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ZOOLOGICAL GARDEN CALCUTTA

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ZOOLOGICAL GARDEN CALCUTTA

A Naturalist in Borneo

BY

DR. T. NORMAN[1]

(*With two plates*)

My wife and I recently had the good fortune to spend 9 months in North Borneo on our way back to England after 14 years in Assam. We were stationed at Wallace Bay on Sibatik Island, 2 hours by launch from Tawau, at the extreme SE. of the Colony and only 3 miles from the Indonesian border. Wallace Bay consists only of the headquarters of the Borneo branch of the Bombay Burmah Trading Corporation, but the isolation of the station was redeemed for us by the fact that good forest began only 200 yards behind our bungalow, and the sea, sometimes with as many as 5 timber ships at anchor at a time, 100 yards in front of us. We spent 2 consecutive days a fortnight at the Corporation's main timber camp, 3 hours from Wallace Bay by launch up the Kalabakan River, and 2 days a fortnight at Tawau to visit another timber camp and a cocoa estate, 17 and 25 miles respectively from Tawau on the road which will eventually lead to Mostyn. Living and working in such close proximity to the forest we were able to spend the midday hours there whenever the weather permitted. My wife's primary interest is ornithology, and my own butterflies, but we are sufficiently general Natural Historians for our interests to overlap and for us to take an intelligent interest in other branches.

Our biggest and continuing surprise in the Tawau area of Borneo was the climate. Rainfall is approximately the same as in central

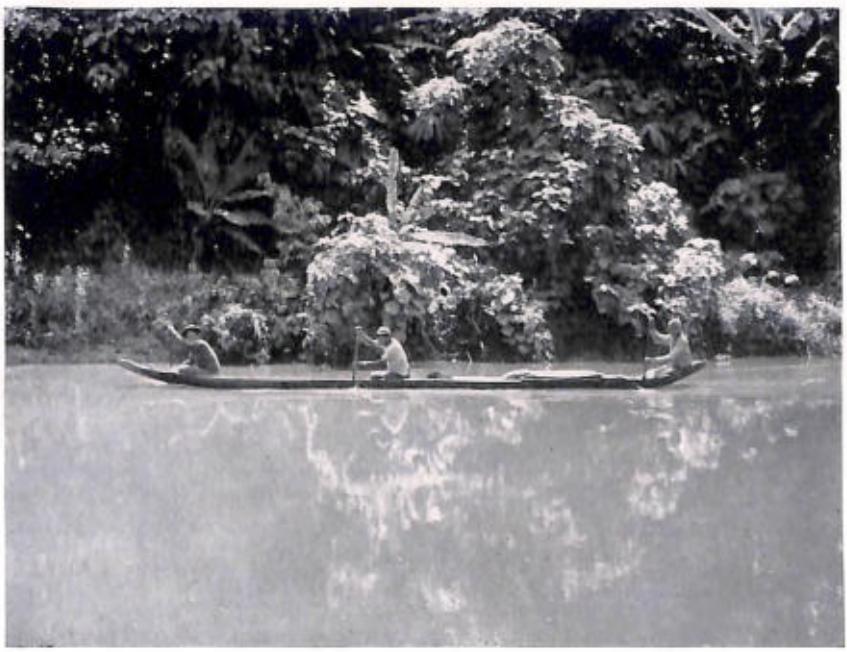
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Assam, i.e. 80 in. a year, but is far more equally distributed. Without going into meteorological details, subjectively the climate is mild and pleasant, no single day of our 9 months being as unpleasantly hot and humid as the coolest monsoon day in the Assam Valley. There were other surprises, both of things present and things absent. *Agathis* sp. (the Kauri of New Zealand and Australia) and Podocarps, both typically Southern Hemisphere conifers, grew in the interior, and several *Rhododendron* spp. in the equatorial lowland rains forest. Unfortunately we saw none of these, nor will it be a surprise to a zoologist to learn that we failed to see the tapir, cassowary, and great black cockatoo illustrated on the stamps of the Chartered Company, pre-war rulers of what is now the Colony of North Borneo. After enquiring about these 3 vertebrates and vehemently denying the possibility of lowland rhododendrons I quickly learnt to keep to myself opinions based on Indian experience.

The figures usually given for the forest area of Borneo are 75% of the land under primary forest with another 15% under secondary forest, and a flight across the island certainly seems to bear these figures out. One can fly for half an hour and see nothing but virgin forest in every direction—although it must be explained that half an hour in a jet plane, or even in the familiar Dakota, is not the same thing as half an hour in a Borneo Airways' Pioneer, which looks as though it ought to be propelled by the piece of twisted rubber familiar in the toy planes of my boyhood. It is not easy to compare the primary forest of the lowlands of Borneo with similar forest areas in Assam, since so many of Assam's virgin forests are not, in fact, true primary forest. In the non-swampy areas the canopy appears to be at least 50 feet higher and more dense than in the best Assam forests, the boles straighter and proportionately more slender, and the forest floor more open. This picture gave place to the familiar Assam pattern of dense undergrowth, with much thorny rattan, wherever light had been let in. In open places, especially along roadsides, *Eupatorium* is firmly in control, coming into flower at about Christmas time but lasting into March. Although Tawau is in the tropics (4° N.), with no real seasons, the familiar plants of the Asian sub-tropics flower in their proper months but with a much longer flowering season. This long flowering season applies also to native plants. It was particularly noticeable with some of the more showy creepers, *Bauhinia kochi*, for instance. This very characteristic and lovely plant of Malaysia is not seen in India. It is a heavy creeper draping trees and stumps at the forest edge or wherever it can reach the sun; the flowers are small for a *Bauhinia*, of a rather variable but always very bright

