bl.)
Vern. Janjan (S.) ; Kondapindi chettu (T.)
Parlakimedi : 305 m. *Corey & Ramamurthy* 20145, Sept. 1903.

Antidesma ghaesembilla Gaertn.
Vern. Oderi (S.) ; Pultem chettu (T.).
Parlakimedi : 30 m. *Corey & Ramamurthy* 20183, Sept. 1903.

Antidesma diandrum Roth.
Parlakimedi : in jungles. *Burkill, Grant & Candler* 20465, Sept. 1903.

***Croton laevifolius** Bl.
Vern. Parta (S.) ; Rana bhedi chettu (T.)
Parlakimedi : 610 m. *Corey & Ramamurthy* 20114, Sept. 1903.

Mallotus philippensis Muell.
Vern. Goso (S.) : Kunkapu chettu (T.)
Parlakimedi. *Corey & Ramamurthy* 20160, Sept. 1903.

Ricinus communis Linn.
Parlakimedi, Devagiri : on the stony hill-side. 2.5 m. *Burkill* 17980, Dec. 1902.
Naupada, Ganjam Dt. Cuttirabad : 2′-3′ high. *Burkill* 17919, Dec. 1902.

Tragia involucrata Linn.
Vern. Janagatar (S.) ; Revatidulagundi chettu (T.).
Parlakimedi : 305 m. *Corey & Ramamurthy* 20144, Sept. 1903.

Sebastiana chamaelea Muell. Arg.

Parlakimedi. *Burkill, Grant & Candler* 20414, Sept. 1903.

MORACEAE

Ficus gibbosa Bl. var. **parasitica** Koen.

Bund of Ramasagaram, Parlakimedi. *Burkill, Candler & Grant* 20555, Sept, 1903.

***Ficus mysorensis** Heyne var. **pubescens** Roth.

Vern. Kambon-tu (S.) ; Kondamarri chettu (T.)
Parlakimedi : 30 m. *Corey & Ramamurthy* 20168, 1903.

Ficus benjamina Linn.

Parlakimedi (after *Lushington*, 2 : 679).

Ficus religiosa Linn.

Bund of Sitasagaram, Parlakimedi.

Ficus bengalensis Linn.

Bund of Sitasagaram, Parlakimedi.

URTICACEAE

Pouzolzia zeylanica (Linn.) Benn. (*Pouzolzia indica* Gaud.)

Parlakimedi. *Burkill, Candler & Grant* 20471, 20484, Sept. 1903.

CASUARINACEAE

Casuarina equisetifolia Forst.

Parlakimedi : planted.

MONOCOTYLEDONS

ZINGIBERACEAE

Globba orixensis Roxb.

Vern. Sanodol, sulli (S.) ; Karupasupu chettu (T.)
Parlakimedi. *Corey & Ramamurthy* 20179, 1903,

HYPOXYDACEAE

Curculigo orchioides Gaertn.

Parlakimedi : abundant in the woods. *Burkill, Candler & Grant* 20509, Sept. 1903.

AGAVEACEAE

Agave veracruz Mill.

Parlakimedi : not common. *Burkill, Candler & Grant* 20420, Sept. 1903.

Agave cantala Roxb.

Parlakimedi : common along the railway line. *Burkill, Candler & Grant* 20421, Sept. 1903.

DIOSCOREACEAE

Dioscorea pentaphylla Linn.

Parlakimedi. *Burkill, Candler & Grant* 20547, Sept. 1903 ; *Corey* 14511, Oct. 1903.

Dioscorea hispida Dennst. (*Dioscorea daemona* Roxb.)

Parlakimedi.

Dioscorea tomentosa Linn.

Vern. Barogi (S.) ; Nunetige chettu (T.)
Devagiri : 823 m. *Burkill* 17967, Dec. 1902.
Parlakimedi : common. *Corey* 20171, 1903 ; *Burkill, Candler & Grant* 20463, Sept. 1903.

Dioscorea bulbifera Linn.

Parlakimedi. *Burkill, Candler & Grant* 20530, Sept. 1903.

Dioscorea oppositifolia Linn.

Parlakimedi. *Corey* 112.
Devagiri : abundant. *Burkill* 17929, 17946, 17954, Dec. 1902.
Parlakimedi. *Burkill* 17991, 17997, Dec. 1902 ; *Burkill, Candler & Grant* 20470. Sept. 1903.

Dioscorea esculenta Burkill (*Dioscorea aculeata* Linn.)

Parlakimedi : abundant at foot of hills in low jungles. *Burkill* 17984, Dec. 1902; 14957, 1903. *Burkill, Candler & Grant* 20444, 20454, Sept. 1903.

***Dioscorea anguina** Roxb.

Devagiri. *Burkill* 17932, Dec. 1902.
Parlakimedi. *Corey* 14989, 1903 ; *Burkill, Candler & Grant* 20440, Sept. 1903.

***Dioscorea glabra** Roxb.

Parlakimedi. *Burkill* 17985, 17993, Dec. 1902.

LILIACEAE

Asparagus racemosus Willd.

Parlakimedi. *Burkill, Candler & Grant* 20486, Sept. 1903.

Gloriosa superba Linn.

Parlakimedi. *Burkill, Candler & Grant* 20407, Sept. 1903.

SMILACACEAE

Smilax zeylanica Linn. (*Smilax macrophylla* Roxb.)

Vern. Ratu, Raathume nape (S.) ; Kondathamara chettu (T.)
Parlakimedi. *Corey* 20174, 1903.

COMMELINACEAE

Commelina nudiflora Linn.

Peddalogidi. *Burkill, Candler & Grant* 20589, Sept. 1903.

Commelina benghalensis Linn.

Parlakimedi. *Burkill, Candler & Grant* 20540, Sept. 1903.

Cyanotis cristata (Linn.) Schultes.

Parlakimedi : among rocks in hill jungle. *Burkill, Candler & Grant* 20482, Sept. 1903.

Cyanotis axillaris Roem. & Sch.

Parlakimedi. *Burkill, Candler & Grant* 20410, Sept. 1903.

PALMAE

Phoenix sylvestris Roxb.

Parlakimedi.

Calamus viminalis Willd.

Vern. Rere (S.) ; Pemu chettu (T.)

Parlakimedi : rattan of low jungles, grows to a height of 6 m., fairly common. *Burkill & Candler* 17988, Dec. 1902. *Corey & Ramamurthy* 20126, 1903.

Cocos nucifera Linn.

Parlakimedi.

Borassus flabellifer Linn. (*Borassus flabelliformis* Murr.)

Parlakimedi.

CYPERACEAE

Cyperus castaneus Willd.

Parlakimedi : on sand. *Burkill, Candler & Grant* 20449, Sept. 1903.

* Cyperus cuspidatus H. B. & K. var. angustifolia Clarke.

Parlakimedi : on sand. *Burkill, Candler & Grant* 20450, Sept. 1903.

Cyperus rotundus Linn. (*Cyperus tuberosus* Rottb.)

Naupada : on sand. *Burkill, Candler & Grant* 20590, Sept. 1903.

Fimbristylis miliacea Vahl

Parlakimedi : common in sandy swamps. *Burkill, Candler* & Grant 20505, Sept. 1903.

Fimbristylis monostachya Hassk.

Parlakimedi : very common in sandy places. *Burkill, Candler & Grant* 20487, Sept. 1903.

Scleria lithosperma Sw.

Parlakimedi : common. *Burkill, Candler & Grant* 20422, Sept. 1903.

GRAMINEAE

***Saccharum arundinaceum** Retz.

Parlakimedi. *Burkill* (through *Dy. Tehsildar*) 21792, Mar. 1904.

Saccharum arundinaceum Retz. var. **ciliare** Anders.

Vern. Jaya karra (T.)

Parlakimedi. *Burkill* (through *Dy. Tehsildar*) 24071, Feb. 1905.

Sorghum roxburghii Stapf var. **semiclausum** Stapf

Vern. Juar.

Devagiri : cultivated on hill sides. *Burkill* 17920, 17960, Dec. 1902.

Chrysopogon aciculatus (Retz.) Trin. (*Andropogon aciculatus* Retz.)
Parlakimedi.

Hackelochloa granularis (Linn. f.) O. Ktze. (*Manisuris granularis* Linn. f.)
Parlakimedi : in hill jungles growing to a height of 1.5 to 2 m. *Burkill, Candler & Grant* 20473, Sept. 1903.

Digitaria granularis (Trin.) Henr. (*Paspalum pedicellare* Trin. ex Steud.)
Parlakimedi : in sandy places. *Burkill, Candler & Grant* 20543, Sept. 1903.

Brachiaria distachya (Linn.) Stapf. (*Panicum distachyum* Linn.)
Parlakimedi : common in sandy places. *Burkill, Candler & Grant* 20583, Sept. 1903.

Panicum montanum Roxb.
Parlakimedi : common. *Burkill, Candler & Grant* 20436, Sept. 1903.

Setaria italica Beauv.
Parlakimedi.

Pennisetum typhoides (Burm. f.) Stapf. & Hubb. (*Pennisetum typhoideum* Rich.)
Vern. Bajri.
Devagiri : cultivated on hill sides. 30-915 m. *Burkill* 17962, 17969, Dec. 1902.

Eragrostis tenella (Linn.) Beauv. ex Roem. & Schult.
(*Eragrostis tenella* Roem. & Schult. var. *plumosa* Stapf.)
Parlakimedi : on rocky hill side. *Burkill, Candler & Grant* 20488, Sept. 1903.

Eragrostis unioloides (Retz.) Nees. (*Eragrostis amabilis* W. & A.)
Parlakimedi. *Burkill, Candler & Grant* 20491, 20523, Sept. 1903.

Cynodon dactylon Pers.
Parlakimedi. *Burkill, Candler & Grant* 20584, Sept. 1903.

Eleusine coracana Gaertn.
Devagiri : 610-915 m. *Burkill* 17959, Dec. 1902.
Parlakimedi : cultivated. *Burkill, Candler & Grant* 20536, Sept. 1903.

Dactyloctenium aegyptium (Desf.) Beauv. (*Eleusine aegyptiaca* Desf.)
Parlakimedi.

Oryza sativa Linn.
Parlakimedi : wild and abundant (*Burkill*).
Devagiri. *Burkill* 17979, Dec. 1902.

Dendrocalamus strictus Nees
Parlakimedi : hill jungles.

SUMMARY

1. The Flora of Parlakimedi (18°47′ N. and 84°5′ E.) in the South Ganjam District in India is described in detail.

2. The vegetation of the locality under broad ecological groups, as those of sandy areas, low hill jungles, dry broken jungles, dry rocky hill slopes, valleys, at different altitudes, river-sides, is described in detail.

3. The total number of species listed from Parlakimedi is 286 under 229 genera and 75 families.

4. 45 species are reported as new to Ganjam District.

5. A new host report for *Dendrophthöe falcata* (Linn. f.) Ettingsh. is recorded.

Acknowledgements

Grateful acknowledgements are due to Rev. Fr. H. Santapau, S.J., Bombay, for critically going through the manuscript and for his valuable advice and help in the preparation of this paper.

References

Bor, N. L. (1947) : Common Grasses of the United Provinces. *Indian For. Rec.*, n. s., **2** (1) : 1-220.

Burkill, I. H. (1913) : Determination of the Prickly Pears now wild in India. *Rec. Bot. Surv. India* **4** : 287-322.

Fischer, C. E. C. (1904) ; Notes on the Flora of Northern Ganjam. *J. Bombay nat. Hist. Soc.* **15** : 537-556.

Gamble, J. S. (1884) : A short account of the Forests of the Northern Forest Circle, Madras Presidency. *Indian For.* **10** : 543-553.

——— (1884-85) : Revised list of the Trees and Shrubs of the Northern Circars recorded on tour in 1883-84 and 1884-85. *Ann. Admin. Rep. For. Dept., Madras*, 1884-85 : 317-331.

——— & Fischer, C. E. C. (1915-1936) : Flora of Madras Presidency. London.

Hooker, J. D. (1872-97) : The Flora of British India. L. Reeve & Co., London.

Lushington, A. W. (1915) : Vernacular list of Trees, Shrubs and Woody Climbers in the Madras Presidency. Madras.

Majumdar, R. (1956) : Studies on the Grasses of 24-Parganas. *Bull. Bot. Soc. Bengal* **10** : 1-114.

Mukherjee, D.B. (1935) : Notes on a collection of plants from Mahendragiri. *Journ. Indian Bot. Soc.* **14** : 305-311.

Raizada, M.B. (1958) : Name changes in common Indian Plants. *Indian For.* **84** : 467-538.

— — (1959). Name changes in common Indian Grasses. ibid. **85** : 473-509.

Ravindra Nath, V. & Narasimha Rao, V.L. (1959) : Additional hosts for flowering parasite, *Dendrophthöe falcata* (Linn. f.) Ettingsh. (*Loranthus longiflorus* Desr.). *Journ. Ind. Bot. Soc.* **38** : 204-212.

Santapau, H. (1953) : The Flora of Khandala on the Western Ghats of India. *Rec. Bot. Surv. India* **16**(1) : xxvii, 1-396, map 3.

— — (1958) : History of Botanical researches in India, Burma and Ceylon. Pt. II. Systematic Botany of Angiosperms. *Ind. Bot. Soc. Spl. Publn.* Bangalore, 1-77.

Sastri, B.N., *et al.*, (1952) : Wealth of India Raw materials 3.

Subba Rao, G. V. (1960) : Occurrence of *Rauvolfia canescens* Linn. in Ganjam District. *Curr. Sc.* **29** : 25-26.

A Review of some Grass-infesting Thrips from India with a Description of a New Species

BY

T. N. ANANTHAKRISHNAN

Dept. of Zoology, Loyola College, Madras

Plants of the families Gramineae and Cyperaceae have been known to harbour a wealth of Thrips fauna. But for records from random collections, no precise information is available in this country of the thrips infesting Gramineae, though an early attempt towards such a study was made by Ananthakrishnan (1956)[1] on *Andropogon pertusus*. Several species of Gramineae were subsequently examined, including *Apluda aristata*, *Chloris barbata*, *Cynodon dactylon*, *Cymbopogon citratus*, *Eragrostis* sp., *Oryza sativa*, *Panicum maximum*, *Sorghum vulgare*.

While it is natural to classify the graminivorous thrips as leaf sheath, leaf blade, and inflorescence inhabitants, the degree of infestation is of importance, particularly when it is observed that many grasses harbour several species of thrips, some primary inhabitants, others secondary, yet others casual or rare, with the possibility of being accidentally carried by wind or other factors. For instance, in *Andropogon pertusus*, Ananthakrishnan (1956) has recorded a large percentage of *Podothrips oryzae* Priesner and *Neolimothrips saccharivora* Shumsher, moderate numbers of *Anaphothrips flavicinctus* Karny, *Phibalothrips peringueyi* Faure, and *Caliothrips indicus* (Bagnall), and negligible numbers of other species. The same is the case with *Panicum maximum*, where *Exothrips madrasensis* Ananthakrishnan and *Anaphothrips flavicinctus* occur in very large numbers, while *Chirothrips maximi* Ananthakrishnan and *Caliothrips indicus* occur in moderate numbers. The table below shows that *Anaphothrips flavicinctus*, *Neolimothrips saccharivora*, and *Caliothrips indicus* occur on several species of grasses and are hence polyphagous. All the same, *Anaphothrips flavicinctus* shows special preference for the guinea grass (*Panicum maximum*) and is abundant throughout the year. The same is true of *Neolimothrips saccharivora* which, though occurring on sugar cane leaves and *Chloris barbata* in good numbers, has a special preference for *Andropogon pertusus*. An interesting feature of this host preference is that, besides *Anaphothrips flavicinctus*, *Exothrips madrasensis* takes to *Panicum maximum* as the preferred

---

[1] *Zool. Anz.* **156** (1-2) : 29-33.

host, and this species is very rarely met with in other species of grasses *Caliothrips indicus*, like *Anaphothrips flavicinctus*, is a highly polyphagous species, known to feed on several plants other than grasses. Instances of monophagous species are seen in *Haplothrips* (*Trybomiella*) *apicalis* Priesner which heavily infests *Cynodon dactylon* almost throughout the year, its distribution to the other host plants being restricted by its being primarily an apterous form, though macropterous and brachypterous forms are met with Ananthakrishnan (1957). Similarly, *Ramakrishnothrips jonnaphila* (Ramk.) inhabits the sheaths of *Sorghum vulgare*, while *Praepodothrips cymbopogonii* Ananthak. infests leaf blades of *Cymbopogon citratus*, and these species maintain this monophagous habit irrespective of the environment, whether it be in the plains or at heights of 5000-7000 feet as observed by the author in the Nilgiri and Kodaikanal hills.

The following table gives the host-species index together with the degree of infestation :

Host	Thrips	Degree of incidence[1]			Distribution
		Frequent (over 25)	Meagre (below 10)	Accidental, or rare	
Andropogon pertusus	*Anaphothrips flavicinctus* Karny	X			Oriental
	Neolimothrips saccharivora Shumsher	X			India
	Caliothrips indicus (Bagnall)	X			India
	Sericothrips graminis Anantha-krishnan		X		India
	Phibalothrips peringueyi Faure	X			India & Africa
	Podothrips oryzae Priesner	X			India, Siam, & Java
	Hoplandrothrips indicus Anan-thakrishnan			X	India
	Haplothrips apicalis Priesner			X	India
	Haplothrips gowdeyii (Franklin)			X	Cosmopolitan
Apluda aristata	*Anaphothrips sakimurai* Anan-thakrishnan	X			India
	Aptinothrips rufus Gmelin		X		Cosmopolitan
	Caliothrips graminicola (Bagnall & Cameron)	X			India & S. Africa
	Caliothrips indicus (Bagnall)	X			India
	Chirothrips ramakrishnai Anan-thakrishnan			X	India
	Chirothrips manicatus Haliday			X	Cosmopolitan

[1] The numbers mentioned represent those collected in an area of 50 sq. yards.

Host	Thrips	Degree of incidence			Distribution
		Frequent (over 25)	Meagre (below 10)	Accidental, or rare	
Chloris barbata	*Neolimothrips sacchariyora* Saxena	X			India
	Chirothrips loyolae Anantha-krishnan	X			India
	Chirothrips manicatus Haliday			X	Cosmopolitan
	Chiraplothrips priesneri sp. nov.		X		India
	Phibalothrips peringueyi Faure		X		India & S. Africa
Cynodon dactylon	*Haplothrips* (*Trybomiella*) *apicalis* Priesner	X			India
Cymbopogon citratus	*Praepodothrips cymbopogonii* Ananthak.	X			India
Eragrostis sp.	*Caprithrips analis* Faure		X		India & S. Africa
	Aptinothrips rufus Gmelin		X		Cosmopolitan
Oryza sativa	*Thrips* (*Oxyrrhinothrips*) *oryzae* Williams	X			India
Panicum maximum	*Anaphothrips flavicinctus* Karny	X			India
	Chirothrips maximi Anantha-krishnan	X			India
	Exothrips madrasensis Ananthak.	X			India
	Caliothrips indicus (Bagnall)		X		India
Sorghum vulgare	*Ramakrishnothrips jonnaphila* (Ramk.)	X			India

Key to Genera of Grass-infesting Thrips

Suborder TEREBRANTIA

Family Thripidae Uzel

Upper surface of body deeply reticulate, with polygonal areas ; terminal antennal joints long and thin

Subfamily HELIOTHRIPINAE

Upper surface not polygonally reticulate, but at most with transverse striae. Antennae 7 or 8-jointed, rarely 6- or 9-jointed ; terminal joints not long and thin

Subfamily THRIPINAE

Subfamily HELIOTHRIPINAE

Antenna 8-jointed, style 2-jointed ; joints 3 and 4 with forked sense cones ; forewings with dark and pale transverse bands

Caliothrips Daniel
[*C. indicus* (Bagnall) and *graminicola* (Bagnall & Cameron)]

Antenna 7-jointed, style 1-jointed ; wings not banded

Phibalothrips Faure
(*P. peringueyi* Faure)

Subfamily THRIPINAE

1. Head distinctly produced in front of eyes into a projection on which is inserted the antenna 2

   Head little or not produced 3

2. Antennal joints 3 and 4 with forked sense cones ; mouth cone broadly rounded ; maxillary palpi 3-jointed

   Ramakrishnothrips Shumsher
   [*R. jonnaphila* (Ramk.)]

   Antennal joints 3 and 4 with simple sense cones ; mouth cone long and narrow ; maxillary palp 2-jointed

   Neolimothrips Shumsher
   (*N. saccharivora* Shumsher)

3. Pronotum without any strong bristles.. 4

   Pronotum with at least one conspicuous bristle at hind angles.. 6

   Pronotum with two well-developed bristles at hind angles .. 7

4. Wings and ocelli absent in both sexes.. 5

5. Antennae 6-jointed ; body long and slender ; dorsal bristles on IX fine ; teeth on abdominal sternites absent

   Aptinothrips Gmelin
   (*A. rufus* Gmelin)

   Antennae 8-jointed ; dorsal bristles on IX stout. Abdominal sternites with 10-15 teeth

   Caprithrips Faure
   (*C. analis* Faure)

6. Antennae 8-jointed, without a cross suture across joint 6; wings and ocelli always present in the females ; absent in the males. Foretibia of male unarmed

   Anaphothrips (Subgenus : *Neophysopus*)

Foretibia of male armed with a distinct tooth at apex within. Antennal joint 1 of male stout, joints 4 and 5 curved within ; females normal (*Anaphothrips*-like)

Exothrips Priesner
(*E. madrasensis* Ananthak.)

7. Antennae 8-jointed, style 2-jointed 8

Antennae 7-jointed, style 1-jointed 15

8. Pronotum with prominent anteroangular bristles .. 9

Pronotum without prominent anteroangular bristles .. 12

9. Maxillary palp 2-jointed 10

Maxillary palp 3-jointed 11

10. Antennae slender, style thin ; wings banded, narrow, with stout bristles ; anteroangulars shorter than anteromarginals

Ayyaria Karny
(*A. chaetophora* Karny)

11. Anteroangulars longer than anteromarginals ; both wing veins with regularly set bristles throughout their length ; antennal style normal

Frankliniella
(*F. sulphurea* Schmutz)

Pronotum with additional long bristle at lateral margin. Anteroangulars and posteroangulars and wing bristles very long

Scolothrips Hinds.
(*S. indicus* Priesner)

12. Forewings with both longitudinal veins distinct 13

Forewings with only the upper vein distinct, the lower vein being represented by a few scattered setae 14

13. Lower vein with only four scattered setae ; outer postangulars longer than inner .. ..

Euphysothrips Bagnall
(*E. minozii* Bagnall)

Lower vein with regular series of setae ; postangular prothoracic setae subequal .. .. ..

Taeniothrips A. & S.

14. Abdominal segment IX with numerous prominent bristles at posterior margin. Abdominal segments with dense microsetulae .. ..

Sericothrips Karny
(*S. graminis* Ananthak.)

15. Pronotum and wings without particularly long bristles. Wings without cross bars or dark areas 16

16. Mouth cone long and narrow surpassing base of prosternum
Thrips, Subgenus :
Oxyrrhinothrips Pr.
(*O. oryzae* Williams)

Mouth cone shorter, not surpassing prosternum
Thrips s. str.

Suborder TUBULIFERA

1. Wings not narrowed nor constricted at middle 2

Wings narrowed or constricted at middle 3

2. Cheeks with bristle-bearing warts ; forefemora of male, with one or two teeth at apex ; that of female unarmed
Hoplandrothrips Priesner
(*H. indicus* Ananthak.)

3. Forefemora and tibiae unarmed 4

Forefemora unarmed, foretibiae armed with teeth ; foretarsus with a well-developed tooth *Podothrips* Priesner
(*P. oryzae* Priesner)

4. Antennal joint 2 produced exteriorly, chirothripoid
Chiridothrips R. & M.
(*C. indicus* R. & M.)

Antennal joint 2 not chirothripoid ; cheeks parallel. Head about as long as wide ; mouth cone broadly rounded, never short. Foretibia normal *Haplothrips* Serville

Cheeks strongly convex ; mouth cone very short, broadly rounded. Foretibia pointed interiorly at apex
Praepodothrips
Priesner & Seshadri

Several other species have also been recorded in many random collections on grasses, but these are of little or no value to be reckoned among

grass-infesting thrips. Some of these forms include *Erythrothrips asiaticus* R. & M., *Frankliniella sulphurea* Schmutz, *Ayyaria chaetophora* Karny, *Euphysothrips minozzii* Bagnall, *Scolothrips indicus* Priesner, and *Chiridothrips indicus* R. & M.

Caprithrips analis Faure

1933 : *Caprithrips analis* Faure, J. C., *Bull. Brook. Ent. Soc.* 28 (1 & 2): 12-14.

This genus is being recorded for the first time in the Oriental region. The only record of this interesting genus, which is monotypic, is by Faure (1933) from two apterous females, from the base of tufts of a grass from Pretoria (S. Africa). This genus is characterised by the 8-jointed antenna, joint 6 not divided ; cheeks narrower, straight ; eyes bulging ; sides of pronotum straight ; dorsal bristles of segment IX stout ; abdomen broadly conical at apex ; abdominal sternites with 10-15 teeth. Apterous.

Habitat : Ten females on *Eragrostis* sp., Madras, March 1959.

Caliothrips graminicola (Bagnall & Cameron)

1932, *Hercothrips graminicola* (Bagnall & Cameron), *Ann. Mag. Nat. Hist.* (10) : 412-419.

1957, *Caliothrips graminicola* Faure, J. C., *J. Ent. Soc. S. Africa* **20** (1) : 79-88.

This species is a new record to the Indian region, the only other species known hitherto being *C. indicus* (Bagnall). *C. graminicola* has pale forewings, with four, short, dark patches, one each at base, at apex and two in between. The forewings are narrow and the ring vein is strong and prominent. Blackish brown wing vein setae are absent. Costa of forewing has 5-8 setae at base and two at apex ; the lower vein has 4-7 setae, though a good many have only 4 or 5 setae.

Habitat: : Several males and females on the grass, *Apluda aristata*, Madras, March 1961.

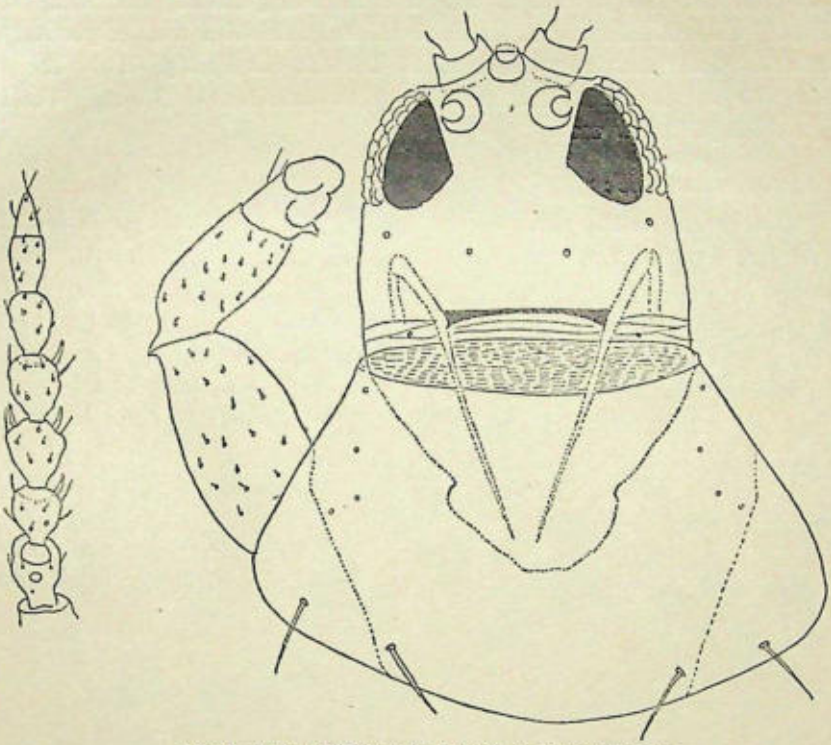
Haplothrips (Chiraplothrips) priesneri sp. n.

Chiraplothrips[1] Priesner is reported for the first time from India and this subgenus is quite distinct from other allied subgenera of *Haplothrips* by the ' short and stout legs, forefemora at the apex of the outer margin, with a small tooth-like projection ; wings narrow, with double fringes ; joint 4 of antenna with only 2 sense cones'.

[1]Priesner, 1931, *Bull. de la Soc. Roy. Ent. d'Egypte* : 271-272

Macropterous female :

Body brown, inclusive of antennal joints ; abdomen and foretibia pale brown, the latter with yellowish tinge. Wings clear. Little red pigment scattered all over.



Haplothrips (*Chiraplothrips*) *priesneri* sp. n.

Head and antenna of female

Head 172 μ long, 154 μ wide across eyes and 168 μ across cheeks. Eyes 70 μ long and 49 μ wide. Ocelli placed above the middle region of eyes ; disposition broadly triangular ; median ocellus 16 μ wide, placed 29 μ from posterior ocelli, also 16 μ wide, placed 48 μ apart. Maxillary bridge 90 μ long, the maxillae at their point of articulation with the basal piece, 128 μ apart. Antennal joints short and stout, individual joints measuring, length (width) in μ :

29 (35) ; 48 (32) ; 38 (32) ; 45 (32) ; 43 (32) ; 43 (22) ; 38 (19) ; 32 (13).

Mouth cone 126 μ long, reaching about the middle of prosternum, 168 μ wide at base, 70 μ at tip, broadly rounded.

Prothorax 196 μ long at middle, 210 μ and 322 μ wide across anterior and posterior margins respectively. Forefemora moderately stout, *with a small tooth-like projection at apex, on outer margin* ; foretarsus with a small tooth.

Pterothorax, 350 μ long, 294 μ wide across mesothorax and 280 μ across metathorax. Forewings 1050 μ long, constricted at middle, with 7 accessory cilia. Basal wing spines short, disposed of in a broad traingle, 22, 22, and 19 μ long respectively.

Abdomen 294 μ wide at base and middle, gradually narrowing at apex. Abdominal segment VIII and IX, 266 and 140 μ wide respectively at base ; outer and inner bristle of IX 420 and 462 μ long. Tube 126 μ long, 70 μ wide at base and 35 μ at tip ; tube setae 112 μ long. Total body length 2.100 mm.

Macropterous male :

Coloration mostly as in the female, but with antennal joints 1 & 2 and 7 & 8 darker brown ; body with plenty of red pigment. Antennal joints, as a rule, stouter than in the female, individual joints measuring, length (width) in μ : 26 (28) ; 43 (32) ; 43 (32) ; 48 (32) ; 45 (26) ; 43 (26) ; 38 (22) ; 32 (16). Forefemora stouter than in female, 74 μ wide at middle ; foretarsus with a stouter tooth. Total body length : 1·64 mm.

Habitat : Holotype ♀ and allotype ♂, on *Chloris barbata*, Madras, January 1959.

This species is named in honour of Dr. Priesner of Linz (Austria) who examined the material.

This species differs from *C. faureanus* Priesner in the uniformly brown antennal coloration, and in the presence of 7 duplicate cilia on the forewing.

The Wildfowl Trust at Slimbridge in Britain

BY

E. P. GEE

(With two plates)

During July, August, and September 1960 I was fortunate enough to be able to spend a number of very pleasant and instructive days at the Wildfowl Trust at Slimbridge in the beautiful county of Gloucestershire in Britain. I have written this note in the belief that members of the Society and other readers of the *Journal* may like to know more about this extremely interesting place.

The Trust is situated on the flats of the southern shore of the broad Severn Estuary, 13 miles south-west of the city of Gloucester and very near the village of Slimbridge. Only a few miles to the east are the picturesque Cotswold Hills. On the Severn flats several thousand wild geese and ducks come every winter to feed, the main feeding grounds being just adjacent to the Trust itself, and members of the Trust have special facilities for viewing these wild birds at close quarters from hides near by. These wild geese are mostly White-fronted Geese from Russia, though all thirteen kinds of British geese have been recorded there.

Several hundred wild Mallard live and breed in the grounds of the Trust at Slimbridge, and during the winter many other wild duck such as Pintail, Shoveller, Teal, and Wigeon come into the pens of their own accord. There may be a thousand or more of these wild ducks in the Trust during the winter months, and they are very willing guests, and welcome ones too.

From the above, it may be assumed that the winter is the best time to see Slimbridge, especially as most of the drakes are in their best plumage (breeding plumage) at that time of the year. This is true—if you can pick a mild day with sunshine in the English winter! For obvious reasons, by far the greater number of visitors (including the writer himself) go to Slimbridge in the summer, the peak times of the largest numbers of visitors being the Whitsun weekend, and the holiday months of July, August, and September. The countryside is very nice during these summer months, but some of the wildfowl,

especially the drakes, are moulting and are in their 'eclipse' plumage. For instance the Rederested Pochard drake appeared to be neither red nor crested in July and August, and only towards the end of September began to look the handsome creature that it is.

There is a branch of the Trust at Peakirk, near Peterborough in Northamptonshire, known as the Peakirk Waterfowl Gardens, opened to the public in 1957. Both at Slimbridge and at Peakirk are maintained and operated two of the last Duck Decoys in England: these are Berkeley New Decoy at Slimbridge, and Borough Fen near Peakirk. In these hundreds of wild ducks are caught, ringed, and released every year.

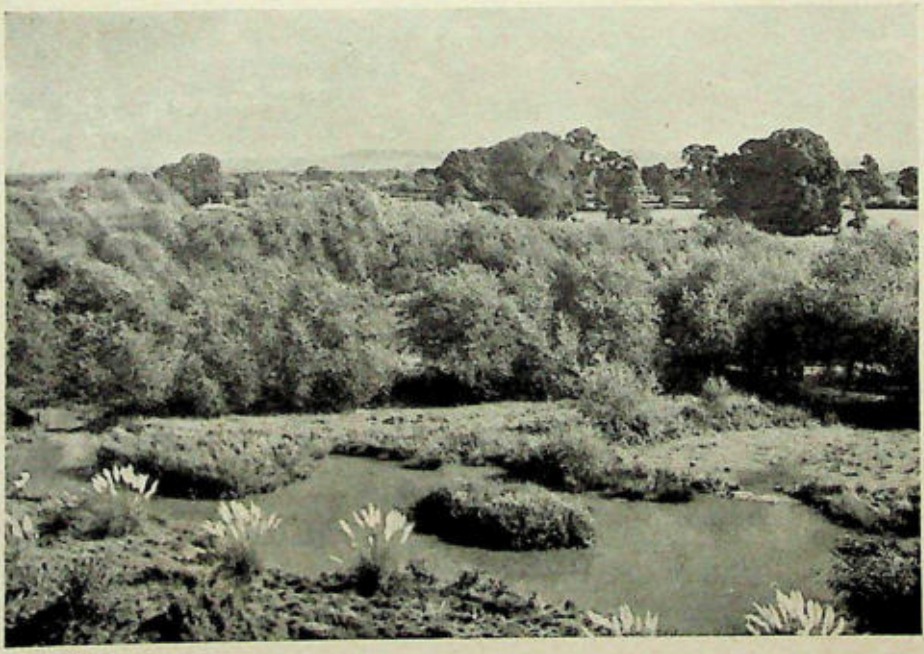
The Wildfowl Trust at Slimbridge was started in 1946, and is now the largest and most varied collection of swans, geese, and ducks in the world. There are some 1500 birds here, of 160 different species and races; and most of them are so tame that they will readily feed out of your hand. There is no notice displayed telling you to 'keep off the grass', but there is one politely asking you to 'be careful not to step on the birds'.

Most of the birds are pinioned, to prevent them flying away—mainly for their own safety, as they might get killed if they strayed from the grounds. But many are 'full-winged', and fly from pen to pen but seldom (if ever) leave. In particular, I noticed that a large number of Snow Geese (from Greenland and North America) were full-winged and yet were so tame that they were nearly always getting fed by visitors. There were also a few Barheaded Geese (central Asia and northern India, Pakistan, and Burma) that were flying about full-winged. Of these, a Barheaded had paired off with a Snow Goose, and this mixed pair together with a pair of Barheaded Geese were always together, in some part of the grounds or another.

Such 'mixed marriages' are not encouraged by the Trust, but are not always easy to prevent—as is evidenced by the large number of hybrids in the Hybrid Pen, where the results of strange crossings present a serious challenge to the experts when it comes to trying to identify them!

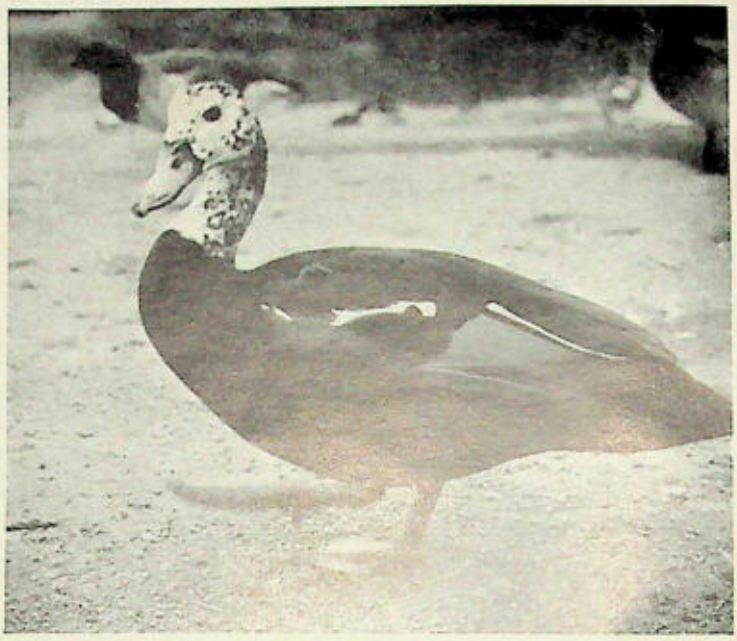
Probably the greatest triumph of wildfowl conservation at Slimbridge, and to a smaller extent at Peakirk, is the case of the Ne-ne or Hawaiian Goose, the rarest of all the world's geese. In 1947 there were only about 50 of these birds left in the whole world. The Trust brought three birds from Hawaii in 1950 and 1951, and these three had increased to no less than 126 in 1960, which was about half the total world population of this goose. It is hoped

Hawaiian Geese or Ne-nes, one of the most important exhibits at the Wildfowl Trust

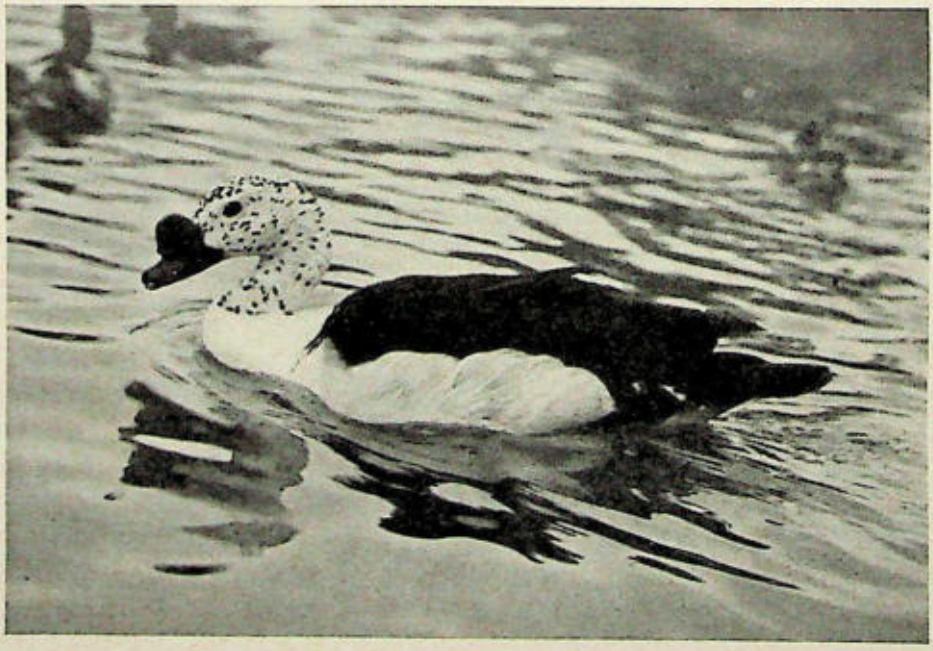


Part of the grounds of the Wildfowl Trust, as seen from the Acrow Tower

Photos : E. P. Gee



Whitewinged Wood Duck (drake) in Rushy Pen



Comb Duck or Nukta (drake) in Rushy Pen

Photos : E. P. Gee

to re-introduce some of these geese back into Hawaii some day. Hawaiian Geese are usually the first birds to greet you when you arrive at Slimbridge, and they are so tame that they almost besiege you for food, taking tit-bits from your hand very gently and carefully —never biting your fingers in the process.

When I was there, I saw the Trumpeter Swans which had been presented to the Queen, who is Patron of the Trust, by the Canadian Government on her tour of that dominion, and which have been placed in the care of the Trust. These are the largest of all wildfowl, and the heaviest of all flying birds, weighing up to 30 lb. There are probably not more than 1300 of them alive in the world today. There was a nest of these swans in 1960, providing one of the very few breeding records of this rare and magnificent swan, but unfortunately the five eggs never hatched. Another nest is reported in 1961 and results are awaited.

In Rushy Pen are nearly all the fish-eating ducks. Here I was most interested to see a pair of the rare Whitewinged Wood Duck, a species which is found in north-east India, East Pakistan, Burma, and south-east Asia. Apparently nine of these ducks were given to the Trust by a Buddhist monk of southern Thailand about 1954, and three of them died before 1960. In 1960 another four of them died of lung fungus. The remaining pair nested in the spring of 1960, but nothing came of it.

Apart from the last mentioned species, the breeding results at the Wildfowl Trust are very good indeed. Nearly 100 species and subspecies breed every year here, and in 1960 no less than 1100 young birds were successfully reared. Six species and several subspecies have bred in captivity for the first time ever in the grounds of the Trust. I saw a pair of Bewick's Swans nesting—the only breeding pair in captivity in the world. These swans in the wild state breed in northern Russia and northern Siberia, and winter in northern Europe and central Asia.

The Wildfowl Trust is a non-profit organization, devoted to the study of wildfowl both captive and wild. There is a research wing, for the study of wildfowl biology including feeding, behaviour, food consumption, diseases, mortality, migration, homing, orientation, and so on.

While the Trust owes its inception to the man who is now its Honorary Director, Peter Scott, it surely owes its existence and continuance to the enthusiastic support of the nature-loving British people, who go there in large numbers not only to observe the

wildfowl but also to enjoy a quiet and peaceful day's recreation in the countryside. The total number of visitors to Slimbridge and Peakirk in the twelve months ending August 1959 was 157,000. Many foreign tourists go there, and the Trust has undoubtedly become a major tourist attraction of Britain.

One of the things that struck me most, going there after many years in India, was the fact that many schoolboys go there in their holidays to work—for no pay at all. So great is their enthusiasm for bird watching, that boys from even the most exclusive of schools go there, stay in a local hotel at their own expense, and work—hard manual work making new ponds, digging, and shovelling, and so on —simply for the privilege of being inside the Trust and being among all the wildfowl, for no pay (Indian school boys, please note!). I met several of these boys, and they knew the names of practically all the birds, and where they came from. Their enthusiasm was remarkable.

The place is a bird photographer's paradise. The great difficulty is to keep far enough away from the birds, as they will come up to you, so tame are they.

There is an opportunity for us in India to develop something along these lines. A Slimbridge in India would not only help us in some of our conservation problems by preserving and breeding the rarer species, but also it would be a tourist attraction in a new country which is fast building up her tourist industry. If no special place for wildfowl alone can be developed, then surely one of our better zoological gardens could specialise in the keeping and exhibiting of wildfowl in natural conditions, with plenty of privacy for nesting birds. Such a project would be a wise and far-sighted undertaking, especially in view of the present rapid and alarming extermination of wild life all over the country.

Vegetation of Jhunjhunu, Mandrela, and the Neighbouring Places

BY

N. C. NAIR

Department of Botany, Birla College, Pilani, Rajasthan[1]

(*With a map and a plate*)

Studies on the vegetation of the arid and semi-arid regions of Rajasthan have, in recent years, increased in both importance and number. Still Rajasthan forms a floristically little-known part of India. There is no complete published account of the flora of the region similar to the floras of Madras, Bombay, Behar, Orissa, Bengal, Punjab, etc., and the need for a flora of this arid tract is very pressing. Therefore, any contribution to the study of the vegetation of this area is of interest and importance.

Joshi (1957, 1958) and Joshi & Khamboj (1959) have reviewed the earlier literature. Other recent contributions include those of Nair & Kanodia (1959) on the vegetation of Ajit Sagar.

A perusal of the literature reveals that most of the floristic investigations of the area relate to cities or important towns that are accessible by railway or motorable road, whereas there are many places in the interior of the arid and semi-arid zones of Rajasthan which hardly any botanist has visited.

The present account is based on a preliminary study of the vegetation of Jhunjhunu, Mandrela, Manpura, Dilarpur, Bhaktavarpura, Dhattarwala, Kasimpura, Bagar, Gumansir, Bhamarwasi, and Lalpur (see map). In this study particular attention was paid to the Katli River bed. In the attached list only trees and shrubs that constitute the structural framework of the vegetation are included. The herbaceous flora will be published after making intensive periodic collections.

VEGETATION

A general account of the climate, soil, and plant associations of Jaipur division was given by Joshi (1957), in which mention is also made of Jhunjhunu and its neighbouring places. A detailed ecological account of the vegetation will, therefore, be superfluous. However, a few words must be said about the vegetation of the interior places and the bed of the Katli River.

[1]Present address: Botanical Survey of India, Dehra Dun.