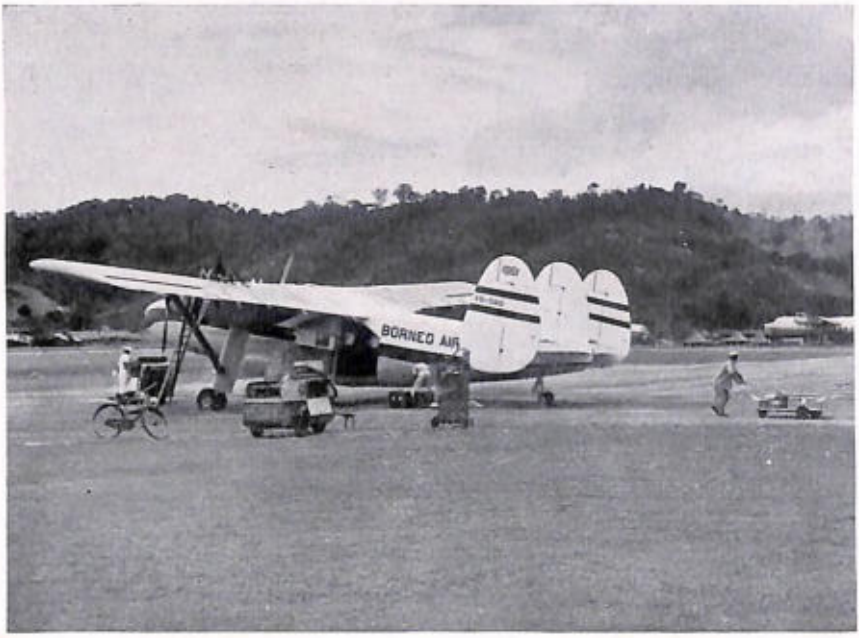


Primary Forest in central North Borneo



Typical Secondary Forest on banks of Kalabakan River

Photos : T. Norman



Jesselton Airport with Borneo Airways' *Pioneer* in foreground



Iban fellers at foot of Red Serayah (*Shorea* sp.) tree

Photos : T. Norman

orange-red, in terminal corymbs which give the appearance of being flat-topped. It is quite as dramatically showy as the 'Golden Shower' (sometime *Bignonia venusta*) of Indian gardens.

A characteristic small tree of cleared areas was a species of *Wormia*, perhaps *burbidgii*, with very large leaves and large yellow flowers similar (except in size) to those of *Ochna* spp. This was a case where familiarity bred, if not contempt, at least disappointment, so that I no longer regretted my failure to make it thrive in Assam. After the excitement of finding a whole riverbank covered with *Nepenthes khasiana* during our last Christmas in Assam we had looked forward to seeing the many species of pitcher plants which grow further east, but they were very scarce in our area and we only found one small group (on Sibatik Island), although we saw many species on brief visits to Brunei and Sarawak. Orchids were a little disappointing. While it is true that many fine species occur in Borneo (for instance *Phalaenopsis* spp.), by far the most remarkable we saw in the wild was *Grammatophyllum speciosum*. This commonly grew perhaps 50 or 60 feet from the ground at the point where the first branches of a forest giant forked from the trunk, dwarfing the enormous size of the orchid itself. This may have 20 or 30 six-foot sprays of large tawny-orange flowers, the whole plant being large enough to fill completely an ordinary-sized room.

As elsewhere in the tropics, the lowland forests are melting away and giving place to cash crops—rubber, manilla hemp, cocoa, coconuts, and oil palm are important ones on the east coast—but the greatest clearing of forest is from the thriving timber industry. The Forest Department is active and progressive, although there is widely expressed concern (in which I agree) about the correctness of its method of forest perpetuation. Large areas have been set aside permanently for timber. After the concessionaires have felled what they require, the Forest Department moves in and poisons off all remaining trees right down to the smallest sapling size. It would be more correct to say that this is what has happened in areas I have personally been able to observe, but I believe the intention is to poison all the 'useless' species and leave only the smallest saplings and a few seed parents of the commercially desirable species, mainly Dipterocarps. The theory is that the 'useless' species will die out while pure stands of Dipterocarps will grow up tall and straight under the protection of the quickly growing secondary species. The method has been used extensively and, I believe, successfully in Malaya. No conservationist can approve of an attempt at such a radical alteration of the forest, but far worse than this, there is grave doubt as to

whether it is even going to achieve its purpose in Borneo. As far as I can see from personal observation of large areas on the east coast, the Dipterocarps are germinating and starting to grow satisfactorily, but the growth of secondary species is so dense and dark that this has strangled the forest species, resulting in pure stands of dense (and useless) secondary growth after 5 years. In sharp contrast to this is the magnificent natural regeneration which has taken place around the Selimpopon River, where selective felling of commercial species took place in the earlier part of the century.

The relatively few species of common large animals occurred in great plenty—pig, particularly, in primeval numbers. Mouse-deer, barking deer, and sambar were common, and tembadau (local equivalent of the Indian gaur or bison) was said still to be plentiful a few days' march from Tawau. Elephants have never been as plentiful as on the Asian mainland, probably due to the less suitable food with relative scarcity of bamboo; in our area there was only known to be one, whose tracks we frequently found. Squirrels, lizards, and monkeys occurred in endless variety and vast numbers: flying squirrels and flying lizards, large monitor lizards and giant Malayan squirrels, and tiny lizards rustling in the dry leaves on the forest floor, often confused with the not much larger rabbit-skinned squirrels. My wife may have seen one orang-utan, but if it occurred in our area at all it was certainly very rare. In compensation, the proboscis monkey was common and could be seen in troops varying from a few individuals up to 50 or more on any launch journey through the mangrove swamps at low tide. There was one old male who used to sit serenely only a few yards from us on his flat-topped mangrove bush (which exactly resembled one of the small-leaved widely-spreading bushes of China-type tea which until recently could be seen on many of the older Assam tea gardens) while his more nervous subjects raced from the mud to the safety of the taller mangroves. Proboscis monkeys were large and handsome clean-looking creatures in sharp contrast to the dirty little grey swamp monkeys who lived in similar places and were characteristically seen with an arm plunged up to the shoulder in the squelchy mud feeling for shell-fish. In the forest proper gibbons (perhaps of two species) were common, as also were several species of langur. We were fortunate to see a small group of the pig-tailed monkey.

Although the Borneo forests are not, any more than other tropical forests, the writhing nightmare of snakes imagined by so many stay-at-home Europeans, I had more narrow snake escapes in 9 months than in 14 years in Assam. There was the magnificent pit-viper of

the species named after the gentleman whose name is spelt something approaching Wangel, banded in two shades of green and looking quite as venomous as, in fact, it was, which I nearly caught in my net with a *Euthalia*. It was lying coiled on a frond of rattan, and nothing I could do succeeded in making it move. This was in a particularly productive spot for butterflies which we visited several times a week. For the next 5 weeks it was always there in one of two places on either side of the narrow track. Once we had located it each day we felt fairly safe, but a day came in the fifth week when we could not do so; and when it reappeared on its first perch next day we regretfully decided that the only safe thing to do was to bring a man with a parang. Within a day of first finding this snake I met another of the same species, equally immobile and on a similar perch, but this second specimen I never saw again. That was a bad period because on the same day I had my foot lifted and was about to put it down when something made me hesitate . . . there was a long green snake (probably non-poisonous) lying across the track. I had the very greatest difficulty in moving it sufficiently to allow me to pass. This immobility seemed to be a feature of Borneo snakes, and rather a disturbing one, which caused us to lose many butterflies from watching too closely where we were treading instead of keeping our eyes on the main objective. On another occasion in very thick and dark secondary jungle I saw several fat caterpillars on a twig just in front of me. I was about to pick up and examine one of these when a movement to the left caught my eye . . . the bright blue flickering tongue of a snake whose folds round the twig I had mistaken for caterpillars. On the other hand, when actively hunting, snakes could be as active in Borneo as anywhere else—the one, for instance, that whistled past my cheek into a stream after a frog I had just disturbed.