The vegetation in the area reveals a striking uniformity being typically a thorny scrub. The components of the vegetation are characteristically similar to those found in adjacent areas (cf. Bakshi, 1954 ; Nair & Nathawat, 1956 ; Nair & Joshi, 1957 ; Joshi, 1958). The open dry vegetation is characterised by associations of *Prosopis*, *Capparis*, *Gymnosporia*, *Calotropis*, *Leptadenia*, etc. In some places near Mandrela there are extensive associations of *Salvadora*, *Zizyphus*, and *Balanites*. In the vast plains near Bhamarwasi and Jhunjhunu the vegetation is very sparse. The soil although stabilized supports only a few tree species like *Prosopis spicigera*, *Acacia arabica*, *Acacia leucophloea*, etc. scattered singly here and there (Fig. 2). Very often these trees are mutilated by cutting down the branches for fodder.

The road from Chirawa to Mandrela is lined on either side with a more or less uniform vegetation consisting of trees like *Capparis*, *Prosopis*, *Balanites*, *Tecomella*, *Acacia*, *Zizyphus*, etc. One significant feature is that at places *Tecomella* forms the dominant element. The undergrowth includes *Tephrosia*, *Justicia*, *Peristrophe*, *Sida*, etc. There are a few sandy localities where the sand forms rippled dunes. These dunes are practically devoid of any vegetation (Fig. 1), except stray plants of *Boerhavia verticillata*, *Aerva javanica*, etc. In the close vicinity of these rippled dune areas are found stabilized dunes of varying size, the largest of them being sometimes over thirty feet in height. These dunes support very good vegetation of *Capparis*, *Gymnosporia*, *Ephedra*, *Balanites*, *Erianthus*, etc. Very often trees of considerable size like *Prosopis spicigera*, *Tecomella undulata*, and *Acacia arabica*, are seen growing on the summit of these dunes. It must be mentioned that these tree species have a very slow rate of growth. Seemingly, therefore, the dunes got stabilized a considerable time ago by encroaching vegetation. This excites two questions. Were the conditions in these places more intense than at present ? Is the area under consideration in a state of natural regeneration ? Obviously, a thorough study of the nature, rate, and trends of dune stabilization is necessary before anything can be said with certainty.

The banks of the Katli River (though called a river it contains water only during July-September) are almost sandy and desolate. Here and there pure associations of *Leptadenia pyrotechnica*, *Calligonum polygonoides*, and *Erianthus munja* are present. At one or two places the encroaching vegetation has made the sand stable.

There are only very few hills in the area studied. These are rocky and barren. Sometimes stray plants of *Acacia senegal* and *Azadirachta indica* are seen. One significant feature is the conspicuous absence of *Euphorbia nivulia* and *E. neriifolia*, that are characteristic of the hills of Rajasthan (*see* Nair & Nathawat, 1956 ; Nair & Kanodia, 1959), from these hills. Only at one place, near Mandrela, a few clumps of *Euphorbia*


JHUNJHUNU, MANDRELA AND NEIGHBOURHOOD
N
W
E
S
HILL
AREA STUDIED
CARTABLE ROAD
VILLAGE
RAILWAY LINE
MILE 1 2
MANDRELA
MANPURA
To Pilani
DABRI
JAKRODO
KUTPURA
JAKRA
GOVINDPURA
DHAT-TARWALA
ALAMPURA
DILARPUR
GUMANSIR
BUDANIO
LAMBA
LALPUR
GOTRA
KASIMPURA
To Chirawa
KATLI
BAKTAWARPURA
NARI HILL
BAGAR
IKTAWARPURA
TOMBON HILL
NARIKHETRI
DHANI
BHAMARWASI
SARI
RATANSHAR
To Sultana
JHUNJHUNU

Fig. 1. A rippled dune area near Mandrela. Fig. 2. A bird's eye view of the plains near Jhunjhunu showing trees of *Prosopis spicigera*, *Acacia arabica* and *A. leucophloea* spotted here and there. Fig 3. The vegetation near about a hilly area. Note the stunted and cushion-shaped form of the plants like *Securinega leucopyrus*, *Zizyphus*, *Gymnosporia*, etc.

nivulia were seen cultivated as a hedge. Near about the hills, in the plains, the vegetation is peculiar in that plants such as *Gymnosporia spinosa*, *Zizyphus nummularia*, *Securinega leucopyrus*, etc. exhibit a stunted cushion-shaped appearance (Fig. 3). Whether this peculiar form is due to edaphic or biotic (grazing) or both factors remains unanswered for the present.

Large temporary ponds are present here and there. The trees growing near about these ponds reach a height of 45-50 feet (13-15 m.). The most common trees around such ponds are *Capparis decidua*, *Balanites aegyptiaca*, *Anogeissus pendula*, and *Salvadora persica*.

Jhunjhunu is the district headquarters. As a result of afforestation work in the area many trees have been planted in and near about Jhunjhunu, and this imparts a green appearance to the neighbourhood. In the outskirts of villages and towns pure associations of *Xanthium strumarium* and *Croton bonplandianum* are frequently seen.

LIST OF PLANTS

1. ANNONACEAE

*Annona squamosa Linn. — *Polyalthia longifolia B. & H.

2. MENISPERMACEAE

Cocculus pendulus (Forst.) Diels — **Tinospora cordifolia** Miers

3. CAPPARIDACEAE

Capparis decidua (Forsk.) Pax. — **Merua arenaria** Hk. f.

4. TAMARICACEAE

Tamarix aphylla (Linn.) Karst.

5. MALVACEAE

Pavonia zeylanica Cav.
Sida grewioides Guill. & Perr.
Sida cordifolia Linn.
Abutilon fructicosum Guill. & Perr.
*Abelmoschus esculentus Linn.
Salmalia malabarica (DC.) Schott. & Endl.
*Hibiscus rosa-sinensis Linn.

6. TILIACEAE

Grewia tenax (Forsk.) Fiori.
*G. asiatica Linn.
G. oppositifolia Roxb.
Corchorus tridens Linn.
C. aestuans Linn.

---

*Cultivated

7. ZYGOPHYLLACEAE

Fagonia cretica Linn.

8. GERANIACEAE

*Averrhoa carambola Linn.

9. RUTACEAE

*Citrus aurantium Linn.
*Citrus medica var. acida Roxb.
*Feronia limonia (Linn.) Swingle
*Aegle marmelos Correa
*Murraya paniculata (Linn.) Jack.
*M. koenigii (Linn.) Spreng.

10. SIMAROUBACEAE

Balanites aegyptiaca Linn.
Ailanthus excelsa Roxb.

11. MELIACEAE

*Melia azedarach Linn.
Azadirachta indica Juss.

12. CELASTRACEAE

Gymnosporia spinosa (Forsk.) Fiori.

13. RHAMNACEAE

Zizyphus nummularia (Burm. f.) W. & A.
Z. xylopyra Willd.
*Z. mauritiana Lamk.

14. SAPINDACEAE

Dodonaea viscosa L.

15. ANACARDIACEAE

*Mangifera indica Linn.

16. MORINGACEAE

Moringa oleifera Lamk.

17. LEGUMINOSAE

Crotolaria medicaginea Lamk.
C. burhia Hamilt.
Cyamopsis tetragonoloba (Linn.) Taub.
Indigofera tinctoria Linn.
Rhynchosia minima DC.
Tephrosia purpurea Pers.
Abrus precatorius Linn.
Sesbania sesban var. picta Santapau
*C. fistula Linn.
C. auriculata Linn.
*Parkinsonia aculeata Linn.
*Tamarindus indica Linn.
*Bauhinia sp.
*Delonix regia (Boj.) Raf.
Caesalpinia pulcherrima Swartz.
Prosopis spicigera Linn.

Clitoria ternatea L.
*Phaseolus sp.
Dalbergia sissoo Roxb.
*Butea monosperma (Lamk.) Taub.
*Erythrina variegata var. orientalis (Linn.) Merr.
Cassia occidentalis Linn.
C. obtusa Roxb.
*C. siamea Lamk.
*P. juliflora DC.
Mimosa hamata Willd.
Acacia arabica Willd.
A. senegal Willd.
A. leucophloea Willd.
A. catechu Willd.
*A. farnesiana Willd.
Albizzia lebbeck Benth.

18. ROSACEAE

*Rosa indica Linn.

19. COMBRETACEAE

Anogeissus pendula Edgw.
*Terminalia arjuna Bedd.
*Quisqualis indica L.

20. MYRTACEAE

*Syzygium cumini (Linn.) Skeels.
*Eucalyptus sp.
*Psidium guajava Linn.

21. LYTHRACEAE

*Lagerstroemia indica Linn.
*Lawsonia inermis Linn.
*Punica granatum Linn.

22. CARICACEAE

*Carica papaya Linn.

23. CUCURBITACEAE

Coccinia cordifolia (Linn.) Cogn.
Citrullus colocynthis Schrad.

24. CACTACEAE

Opuntia dillenii Haw.

25. COMPOSITAE

Xanthium strumarium Linn.

26. OLEACEAE

*Jasminum sp.
*Nyctanthes arbor-tristis Linn.

27. SALVADORACEAE

Salvadora persica Linn.
S. oleoides Decne.

28. APOCYNACEAE

*Nerium indicum Mill.
*Lochnera rosea (Linn.) Reichb.
*Thevetia peruviana (Pers.) K. Schum.
*Plumeria rubra Linn. forma acutifolia (Poir.) Woodson
*Carissa carandas Linn.
*Ervatamia coronaria Stapf.

29. ASCLEPIADACEAE

Calotropis procera R. Br.
C. gigantea R. Br.
Pergularia daemia (Forsk.) Chiov.
Leptadenia pyrotechnica (Forsk.) Decne.
Ceropegia tuberosa Roxb.
Cryptostegia grandiflora R. Br.

30. BORAGINACEAE

Cordia dichotoma Forsk. f.
C. rothii Roem.

31. CONVOLVULACEAE

*Ipomoea cairica (Linn.) Sweet.
*Ipomoea pescaprae (Linn.) Sweet.
*Argyreia nervosa (Burm. f.) Boj.

32. SOLANACEAE

Solanum xanthocarpum S. & W.
S. indicum Linn.
Physalis peruviana Linn.
Datura metel Linn.
Lycium europaeum Linn.
Withania somnifera Dunal
*Capsicum frutescens L.
*Solanum melongena Linn.
*Cestrum nocturnum Linn.

33. BIGNONIACEAE

Tecomella undulata (Smith) Seem.
*T. stans (Linn.) H.B.K.
*Jacaranda mimosaefolia D.Don.
*Kigelia pinnata DC.
*Millingtonia hortensis Linn.

34. PEDALIACEAE

Martynia annua Linn.
Sesamum indicum DC.

35. ACANTHACEAE

Dipteracanthus patulus (Jacq.) Nees
D. prostratus (Poir.) Nees
Barleria prionitis Linn.
Lepidagathis trinervis Nees
Peristrophe bicalyculata Nees
Adhatoda vasica Nees

36. VERBENACEAE

Stachytarpheta indica Vahl.
*Vitex negundo Linn.
Clerodendrum phlomidis Linn.
C. inerme Benth.
*Duranta repens Linn.
Lantana camara Linn. var. aculeata (Linn.) Moldenke

37. NYCTAGINACEAE

Boerhavia verticillata Poir. *Bougainvillea sp.
*Mirabilis jalapa Linn.

38. AMARANTHACEAE

Aerva javanica (Burm. f.) Spreng. A. pseudotomentosa Blatter & Hallberg
Amaranthus spinosus Linn.

39. POLYGONACEAE

Calligonum polygonoides Linn. *Antigonon leptopus Hook. & Arn.

40. EUPHORBIACEAE

Euphorbia nivulia Buch.-Ham. Ricinus communis Linn.
*Emblica officinalis Gaertn. Croton bonplandianum Baill.
Securinega leucopyrus (Willd.)
Muell. Arg.

41. MORACEAE

*Morus alba Linn. F. benghalensis Linn.
Ficus glomerata Roxb. *F. religiosa Linn.
*F. carica Linn.

42. SCITAMINACEAE

*Musa sapientum Linn. *Canna indica Linn.

43. AMARYLLIDACEAE

*Agave sp. *Crinum asiaticum Linn.

44. LILIACEAE

Aloe barbadensis Mill.

45. PALMAE

*Phoenix sylvestris Roxb.

46. GRAMINEAE

Erianthus munja (Roxb.) Jesweit *Arundo donax
*Saccharum officinale Linn. *Zea mays Linn.
*Pennisetum typhoides (Burm. f.) Stapf. & Hubb.

47. GNETACEAE

Ephedra foliata Boiss.

REFERENCES

Bakshi, T. S. (1954) : Vegetation of Pilani and its neighbourhood. *J. Bombay nat. Hist. Soc.* **52** : 484-514.

Joshi, M. C. (1957) : Vegetation of some areas in Jaipur division. *J. Indian bot. Soc.* **36** : 272-291.

— (1958) : A preliminary survey of the sand dune vegetation of Pilani and its neighbourhood. ibid. **37** : 309-327.

—— & Khamboj, O. P. (1959) : Studies on the autecology of *Gisekia pharnaceoides* Linn. ibid. **38** : 8-34.

Nair, N. C. (1956) : Flora of Chirawa. *Proc. Rajasthan Acad. Sci.* **6** : 50-64.

Nair, N. C. & Joshi, M. C. (1957) : Sand dune vegetation of Pilani and its neighbourhood. *J. Indian bot. Soc.* **36** : 599.

—— & Nathawat, G. S. (1956) : Vegetation of Pilani and its neighbourhood. *J. Bombay nat. Hist. Soc.* **54** : 91-106.

— —— (1957) : Vegetation of Harsh Nath, Aravalli Hills. ibid. **54** : 289-301.

—— & Kanodia, K. C. (1959) : A study of the vegetation of Ajit Sagar in Rajasthan. ibid. **56** : 524-557.

The Birds of Nepal

PART 4

BY

BISWAMOY BISWAS

Zoological Survey of India, Indian Museum, Calcutta

[*Continued from Vol.* **58** (1) : 134]

Order PASSERIFORMES

Family EURYLAIMIDAE

*330. **Serilophus lunatus rubropygius** (Hodgson). Hodgson's Broadbill.

The only record of Hodgson's Broadbill from Nepal is based on Hodgson's collection (Gray & Gray, 1846, p. 56).

331. **Psarisomus dalhousiae dalhousiae** (Jameson). Longtailed Broadbill.

DUN : Hitaura, Kusumtar, Bhimphedi : 7 ♂♂, 6 ♀♀ (May 5-25, June 2, 3, 19).

The Longtailed Broadbill is common about ravines in dense forests of the central duns. Both Scully (1879) and Ripley (1950b) failed to notice it in Nepal, but Rand & Fleming (1957, p. 98) recorded it from west-central Nepal at about 760 m.

A male had somewhat enlarged testes on June 3 : R : 4·5 × 2·5 mm.; L : 6 × 3·5 mm.

Colours of soft parts : Iris brown; bill green with yellow on anterior two-third of culmen and yellowish green on edges ; legs and feet dull green ; claws dark horny ; pads white.

Measurements :

	7 ♂♂	6 ♀♀
Wing :	107, 111, 113 (2), 114 (2), 116	96, 99, 102 (2), 103 (2)
Tail :	116, 120, 122 (2), 124, 131, 132	116, 118, 119, 121, 122, 127
Bill :	21 (2), 22 (4), 22.5	21 (2),—, 22 (3)

The apparent sexual dimorphism in size can be proved only by measuring many more correctly sexed specimens.

Family PITTIDAE

*332. **Pitta nipalensis nipalensis** (Hodgson). Bluenaped Pitta.

Proud (1952b, p. 669) was the first to report it from Nepal after Hodgson. She found it only once in the Nepal Valley in January. Subsequently, Rand & Fleming (1957, p. 98) obtained a few specimens from the Nepal Valley in February.

*333. **Pitta brachyura brachyura** (Linnaeus). Indian Pitta.

Hodgson's collection (Gray & Gray, 1846, p. 78) provides the sole record of the Indian Pitta in Nepal.

334. **Pitta sordida cucullata** Hartlaub. Greenbreasted Pitta.

DUN : Hitaura, Kusumtar : 9 ♂♂, 3 ♀♀ (May 11-29, June 3).

The Greenbreasted Pitta is not an uncommon bird of the central dun in dense forest, particularly at spots rich in undergrowth or where the ground is covered with fallen leaves. Scully (1879), Ripley (1950b), and Rand & Fleming (1957) all failed to find this pitta in Nepal. It would, therefore, appear that ours is the first post-Hodgsonian record of the species from Nepal.

A male specimen had much swollen testes[1] on June 3.

Colours of soft parts : Iris dark brown ; bill black ; legs and feet dark slate ; claws yellowish grey.

Measurements :

	9 ♂♂	3 ♀♀
Wing :	108, 110, 111, 113, 114 (2), 115 (2) 118	110, 112, 113
Tail :	37, 37·5, 38 (4), 39,—, 41	37, 37·5, 40
Bill :	24·5, 25 (2), 26 (2), 27 (4)	25 (2), 25·5

Family ALAUDIDAE

*335. **Mirafra assamica assamica** Horsfield. Bengal Bush Lark.

Since Hodgson's collection from the tarai (Gray & Gray, 1846, p. 109), the Bengal Bush Lark has been reported from Nepal only by Rand & Fleming (1957, p. 99) from the western lowlands in winter and the central plains in spring.

*336. **Eremopterix grisea** (Scopoli). Ashycrowned Finch-Lark.

The post-Hodgsonian records of the Ashycrowned Finch-Lark from Nepal consist of Scully's (1879, p. 337) who found it to be common in the plains and tarai of central Nepal in winter, and Rand & Fleming's (1957, p. 99) who noted small flocks in the western and eastern tarai in winter.

*337. **Calandrella cinerea dukhunensis** (Sykes). Rufous Short-toed Lark.

The last Nepali record of this short-toed lark is based on Scully's (1879, pp. 337-338) finding it on passage in the Nepal Valley on autumnal migration (October).

---

[1] The right testis was present in two lobes, an abnormal condition. The case had already been reported (Biswas, 1961c).

*338. **Calandrella acutirostris tibetana** Brooks. Brooks's Short-toed Lark.

The only post-Hodgsonian record of Brooks's Short-toed Lark from Nepal has been provided by Biswas (1960a) who reported it from *c.* 4570-5030 m. in Khumbu, eastern Nepal, in May.

*339. **Calandrella raytal raytal** (Blyth). Ganges Sandlark.

Scully (1879, p. 338) noted this lark to be common in the plains of central Nepal, close to the tarai, in December, and Rand & Fleming (1957, p. 99) obtained a single example from the eastern tarai also in December. These constitute the only post-Hodgsonian records of the species from Nepal.

*340. **Galerida cristata chendoola** (Franklin). Franklin's Crested Lark.

The post-Hodgsonian records of Franklin's Crested Lark from Nepal are Scully's (1879, p. 338) who found it common in the central plains near the tarai in winter, and Rand & Fleming's (1957, p. 99) from the central plains near the Indian border (Birganj) in April.

*341. **Alauda gulgula lhamarum** R. & A. Meinertzhagen. Kashmir Skylark.

Scully (1879, p. 338) was the first to report the occurrence of the Kashmir Skylark in Nepal from a single specimen taken in the Nepal Valley in February. He observed it in Nawakot district also, but since he took no specimen there, he entered it in his Nawakot list (op. cit., p. 367) with a question mark (see Ripley 1950b, p. 380 in this connexion). Later Ripley (loc. cit.) found it in the Nepal Valley and in western Nepal in December. Rand & Fleming's (1957, p. 98) specimens from western, central, and eastern Nepal were not identified subspecifically. I am unable to state, therefore, if they represent this form or the eastern *inopinata* or both.

Vaurie (1959a, p. 59) gives the range of this form eastward up to the Punjab, placing the Nepal birds under *inopinata*. Ripley (in press), however, gives Nepal as the eastern limit of this subspecies.

342. **Alauda gulgula inopinata** Bianchi. Tibetan Skylark.

NEPAL VALLEY : Thankot : 2 ♂♂, 2 ♀♀ (April 8-12).

The Tibetan Skylark is found in small flocks in central Nepal. It occurs in the paddy fields during March-April.

Scully (1879, p. 338) had earlier recorded it from the Nepal Valley in February-March.

Measurements :

	Wing	Tail	Bill
2 ♂♂ :	102, 105	64, 68	15·5, 16·5
2 ♀♀ :	97, 99	59, 60	15·5, 16·5

All these four specimens have already been studied and reported upon by Vaurie (1951c, pp. 518, 522).

*343. **Eremophila alpestris elwesi** (Blanford). Elwes's Horned Lark.

I am unable to trace any record of Elwes's Horned Lark from Nepal after Hodgson's collection (Gray, 1863, p. 58).

Family HIRUNDINIDAE

344. **Riparia paludicola chinensis** (J. E. Gray). Indian Sand Martin.

NEPAL VALLEY : nr. Kathmandu : 2 juv. ♂♂, 2 juv. ♀♀ (April 5).

During late March and early April the Indian Sand Martin is found to be common in flocks of 30-50 in the outskirts of Kathmandu, not far from streams. On April 5, 1947, a large congregation of this sand martin was noticed busily feeding on the myriads of insects that were disturbed by the harvesting of pulses in a field situated on the bank of a stream.

Scully (1879, p. 234) found it a resident bird of the Nepal Valley, and reported it also from the Markhu Valley and Nawakot district in winter. Ripley (1950b, p. 381) recorded it from the western tarai and the Nepal Valley in winter. Rand & Fleming (1957, p. 100) found it in the western, west-central and eastern tarai and foothills in winter.

The coloration of the upper parts of my specimens agrees nicely with that given by Baker (1926, p. 235) for the young birds, but the chin, throat and breast have a rufous wash.

*345. **Riparia riparia diluta** (Sharpe & Wyatt). Collared Sand Martin.

The only post-Hodgsonian record of this sand martin from Nepal is based on Proud's (1949, p. 711) sight record in the Nepal Valley throughout the year along river banks. It is significant to note here that the very common Indian Sand Martin was missed by her in the Nepal Valley.

*346. **Hirundo rupestris** Scopoli. Crag Martin.

We were unable to find the Crag Martin in Nepal. Scully (1879, p. 234), however, noted it in central Nepal (Nepal and Markhu Valleys and Nawakot district) in winter. Ripley (1950b, p. 380) found it at *c.* 1525 m. in eastern Nepal in February. Rand & Fleming (1957, p. 100) reported it from west-central Nepal (*c.* 915 m.) in December.

347. **Hirundo rustica rustica** Linnaeus. Common Swallow.

Dun : Bhimphedi 1 ♂, 1 ♀ (March 12, 14). NEPAL VALLEY : Thankot : 1 ♂, 2 juv. ♂♂, 1 ♀ (March 21, 31, April 13, 14).

The Common Swallow was observed by us from the upper dun

(Bhimphedi area) to the Nepal Valley from about the middle of March. It was breeding in Bhimphedi area in mid-March.

Measurements :

	Wing	Tail	Bill
2 ♂♂ :	121, 123	90, 94	12 (2)
2 ♀♀ :	116, 117	77, 79	12 (2)

The abovementioned specimens have been studied and reported upon by Vaurie (1951b, pp. 19-25).

348. **Hirundo rustica gutturalis** Scopoli. Eastern Swallow.

Dun : Hitaura : 2 juv. ♀♀ (July 15).

This appears to be the only record of the Eastern Swallow from Nepal. For notes on these specimens, see Vaurie (1951b, pp. 23, 25).

*349. **Hirundo smithii filifera** Stephens. Indian Wiretailed Swallow.

Although not listed in either edition of the catalogue of Hodgson's collection (Gray & Gray, 1846 ; Gray, 1863), two specimens of the Indian Wiretailed Swallow presented by Hodgson to the British Museum have been included by Sharpe (1885, p. 151). The locality for one of them has been given as Nepal, and for the other ' Behar '. There does not seem to be any other record of the species from Nepal.

*350. **Hirundo daurica daurica** Linnaeus. Daurian Striated Swallow.

The only record of the Daurian Striated Swallow from Nepal appears to be that of Ripley (1950b, p. 380) who took a single example in central Nepal at *c.* 1525 m. in December.

351. **Hirundo daurica nipalensis** Hodgson. Hodgson's Striated Swallow.

DUN : Hitaura, Bhimphedi : 1 ♂, 1 juv. ♂ (May 6, June 2). CHITLANG VALLEY : Chitlang : 2 ♂♂, 2 ♀♀ (March 15-18). NEPAL VALLEY : Kathmandu, Thankot, Godavari : 4 ♂♂, 5 ♀♀ (March 22-April 10, May 16).

Hodgson's Striated Swallow is very common in the Nepal Valley as well as in the lower ranges, usually in and around towns and villages. Rand & Fleming (1957, p. 100) reported it from western, west-central and central Nepal, at *c.* 275-1980 m. in winter. Biswas (1960a) recorded it from eastern Nepal at *c.* 1525-2240 m. in June.

In April and May it was breeding in Chitlang and Nepal valleys. Specimens taken in March had slightly swollen gonads ; those in April had them more enlarged (a male, April 6, had the right testis 5 × 5 mm., and a female of same date had 8 × 5 mm. ovary with a 2.5 mm. ovum), while a female taken May 16, had the ovary more developed.

Colours of soft parts: Iris dark brown ; bill black ; legs and feet dark horny ; claws black ; pads greyish white.

Measurements :

	7 ♂♂	7 ♀♀
Wing :	115, 116 (3), 117, 118, 120	109, 115 (3), 116 (2), 120
Tail :	86, 91 (2), 92, 96, 97, 102	82, 86 (2),—, 90, 91, 95
Bill :	10 (2), 10.5, —, 11 (2), 11.5.	10 (2), 10.5 (3), 11 (2)

Vaurie (1951b, pp. 28-34) had reported on a part of the above-mentioned collection.

[**Hirundo fluvicola** Blyth. Indian Cliff Swallow.

Although Nepal is generally included in the range of the Indian Cliff Swallow (Baker, 1926, p. 247 ; Vaurie, 1959a, p. 14 ; Peters, 1960, p. 122, but *not* Ripley, in press), there does not seem to be any authentic record of its occurrence there. The nearest I can trace is Sharpe's (1885, p. 201) listing of a single Hodgson specimen from ' Behar '.]

*352. **Delichon nipalensis nipalensis** Horsfield & Moore. Nepal House Martin.

The only post-Hodgsonian records of the Nepal House Martin are Stevens's (1925a, p. 375) from the Mai Valley, eastern Nepal, at *c.* 2440 m. in late April, and Biswas's (1960a) from eastern Nepal at *c.* 1525 m. in June.

Family MOTACILLIDAE

353. **Motacilla flava beema** (Sykes). Indian Blueheaded Wagtail.

NEPAL VALLEY : Thankot : 1 ♂ (April 12).

The Blueheaded Wagtail was rarely seen by us in central Nepal. We came across it a few times when it was found to occur in small flocks (4-6 individuals) in hill streams around Thankot in early April, and a pair was once seen on the edge of water in an open drain in Kathmandu on April 25.

Scully (1879) and Ripley (1950b) did not record it. Proud (1955, p. 68) found it in the Nepal Valley in winter, and Rand & Fleming (1957, p. 186) reported it in addition from the western and eastern tarai in winter.

Measurements : 1 ♂ : Wing 79 ; tail 69 ; bill 16.

354. **Motacilla flava thunbergi** Billberg. Greyheaded Wagtail.

Proud (1955, p. 68) is responsible for the only record of the Greyheaded Wagtail from Nepal. She obtained specimens in the Nepal Valley and reported its occurrence also in the eastern tarai on passage in spring.

*355. **Motacilla flava melanogrisea** (Homeyer). Turkestan Black-headed Wagtail.

This wagtail has so far been reported from Nepal only once and that was by Rand & Fleming (1957, p. 186) from cut-over rice fields in the lowlands of western Nepal in December.

*356. **Motacilla citreola citreola** Pallas. Yellowheaded Wagtail.

The only record of the Yellowheaded Wagtail from Nepal has been made by Rand & Fleming (1957, p. 187) from the western and eastern tarai in winter.

357. **Motacilla citreola calcarata** Hodgson. Hodgson's Yellowheaded Wagtail.

NEPAL VALLEY : Thankot : 1 ♂ (April 12).

This Yellowheaded Wagtail was observed by us only once in a swampy patch at Thankot when the abovementioned specimen was collected. It is apparently a rare bird of central Nepal. Scully's (1879, p. 316) only record was a probable sight record; Ripley (1950b) did not find it; and Proud (1955, p. 68) reported it as a passage migrant in the Nepal Valley, a few remaining there for the winter. Rand & Fleming (1957, p. 187) record it from the western lowlands as fairly common in winter.

Measurements : 1 ♂ : Wing 88; tail 84; bill 18.

The measurements as given by Baker (1926, p. 274) for this bird are inaccurate.

358. **Motacilla cinerea cinerea** Tunstall. Eastern Grey Wagtail.

BHABAR : Amlekhganj : 2 ♀♀ (March 7). CHITLANG VALLEY : Chitlang : 1 unsexed (April 17). NEPAL VALLEY : Thankot : 6 ♂♂, 3 ♀♀ (March 24, April 5-13).

The Eastern Grey Wagtail is a common bird about streams and tanks on the edges of forests in Nepal.

Scully (1879, pp. 315-316) found it common in the Nepal and Markhu valleys and Nawakot district in winter. Ripley (1950b, p. 381) noted it in the tarai and the Nepal Valley. Polunin (1955, p. 894) recorded it in the Langtang Valley, central Nepal, at *c.* 3505 m. and 4115 m. in summer. Lowndes (1955, pp. 34-35) observed it in Manangbhot, central Nepal, from *c.* 2135 to 4115 m. in summer. Rand & Fleming (1957, p. 186) reported it in west-central and central Nepal from the tarai up to *c.* 1980 m. during winter and spring.

A female specimen (Thankot, March 24) has the chin and throat in moult, while another female from the same locality (April 10) has some of its rectrices still growing.

Measurements :

	Wing	Tail	Bill
6 ♂♂ :	82 (3), 83 (2), 84	92 (2), 93 (2), 96, 98	16, —(2), 17 (3)
5 ♀♀ :	80, 81, 82 (2), 84	92 (2), —, 93, 97	16 (2), 17 (2), 17.5
1 unsexed :	82	91	—

The measurements of tail and tarsus as given by Baker (1926, pp. 265-266) are evidently incorrect.

Vaurie (1957a, p. 10) has shown that both *caspica* Gmelin and *melanope* Pallas should be synonymized with nominate *cinerea*.

Motacilla alba Linnaeus

Six races of the White Wagtail group have so far been recorded from Nepal, and all of them from central Nepal. Curiously, Ripley (1950b) did not report any.

359. **Motacilla alba dukhunensis** Sykes. Indian White Wagtail.

NEPAL VALLEY : Thankot : 3 ♂♂ (April 12).

This White Wagtail is fairly common in the Nepal Valley during April on rivers, in paddy or wheat fields, etc.

Scully (1879, pp. 314-315) and Proud (1955, p. 67) reported it to be common in the Nepal Valley throughout the winter up to May. Rand & Fleming (1957, p. 185) found it from western to eastern Nepal at *c.* 275-1340 m. between November and April. Biswas (1960a) reported it from Chautara district, central Nepal, at *c.* 855 m. in January.

Measurements : 3 ♂♂ : Wing 90 (2), 91 ; tail 90, 91 (2) ; bill 17, —, 18.

*360. **Motacilla alba personata** Gould. Masked Wagtail.

Lowndes (1955, p. 35) reported the Masked Wagtail for the first time from Nepal. He came across it in Manangbhot, central Nepal, at *c.* 3505 m. in July. Proud (1955, p. 67) found it as a very rare winter visitor to the Nepal Valley. Rand & Fleming (1957, p. 185) recorded it from the western and eastern tarai in winter.

361. **Motacilla alba baicalensis** Swinhoe. Swinhoe's White Wagtail.

NEPAL VALLEY : Kathmandu : 1 ♂ (April 8).

This wagtail appeared rare in central Nepal during March-April. The specimen mentioned above was found on Bagmati River in a mixed flock of *M. a. alboides* and *M. a. leucopsis*. None of Hodgson's or Scully's specimens is *baicalensis* ; nor do their lists contain it (it was, however, not recognized during Hodgson's time), and Ripley (1950b), and Rand & Fleming (1957) did not record it either. The only other specimen of this race from Nepal that I could find was one in the Bailey collection in the British Museum, labelled as *leucopsis*. Polunin

(1955, p. 894) reported it from the Langtang Valley, central Nepal, in summer. Proud (1955, pp. 67-68) found it on passage in the Nepal Valley in spring, a few examples remaining there in winter.

My specimen had non-breeding testes.

Measurements : 1 ♂ : Wing 93 ; tail 92 ; bill 17.

362. **Motacilla alba ocularis** Swinhoe. Streakeyed Wagtail.

NEPAL VALLEY : Kathmandu : 1 ♂ (April 25).

The Streakeyed Wagtail was observed by us along Bagmati River in very small numbers for about 10 days from mid-April. It was seen in mixed flocks with *M. a. dukhunensis*. Scully (1879, p. 315) was the first to report its occurrence in Nepal. He obtained a single example in the Nepal Valley on May 7. Subsequently, it was observed only by Proud (1955, p. 67) as common there on spring migration.

My specimen had non-breeding testes.

Measurements : 1 ♂ : Wing 97 ; tail 99 ; bill 16.

363. **Motacilla alba leucopsis** Gould. Whitefaced Wagtail.

NEPAL VALLEY: Kathmandu, Thankot: 7 ♂♂, 6 ♀♀ (March 21, 23, April 8-12).

The Whitefaced Wagtail was found by us to be quite common in the Nepal Valley during March-April on sandy banks and sandy islands of rivers, frequently in mixed flocks with *M. a. alboides*.

Scully (1879, p. 314) found it common in winter from the Nepal Valley down to the central plains. Proud (1949, p. 712 ; 1955, p. 68) reported it extremely common in the Nepal Valley in winter. Rand & Fleming (1957) did not include it in their list.

All my specimens had non-breeding gonads.

Measurements :

	Wing	Tail	Bill
7 ♂♂ :	87, 88 (2), 89 (2), 91 (2)	85, 86, 89 (2), 90 (2), 91	17 (4), 17.5, 18 (2)
6 ♀♀ :	85, 86, 87, 88, 89, 90	86 (3), 87, 92 (2)	17 (4), 17.5 (2)

364. **Motacilla alba alboides** Hodgson. Hodgson's White Wagtail.

BHABAR: Amlekhganj: 1 ♂ (March 8). NEPAL VALLEY: Kathmandu, Thankot : 6 ♂♂, 5 ♀♀, 1 unsexed (March 23, 24, April 9-14).

Hodgson's White Wagtail is quite a common bird of the Nepal Valley during March-April, usually at the same sites as *M. a. leucopsis*, sometimes in mixed flocks with it. On a few occasions it has also been seen roving over cultivated fields on river banks.

Lowndes (1955, p. 35) did not find it common in Manangbhot, *c.* 3655 m., central Nepal, in summer. Rand & Fleming (1957, p. 184) recorded it from west-central to eastern Nepal (*c.* 290-2745 m.) in winter. Biswas (1960a) reported it from eastern Nepal at *c.* 855-2135 m. in January-February, and *c.* 3960-4570 m. in March-May.

All my examples had non-breeding gonads.

My female specimens are blackish grey on the upper side.

Measurements :

	Wing	Tail	Bill
7 ♂♂ :	90, 93, 94 (2), 95, 96, 97	90, 91 (2), 93, 94, 95, 97	18 (2), 18.5, 19 (4)
5 ♀♀ :	87 (3), 88 (2)	86 (3), 88 (2)	18 (2), 18.5, 19,—
1 unsexed :	94	92	19

365. **Motacilla maderaspatensis** Gmelin. Large Pied Wagtail.

BHABAR : Amlekhganj : 1 subad. ♂ (June 8). DUN: Hitaura : 3 subad. ♂♂, 5 juv. ♂♂, 7 subad. ♀♀ (May 15, 16, 27, June 2, 12, 24, July 11, 18). MARKHU VALLEY : Kulikhani : 1 ♂ (July 2). NEPAL VALLEY : Thankot : 2 subad. ♂♂, 1 subad. ♀ (April 10-12).

This pied wagtail is not a common bird of the Nepal Valley during March-May, but fairly common along the principal rivers of the central bhabar and dun in summer. Several times it was seen far away from rivers on other bodies of water.

Scully (1879) did not record the species from Nepal. Proud (1949, p. 712) found it very scarce in the Nepal Valley where Ripley (1950b, p. 381) found it in December. Rand & Fleming (1957, p. 184) reported it from the lowlands and foothills of west-central and central Nepal in winter and spring.

All the specimens marked subadult are not in full adult plumage. They have nearly completed post-juvenile moult. This moult has just started in three male specimens (Hitaura, June 12, 17, 22). Another male bird (Thankot, April 12) has nearly attained the adult dress, while the male specimen from Kulikhani (July 2) has just attained the adult plumage, although its outer and two central pairs of rectrices are still growing.

Measurements of adult and subadult birds :

	Wing	Tail	Bill
4 ♂♂ :	91, 92, 93, 96	93, 94,—, 98	19 (2), 20 (2)
7 ♀♀ :	88, 89, 90 (2),—,91 (2)	90 (2),—(2), 91 (2), 95	19 (2), 19.5 (4),—

*366. **Anthus novaeseelandiae richardi** Vieillot. Richard's Pipit.

Scully (1879, pp. 316-317) had a single female specimen of Richard's Pipit from the Nepal Valley in winter. He noted it as 'decidedly rare'. Later, Rand & Fleming (1957, p. 188) recorded it only from the eastern tarai in winter. There does not appear to be any other Nepali record of this pipit after Hodgson's.

367. **Anthus novaeseelandiae rufulus** Vieillot. Indian Pipit.

DUN : Hitaura, Bhimphedi : 1 juv. ♂, 2 ♀♀, 2 juv. unsexed (May 8, June 3, 4, 12, 19). NEPAL VALLEY : Burhanilkantha, Kathmandu, Thankot : 13 ♂♂, 1 juv. ♂, 1 subad. ♀ (April 1-14, May 3).

The Indian Pipit is common in central Nepal, from the dun up to the Nepal Valley in and about grasslands, and cultivated fields of wheat, maize, etc.

Scully (1879, p. 317) reported it resident in the Nepal Valley, and common in the Markhu Valley and Nawakot district in winter. Ripley (1950b, p. 381) found it in the Valley in April (breeding) and in the central plains in November. Rand & Fleming (1957, p. 188) noted it from western to eastern Nepal (*c.* 275-1065 m.) in winter.

The subadult female specimen (Burhanilkantha, May 3) is in very fresh plumage, immediately after a general moult. The blackish-brown centres of feathers of its upper parts and tail are somewhat darker than those of adult birds, and with broader and more prominent pale fulvous edges. Underparts are similar to adults. Hindclaw is a little shorter. It had non-breeding ovary.

Birds taken in April and May had fully breeding gonads, while a female taken on June 12, had exhausted ovary. The June 12 female is very worn.

Colours of soft parts: Iris brown to dark brown; upper mandible dark horny paler on edges and tip; lower mandible fleshy with yellowish tinge on base and smoky on tip (the subadult female specimen lacks yellow); legs and feet yellowish fleshy (the subadult female has yellow only on the dorsal side); claws horny; pads pale yellow (white in subadult female).

Measurements:

	13 ♂♂	2 ♀♀	1 subad. ♀
Wing:	79.5, 81 (3), 82 (3), 82.5 (2), 83 (2), 84 (2)	76+, 78	80.5
Tail:	55, 57 (2), 58 (3), 59 (2), 59.5, 60, 62 (2), 63	55+, 60	59
Bill:	16 (2), 16.5 (4), 17 (5), 17.5 (2)	16, 17	15.5

*368. **Anthus godlewskii** (Taczanowski). Blyth's Pipit.

Polunin (1955, p. 894) provided the first authentic post-Hodgsonian record of this pipit from Nepal. He found a few specimens in the Langtang Valley, central Nepal, at *c.* 4115 m. early in September.

Proud's (1949, p. 712) report of the extra-limital *Anthus campestris*[1] from the Nepal Valley, refers in all probability to this species with which until recently, there has been a great deal of confusion (see Hall, 1957, pp. 726-731).

*369. **Anthus similis jerdoni** (Finsch). Brown Rock Pipit.

The only record of the Brown Rock Pipit from Nepal appears to be that of Rand & Fleming (1957, pp. 188-189) who occasionally found it in western Nepal near cultivation in winter.

370. **Anthus trivialis trivialis** Linnaeus. Tree Pipit.

NEPAL VALLEY: Thankot: 1 ♀ (April 11).

The Tree Pipit is apparently a rare bird in Nepal. Neither Hodgson (Gray & Gray 1846; Gray 1863), nor Scully (1879) or Ripley (1950b) found it there, but Rand & Fleming (1957, p. 187) record a single female specimen from west-central Nepal (*c.* 1370 m.) in December.

[1]We have a recent letter from Mrs. Proud stating that this was an error and she never found this species in Nepal.— EDS.

My specimen was taken out of a flock of seven birds.

Measurements : 1 ♀ : Wing 83 ; tail 62 ; bill 15.5.

Anthus hodgsoni Richmond. Indian Tree Pipit.

The Indian Tree Pipit is a very common bird of central Nepal from Bhimphedi region to the Nepal Valley during March-April in gardens, light forests, outskirts of and clearings in forests. They usually occur in small flocks, individuals feeding together in a small patch of ground or scattered over a wide area. During the third week of April, however, one flock was found broken up into feeding pairs.

While I have not made any special study of this pipit, I find that the latest and the best available revision of the species by Ripley (1948b), has only limited utility by not answering many points. His characterization of the subspecies does not hold good in many cases. The striations particularly are very variable, and I have examined many specimens which, according to his definition, should be called *hodgsoni* when their dorsal side alone is examined, but *yunnanensis* from the ventral side. I believe, the question of the subspecies of *Anthus hodgsoni* still remains open.

I am not sure if the 33 specimens from Nepal at my disposal should all be placed under one subspecies or more. On the basis of characters of the dorsal side alone, as given by Ripley, they may, however, be grouped under the two[1] subspecies that are known to occur in India, as follows :

371. **Anthus hodgsoni yunnanensis** Uchida & Kuroda. Northern Tree Pipit.

TARAI : Simra : 1 ♀ (March 4). CHITLANG VALLEY : Chitlang : 1 ♀ (April 19). NEPAL VALLEY : Kathmandu, Pashupatinath, Thankot : 4 ♂♂, 6 ♀♀, 1 unsexed (March 21-April 17).

Ripley (1950b, p. 381) reported this form from western central and eastern Nepal at *c.* 1220-2440 m. in winter and spring. Rand & Fleming (1957, p. 187) found it from western to eastern Nepal at *c.* 275-2775 m. in winter.

Most of my specimens are in some stage of moult, e.g.:

March 4, ♀ : crown and throat
21, ♂ : crown, chin, throat and tail
22, ♂ : crown, chin and throat ; tail moult finished
23, ♂ : crown to nape and chin to upper breast
27, ♀ : crown
30, ♂ : posterior crown with just grown feathers ; central rectrices in moult
30, ♀ : whole head and chin to upper breast

[1] There appears to be no authentic record of the occurrence of the third accepted subspecies, *A. h. berezowskii* Zarudny in India. Ripley's (op. cit., pp. 623, 626) record, followed by Vaurie (1959a, p. 68), is based on three specimens in the Koelz collection from Uttar Pradesh (United Provinces) that are in fact juvenile *Anthus pelopus.*

April 1, ♀ : crown, chin and throat
8, ♀ : crown to upper back, and chin to upper breast
11, ♀ : upper tail coverts

The gonads of a male (March 23) and two female (April 8 and 11) specimens were just beginning to swell.

Colours of soft parts : Iris dark brown ; upper mandible horny with fleshy on base ; lower mandible fleshy with horny tip ; legs and feet horny fleshy ; claws horny ; pads fleshy white.

Measurements :

	4♂♂	8♀♀	1 unsexed
Wing :	85 (2), 87, 87.5	79, 80 (2), 81 (2). 82 (2), 83	84
Tail :	64, 64+, 66, 66+	58, 59 (3), 61 (2), 62 (2)	62
Bill :	15 (3), 16	15 (6), 16 (2)	—

372. **Anthus hodgsoni hodgsoni** Richmond. Hodgson's Tree Pipit.

BHABAR : Amlekhganj : 1 ♂ (March 7). DUN : Bhimphedi : 1 ♂, 1 ♀ (March 11, 12). CHITLANG VALLEY : Chitlang : 2 ♂♂ (April 19, 20). NEPAL VALLEY : Kathmandu, Pashupatinath, Gowchar, Thankot, Chandragiri Pass : 8♂♂, 5♀♀, 2 unsexed (March 20-April 13).

Ripley (1950b, p. 381) found this Tree Pipit only in eastern Nepal in winter, and Rand & Fleming (1957) did not find it at all.

Some of my specimens are in moult, e.g. :

March 7, ♂ : moult just commenced on throat.
11, ♂ : crown, throat and tail.
20, ♀ : crown to upper back, and chin to breast
24, unsexed : crown to nape, and chin to upper breast
26, ♂ : whole head, chin, throat
26, ♂ : just commenced on chin and throat

April 1, ♂ : moult just finished
5, ♂ : head feathers still with sheaths
5, ♀ : crown to back, and chin to breast
10, unsexed : throat in moult, tail very worn
12, ♂ : moult just finished
13, ♂ : sheaths still present on feathers of crown to upper back, and chin to throat
19, ♂ : posterior crown
20, ♂ : crown

All the specimens had non-breeding gonads.

Measurements :

	12 ♂♂	6 ♀♀	2 unsexed
Wing :	83 (2), 84, 85, 85. 5, 86 (3), 87 (3), 90[a]	80, 81 (2), 82 (2), 82. 5	81, 84
Tail :	59, 62 (4), 63 (2), 64 (2), 65.5, 66, 68[a]	58, 59, 60 (2), 62 (2)	—, 60
Bill :	15 (4), 15.5 (2), 16 (3), —, 16[a], 17	15 (3), 15.5 (3)	15.5 (2)

[a] This, the largest specimen (Chitlang, April 19), also has the striations on the upper side intermediate between *yunnanensis* and *hodgsoni*.