We not only saw animals in the forest more frequently than in Assam, but we also from time to time had a curious feeling that the barriers between them and us were down, possibly because less intensive hunting through the ages has caused a less intense alertness towards humans. Two incidents will illustrate this. On an early morning walk along a disused timber road through the forest my wife saw a leopard cat with three kittens cross the track and go into the thick bushes. The kittens saw her and immediately emerged on to the track, approaching to within a few feet with every sign of friendliness. My wife had visions of the enraged mother and moved off, but the kittens followed her and in the end she had to shoo them off. This incident was all the more remarkable because the smaller cats

are no more tractable in captivity in Borneo than in India. The other incident occurred during one of my midday collecting trips. I was in the Place of the Pit Viper when I became aware of a large animal coming at speed towards me down the track. Quite suddenly a sambar stag appeared, and as avoiding action was absolutely necessary I shouted at him. The shout registered, but not its source or direction, and for about 2 minutes he stood 8 feet from me, with his flank towards me, staring into the bushes on the right. Oddly enough he appeared to be using his eyes rather than his nose, otherwise at such a range he could hardly have failed to scent my sweaty body. It is difficult to describe the feeling of utter nakedness standing alone in the forest with not even a bush between myself and a large wild animal which I could have touched with my net. It is not easy to judge time under such circumstances, but after perhaps two minutes the sambar turned and started to move in my direction again. Another loud shout was necessary to avoid a collision, and this time he bounded off and away into the forest. Pig were noticeably more alert than most other animals, but even so there was always the danger of meeting them head-on on a narrow track. Near the end of our time in Borneo we were on a narrow track following the crest of a hill. To the right this fell away for 800 ft. in an apparently sheer rocky precipice, and at this particular place there was a view point a few feet wide and screened from the track by a few bushes. We had just reached this point when there was the thunder of hooves on the track ahead. It crossed my mind to move quickly to the view point and watch the sounder go by, but very fortunately I decided to shout instead and they changed course off into the forest on the left—'as large as landrovers' as my wife described them later. We found afterwards that a well-used pig track went over the edge of the precipice and obliquely down and I am quite sure that if I had obeyed my first impulse to stand aside on the view point we would have been swept over the side.

In all fields of Bornean Natural History an enormous amount yet remains to be learnt, and this applies even to birds, where Smythies's book is full of the challenging 'not recorded from Borneo' under the headings of habits, voice, and nidification. My wife was able to fill in a surprising number of gaps in such a short stay and will be writing these up elsewhere when she has a respite from cooking and washing. As a generalisation one might say that the tropical groups are bigger and brighter than in India and more numerous in numbers, and that there are fewer of the nondescript 'little brown jobs'. No apology is required for using a term originated by such an eminent ornitholo-

gist as Mr. Roger Peterson—nor would it be given after the comments frequently passed on some of my Lycaenids and Hesperids! Broadbills, trogons, woodpeckers, kingfishers, malkohas, and cuckoos are all conspicuous groups. Hornbills of 8 species make the forest resound with a variety of weird sounds from the blood-chilling roar of the rhinoceros hornbill (*Buceros rhinoceros*) to the demoniac laughter of the rarely seen but often heard helmeted hornbill (*Rhinoplax vigil*). This is an extraordinary creature with the two central tail feathers prolonged for 2 feet as a thin streamer. It is also the source of hornbill ivory, since the casque is of solid instead of cancellous bone, and one also finds a whole head with the casque beautifully and intricately carved by Chinese craftsmen. I have one such whose origin I cannot trace, but which was always reputed in the family to be a toucan and to have come from South America. So much for the accuracy of oral tradition. For sheer colour the pittas are hard to beat, and as in India, although reputedly not rare, they are very infrequently seen. One has the feeling that when the Creator came to the pittas he had become tired of the dull brown warblers and babblers and just tried to see how many and how bright colours could be painted harmoniously on to one bird. For grace and beauty of line I shall not forget the frigate birds which we occasionally saw off Wallace Bay, and for tameness the common sandpipers (*Tringa hypoleucos*) which were the common birds of our lawn from October to February, feeding unconcernedly by our windows and steps.

It was pleasant to be welcomed in Borneo by the call of the plaintive cuckoo (*Cacomantis merulinus*) and, more rarely and less melodiously than in Assam, the Indian cuckoo (*Cuculus micropterus*) —but one could hardly expect more of it in a land where the urgency to make more Pekoe does not arise. Apart from these and a few other old friends the common birds made a marked contrast. There are no sparrows in Borneo, their place being taken by the very common chestnut and dusky munias (*Lonchura malacca* and *L. fuscans*); the only myna is the grackle (*Gracula religiosa*), which normally keeps to the forest; the common house crow does not occur and the jungle crow (*Corvus macrorhynchos*) has only been recorded 4 times, their place being taken by another forest bird, the slenderbilled crow (*Corvus enca*). These gaps are all the more extraordinary when one considers the wide distribution and aggressive invasiveness of these birds.

Apart from check-lists and the inclusion of Bornean forms in works covering the whole of the Indo-Australian region there do not

appear to be any books in English on the butterflies of Borneo. Even using papers such as Evans's recent monograph on the Oriental *Arhopala* is not entirely satisfactory without access to a museum when one is dealing with material which one hopes and expects to include new forms, and this must explain and excuse the ambiguity of the names I shall use. I cannot attempt a satisfactory identification of the mass of material I brought back until I can find the time to spend a month or more working at the British Museum.

My great love amongst the butterflies has always been for the Lycaenidae (and to a lesser extent for the Hesperiidae), and in the tropics particularly for the fascinating complex formerly known as the genus *Amblypodia*. The latter are very well represented in Borneo where there are 74 out of a total of 187 species for the whole Indo-Australian region, the individual butterflies of the group often being very plentiful indeed. Their favoured habitat was not the dark, bare floor of the primary forest but places where the loss of a few forest giants had allowed sunlight to reach the ground, and not too dense low leafy vegetation to flourish. Such conditions could be found where trees had fallen in primary forest, forming natural clearings, or where only a few of the larger trees had been felled a few years previously—though the latter areas could be very difficult for the collector due to the dense secondary growth of prickly rattan. Some of the very best places were beside newly made roads just inside the forest border, where extra light filtered through before the wound in the forest was covered by a dense leafy growth of granulation tissue, if I may use a medical parallel. Equivalent conditions could be found at a stage of felling when tracks had been driven through the forest and only a few trees felled, but these places had to be exploited quickly before they became an impenetrable mass of lopped and tangled branches in which it became impossible to collect. I could not decide whether the Borneo butterflies, and particularly the *Arhopala* group and the Hesperiidae, were faster and more restless than in Assam, or whether I had become slower, but we quite certainly found them more difficult to take.

Other inhabitants of the forest floor were a limited number of rather striking Satyrid species, Erycinids in great and exciting variety but not very great numbers, Amathusiids of many species, *Euthalia* spp. in great numbers, and (on the undersides of leaves) a single common species of *Eulacera*, an endless variety of Lycaenids, and disappointingly few Hesperids. Of the last mentioned family *Erionota* spp. (or perhaps only one species) were common and there were some exciting *Plastingia* spp. The Lycaenids included a few *Poritia* spp., a very

great number of *Allotinus* of many species, *Jamides* spp., *Nacaduba* spp., and very many species allied to *Cheritra*, although only a few of the individual species of this group were common. Even during our few periods of really dry weather we very rarely found butterflies at damp places on the ground except to a limited extent in January and February, and never anything approaching a real congregation. Until the *Eupatorium* came out and introduced us to a new world of butterflies there were very few flowers to attract them except for two or three shrubs with insignificant white flowers which were favoured by *Plastingia* spp., as were similar plants in Assam.

The problem of Borneo, as of tall primary rains forest the world over, is the forest canopy. I did not regret the Papilios and Nymphalids (judging from the Sarawak Museum the latter were poor anyway), but I would have given a lot to have had one single day of the sort of weather conditions which would have driven the Poritiinae as well as *Tajuria* and *Pratapa* to the forest floor. The few I took of these groups were sufficient to keep me awake at night imagining the treasure, perhaps unknown to science, which I was sure must be in the canopy. The most surprisingly unrewarding habitat of all was gardens. A few common Papilios (with an occasional *Troides brookiana*), a few common Hesperids, the ubiquitous *Zizeeria maha* and *otis*, an occasional *Neptis* sp., and that was all.

I had been intending to conclude with a paragraph about the very happy race relationships and the peacefulness of this small territory, but the Brunei rising and its aftermath of rumbles from Indonesia have shown that so quickly do events move in the world to-day that it would be unwise to make remarks which may be nonsense by the time they appear in print.

The Indian Wild Ass: A Survey[1]

February 1962

BY

E. P. GEE

(With a plate and one map)

I. INTRODUCTION

Information on the present population and status of the Indian Wild Ass *Equus hemionus khur* Lesson, 1827, is scanty. For this reason I was prompted to undertake this brief fact-finding survey, especially as South African Horse Sickness[2] had been reported in that part of India recently. The International Union for the Conservation of Nature and Natural Resources sponsored my expedition, and the World Wildlife Fund very kindly paid my travelling expenses from the eastern part of India to the furthest western tip of the country.

The Report deals with the Indian Wild Ass. There are altogether in Asia five subspecies of *Equus hemionus* listed by Ellerman & Morrison-Scott (1951):

"*Equus hemionus hemionus* Pallas, 1775. Chigetai, Kulan, or Mongolian Wild Ass. Range: now apparently only found about Orok Nor and Zagan Nor, in Central Mongolia.

"*Equus hemionus onager* Boddaert, 1785. Persian Onager or Ghor-khar. Range: north-eastern parts of Persia and North-Western Afghanistan; Russian Turkestan, as above.

"*Equus hemionus khur* Lesson, 1827. Indian Wild Ass or Ghor-khar. Range: the Rann of Cutch, possibly Baluchistan, and South-Eastern Persia.

"*Equus hemionus kiang* Moorcroft, 1841. Kiang. Range: Ladak, Nepal, Sikkim, Tibet to Kukunor district.

"*Equus hemionus hemippus* I. Geoffroy, 1855. Range: Syrian Desert and adjacent parts. Possibly now extinct."

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[1] This survey was done for the Survival Service Commission of the International Union for the Conservation of Nature and Natural Resources. The report was first published in *Oryx* 7 (1): 9-21, April 1963, and is reproduced here by courtesy of the editor, the IUCN, and the author.—EDS.

[2] A virus disease of equines known from Africa for a long time. It spread to the Middle East a few years ago, and thence in 1959 to Pakistan. In April 1960 it began in Rajasthan in epidemic form, and by the end of the year over 9000 horses were reported to have died of it in various parts of India. Believed to be transmitted by midges of the genus *Culicoides*. Horses which recover from the disease are immune.—EDS.

The last mentioned is the Syrian Wild Ass which is considered by Talbot (1960) to be extinct. Of the wild asses of Egypt Talbot (1960) states: 'The wild ass was once found over much of the Eastern Desert, occasionally ranging further west along the Sudan border. At present the only concentrations known are in the isolated mountain groups north of the Sudan between the Nile and the Red Sea. They apparently are also partly feral, as they are considered the property of the local Bedouin.' And of the Nubian Wild Ass Talbot says: 'There is considerable doubt whether the animals now considered "wild asses" in Sudan are truly wild or merely "feral" '.

The Indian Wild Ass stands 11 to 12 hands (44 to 48 inches) high at the shoulder, whereas the local domestic donkeys only average 9¼ hands (37 inches). The wild ass is a bright yellowish sandy colour, with a short mane of dark chestnut colour and a line of the same colour extending down the back to the root of the tail. The lower parts are white. It has light fawn-coloured shoulders, saddle and sides to the rump, constituting an example of disruptive coloration. The ears are shortish, like those of a zebra.