* 373. **Anthus cervinus** (Pallas). Redthroated Pipit.

The only post-Hodgsonian record of the Redthroated Pipit from Nepal has been furnished by Rand & Fleming (1957, p. 188) who took a single example in west-central Nepal at *c.* 5180 m. in December.

374. **Anthus pelopus** J. E. & G. R. Gray. Hodgson's Pipit.

Anthus pelopus J. E. & G. R. Gray, 1846, Cat. spec. drawings Mam. Birds Nepal pres. Hodgson, p. 154. (Nepal.)

A. (nthus) roseatus Blyth, 1847, *J. Asiat. Soc. Beng.* **16** : 437. (Nepal.)

NEPAL VALLEY : Thankot : 5 ♂♂, 1 ♀ (April 9-12).

We did not find Hodgson's Pipit to be common in central Nepal. Small flocks were occasionally seen in wet fields and grassy patches.

Scully (1879, pp. 317-318), found it to be fairly common in the Nepal and Chitlang valleys, central Nepal, from October to March, but always solitary. Ripley (1950b) did not find it in Nepal. Polunin (1955, p. 894) reported it as very common at *c.* 3050 m. up in the Langtang Valley, central Nepal, during summer. Lowndes (1955, p. 35) found it locally fairly common in summer up to *c.* 4725 m. in Manangbhot, central Nepal. Biswas (1960a) reported it breeding at *c.* 4570-4725 m. in April-May and observed it commonly up to *c.* 5335 m. in May in Khumbu, eastern Nepal.

A male specimen taken on April 10 is undergoing post-juvenile moult.

Measurements :

	Wing	Tail	Bill
4 ♂♂ :	84.5 [a], 86.5[a], 90, 91	63[a], 64[a], 67, 69	16[a], —, 17[a], 17
1 ♀ :	85	64	16.5

[a] These two specimens appear to be female from size, but they are marked male on their labels.

375. **Anthus sylvanus** (Blyth). Upland Pipit.

MARKHU VALLEY : Deorali : 1 ♂ (April 29). CHITLANG VALLEY : Chitlang : 4 ♂♂, 1 ♀ (April 29, July 2, 26).

This pipit was occasionally found by us on the Chandragiri above Chitlang and on the Mahabharat Range around Deorali.

Scully (1879, p. 318) and Proud (1949, p. 712) found it resident on hills round the Nepal Valley. Polunin (1955, p. 895) reported a single example in the Langtang Valley, central Nepal, at *c.* 2745 m. in summer. Ripley (1950b) did not find it in Nepal. Rand & Fleming (1957, p. 189) record it from west-central Nepal at *c.* 1435 and 2285 m. in winter.

It was breeding in July.

Measurements :

	Wing	Tail	Bill
5 ♂♂ :	78, 79 (2), 80 (2)	66, 69, 70 (3)	17.5, —, 18 (3)
1 ♀ :	79	69	18

Family CAMPEPHAGIDAE

376. **Coracina novaehollandiae nipalensis** (Hodgson). Large Himalayan Cuckoo-Shrike.

TARAI : Simra : 2 ♂♂ (March 5, 6), BHABAR : Amlekhganj : 1 ♂, 1 ♀ (March 9, 10). DUN : Hitaura : 1 ♂, 1 subad. ♂, 3 ♀♀ (May 22, 28, June 1, 9, 15). NEPAL VALLEY : Godavari, crest of Chandragiri above Thankot : 1 ♂, 3 ♀♀ (April 14, May 10, 15).

This large cuckoo-shrike is a common bird of different types of forests of central Nepal, usually in pairs at least during spring and summer. It is shy.

Scully (1879, p. 268) found it common in Nawakot district and the central bhabar and dun in winter, but merely as a straggler in the Nepal Valley from end October to mid-November. Proud (1949, p. 707), however, reported it to be resident there from *c.* 1525 to 2440 m., and saw it even in January and February. Ripley (1950b, p. 383) came across it from the tarai up to *c.* 1830 m. Rand & Fleming (1957, p. 104) reported it from *c.* 275 to 1830 m. in western through eastern Nepal.

The subadult male specimen (Hitaura, June 1) is moulting into adult dress. A female bird (Godavari, May 10) has the forecrown and upper breast moulting. Two other birds (Hitaura, ♀, May 22, and ♂, June 15) are also in partial moult, while another female (Hitaura, June 9) is finishing a complete moult.

In mid-April a female had granular ovary, measuring 10 × 6 mm., while in mid-May birds had almost breeding gonads, but females taken on May 28 and June 9 had spent up ovaries.

Colours of soft parts : Iris brownish red ; bill, legs, feet and claws black ; pads grey or yellowish grey.

Measurements :

	Wing	Tail	Bill
5 ♂♂ :	175, 176, 180, 181, 187	132, 135, 136, 143, 148	31(2), 32, 32.5,33
6 ♀♀ :	173, 177 (2), 178, 179, 180	133, 138, 141, 142 (2), 143	31 (3), 31.5 (2), 32

377. **Coracina melaschistos melaschistos** (Hodgson). Dark Grey Cuckoo-Shrike.

TARAI : Simra : 1 ♀ (March 6). DUN : Hitaura, Kusumtar, Bhimphedi : 1 subad. ♂, 2 ♀♀ (May 6, 19, 31). MARKHU VALLEY : Deorali : 1 ♂ (May 1). CHITLANG VALLEY : Chitlang : 1 subad. ♂ (April 16). NEPAL VALLEY : Thankot : 7 ♂♂, 3 ♀♀, 2 subad. ♀♀, 1 juv. ♀ (March 21-29, April 1, 14, June 29).

This smaller cuckoo-shrike is common in the Nepal Valley from about the third week of March. It is common also in the dun during May-June. Rand & Fleming (1957, p. 104) did not find it to be common in the Nepal Valley. However, it was very frequently heard and as a matter of fact, observed by us in fair numbers

on the slopes of Chandragiri about Thankot, also at Godavari and in smaller numbers in the central woods.

Scully (1879, p. 267) noted it in the Nepal Valley from April to September, while Proud (1949, p. 707) found it there from March to mid-October. Ripley (1950b, p. 382) found it in the eastern tarai in winter. Rand & Fleming (loc. cit.) recorded it from west-central Nepal also.

A subadult female bird from Thankot (April 1) has the primaries brown. The subadult male from Chitlang (April 16) has brown primaries and some bars on the undertail coverts, while another subadult male (Hitaura, May 19) has brownish general coloration with brown primaries and rectrices. The juvenile female specimen (Thankot, June 29) is barred both above and below.

Birds taken towards the end of March (28-29) had somewhat swollen gonads, the ovaries being granular, and a female shot two months later (Hitaura, May 31) had much developed ovary, measuring 7 × 8 mm. with a few ova 3-4 mm. in diameter.

Colours of soft parts : Iris reddish brown ; bill, legs, feet and claws black ; pads dirty white, sometimes with yellowish tinge.

Measurements :

	8 ♂♂	6 ♀♀
Wing :	119, 121 (3), 124, 125, 127, 128	114, 117, 118 (2), 120, 122
Tail :	114, 117, 119, 120 (3), 121, 123	109, 110, 111,—, 118, 120
Bill :	20.5, 21, 21.5 (2), 22 (3), 23	21 (3), 21.5, 22, —

378. **Coracina melanoptera sykesi** (Strickland). Blackheaded Cuckoo-Shrike.

Lalage sykesi Strickland, 1844, *Ann. Mag. nat. Hist.* **13** : 36. (Deccan[1].)
DUN : Hitaura : 1 ♂ (May 21).

The Blackheaded Cuckoo-Shrike was seen by us only once in a patch of light forest bordering cultivated fields in the central dun. There does not appear to be any record of this species so far from Nepal.

Measurements : 1 ♂ : Wing 106 ; tail 94.

Delacour (1951, p. 14) has included this specimen in his studies on this species.

*379. **Pericrocotus roseus roseus** (Vieillot). Rosy Minivet.

The Rosy Minivet does not seem to have been reported from Nepal after Hodgson.

*380. **Pericrocotus cinnamomeus peregrinus** (Linnaeus). Northern Small Minivet.

We had not been lucky enough to come across the Small Minivet in Nepal, nor was Scully (1879) either. However, Ripley (1950b,

[1] Strickland referred to Sykes's bird from the Deccan. Baker's (1921b, p. 696 ; 1924, p. 240 ; 1930a, p. 158) designation of the type locality as 'Calcutta' was therefore an error.

p. 382) found it in the western and eastern tarai, and Rand & Fleming (1957, p. 102) reported it from the western and west-central tarai.

381. **Pericrocotus solaris solaris** Blyth. Yellowthroated Minivet.

MARKHU VALLEY: Deorali: 1 ♂, 1 ♀ (April 29, 30).

The Yellowthroated Minivet was observed by us on two or three occasions in the oak forest about Deorali towards the end of April and early May. It was in all probability breeding around there. I am unable to find any other post-Hodgsonian record of its occurrence in Nepal.

Measurements :

	Wing	Tail	Bill
1 ♂:	86	102	16
1 ♀:	81	92	15

382. **Pericrocotus ethologus favillaceus** Bangs & Phillips. Western Longtailed Minivet.

383. **Pericrocotus ethologus laetus** Mayr. Sikkim Longtailed Minivet.

DUN: Bhimphedi: 1 ♂, 1 ♀ (March 13, May 7). CHITLANG VALLEY: Chitlang, Chandragiri above Chitlang: 2 ♂♂, 1 ♀ (April 18-24). NEPAL VALLEY: Thankot, Chandragiri above Thankot: 3 ♂♂, 1 juv. ♂, 4 ♀♀, 1 juv. ♀ (March 24-April 13).

The Longtailed Minivet is quite common from Bhimphedi up to the Nepal Valley, particularly in the forests at the foot of Chandragiri, both on Thankot side and on Chitlang side. On some occasions we observed it passing in a flock from one side of the range to the other across the crest. This crossing would be done rather leisurely, the birds stopping several times on the way to feed or indulge in love-play.

Ripley (1950b, pp. 381-382) reported it from western and eastern Nepal also. Lowndes (1955, p. 33) found it in Manangbhot, central Nepal, occasionally at *c.* 3655-3930 m. in summer. Rand & Fleming (1957, p. 102) recorded it from western to eastern Nepal.

On March 24, a male bird had quite enlarged testes, 10 × 6 (R) and 11 × 7 mm. (L), and a female on April 9 was laying; but another female on April 13 had only granular ovary, 5 × 3 mm.

Measurements :

	Wing	Tail	Bill
6 ♂♂:	89, 91, 92 (2), 92.5, 94	102, 103 (2), 103.5, 104, —	15.5 (2), 16 (2), 16.5—
6 ♀♀:	89 (2), 89.5, 90, 91, 92	101.5, 102 (2), 103, 107, 108	15.5 (2), 16.5, — (3)

Scully (1879, pp. 268-270) listed all his specimens of *P. ethologus* under the closely similar species *P. brevirostris*. Those of his specimens that I have examined, undoubtedly belong to *P. ethologus*. Furthermore, his description and measurements also bear this out. Ripley (loc. cit.)

called his eastern Nepal examples *laetus*, and the central and western ones, *favillaceus*, while Rand & Fleming (loc. cit.) placed all their examples from western, west-central and eastern Nepal under *favillaceus*. Lowndes (loc. cit.) identified his specimens from the westernmost part of central Nepal as *laetus*. From an examination of the collections at the British and American Museums of Natural History, however, I am unable to subscribe fully to their views. All my female specimens have reduced yellow on forehead, thus approaching *laetus*, but olive green on the back is not pronounced, thereby leaning towards *favillaceus*. Moreover, the wing-tail ratio in the males is closer to that of *laetus*. I would, therefore, treat the central Nepal population as intermediate between the western Himalayan *favillaceus* and the eastern *laetus* with perhaps a slight leaning towards the latter. The intergrading zone extends eastward at least up to the Dudh Kosi Valley, for the single specimen examined thence appears near *favillaceus*. I have not had the opportunity to compare any specimen from west-central or western Nepal, nor from east of the Dudh Kosi Valley. But from the data furnished by Ripley and Rand & Fleming, I would imagine the ranges of the two subspecies in Nepal to be as follows :

Western and west-central	..	*P. e. favillaceus.*
Central and eastern up to Dudh Kosi Valley	..	*P. e. favillaceus* $\gtrless$ *laetus*
Eastern, Arun Valley eastward	..	*P. e. laetus*

384. **Pericrocotus brevirostris brevirostris** (Vigors). Shortbilled Minivet.

MARKHU VALLEY : Deorali : 1♂, 1♀ (April 29, 30).

The Shortbilled Minivet did by no means appear to be common in central Nepal. A small flock was seen in the pine forest near Deorali when two specimens were collected. Very probably it breeds somewhere in central Nepal, for my specimens had much enlarged gonads, and in the flock the males were seen chasing the females.

Scully's birds listed under *P. brevirostris* are, as has been noted above, all *P. ethologus*. Ripley (1950b) did not come across *P. brevirostris* in Nepal, and Rand & Fleming (1957, p. 101) hesitantly placed an immature male specimen taken near Beni, west-central Nepal (November) under this species. The reports of this species by Proud (1949, p. 707) from the Nepal Valley, and Polunin (1955, p. 892) from the Langtang Valley, central Nepal, are based on sight records. My specimens would, therefore, constitute the first unmistakable record of the occurrence of the species west of Sikkim.

Measurements :

	Wing	Tail	Bill
1♂:	90	101	15.5
1♀:	89	95	15

385. **Pericrocotus flammeus speciosus** (Latham). Indian Scarlet Minivet.

TARAI : Simra : 2 ♂♂, 2 ♀♀ (March 4). BHABAR : Amlekhganj : 1 ♂, 2 ♀♀ (March 6-11). DUN : Hitaura, Bhimphedi : 6 ♂♂, 2 juv. ♂♂, 7 ♀♀ (May 7-June 1, 12). NEPAL VALLEY : Thankot : 1 ♂, 2 ♀♀ (March 23, April 1, 2).

The Scarlet Minivet is common in all the forests of central Nepal except those of the tarai, probably because it had already started moving to higher elevations by the time we arrived there in March. It has also been found in eastern Nepal by Ripley (1950b, p. 381) in February, and in western, west-central and eastern by Rand & Fleming (1957, p. 101) in November-February.

All my male specimens have the first two outer primaries unmarked and the females generally have three such unmarked feathers. The following variations in the female may be noted :

1. First two primaries unmarked (as in male) : Two specimens (Bhimphedi, May 7, and Hitaura, May 27).

The first-named specimen in this category has some faint scarlet patches on the under tail coverts. This incidentally is the largest of my female specimens.

2. First two primaries unmarked and the third primary with about 8 mm. long mark : One specimen (Amlekhganj, March 6).

3. Three left and two right primaries unmarked, the third right primary having only a small speck of yellow mark : One specimen (Hitaura, May 16).

The presence or extent of scarlet on the central tail feathers of males is somewhat variable. Of the 10 examples noted above, there is no scarlet on the central tail feathers in four of them, and in the remaining six specimens it is present as follows :

(1) As a small wedge on the tip : Two specimens : Simra, March 4 (8 and 11 mm.), Amlekhganj, March 11 (4 and 4.5 mm.).

(2) Spindle-shaped, not symmetrical on the two feathers : Three specimens :

(i) Simra, March 4—on one : 52 mm. long, tip to about the middle of the feather, 4 mm. across the widest part, does not touch the shaft ; on the other : 37 mm. long, anterior end is at 15 mm. from tip of the feather, 1.5 mm. across the widest part.

(ii) Thankot, April 1—similar to (i), but size 36 × 2.5 mm. and 45 × 3 mm. does not reach the tips of feathers.

(iii) Hitaura, May 23—similar to (ii) but 55 × 3.5 mm.

(3) Irregular and asymmetrical : one specimen—Hitaura, May 16. On one central rectrix there is a 6 mm. wedge, but on the other it is as if a wedge has fused with a spindle-shaped mark (Fig. 1), 43 × 4 mm.

Fig. 1. Right central rectrix of a male specimen of *Pericrocotus flammeus speciosus* (Latham) from Hitaura, Nepal. The shaded area represents the irregular and asymmetrical scarlet patch.

A male on April 1 (Thankot) had much swollen testes, but the female of April 2 from the same locality had only granular ovary, 4 × 5 mm. End May—early June specimens had the testes about similar in size to those of April 1, but more enlarged ovaries.

Measurements :

	10 ♂♂	13 ♀♀
Wing :	100 (3), 102 (2), 103, 104 (3), 105	96, 97 (2), 97.5, 98 (2), 98.5, 99, 100, 101, 102, 102.5, 103[a]
Tail :	98, 99, 100 (2), 103, 104, 105 (4)	94, 96, 96.5, 98, 100 (3), 100.5, 102, 102.5, 103[a], 104, 105
Bill :	20 (4), 20.5 (2), 21 (2), 21.5 (2)	19, 19.5, 20 (4), 20.5, 21 (3), 21.5, 21.5[a], 22

[a] Specimen with the first two primaries unmarked, Bhimphedi, May 7 (also see above).

386. **Hemipus picatus capitalis** (Horsfield). Brownbacked Pied Shrike.

TARAI : Simra : 1 ♂, 1 ♀ (March 4, 6). BHABAR : Amlekhganj : 1 ♂, 1 ♀ (March 6, 7). DUN : Hitaura, Bhimphedi : 8 ♂♂, 1 subad. ♂, 3 ♀♀, 1 juv. ♀, 1 unsexed (May 4-6, 15, 24-29, June 7).

The Brownbacked Pied Shrike is commonly found in pairs or small parties in the denser parts of forests of the tarai, bhabar and dun of central Nepal. We were unable to locate it in the Nepal Valley, where Proud (1949, p. 707) found it but very rarely. Ripley (1950b, p. 382) recorded it from western and central Nepal up to *c.* 1525 m. in winter and spring. Rand & Fleming (1957, pp. 102-103) found it in west-central Nepal, *c.* 915-1400 m. in winter, and on the Chandragiri, *c.* 1830 m. central Nepal, in May.

The juvenile female (Hitaura, May 29) has the upper plumage barred with rufous, lower plumage white with fulvous tinge in irregular patches on throat, breast and abdomen ; wing coverts fulvous white barred with brown. Its crown feathers have an interesting colour pattern : a rufous bar on the tip, followed by a crescent of brown and the rest pale ashy with white shaft (Fig. 2).

The subadult male (Hitaura, May 24) is undergoing the post-juvenile moult.

The unsexed specimen (Bhimphedi, May 4) is very worn ; and an adult female (Hitaura, June 7) is in moult.

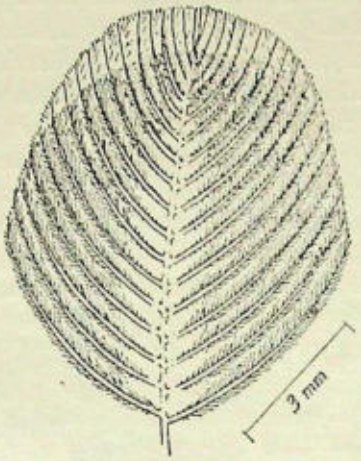


Fig. 2. A crown feather of a juvenile female specimen of *Hemipus picatus capitalis* (Horsfield) from Hitaura, Nepal. The apical bar is rufous, the shaft is white, the pale area adjacent to the shaft is pale ashy, and the remaining broad crescentic portion is brown.

Towards the end of May, the female birds had spent-up ovaries, and the males somewhat swollen testes; breeding was evidently over.

Colours of soft parts: Iris brown (dark brown in juv. ♀); bill black; legs and feet dark horny (slaty in juv. ♀); claws black; pads white.

Measurements:

	10 ♂♂	4 ♀♀
Wing:	62, 63 (2), 63.5, 64 (2), 64.5, 65 (2), 67	64 (2), 64.5 (2)
Tail:	59, 60, 61 (3), 62, 63, 64 (2), 65	61 (3), 63.5
Bill:	16, 16.5 (2), 17 (3), 17.5,— (3)	17 (3), 18

387. **Tephrodornis gularis pelvicus** Hodgson. Nepal Wood Shrike.

DUN: Kusumtar, Hitaura, Bhimphedi: 2 ♂♂, 7 subad. ♂♂, 2 juv. ♂♂, 3 ♀♀, 6 subad. ♀♀, 1 juv. ♀ (May 3-22, 31, June 3, 4, 16, July 15).

The Nepal Wood Shrike is common in the central dun. It usually occurs in pairs in open parts of forests.

Scully (1879) did not record the species from Nepal. Ripley (1950b, p. 382) found it in the tarai and dun. Rand & Fleming (1957, p. 103) reported it from the lowlands to *c.* 1065 m. of western, west-central and eastern Nepal.

All the subadult specimens which do not differ from adults in size, have somewhat barred secondaries and upper tail coverts, and two of them (♂, Kusumtar, May 31 and June 4) have some blotches of brown on ashy grey of crown, and white or mixed white and rufous tips of outermost rectrices (an adult ♀, June 4, also has white tips).

All the adult and subadult specimens are in worn plumage. One of the juvenile specimens (♂, May 19) is moulting into adult dress, while another (♀, July 15) is very young, with downy white feathers on the underside, evidently born during that season.

It does breed in subadult plumage. A subadult male had 13 mm. long testes on May 5. But towards the end of May and early in June, males had the testes reduced, and females had shrunken and exhausted ovaries.

Colours of soft parts : Iris yellowish brown (in one subad. ♂ almost reddish brown) ; upper mandible brownish black with brownish horny on base and round nostrils ; lower mandible brownish horny, paler on base (in two subad. ♂♂ both mandibles black); legs and feet dull plumbeous (with horny tinge in a subad. ♂); claws black (horny in a subad. ♂) ; pads yellowish grey.

Measurements :

	Wing	Tail	Bill
2 ad. ♂♂ :	120, 123	90, 91	27.5 (2)
6 subad. ♂♂ :	119, 120 (3), 122 (2)	87 (3), 90 (3)	26, 27, —, 28, 28.5, 29
3 ad. ♀♀ :	—, 123 (2)	89, 90, 92	25.5 +, 27, 29
6 subad. ♀♀ :	116, 118 (2), 119, 120, 121	84, 86 (2), 87 (2), 88	—, 27.5 (2), 28, 28.5, 29

388. Tephrodornis pondicerianus pondicerianus (Gmelin). Common Indian Wood Shrike.

TARAI : Simra : 1 ♀ (March 4). DUN : Hitaura : 4 ♂♂, 1 ♀, 1 juv. ♀ (May 18, 23, June 1, 12).

The Common Wood Shrike is not uncommon in small flocks in light forests of the tarai and duns of central Nepal.

Ripley (1950b, p. 382) found it in the western tarai also, and Rand & Fleming (1957, p. 103), from *c.* 275-455 m. in western, west-central and eastern Nepal.

The March bird has the central rectrices in moult, and the other adult examples (May-June) are worn.

Measurements :

	Wing	Tail	Bill
4 ♂♂ :	86 (2), 87, 91	64, 68 (2), 69	23 (4)
2 ♀♀ :	86, 86.5	68, 71	23, —

FAMILY PYCNONOTIDAE

389. **Pycnonotus striatus striatus** (Blyth). Himalayan Striated Green Bulbul.

RAPTI VALLEY : Mahabharat Range above Bhimphedi : 1 ♂, 1 imm. ♂, 2 ♀♀ (May 4, 6). MARKHU VALLEY : Deorali : 1 ♂ (May 1). CHITLANG VALLEY : Chitlang : 1 ♂, 1 ♀ (April 16, 25). NEPAL VALLEY : Thankot : 5 ♂♂, 3 ♀♀ (March 30-April 8).

The Striated Green Bulbul is not uncommon in central Nepal. It was found by us in small flocks during March-April on both sides of Chandragiri above 1525 m., and in May on Mahabharat Range above Bhimphedi about the same altitude.

Scully (1879) did not include it in his Nepal list. Ripley (1950b, p. 385) reported it also from *c.* 2285 m. in eastern Nepal.

A male bird (April 25) from Chitlang has two outer rectrices still growing.

The immature male specimen (Bhimphedi, May 6) is smaller in size and has narrow, but not pointed tail feathers.

A female example taken on May 6 (Bhimphedi) was laying.

Measurements :

	Wing	Tail	Bill
8 ♂♂ :	106, 107 (2), 109 (2), 111, 112, 113	98, 99 (2), 100, 101, 102, 105, 106	20.5 (2), 21 (4), 21.5, 22
6 ♀♀ :	105 (3), 106, 107 (2)	97, 100 (2), 101, 103 (2)	20.5 (2), 21 (3), 21.5

390. **Pycnonotus melanicterus flaviventris** (Tickell). Blackcrested Yellow Bulbul.

TARAI : Simra : 3 ♂♂, 3 ♀♀ (March 4-7). DUN : Hitaura, Bhairab Thumka : 5 ♂♂, 3 ♀♀, 2 feathered chicks (May 16, 20, 30, June 1-6, 11).

The Blackcrested Yellow Bulbul is not uncommon in pairs in the tarai, bhabar and dun usually in light forests, but on one or two occasions was seen in fairly dense forests too.

Scully (1879, pp. 295-296) found it in the central bhabar in winter. Ripley (1950b, p. 384) reported it from tarai close to the foothills. Rand & Fleming (1957, pp. 144-145) found it from western to eastern Nepal *c.* 275-1065 m.

A male on June 1 (Hitaura) had somewhat swollen testes. The gonad of a female taken on the same day, however, was more advanced. Another male collected on June 11 had fully breeding testes.

Colours of soft parts : Iris pale yellow ; bill black ; legs and feet horny ; claws dark horny ; pads yellowish white.

Measurements :

	8 ♂♂	6 ♀♀
Wing :	86 +, 89, 90 (4), 91, 93	86 (2), 87 (2), 88, 89
Tail :	85 +, 86, 87, 88 (2), 89, 90 (2)	83, 84, 85 (3), 86
Bill :	16 (6), 16.5, 17	15.5 (2), 16 (2), 16.5 (2)

Deignan (1954a, p. 123) has shown that *Pycnonotus gularis, P. flaviventris, P. dispar* and *P. melanicterus* are all conspecific (*contra* Ripley, 1946, p. 228 ; 1950b, p. 384; and Rand & Fleming, 1957, pp. 144-145).

391. **Pycnonotus jocosus pyrrhotis** (Bonaparte). Northern Redwhiskered Bulbul.

I. (xos) pyrrhotis ' Hodgs.' Bonaparte, 1850, Consp. Gen. Av. **1**: 265. (India = Nepal, ex Hodgson, 1844, *nom. nud.*)

Otocompsa jocosa provincialis Whistler, 1931, *Bull. Brit. orn. Cl.* **52** : 40. (Kumaon Bhabar.)

DUN : Hitaura : 3 ♂♂, 3♀♀, 2 nestlings (May 12-27, June 9).

The Redwhiskered Bulbul is fairly common in the bhabar and dun of central Nepal during May-June in scrub jungle and light forests. It is usually found in small flocks, but pairs as well as mixed feeding parties of this species and *M. cafer* are also seen.

Scully (1879, p. 296) reported only caged specimens. Ripley (1950b) did not find it in Nepal. Rand & Fleming (1957, p. 145) reported it fairly common in the tarai and dun from western to eastern Nepal.

Almost all my adult examples are fairly worn. A female (May 17) has worn body plumage but fresh wings and tail.

One of the nestlings (May 12) has a dark brown crest and incomplete pectoral band, while the other specimen, taken June 9, is downy, with a few black feathers on crest and a complete pectoral band.

Measurements :

	Wing	Tail	Bill
3 ♂♂ :	88 + , 90 (2)	85, 85 + , 86	19 (2),—
3 ♀♀ :	80, 81, 83	73, 77 (2)	18·5 (2), 19

392. Pycnonotus leucogenys leucogenys (J. E. Gray). Indian White-cheeked Bulbul.

Brachypus leucogenys J. E. Gray, 1835, Illustr. Indian Zool. 2 : pl. 35, fig. 3. (India = Himalaya and in Kashmir, according to Blyth, 1845, p. 567 ; = Darjeeling according to Baker, 1921a, p. 469 ; = Kashmir according to Vaurie 1958, p. 19.)

TARAI : Simra : 2 ♂♂ (March 4). BHABAR : Amlekhganj : 2 ♂♂, 1 juv. ♀ (March 6, 8). DUN : Hitaura, Bhimphedi : 3 ♂♂, 1 juv. ♀, 1 unsexed juv. (March 11, May 6, 8, 25, 26). CHITLANG VALLEY : Chitlang : 2 ♀♀ (April 18, 22). NEPAL VALLEY : Sheopuri ridge (east of Barhanilkantha), Godavari, Thankot, Crest of Chandragiri 5 ♂♂, 5 ♀♀ (March 23-30, April 2-9, May 2, 10-13).

The Whitecheeked Bulbul is a very common bird of central Nepal from the bhabar up to the Nepal Valley. It was also reported from western and west-central Nepal, up to *c.* 2440 m. by Rand & Fleming (1957, p. 145), northern part of central Nepal (Langtang Valley, *c.* 2440 m.) by Polunin (1955, p. 889), and the Arun Valley (*c.* 1525 m.), eastern Nepal, by Biswas (1960a).

A female taken March 30 (Crest of Chandragiri) had swollen ovary, with ova as large as 2.75 and 2 mm., while another female collected at Thankot on April 2 had a granular ovary. Birds taken in May and June had full breeding gonads.

Colours of soft parts : Iris dark brown ; bill, legs, feet and claws black ; pads grey to white.

Measurements [1] *:*

	18 ♂♂	8 ♀♀	2 unsexed
Wing :	85,—, 86, 87, 88 (2), 89 (4), 90, 91 (3), 92 (3), 94	82, 83, 84 (2), 85 (3), 86	86, 88
Tail :	81, 82, 83 (3), 84, 85 (3),—(2), 86 (2), 87, 88 (2), 89, 90	80, 81 (2), 82, 84 (2), 85, 86	84, 85
Bill :	19 (3), 19.5 (5), 20 (6), 20.5 (2), 21,—	18.5 (4), 19 (4)	19, 19.5

[1] Including those of some additional specimens from Nepal present in the Zoological Survey of India.

For a discussion as to whether the White-eared Bulbul, *P. leucotis*, should be considered conspecific with *P. leucogenys*, see Vaurie (1958, pp. 14-15 ; 1959a, p. 191) and Ripley (1958a, pp. 1-5 ; and in press).

393. **Pycnonotus cafer bengalensis** Blyth. Bengal Redvented Bulbul.

TARAI : Simra : 1 ♀ (March 4). DUN : Hitaura : 1 ♂, 1 juv. ♂, 2 ♀♀, 2 juv. ♀♀, 1 chick in down (May 19, 26, 27, June 4, July 28). CHITLANG VALLEY:: Chitlang : 3 ♂♂ (March 18, April 21, 24). NEPAL VALLEY : Kathmandu, Thankot : 4 ♂♂, 2 ♀♀ (March 21-24, 30, April 7, 9).

The Redvented Bulbul is a very common bird in central Nepal from the plains up to the Nepal Valley in and around villages. It has been reported from western and eastern Nepal by Ripley (1950b, p. 384), and Rand & Fleming (1957, pp. 145-146).

A male and a female bird taken on May 19 and 26 respectively, are not in full adult plumage : they have very brown primaries, but in size they are fully grown. The male specimen has the central rectrices in moult, but the female is worn. The juvenile female specimen of July 28 (Hitaura) has black feathers coming on the crown, throat and breast. The chick in down (Hitaura, May 27) has brown body with paler vent, and rufous on wing coverts and remiges.

A female taken on April 7 (Thankot) has just finished moult.

The gonads were already somewhat enlarged in the latter half of March and early April. Towards the end of May the gonads were in full breeding condition, and a female taken on June 4 had an exhausted ovary.

Colours of soft parts: Iris dark brown ; bill black ; legs, feet and claws very dark horny to black ; pads white.

Measurements :

	8 ♂♂	5 ♀♀
Wing :	101, 102, 103, 104 (2), 106 (2), 107	91, 96, 97, 98, 100
Tail :	95 +, 96+, 97, 98,99, 99+, 103, 103+	87 (2), 92, 93+, 95+
Bill :	20, 20.5, 21 (2), 21.5 (2), 22 (2)	19.5, 20, 20.5, 21.5 (2)

The sexual dimorphism of size in this species, already noted by earlier authors (e.g. Whistler & Kinnear, 1932b, pp. 775-756), is not apparent from the wing measurements given by Rand & Fleming (op. cit., p. 146).

394. **Cringer flaveolus flaveolus** (Gould). Indian Whitethroated Bulbul.

Trichophorus flaveolus Gould, 1836, *Proc. zool. Soc. Lond.* (4) : 6. (In Himalaya mountains, in Nepal, etc. [1], restricted to Nepal by Koelz, 1954, p. 10.)

DUN : Hitaura : 5 ♂♂, 6 ♀♀ (May 14-June 4).

[1] Baker was obviously wrong in giving the type locality as ' (India) (Cachar) ' (1921a, p. 466 ; 1922d, p. 363) or as ' Himalayas, Cachar ' (1930a, p. 75). His restriction cannot in any case stand, since Cachar is not in the Himalayas.

The Whitethroated Bulbul is not common in central Nepal. It was observed by us in small flocks in the forests around Hitaura in the dun, and was also seen once near Amlekhganj in the bhabar.

Scully (1879, p. 295) found it to be common in winter between the bhabar and dun, but Ripley (1950b) and Rand & Fleming (1957) did not report it from Nepal.

A female specimen (May 23) has moulting central rectrices, the left one being only half grown and the right one although apparently fully grown, had still the sheath on base.

Measurements :

	Wing	Tail	Bill
5 ♂♂ :	104, 105, 106 (2), 107	92, 93, 94 (2), 97	20, 21 (2), 21.5, 22
6 ♀♀ :	100 (3), 102, 103, 105	—, 88, 90 (2), 93 (2)	—(2), 21 (3), 21.5

395. **Hypsipetes virescens mcclellandii** (Horsfield). Rufousbellied Bulbul.

Hypsipetes mcclellandii Horsfield, 1839 (1840), *Proc. zool. Soc. Lond.* (7) : 159. (Assam.)

Ixos mcclellandii vargus Koelz, 1954, Contr. Inst. Reg. Expl. (1) : 10. (Bhimphedi, Nepal.)

DUN : Hitaura, Bhimphedi : 6 ♂♂, 4 ♀♀, 1 unsexed (March 12, 13, May 6, 13, June 17, 18). CHITLANG VALLEY : Chitlang : 2 ♂♂ (April 17, 20). NEPAL VALLEY : Thankot : 8 ♂♂ (March 21-April 9).

The Rufousbellied Bulbul is common in central Nepal from the dun up to the Nepal Valley in pairs or in small parties. It was also found in western Nepal by Ripley (1950b, p. 385), and west-central Nepal by Rand & Fleming (1957, p. 146).

It was breeding in the forests of Bhimphedi during mid-June.

Colours of soft parts : Iris brownish red ; upper mandible very dark horny, a little paler on the sides of the anterior half; lower mandible fleshy with horny on base and tip ; legs, feet and claws dark horny ; pads rusty.

Measurements :

	16 ♂♂	4 ♀♀	1 unsexed
Wing :	100, 103 (2),—, 105 (3), 106, 107 (2), 108[a], 108 (2), 109 (2), 110	100, 102, 104, 107	109
Tail :	98 (2), 100 (2), 101 (2), 102 (3), 103[a], 105 (3), 107 (2), 109	99, 102, 104, 105	107
Bill :	25, 25[a], 26 (5), 26.5, 27 (2),—, 28 (4), 29	25, 26 (2), 27	26.5

[a] Type of *vargus* Koelz.

The measurements of tail and tarsus as given by Baker (1922d, p. 337), viz. 'about 110' and 'about 19' respectively, do not appear to be very accurate. Sixty-nine specimens taken from all over its range (Kumaon east to Manipur) measure :

	Tail	Tarsus
33 ♂♂ :	98-113 (av. 105.2)	16.5—19 (av. 17.4)
12 ♀♀ :	99-109 (av. 104.2)	16.5—18.5 (av. 17.8)
24 unsexed :	100-112 (av. 105.0)	16—18.5 (av. 17.3)

396. **Hypsipetes flavala flavala** (Blyth). Himalayan Brown-eared Bulbul.

Hemixos flavala Blyth, 1845, *J. Asiat. Soc. Beng.* **14**: 572. ('Sub-Himalayan ranges, extending to Assam, Sylhet and Arracan' = Nepal, ex Hodgson, MS. Hereby further restricted to Hitaura, Chisapani Garhi district.)

DUN: Hitaura, Bhimphedi: 11 ♂♂, 6 ♀♀, 2 unsexed (May 3-5, 11-29, June 5, 18).

The Brown-eared Bulbul is not uncommon in the central dun. It occurs in pairs in deeper forests. It was breeding in May-June.

Rand & Fleming (1957, p. 146) recorded it also from western and west-central Nepal, *c.* 305-1065 m.

Colours of soft parts: Iris brownish red; bill black; legs dark horny; feet horny; claws dark horny; pads white.

Measurements:

	11 ♂♂	6 ♀♀	2 unsexed
Wing:	95, 96, 97, 98[a], 98, 99 (3), 100 (2), 102	89, 93 (3), 94, 95	92, 98
Tail:	85, 87, 88[a], 88, 89 (3), 90, 91, 92, 95	81, 83 (2), 84, 85, 86	82, 88
Bill:	20, 20.5 (2), 21 (3), 21.5[a], 21.5 (3), 22	20 (6)	20, 21.5

[a] This specimen (Hitaura, May 14) has a rather long tarsus, 20 mm., against 19 ♂ ♀: 17-18.5.

397. **Hypsipetes madagascariensis psaroides** (Vigors). Himalayan Black Bulbul.

DUN: Hitaura, Bhimphedi: 10 ♂♂, 7 ♀♀ (March 12, 13, May 3-11, 19, 25-28). MARKHU VALLEY: Deorali: 3 ♂♂, 1 ♀ (April 29-May 2). NEPAL VALLEY: Thankot: 1 ♂ (March 29).

The Black Bulbul is common in the dense forests of central Nepal from the dun to the Nepal Valley. In the latter place, however, it is not so common as it is in the dun. In May-June it was seen in small loose parties or a few pairs feeding together.

Ripley (1950b, p. 385) noted it as common in central and eastern Nepal, but did not see it in western Nepal. Polunin (1955, p. 889) reported it from *c.* 2440 m. in the Langtang Valley, central Nepal. Rand & Fleming (1957, p. 147) recorded it from western, west-central and eastern Nepal. Biswas (1960a) observed it in Chautara district, central Nepal and Ramechhāp district, western Nepal, in January-February.

Birds taken towards the end of May had breeding gonads.

Colours of soft parts: Iris dark brown; bill coral red; legs pale orange; feet deep orange; claws horny; pads white to pale orange.

Measurements:

	14 ♂♂	8 ♀♀
Wing:	116 (2), 121 (2), 122 (2), 123, 124 (3), 125 (2), 128, 129	111, 115 (3), 116 (2), 118, 122
Tail:	102, 108, 109 (2), 110, 111 (2), 112 (4), 114, 116 (2)	97, 99, 100, 101, 105, 106, 110, 111
Bill:	26 (2), 27 (3), 27.5 (3),—, 28 (4), 29	26 (3), 27.5,—, 28 (3)

Family IRENIDAE

398. **Aegithina tiphia tiphia** (Linnaeus). Common Iora.

DUN : Hitaura : 10 ♂♂, 2 subad. ♂♂, 5 ♀♀, 1 juv. unsexed (May 14-June 6).

The Iora is common in the central dun usually in the borders of forests near villages. During May-June it was generally seen in pairs, but sometimes singly also.

We missed it in the Nepal Valley where Proud (1949, p. 700 ; 1955, p. 60) and Rand & Fleming (1957, p. 143) found it. Ripley (1950 b, p. 383) reported it only from the tarai. Rand & Fleming (loc. cit.) recorded it also in western, west-central and eastern Nepal, at *c.* 275-2000 m. Scully (1879) did not find it in Nepal. It was not included in the earlier list of Hodgson's collection (Gray & Gray, 1846), but in the list of his later collection (Gray, 1863, p. 38) it was entered without any locality.

The juvenile specimen (May 25) has pale yellow downy feathers on underside. One of the subadult males (May 18) has the central rectrices in moult, and the other subadult male (June 6) has only the two central pairs of rectrices black.

The birds were breeding in May-June. Two males taken on May 28 and June 1 had much enlarged testes.

Colours of soft parts : Iris pale yellow ; bill bluish slate, black on culmen and whitish on tip of upper mandible ; legs and feet plumbeous ; claws bluish slate ; pads white.

Measurements :

	10 ♂♂	5 ♀♀
Wing :	62 (2), 63.5, 64 (3), 65, 65+, 66	60, 61, 63, 64, 65
Tail :	49 (2), 49.5, 50 (3), 50.5, 51, 52 (2)	50 (3), 51, 52
Bill :	—, 17.5, 18, 18.5 (4), 19 (3)	18 (2), 18.5 (3)

Marien (1952) utilized part of the material mentioned above in connexion with his studies on the species.

399. **Chloropsis aurifrons aurifrons** (Temminck). Goldfronted Chloropsis.

TARAI : Simra : 3 ♂♂, 3 ♀♀ (March 4-6). BHABAR : Amlekhganj : 4 ♂♂ (March 7, 8, June 8). DUN : Hitaura, Kusumtar, Paharé Ghat : 4 ♂♂, 1 juv. ♂, 2 ♀♀, 1 juv. ♀ (May 17, 18, 27-June 2, 11).

The Goldfronted Chloropsis is common in the dense forests of lower regions of central Nepal.

Ripley (1950b, p. 384) recorded it also from the eastern tarai. Rand & Fleming (1957, p. 144) found it in the west-central and eastern tarai.

Most of the specimens taken in March have freshly moulted wings and tails, but moult has not started in two male birds (March 4) which are in worn plumage. Two females (March 4, 5) are moulting into adult dress. A male specimen of May 18 has its moult nearly finished, the wing coverts and crown still moulting. Other May-June specimens are more or less worn.

The juvenile male specimen (June 11) looks somewhat like the adult female. Its gold-orange on the forehead and forecrown is dull, it has no trace of golden collar and has very little blue but more of black on the chin and throat.

The juvenile female bird (June 2) has only the anteriormost part of the forehead golden, the remaining part of the forehead and the forecrown have merely a trace of yellow on green. It has no trace of golden collar or any blue patch on the wings or the edges of the wings. Its chin and throat are mixed blue, green and black, and the under tail coverts are with bluish terminal halves. The bill is paler in colour.

Birds taken towards the end of May and early June had almost breeding gonads.

Colours of soft parts : Iris dark brown ; bill black ; legs greenish slate ; feet plumbeous ; claws black ; pads yellowish white.

Measurements :

	11 ♂♂	5 ♀♀
Wing :	93, 95, 96 (3), 96.5, 97 (3), 98, 100	89 (2), 90, 92 (2)
Tail :	65, 68, 69 (2), 70 (4),—, 72, 73	66, 67, 68.5, 69, 70
Bill :	24.5, 25 (5), 25.5 (2), 26 (2), 26.5	24, 25 (3),—

On the basis of the measurements of the material available to me, I do not see any great difference in size between the Cachar and Himalayan birds, so as to warrant the separation of the latter as *Chloropsis aurifrons hodgsoni* Gould, 1861 (type locality Nepal), as suggested by Deignan (1946) (see also Rand & Fleming, 1957, p. 144). My measurements are as follows :

		Wing	Tail	Bill
Nepal :	11 ♂♂ :	93-100 (96.5)[a]	65-73 (69.6) 10 specimens	24.5-26.5 (25.4)
	5 ♀♀ :	89-92 (90.4)	66-70 (68.1)	24-25 (24.8) 4 specimens
North Bengal :	2 ♂♂ :	94, 96	68, 69	25,—
	1 ♀ :	87	—	24
Assam (Darrang, Khasi Hills, Sylhet) :	1 ♂ :	97	71	25
	2 ♀♀ :	91, 95	65, 68	24 (2)
	2 unsexed :	86, 90	62+, 66	—(2)
Assam (Cachar):	1 ♂ :	94	68	—
South Bengal, Bihar (Ranchi, Singhbhum):	7 ♂♂:	95-103 (98.9)	69-77 (72.1) 6 specimens	25-26.5 (26.1) 4 specimens
Orissa, Madhya Pradesh (Mandala, Balaghat) :	1 unsexed :	95 +	70	—

[a] Mean values are given in parentheses.

400. **Chloropsis hardwickei hardwickei** Jardine & Selby. Orange-bellied Chloropsis.

DUN : Hitaura, Bhimphedi : 4 ♂♂, 6 ♀♀, 1 subad. ♀ (March 12, May 4-28). NEPAL VALLEY : Thankot : 1 ♂, 1 ♀ (March 26).

The Orangebellied Chloropsis did not appear to us to be particularly common in central Nepal. We found it in the lighter parts of forests in the dun and the Nepal Valley, occurring in pairs or small parties ; and on one or two occasions noted single specimens.

Proud (1949, pp. 700-701) observed it as very common in the Nepal Valley. Rand & Fleming (1957, pp. 143-144) reported it also from west-central and eastern Nepal at *c.* 915-2285 m.

My March birds are in fresh plumage, and those taken later are more or less worn. A female collected on May 6 has nearly finished its body moult, while another female shot on May 13 has worn tail feathers except the central pair which are moulting. Its body moult is nearly finished.

The subadult female bird (May 22) has brown primaries.

A male specimen taken on May 28 had somewhat swollen testes indicating its nearness to breeding.

Colours of soft parts : Iris dark brown ; bill black ; legs bluish grey ; feet bluish slaty ; claws black ; pads white.