The local domestic donkeys, on the other hand, are a dingy grey or dirty brown, with long ears From all accounts it is evident that not only does the wild ass never interbreed with the domestic donkeys, but it keeps entirely aloof and never mixes at all with them or with any other domestic animals. Domestic donkeys breed at any time of the year; but the wild ass is said to mate in August, September and October, and to bring forth young in July, August and September, the gestation period being eleven months. The call of the wild ass is shriller than that of a domestic donkey.

II. General Review and Summary of Report

The Indian Wild Asses are handsome, zebra-like creatures. They live in a unique habitat, which has to be seen to be believed.

The human population round the borders of the Little Rann of Kutch are peaceful, vegetarian folk, who do not molest the wild asses beyond driving them away from their cultivations when crops are raided. Previous estimates of the numbers of the wild asses were given in 'thousands'. I actually saw 214 in five days, and in close consultation with the local Forest Officers I estimate them now at 870. This lower figure may be due either to earlier exaggerations of their numbers, or to the fact that diseases may have taken a toll of them, or to both.

It is evident that a number of them died of *surra*[1] in 1958 and in 1960, and that at least some had died during the recent epidemic of South African Horse Sickness in November and December, 1961.

A census is urgently required of these rare creatures and should be repeated annually or bi-annually. All possible precautions should be taken by the authorities against diseases prevalent among domestic horses and donkeys.

III. History of the Area

The Little Rann, which is the home of the wild ass, and most of the Great Rann, into whose eastern end a few asses may occasionally stray, used to form part of the princely state of Kutch. During this time, I understand, wild life was preserved by the rulers.

After India gained independence in 1947 this part of the country became the new State of Saurashtra. Later Saurashtra was merged with the larger Bombay State. More recently Bombay State has become divided into Maharashtra in the south and Gujarat in the north. So now Kutch is a district of Gujarat State.

The only serious expedition to obtain information on the wild asses was the one made by Sálim Ali in 1946. In his excellent and most valuable paper he has described how he visited the Little Rann from 24th February to 3rd March 1946, chiefly in order to obtain specimens for R. I. Pocock who was revising the Mammalia volumes of the FAUNA OF BRITISH INDIA. Sálim Ali again visited the Little Rann in 1960 to select places for field studies in bird migration.

Occasionally wild asses have been captured by running down and noosing from a moving vehicle, for zoos and to breed mules for the army. For example in February 1953, six were captured and sent to Jullunder. And in the old days, before the advent of the motor vehicle, spearing and capturing of wild asses were evidently done by relays of horsemen. No single horse, it is said, could keep up with them : only by changing horses and wearing down the wild asses could they be speared or captured. Gravid mares were the easiest to catch up with.

I was told that a pair was captured about thirty years ago by the princely family of Dhrangadhra, and trained to draw a carriage, and that they worked very well.

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[1] An arthropod-borne disease of horses and other animals caused by a protozoan blood parasite *Trypanosoma evansi*. The disease is almost always fatal to horses unless injection of arsenical preparations is given as a curative. Prophylactic doses give an immunity of about six months. Transmitted by various blood-sucking flies.—EDS.

IV. Geographical and Ecological

The Little Rann of Kutch, an area of about 1000 square miles, is a salt-impregnated, flat waste, only a foot or two above sea level. It is sometimes described as an old estuary, from which the sea has receded. It is completely dried up from about November to June when motor vehicles can travel over most of the surface quite easily, avoiding the darker patches which might be soft.

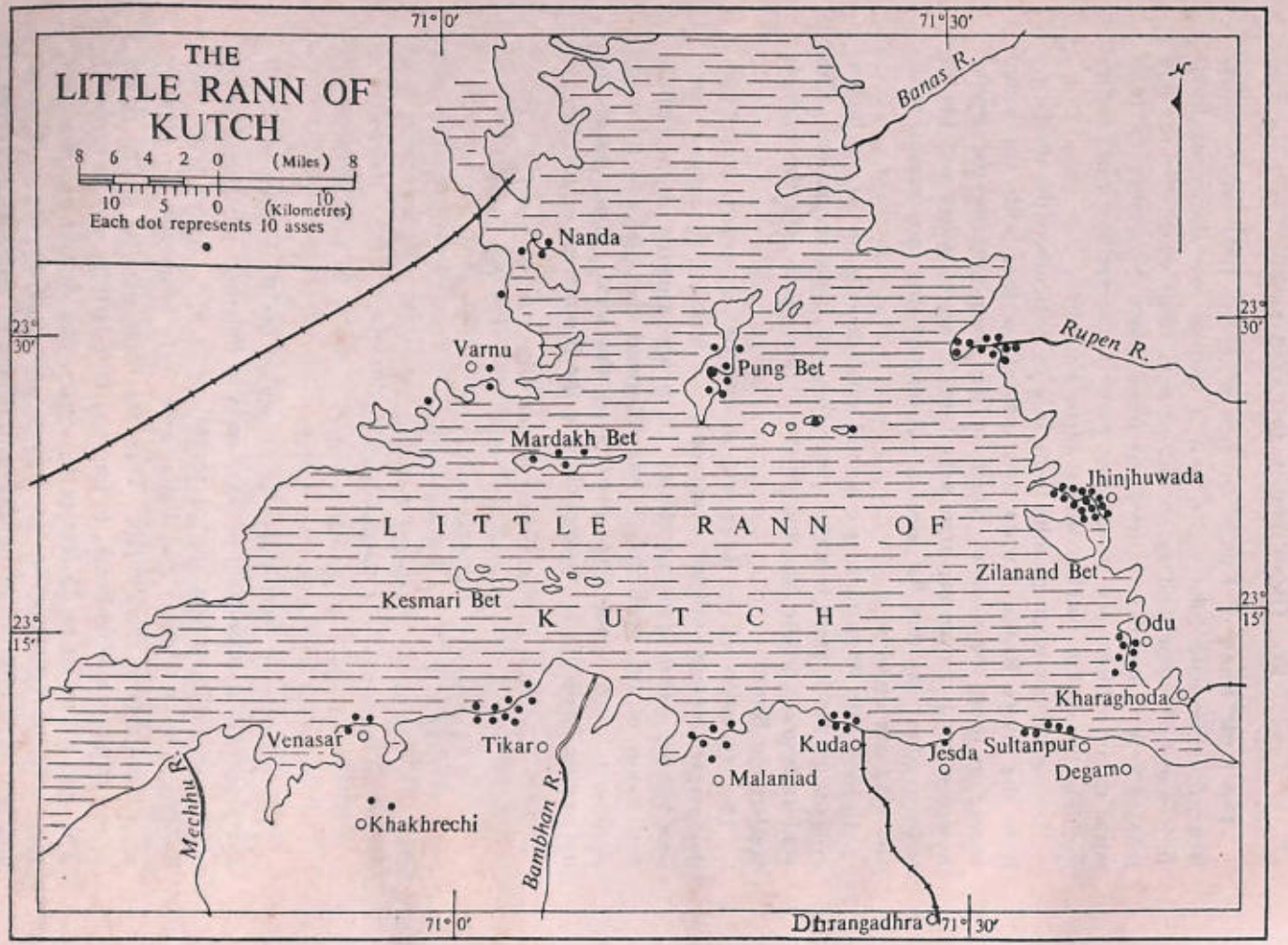
During the monsoon months from July to September, the discharge from the rivers Banas, Rupen and others, together with sea water blown up from the Gulf of Kutch in the south-west by the strong monsoon winds, cover the area with 1 or 2 feet of water and render it impassable. As this flat area is salt-impregnated, no vegetation of any kind can grow on it.