Measurements :

	Wing	Tail	Bill
5 ♂♂ :	94 (2), 95, 98 (2)	73, 75 (2), 79 (2)	25, 25. 5,—, 26 (2)
7 ♀♀ :	88 + , 90 (3), 91, 92 (2)	67, 68 (3),—, 69, 72	24, 24.5 (3),—, 25 (2)

Family LANIIDAE

[**Lanius collurio isabellinus** Hemprich & Ehrenberg. Pale Brown Shrike.

Ripley (in press) states under the range of this bird : ' stragglers noted from Nepal '. I am, however, unable to find any record of this species in Nepal.]

*401. **Lanius vittatus vittatus** Valenciennes. Baybacked Shrike.

The only record of the Baybacked Shrike from Nepal, after Hodgson's collection, has been provided by Rand & Fleming (1957, p. 189) who came across a few specimens in the eastern tarai in January.

402. **Lanius schach tricolor** (Hodgson) Blackheaded Shrike.

BHABAR : Amlekhganj : 1 ♂ (March 6). DUN : Bhimphedi : 1 ♂ (March 11). NEPAL VALLEY : Kathmandu, Thankot, 3.5 km. E. of Thankot on Kathmandu Road : 6 ♂♂, 8 ♀♀, 1 unsexed (March 21-April 10).

The Blackheaded Shrike is a common bird of the Nepal Valley during March-April. In the lower regions of central Nepal, such as

the dun and bhabar, it was getting gradually scarcer from March when it began moving towards the breeding grounds. As Ripley (1950b, p. 383) has pointed out, it was found to prefer light forests, scrub jungle and edges of forests in contrast to the Tibetan Shrike's (*L. tephronotus*) preference for more open country.

Polunin (1955, p. 892) found it at *c.* 2745 m. in the Langtang Valley, central Nepal, in summer. Rand & Fleming (1957, p. 190) reported it from western, west-central and central Nepal. Biswas (1960a) recorded it late in May from Khumbu, eastern Nepal, at *c.* 3050 m.

Hybrids between this form and *erythronotus* have been reported from western and west-central Nepal by Ripley (loc. cit.) and Rand & Fleming (op. cit., pp. 189-190). My specimen from Amlekhganj (♂, March 6) is also a hybrid.

One of my male specimens (March 29, Thankot) is highly melanistic, as has already been reported (Biswas, 1950c, p. 452).

Birds were coming to breeding condition towards the end of March and early April, their gonads showing various stages of development.

Colours of soft parts : Iris dark brown ; bill black (sometimes paling to slate posteriorly near the base, and then to white on base) ; legs and feet very dark horny; claws black ; pads white.

Measurements :

	8 ♂♂	8 ♀♀	1 unsexed
Wing :	94, 95 (2), 97 (3), 98, 99[a]	93 (2), 94 (2), 95 (3), 96	96
Tail :	117.5, 118, 120.5, 122, 123, 123[a], 127 (2)	112, 114, 115, 117, 119, 121, 122, 123	—
Bill :	21 (2), 22 (3), 22.5, 23, 23.5	19.5, 20 (2), 21 (3), 21.5, 22.5	22.5

[a] The hybrid specimen.

403. **Lanius tephronotus tephronotus** (Vigors). Eastern Tibetan Shrike.

NEPAL VALLEY : Kathmandu, Thankot : 1 ♂, 1 juv. ♂, 1 ♀ (March 20, 24, April 13).

The Tibetan Shrike did not appear to us to be common in the Nepal Valley during March-April. Single specimens were seen from time to time on tops of trees and other suitable perches in open areas, scrub, about cultivation, etc., especially in the early mornings, until about the end of April.

It was recorded in the Nepal Valley from late September to mid-March by Scully (1879, p. 264), from November to March by Proud (1949, p. 707), and in April by Ripley (1950b, p. 383). In northern central Nepal it was found in summer by Polunin (1955, p. 892) in the Langtang Valley between *c.* 3050 and 4265 m. and by Lowndes (1955, p. 33) in Manangbhot from *c.* 2440 to 3960 m. Ripley (loc. cit.) recorded it also from the eastern tarai in winter. Rand & Fleming (1957, p. 190)

reported it from western and west-central Nepal, at *c.* 275-2440 m. in winter. Biswas (1960a) found it in Khumbu, eastern Nepal, at *c.* 4570 m. in April, and preparing to breed at *c.* 3050 m. in late May.

Measurements :

	Wing	Tail	Bill
1 ♂ :	102.5	116	22.5
1 unsexed :	108	124	23.5

I should think Koelz's *lahulensis* (1950, p. 7) is a perfectly distinct subspecies (*contra* Ripley, in press). Regarding the systematic status of the Tibetan Shrike, see Biswas (1961b).

Family CINCLIDAE

404. **Cinclus pallasii tenuirostris** Bonaparte. Brown Dipper.

MARKHU VALLEY : Kulikhani : 1 juv. ♂, 1 ♀, 1 unsexed (April 27).

The Brown Dipper was not frequently encountered by us in central Nepal.

It was reported in central Nepal by Scully (1879, p. 281) from Nawakot district, and the Nepal and Markhu valleys, by Proud (1949, p. 701 ; 1955, p. 60) from the Nepal Valley, by Ripley (1950b, p. 385) from the Markhu Valley, by Lowndes (1955, p. 31) from Manangbhot at *c.* 3350 m. In west-central Nepal it was recorded by Rand & Fleming (1957, p. 147). In eastern Nepal, Stevens (1925a, p. 364) reported it from the Mai Valley at *c.* 2285 m. in May ; Ripley (loc. cit.) found it in the Arun Valley in winter, and Biswas (1960a) in Khumbu up to *c.* 4570 m. between February and May.

The female specimen is in moulting condition.

Measurements :

1 unsexed : Wing 100 + ; tail — ; bill 24.5.

Vaurie (1951a, pp. 15-17) utilized the abovementioned specimens for his studies.

Family TROGLODYTIDAE

*405. **Troglodytes troglodytes nipalensis** Blyth. Nepal Wren.

Troglodytes nipalensis ' Hodgson ' Blyth, 1845, *J. Asiat. Soc. Beng.* **14** : 589. (Nepal, hereby restricted to Sheopuri Range, Nepal Valley.)

We were unable to find this wren in Nepal, and so was Scully (1879). Smythies (1948, p. 440) noted it in autumn up to *c.* 4875 m. in the Gandak-Kosi watershed, central Nepal, where Proud (1952a, p. 363) also found it in spring at *c.* 3050-3505 m. Ripley (1950b, p. 385) reported it only from eastern Nepal at *c.* 2590-3050 m. Polunin (1955, p. 890) found it common in the Langtang Valley, central Nepal, at

c. 4115-5030 m. in summer. Rand & Fleming (1957, pp. 147-148) recorded it in winter in west-central Nepal at *c.* 2895 m. and in eastern Nepal at *c.* 3050 m.

*406. **Troglodytes troglodytes kinneari** Biswas. Kinnear's Wren.

This wren has not been reported from Nepal by any one except Biswas (1955, p. 87, and 1960a).

In my opinion, both *tibetana* Walton and *kinneari* Biswas are distinct from *nipalensis* Blyth (*contra* Vaurie, 1960, p. 419; Ripley, in press).

Family PRUNELLIDAE

*407. **Prunella collaris nipalensis** Blyth. Eastern Alpine Hedge-Sparrow.

After Hodgson's collection, the Eastern Alpine Hedge-Sparrow was reported from Nepal by Smythies (1948, p. 441) in the Gandak-Kosi watershed, central Nepal, at *c.* 4570 m. in autumn, by Lowndes (1955, p. 32) in Manangbhot, central Nepal, at *c.* 4570-4875 m. in summer, and by Biswas (1960a) in Khumbu, eastern Nepal, at *c.* 3655-5485 m. during March-May.

*408. **Prunella himalayana** (Blyth). Altai Hedge-Sparrow.

After Hodgson's collection (Gray, 1863, p. 36), the Altai Hedge-Sparrow was recorded in Nepal by Proud (1952a, p. 364) in Gandak-Kosi watershed at *c.* 2440-3505 m. in spring, and by Rand & Fleming (1957, p. 182) in the Kali Gandak Valley, west-central Nepal, at *c.* 2810-4265 m. in winter.

*409. **Prunella strophiata strophiata** (Blyth). Rufousbreasted Hedge-Sparrow.

The post-Hodgsonian records of the Rufousbreasted Hedge-Sparrow from Nepal consist of Ripley's (1950b, p. 387) from eastern Nepal at *c.* 1310 m. and 2670 m. in winter; Polunin's (1955, p. 891) from the Langtang Valley, central Nepal, at *c.* 3655-4265 m. in summer; Lowndes's (1955, p. 32) from Manangbhot, central Nepal, at *c.* 3960-4570 m. in summer; Proud's (1955, p. 61) from Sheopuri Range, Nepal Valley, at *c.* 2135 m., and beyond Sheopuri on the north at *c.* 3655 m.; Rand & Fleming's (1957, p. 183) from eastern Nepal at *c.* 3050 m. in winter; and Biswas's (1960a) from Khumbu, eastern Nepal, at *c.* 3655-5335 m. in February-May.

Rand & Fleming's (op. cit., pp. 182-183) birds from west-central Nepal, taken at *c.* 1370-2775 m. in winter and listed under this form and *P. s. jerdoni* (Brooks), are intermediate between these two subspecies according to Ripley (in press).

410. **Prunella rubeculoides rubeculoides** Horsfield & Moore. Robin Hedge-Sparrow.

After Hodgson's collection (Gray, 1863, p. 36), the Robin Hedge-Sparrow was recorded in Nepal by Smythies (1948, p. 441) in the Gandak-Kosi watershed, central Nepal, in autumn (a doubtful observation), by Rand & Fleming (1957, p. 182) from the Kali Gandak Valley, west-central Nepal, in winter as an uncommon bird, and by Biswas (1960a) who found it in small numbers in Khumbu, eastern Nepal, at *c.* 3960-5335 m. in February-May.

*411. **Prunella fulvescens sushkini** Collin & Hartert. Eastern Brown Hedge-Sparrow.

The only record of the occurrence of this hedge-sparrow in Nepal is to be credited to Rand & Fleming (1957, p. 183) who found a single example in the Kali Gandak Valley, west-central Nepal, at *c.* 2805 m. in December.

*412. **Prunella immaculata** (Hodgson). Maroonbacked Hedge-Sparrow.

The only post-Hodgsonian records of the Maroonbacked Hedge-Sparrow from Nepal are Ripley's (1950b, p. 387) from eastern Nepal, at *c.* 2745 m. in winter, and Rand & Fleming's (1957, p. 184), also from eastern Nepal at *c.* 2285 m. in winter.

(*To be continued*)

On the Marine Fauna of the Gulf of Kutch

PART II—GASTROPODS

BY

P. K. B. MENON, A. K. DATTA GUPTA, AND D. DAS GUPTA

Department of Zoology, Birla College, Pilani

(*With ten plates*)

[*Continued from Vol.* **54** (3) : 706]

INTRODUCTION

The molluscans of the Gulf of Kutch have not yet been studied in a comprehensive manner. Hornell (1916), in one of the pioneering works on the marine zoology of Okha Mandal, described the most common forms. The second attempt to study the marine fauna of the Gulf of Kutch was undertaken by the Department of Zoology, Birla College, Pilani, in 1956 (Gideon *et al.*, 1957). The present account is based mainly on shells collected in three surveys made after that between June 1956 and October 1958. Compared with the Gulf of Kutch the littoral molluscan fauna of the Bombay coast has been better studied (Melvill, 1893, 1894, 1896; Melvill & Abercrombie, 1893; Melvill & Standen, 1906).

The present study is undertaken with the additional aim of studying the distribution of molluscans in the Gulf of Kutch and its comparison with the other well-surveyed Indian coastal regions (Subramaniam *et al.*, 1951; Gravely, 1927, 1942; Satyamurthi, 1952). It is certain that several species are common to all these places but at the same time there are a few which are characteristic of each place. The authors believe that there are still a number of Gastropods in this region which have not been collected. A key to the identification of the Gastropods of the Gulf of Kutch will be published after more material has been studied.

Materials and Methods

The material for the present study was collected from Port Okha, Pirotan Island, Byet Dwarka, and Sika. The collections were made mostly from the intertidal zone, both in the morning and in the evening. The low tide allowed two to three hours of collection in the morning and one to two hours in the evening.

Live specimens were narcotised before preservation. The classification followed is that of Thiele (1931) as adopted by Satyamurthi (1952).

Description of the Area Surveyed

In addition to the regions already described (Gideon *et al.*, 1957) the present survey covers the Beacon area of Pirotan Island and Sika 6 miles off Kanalus:

Beacon area. The Beacon area is mainly sandy interspersed with broken coral rock. At low tide there is three to six inches of water over the rocks, which are covered by a thin layer of mud. This region is marked by the presence of a large number of *Octopus*, *Onchidium*, and *Tetradon*.

Sika. The intertidal zone of Sika is muddy and very vast. The mud is deposited over coral rocks and is waist deep in places. This area is surveyed for the first time.

Family **FISSURELLIDAE**

This family is represented by three genera and five species, as a rule not very abundant. The three genera described here also occur on the east coast of India (Satyamurthi, 1952). Hornell's (1951) revised catalogue of Bombay Mollusca includes four genera of Fissurellidae.

Genus **Diodora** Gray Syn. *Glyphis* Carpenter

The members of this genus are mostly confined to the rocky shores of Okha and Hanuman Dandi. Hornell (1951) observed that they live below low-tide mark and are seldom found except by dredging. This may be true of some species of *Diodora* but in the present survey a large number of living specimens were collected from the rocky shore of Hanuman Dandi. In this area even in the spring tides a large number of rock pools are cut off among the rocks and these specimens were collected from the rocks which surround these

rock pools. They are found associated with members of Patellidae, Neritidae, and Turbinidae.

The members of this genus are known as the key-hole limpets because of the presence of an oval or rounded aperture at the apex of the conical shell. The shell is generally provided with radial and trans-spiral ribs. The shape and size vary greatly even within the species.

Diodora bombayana (Sowerby) (Plate 1, Figs. 1 & 2)

Collected from Okha and Hanuman Dandi. It is the only species of this genus collected alive. In their natural environment most of them are covered with algae and it is difficult to distinguish *Diodora* from *Cellana*.

Diodora funiculata (Reeve) (Plate 1, Figs. 3 & 4)

Only empty shells were collected from Okha and Hanuman Dandi.

Diodora ticaonica (Reeve) (Plate 1, Figs. 5 & 6)

Collected from Hanuman Dandi.

Genus **Emarginula** Lamarck

The genus is represented by a single species. The shells are popularly known as slit limpets and can be easily identified from *Diodora* by the presence of a slit on the anterior margin of the shell along the middle line.

Emarginula elongata (Phil.) (Plate 1, Fig. 7)

Collected from Pirotan Island.

Genus **Scutus** Montfort

The genus is represented by a single species. The most characteristic feature is the presence of a marginal notch. The shell is flat and elongated and it does not cover the body of the animal completely. There is no radial sculpture on the outer surface of the shell. There is a line running all around the margin of the shell forming a ring which is incomplete anteriorly.

Scutus unguis (Linn.) (Plate 1, Fig. 8)

Living specimens collected from the Beacon area of Pirotan Island.

Family PATELLIDAE

The family Patellidae is represented only by a single genus and a single species.

Genus **Cellana** H. Adams

The shell is conical and the inner surface of the shell has got a pearly lustre. The shells are popularly known as true limpets and can be easily recognised from the key-hole limpets by the absence of the apical aperture. The surface of the shell in its habitat is covered by greenish algae which match very well with the colour of the environment.

Cellana radiata (Born) (Plate 1, Fig. 9)

They are abundant in Hanuman Dandi, common in Okha.

Family TROCHIDAE

Genus **Trochus**

The shells are conical in shape. The lower part of the body-whorl is angular with flattened base. The outer surface of the shell is sculptured and the umbilicus is usually present. These are commonly found attached to the rocks at low tide.

Trochus stellatus Gmelin (Plate 2, Fig. 10)

Collected from Hanuman Dandi. This species is comparatively rare.

Trochus radiatus Gmelin (Plate 2, Fig. 11)

Collected from Hanuman Dandi.

Genus **Monodonta** Lamarck

The shell is trochiform with inflated body-whorl. The surface is provided with minute spiral ribs. The aperture is ovate. There is no umbilicus. The outer lip is thick and ridged throughout while there is a strong tooth in the inner lip. The shell is purple in colour with white spots alternating with brown elongated spots.

Monodonta australis Lamarck (Plate 2, Fig. 12)

Very common in the coral reefs of Hanuman Dandi.

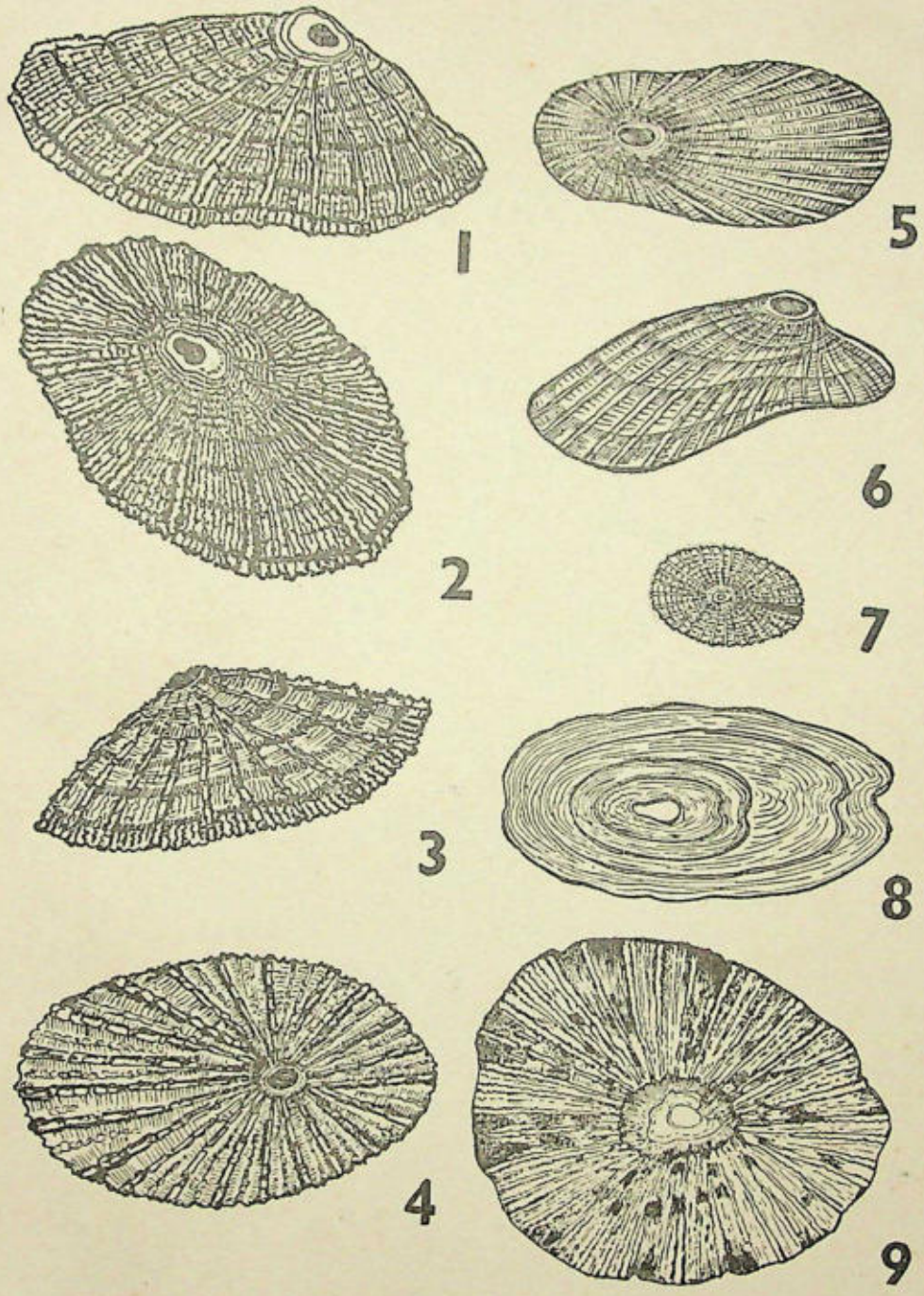


Fig. 1. *Diodora bombayana* : side view × 1¼ ; Fig. 2. *D. bombayana* : from above × 1½; Fig. 3. *D. funiculata* : side view × 1½ ; Fig. 4. *D. funiculata* : from above × 1½ ; Fig. 5. *D. ticaonica* : from above × 1½ ; Fig. 6. *D. ticaonica* : side view × 1¼ ; Fig. 7. *Emarginula elongata* : from above × 1½ ; Fig. 8. *Scutus unguis* : from above ; Fig. 9. *Cellana radiata* : from above × 1½.

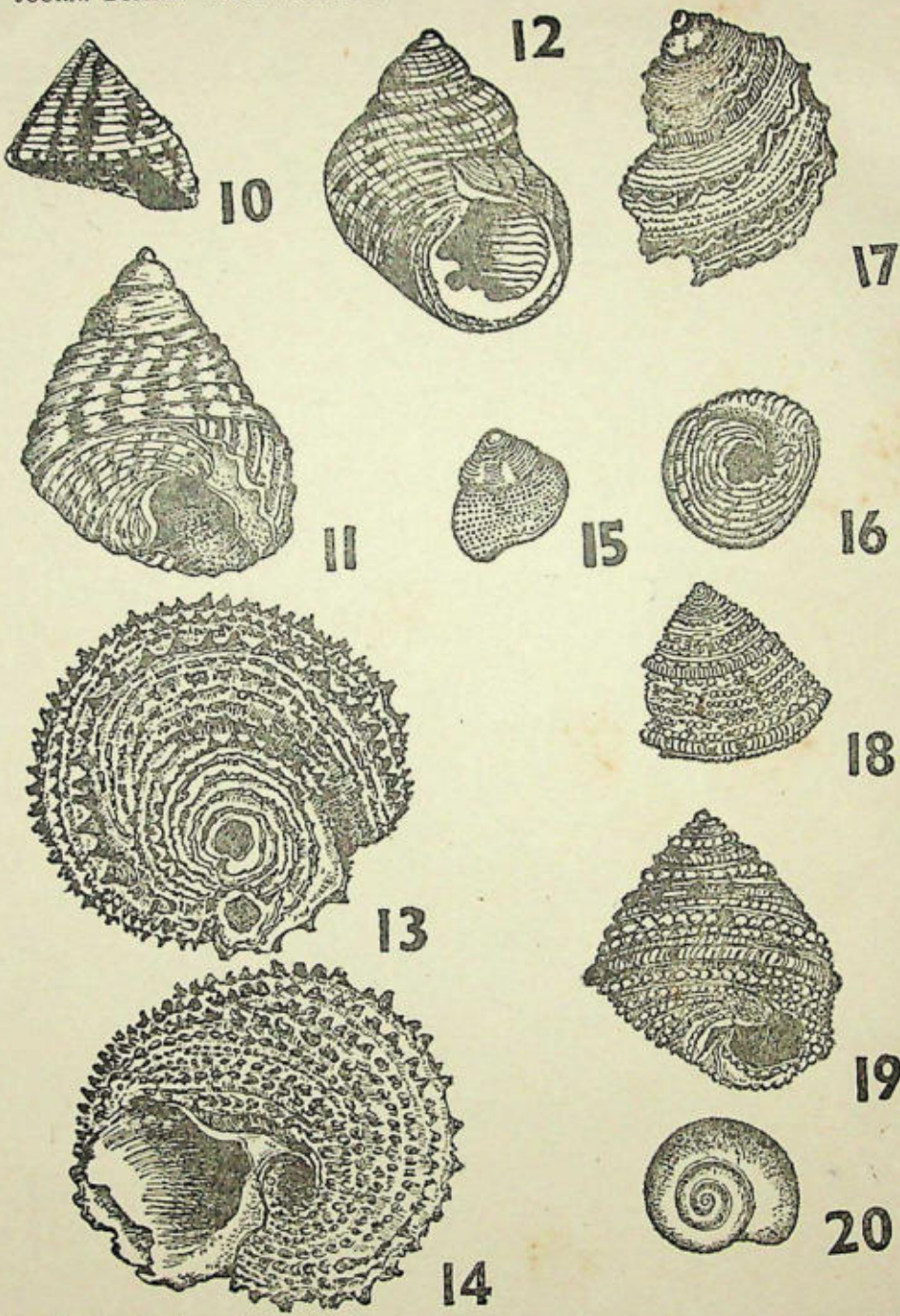


Fig. 10. *Trochus stellatus* : side view ; Fig. 11. *T. radiatus* : showing the base and the aperture ; Fig. 12. *Monodonta australis* : showing the aperture ; Fig. 13. *Angaria plicata* : from above ; Fig. 14. *A. plicata* : from below ; Fig. 15. *Clanculus microdon* : showing the body-whorl ; Fig. 16. *C. microdon* : showing the base ; Fig. 17. *Euchelus asper* : side view ; Fig. 18. *Callistoma* sp. : side view ; Fig. 19. *Callistoma* sp. : showing the base and the aperture ; Fig. 20. *Umbonium vestiarium* : showing the apex.

Genus **Angaria** Röding

It is represented by a single species. The shell is characterised by a low flattened spire. The outer surface of the shell is covered by large spiny processes. The spines are arranged in spiral rows. A large umbilicus is present. The shell is thick, massive and reddish in colour.

Angaria plicata (Kiener) (Plate 2, Figs. 13 & 14)

Living specimens were collected from the low-tide mark of Pirotan Island and were found attached to the smaller broken rocks.

Genus **Clanculus** Montfort

The shell is conical with rounded whorls. The outer surface is smoothly sculptured consisting of beaded spiral ridges. The umbilicus is rounded, large, and toothed inside. The shell is dark reddish-brown with white spots.

Clanculus microdon A. Adams (Plate 2, Figs. 15 & 16)

Collected from Hanuman Dandi.

Genus **Euchelus** Phil.

The genus is represented by a single species. The shell in general shape is rounded with a somewhat inflated body whorl. The suture is deep. The surface of the shell bears granular spiral ridges which are very prominent below the suture. The shell is reddish brown in colour.

Euchelus asper Gmelin (Plate 2, Fig. 17)

Collected from Hanuman Dandi.

Genus **Calliostoma** Swainson

The shell is conical, broader than high, with a pointed apex. The body whorl is angular and spirally sculptured. The beaded spiral ridges are very prominent in the lowermost whorl, while in the upper whorl they are feeble. There is no umbilicus. The shell is whitish.

Calliostoma sp. (Plate 2, Figs. 18 & 19)

Collected from Hanuman Dandi.

Genus **Umbonium** Link

The shells are generally known as button shells. Members of this genus comprise some of the most common and abundant shells on the sandy area of Pirotan Island. This shell is small, brightly coloured, and highly polished. The spire is depressed and the body-whorl is inflated with an angular base. The aperture is somewhat D-shaped. The umbilicus is absent and is filled up by a whitish callus. There is a wide range of colour variation within a species.

Umbonium vestiarium (Linn.) (Plate 2, Fig. 20)

This species was not found in Hanuman Dandi, Balarpur Bay, or Sika. Many shells collected from Pirotan Island were harbouring hermit crabs.

Family **TURBINIDAE**

The shells of this family are known as turban shells though all of them are not turban-like. *Astrea* looks very similar to top shells. The operculum is stony.

Genus **Turbo** Linn.

The shells are of moderate size with a rounded and inflated body-whorl. The aperture is round and the operculum is hard and stony.

Turbo intercostalis Menke (Plate 3, Fig. 21)

Turbo coronatus Gmelin (Plate 3, Fig. 22)

Next to *Cellana* these are perhaps the most common molluscans in Hanuman Dandi and Okha.

Genus **Astrea** (Bolten) Röding

The shell is top-shaped without an umbilicus. The body-whorls are spinous and the base is flattened. The shell in general appearance resembles a *Trochus*. The colour is pale yellowish brown.

Astrea semicostata (Kiener) (Plate 3, Fig. 23)

Collected from Hanuman Dandi.

Family **NERITIDAE**

This family is represented in the Gulf of Kutch by a single genus and three species.

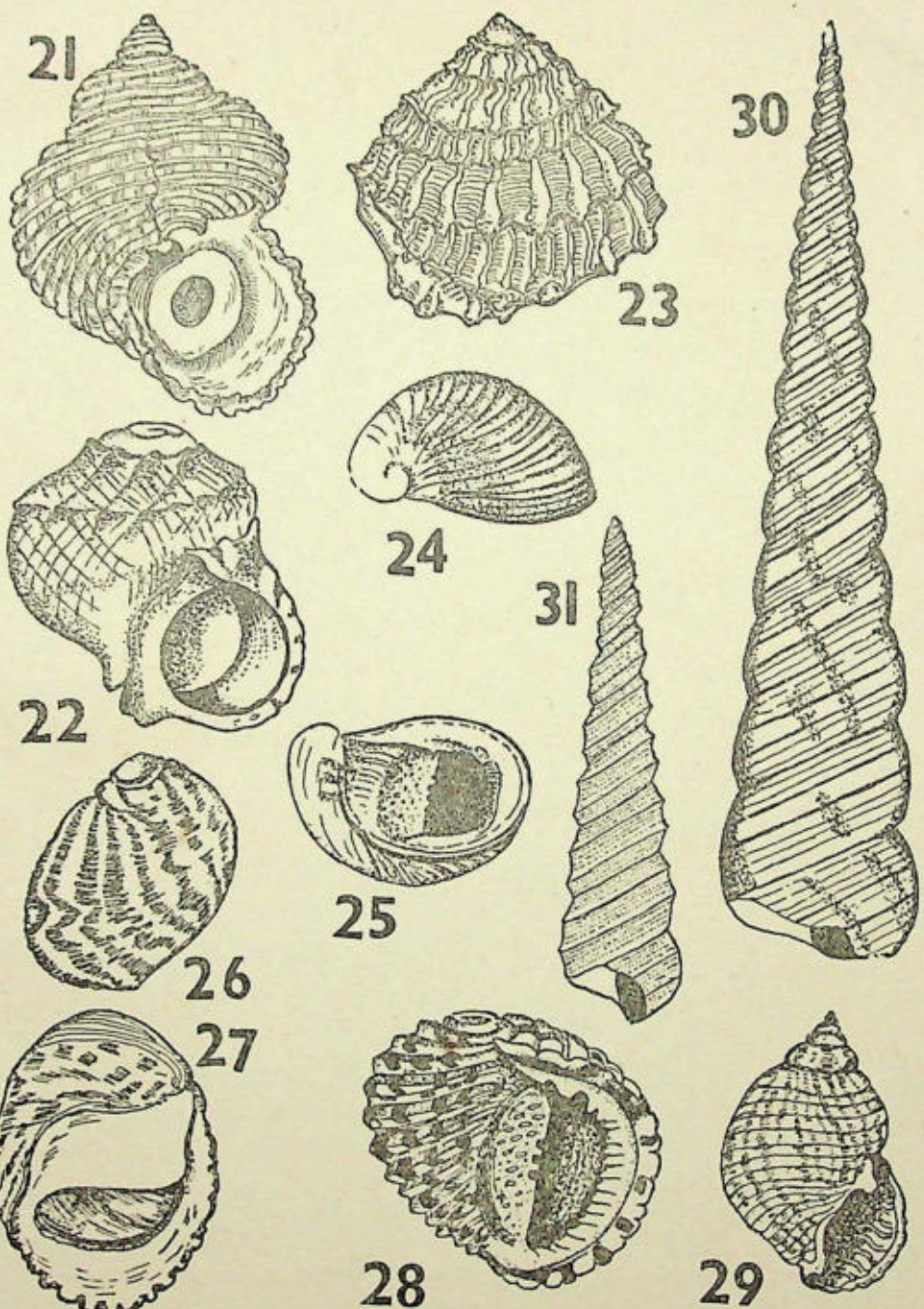


Fig. 21. *Turbo intercostalis* : showing the operculum ; Fig. 22. *T. coronatus* : showing the aperture ; Fig. 23. *Astrea semicostata* : showing the ridges ; Fig. 24. *Nerita albicilla* : side view ; Fig. 25. *N. albicilla* : showing the aperture ; Fig. 26. *N. dombeyi* : showing the body-whorl ; Fig. 27. *N. dombeyi* : showing the aperture ; Fig. 28. *N. plexa* : showing the aperture ; Fig. 29. *Littorina undulata* : aperture side ; Fig. 30. *Turritella acutangula* : Fig. 31. *T. columnaris*.

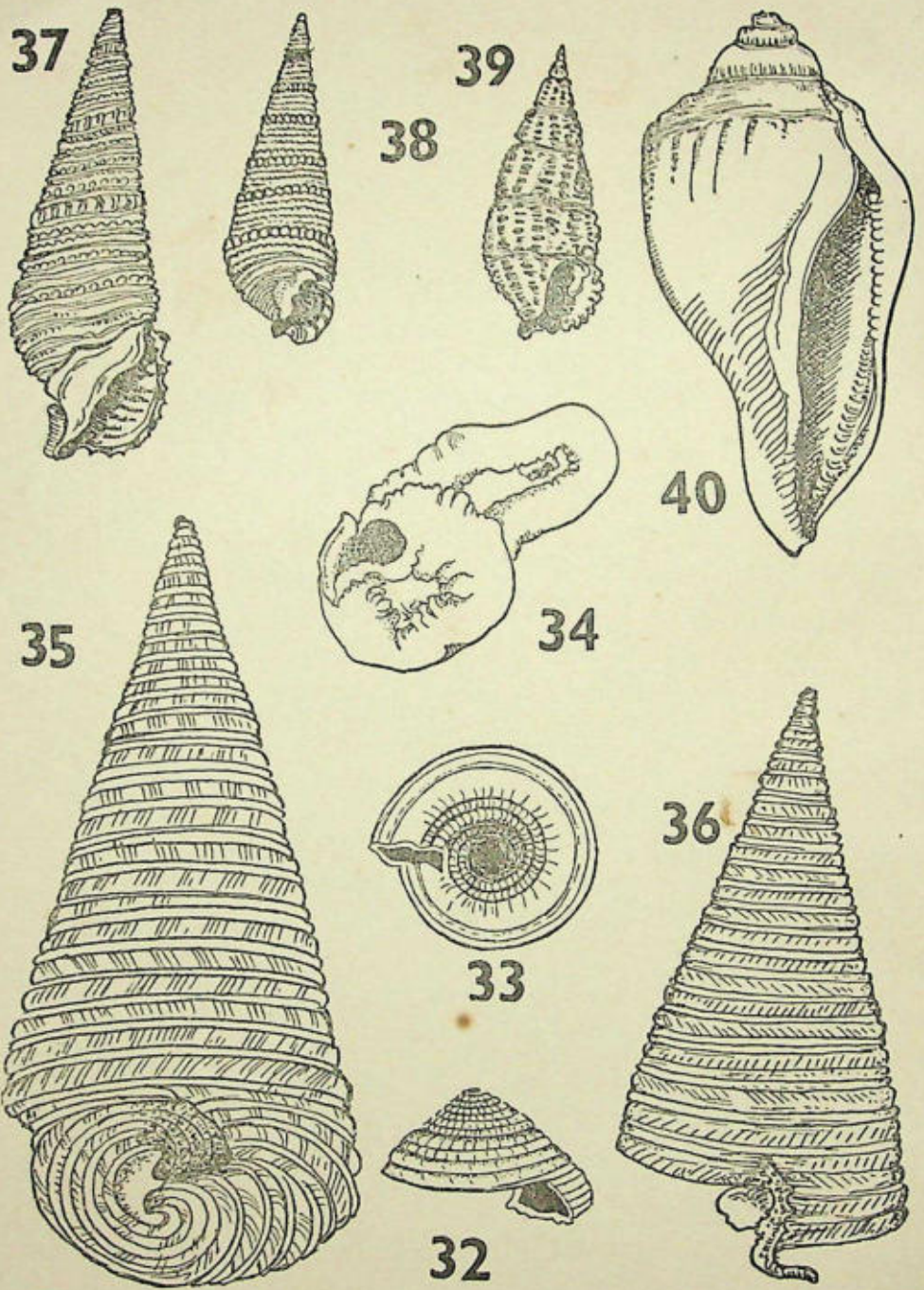


Fig. 32. *Architectonica laevigata* : side view; Fig. 33. *A. laevigata* : from below; Fig. 34. *Vermetes* sp.; Fig. 35. *Telescopium telescopium* : showing the base; Fig. 36. *T. telescopium* : side view; Fig. 37. *Cerithidea fluviatilis* : showing the aperture; Fig. 38. *Cerithium obeliscus* $\times 1\frac{1}{2}$: showing the aperture; Fig. 39. *C. scabridum* $\times 1\frac{1}{2}$; Fig. 40. *Strombus urecus* : aperture side.

Genus **Nerita** Linn.

The shells are thick and are characterised by a large body-whorl and a depressed spire. In some cases the spire may be absent. It has got a D-shaped opercular opening. The umbilicus is absent. The size, shape, and colour of the shells are variable. Living specimens of this genus are abundant in Hanuman Dandi and Okha; no specimens have been collected from Pirotan Island or Balarpur Bay.

Nerita albicilla Linn. (Plate 3, Figs. 24 & 25)

Collected from Hanuman Dandi and Okha.

Nerita dombeyi Récluz (Plate 3, Figs. 26 & 27)

Collected from Hanuman Dandi. Very rare.

Nerita plexa Chemnitz (Plate 3, Fig. 28)

Living specimens were collected from Pirotan Island.

Family **LITTORINIDAE**

They are popularly known as periwinkles. According to Hornell (1951) they are found on rocky shores of all parts of the world. The shells are *Turbo*-like in form but differ from it by the absence of the pearly inner lining. The operculum is horny. Only one genus has been found.

Genus **Littorina** Férussac

Littorina undulata Gray (Plate 3, Fig. 29)

Collected from Hanuman Dandi.

Family **TURRITELLIDAE**

Popularly known as 'turret' or screw shells. They are represented by a single genus and are widely distributed in the Gulf of Kutch.

Genus **Turritella** Lamarck

Turritella acutangula (Linn.) (Plate 3, Fig. 30)

Collected from Hanuman Dandi.

Turritella columnaris (Kiener) (Plate 3, Fig. 31)

Collected from Hanuman Dandi.

Family **ARCHITECTONIDAE** (=**SOLARIIDAE**) (Bolten) Röding

Generally known as staircase shells. The umbilicus resembles a winding staircase. Only one genus is recorded.

Genus **Architectonica** (Bolten) Röding

The shell is broad with an angular lower edge and a flattened base.

Architectonica laevigata Lamarck (Plate 4, Figs. 32 & 33)

Collected from Hanuman Dandi.

Family **VERMETIDAE**

They are known as worm shells and are generally confused with the tube of Polychaetes. The shell is irregularly coiled, the aperture is small, and the foot is reduced.

Genus **Vermetes** (Adanson) Daudin

Vermetes sp. (Plate 4, Fig. 34)

Large numbers of living specimens were collected from Pirotan Island and Hanuman Dandi. Fine threads of mucus emerging from the operculum are characteristic of this gastropod. They are found in association with tubicolous Polychaetes.

Family **POTAMIDIDAE**

Popularly known as telescope shells. Two genera are recorded.

Genus **Telescopium** Linn.

The shell is elongated and its whorls are spirally ribbed. It has got a broad flattened angular base. The shell is gradually narrowing towards the apex. The ribs are alternately dark brown and light brown in colour.

Telescopium telescopium Linn. (Plate 4, Figs. 35 & 36)

Collected from Pirotan Island, Hanuman Dandi, and Balarpur Bay.

Genus **Cerithidea** Swainson

The shell is narrow and elongated. The surface is ornamented with small tubercles which are arranged in regular transpiral rows. The aperture is ovate and the outer lip is expanded. The shell is dark grey in colour.

Cerithidea fluviatilis (Potiéz & Michaud) (Plate 4, Fig. 37)

Found everywhere.

Family CERITHIIDAE

Popularly known as horn shells. According to Hornell (1951) these gastropods have a tendency to migrate from sea to land.

Genus **Cerithium** Bruguière

The shell is tower-shaped and the apex is drawn into an elongated spire. It resembles somewhat the turret shells but differ from them in having a widely channelled aperture and an everted thickened lip. The surface is ornamented with small tubercles.

Cerithium obeliscus Bruguière (Plate 4, Fig. 38)

Collected from Pirotan Island and Balarpur Bay.

Cerithium scabridum Phil. (Plate 4, Fig. 39)

Collected from Pirotan Island and Balarpur Bay.

Family CALYPTRAEIDAE

This family is represented by a single genus. The shells are generally known as crucible shells. It is conical or cap-shaped with an eccentric pointed apex. The interior of the shell is provided with a folded appendage.

Genus **Calyptraea** Lamarck

Calyptraea sp. (Plate 10, Figs. 85 & 86)

Collected from Pirotan Island.

Family STROMBIDAE

Popularly known as wing shells.

Genus **Strombus** Linn.

The shell is very thick, smooth with the spire considerably wider and less elevated. The aperture is elongated and narrow and the

outer lip is everted into a wing-like expansion. The columella bears a thick callus.

Strombus urceus Linn. (Plate 4, Fig. 40)

Collected from Hanuman Dandi.

Family NATICIDAE

The family is represented by two genera.

Genus **Natica** Scopoli

The shell is globular with a depressed spire. It is highly polished. The operculum is horny. The body-whorl is very large. An umbilicus is always present, and the callus is very thick.

Natica tigrina (Röding) (Plate 5, Figs. 41 & 42)

Collected from coral reef off Pirotan Island and Hanuman Dandi.

Natica didyma (Röding) (Plate 5, Figs. 43 & 44)

Collected from Pirotan Island and Hanuman Dandi.

Natica lamarckii Chenu (Plate 5, Fig. 45)

Collected from Pirotan Island and Hanuman Dandi.

Genus **Sinum** (Bolten) Röding

The shell is very easy to identify by its characteristic depressed spire, and its finely striated body-whorl which is inflated and ovoid in shape. The shell is very thin and its inner surface is glossy and iridescent. The spire is visible only in profile. Umbilicus is absent.

Sinum cuvierianum (Récluz) (Plate 5, Figs. 46 & 47)

Collected from Pirotan Island and Hanuman Dandi.

Family CYPRAEIDAE

They are popularly known as 'cowries' and are notable for their polished surface and beautiful coloration. The shell is inrolled and the aperture looks like a long narrow slit extending from one end to the other. Both the margins of the aperture are toothed.

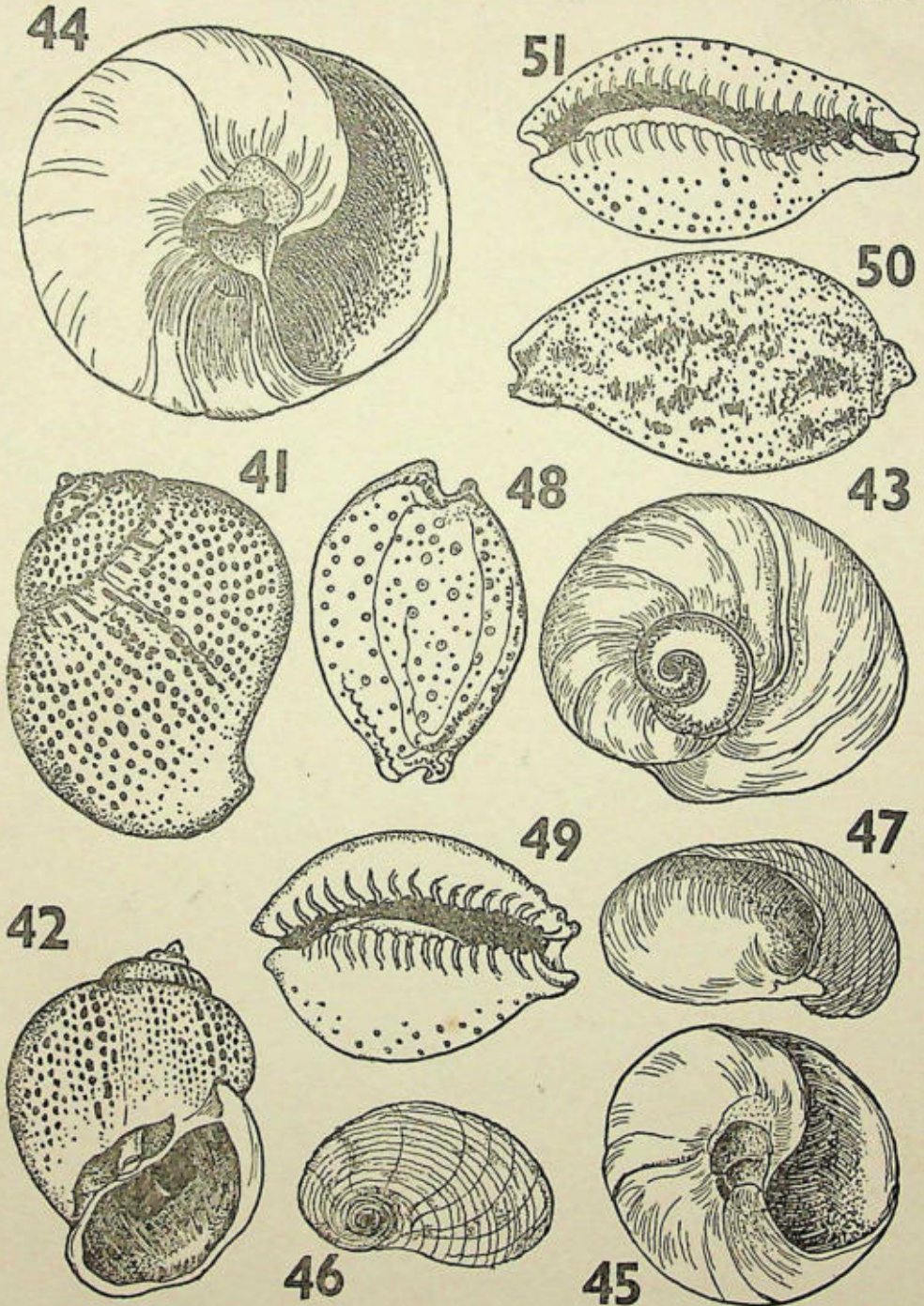


Fig. 41. *Natica tigrina* ; Fig. 42. *N. tigrina* : aperture side ; Fig. 43. *N. didyma* : from the apex ; Fig. 44. *N. didyma* : aperture side ; Fig. 45. *N. lamarcki* : aperture side ; Fig. 46. *Sinum cuvierianum* : showing the body-whorl; Fig. 47. *S. cuvierianum* : aperture side ; Fig. 48. *Cyparea ocellata* : from above ; Fig. 49. *C. ocellata* : aperture side ; Fig. 50. *C. arabica* : from above ; Fig. 51. *C. arabica* : aperture side.

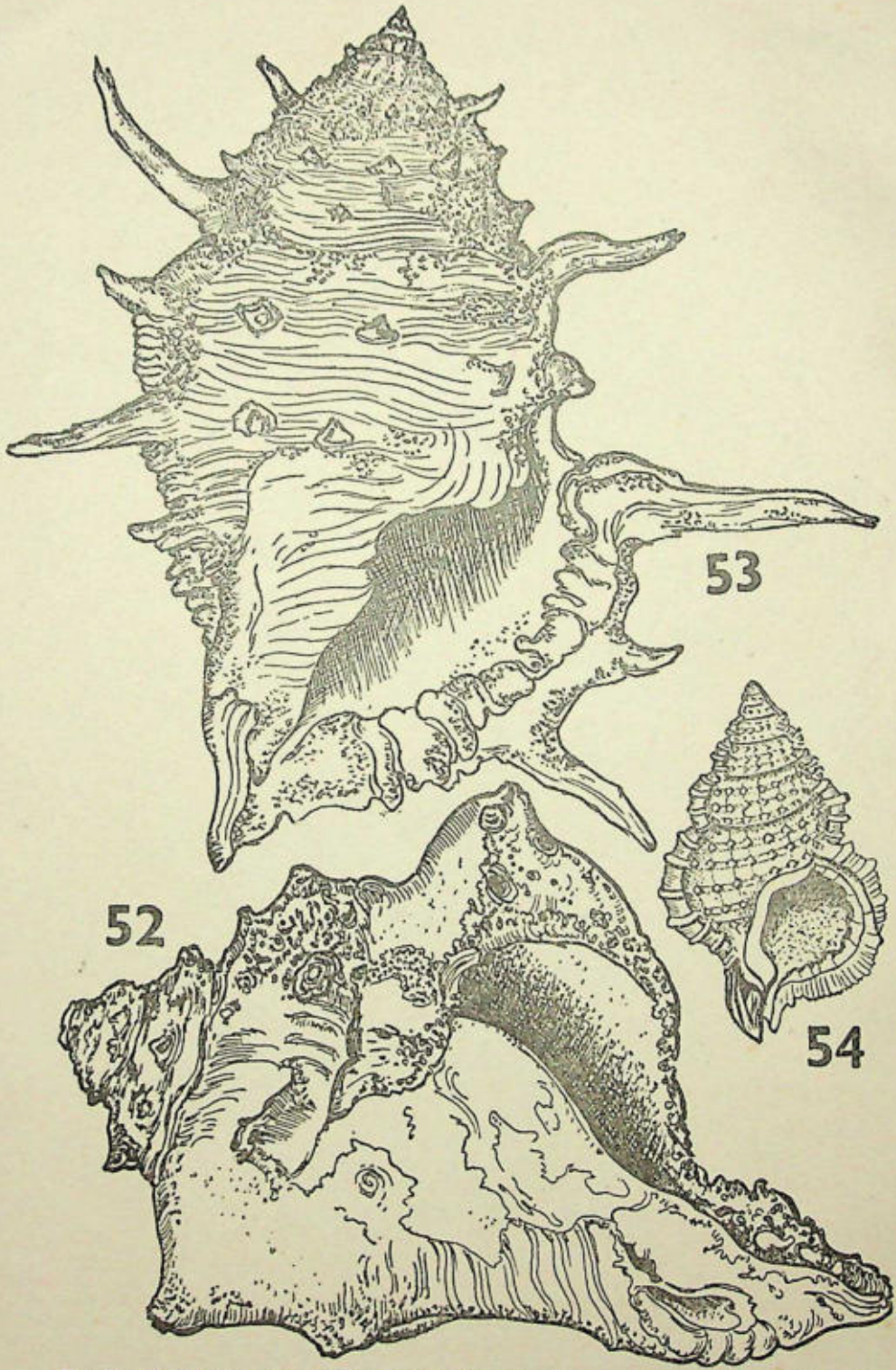


Fig. 52. *Hemifusus* sp.: aperture side; Fig. 53. *Bursa spinosa*: aperture side × 1½; Fig. 54. *B. granularis*: aperture side.

Genus **Cypraea** Linn.

Cypraea ocellata Linn. (Plate 5, Figs. 48 & 49)

Live specimens were collected from Pirotan Island.

Cypraea arabica Linn. (Plate 5, Figs. 50 & 51)

Collected from Pirotan Island.

Family **VOLEMIDAE**

This family includes shells which are commonly known as knobbed chanks

Genus **Hemifusus** Swainson

The shell is large, thick and solid. The whorls are angularly shouldered with nodule-like swellings in a row. The varices are well developed. The aperture is provided with a long anterior canal. The callus on the columella is thick and strongly wrinkled.

Hemifusus sp. (Plate 6, Fig. 52)

The species could not be identified since the shell was incomplete.

Family **BURSIDAE**

One of the most common families represented in Pirotan Island.

Genus **Bursa** (Bolten) Röding

The shell is strongly sculptured on the outer surface. In some cases spines are present and in some granules. Most characteristic feature is the presence of both the anterior and the posterior canals.

Bursa spinosa (Lamarck) (Plate 6, Fig. 53)

Collected from coral reefs off Pirotas Island.

Bursa granularis (Röding)

Collected from Pirotan Island and Hanuman Dandi.

Family **MURICIDAE**

This family has a world-wide distribution. Tropical species are numerous and include many pretty and peculiar forms ornamented with prominent ridges and spines. The shells are stoutly built, variable

in form, sometimes fusiform but more often with a shortened spire and a wide body-whorl. In many species the anterior canal is very long and narrow.

They are widely distributed in the Gulf of Kutch.

Genus **Murex** Linn.

The shell is large with a moderately high spire. The shape is variable, often with varices bearing long spines or stout foliaceous tubercles. The aperture is rounded or ovate; columella mostly with folds; anterior canal long.

Murex trapa Röding (Plate 7, Fig. 55)

Collected from Pirotan Island.

Murex virgineus (Röding) (Plate 7, Fig. 56)

Collected from Pirotan Island.

Murex adustus Lamarck (Plate 7, Fig. 57)

Living specimens collected from Pirotan Island and Hanuman Dandi.

Genus **Thais** (Bolten) Röding

The shells are very variable in shape and size. The spines are generally short and the aperture wide. The sculpture is in the form either of tubercles or of ridges.

Thais rudolphi (Lamarck) (Plate 7, Fig 58)

Collected from Pirotan Island and Hanuman Dandi.

Thais rugosa (Born) (Plate 7, Fig. 59)

Collected from Pirotan Island.

Genus **Drupa** (Bolten) Röding

The shells are small with a low spire. There is distinct sculpture on the surface. The interior of the outer lip is strongly toothed. The anterior canal is short and open.

Drupa tuberculata (Blainville) (Plate 8, Fig. 60)

Collected from Pirotan Island.

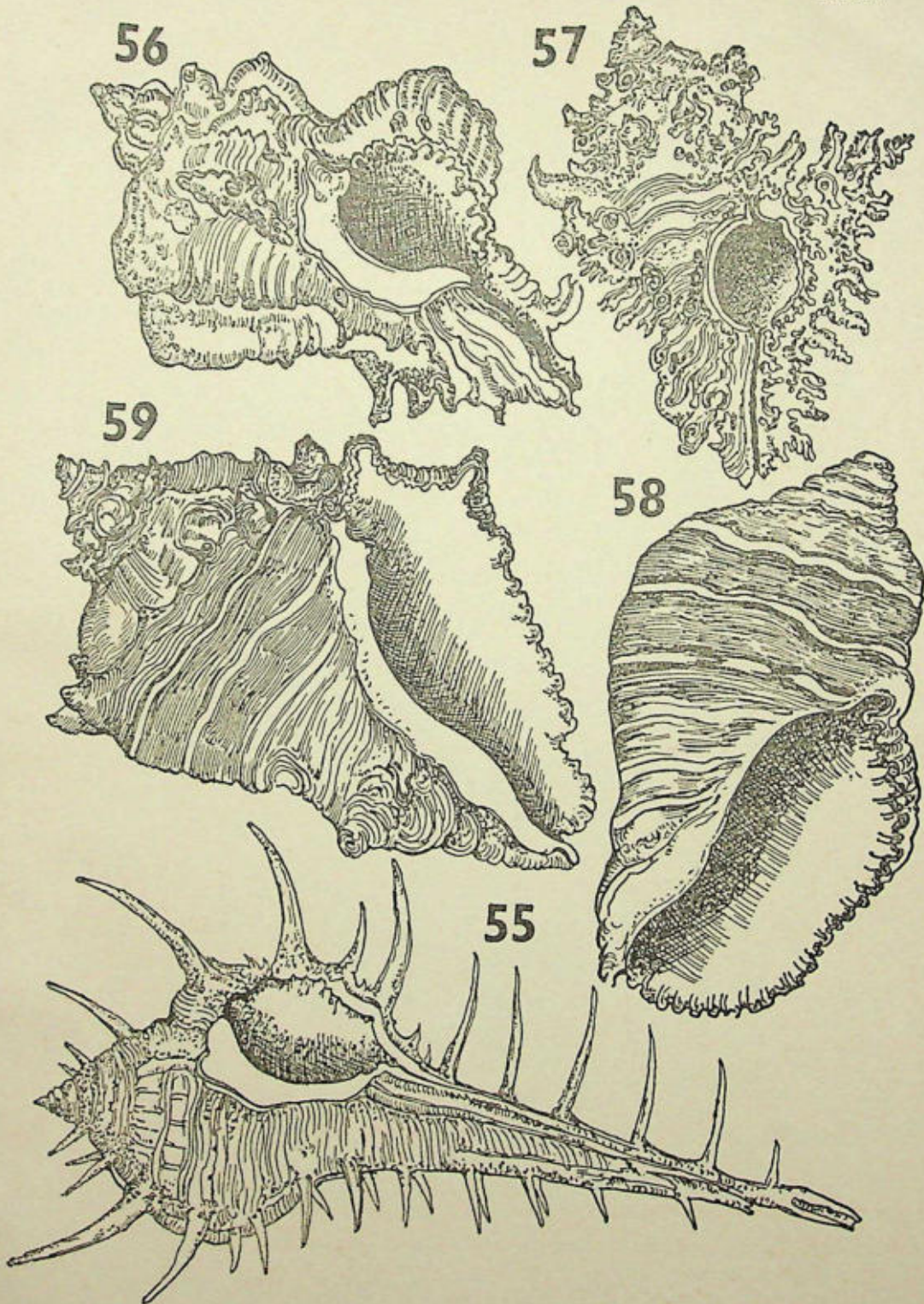


Fig. 55. *Murex trapa*: aperture side; Fig. 56. *M. virgineus*: aperture side; Fig. 57. *M. adustus*: aperture side; Fig. 58. *Thais rudolphi*: aperture side × 1½; Fig. 59. *T. rugosa*: aperture side × 1½.

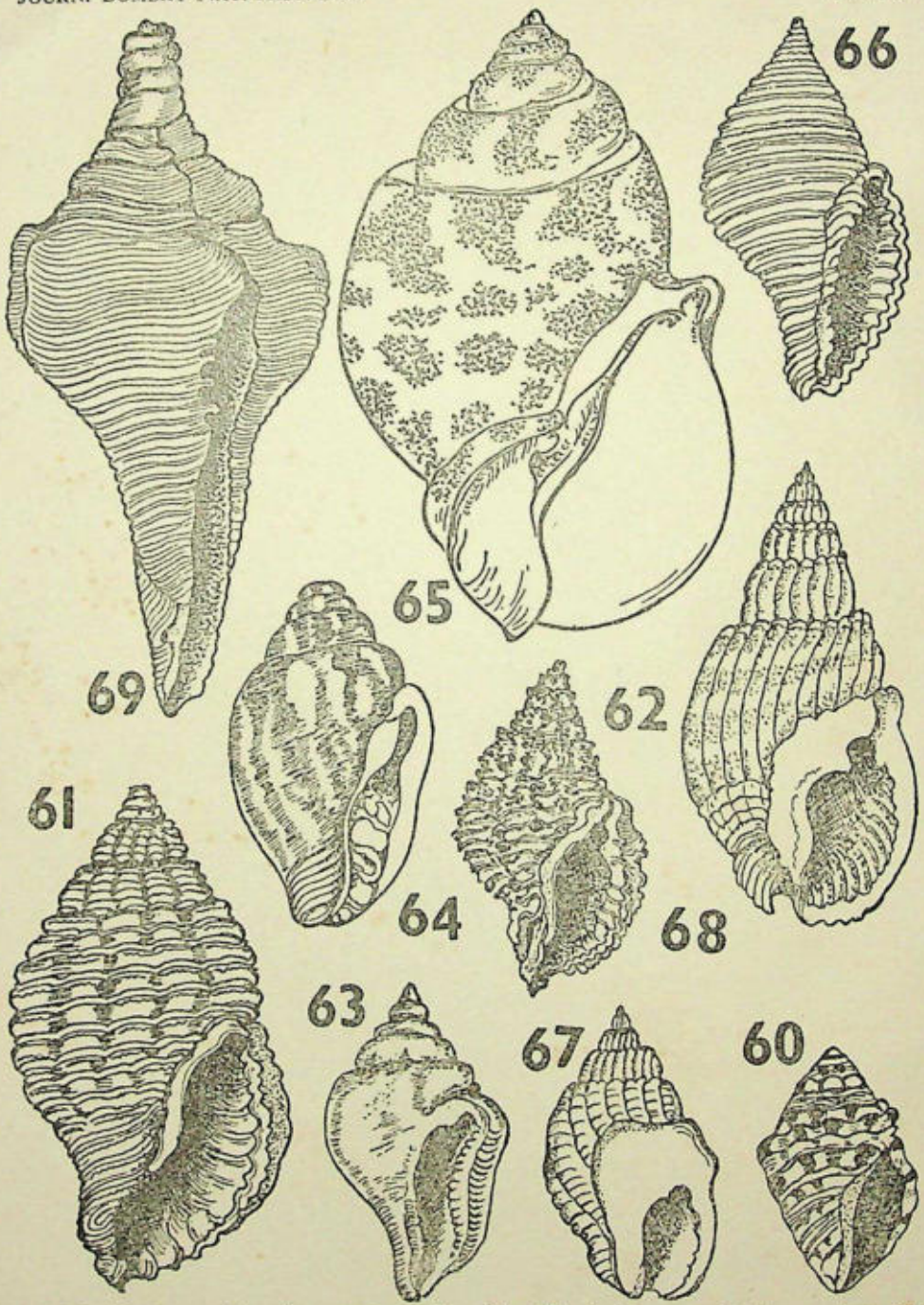


Fig. 60. *Drupa tuberculata* : aperture side × 1½ ; Fig. 61. *D. margariticola* : aperture side × 1½ ; Fig. 62. *D. heptagonalis* : aperture side × 2 ; Fig. 63. *Pyrene versicolor* : aperture side × 3 ; Fig. 64. *P. flavida* : aperture side × 3 ; Fig. 65. *Babylonia spirata* : aperture side × 1½ ; Fig. 66. *Cantharus undosus* : aperture side × 1½ ; Fig. 67. *Nassa thersites* : aperture side × 1¾ ; Fig. 68. *N. hepatica* : aperture side × 2 ; Fig. 69. *Fusus* sp. : aperture side × 2½.

Drupa margariticola (Broderip) (Plate 8, Fig. 61)
Collected from Pirotan Island.

Drupa heptagonalis (Reeve) (Plate 8, Fig. 62)
Collected from Pirotan Island.

Family PYRENIDAE

The shell is usually small and spindle-shaped. The aperture is narrow and elongated. The surface is smooth or ridged. The outer lip is thick and toothed inside. The anterior canal is open. There is no umbilicus or posterior canal.

Genus **Pyrene** (Bolten) Röding

Pyrene versicolor (Sowerby) (Plate 8, Fig. 63)
Collected from Pirotan Island.

Pyrene flavida (Lamarck) (Plate 8, Fig. 64)
Collected from Pirotan Island and Hanuman Dandi.

Family BUCCINIDAE

They are popularly known as whelks.

Genus **Babylonia** Schluter

The shell is more or less oval in shape and its surface is smooth. The colour of the shell is white with brown patches. The spire is not very elongated. The suture is deep and broad. The umbilicus is present in younger animals, in older ones it is completely covered by callus. A very characteristic feature of the genus is a continuous flat winding shelf along the suture.

Babylonia spirata (Linn.) (Plate 8, Fig. 65)
Collected from Byet Dwarka (Balarpur Bay).

Genus **Cantharus** (Bolten) Röding

The shell is somewhat spindle-shaped with close-set spiral ribs. A thick periostracum covers the shell completely. The aperture is

oval and the columella is arched. The outer lip is thick and grooved inside.

Cantharus undosus (Linn.) (Plate 8, Fig. 66)

Collected from Pirotan Island.

N.B. When the periostracum remains intact it is greenish brown in colour. It is reddish brown if it is worn out completely.

Family NASSIDAE

This family is represented by a single genus and two species.

Genus **Nassa** (Martini) Lamarck

The shell is without an umbilicus. The spire is pointed and the aperture is oval. The spire is traversed by trans-spiral ribs.

Nassa thersites (Bruguière) (Plate 8, Fig. 67)

Collected from Pirotan Island.

Nassa hepatica (Montagu) (Plate 8, Fig. 68)

Collected from Pirotan Island.

Family FASCIOLARIIDAE

Represented by a single genus.

Genus **Fusus** (Klein) Bruguière

The shell is thin, more or less elongately spindle-shaped with a turretted spire, and is sculptured with minute spiral ridges. There is no umbilicus. The anterior canal is long and slender. The columella bears a thin deposit of callus and is ridged anteriorly. The body-whorl has got prominent shoulders.

Fusus sp. (Plate 8, Fig. 69)

Collected from Hanuman Dandi.

Family OLIVIDAE

This family is represented by two genera and three species. These are generally known as olives and are notable for their highly polished shells. These are burrowing forms.

Genus **Oliva** Bruguière

The shell is roughly cylindrical or barrel-shaped with a short spire. The aperture is elongated and the columellar callus is either smooth or is provided with feeble oblique ridges. A posterior canal is present in the form of a distinct notch.

Oliva gibbosa (Born) (Plate 9, Fig. 70)
Collected from Pirotan Island.

Oliva nebulosa Lamarck (Plate 9, Fig. 71)
Collected from Pirotan Island and Hanuman Dandi.

Oliva lepida Duclos. (Plate 9, Fig. 72)
Collected from Pirotan Island and Hanuman Dandi.

Genus **Ancilla** Lamarck

The shell resembles *Oliva* in many respects. The posterior canal is absent. The most important difference between *Oliva* and *Ancilla* is the presence in the former of a canal running along the suture which is absent in the latter.

Ancilla sp. (Plate 9, Fig. 73)
Collected from Pirotan Island and Hanuman Dandi.

Family **MITRIDAE**

Popularly known as mitre shells and are often very brightly coloured.

Genus **Mitra** Lamarck

The shell is slender and spindle-shaped. There is no distinct anterior canal. The spire is elongated. The shell has a broad whitish band above the suture. They are small, exceeding not more than half inch in length.

Mitra mica Reeve (Plate 9, Fig. 74)
Collected from Pirotan Island.

Family **VASIDAE** (Turbinellidae)

The shells are commonly known as chank or 'sankha'.

Genus **Xancus** (Bolten) Röding

The shell is large, thick and heavy, and is covered with a thick dark brownish periostracum. The body-whorl is large. The anterior canal is elongated and broadly open. The columella bears strong transverse folds.

Xancus pyrum (Linn.) (Plate 9, Fig. 75)

Collected from Pirotan Island and Sika.

Family **CONIDAE**

These are commonly known as cone shells.

Genus **Conus** Linn.

The shell is conical with a very short broad low spire. The aperture is narrow and elongated. The lips are straight and parallel.

Conus punctatus Chemitz (Plate 9, Fig. 76)

Collected from Hanuman Dandi.

Family **TEREBRIDAE**

Generally known as auger shells.

Genus **Duplicaria** Dall.

The shell is tower-shaped with a tall spire bearing numerous whorls which form a narrowly elongated straight-sided cone. The spiral groove dividing each whorl is well marked and it is as deep as the suture. The surface bears flattened trans-spiral ribs.

Duplicaria duplicata (Linn.) (Plate 9, Fig. 77)

Collected from Hanuman Dandi.

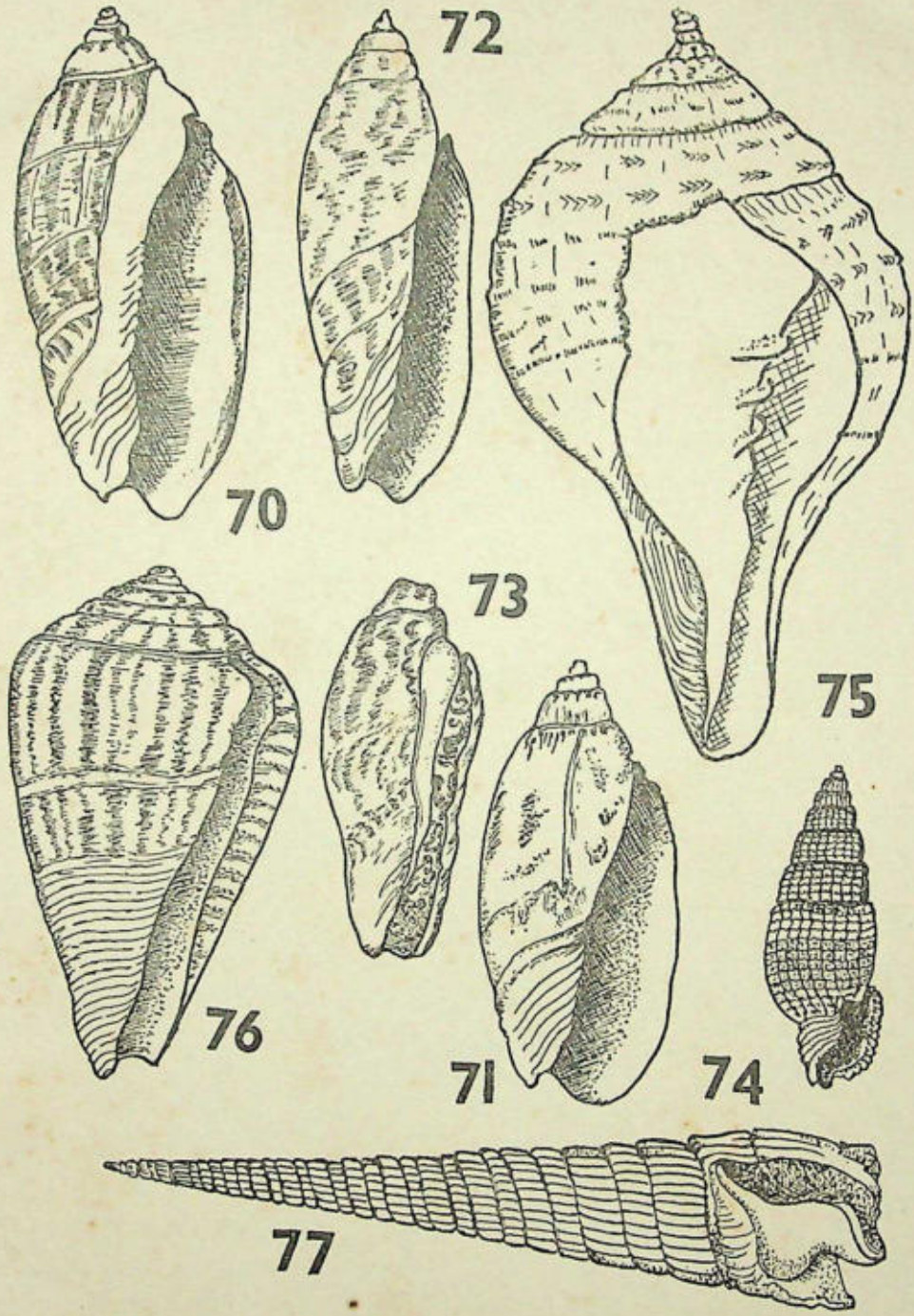


Fig. 70. *Oliva gibbosa* : aperture side ; Fig. 71. *O. nebulosa* : aperture side ; Fig. 72. *O. lepida* : aperture side × 1½ ; Fig. 73. *Ancilla* sp. : aperture side × 1½ ; Fig. 74. *Mitra mica* : aperture side × 4 ; Fig. 75. *Xancus pyrum* : aperture side ; Fig. 76. *Conus punctatus* : aperture side × 3 ; Fig. 77. *Duplicaria duplicata* : aperture side × 1¼.

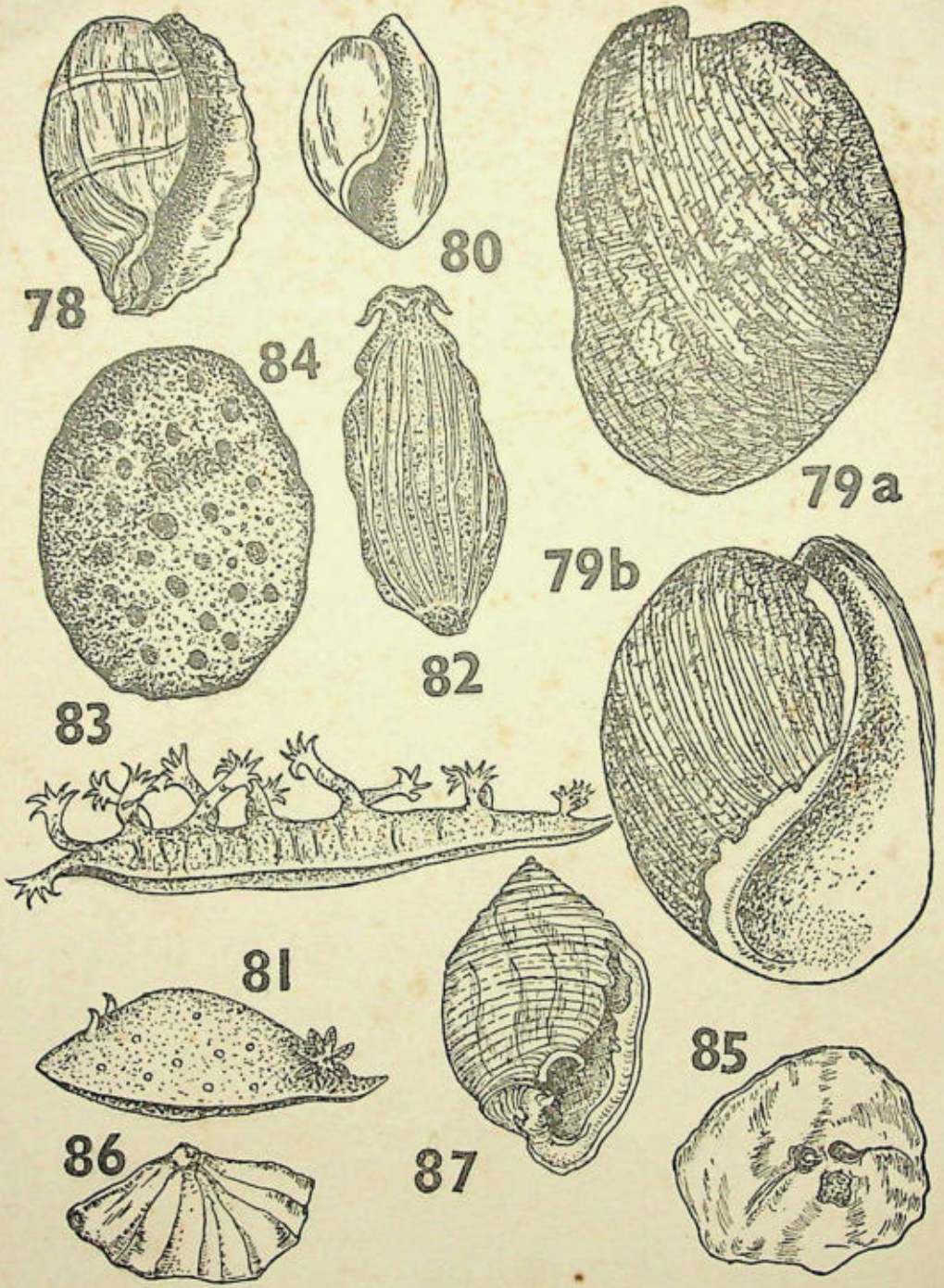


Fig. 78. *Hydatina velum* : aperture side ; Fig. 79a & 79b. *Bulla ampulla* ; Fig. 80. *Haminoea tenera* : aperture side × 1½ ; Fig. 81. *Dendrodoris nigra* × 2 ; Fig. 82. *Pleurophyllidiella* sp. ×7 ; Fig. 83. *Bornella digitata* ×2 ; Fig. 84. *Onchidium verruculatum* ; Fig. 85. *Calyptraea* sp. ×2½ ; Fig. 86. *Calyptraea* sp. : side view ×2½ ; Fig. 87. *Cassidula nucleus* : aperture side.

Family HYDATINIDAE

The shell has the form of bulla and is striped with black and white bands.

Genus **Hydatina** Schumacher

The shell is thin and the body-whorl is oval. The spire is very much reduced and sunk inwards to form a cavity. The shell is yellowish brown in colour with alternating dark and white bands. The foot is very large; no columella and no umbilicus.

Hydatina velum (Gmelin) (Plate 10, Fig. 78)

Collected from muddy region of Balarpur Bay (Byet Dwarka).

Family BULLIDAE

The shells are popularly known as bubble shells and the family is represented by a single genus and a single species.

Genus **Bulla** Linn.

The shell is smooth and the body-whorl is very large. The spire is deeply invaginated into a small cavity to form a crucible-like depression. The columella is covered by a thick polished callus. The shells are brownish in colour.

Bulla ampulla Linn. (Plate 10, Fig. 79 *a* & 79 *b*)

Collected from Hanuman Dandi and Pirotan Island.

Family ATYIDAE

Represented by a single genus.

Genus **Haminoea** Turton

The shell is thin and ovoid, with a wide aperture. It resembles somewhat *Bulla* or *Hydatina*. The colour is greenish white. The shell never completely covers the animal.

Haminoea tenera (Adams) (Plate 10, Fig. 80)

Live specimens are abundant in Pirotan Island and Balarpur Bay. They prefer muddy to sandy areas.

Family ELLOBIIDAE

Commonly known as ear shells.

Genus **Cassidula** Férussac

The shell is oblong or ovate. The outer and the inner lips are thickened and expanded. The columella is strongly folded.

Cassidula nucleus Gmelin (Plate 10, Fig. 87)

Collected from Pirotan Island.

Family DORIDIDAE

The commonest of Indian Nudibranchs belong to the family Doridida, distinguished by the presence of a rough tubercu'ated dorsal shield and the possession of external retractile gills.

Genus **Dendrodoris** Ehrenberg

The body is elongately ovate smooth and brightly coloured. The head is small and placed between the overhanging mantle above and the anterior end of the foot below. The gills are nine in number. The colour of the specimen is dark brown. There are numerous black spots on the dorsal side.

Dendrodoris nigra (Stimpson) (Plate 10, Fig. 81)

Collected from Pirotan Island.

Family ARMINIDAE

They usually burrow in sand or mud. The family is represented by a single genus.

Genus **Pleurophyllidiella** Eliot

The body is flat. The dorsal side bears a series of well-developed longitudinal ridges. The mouth is ventrally placed. There is no external shell; dorsal papillae absent.

Pleurophyllidiella sp. (Plate 10, Fig. 82)

Collected from Hanuman Dandi and Pirotan Island.

Family BORNELLIDAE

The body is more or less elongated and laterally compressed. The rhinophores are large and long-stalked. The lateral margins of the dorsal side bear a series of long-branched branchial processes.

Genus **Bornella** (Gray) Adams & Reeve

Bornella digitata Adams & Reeve (Plate 10, Fig. 83)
Collected from Pirotan Island.

Family ONCHIDIDAE

Members of this family are known as sea-slugs. The shell is altogether absent.

Genus **Onchidium** Buchanan

The dorsal surface is convexly arched. The mantle is thick and is provided with numerous tubercles of different sizes. The branchial tubercles are placed towards the posterior margin of the dorsal side. The head bears a pair of eye-bearing tentacles. It is dark green in colour.

Onchidium verruculatum Cuvier (Plate 10, Fig. 84)
Collected from Okha, Pirotan Island, and Sika.

GENERAL REMARKS

In the present study 35 families, 51 genera and 72 species are recorded which include those of the preliminary survey (Gideon *et al.*, 1957). There are still many more shells which are being identified and could not be included in the present report. It can only be predicted at this stage that the Gulf of Kutch is as rich in Gastropod molluscs as any other coasts surveyed.

It is interesting to note that a number of species which are not recorded from Madras or Krusadai (Gravely, 1941; Satyamurthi, 1952) or even from Bombay (Subramanium *et al.*, 1951) are found in abundance in the Gulf of Kutch. *Turbo coronatus* (Turbinidae), *Nerita plexa* (Neritidae), and *Monodonta australis* (Trochidae) are

recorded for the first time from the Gulf of Kutch. The authors hope to bring out soon a full record together with a key to the identification of the Gastropods of the Gulf of Kutch.

Acknowledgements

The authors are thankful to the Zoological Survey of India for kindly confirming some of our identified specimens. The authors are also thankful to Dr. S. V. Gokhale, Fisheries Department, Jamnagar, for providing all facilities during the survey work, and to Dr. S. M. Mitra, Principal, Birla College, for his interest and encouragement throughout the work.

Grateful thanks are due to the post-graduate students of the Zoology Department, Birla College, Pilani, for their untiring assistance in the collection.

References

Gideon, P. W., Menon, P. K. B., Rao, S. R. V., & Jose, K. V. (1957) : On the Marine Funa of Gulf of Kutch: A preliminary survey. *J. Bombay. nat. Hist. Soc.* **54** (3) : 690-706.

Gravely, F. H. (1927) : Littoral Fauna of Krusadai Island, Mollusca. *Bull. Mad. Govt. Mus.* (*Nat. Hist.*) **1** (1) : 1-196.

———(1942) : Shells and other Animal Remains found on the Madras Beach. *Bull. Mad. Govt. Mus.* (*Nat. Hist.*) **5** (2) : 1-104

Hornell, J. (1916): Report to the Govt. of Baroda on the Marine Zoology of Okhamandal in Kathiawar. Vol. 2. London.

———(1951) : Indian Molluscs. Bombay Nat. Hist. Soc., Bombay.

Melvill, J. C. (1893) : Description of 25 new species of Marine Shells from Bombay. *Mem. & Proc. Manchester Lit. & Phil Soc.* Ser. 7 (4) : 52-66.

Melvill, J. C.(1896): Description of new Species of minute Marine Shells from Bombay. ibid. 2 (8) : 108-116.

———————& Abercrombie, A. (1893): The Marine Mollusca of Bombay, ibid. Ser. 7 (4) : 17-51.

Subrahmanyam, T. V., Karandikar, H. R., & Murthi, N. N. (1951) : The Marine Gastropoda of Bombay. *Jour. Univ. Bom.* **20** (1) : 21-34.

Satyamurthi, T. (1952) : The Mollusca of Krusadai Island. I. Amphineura and Gastropoda. *Bull. Mad. Govt. Mus.* (*Nat. Hist.*) **1** (2) pt. 6.

Thiele, J. (1931) : Handbuch der Systematischen Weichterkunde. Erster Band.

Reviews

1. FORESTS OF THE NIGHT. By Jack Denton Scott. Pp. 190 (21.5×14 cm.). 13 illustrations. London, 1960. Robert Hale Limited. Price 18*s*.

Interest in Jack Denton Scott's FORESTS OF THE NIGHT is aroused right from the blurb when this tells us that for the first time the Indian Government has invited an American hunter to shoot in our jungles. Mr. Scott is an experienced journalist, and in return for his trip he is going to write about shikar so that other Americans, with their much-needed dollars, may be tempted to follow in his footsteps. According to Mr. Scott, the shikar firm to arrange his tour was selected by a Government official and the hunter in charge of the shooting party was reputed to be 'the best professional tiger hunter in the business'.

From the start the story moves fast in a delightfully crisp and smooth style. Many readers will already know Mr. Scott's work, and those who do know it will be aware that he is a great sportsman who, on his own ground, is a very sound man. In the course of the book, Mr. Scott also has some very nice things to say about our country and about Indians.

So far so good, but at this point there crops up a question which needs an answer before going on: Does Mr. Scott's book create a good enough impression to attract foreign sportsmen to our jungles? The answer, regrettably, is an emphatic 'No'. Mr. Scott's tour being sponsored by the Indian Government, the methods described by him will be taken by sportsmen abroad as typical of India and, as such, will brand shikar in India as merciless slaughter, heedless of the safety of the villagers living in the vicinity.

The first shock from this book comes on page 42: 'It would be dark soon, Rao told us and suggested that we use what light was remaining to sight in our rifles. "We hunt for cats by jeep at night. Our plan is to go out this night immediately after dinner."' Then, as if to make quite sure that Mr. Scott has understood him, Rao Naidu says much the same thing again on page 44: '"We hunt the cats and other night prowlers like the wild boar and even the sloth-bear," Rao said. "We use a light and drive the roads. Many of our hunters find it interesting. Have you ever done it?"

'"It's against the law in the States to hunt most animals by night," I said. "Of course we don't have animals that prey on people and that makes all the difference, I guess."

'"You will find that night is the element of the leopard and the tiger," Rao said. "You are meeting him on an uneven basis. He knows the roads, the forests, every ravine around Bori better than any of us. The light, however, almost puts us on an equal footing with him. But not quite. These cats are animals that are always hunting, always on the alert. They may be hunting us before we know that we are hunting them."'

Is this how our Government would have shikar in Indian jungles shown to hunters abroad? True American sportsmen will not come thousands of miles to shoot animals approached in security and comfort by jeep and dazzled by powerful lights. In case our Government doesn't know it, it should perhaps be said here that many Americans will refuse to shoot a driven bird because they regard it as a thoroughly unsporting proposition.

Next, from the bottom of page 47, we are taken out on one of these sneaking, cowardly raids: 'We hadn't ridden with Pathak (the driver) ten minutes before we began to feel secure. This was half the battle, for we would be spending much time in the jeep, hunting at night.

'Everyone was silent now and suddenly Rao switched on a sealed-beam searchlight and began probing the dark forests with it, looking for the burning eyes; every head in the jeep followed the movement like spectators at a tennis match. Every head except that of Pathak. He needed full concentration at the wheel . . . .

'Shortly, without warning, we were at a village. The gaon, a slender man with an amazingly smooth face but faded old eyes and practically no hair, held his arms high and said several Hindi words to Rao. He was vehement and excited.

'Climbing into the back of the jeep, Rao said to me, "He would like us to try to kill the wild boars. Not only do the villagers need the meat badly, but these animals are about as dangerous as anything in the jungle. They charge without provocation."

'While we were driving to the spot where the wild boars were supposed to be, Rao told of what one of the tusked monsters had done a couple of months ago. It seemed that a shikar client had shot at a boar, wounding it.

'"This is our nightmare here in the jungle," Rao said soberly. "It is one reason I try to be very careful of people I take out on shikar.

When an animal like a boar, a bear or any of the cats is wounded, its danger to humans is increased at least fifty per cent. Careless or too quick shooting can wound a tiger or a leopard, and it can prey on these unarmed villagers for months after the hunter has gone back to America. I know you will be sure of your target. The man who shot the wild boar was not. He flashed a shot at it as it headed for heavy cover. He couldn't really see enough of the animal to shoot, and he wasn't a good enough shot to try for the boar while it was running."

'They had trailed it and observed blood, but couldn't find the animal. *So they forgot about it. "There wasn't really much else we could do,"* Rao said (The italics are mine). "I did search for it again, but it had penetrated deeply into the jungle apparently and we never saw it again."

'But one of the village people did. One of the older men from Bori was returning from a neighbouring village about ten miles away where he had been working at a charcoal pit, walking quickly along a yellow dust road, trying to make it to his hut before darkness fell.

' "We never found out exactly what happened," said Rao. "There were long, deep, scuffs in the road where the man had apparently been dragged. From the tracks it was evident that it was a big boar. The man was dead, his stomach had been almost completely ripped out. He never had a chance." '

We are not told the nature and duration of the search that was made for the wounded animal.

Another such incident is described from page 50. The italics again are mine:

'There was silence now and we watched the long beam of Rao's light as it pushed aside the patches of forest-dark. Then, suddenly, dramatically, as these things always happen, the light picked out two big, black animals. They wheeled immediately as the light hit them, charged towards us, then veered, making a sharp, right-angled turn. Sitting on the outside, I tried for them. Rao *attempted* to keep the light on their fleeing bodies. I swung, led the boar in the rear, and squeezed the trigger. *It was a clear shot in the open* and the big .458 boomed like a cannon, but the pigs kept on going and vanished in the thick tangle of ringal, a stunted bamboo growth where even the light couldn't detect them. I started to get out of the jeep.

' "No," said Rao softly. *"It is not safe to get out into the darkness with wild boars around.* They are probably in there now watching and may charge." . . . .

'"Wonder where the third one is?" I asked Rao.

'His face impassive, he said, "It could be a wiser animal, standing back in the thickets and watching us while the other two panicked."

'"Are they that smart?"

'"Smarter," he said. "They are a noble adversary."'

There we have it. The whole sickening sequence ending in the flat, gutless refusal to get out and look for an animal that should never have been fired at in this way and which may or may not have been wounded. No one in that jeep could have been sure beyond doubt that that boar had not been hit. It's all a shocking revelation. One man has already been killed, and now the stage may well be set for another such tragedy. We are not told about a later search, if any, made for the boar that was shot at.

The rest of the book is punctuated with several more shocks of the same kind. There's the incident of the wounded bison: 'There always seemed to be someone waiting with a message, someone to ask us to do something. I was looking forward to some much-needed rest and anything that looked like an interruption was unwelcome. "Another emergency? We might as well belong to a fire-department!"

'Rao smiled. He, too, was tired. But we were his clients and by damn he was going to see that we got our money's worth. "Both bad and good news," he said.

'"Well, give me the bad first, then we can enjoy the good."

'"You know that bison that Mr. Maddox (a client just before Mr. Scott) shot at and I thought he had missed? He has been found."

'"You call that bad news?"

'"Yes, there is only half of him. Apparently Mr. Maddox did hit him and he was dragged down by a tiger. One tiger could never kill the great gaur. He had to be wounded."'

And Mr. Rao Naidu, professional shikari, didn't know! He can let a client shoot at an animal the size of a bison and, unless the animal drops dead, can apparently remain in complete ignorance about the result of the shot! It's all too horribly casual, and his naïve remark that 'I thought he had missed' sounds so like a snatch from some old music-hall ditty that it would be funny if it did not strengthen the impression already gained that, to Mr. Naidu, wounded animals left to die simply do not matter and are just a natural by-product of any of his hunts.

Towards the end of the book another unfortunate leopard (there were two before it) meets the jeep on the road: 'It was close to

dawn now with a light that made you think you were under water. Rao stopped the jeep. There on a hummock, crouching at the sight of us, was a leopard . . . It was Mary Lou's (Mr. Scott's wife) turn to bat. She sat, cool as usual, the .308 at her shoulder, stock tight against her cheek. Just before the rifle cracked I saw the cat crouch farther down. Then he was gone on the other side of the knoll, and we were out of the car after him. But he had disappeared. I had stayed with the jeep and Pathak while the other three went searching.

'I was leaning against the jeep talking to Pathak when I saw it. The cat had come back, circling behind us, and there he was about two hundred yards from me, crouching but moving forward, seemingly almost on his stomach. Pathak was petrified. I had the .308 on him fast—too fast. My first shot raised dust spirals beyond him, the other, corrected too hastily, was a little lower but not low enough. Then he was gone. Hearing my shots, Rao came on the run, Mary Lou and Tiwang close behind.

'"Two misses on one cat," Mary Lou said. "That's too much! I can understand yours, the leopard was moving, but mine was almost a set-up shot. I should have had him—."

'"He crouched just as you pressed the trigger," Rao said. "You missed by a bare fraction."'

Perhaps. But it is here suggested that experienced shikaris will see in that last description one clear piece of evidence which shows that the leopard had indeed been hit and deserved to be followed up until the truth, one way or the other, was known. But almost at once the jeep was on the move again, and it had hardly gone five hundred yards when Rao said, '"*Chausingha*! Fourhorned antelope!"

'It was standing about a hundred yards off the road on the edge of a patch of ringals. I got out fast, sighting on it as it broke into a peculiar lope, heading for the trees. At the shot it jumped ahead, turned to the left and fell.'

They certainly got that one, and the shot wasn't actually taken from the front seat of the jeep: just near enough to catch the unsuspecting animal off its guard. Now in Africa, and in America, this kind of shooting would earn the guilty hunter a whopping fine, and the firm responsible for taking him out would stand in peril of losing its licence. Why not the same penalties here?

I have expressed my opinion on the facts as set out by Mr. Scott, and as they will appear to the readers of the book. If the facts are not correctly presented, I would invite the Government of India

at an early date to counteract the effect of the book by publishing the true facts, and by expressing its disapproval of the methods of shikar described.