In the Little Rann there are several small islands or *bets* of higher ground, on which there is some sparse tree and grass vegetation. The wild asses graze on the *bets* and on the 'shores' of the mainland which borders the Rann.

The vegetation of the Rann and its environs is largely xerophytic, the average annual rainfall being only 13 inches. A common tree seen was the *babul*, *Acacia arabica*. Of grasses growing on the islands and shores of the mainland, I was informed that *thegado* (*Cyperus capillaris*) forms about three-quarters of the total. The grasses of the pasture lands of the villagers close to the Rann were said to be:

dabhado	*Eragrostis cynosuroides*	(30 per cent)
zinzvo	*Andropogon* spp.	(25 per cent)
kynyadi	*Andropogon laniger*	
khariga	*Sporobolus indicus*	
lampdos	*Aristida hystricula*	
kadvano	*Aeluropus villosus*	
julisenur	*Eragrostis ciliaris*	
dhrokad	*Cynodon dactylon*	

The planting of 3000 acres per annum in the Rann area in Kutch Division (plus another 1000 to 2000 acres in Palanpur Division nearby) of *Prosopis juliflora* was started several years ago. These trees were introduced from Mexico into India some forty years ago for planting up saline tracts in the Punjab. They are being planted on the shores of the Rann as a wind-break, to improve land fertility and as firewood. The tree grows 20 to 25 feet in ten years, and flowers twice a year. Its dry seed pods, but not its leaves, are eaten by the wild asses, and the seeds (500 to an ounce) grow from the animals' droppings—thus aiding the forest staff in their work.


THE
LITTLE RANN OF
KUTCH
8 6 4 2 0 (Miles) 8
10 5 0 (Kilometres) 10
Each dot represents 10 asses
71° 0'
71° 30'
23° 30'
23° 15'
Banas R.
Nanda
Varnu
Pung Bet
Rupen R.
Mardakh Bet
Jhinjhuwada
LITTLE RANN OF
Zilanand Bet
Kesmari Bet
KUTCH
Odu
Kharaghoda
Venasar
Tikar
Kudao
Jesda
Sultanpur
Degamo
Malaniad
Khakhrechi
Meehhu R.
Bambhan R.
Dhrangadhra

These plantations on the mainland border of the Little Rann will eventually change the terrain and ecology considerably, with an effect on the wild asses which it is hoped will not be injurious in any way. It may be beneficial to them.

Near Kuda and even more so in the vicinity of Kharaghoda, to which places two railways run, are extensive salt workings. Holes are dug at the edge of the Rann, and the white saline water extracted and run off into pans. After evaporation the salt is collected, forming quite a big industry.

V. Administrative and Political

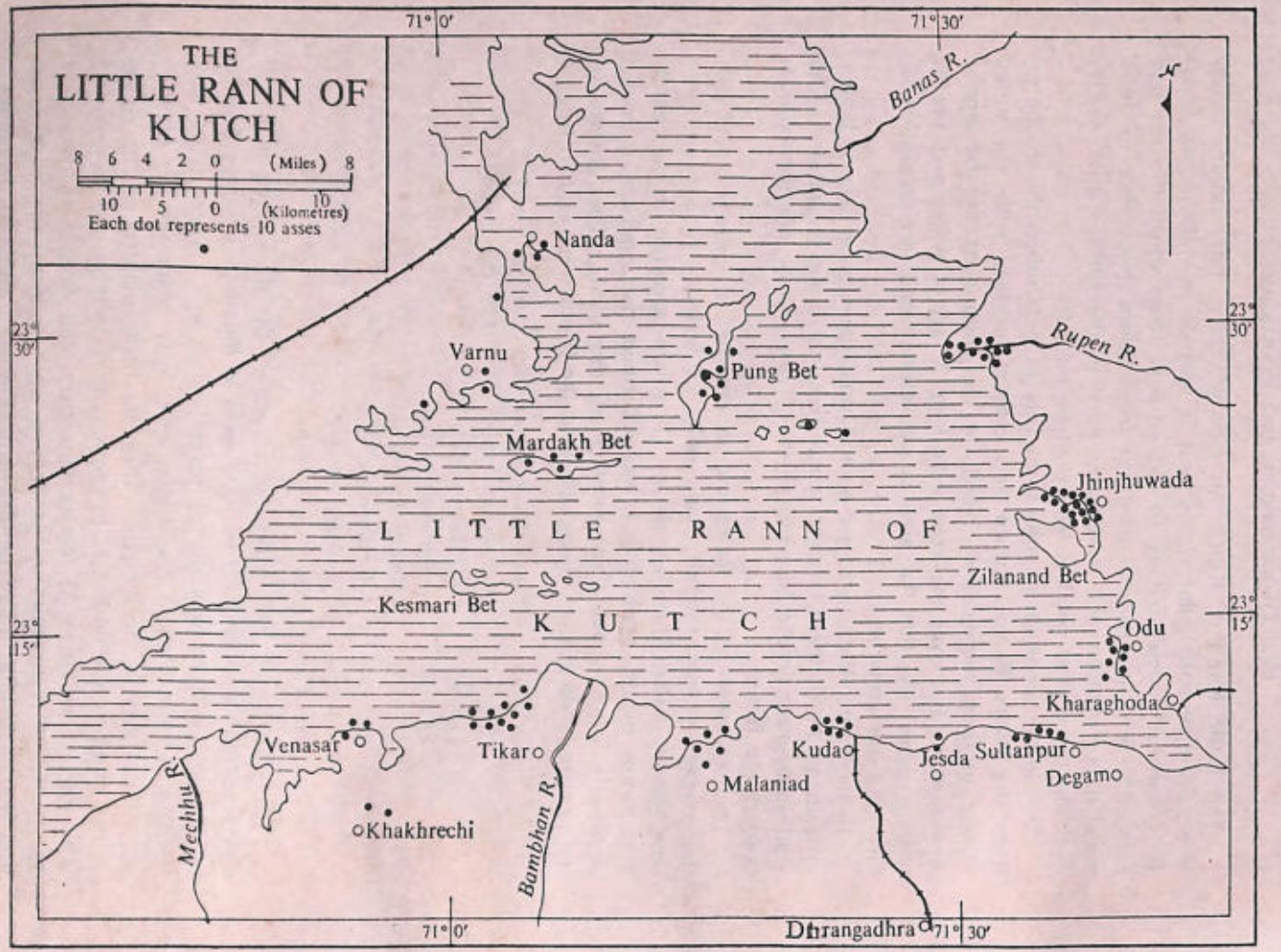
The responsibility for the preservation of wild life in the area, particularly the wild asses, mainly rests with the State Forest Department. In Gujarat there is a State Wild Life Officer, directly under the Chief Conservator of Forests.