HUGH ALLEN

2. THE OXFORD BOOK OF WILD FLOWERS. By S. Ary and M. Gregory. Illustrations by B. E. Nicholson. Pp. viii+232 (24.5×18 cm.). Oxford University Press, 1960. Price 30*s*.

This is a splendid book, in no way inferior to the already rich collection of volumes illustrating the flora of Britain. To this reviewer this book is a sort of answer to prayer, the sort of dream I have had for many years for the flora of India in general and of Bombay in particular: a book with plenty of illustrations, and good descriptions, and of a price easily within the reach of the average university student.

The present book is meant particularly for the general educated public, especially for such people as find it impossible to wade through the heavy technical books in regional or national floras. But even the experts will find this book interesting. The more common plants of Britain are grouped in the various colour plates by the colour of their flowers; by this grouping even a mere tiro can identify many of the flowers of the field without undue leafing through the book. The right-hand page shows a number, usually 4 to 6, of colour illustrations; on the page facing the plate there is a simple explanation, often with neat line diagrams, of the plants given in the colour illustrations; in addition some other species allied to those pictured in colour are also described in the text. The colour plates all carry an indication of the size of the plants pictured thereon; usually the paintings are life size, occasionally half or one-third life size.

Colour plates and text fill up to page 191; then there follow a few pages of black-and-white illustrations (pp. 193-201); there is next a set of very interesting line drawings (pp. 202-205) giving the general outline and appearance of some of the commoner British trees in winter, when they are leafless, and in summer with their full foliage.

At the end of the book there are notes on naming and classifying plants, on ecology, and on other matters, meant to help the more

botanically inclined reader. The book closes with an index of all scientific and vernacular names mentioned in the text.

This reviewer has gone through the book in detail, and finds nothing but praise for the splendid and artistic illustrations and the concise but very careful descriptions. To put it briefly: I find this book a challenge to Indian botanists and artists. Our school children would certainly feel more attracted to the study of nature in all its aspects if we could provide them with books such as the present under review at a moderate price.

The printing both of the text and of the illustrations and the general presentation of the book is in keeping with the very high standards of Oxford University Press.

H. SANTAPAU

3. YOUR FACE FROM FISH TO MAN. By M. S. Mani. Pp. 85+ii (19.25×12.5 cm.). With line drawings. Bangalore, 1960. The P.T.I. Book Depot. Price Rs. 3.

This is the first of a series of popular books on biology. The author gives a short account of vertebrate evolution, taking as his central theme the evolution of the human face from the ancestral fish-head. He discusses among other things the changes in the muscular system which gave rise to the upright posture. This meant that the head, instead of weighing down one end of the spinal column, was balanced on top of it. It was therefore freed for growth. The bones of the ancestral cranium bulged outwards to accommodate the larger brain, and the bones of the face changed in size and proportion with them. The facial muscles shifted their attachments and some of them grew until they became capable of giving rise to the complex expressions characteristic of the human face today. A final chapter sums up the possible future of the race—not a very bright one from the aesthetic point of view. If present trends continue, the dominant species of the future will have a hairless, toothless brain-case, to which a diminished trunk and limbs will be attached as an appendage!

The illustrations are a valuable aid to the understanding of the text.

One hopes that this series will succeed in introducing biology to a wider public.

A.B.

4. TIGER TRAILS IN ASSAM. By Patrick Hanley. Pp. 174 (22.20×14 cm.). With 15 photographs and 1 map. London, 1961. Robert Hale Ltd. 18*s*.

A new book on India's wild life is all too rare an event and is therefore doubly welcome to the naturalist and the lover of wild things, more particularly if its main content comprises personal observations on the habits and ways of life of the animals, as opposed to a recital of shooting trips. Mr. Hanley's book has an added interest in that it is almost exclusively about the wild life of Assam, a subject on which the few books which have appeared in recent years have had little to say.

The thesis of the book is very agreeable—'there is far greater thrill to be had out of watching and learning about the habits and behaviour of wild animals in the jungle, than one can ever experience when shooting them. And if danger and excitement is wanted, there is far more of these to be found in one journey into the jungle on foot, unarmed, than can ever be had by hunting tigers, leopards, or other wild animals from the back of an elephant, or from a safe seat in a machan on a tree, or even by gunning for them on foot.'

I read with the greatest sympathy of the loss of the author's entire collection of photographs in the war, for they were taken, Mr. Hanley tells us, 'at great risk' and 'recorded jungle incidents of the rarer kind of animal behaviour which only falls to the lot of man to witness perhaps once in a lifetime'. Some of these must have been unique, as few men have had the uncommon good luck even to have seen such jungle incidents, let alone photograph them.

Mr. Hanley makes no claim that what he has written is to be taken as authoritative on animal behaviour, and says he merely records what he saw at different times. This is disarming, but some of his experiences and observations related in the book are most unusual.

He must have been singularly fortunate to have seen tigers kill their prey on more than one hundred and twenty separate occasions (I have seen it only once!), and have exercised an equally singular attraction for tigers to have had sixty odd encounters with them at distances from six to twenty feet. He must, too, have seen more giant encounters between the great animals of the jungle than any other man, living or dead—tiger against tiger (more than once), fighting for a mate; tiger against wild boar; sambar against wild dogs; leopard against python; leopard against tiger; and so on. His record.

besides, of ducking out of a charging leopard's way twice must be unique.

The account of Bengala, the great tiger, makes fascinating reading. I was not however greatly convinced of this tiger's wisdom, about which much is said when he is introduced to the reader. He was said to have evaded every hunter for ten years despite their determined efforts to shoot him. Yet the same tiger gave so many separate opportunities to Mr. Hanley to summarily get him. Or perhaps he was that bit extra clever to know that Mr. Hanley was harmless. Four times the author saw him in the moonlight standing still at a distance of only a few feet. Mr. Hanley admits that if he had had a gun with him, he could not have missed him. Then there was the occasion when Bengala killed a buffalo to the rear of his bungalow and made a sitting target while he settled down to a long and leisurely meal.

The estimate of Bengala's weight of 650 lb. cannot be accepted. A tiger ten feet six inches long (estimated) *over curves* cannot possibly weigh this much. Compare Brig.-Gen. Burton's estimate of the weight of the great Ambari tiger which he shot and examined—550 lb. for a length of nine feet eight inches *nose to tip*. Bengala's photograph shows a splendid, muscular tiger, without an ounce of surplus fat on him. A great tiger immediately after a big feed might conceivably weigh considerably more than normal, but a weight of 650 lb. would be more appropriate to Baikov's Manchurian tigers. There are a couple of these in the Alipore Zoo in Calcutta, and, judging from size, might tip the scale well in excess of 600 lb. in their natural habitat, the *Taiga*.

References to tigers and leopards hunting by scent contradict the known facts about these animals. Even so great an authority as Dunbar Brander showed conclusively that the sense of scent of the tiger was extremely poor, and the great carnivores depended entirely on sight and hearing both to hunt and for most other purposes. Mr. Hanley makes the astounding statement that 'the sense of smell of a tiger is more acute than any other animal in the jungle . . .' I should think, on the other hand, that every other major animal in our jungles has a far better sense of smell than the tiger.

Certain inaccuracies in the book could have been avoided by so experienced an observer of wild life as the author. He divides the leopard into three different types—the leopard, the cheetah, and the panther. He admits that the panther is a leopard posing under a silly alias. But he goes on to say that the panther is slightly larger

than the leopard. The fact is, of course, the leopard and the panther are two names for the same animal—despite what some old-time hunters and a few others have said. The two names have been given based almost entirely on variation in size, and sometimes a small variation in colour. The size differences are associated with differences in skull conformation and it is known that the animal develops the occipital ridge with age. Its absence in a younger animal does not make it another variety. The cheetah is no kind of a leopard. The name by which it used to be popularly known—hunting leopard—was attractive, but a misnomer just the same.

Again, Mr. Hanley says that Assam hoolocks are called langurs in other parts of India. This is of course incorrect. The hoolock is a gibbon and an ape, and does not occur west of Assam. The langur is a monkey with a very wide distribution. An incredible observation is that while sitting up in a *machan* overlooking a water-hole, numbers of lynx and civet cats came down to drink.

Nevertheless, Mr. Hanley's accounts of jungle life are full of interest, and his great humanity towards its inhabitants made a deep impression on me.

B. SESHADRI

Miscellaneous Notes

1. GOLDEN LANGURS *PRESBYTIS GEEI* GEE (KHAJURIA, 1956) IN CAPTIVITY

During early December 1955, a friend and I visited the Sankosh River on a fishing holiday. On arrival at the Jamduar Forest Bungalow, we found a scientific party there, who were collecting specimens of the Golden Langur, *Presbytis geei* Gee (Khajuria, 1956), for the Calcutta Museum. We helped the collectors obtain some specimens during the course of which I acquired two baby Golden Langurs, male and female, for myself. These I estimated to be 2-3 months old at the time of capture.

They did not show any signs of being afraid of humans, and took quite readily to a bottle of diluted condensed milk, and also ate oranges and bananas.

I took these young langurs back to the garden in the Terai (Darjeeling District). There they were kept tied up on the lawn or verandah during the day, and were put away in a box, well padded with old blankets for the cold nights.

After a month or so they became very tame and would come eagerly when they saw one approaching with food, and so I was able to let them play around in the compound, where they generally stayed in the bauhinia trees, and we could always catch them again by enticing them with food.

At the end of about 3 months the male died, without having shown any indication of ill health. The female thereupon became very lonely, and showed her unhappiness by making the wailing, almost a whistling, noise that seems to be peculiar to the Golden Langur.

It so happened at this time that the female of a pair of tame hoolocks of mine died. For a number of years these monkeys lived a perfectly free and normal life in the jungle behind my bungalow, which was at an elevation of approximately 1800 feet (550 m.). They wandered over vast areas of jungle, but always came back to the bungalow to take food, particularly when natural foods in the jungle were scarce. After the death of the female the male hoolock became lonely and dejected and seldom ventured far from the bungalow. When his mate was alive they took little notice of the young langurs, although they often fed together, but now the female

langur appeared to be attracted to the hoolock, and though he was rather shy of her approach to begin with, invariably taking to the roof of the bungalow where the langur was unable to follow, he gradually overcame his timidity. It happened that one very cold, wet morning he actually allowed the langur to snuggle up to him while he was sheltering under the front porch. They spent the rest of the night sheltering there and from that day on they were firm friends. The hoolock used to go off occasionally into the jungle, and at such times the langur would sit on the roof and wail as she could not follow, being too young to face the hazards of the jungle. The male for his part never stayed away long, coming back almost every day, but spending the nights in his own haunts among the trees.

As the langur grew stronger she followed more and more after the hoolock. He would often be well ahead, but would come back on hearing her wail and help her along, and in this manner soon built up her confidence to move through the jungle on her own. Now they would go off long periods at a time and, although to begin with the langur always came back to the bungalow to pass the night on the beams of the porch, she eventually adopted the habit of the hoolock and took to spending the nights in the trees. They always called at the bungalow first thing in the morning and were given a meal of bread and milk and fruit, and then either sat on the bungalow roof or went for a short jaunt in the jungle. They would return in the early afternoon for a second meal, after which they played among the bauhinia trees in the compound, and as evening approached they made off into the jungle to their sleeping places (which, by the way, I never discovered).

When natural foods were plentiful they often missed out their visits to the bungalow for a day or two at a time.

This state of affairs continued until mid 1957, by which time the langur was fully grown. The visits became very infrequent at this time as far as the langur was concerned, but the hoolock continued to come on his own, and ultimately the langur stopped coming altogether. I rather think she must have paired up with a Common Langur, as I had often noticed a troupe in the same area of jungle where my monkeys used to live, particularly an old solitary male who was often observed quite near the bungalow.

The following are points of interest observed during the period I had the langurs:

FEEDING. When first captured they were fed from a bottle containing very diluted condensed milk which was later replaced by

diluted cow's milk. They became very used to the bottle and frequently quarrelled over its possession. Oranges were eaten readily from the outset, and later bananas, bread-and-milk, rice-and-milk, and any fruits that were available, e.g. mango, papaya, litchis, etc. From the age of about 5 months onwards, they started to catch and eat insects such as spiders, grubs, and caterpillars, and had a special liking for grasshoppers, which were caught for them. This habit continued into the adult stage, as I often saw the female hunting insects immediately after having eaten her meal from the bungalow. She appeared to be fond of any brightly coloured flowers, with the result that the buds of orchids, bauhinia, roses, etc. were pulled to pieces, and the tastier petals eaten with relish. I also noticed her eating tender green leaves, but unfortunately do not know the names of the trees from which they were taken. Amongst wild fruit the yellow ficus or peepul was eaten as well as others, but here again I cannot give the names.

COLORATION. When first obtained they were a light golden yellow which gradually darkened to a rusty gold with maturity, the male appearing to be a shade darker than the female. No change of colour was remarked with the different seasons, but this may have escaped my notice.

HABITS. Appeared to be extremely gentle by nature. Gregarious, as at any time one was left it would wail continually until reunited with its companion. Curiosity not so marked as with other species of monkey, but intelligence I would rate quite high. Did not show any affection towards human beings, but very much so amongst themselves, and of course later with the hoolock. Extremely clean in all their habits: no distinctive body smell as is evident with other monkeys.

They had the usual monkey's fascination for a mirror. The female used to spend hours together snuggling up to her own reflection in the window panes of the bungalow. Very playful in the company of the hoolock.

SOLGAI T. E. & P. O.,
CACHAR,
ASSAM.
May 25, 1961.

P. L. ACHARD

2. RECOVERY OF A RINGED TIGER!

Last March I had some guests at my farm near Kichha (Kumaon terai) for a shoot. One of the tigers shot was found to have a collar of twisted iron wire round its neck (two rounds of wire with a loop in which the loose end of the wire was secured). The tiger, a male measuring 8 ft. 7 in. between pegs, was in good condition and quite wild. When followed up after being wounded, it charged our elephants viciously and put them to flight before being shot. The collar was quite loose indicating that the animal was not very young when it escaped from captivity. The tiger had perhaps escaped from a circus, but curiously we did not hear of any such escape, or of any circus camping within 20 miles of the farm in the last year or so. My brother mentioned that he had read in the Lucknow *Pioneer* of a tiger escaping from a circus camping at Mainpuri a few months back. A letter to the editor of the newspaper has remained unreplied. Mainpuri is about 180 miles (290 km.) from Kichha in a straight line. Do you think that the Mainpuri tiger could be the one shot on the farm? The distance and the wildness of the tiger are perhaps against the assumption.

464, BEHARIPUR,
BAREILLY, U.P.,
July 26, 1960.

C. M. CHAUDHRI,
I.F.S. (Retired)

[The Editor of *The Pioneer* has been unable to trace any reference to a report of the tiger at any time between July 1959 and February 1960. Can any reader give us more information about this tiger?—EDS.]

3. SOME NOTES ON THE GOLDEN CAT, *FELIS TEMMINCKI* VIGORS & HORSFIELD

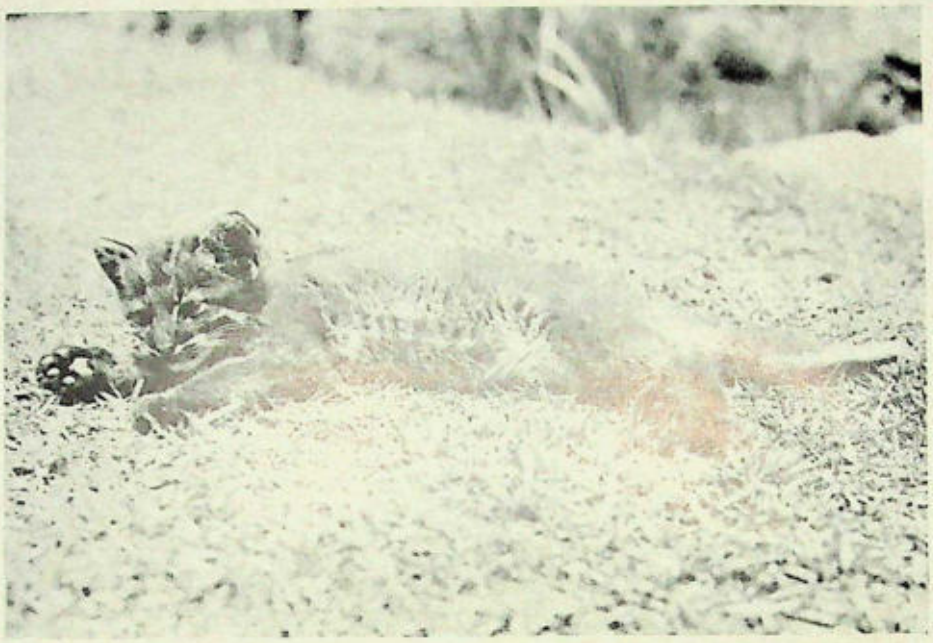
(With two plates)

This beautiful cat is found in Nepal, north-east India, Burma, and south-east Asia down to Sumatra; Tibet, Szechuan, and (?) upper Burma; and southern China. Ellerman & Morrison-Scott list three subspecies in these three geographical areas respectively: *F. t. temmincki*, *F. t. tristis*, and *F. t. dominicanorum*.

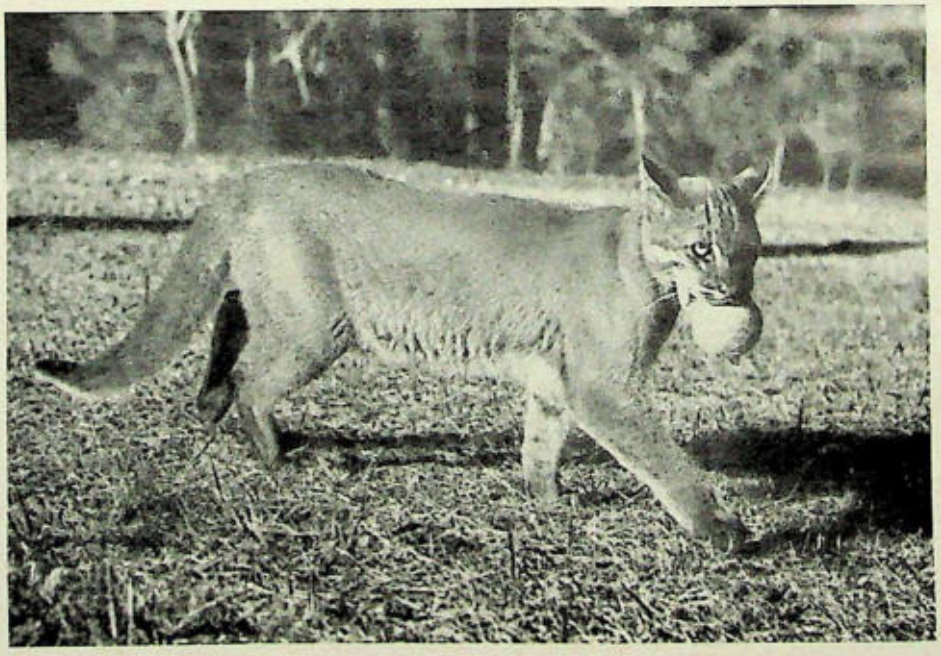
Felis temmincki temmincki

Perhaps the most handsome and brilliantly coloured of all the smaller cats

Photo : E. P. Gee



As a kitten, he was dark brown and fluffy



About three-quarters grown. His size can be gauged from the tennis ball he is retrieving

Photos : E. P. Gee

F. temmincki is extremely variable in coloration, and the typical race *F. t. temmincki* varies from very dark brown (even black) to rusty red or chestnut, ochreous-tawny, and grey. There are prominent striped markings on the face and cheeks, with faint markings on the chest and under parts. The tail is dark above and whitish below. This is a large cat, the length of an adult male being 4 ft. 2 in. (1.27 m.) including the tail.

This cat has very seldom been observed in the live state. One was seen and shot at Maymyo over a calf it had killed, and another was speared at Victoria Point, Tenasserim, while feeding on a buffalo calf. A pair of them were shot at Shilingkhet (also in Burma?) while feeding on a buffalo calf. In the Lushai Hills (of Assam) it is said to live among rocks, while in the Mishmi Hills (of N. E. F. A.) the female is said to lie up in hollow trees with her two young ones.

Sterndale quotes Hodgson to the effect that his first specimen 'was caught in a tree by some hunters in the midst of an exceedingly dense forest. Though only just taken it bore confinement very tranquilly, and gave evident signs of a tractable disposition, but manifested high courage, for the approach of a huge Bhotea dog to its cage excited in it symptoms of wrath only, not of fear.'

E. O. Shebbeare tells me that A. W. Pullan once kept a Golden Cat in captivity, and eventually presented it to the London Zoo where it died of feline distemper. It was said to be very tame, and was 'grey with darker mottling'.

In April 1960, while in Goalpara town in western Assam, I found a tiny kitten in the shop of an animal dealer, and instantly recognised it as a kitten of *F. t. temmincki*. After much bargaining I acquired it. I was told by the dealer that it and two others had been brought from the Garo Hills near by in February. They must have been found when very young indeed as this one had been in the dealer's possession for a month and was still very tiny. The other two had been sent to Calcutta but had both died on the way.

I took the kitten to my house in Upper Shillong, where he immediately made himself at home both inside the house and also all over the garden. Tishi, as he was called, proved to be remarkably tame and intelligent. He quickly came to know the servants and all the windows and doors of the rooms. He would come instantly when called, even without a chance of getting food, and would follow me everywhere. Each time I passed a tree he would leave me, dash up the tree almost to the top, dash down again and catch me up in time to do a repeat performance at the next tree. He

seemed to be equally at home in a tree as on the ground—a pointer to the habits of this cat in the wild.

Tishi used to suckle the lobes of my ears, both as a kitten and even when almost fully grown up, over 3 ft. 9 in. (1.15 m.) in length. When he was bigger, I had to discourage this habit, as he sometimes became over-enthusiastic. So instead he developed the habit in later months of springing up on to my shoulders clawlessly, and licking my head. If I were to sit down, he would be in my lap immediately, and would start treading with his paws and forming saliva at the mouth. There is no doubt that, as he had hardly (if ever) seen his own mother, he came to regard me as his own kind, as a sort of father and mother combined.

As a kitten Tishi had been dark brown and fluffy. After a few months he began to change colour, and by November had grown into a strikingly handsome and truly golden cat. Everyone who saw him remarked on his brilliant colouring, as well as on his extraordinary tameness and devotion to me. Right up to the end of his stay with me, he rarely showed any signs of temper and was almost invariably well behaved and docile.

In the late afternoons he used to go 'hunting' in the forest below my house, as much as a mile away. Sometimes he even entered villages. But an hour or so after dark we used to call him, and within a very short time he was back for his evening meal and to be shut up at night—for his safety.

He would play for hours with the other cat, with the dogs, with himself: and above all he loved to have a tennis ball to catch six feet up in the air and bring back to hand—a veritable 'golden retriever'.

As there had been no chance of getting a mate for such a rare creature, and in order to improve the chance of his becoming and remaining tame, I had had him castrated in July. Then, when the following January (1961) came round and I was about to go on a trip to south India, it became a problem what to do with him. He could not be left behind with the servants. Every day I was afraid that a Khasi arrow might find its mark in him, or that he might get run over on the main road outside my garden. There was only one solution: Tishi must go to a zoo.

As there is no fully established hill zoo in India available to take a golden cat, a creature of the mountains and forests, I made arrangements with the London Zoo. On January 16th 1961 Tishi travelled the 6000 miles (9700 km.) by air to his new home, where

he thrives. In his letter dated May 3rd the Curator of Mammals, London Zoo, wrote: 'Tishi has settled in splendidly and is in marvellous condition. He is a superb exhibit . . . We have already recorded a television programme . . . in which Tishi featured and I must say he looked magnificent when I saw the recording that was made.'

EVERGREEN COTTAGE,
UPPER SHILLONG,
ASSAM,
May 28, 1961.

E. P. GEE

4. WHAT DO LARGE PREDATORS IN THE FOREST LIVE ON?

In January 1961 Mr. C. E. Norris, of Pingarawa Estate, Namunukula, Ceylon, wrote to us commenting on Mrs. Jamal Ara's estimate of the large predator population in her ecological survey of the Hazaribagh National Park (*J. Bombay nat. Hist. Soc.* **57**: 325-338 at p. 334). He pointed out that, at an assumed killing rate of one per week per predator and a recruitment rate of 20% per year for the large herbivore population, there would have to be a herbivore population of $20 \times 52 \times 5 = 5200$ to feed the ten tigers and ten leopards estimated as living in the Park, whereas the estimate of the deer population of the park is only 235. Mrs. Jamal Ara replied by calculations showing the absurd results that followed from the assumptions on which Mr. Norris's figures were based. For instance, the Palamau Forest Division in Bihar State, estimated by the Forest Department in the 1930s to have a tiger population of 35 and perhaps a leopard population of 25, would require for their maintenance a herbivore population of $60 \times 52 \times 5 = 15{,}600$, a figure that even the most ardent admirer of the richness of Palamau forest life would not accept as possible. Similarly, the population of 250 lions recently estimated to live in the Gir Forest would require a herbivore population of 65,000. As a result of this correspondence Mr. Norris has re-examined the question and, after consulting naturalists, game-wardens, and other knowledgeable persons in Ceylon, Africa, and India, writes that the old belief of one kill per week is 'very far from correct', and that in the course of his inquiries he has collected some 'interesting data' which he is in the process of analysing. While we

await his report it would be interesting to have some other opinions too.

BOMBAY NATURAL HISTORY SOCIETY,
91, WALKESHWAR ROAD,
BOMBAY 6,
July 29, 1961.

EDITORS

5. COMMUNAL DISTRACTION DISPLAY IN LARGE GREY BABBLER [*TURDOIDES MALCOLMI* (SYKES)]

A pair of Large Grey Babblers [*Turdoides malcolmi* (Sykes)] breed regularly in a solitary thorny tree in my compound here. On 19 May 1961 there were four fledglings in the nest, being fed by the parents while the rest of the flock of babblers from time to time would gather close by watching for danger and giving alarm on sighting a crow, or mongoose, or pariah kite. On 25 May 1961 one of the fledglings flew out of the nest and probably perished in a heavy rain storm which occurred that evening. Another fledgling was missing after the storm. On 29 May 1961 the two remaining fledglings left the nest and hopped about on the ground, either following the group of babblers or being followed by them. As the fledglings were at the mercy of a mongoose living close by, the babblers defended the young in a group, fluttering their wings and guiding the young ones in the direction they ought to follow. The whole flock of 8 babblers would surround the fledglings and flutter their wings. The babblers appeared to be acting as a group, attracting attention to themselves and distracting likely enemies from the young, and also somewhat guiding the young. During my few days' observation I noticed that only the parents fed the young, and the rest of the group cordoned the young ones when on the ground and were constantly on the look out for danger. The group of birds now and then fluttered their wings and often babbled in unison. When the group left for feeding, one pair of babblers which I recognised to be the parents of the fledglings remained with the young. Although communal feeding of the young is possible, I did not see it being done in this instance.

DIL BAHAR,
BHAVNAGAR,
June 6, 1961.

R. S. DHARMAKUMARSINHJI

6. THE MOUSTACHED SEDGE WARBLER [*LUSCINIOLA MELANOPOGON* (TEMMINCK)] AND THE YELLOW BITTERN [*IXOBRYCHUS SINENSIS* (GMELIN)] : ADDITIONS TO THE BIRDS OF KUTCH

At the BNHS/WHO Bird Migration Study camp at Wanoti about 9 miles north of Mandvi, Kutch, 10th to 26th March 1961, no less than six Moustached Sedge Warblers, *Lusciniola melanopogon* (Temminck), were trapped in bird nets, all singly on different days. The only previous record from the whole of Gujarat is of Dr. W. Koelz from Sihor near Bhavnagar. It would seem from the above that this sedge warbler is not an uncommon winter visitor to Kutch, but escapes notice in the thick reed beds it frequents.

A Yellow Bittern, *Ixobrychus sinensis* (Gmelin), was noted and later collected by P. W. Soman. The only record from Gujarat is that of Butler from Deesa, where he found a few pairs breeding in 1876.

JASDAN,
SAURASHTRA, Y. S. SHIVRAJKUMAR
March 29, 1961.

[A specimen of *Lusciniola melanopogon* collected has the wing 62 mm. and is no doubt of the eastern race *L. m. mimica* Madarász.

The Yellow Bittern, *I. sinensis*, has not been specifically recorded from Kutch but in *J. Bombay nat. Hist. Soc.* Vol. 1, page 143, is published a list of 102 specimens presented by A. H. T. Newnham, which in the course of the Annual Report published on page 89 of the same volume are said to be collected from Bhuj, Kutch. This includes two specimens of *I. sinensis* though they no longer exist with us.

The Yellow Bittern is said to occur all over India and Ceylon, east to South China through Burma, the Malay States and Archipelago, to Celebes. In India, however, it has a more restricted distribution. While common in Bengal, Assam, and parts of Burma, the other records from India are restricted to the west, i.e. Sind, Deesa (Gujarat), Bombay, and Malabar, in all of which places it is believed to breed.—EDS.]

7. RUFOUSBELLIED HAWK-EAGLE, *LOPHOTRIORCHIS KIENERII KIENERII* (E. GEOFFROY) IN NORTH KANARA

While I was on tour in North Kanara as the Wild Life Preservation Officer of the pre-1961 Bombay State, I had occasion to visit the Dandeli Game Sanctuary which was then being completed. The area of the Sanctuary is about 80 sq. miles and consists of moist deciduous forest containing valuable teak forest but mostly overgrown with bamboos and other trees. The area in some parts is hilly with deep ravines. A beautiful view of this type of country is seen at Sykes's Point and it was here that I saw a Rufousbellied Hawk-Eagle [*Lophotriorchis kienerii kienerii* (E. Geoffroy)] glide past me and then rise up at an acute angle disclosing the upper and lower parts of the body and wings. The first impression of the bird's coloration is much like that of the Indian Shahin, dark slaty upper parts to the lores and ear coverts but with a light patch on the lower side of the primaries, the lower wing appearing grey but the axillaries and under wing-coverts looking rufous; breast whitish with dark stripes and belly deep chestnut; the small crest was also seen. While gliding in air currents the bird was seen rising and falling with half closed wings sometimes at steep angles. I had a number of glimpses of the bird through binoculars on Monday, 19 December 1955. I also heard the grey junglefowl cackling when this Hawk-Eagle swooped low over the forest roof.

26, LOTUS COURT,
JAMSHEDJI TATA ROAD, R. S. DHARMAKUMARSINHJI
BOMBAY 1,
June 2, 1961.

[This race occurs in Ceylon and SW. India, the northernmost record so far being from Settihalli, 2500 ft., Shimoga, Mysore, where Dr. Sálim Ali saw a single bird between 25 Jan. and 2 Feb. 1940 (*J. Bombay nat. Hist. Soc.* **44** : 20).—EDS.]

8. PELICANRY AT KUNDAKULAM, TIRUNELVELI DISTRICT

In his article on the Grey, or Spotbilled Pelican (*Pelecanus philippensis* Gmelin) in the *Journal of the Bombay Natural History Society* (Vol. 57, page 246) E. P. Gee writes of a small pelicanry in the village of Kundakulam, Tirunelveli District, in the extreme

south of Madras State. He says that since the visit of C. G. Webb-Peploe in April 1944 (Vol. 45, page 426) there is no further news of this diminutive colony of pelicans.

On January 7th 1960 I visited Kundakulam. On that occasion, although about a hundred Painted Storks [*Ibis leucocephalus* (Pennant)] had arrived and were inspecting sites for nesting, I saw only one pelican. Women from the village told me subsequently that about a week after my visit further pelicans arrived.

On 22nd March of this year a friend visited Kundakulam and brought me back the following information.

Pelicans had built in about five trees but there were no young in the nests yet. There were two or possibly three nests in a tree along with nests of Painted Storks in which there were already young birds. There were also many nests of Night Heron and Little Egret.

Some of the trees on which the birds nest are quite low. They include *Azadirachta indica*, *Thespesia populnea*, and *Delonix elata*.

The headmen of the village still protect the birds and their women-folk spoke with scorn of a village of which they had heard where the people had so ill-treated their birds that 'not even a sparrow is to be found there now!' The women also said that a few years previously the birds came at their customary time but, finding no water in the tank, they circled round for several days and then left. They did not know where the birds nested that season but the following year they returned to Kundakulam in their usual numbers. As the Kundakulam tank is now fed by a channel from a newly constructed dam in the mountains to the west it is more likely to be filled in future even in years of poor rainfall.

In January 1960 I saw the nest of a pair of Black Ibis, *Pseudibis papillosa* (Tem.)[1]. The nest was high up in a palmyra palm on the edge of the village several hundred yards from the nearest tree on which the Painted Storks were nesting.

DOHNAVUR,
TIRUNELVELI DT.,
SOUTH INDIA,
March 4, 1961.

MARGARET E. WILKINSON

[1] This appears to be first definite record of the Black Ibis, *Pseudibis papillosa* (Tem.), breeding in south India.—EDS.

9. FOOD OF THE RUDDY SHELDUCK, *TADORNA FERRUGINEA* (PALLAS)

On pages 273-4 of Vol. 53 of our *Journal* there was some discussion regarding the statement that the Ruddy Shelduck [*Tadorna ferruginea* (Pallas)] feeds on carrion.

Though Meinertzhagen was quoted as having seen them lopping up bits of a putrid horse and as many as 20 birds gorging on a corpse in the Ganges, the stories of carrion-eating were generally accepted as erroneous. In an attempt to obtain a clarification we wrote to Col. Meinertzhagen and his reply reads in part: 'It is quite possible that the Ruddy Shelduck which I saw feeding on carrion in India were feeding on maggots, but I'm quite sure they were snatching meat, perhaps to expose maggots.'

It may therefore be interesting to record that P. S. Nazaroff in HUNTED THROUGH CENTRAL ASIA (1932) at page 246 says: 'I have found their nests even in fresh Kirghiz graves, and as they often feed on carrion, joining in with vultures and crows, it is better to cut them out of the list of edible game, especially as the meat is tough and stringy.'

Andrews in NEW CONQUEST OF CENTRAL ASIA (1932), p. 49, refers to experiences in Tuerin in Outer Mongolia. He says: 'No water within many miles but about 20 had taken up their residence among the granite rocks. All day long we could hear their mournful notes as they circled about camp and contended for a favourite roosting place on one of the highest peaks. Often we would see one silhouetted against the sky on the very summit of a ragged pinnacle, looking more like an eagle than a water bird. We found them throughout the desert. There, I suppose they feed as do cranes upon grasshoppers and other insects, but I am sorry to say that I surprised one pulling lustily at the decaying flesh of a defunct camel.'

BOMBAY NATURAL HISTORY SOCIETY,
91, WALKESHWAR ROAD, EDITORS
BOMBAY 6,
July 26, 1961.

10. A LATE DUCK RECORD ?

During our recent holiday in Naini Tal, my children and I noticed three different species of duck on the lake in May. A small flock of about 10 Tufted Pochard [*Aythya fuligula* (L.)] (both sexes) kept

strictly to themselves; but two Redcrested Pochard [*Netta rufina* (Pall.)] drakes were usually not far away from a flock of about 8 Common Pochard [*A. ferina* (L.)] (both sexes). All these birds appeared to be wild, and were certainly under no sort of restraint or protection. They showed almost no fear of mankind, and would allow a fairly close approach by boat. They were invariably to be seen along the Mall shore of the lake; this, though of course much noisier and more populous than the opposite shore, probably affords a richer food supply, thanks to all the drainage ditches that empty from it into the lake.

All these duck were to be seen daily, right up to 16 May, on which date we reluctantly left this delightful hill station. I am sending this note, in case this constitutes a 'late record' for the lingering of duck in Indian waters.

MAIDSTONE,
PANCHGANI, T. GAY
SATARA,
June 14, 1961.

[As a general rule these duck commence nesting in late April or early May. None of them breed in India and the dates reported by Mr. Gay are of interest.—EDS.]

11. NOTES ON BIRD MIGRATION DURING A VOYAGE FROM ENGLAND TO INDIA IN SEPTEMBER 1960

Last year we returned to India on board S. S. *Carthage*, leaving Southampton on 16 September and arriving in Bombay on 4 October. Bird migration in the eastern Mediterranean, the Red Sea, and the Indian Ocean was in full swing; perhaps the following notes might be of interest to other travellers.

We left Southampton in a dense fog and continuous rain. I have seldom been so contented to leave my native land. The white cliffs were totally invisible and we soon ran into a heavy gale which continued until 19 September when we emerged into the Spanish sunshine. The usual gulls and shearwaters were seen. Quite a number of Great Skuas (how this species is increasing its numbers!) and a few Arctic Skuas harrying flocks of Sandwich Terns, but no small migrants rather to my surprise. In fact we saw none, except a single Turtle Dove near Gibraltar, and a swallow off the Algerian

coast, until the 22 September when we passed Malta in heavy rain. Swallows then began to appear in small numbers, and these increased rapidly, together with wheatears etc. as we approached Port Said, which we reached at midnight on 24 September. We left at dawn for the Suez Canal. I was not on deck as early as I might have been and bitterly regretted my laziness on hearing that I had missed several hundred flamingos! The country on both sides of the Canal was alive with birds. Thousands of waders swarmed along the little irrigation canals. Greenshank, Redshank, and Ringed Plovers could be identified, but the great majority could not. Shrikes, Doves, Kestrels were numerous. Then I saw what looked like a black falcon on the ground. At first I could not believe my eyes until I saw another and then another and realised I was looking at the Redfooted Falcon. The brilliant red legs and red eye patches could be clearly seen. On consulting Peter's invaluable FIELD GUIDE I read that they often hunt insects on the ground. During the next two hours others were seen, females as well as males.

Another excitement was a flock of Lesser Kestrels. The late Sir Norman Kinnear had asked me to look out for these birds in Nepal, and I sometimes wondered if I could have overlooked them and confused them with the common Kestrel. Now that at last I did see them it was clear that no mistake was possible. These birds are much brighter, smaller, and in flocks. They called and chattered and behaved in quite a different manner from the Kestrel. I am now quite certain that I have never seen these birds in Nepal, nor anywhere else in India.

Caspian Terns were also common in the Canal, and many other terns, some with black wings.

In fact it was utterly frustrating to be swept inexorably through this paradise of bird life, on into the desert country further south where little life was seen.

In the Red Sea there was also much migration and even in the Indian Ocean where I had expected to see little except the Phalaropes, which were there in their thousands. We also saw herons, swallows, Short-toed Larks, and doves. We wondered how many of these luckless birds would survive. I had never realised before what terrible wastage must occur during the migrations.

A detailed list of species seen is given below:

Ardea cinerea Grey Heron.

A single heron was seen south of Crete, on 23 September, flying in a south-easterly direction.

On 29 September a pair of these birds appeared—we were then about 5 hours out of Aden harbour. They flew very close to the ship and made several unsuccessful attempts to land on the mast and upper decks. They appeared tired and one bird had several primaries missing. They continued with us for about an hour, frequently flying off to the north and then returning to the ship. It was almost dark when they finally left us and flew off in a NNE. direction. The captain said that land would be about 50 miles away in that direction. They were flying strongly so I hope they made it, but what could they have been doing there at all. I did not know that herons were migratory, except locally.

Still stranger was the report of another passenger (who was a very reliable observer) that he had seen two herons in the middle of the Indian Ocean. We were then rather nearer Bombay than Aden. He said they were flying due south and took no notice of the ship. I suppose these last might have been Reef Herons, but even so it was surely extraordinary for them to be so far from land.

Oceanites oceanicus Wilson's Petrel.

A few of these birds were seen north of Sokotra on 30 September. Singles and not more than a dozen altogether. None were seen as we approached Bombay.

Eagles, Buzzards spp. ?

From Suez to Aden (26-29 September) there was a continual migration of large brown raptores. They were most numerous in the Gulf of Suez where one was seen on an average every 5 minutes, and less so as we went south. In the south Red Sea perhaps only one would be noticed in 3 or 4 hours, but I saw an occasional bird up to 10 hours of reaching Aden. They flew singly. Sometimes 2 or 3 birds could be seen at the same time, but they never flew together. Some flew 20 feet or so above the water, but the great majority just above the waves. They flew steadily in a SW. or W. direction. The wind was strong from the N. or NE., so they flew either across the wind or downwind. Sometimes an extra strong gust seemed to bother them somewhat and they would turn into the wind, banking for a moment and then resume their original direction. They took no notice of the ship and were never diverted from their steady flight. Unfortunately I was unable to identify them. They appeared a uniform brown, some lighter than others. There were no bars in the wing, no white on the upper tail-coverts. The underwings could not be seen. It is very difficult to judge the size of birds at

sea, as in the waste of water there is nothing to compare them with and it is hard to tell how far away they are from the observer. I am inclined to think they were eagles, some race of *A. rapax* perhaps.

Once in the middle of the Red Sea, north of the Apostles Islands, I saw two buzzards, flying together and wheeling in great circles one above the other. They had the moth-like pattern of a buzzard on their underwings and seemed smaller than the others.

Accipiter nisus Sparrow-Hawk.

A very large sparrow-hawk came on board the evening before we reached Aden, 28 September. It sat on the mast but frequently flew off behind the ship, where it circled, sometimes disappearing behind the low rain clouds, but it always returned flying rapidly after the ship, and after alighting for a minute on the rigging in the stern would fly up to the cross-trees on the main mast, and was still there when darkness fell. It was so large that I might have thought it a Goshawk, if the long yellow brittle-looking legs had not been so clearly those of an *Accipiter*.

Next day as we left Aden in the afternoon another but much smaller Sparrow-Hawk followed the ship, alighting in exactly the same place. It also was still there at dusk but gone in the morning.

Circus aeruginosus Marsh Harrier.

A single male was seen in the north Red Sea, just north of the islands, The Brothers. It was flying west.

Falco vespertinus Redfooted Falcon.

In the Suez Canal about 3 hours after leaving Port Said, on 25 September, I saw 5 males of this species together in a fallow field. They were on the ground. Later 2 females on telegraph wires, then another single female. Later another group of 3 males on the ground with a single female.

Falco naumanni Lesser Kestrel

A flock of 15 of these birds was seen in the Canal. They were restless flying about and then returning to a stunted tree on which they congregated. They were very noisy, screaming and chattering and behaving very differently from the Common Kestrel. They were also much brighter. Later I thought I saw another flock but a good distance away and I could not be sure.

Falco tinnunculus Kestrel

Very common all along the Canal, but I could not of course tell what proportion were on migration. I never saw one of these birds at sea.

Tringa totanus, T. nebularia, Calidris alpina

Greenshank and Redshank formed part of the huge flocks of waders near Port Said. There were also I think large numbers of Dunlin, and certainly Ringed Plover, but I could not tell which species.

Phalaropus lobatus, P. fulicarius

Vast concentrations of phalarope were seen north of Sokotra on 30 September. Visibility was poor and no land could be seen, but from the chart I thought we were due north of the island. We began to run into little groups of these birds at about 11 o'clock. By midday there were thousands of them. Some of the flocks must have contained 200 to 300 birds, but mostly they were in groups of 20 to 70 or so. They were often sitting on the water, riding very high and looking incredibly fragile for ocean birds, but unfortunately the ship always frightened them into flight before one could examine them closely.

Twice single birds came on deck; these had black legs and very fine black bills so were presumably *P. lobatus*, the Rednecked Phalarope. On the water I could not tell to which species they belonged. For three hours we sailed through great numbers of the birds. Then the numbers grew rapidly less and by evening only small groups of 5 or so were occasionally seen. Next day we passed some single birds and a few small groups and these were all flying west so perhaps on their way to joining the large flocks north of Sokotra.

Streptopelia turtur[1] Turtle Dove

Doves formed a large proportion of the migrants seen. One was seen near Gibraltar, and small numbers in the eastern Mediterranean. In the Red Sea they were seen all the time, though there were seldom more than 5 or 6 round the ship at one time. These last appeared very pale, but perhaps this due only to the brilliant light which makes everything appear to be drained of colour. None were seen after leaving Aden until 24 hours out of Bombay when doves again appeared but sat on the rigging too high for identification. Migrating Turtle Doves are much attracted by a ship, and sometimes seem unable to decide to leave it even when land is plainly visible. I have often seen dead birds floating past the ship, although others will rest for a moment and continue on their way.

[1] This species does not occur in India.—Eds.

Merops apiaster European Bee-eater

This lovely bird came on board on 27 September, south of the Gulf of Suez. It sat on the rigging and was very tame, allowing passengers to come within a few feet of it. It remained on board till dusk fell but was gone in the morning.

Upupa epops Hoopoe

The Hoopoe was only seen once flying alongside the ship near Port Said on 24 September.

Hirundo rustica Swallow

No swallows were seen in the Atlantic, and only one in the western Mediterranean off the Algerian coast. On 22 September as we approached Malta swallows were seen in small numbers, and often sat on the rigging to preen themselves. There were many young birds with short tails. On leaving Malta a small party (5 birds), which had been with us all day, took off in a NE. direction. Between Malta and Port Said swallows were abundant and there were always numbers round the ship. Several birds sat on the rigging with closed eyes and one collapsed and died. It appeared in perfect condition.

All down the Red Sea swallows were seen, but not in great numbers usually 2 or 3 together. They became fewer as we went south, and none were seen in Aden.

Two days out from Bombay 3 birds came on board and remained with us for a few hours before taking off in a due south direction. I wondered if these had any chance of reaching land. 12 hours from Bombay a single bird alighted on the rigging for a minute and then flew on. It was definitely *rustica* not the eastern race. Near Bombay I saw others but they did not come very close.

Hirundo daurica Redrumped Swallow

Several seen on 23 September south of Crete. A few were also seen in the Canal and north Red Sea.

Delichon urbica House Martin

Two martins were seen south of Crete. They flew round the ship and dipped low over the water exactly as if they had been sipping it, though I could not see if they actually touched the water and it seems unlikely. Martins were also seen occasionally in the Red Sea. 2 just as we passed the island the Apostles. None after that.

Riparia riparia Sand Martin

One seen with swallows near the Apostles Islands in the Red Sea.