The Divisional Forest Officer of Kutch Division, with headquarters at Bhuj, has jurisdiction over most of the Little Rann, up to 15 miles north of Jhinjhuwada. North of that point is Palanpur Division, under the DFO of that Division. Under the DFO of Kutch is a Range Officer stationed at Dhrangadhra, and under the latter officer is a Round Officer at Jhinjhuwada, as well as other subordinate staff. Their chief duty consists of planting and protecting the *Prosopis juliflora* trees.

The population of the environs of the Little Rann of Kutch, all Gujarati speaking, are vegetarian. They do not harm the wild asses or other wild life. In fact some of them are reputed to be so 'orthodox' that they are very reluctant to kill the locusts which devour their crops, but wish only to drive them away. One village, I was informed, does not allow even eggs to be eaten by others in the vicinity of their village. This belief in the sanctity of life has obvious advantages when the preservation of wild life is in question.

VI. General Account of the Survey

On 9th February 1962, a brief train stop at Baroda enabled me to discuss my proposed tour with Conservator of Forests, Shri S. R. Umbarje and the State Wild Life Officer, who came to meet me and brought my tour programme. This tour was to be rather short and circumscribed, I was informed, due to the fact that the DFO of Kutch and his jeep were required for the forthcoming Election. As


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there was no time to be lost, I continued my journey on the same train and arrived at Surendranagar about midnight. There I was met by Shri R. K. Rathod, DFO of Kutch, who had jeeped from Bhuj across the Little Rann to meet me. He had crossed the Rann via Kesmari Bet and other small *bets*, but had seen no wild asses. Shri P. G. Joshipura, Range Officer of Dhrangadhra, was also there to meet me.

At noon on 10th February we arrived at Dhrangadhra, which is very close to the Little Rann where we were to camp for at least one night. At 3 p.m. we jeeped the few remaining miles to the village of Kuda on the shore of the Rann and looked at a freshwater pond where a forest guard had seen 59 wild asses drinking on the previous afternoon. A little further on we saw herds of 22, 11 and 3 wild asses. They were very alert, usually keeping a sharp look-out for human approach.

I tried to observe carefully whether each herd had a leader or not, and particular 'look-out' animals. I noticed that two animals were slightly lame—probably due (I was told) to having stones thrown at them when they raided crops at night. As we drew near to each herd, it moved away from the undulating shore of the mainland, and made off on the flat and barren Rann.

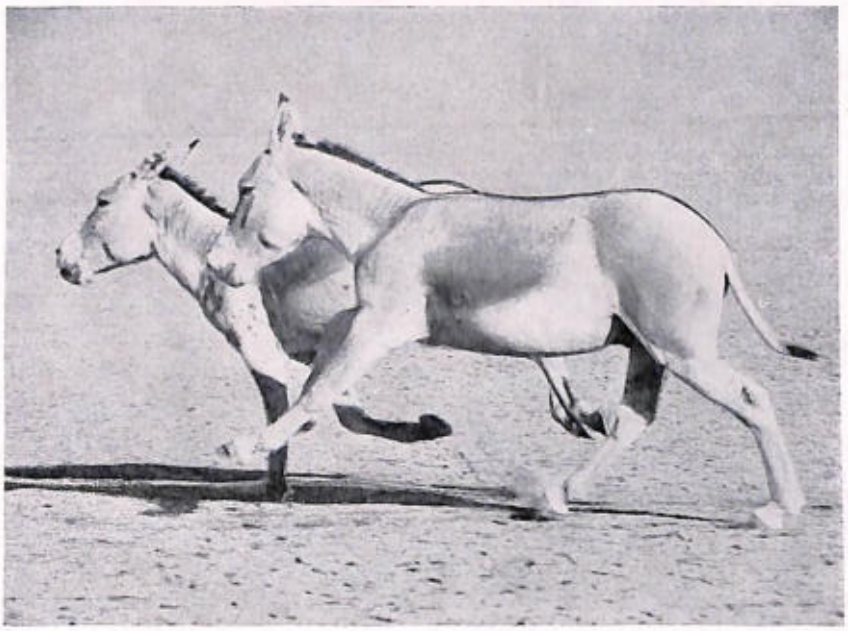
While we followed each herd as it galloped across the Rann, we were able to catch up quite easily in the jeep by doing 40 m.p.h. and then slowing down to 32 to 34 m.p.h. which is the maximum speed of the asses. The driver was instructed to drive to the left of each herd, so that I could observe and take photographs of the animals on my right.

The asses were not panicky—in fact they seemed almost to enjoy the gallop which is their normal method of evading enemies. Every now and then they would suddenly wheel to the right, away from the jeep, or to the left just in front of the jeep; and we had ourselves to stop and turn to the required direction if we wanted to follow them again. After a mile or two their speed would drop to about 28 m.p.h.

Whenever, during the course of our investigation we came to a sizeable village, I requested the DFO and RO to make inquiries about wild asses, especially whether any had died, and whether any domestic horses or donkeys had died from diseases. The information so collected is summarized later in the Report.

On 11th February we packed our belongings and set off on a journey along the south and up the east border of the Rann to the large *bet* of Zilanand (Jalander) and the nearby village of Jhinjhuwada.