Oenanthe oenanthe Wheatear

None seen in the western Mediterranean, but frequently in the eastern Mediterranean after Malta. One spent the night in the bar. None in the Canal nor after that.

Calandrella brachydactyla

Short-toed Larks were seen 24 hours out of Bombay. We first saw them sitting high on the cross-trees of the mast, 3 together. During the day more were seen. They came down on to the decks and drank water put down for them by passengers. They were very tame. I never saw any leave the ship and when we sailed into Bombay on 4 October, there were still numbers on board. I could not tell to which race they belonged. The short hind claw was clearly visible. It is interesting to see what considerable migration takes place out at sea when one would think it much easier for birds to follow the coast line.

BRITISH EMBASSY,
KATHMANDU, DESIRÉE PROUD
NEPAL,
March 21, 1961.

12. THE EGGS AND FLIGHT OF THE GECKO *PTYCHOZOON KUHLI* STEJNEGER FROM CAR NICOBAR

(*With one text-figure*)

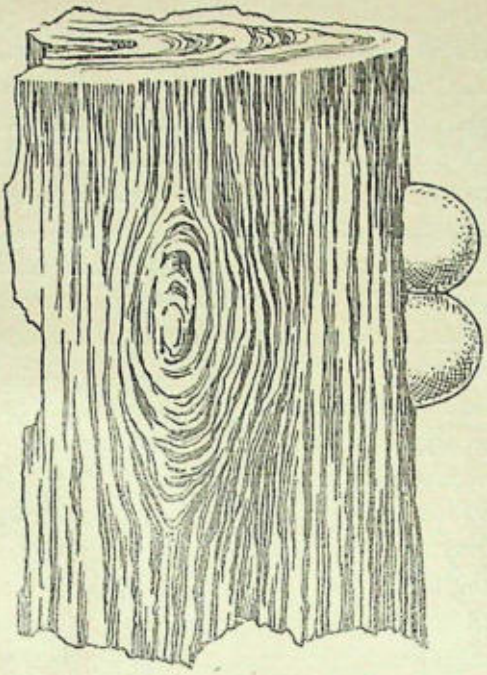
The eggs of *Ptychozoon kuhli* Stejneger are unusual in two features: they are hemispherical in shape with a flat, circular 'base', and they are often laid (at least under natural conditions) on surfaces vertical to, and above, the ground. I have seen a few pairs of such eggs laid on bark of trees about 1½ to 2 ft. (45 to 60 cm.) above ground in Car Nicobar Island. These eggs, which are easily mistaken for mushrooms and thus overlooked, are firmly attached to the bark by a thick layer of a coarse cementing substance which often overflows the boundaries of the 'base' of egg. In a pair of eggs collected by me from the bark of a tree at Passa Bridge in Car Nicobar on 23 March 1959, the diameter of base measured 15 mm., while the maximum height was 11 mm. The shell was dirty white in colour, and when broken open, one of the eggs yielded an almost full-grown embryo of *Ptychozoon*.

Tweedie (1954) has given an excellent photograph of a pair of eggs of *Ptychozoon kuhli* collected from the bark of a tree in Malaya. Those observed by me in Car Nicobar (see Text-fig.) were similar to Tweedie's photograph.

Cantor (1847), who was the first to record the eggs of *Ptychozoon*, refers to a female that deposited a *single egg of a spherical form*, about half an inch in diameter, soft and of a yellowish white colour. Bauer (1885), reporting later, mentioned a captive female of this species from Java that laid a pair of eggs in the box in which she was kept. He says nothing about the shape of the eggs but records the long incubation period of the eggs which, laid in November, did not hatch out until the middle of the following May. Annandale (1904) refers to the eggs of *P. homalocephalum*, which are laid two at a time and which 'adhere to leaves and tree trunks'. Barbour (1912) also remarks: 'The two small white eggs of *Ptychozoon* are always found stuck together in pairs, usually against the wood under the bark of trees'.

The period of incubation of the eggs of *Ptychozoon* appears to be variable. According to Bauer (1885) it should be about six months, but Tweedie (1954) gives the actual time between laying and hatching of two eggs by a captive female kept by Mr. H. J. Kitchener as 73 days. The pair photographed by Tweedie hatched out 67 and 68 days after being found, and according to Mr. C. S. Ogilvie, who actually got these eggs, they were fresh at the time of collection. It appears that the egg-laying period in this species is November-December and the period of incubation may vary from about ten weeks to more than five months. Annandale (1904) thinks that the hard shell of the egg is impermeable to fluids. Its habit of attaching the eggs to the bark of trees, leaves, etc., and the long incubation period may account for the presence of this species of gecko in the Andaman and Nicobar group of islands. This is possible because logs of wood, bamboos, etc. from the Burmese and Malayan coasts quite often find their way to the Andaman and Nicobar Islands drifting along with the current.

Ptychozoon is a genus of gecko which, among other features, is characterised by the possession of widely-webbed digits and lateral cutaneous expansions of head, body, and tail (the last is frilled). The function of these expansions was subject to much speculation till recently. Cantor (1847) thought that these membranous expansions act like a 'parachute', helping the animal in



Text-fig. Eggs of *Ptychozoon kuhli* Stejneger

'flying' from one branch to another. Boulenger (1908) confirmed Cantor's views by recording a specimen 'caught by a native in the act of flight'. Annandale (1905), however, disputed the flight theory. He opined that these membranes, which lie curled round the body, help to conceal the animal in its surroundings. Barbour (1912) agreed with Annandale and said: 'As for flying with such weak supports this struck us at once as both being impossible and ridiculous. Individuals were teased into jumping from a table, were dropped from several feet up in the air, and were in every way induced to try to use what has so often been called their parachute. They never did this once.' Smith (1935) rejected Annandale's contention and believed in Cantor's view, suggesting that the extensions are raised by wind resistance, thereby acting as sort of 'parachutes' and thus aiding the lizard in gliding.

Recently Tweedie (1950, 1954) performed certain experiments on *Ptychozoon kuhli* to test the flight theory. He reports that these cutaneous flaps lie curled round the body when the animal is

at rest or crawling, and are only accidentally expanded. They do have a procryptic value, and help the animal in making it less conspicuous against the background when expanded, but they are not an adaptation to that end. On the other hand, when launched into the air from a height the animal, after a drop varying from 2½ to 5 ft. (.75 to 1.50 m.), invariably glides, always in the direction of the wind, making an angle of 52°-53° from the vertical. While gliding the lateral cutaneous expansions are widely spread, the limbs and tails are stiffly outstretched, landing on the ground like a true Flying Lizard (*Draco*). On the basis of his experiments Tweedie (1950) concludes that the dorsal pattern of coloration, in lighter and darker shades of brown, 'is very effective as an aid to self effacement on a background of bark', and the frilled tail and webbed feet enhance the procryptic effect. The lateral expansions on the head and body are adaptations for gliding alone, and in this again they are helped by the widely webbed digits and frilled tail, all of which, by offering resistance to wind, aid in the process.

As far as the procryptic nature of the dorsal pattern, the webbed feet, and frilled tail are concerned, my observations are entirely in conformity with those of Tweedie. Against a background of bark, the animal almost totally disappears and is very difficult to make out. However, I did not see any gliding by this gecko, which does not seem to be uncommon in the Car Nicobar, during my fortnight's stay there. Though Barbour (1912), failing to induce his individuals to glide, rejected the flight theory 'as both being impossible and ridiculous', Tweedie's experiments conclusively prove the gliding capacity of *Ptychozoon kuhli*. In his first experiment Tweedie launched the animal from a height of 20 ft. (6.10 m.), from the ground, while in his subsequent efforts a height of 34 ft. 6 in. (10.50 m.) was used. The descent had two components, an initial drop of 2½ ft. (.75 m.) and 5 ft. (1.50 m.), followed by gliding at an angle of 52°-53° to vertical in the direction of the wind. It is apparent that Barbour failed because he did not launch his specimens from a sufficient height, thus giving no time for the membranous expansions to be raised by wind resistance. As these membranes do not have any muscular supports, they cannot expand and shut voluntarily, and are passive like parachutes. In falling from greater heights, the wind resistance encountered is strong enough to open the membranes, thus enabling the individual to glide obviously along the direction of wind. It would thus appear that an important

factor in the gliding of *Ptychozoon* is the height from which the animal launches itself into the air.

ZOOLOGICAL SURVEY OF INDIA,
CALCUTTA-12. K. K. TIWARI

June 12, 1961.

REFERENCES

Annandale, N. (1904): Contributions to Oriental Herpetology I.—The Lizards of the Andamans, with the description of a new Gecko and a note on the Reproduced Tail in *Ptychozoon homalocephalum*. *J. Asiat. Soc. Beng.* 73, Pt. 2 Suppl.: 12-22.

——— (1905): Notes on some Oriental Geckoes in the Indian Museum, Calcutta, with Description of New Forms. *Ann. Mag. nat. Hist.* (7) 15: 26-32.

Barbour, T. (1912): A contribution to the Zoogeography of the East Indian Islands. *Mem. Harv. Mus. comp. Zool.* 44: 1-203, pl. i-viii.

Bauer, F. H. (1885): in Secretary's Report. *Proc. zool. Soc. Lond.*: 718.

Boulenger, G. A. (1908): Fishes, Batrachians, and Reptiles. *J. Fed. Malay St. Mus.* 3: 64.

Cantor, T. (1847): Catalogue of Reptiles inhabiting the Malayan Peninsula and Islands, collected or observed by Theodore Cantor, Esqr., M. D. *J. Asiat. Soc. Beng.* 16: 607-656.

Smith, M. A. (1935): Fauna Brit. India., Rept. and Amph. Vol. 2 Sauria, pp. ix + 422, 1 pl.

Tweedie, M. W. F. (1950): The flying Gecko, *Ptychozoon kuhli* Stejn. *Proc. zool. Soc. Lond.* 120: 13, pl. i.

——— (1954): Notes on Malayan Reptiles. No. 3. *Bull. Raffles Mus.* 25 107-117, pl. i.

13. THE COMMON CALOTES OR BLOODSUCKER LIZARD [*CALOTES VERSICOLOR* (DAUDIN)] AS A PREDATOR OF BIRDS

During the recent (March 1961) Bombay Natural History Society/ World Health Organization Bird Migration work at Wanoti (Bhuj, Kutch) I twice had occasion to rescue from a Common Calotes or Bloodsucker Lizard [*Calotes versicolor* (Daudin)] birds caught in one of our nets stretched out near a pond. In the first instance it was a Bluethroat (*Erithacus svecicus*). Little damage was done as I was present when the lizard ran along the ground and seized the bird which was caught low down in the net.

A few days later I heard cries of distress from the same net and saw that a *Calotes* had caught a Baya (*Ploceus philippinus*) in similar conditions. The bird was bitten on the forehead and the wing but flew away when released. The lizard, probably the same individual, was secured and found to be a male measuring 16 inches (405 mm.).

There do not appear to be many specific records of this lizard catching birds though I understand that it is commonly known to take eggs and nestlings of the smaller species.

BOMBAY NATURAL HISTORY SOCIETY,
91, WALKESHWAR ROAD,
BOMBAY 6,
April 27, 1961.

M. J. PEREIRA

14. OCCURRENCE OF THE PHOORSA, *ECHIS CARINATA* (SCHNEIDER) ALONG THE MALABAR COAST SOUTH OF KARWAR

According to Smith [(1943) FAUNA OF BRITISH INDIA, REPTILIA AND AMPHIBIA 3, SERPENTES] the Phoorsa, *Echis carinata* (Schneider) (Malayalam : Churutta) is a common snake, inhabiting the whole of India south of the Ganges but absent from Bengal and the coast strip west of the Western Ghats, south of Karwar. It is well known as a desert-loving snake. The Bengal and Malabar coasts get an abundant supply of rain, which would naturally act as a barrier to the entry of *E. carinata* into these areas. However, the snake is not altogether absent along the Malabar Coast, being fairly common in arid hilly regions especially from November to March, and rare or even absent in the plains. One specimen was collected at Devagiri (300 ft.=90 m. above sea-level), Calicut, Malabar. Its lepidosis is:

Costals at three head-lengths behind the neck ...	23
Costals at midbody	25
Costals at three head-lengths in front of the vent	23
Ventral shields	139
Subcaudals (single)	28
Anal	1

DEPARTMENT OF ZOOLOGY,
ST. JOSEPH'S COLLEGE,
DEVAGIRI, KOVUR, CALICUT,
March 23, 1961.

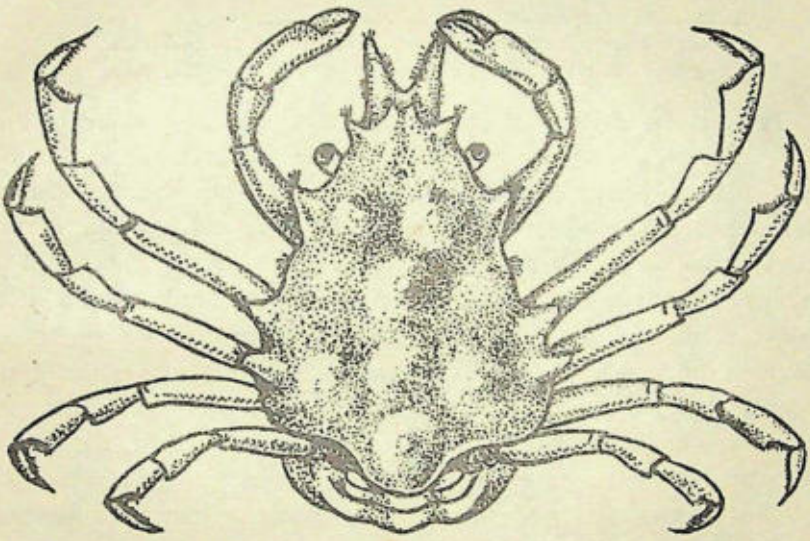
K. G. ADIYODI

[Enquiry at the State Museum and the Zoo at Trivandrum and Trichur, and the Government Museum, Madras, reveals that they have no specimens from this area.—EDS.]

15. EXTENSION OF RANGE OF THE CRAB, *ACANTHONYX LIMBATUS* MILNE-EDWARDS, TO INDIAN WATERS[1]

(*With one text-figure*)

In a collection of crabs made at Okha port (Gujarat State; 22° 28′ N., 69° 05′ E.), the author came across a single female specimen of an Oxyrhynch crab. This was identified as *Acanthonyx limbatus* Milne-Edwards. The characters of this crab are given below.



Acanthonyx limbatus Milne-Edwards

Female, dorsal view

The carapace is sub-triangular, its greatest breadth being ¾ the length excluding the rostrum. The rostral horns are one-fifth the carapace length, and bear hooked setae apically and along the inner margins. In addition to the supra-ocular tooth, there are three well-developed lateral teeth on each side of the carapace, decreasing in size backward.

[1] Communicated by the Director of Fisheries, Maharashtra.

There are seven tubercles on the dorsal surface of the carapace arranged in the following manner: three tubercles forming an inverted triangle on the gastric region, one cardiac, one intestinal, and one each on the mesobranchial regions. Hooked setae occur in front of the anterior pair of tubercles on the gastric region, on the tips of all the teeth and the rostral horns, and on swellings on the lateral margins between the first and second pairs of lateral teeth.

The abdomen has five segments, segments 4-6 being fused.

Length of carapace (excluding rostrum)	.. 12.12 mm.
Breadth of carapace (at the level of, and inclusive of, the lateral teeth)	.. .. 9.75 mm.
Length of rostral horns	.. .. 2.11 mm.

There is a difference of opinion about the generic position of this crab. The type-specimen was placed in the genus *Dehaanius* on the basis of the presence of seven segments in the male abdomen. However, the specimens collected in Iran have been placed in the genus *Acanthonyx*, the abdomen of these being six-jointed. The validity of the genus *Dehaanius* has been challenged, as the most important difference between the two is the number of segments in the male abdomen, and this character is not constant in the same species, and so also the degree of coalescence of the abdominal segments. In the absence of a male specimen from Okha, the author has placed it in the genus *Acanthonyx*.

This species has been previously recorded from the Reunion Islands (longitude 55° E.) by A. Milne-Edwards[1], and at Bustani and Quais (longitude 54° E.) in the Persian Gulf by Stephenson[2]. Its occurrence at Okha port (longitude 69° E.), therefore, constitutes the first record of this species from India, as well as a considerable extension of its range of distribution eastward. The specimen will be deposited in the collections of the Zoological Survey of India.

The author is thankful to Dr. (Mrs.) D. Guinot-Dumortier of the National Museum of Natural History, Paris, France, for sending photostat copies of literature not available in India, to Mr. K. N. Sankolli for donating the specimen, and to Dr. C. V. Kulkarni, Director

---

[1] Milne-Edwards, A. (1862) : Faune Carcinologique de l'Ile de la Réunion—in : L. Maillard : Notes sur l'Ile de la Réunion (Bourbon), Paris, second partie, Annexes, F, p. 7, pl. 17, figs. 4, 4a, 4b.

[2] Stephenson, K. (1945) : The Brachyura of the Iranian Gulf—in : Danish scientific Investigations in Iran, Part IV, p. 102, fig. 19.

of Fisheries, Maharashtra State, and Dr. H. G. Kewalramani, Research Officer, for going carefully through this paper.

TARAPOREVALA MARINE BIOLOGICAL STATION,
BOMBAY, B. F. CHHAPGAR, M.SC.
April 28, 1961.

16. 'AN UNUSUAL METHOD OF CURING SCORPION STINGS'

I was interested in Mr. Humayun Abdulali's letter of August 1st, 1960 (Vol. 57, No. 3) on the subject of curing scorpion stings.

I remember, when I was in the Army and my Division was, in 1942, in a training area in the Deccan, meeting an Irish doctor in charge of a Field Hospital who told me he had to cope with something like a hundred scorpion stings a day. He said he had been most impressed by a method he had learned locally of how to cure them. He stated that, provided the sting was on some part of the body where you could work the poison out to an extremity, such as a foot or a hand, a full cure could be achieved in relatively few minutes. All that you had to do was to bring together, on to the place where the patient had been stung, the points of—well, he said more or less anything, a pair of sharpened pencils, a couple of scissors or even two rusty nails!—and then slowly start stroking the flesh, firmly but not to the point of breaking the skin, in a downward direction towards an extremity. He said it was amazing how you could literally push the poison along quite quickly, the end of the exercise being achieved when you had brought it down to the ball of, say, a finger-tip, at which stage you could, merely by pricking the skin and exerting pressure with your thumb-nails, eject the blob of poison out of the finger with a sharp pinch.

I never had the opportunity of witnessing the curing of a patient by these means (though I was invited to do so) but that was his story.

TRIBENI TISSUES PRIVATE LTD.,
24B, PARK STREET, P. H. SYKES
CALCUTTA 16,
July 26, 1961.

17. 'NOTES ON THE BUTTERFLY GENUS *YPTHIMA*'

In our 'Notes on the Butterfly Genus *Ypthima*' in *J. Bombay nat. Hist. Soc.* (1959) **56** (1): 66-71 we said that *Y. newara* Moore should be a species separate from *Y. nareda* Kollar and not merely a subspecies, because the clasps were so different. Norman on a visit to Japan has met Professor Takashi Shirozu of Kyushu University who has informed him that he published the same opinion in 1955 (T. Shirozu in FAUNA AND FLORA OF NEPAL HIMALAYA vol. 1, ed. H. Kihara, Kyoto). If we had known of this fact we would have been glad to quote so eminent an authority.

5, UPPER WIMPOLE STREET,
LONDON, W. 1,
June 13, 1961.

K. CANTLIE
T. NORMAN

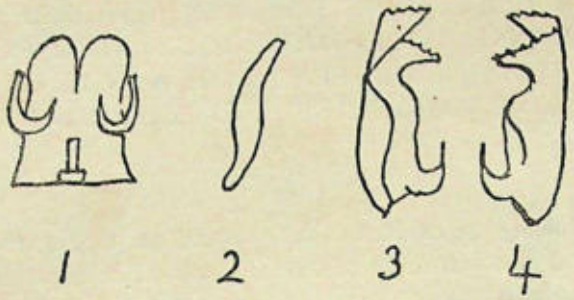
18. HESPERIIDAE. *HALPE SCISSA* SP. NOV.

(With four text-figures)

Found among the huge collection of Tytler in papers in the British Museum (Natural History). Taken in East Dawnas, Burma, in February 1926. The genitalia were examined by me in order to identify the specimen. They were found to be unlike any figured by Evans in plates 33 and 34 of his CATALOGUE OF THE HESPERIIDAE OF EUROPE, ASIA AND AUSTRALIA, 1949. They are drawn below.

Description of facies. Upper fore: the spots in 2 and 3 (in this case pale yellow) and the two tiny apical spots are all characteristic of the genus. No cell spot. Male stigma present. Upperhind unmarked, disc covered with tawny hairs. Underhind unmarked. F. 16 mm. Termen equal to dorsum. Cilia grey. Antennal club above not whitish or yellowish ringed before apiculus.

Genitalia. Fig. 1 shows the uncus with a narrow deep cleft like *luteisquama*. Fig. 2 shows the aedeagus. It is bent towards the clasps, not towards the uncus. Fig. 3 is the inside of the left clasp and Fig. 4 the outside. Footstalk unusually long, more slender than in any other species, terminating in a long narrow point. It is not serrated. The upper crest of the cuiller is serrated on its crest, which is wider than any other flat-topped species and of a different shape. The



Text-figs. 1-4. *Halpe scissa* sp. nov.
1. uncus; 2. aedeagus; 3. inside of left clasp; 4. outside of left clasp.

clasp is best understood by looking at Fig. 4. The serrations are continuous from the lower branch to the upper branch, lying across the figure of the clasp. Fig. 3 shows the upper branch folded over so as to conceal the serrations from the lower to the upper branch as they lie behind it. Evans does not fill in details. Folds exist for example in *homolea atacma* and in *arcuata*. Their serrations are actually like those in fig. 4 when viewed from the outside. The figure in Evans of *arcuata* is incorrect. If he had shown the narrow fold of the upper branch, diagonally across the clasp, it would have concealed some of the serrations. As the fold is narrow in *arcuata*, if the clasp is not viewed quite flat but at a slight angle, all of the serration is just visible from the inside as so has been drawn on Evans's figure. But this is incorrect. On the other hand, to take some examples: the figures of *kumara*, *knyvetti*, and *wantona* showing the complete serrations are correct because the upper branch is not folded over. The interior markings showing the edges of folds or edges of double layers of the cuiller are very hard to figure as one is uncertain whether they should be shown on the outer or inner aspect of the clasp.

I give the name *scissa* to the butterfly because of the deeply cleft uncus. There are variations in depth of cleft in individuals of other species. I have an *arcuata* with a cleft almost as deep.

5, Upper Wimpole Street,
London, W. 1.
July 15, 1961.

KEITH CANTLIE

19. MORPHOLOGICAL DIFFERENTIATION OF THE LARVAL INSTARS OF *SIMULIUM ORNATUM* MEIGEN (NEMATOCERA, DIPTERA), WITH A NOTE ON ITS METAMORPHOSIS AND ECOLOGY

(With a plate)

The following observations were made on thousands of living specimens in the streams of Priddy and Limpleystoke, Bristol, England, and also on larvae kept alive in large aquaria in the zoology laboratory of the University of Bristol at 14°-16° C., and artificially aerating the water.

It is a very old idea to presume that larvae are precocious embryos. According to Lubbock (1874), the occurrence of metamorphosis arises from the immaturity of the condition in which some animals quit the egg. This may be true in the case of the primary larvae of some parasitic Hymenoptera, which have unsegmented abdomens and undeveloped respiratory and nervous systems on hatching. This is not true, however, of all insect larvae, particularly of the *Simulium* larva, because its morphological features and anatomical structures are very well developed, even at the time of emergence from the egg.

The larva of *Simulium ornatum* lives attached to stones or weeds in swift-flowing streams (5-7 ft. = 1.5-2.1 m. per second). Some of the outstanding features possessed by the larva to cope with its aquatic environment are: the specialized mouth brush for collecting food; the sticky salivary secretion, often used for suspension when it is detached; the thoracic proleg and the posterior sucker with hooks, enabling movement and fixation; and anal gills for respiration.

When the larva is detached from its point of attachment, it clings on to a silken thread (salivary secretion) and soon regains its original position. In this endeavour the thoracic proleg and the posterior sucker are of immense help. The posterior sucker is the main organ of attachment. The radiating rows of hooks, about seventy-five in number, strongly grip the sticky salivary secretion which fills up the spaces between the hooks, forming a complete rim all round. The term 'posterior sucker', adopted by many authors, suggests the idea that this organ functions like a true sucker. Helped by the muscles attached to the periphery of the sucker and the centre of the disc, this organ actually works like a sucker, especially at the initial stage of attachment, when the salivary secretion is not sticky enough for the firm fixation of the hooks.

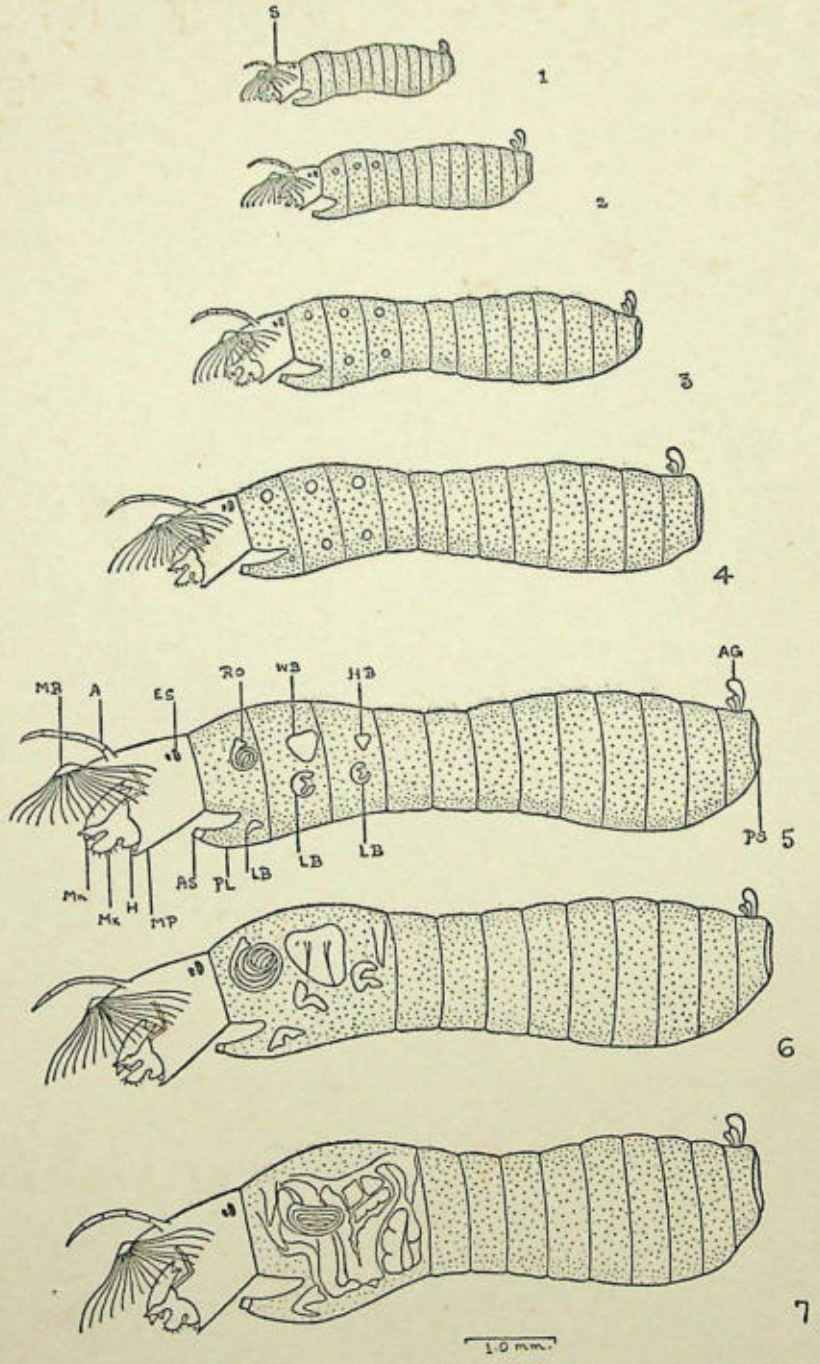


Fig. 1. 72-hour old first instar larva ; Fig 2. 120-hour old second instar larva ; Fig. 3. 96-hour old third instar larva ; Fig. 4. 72-hour old fourth instar larva ; Fig. 5. 120-hour old fifth instar larva ; Fig. 6. 72-hour old sixth instar larva ; Fig. 7. 108-hour old pharate pupa.

A. Antenna, AG. Anal gill, AS. Anterior sucker, ES. Eye spot, H. Hypopharynx, HB. Haltere bud, LB. Leg bud, MB. Mouth brush, MN. Mandible, MP. Mental plate, Mx. Maxilla, PL. Proleg, PS. Posterior sucker, RO. Respiratory organ, S. Spine, WB. Wing bud.

Usually three generations are produced every year, with longer intervals between the various stadia, during the winter.

According to Puri (1925) and Smart (1944) there are three thoracic and eight abdominal segments in *Simulium* larvae. But, actually there are three thoracic and nine abdominal segments, as suggested by Grunberg (1910) and Hermes (1923). This is clearly revealed by the arrangement of the muscles in the larva of *Simulium ornatum* (to be published elsewhere).

During the initial stages of an instar, when the old and new cuticles lie near to each other, the space between them is filled by the exuvial fluid. Later on, when the space between them increases, the moulting fluid is withdrawn and the space is partially filled with air. At this stage the outer cuticle lies around the body as a loose bag and many tonofibrillae connections between the two cuticles become gradually detached. The old cuticle usually stays on for several hours, even after all the tonofibrillae connections between the two cuticles have become completely detached. This often leads to underestimation of the age of the larva. Generally in calculating the duration of each instar, the time spent by the new instar within the cuticle of the previous instar is attributed to the old instar. But, actually the moult has occurred already, though ecdysis has not taken place. As pointed out by Hinton (1958), the detachment and the retraction of the epidermis from the cuticle indicates the real moult.

First instar larva (Fig. 1). The three thoracic and nine abdominal segments, with all the specialized organs are present in this instar. A spine, the egg burster, situated dorso-medianly on the head in between the eyes, is a characteristic organ of this larval instar. It helps the larva to come out of the egg. The imaginal buds are not morphologically evident. The length of the body is about 2 mm. and thickness about 0.5 mm. This instar lasts for five to seven days.

Second instar larva (Fig. 2). The body is cylindrical in shape. Three pairs of small spherical imaginal buds, one pair in each of the thoracic segments, situated dorso-laterally, become morphologically visible. The imaginal buds are not very distinct and conspicuous.

The imaginal bud in the first thoracic segment is destined to give rise to the respiratory filament, that in the second thoracic segment to the wing, and that in the third thoracic segment to the haltere. The body is about 3 mm. long and 0.8 mm. thick. This larval instar lasts from six to eight days.

Third instar larva (Fig. 3). During this stage the contour of the body becomes a little altered. The thorax becomes humped and the abdomen gradually assumes the clubbed shape. Abdominal segments one to three are comparatively smaller than the rest. In addition to the three thoracic imaginal buds of the previous instar, two imaginal buds become evident, situated ventro-laterally in the second and third thoracic segments. These two buds are destined to develop into legs. The length of the larva is about 5 mm. and the thickness is about 1 mm. This larval instar lasts for seven to nine days.

Fourth instar larva (Fig. 4). Another pair of buds appear on the ventro-lateral aspect of the prothorax, near the place where the proleg joins it. This is destined to develop into the prothoracic leg. This is the six-bud stage. No more buds appear, but these six buds gradually expand in size due to the multiplication of cells. The length of the body is about 7.5 mm. and the thickness is about 1.2 mm. This larval instar lasts for six to eight days.

Fifth instar larva (Fig. 5). The larva attains its maximum length at this stage. The humped thorax, club-shaped abdomen, and cylindrical body gives the larva its characteristic graceful contour. The respiratory bud becomes black in colour and shows the developing respiratory organ inside. The wing and the haltere buds have become roughly triangular in shape, with the base of the triangle towards the dorsal aspect of the body. The wing bud is larger than the haltere bud. The leg buds of the meso- and meta-thoracic segments show the developing legs inside. The prothoracic leg bud remains smaller than the other two leg buds. The length of the body is about 9 mm. and the thickness is about 1.5 mm. This larval instar lasts for six to eight days.

Sixth instar larva (Fig. 6). Due to rapid segmentation, all the buds become enlarged and show the characteristic shape of the organ into which they are destined to develop. The superficial lines of demarcation between the three thoracic segments disappear. But the three thoracic segments can be differentiated with the help of their developing imaginal organs. The length of the body is about 9 mm. and the thickness about 1.8 mm. This larval instar lasts for six to eight days.

Pharate pupa (Pre-pupa) (Fig. 7). This is actually the pupa within the larval cuticle. According to Hinton (1946), the term 'pharate' denotes the phase of an instar which is enclosed within the cuticle

of the previous instar. The thorax becomes much more humped and the abdomen highly club-shaped. The body becomes shorter and thicker. Dissections of this stage show that the mesothorax becomes much enlarged, providing more space for the accommodation of the rapidly differentiating indirect flight muscles. The imaginal buds have spread out in such a way that the three thoracic segments become indistinguishable externally. The respiratory organ remains conspicuous. Body of this instar is about 8 mm. long and 2 mm. thick. This instar lasts for four to six days.

The termination of the larval stage and the onset of the pupal phase necessitates the modification, replacement, or reconstruction of some larval organs and tissues. This is because the aquatic larva has organs to suit its immediate requirements and the transformation of most of the organs becomes inevitable, since the adult has to live in a different environment altogether. This requires a good deal of internal change consisting of tissue destruction or histolysis, and tissue rebuilding or histogenesis, along with external morphological changes.

In *Simulium ornatum* the cocoon is spun by the pharate pupa and not by the larva. The pharate pupa is active. At this stage the larval muscles and imaginal muscles exist side by side, because the larval muscles are necessary to spin the cocoon. After the cocoon is spun the larval muscles have no significant function to perform and hence they become histolysed. The pharate pupa becomes inactive after the larval cuticle is shed. Subsequently the body is reconstructed and remoulded resulting in the imago.

Large-scale biological observations on *Simulium ornatum* Meigen are not possible in India owing to the paucity of its occurrence. It is profusely present in many localities in the United Kingdom owing to the favourable cold climate.

DEPARTMENT OF ZOOLOGY,
SCOTT CHRISTIAN COLLEGE,
NAGERCOIL,
April 12, 1961.

V. J. I. GRANT

[*Simulium ornatum* is a Palaearctic species but allied forms occur in India, one of them, *S. indicum*, being a troublesome pest in parts of the Himalayas.—EDS.]

REFERENCES

Grunberg, K. (1910) : in Brauer, A. Die-Süsswasser Fauna Deutschlands : 2A. Diptera : Zweiflügler.

Hermes, W. B. (1923) : Medical and Veterinary Entomology. The Macmillan Company, New York.

Hinton, H. E. (1946) : Concealed phases in the metamorphosis of insects. *Nature*, London. 157 : 552.

— — — — (1958) : Concealed phases in the metamorphosis of insects. *Sci. Progr.* 46 : 260-275.

Lubbock, J. (1874) : Origin and metamorphosis of insects. Macmillan & Co., London.

Puri, I. M. (1925) : On the life history and structure of the early stages of Simuliidae. *Parasitology* 17 : 295-369.

Smart, J. (1944) : The British Simuliidae—with keys to the species in the adult, pupal and larval stages. Fresh. W. biol. Assn. Brit. Emp. Sci. Pub. 9.

20. A NEW SPECIES OF THE GENUS *CALLANTRA* WALKER FROM INDIA (DIPTERA: TRYPETIDAE)

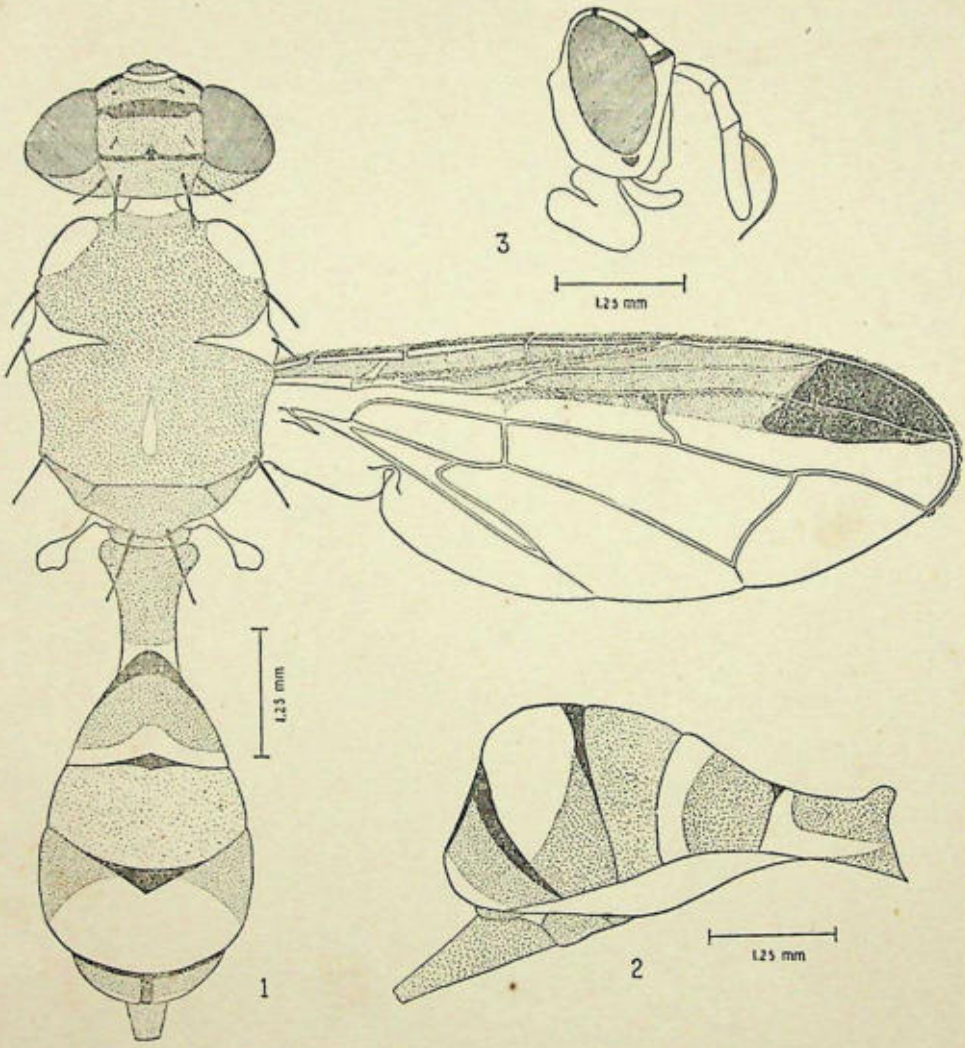
(With a plate)

The genus *Callantra* was first proposed by Walker in 1860 with a new species *Callantra smieroides* designated as the type. Genus *Mellesis* Bezzi with *Mellesis crabroniformis* as the genotype was transferred to *Callantra* by Hendel (1927). Malloch (1939) considered *Callantra* as a sub-genus of *Dacus* Fabricius; this is not accepted by recent taxonomists.

Callantra munroi sp. nov.

Female. General coloration of the body pale red; length of body (excluding the oviscape) 1.0 cm.; wing 6.89 mm. long, 2.55 mm. broad, 2.7 times as long as broad; entire body covered with very fine white hairs.

Head. 1.09 mm. long, 2.31 mm. wide, 1.69 mm. high; frons flattened, 0.37 mm. long, 1.04 mm. wide, 0.44 times as long as the maximum width of either eye; colour of the frons yellowish red, darker than the face; ocellar triangle black; face lighter in shade than frons, 0.86 mm. long; face with a black, transverse band along the epistomal margin, its ends slightly curving upwards; a black spot on each gena slightly below the eye; lunule light black; a black rectangular spot on either side of the top of the ptilinal fissure at the level of lunule; a complete transverse band in the middle of frons connecting the eyes; a black spot on either side of the ocellar triangle connecting the latter with the corresponding eye margin; each eye



Callantra munroi sp. nov.

Fig. 1. Adult female; 2. Abdomen, lateral view; 3. Head, lateral view

1.4 mm. high, 0.84 mm. wide; first antennal segment 0.42 mm. long, 0.13 mm. wide in the middle, 0.48 times as long as the face; second antennal segment 0.42 mm. long, 0.17 mm. wide in the middle; third antennal segment 0.9 mm. long, 0.19 mm. wide in the middle; first, second and third antennal segments 3.23, 2.47, and 4.7 times as long as wide, respectively; posterior surface of the head dirty yellow, gulomental region a little darker; lower orbital one, black; upper orbital one, black; inner verticals brownish yellow; outer verticals brownish yellow; ocellars black; postorbitals (occipital row) approximately six, all brownish yellow; genal one, black; a few small black hairs surrounding the inner verticals at base.

Thorax. Thorax yellowish red, covered over with tiny white hairs; the following regions are yellow: humeral calli (slightly tinged with red along postero-dorsal margin), sutural calli, a border along the anterior margin of the suture laterally expanding to merge with the yellow sutural callus on either side, a faint stripe in the middle of scutum behind the suture sharply tapering anteriorly and rounded posteriorly, the scutellum (basal margin narrowly tinged with red), a large spot on the lateral plate of postscutellum, posterior half of mesopleura, postero-dorsal region of sternopleura below the mesopleural yellow band, upper region of the hypopleura; all coxae concolorous with thorax; fore legs much shorter than others; fore femora entirely red, proximal ends of mid and hind femora pale white; fore femora with three stout black bristles beneath, and a longitudinal row of five pale bristles on the dorsal side; all tarsi, except the terminal ones, pale white; the terminal tarsi yellowish red; mid tibiae with a stout black terminal spur flanked on either side by a brownish yellow spine close to it, and two yellow smaller spines situated slightly away; notopleurals two, brownish yellow; posterior supra-alars (anterior pair) brownish yellow; scutellars one pair (apical pair), brownish yellow; mesopleural one, black and weak; pteropleural one, very thin and pale red, discernible with difficulty; scutellum 0.71 mm. long, 1.36 mm. wide, 0.52 times as long as wide; wings with first and second veins bristly; a broad costal band which is light brown in colour and includes the costal cells, stigma, marginal and sub-marginal cells, the anterior half of the first posterior cell, and the anterior margin of the first basal cell; the apical spot of the costal border fuscous and roughly triangular in shape (the base lying between the ends of second and third veins, and the apex extending into the first posterior cell); a small fuscous triangular spot along the upper portion of the anterior cross-vein; stigma smoky yellow; base of the

anal cell extension slightly narrowed; anal cell extension 0.83 times as long as the second basal cell; anterior cross-vein 2.2 times its length away from the posterior cross-vein; anterior cross-vein sinuate; first vein ending above the anterior cross-vein; halteres pale white.

Abdomen. Distinctly petiolate and clavate; yellowish red in colour and covered over with abundant white hairs which are comparatively longer on the sternites; except these white hairs there are no other bristles on the abdomen; length of abdomen (excluding the oviscape) 4.38 mm., width 2.07 mm.; first segment 1.09 mm. long, 0.94 mm. wide at base, 0.52 mm. wide at apex, 2.09 times as long as its width at the apex; abdomen highly arched up in lateral view; second, third, fourth, and fifth segments approximately 1.5, 2.8, 3.1, and 1.9 times as high as the first segment, respectively (all heights taken in the middle of the segments concerned); junction of third and fourth terga only moderately concave; oviscape in lateral view 1.5 mm. long, 0.82 mm. high at base, and 0.17 mm. high at apex, tubular in shape; first abdominal tergum yellowish red, pale white posteriorly; second tergum with a narrow black border along its anterior margin getting broadened in the middle, a pale white border along the posterior margin slightly arched anteriorly in the middle of the tergum, rest of the tergum yellowish red; third tergum uniformly yellowish red, darkest in shade, median part of its anterior margin tinged with black; fourth tergum with a black border along its anterior margin which gets broadened in the middle, a large pale spot (faintly tinged with red) occupies a great part of the tergum in the middle and extends up to the posterior margin restricting the yellowish red ground colour of the tergum to the lateral sides; fifth tergum strongly slopes down, with a black border along its anterior margin and a black mid-longitudinal stripe traversing the entire length of the tergum, the latter stripe unites with the former to form a T-shaped black pattern, posterior margin of the fifth tergum pale (faintly tinged with red); sixth tergum very small, completely concealed by the fifth; first sternite yellowish red, the subsequent sternites getting progressively darker in shade; the membrane intervening between the terga and sterna pale white

Male. Unknown.

Holotype: A single female in personal collection (ZR 2), taken at light, 7-9-1958. The holotype will be deposited in the Zoology Museum, Muslim University, Aligarh.

Host: Unknown.

Locality: University Campus, Aligarh, India.

Discussion

The present species differs from:

1. *Callantra polistiformis* (Senior-White) in having the central transverse band of the frons complete, the presence of the ocellars, one pair of upper orbitals, one pair of lower orbitals (two pairs in *C. polistiformis*), presence of anterior notopleurals, only one pair of posterior supra-alars (postalars), and the distinctly defined different abdominal markings.

2. *Callantra destillatoria* (Bezzi) in having the bristles brownish yellow instead of black, the absence of scapulars and the anterior supra-alars, and the different abdominal markings.

3. *Callantra eumenoides* (Bezzi) in having a complete central transverse band on the frons, the presence of one pair of lower orbitals, and the tubular oviscape which is uniformly coloured.

4. *Callantra crabroniformis* (Bezzi) in having the fore femora spined beneath, the yellowish red coloration of the body, and the different pattern of the abdominal markings. Moreover, the bristles are brownish yellow and not black as in *C. crabroniformis*.

5. *Callantra icariiformis* Enderlein in having a complete black border along the ventral margin of the face, the proximally pale hind femora. The yellowish red underside of the first abdominal segment, and the different pattern of the abdominal markings.

The species is named after Dr. H. K. Munro, Division of Entomology, Department of Agriculture, Pretoria, South Africa, a well-known authority on Trypetidae, in token of the high regard which the present writer has for him.

Acknowledgements

The present writer feels privileged to acknowledge his grateful thanks to Dr. S. M. Alam, in-charge Entomology Section, and Prof. M. A. Basir Khan, Head of the Zoology Department, for the provision of research facilities.

Department of Zoology,
Aligarh Muslim University, MD. ZAKA-UR-RAB
Aligarh, India,
July 14, 1961.

REFERENCES

Bezzi, M. (1914) : Two new species of fruit flies from South India. *Bull. Ent. Res.* 5 (2) : 153-154.

— — (1916) : On the fruit flies of the genus *Dacus* (s. l.) occurring in India, Burma and Ceylon. *Bull. Ent. Res.* 7 : 99-113.

Enderlein, G. (1920) : Zur Kenntnis tropischer Frucht-fliegen. *Zool. Jb. (Syst.)* 43 : 336-360.

Hendel, F. (1927) : *Fliegen Palaearkt. Reg.* 49 : 1-221 (Trypetidae).

Malloch, J. R. (1939) : The Diptera of the territory of New Guinea, XI. Family Trypetidae. *Proc. Linn. Soc. N.S.W.* 44 (3-4) : 409-465.

Senior-White, R. (1922) : Notes on Indian Diptera. *Mem. Dept. Agr. India, Ent. Ser.*, 7 : 156-164.

Walker, F. (1860) : Catalogue of the dipterous insects collected at Makassar in Celebs by Mr. A. R. Wallace, with description of new species. *Proc. Linn. Soc. Lond.* 4 : 153.

21. A COMMENT ON THE RECORD OF *KHAYA SENEGALENSIS* A. JUSS. FROM PONDICHERRY[1]

Dr. K. A. Shankarnarayan's claim (Shankarnarayan, 1959) that *Khaya senegalensis* A. Juss. is a new plant record from Pondicherry calls for comment.

It is reported by Dr. Shankarnarayan (1959) and Viart (1960) that the plant was introduced in the Empress Garden at Poona and in the Botanical Garden at Pondicherry. The seeds for Poona were obtained from Uganda in 1941; but the source of the seed for Pondicherry is not known.

Khaya senegalensis A. Juss. occurs naturally under two types of African climate—(i) the Sudano-Guinean climate, and (ii) the Sahalo-Sudanese climate, and so far I am aware, the plant has not been reported to be growing wild anywhere in India.

A plant is said to be a new record for a country when it is indigenous to that country, but has not been reported earlier; alternatively, as Rev. Fr. H. Santapau has pointed out in a personal communication, a plant is a new record for a country when it was brought into that country as a garden plant but escaped from the garden and established itself freely in waste lands. This is the case with plants of the genus *Cosmos*, which are garden plants but have now been observed widely spread on the hills between Jeypore in Orissa and Anantagiri in Andhra. It also happens sometimes that a plant introduced in a country escapes and naturalises itself in the neighbouring country. For instance *Lantana camara* Linn. a native of tropical America was introduced into Ceylon and is now naturalised in India. Similar, though not identical, are the cases with

[1] Communicated by the Regional Research Laboratory, Jammu.

Gomphrena celosioides Mart., *Eichhornia crassipes* Solms., *Martynia diandra* Glox., etc. Apparently *Khaya senegalensis* A. Juss. does not come under any of these categories and the claim of Dr. Shankarnarayan needs modification. However, he deserves thanks for giving us the morphological description of the plant and other relevant information relating to the introduction into our country of a plant, whose wood is reported to be akin to true Mahogany.

Since the record of *Khaya senegalensis* A. Juss. from Indian soil may create subsequent complications, I consider it necessary that the comment be published.

The author is grateful to Dr. L. D. Kapoor for kindly going through the manuscript critically and to Rev. Father H. Santapau, St. Xavier's College, Bombay, for his kind suggestions.

REGIONAL RESEARCH LABORATORY,
CANAL ROAD,
JAMMU,
May 2, 1961.

A. K. DUTT

REFERENCES

Shankarnarayan, K. A. (1959) : *Khaya senegalensis* A. Juss., A new plant record from Pondicherry. *J. Bombay nat. Hist. Soc.* 56 (2) : 370-374.

Viart, M. (1960) : *Khaya senegalensis* A. Juss. *Ind. For.* 8 (7) : 395-399.

22. *SHOREA TALURA* ROXB., A SYNONYM OF *S. ROXBURGHII* G. DON

In our Indian floras one species of *Sal* goes under the name of *Shorea talura* Roxb. In accordance with the INTERNATIONAL CODE OF BOTANICAL NOMENCLATURE (ed. 1956), this name cannot stand and must be changed to *Shorea roxburghii* Don.

The nomenclature of the plant given in Hooker's FLORA OF BRITISH INDIA (1 : 304, 1874) is the following: *Shorea talura* Roxb. Hort. Beng. 93, 1814, nom. nud. et Fl. Ind. 2 : 618, 1832; *S. laccifera* Heyne ex Wall. Cat. 967, 1829, nom. nud., A. DC. Prodr. 16 (2) : 630, 1868; *S. roxburghii* G. Don, Gen. Syst. 1 : 813, 1831; *S. robusta* Roth, Nov. Pl. Sp. 221, 1821 (non Gaertn. f. Fruct. 3 : 48, t. 186, 1805-1807); *Vatica laccifera* Wt. & Arn. Prodr. 84, 1834, Wight, Icon. t. 164, 1839.

Of these names, *Shorea talura* Roxb. dates from 1814 but the validity only counts from 1832, when the plant was given a description; *S. laccifera* Heyne ex Wall. was only validated by A. De Candolle in 1868; *S. robusta* Roth was described in 1821, but the name is a later homonym of that of Gaertner f. of 1805-07, and therefore invalid in accordance with the CODE. The oldest valid name for this plant, in accordance with the CODE, is *Shorea roxburghii* G. Don.

C.S.I.R., PUBLICATIONS DIVISION,
OLD MILL ROAD,
NEW DELHI 1,
May 25, 1961.

G. KASHYAPA

23. AMENDED DESCRIPTION OF *HYDROCERA TRIFLORA* WT. & ARN.[1]

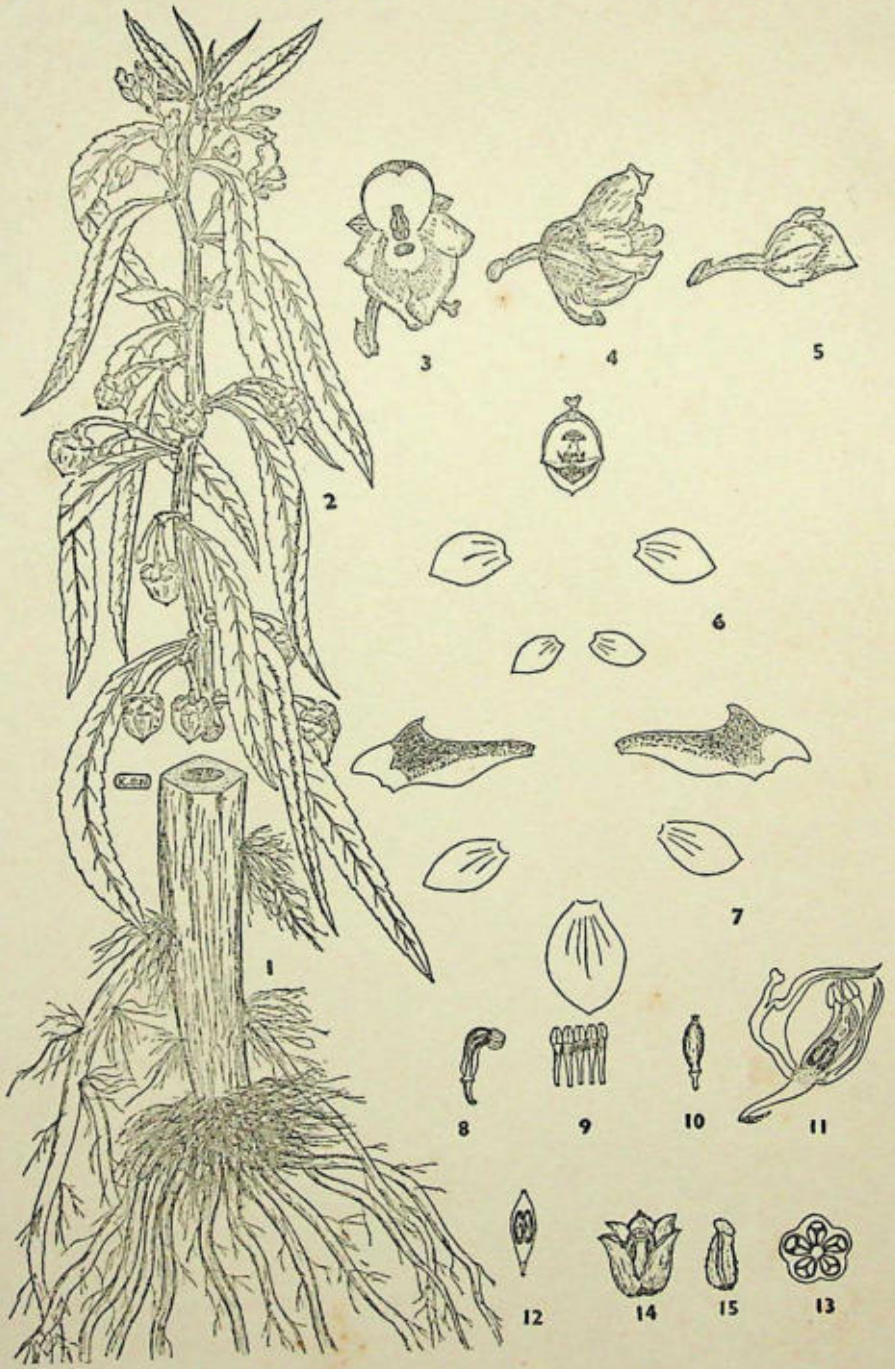
(With one plate)

Since the description of the monotypic Indo-Malayan genus *Hydrocera* as given in FLORAS (1, 2) has been found to be inadequate and incorrect in certain respects, it was felt desirable to revise its description to include certain features so far either unrecorded or incorrectly described. For instance, extrafloral nectaries occur on the leaf bases and this is not recorded in the descriptions available so far. The fruit is described as a drupe, but on closer examination it is found to be a capsular berry liberating the seeds.

The genus *Hydrocera* is distinguished from *Impatiens* by the presence of two lateral petals that are free and the fruit which is described as a drupe, whereas in *Impatiens* the lateral petals are united and the fruit is capsular. Since the fruit of *Hydrocera* is now found to be capsular the differences between this genus and *Impatiens* become narrowed. However, the freedom of two lateral petals and the distinctive aquatic habit may still serve to distinguish the monotypic *Hydrocera* from the large genus *Impatiens*.

---

[1] Communicated by Rev. Fr. H. Santapau, S.J.



Hydrocera triflora Wt. & Arn. emend. Venkat. & Dutt

1. Basal part of the stem showing fibrous roots; 2. A twig (note the extrafloral nectaries on the leaf bases); 3, 4. Flower in front and side view; 5. A flower bud in side view; 6. Sepals; 7. Petals; 8. Essential organs; 9. Stamens; 10. Gynoecium; 11. L. S. flower; 12. L. S. Gynoecium; 13. T. S. ovary; 14. Fruit (note the dehiscence); 15. Seed.

Figures 1 & 2 × 0.44.
Figures 3 to 12, 14 & 15 × 0.88.
Figure 13 × 2.64.

DESCRIPTION

Hydrocera triflora Wt. & Arn. emend. Venkat. & Dutt

Herba aquatica profuse ramosa, radicibus longis fibrosisque ornata, altitudinem attingens c. 1 m. *Culmis* pentangularis et cavus in spatiis internodalibus diametiens c. 2.4 cm. ad punctum 20 cm. supra solum. *Folia* alterna, linearia, 11.7×1.5 cm., sessilia, glandularia ad basim, serrata ad margines. *Inflorescentia* axillaris, cymosa, constans floribus tribus, quorum unus vulgo abortivus, caeteri vero bene evoluti sunt. *Flores* bracteati, zygomorphi; *sepala* 5, petaloidea et imbricata, quorum posterius calcaratum et vexillare evadit anterius in flore aperto ob resupinationem. *Petala* 5, libera, quorum bina posteriora longiora, colorata et alis similia. *Stamina* 5, filamentis brevioribus gynoecio sed supra evadentibus latioribus, antheris connatis. *Gynoecium* 5-loculare, ad calcaris latus inclinatum, ovulis ternis in singulis loculis placentae axiali insidentibus; stigmata quina, sessilia, perdurantia in fructu. *Fructus* purpureo-ruber, ad basim truncatus, rostro brevi et curvato ornatus constante stigmatibus perdurantibus; bacca capsularis dehiscit septicide, seminibus remanentibus columnae axiali fixis sed postea liberis. *Semina* vulgo solitaria in singulis loculis, curvata et rugosa, exalbuminata; cotyledones crassi, radicula brevi.

Profusely branched aquatic herb with long fibrous roots and reaching a height of about a metre. Stem five-angular and hollow in inter-nodal region and measuring about 2.4 cm. in diameter at a height of about 20 cm. above soil level. Leaves alternate, linear, measuring 11.7 cm. by 1.5 cm. Petiole 0; leaf base glandular, leaf margin serrate. Inflorescence axillary, cymose with two well-developed flowers and the third usually suppressed. Flower bracteate and zygomorphic; sepals 5, petaloid and imbricate. The posterior sepal spurred and vexillar becoming anterior in open flower due to resupination. Petals 5, free, the two posterior longer, coloured and alae-like. Stamens 5, filaments slightly shorter than the gynoecium and becoming broader and united towards the connective; anthers connate. Gynoecium 5-carpellary superior, bent towards the spur side; ovary 5-locular with three ovules in each loculus borne on axile placentae. Stigmas 5, sessile and persisting in fruit. Fruit purplish red, truncate at base and with a short bent beak of persisting stigmas; capsular berry dehiscing septicidally leaving the seeds attached to the column but separating later. Seeds usually solitary in each cell, curved and corrugated, albumin 0; cotyledons thick, radicle short. (See Plate, Figs. 1 to 15.)

ACKNOWLEDGEMENTS

We are grateful to Rev. Fr. H. Santapau, S.J., for providing the Latin description and for suggestions in the preparation of this paper. We are thankful to Mr. K. Satyanandam, M.SC., for the drawings.

BOTANY DEPARTMENT,
ANDHRA UNIVERSITY,
WALTAIR,
July 7, 1961.

J. VENKATESWARLU
B. S. M. DUTT

REFERENCES

1. Gamble, J. S. (1957) : Flora of the Presidency of Madras.

2. Hooker, J. D. (1875-97) : Flora of British India.

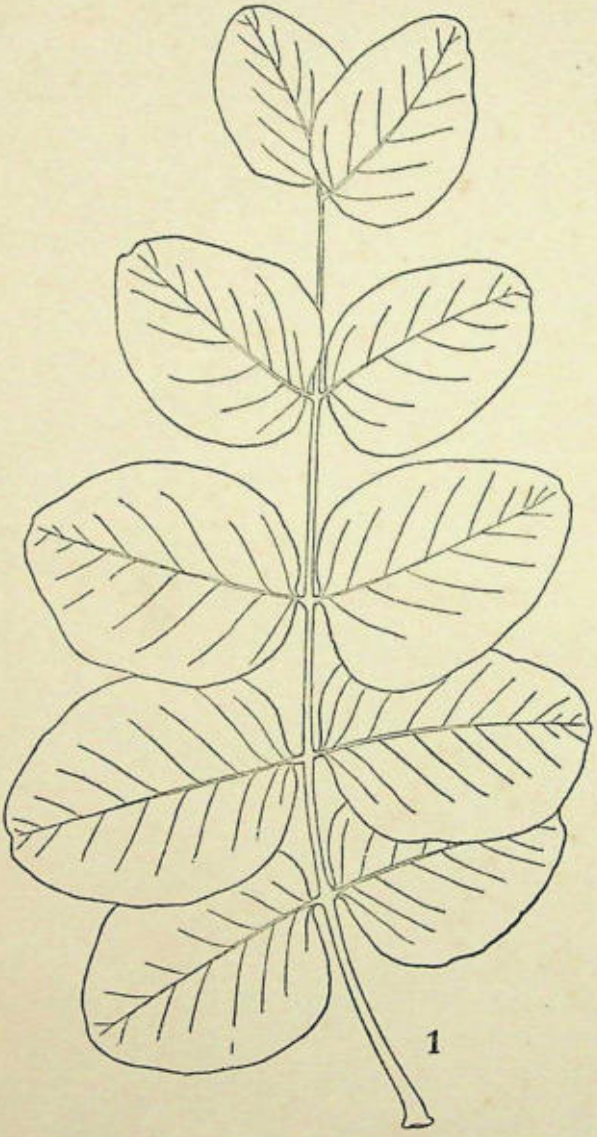
24. *BOSWELLIA OVALIFOLIOLATA* SP. NOV.: A NEW SPECIES OF *BOSWELLIA* FROM SOUTH INDIA[1]

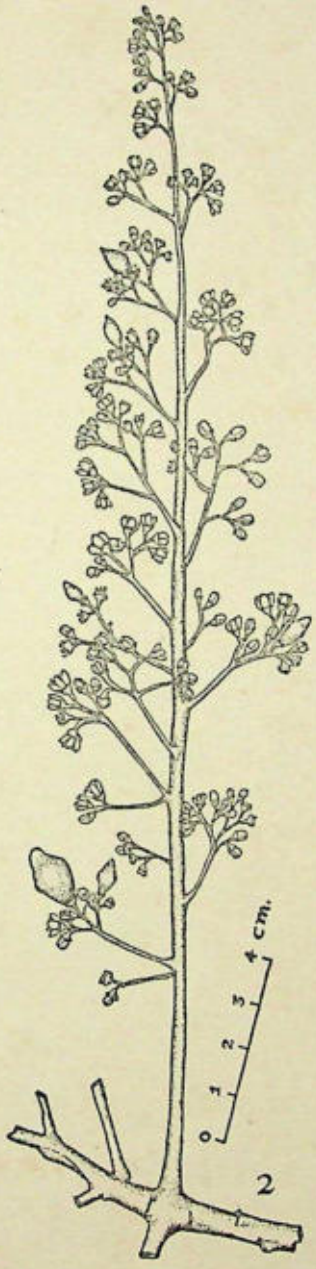
(*With two plates*)

Boswellia ovalifoliolata *Bal.* et *Henry* sp. nov., affinis *B. glabrae* Roxb., a qua tamen differt eo quod sit penitus glabra, eiusque foliola sint ovata, oblonga, obtusa retusaque ad apicem, rotundata ad basim, marginibus integris vel paulum undulatis, paniculae profusius furcatae, sepala et petala glabra.

Arbor decidua 7-10 m. alta, cortice papyraceo, cinereo, decorticante in frustula tenuia. *Folia* 9-25 cm. longa, alterna, stipata ad apices ramorum, imparipinnata, exstipulata; foliola opposita vel alterna, sessilia, 9-13 numero, 1.6-7.4×1.0-5.2 cm., ovato-oblonga, inaequalia et rotundata ad basim, obtusa et retusa ad apicem, integra ad margines vel paulum undulata, glabra, glauca infra, nervis rubescentibus. *Flores* in paniculas magnas axillares dispositi; paniculae foliis vulgo longiores, 5-32 cm. longae; pedicelli 4-6 mm. longi. *Calyx* 5-dentatus, lobis brevibus late triangularibus, persistentibus, glabris. *Petala* 5, distincta, imbricata, glabra, angusta ad basim, obovata, oblonga, 4-5 mm. longa, 2.5-3.0 mm. lata, decidua. *Discus* annularis, crenatus, carnosus, adnatus calycis tubo. *Stamina* 10, longa brevibus alternantia, extus inserta sub discum; filamenta subulata, lata ad basim,

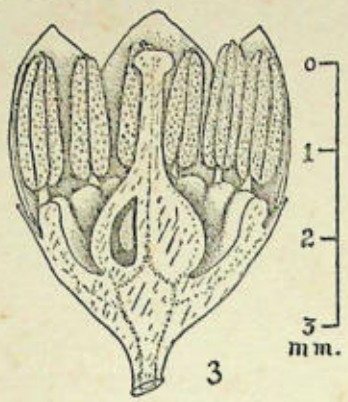
[1] Communicated by Rev. Fr. H. Santapau, S. J.



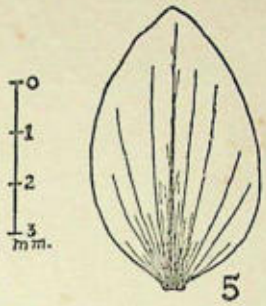


Boswellia ovalifoliolata sp. nov.

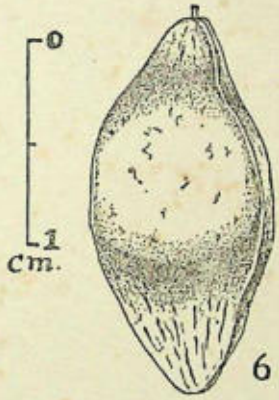
1. Leaf, 2. Inflorescence.



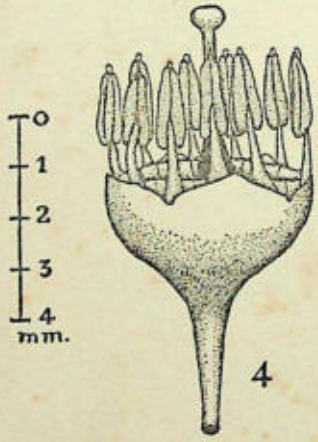
3



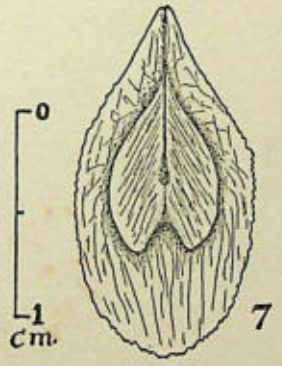
5



6



4



7

Boswellia ovalifoliolata sp. nov.

3. l. s. of flower; 4. flower with sepals removed; 5. petal, outer view; 6. fruit; 7. winged pyrene.

± 1 mm. longa; antherae versatiles, dehiscentes longitudinaliter, parietibus tuberculatis. *Ovarium* sessile, 3-cellulare, disco circumdatum; stylus brevis, ± 2.5 mm. longus, quadruplici sulco verticali ornatus; stigma capitatum; ovula bina in singulis cellulis, collateralia, pendula. *Drupa* trigona, 3-pyrena, 1.0-1.5 cm. longa, 5-8 mm. lata, valvulis septicidis; pyrenae osseae, cordatae, ornatae apice longo et ala lata circumdante, tandem dehiscentes ex axi trigono. *Semina* compressa, pendula; testa membranacea.

Typus lectus in collibus Tirupati dictis, in Dist. Chittoor, in regione Andhrica, ad altit. c. 300 m. die tertio mensis martii anni 1959 a cl. *K. Subramanyam* (7836 A-F); holotypus (*K. Subramanyam* 7836 A) positus in herbario regionis australis Bot. Surv. Ind. ad Coimbatore, sub numero accessionis 15373; isotypi positi ibidem sub numeris *K. Subramanyam* 7836 B-F.

Medium-sized *tree*, 7-10 m. tall; bark papery, ash-coloured, peeling off in thin flakes. *Leaves* 9-25 cm. long, alternate, crowded at the ends of branches, imparipinnate, exstipulate; leaflets opposite or alternate, sessile, 9-13 in number, 1.6-7.4×1.0-5.2 cm., ovate-oblong, inaequilateral and rounded at base, obtuse and retuse at apex, margin entire or slightly wavy, glabrous, glaucous beneath, veins reddish. *Flowers* in large axillary panicles; panicles longer than leaves, 5-32 cm. long; pedicels 4-6 mm. long. *Calyx* 5-toothed, lobes short, broadly triangular, persistent, glabrous. *Petals* 5, distinct, imbricate, glabrous, narrowed at the base, obovate, oblong, 4-5 mm. long, 2.5-3.0 mm. wide, deciduous. *Disc* annular, crenate, fleshy, adnate to the calyx-tube. *Stamens* 10, alternately long and short, inserted outside under the disc; filaments subulate, base broad, ± 1 mm. long; anthers versatile, longitudinally dehiscing, anther-wall tuberculate. *Ovary* sessile, 3-celled, surrounded by the disc; style short, ± 2.5 mm. long, with four vertical grooves; stigma capitate; ovules 2 in each cell, collateral, pendulous. *Fruit* trigonous drupe containing 3 pyrenes, 1.0-1.5 cm. long, 0.5-0.8 cm. wide, valves septicidal; pyrenes bony, cordate with a long apex surrounded by a broad wing, finally separating from the trigonous axis. *Seeds* compressed, pendulous; testa membranous (Figs. 1-7).

The type of this species was collected in Tirupati Hills, Chittoor district, in Andhra, at an alt. of about 300 m. on the 3rd of March 1959 by *K. Subramanyam* (7836 A-F); the holotype (*K. Subramanyam* 7836 A) has been deposited in the herbarium of the Southern Circle of the Botanical Survey of India at Coimbatore under accession

number 15373; isotypes preserved in the same herbarium under the numbers *K. Subramanyam* 7836 B-F.

It may be mentioned here that there is one specimen in Madras Herbarium, under accession number 8776, collected by R. H. Beddome from Nallamalai Hills of Kurnool Dist., Andhra Pradesh, which perfectly matches the present specimen. Gamble has written on Beddome's sheet: 'Not in Br. Mus. This seems to be distinct from *Boswellia glabra* and probably a new species. But the material is insufficient for description. It should be carefully searched for again in the Nallamalai Hills of Kurnool.'

B. ovalifoliolata Bal. & Henry	*B. glabra* Roxb.
1. Leaves 9-25 cm. long, completely glabrous; leaflets 9-13 per leaf.	1. Leaves 12-42 cm. long, rarely pubescent on nerves; leaflets 17-27 per leaf.
2. Leaflets ovate-oblong, suborbicular, obtuse or rarely retuse at apex, rounded at base, margins entire.	2. Leaflets elliptic-lanceolate, acute or subacute at apex, margins entire or rarely crenate-serrate or wavy.
3. Panicles up to 31 cm. long, longer than leaves, much branched, peduncles and pedicels glabrous.	3. Panicles up to 20 cm. long, shorter than leaves, very little branched, peduncles and pedicels pubescent.
4. Sepals and petals completely glabrous; petals smaller, ± 5 × 3 mm., obovate-oblong.	4. Sepals and petals puberulous outside; petals larger, ± 7 × 4 mm., ovate-oblong.

ACKNOWLEDGEMENTS

We thank the Director, Royal Botanic Gardens, Kew, for his kind help in connection with the comparison of our specimen with the specimens of *Boswellia* in Kew Herbarium. Our thanks are due to Rev. Fr. H. Santapau, S.J., Chief Botanist, Botanical Survey of India, for kindly translating the description into Latin. We are also thankful to Dr. K. Subramanyam, Deputy Chief Botanist, Botanical Survey of India, for having kindly placed the material for our study and for his valuable guidance and encouragement.

BOTANICAL SURVEY OF INDIA,
SOUTHERN CIRCLE,
COIMBATORE,
July 1, 1961.

N. P. BALAKRISHNAN[1]
A. N. HENRY

[1] Present address: Botanist, Central National Herbarium, Sibpore.

25. NEW RECORD OF A HOST (*LITSEA UMBROSA* NEES) FOR *KORTHALSELLA OPUNTIA* (THUNB.) MERR.[1]

(*With a text-figure*)

In the NW. and central regions of the Himalayas this tufted, little plant parasite, hitherto known as *Viscum japonicum* Thunb., has been thriving on the various species of *Quercus*. Although the parasite exhibits a preferential partiality towards the Oaks, stray cases of its presence on *Rhus*, *Olea*, *Rhododendron*, *Punica*, and Apricot have also been reported.

Korthalsella opuntia (Thunb.) Merr.

It was a few years ago during a visit to Mussoorie that I chanced to find a couple of plants of this '*banda*' parasite coming up on a small tree of *Litsea umbrosa* Nees. Owing to my close proximity to the place, I kept this particular tree of '*shurur*' (*Litsea*) under close observation and during the course of a couple of years watched

[1] Communicated by Shri M.B. Raizada, Dehra Dun.

the steady spread of the parasite, which had infected almost every branch of this tree. The parasite seems to have developed an adaptability to grow on this new host, as another similar specimen has recently been collected by Dr. M. A. Rau, Regional Botanist, B.S.I., from Garhwal, a place much farther away from Mussoorie.

Specimen collected on 16-11-1958.

BOTANY BRANCH,
FOREST RESEARCH INSTITUTE,
DEHRA DUN,
March 28, 1961.

K. M. VAID

26. NEW PLANT RECORD FROM BOMBAY : *PHYSALIS LONGIFOLIA* NUTT.

Physalis longifolia Nutt. in *Trans. Amer. Phil. Soc.* **5**: 93, 1837; Dunal in DC. Prodr. 13 (1): 447, 1852.

Perennial herbs, erect, 90-120 cm. tall; stems stout, dichotomously branched, hollow, deeply striate or furrowed, 2-2.5 cm. across near the base, pale green, finely pubescent in younger parts, glabrascent in older. Leaves 2-11.5×1.8-6 cm., ovate or oblong-ovate, subentire or irregularly serrate, glabrous above, minutely puberulous beneath; apex acute or shortly acuminate; base cuneate or rounded, decurrent, sometimes oblique; petioles 2.5-7.5 cm. long, glabrous. Flowers solitary, axillary or in the forks of the branches, erect or drooping; peduncles 0.8-2 cm. long, filiform, glabrous or minutely puberulous. Calyx 3-6 mm. long, tubular-campanulate, puberulous outside, divided to about the middle; lobes triangular, short, acuminate; in fruit entire calyx accrescent up to 3 cm. long, purple-veined. Corolla pale to lemon-yellow, with 5 purple or brownish spots on the inside at the base, campanulate, 0.7-1.2 cm. long, limb 0.8-1.5 cm. across. Stamens 5; anthers greenish or greyish blue; filaments 2-3 mm. long, glabrous, yellow. Berries about 1 cm. across, subglobose or somewhat ovate, slightly depressed at the apex, yellow or orange, enclosed in the persistent, accrescent calyx. Seeds auriculate about 1.5 mm. long, yellow, minutely tubercled.

Common, often gregarious by the roadsides and railway lines; occasional in undergrowth on hills.

Flowers and fruits: Nearly all the year.

Specimens examined in the Blatter Herbarium: Khandala, *Santapau* 9614, 11164, 12740; Karjat, *Santapau* 9650; Bombay and Salsette Islands, *Irani* 2027; *V. Patel* 775-761, 963 1247, 1294, 1771; *Shah* 152, 7023, 7036, 8407-08, 8967; *Santapau* 144-10, 5556, 9932, 20948; *Shenoy* 985, 1867, 1938, 4265; Andhra, *SKW* 6973.

World distribution: Native in America; introduced and at present naturalised in the coastal parts of Bombay and Andhra.

Critical notes: In Bombay we have the following species of *Physalis: Ph. peruviana, Ph. minima,* and *Ph. longifolia.* The first is a fairly large shrub, and is found only under cultivation in gardens, where the plant is a favourite of gardeners on account of the 'Chinese Lanterns', that is to say the pendulous, enlarged calyx hanging down from the plant in the manner of a Chinese paper lantern; the plant is cultivated further for the sake of its fruit or berries, which under the name of 'Bombay Gooseberries' are sold in the market, and make excellent tarts etc. The other two species have often been confused, but in general *minima* is much smaller than *longifolia*; they are further distinguished thus:

Corolla uniformly yellow without spots, 5-8 mm. long, the open flowers 4-8 mm. across; anthers yellow ...	*minima*
Corolla pale yellow with a few purple or brown spots, 7-12 mm. long, 8-15 mm. across; anthers greenish or greyish blue ...	*longifolia*

ST. XAVIER'S COLLEGE,
BOMBAY 1,
June 1, 1961.

H. SANTAPAU, S.J.
G. L. SHAH, M.SC., PH.D.
MRS. Z. KAPADIA, (*née* V. Patel)

27. NEW PLANT RECORD FROM BOMBAY: *ALTERNANTHERA PUNGENS* H.B.K.

Alternanthera pungens H.B.K. Nov. Gen. et Sp. 2 : 206, 1818; Melville in Kew Bull. 13 : 174, 1958. *Alternanthera repens* (L.) Link, Enum. Pl. Hort. Berol. 1 : 154, 1821; Baker in Fl. Males. ser I, 4 (5) : 91 & 594, 1954; Santapau, Fl. Purandh. 112, 1957 (non Gmelin, 1791). *Achyranthes repens* Linn. Sp. Pl. 205, 1753. *Illecebrum pungens* (H.B.K.) Spr. in Syst. Veg. 1 : 820, 1825.

Creeping herbs, rooting at the nodes, with radially spreading branches, often closely appressed to the ground; stems and branches slender, wiry, often rusty-brown, densely appressedly hairy, 10-40 cm. long. Leaves 1.2-3×0.6-2.5 cm., broadly ovate, obovate or almost orbicular, alternate, subopposite or subfascicled, glabrous or thinly hairy above, densely so beneath; apex obtuse, rounded or subacute, minutely apiculate; base rounded, cuneate or tapering, at times somewhat oblique; petioles 5-10 mm. long, slender, pilose; spikes 5-10 mm. across, solitary or 2-3 together, axillary, globose or oblong, shining white, at length pale straw-coloured; bracts spine-tipped; bracteoles hyaline, very acute or acuminate but not spine-tipped, strongly 3-nerved; the median adaxial tepal is rather flat, hyaline, dentate or toothed at the apex; the two lateral inner adaxial tepals are smallest; all tepals bear a pair of small tufts of glochidiate hairs, abaxial and median adaxial tepals at the base, lateral adaxial tepals about the middle. Stamens five, all fertile. Seeds orbicular, reddish brown.

An occasional weed along roadsides and railway lines. Abundant in reclamation in Bombay. The senior author has been watching this weed for many years and has noted its spread in Bombay. He first noted it as rather common in bare wasteland near the bus station at Saswad, Poona Dt. Some three years later the plant was observed in Poona; then again some four or five years ago he collected this weed along the railway line just past Khandala station on the way down the Ghats. It took the plant about two years further to reach Mumbra, 26 miles along the railway line from Bombay. Finally it has reached Bombay Island of late, but at the time of writing this note it is not yet common nor troublesome. The spiny bracts and perianth parts become hard on drying, and may be an unpleasant surprise if trod upon with bare feet. From the way this plant has been spreading in Bombay, it would seem as if it entered India via the South and is gradually spreading northwards in all directions. The junior author found this plant to be common at Broach and Baroda.

Flowers and fruits: August-May.

Illustration: Melville, t. 2.

Specimens examined in the Blatter Herbarium: Nagpur, *Mirashi* 217; Khandala, *Santapau* 15541; Purandhar, *Santapau* 7075, 7274, 11311, 13927; Bombay and Salsette Islands, *Santapau* 3954, 7224,

7353, 9945; *Shah* 7909; Broach, *Shah* 6509; Baroda, *Shah* 530; Andhra, *SKW* 5203, 6123.

World Distribution: Urban in Symb. Ant. 4 : 221, 1905, makes this plant native in the Central American Islands and in the American continent; the senior author, in 1948, studied this plant in Kew Herbarium, London, and to judge from the specimens available in Kew, the plant in 1948 was found all over tropical America, extending westwards to the Azores (Funchal), the Canaries (Tenerife etc.), Cadiz in S. Spain; and Balearic Islands. There were no specimens from the area between Balearic Islands and India in Kew; specimens from India were very rare. At present it is spread all over peninsular India, and recently it was found in Java.

Critical notes: The oldest name for this plant is *Achyranthes repens* Linn. 1753; in the present genus, the name should have been *Alternanthera repens* Link, 1821, which is the name by which the plant is known to some authors in India; this name, however, is preoccupied by *Alternanthera repens* Gmel. 1791, for quite a different plant. The next oldest available name for the Linnean species in the genus *Alternanthera* is *Altern. pungens* H.B.K., 1818.

ST. XAVIER'S COLLEGE,
BOMBAY 1,
June 1, 1961.

H. SANTAPAU, S.J.
G. L. SHAH, M.SC., PH.D.

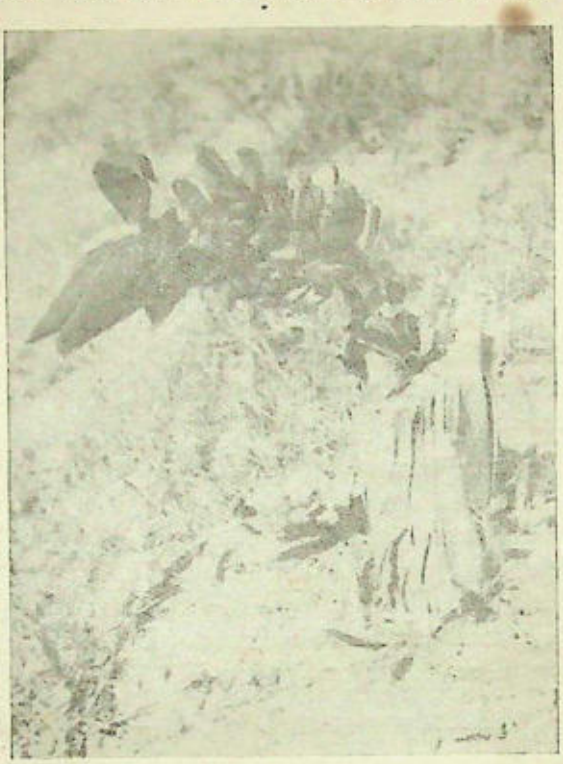
28. AN INTERESTING CONDITION OF FRUITING IN BANANA[1]

(*With one photograph*)

The stem of the banana plant is a pseudo-stem composed of a collection of leaf stalks densely packed together. In the banana and quite a few other plants the real stem is more or less a massive rhizome that usually remains underground or just reaches the surface.

Flowering scapes appear on the top of the rhizome and normally become elongated so that flowers and fruits emerge among the expanded leaf blades on the upper part of the plants. If due to injury this false stem is damaged, premature emergence of flowers and fruits often occurs.

[1]Communicated by the Director, National Botanic Gardens, Lucknow.



Recently some banana plants from a local orchard were transplanted at Banthra nursery of the National Botanic Gardens, Lucknow. After transplanting some plants started drying up at the top. They were cut back to about 45 cm. from the ground level. One of the plants burst into flower and fruit as shown in the above photograph.

NATIONAL BOTANIC GARDENS,
LUCKNOW,
May 26, 1961.

G. S. SRIVASTAVA

29. THE OPHIOGLOSSALES IN NEPAL

The Ophioglossales, due to their primitive position amongst the living ferns, have long attracted the attention of botanists. The three genera, *Ophioglossum*, *Helminthostachys*, and *Botrychium*, are closely related and form a gradual series in complexity of vegetative structures; they have a limited distribution. Thus, the find of a specimen

provides material and creates interest in the study of the distribution of the genus or even the species to which it belongs.

The *Botrychia*, also known as the Evergreen Grapeferns, have in recent times received great attention; in America attention is being focused on the distribution, classification, etc., even to the degree of pigmentation amongst the different species. According to Clausen (1944) the classification of the ternate *Botrychia* 'still stands far short of perfection'; they 'are controversial taxonomically' to quote the words of Wagner (1960).

The distribution and taxonomy of the Indian *Ophioglossum* species has been worked out by Chakravarty (1951). Information and data about the representation of this order in Nepal are very incomplete, and the aim of this note is to provide all information that has accumulated so far. Raizada & Vaid (1952), who worked out the collection of ferns made by Fleming from west Nepal, do not mention any member of the order; similarly Alston and Bonner (1956), who have described the sizeable collection of ferns made by Zimmerman of the Swiss Mt. Everest Expedition during 1952 and 1954, make no mention of any *Ophioglossum* species. My explorations of east Nepal over several years have resulted in the collection of some *Ophioglossum* and *Botrychium*, which throw some light on their distribution in Nepal and the Himalayas in general. The different species that are so far known from Nepal are detailed below.

Ophioglossum vulgatum Linn. This species was first reported by Burkill (1910), who collected on the Trisuli banks below Naikot, *c.* 2000 ft. (610 m.). My specimens have been collected in Kathmandu Valley, *c.* 4200 ft. (1280 m.). In east Himalayas, this species is reported from Suriel, 5200 ft. (1520 m.); Goke, 4000 ft. (1220 m.); Rungeet, (no altitude given); south of Sinchul, 7500 ft. (2290 m.). The Nepal specimens come from a lower altitude.

Ophioglossum reticulatum Linn. My specimen comes from Kalinchok Ridge *c.* 10,500 ft. (3200 m.). This was collected in October 1960. There were many immature plants on the grassy slope facing east, but I could collect only three mature specimens. This is a new record for Nepal. There are two specimens of the same gathering deposited in the Nepal Government's herbarium. This species has so far not been reported from east Himalayas. The species is known from Assam, 200 ft. (60 m.); Burma, 6000 ft. (1830 m.); and also Mussoorie 6500 ft. (1980 m.). It may be worth

mentioning that I have not been able to find any record of *Ophioglossum* growing at a height of 10,500 ft. (3200 m.). Thus, the present collection records the maximum altitude not only for the species but also for the genus.

Botrychium lunaria (Linn.) Sw. This species has been recorded in west Nepal only by Tagawa (1955) based on specimens collected at Manaslu, *c.* 10,800 ft. (3290 m.). This is the only record for this species.

Botrychium lanuginosum Wall. This species has also been recorded from west Nepal by Tagawa (loc. cit.); he has named the specimens collected at Chokang *c.* 9000 ft. (2740 m.) as *Osmundopteris lanuginosa* (Wall.) Nishida[1]. I have collected this species from two different localities in east Nepal. The first gathering was made in September 1956 above Makaibari on way from Charikot to Kalinchok at *c.* 8000 ft. (2440 m.). There were very few specimens growing in shade and all plants were fully mature. The second collection was made in October 1960 at Sanga Soti *c.* 7500 ft. (2290 m.). Plants were at different stages of growth and maturity.

Botrychium ternatum (Thunb.) Sw.[2] This species is being reported for the first time from Nepal. Specimens collected are from the same locality as for *B. lanuginosum* Wall., i.e. Sanga Soti *c.* 7500 ft. (2290 m.). There were very few plants growing and only two were fully mature, and these were pressed. These Nepal specimens are much more robust than the specimens housed in the Calcutta and Dehra Dun herbaria. This species is also reported from Mussoorie.

ACKNOWLEDGEMENTS

Thanks are due to the University Grants Commission for the travel grant given to me to work out the ferns and fern allies collected in east Nepal. I am indebted to Prof. V. Puri for his suggestions and helpful consultations.

MEERUT COLLEGE,
MEERUT,
March 23, 1961.

M. L. BANERJI

---

[1]The genus *Osmundopteris* has recently been changed to *Japano-Botrychium* by Nishida (See *Amer. Fern Journ.* 50 : 128, 1960).

[2]According to Nishida, *Scepteridium ternatum* (Thunb.) Lyon var. *ternatum* Nishida syn. *Botrychium ternatum* Sw. (See *Amer. Fern Journ.* 50: 131, 1960).

REFERENCES

Alston, A. H. H. & Bonner, C. E. B. (1956) : *Candollea* **15** : 193-220.

Burkill, I. H. (1910) : *Rec. Bot. Surv. Ind.* **4** : 59-140.

Chakravarty, H. L. (1951) : *Bull. Bot. Soc. Beng.* **5** : 1-10.

Clausen, R. T. (1944) : *Amer. Fern Journ.* **34** : 55-60.

Raizada, M. B. & Vaid, K. M. (1952) : *Indian For.* **78** : 576-81.

Tagawa, M. (1955) : Fauna and Flora of Nepal Himalayas. Kyoto, Japan.

Wagner, W. H. (1960) : *Bull. Torrey Bot. Club* **87** : 303-325.

Notes and News

The XVIth International Horticultural Congress will be held under the sponsorship of the Belgian Government in Brussels from 31st August to 8th September 1962. The Congress secretariat is located at the State Agricultural College, Coupure links, 235, Ghent, whence all further information can be obtained.

* * * *

Vol. III of the late J. L. Peters's CHECK-LIST OF THE BIRDS OF THE WORLD (1937) which has long been out of print has been reprinted. This volume lists the Columbidae and Psittacidae and related families, and is available from the Museum of Comparative Zoology at Harvard College, Cambridge 38, Mass., for $10.

Vol. V ($7), VII ($6), and IX ($7.50) are still available.

With the co-operation of specialists all over the world work is progressing rapidly towards completing the unpublished volumes. Vol. XV, containing the Ploceidae, Sturnidae, Oriolidae, Dicruridae, Paradisaeidae, Corvidae, etc., is in the press, and should be ready early in 1962.

* * * *

Mr. Tom Schnabel, 224 Vance Street, Pacific Palisades, California, U.S.A., is interested in exchanging specimens of American butterflies for Indian varieties. Members interested will please correspond directly with him.

* * * *

A SYNOPSIS OF THE BIRDS OF INDIA AND PAKISTAN, by S. Dillon Ripley II, published by the Society is now ready.

Also, the 6th (revised and enlarged) edition of THE BOOK OF INDIAN BIRDS, by Sálim Ali, which includes eight new coloured plates illustrating a total of 256 species.

* * * *

PRINTED AND PUBLISHED BY V. M. PHILIP AT THE DIOCESAN PRESS
18 CHURCH ROAD, VEPERY, MADRAS—11-11-1961. C6340
EDITORS: H. SANTAPAU & HUMAYUN ABDULALI

CONTENTS