The Indian Wild Ass



A close-up of two asses doing 32–34 m.p.h.



Young ones, about six months old, can be seen on the extreme left and right. Mirage effect in the distance, but no water.

Photos : E. P. Gee

Near Sultanpur we saw a herd of 22 wild asses, with two solitary ones wandering close by. I am not sure what is the reason for certain asses going solitary. Presumably they were oldish males, in either enforced or voluntary exile; but we noticed that they were always close to their herd and sometimes even rejoined it.

I tried to photograph one of these solitary ones by remaining hidden in a thorny thicket while the others of the party tried to drive the animal towards me. Several attempts ended in dismal failure, for the animal each time cleverly made off in another direction. Inevitably I had a feeling that I was the 'ass' and that the wild animal I was trying to capture on film was an alert and astute creature! Only by returning to the jeep and following the herd on to the Rann and photographing them at 32 to 34 m.p.h. at 1/1000 second shutter speed was I able to regain some of my self-respect! I was told by a smiling informant that on a certain occasion the local police had been detailed to drive the asses away from the cultivations they were raiding. The asses galloped out in front to the Rann with the police following behind in jeeps. On the return journey, which took place immediately, the order was reversed: the police were in front and the asses behind!

At Degam village we met the *sarpanch* (president of the village council) and the *panchayat* (council members), from whom we got much information. It was particularly fortunate that I could meet these men, as I was able to learn from them what the feelings of the local people were regarding the wild asses. With the help of the DFO and RO, who did the English-Gujarati Gujarati-English interpretation, I explained to them the value of the wild asses as a rare species found only in their part of India; how the animals could be a source of pride to them, and that they could perhaps tolerate some damage to their crops, in order that a valuable species might survive.

In other parts of the country, I explained, the lions of the Gir Forest caused some destruction to cattle, and the rhino of Assam and West Bengal raided rice fields—but the local people commendably tolerated this. The reactions of the council members were very gratifying : the *sarpanch* confirmed that the villagers only drove away the wild asses from their crops at night, and never harmed the animals. They were proud to be the only custodians of a rare species of India.

We drove past the extensive salt workings near Kharaghoda, and then, further north near the southern tip of Zilanand Bet, saw 60 wild asses in herds of 10, 7 and 43. In this area the mirage effects in the shimmering heat were even more striking than previously : asses seemed to be walking in water complete with their reflections, and the

bets seemed real islands in a real sea—though every yard of the Rann was dusty dry.

The next day, 12th February, we explored fresh terrain near Zilanand Bet on the north and east sides, and encountered wild asses in groups of 8, 7, 45 and 22. I found a carcase of a wild ass, about two or three months old, which I photographed. We glimpsed a frightened blackbuck—the only one on our tour. Earlier, on the mainland, we had seen two or three nilgai.

In Jhinjhuwada village we met, among others, the Veterinary Assistant and were able to get more authoritative information about deaths from diseases of wild asses, domestic horses, and donkeys during the past few years.

On the morning of 13th we met the Vet. again, and also the members of the village council. We obtained more information and as at Degam spoke about preservation of the wild asses—with very gratifying response. I feel certain that direct personal contact with these village *panchayats* is a very effective way of putting across the reasons and need for wild life preservation.

I longed for the opportunity to explore further, and to visit Pung Bet, but our time was circumscribed by the forthcoming Election for which the DFO had to return. So in the afternoon we jeeped back to Dhrangadhra by the route along which we had come. In the evening I made a special point of contacting the Veterinary Officer of Dhrangadhra, who had 60 villages under his charge. He informed me that from 15th November to 7th December 1961, no less than 392 domestic horses (and some donkeys) had been inoculated against South African Horse Sickness, a dose giving six months' immunity and costing Re. 1 each at Government expense. The vaccine is prepared in the brains of mice, one mouse providing 20 doses of 5 c.c. each.

It was interesting to learn that it was proposed to inoculate all domestic horses and donkeys by the end of September, 1962, for this disease breaks out in epidemic form from the end of the monsoon, chiefly in November.

During my survey I was able to contact the local military, including the Commanding Officer, for firing practice is often done at Kesmari Bet near Tikar. They stated that they had never seen any wild asses in that area, nor had they shot at any.

On 14th we paid a second visit to Kuda and its environs, and set up a hide near a freshwater drinking place in order to get a close-up view of the asses moving about freely and undisturbed. A herd could be seen about half a mile away, keeping a sharp look out in all

directions. The animals were much too clever to approach the hide. Once again a very strong conviction obsessed me that I, crouching uncomfortably in the hide in the heat of the day, was the 'ass' and once again my self-respect could only be restored by following the herd in the jeep. The usual thing happened: the asses galloped away to the safety of the Rann, and at 32 to 34 m.p.h. I took photographs of them at 1/1000 second shutter speed. They numbered 48 this time, but of these 36 may have been seen by us on the first day, so I added only 12 to the score!

Thus ended my brief field observations of the wild asses in their unique habitat.

VII. Distribution, Status, and Future of the Indian Wild Ass

Distribution. Wild asses appear to have once had a fairly wide distribution in the dry regions of North-West India and West Pakistan. During the last century they existed as far north as Jaisalmer and Bikaner of Rajasthan (India), and Sind and Baluchistan (West Pakistan).

Talbot (1960) was mistaken when he wrote of the wild asses: 'Most of them live in the Great Rann of Kutch, northward from Bombay . . .'. As far as I can ascertain, there are no wild asses actually in the Great Rann. Only a few stragglers are reported to pass along the eastern border of the Great Rann, presumably on their way to and from West Pakistan where a few animals have been reported.

I have been trying to check these reports of wild asses in West Pakistan, and have been in correspondence with Dr. A. R. Ranjha, Director of the Zoological Survey Department of Pakistan. From him has come information that a local *shikari* (sportsman) shot one in 1959, and that the *shikari* has stated that wild asses are found in the Nagarparkar and Chacro *tehsils* of Tharparkar District, which adjoins the (Great) Rann of Kutch on the Pakistan side, and are hunted by *shikaris*. The *shikari* also reports that between the Indian and Pakistani outposts the wild asses come over to the Pakistan side for grazing; that they move back to the open spaces of the Rann of Kutch in the morning, and live and breed on the Indian side of the border because they feel safe and free from molestation there; that no data regarding their population is available.

From Baluchistan the information is that the wild ass is no longer found at Tallab on the border of Kharan District, that it was 'originally met with in Balgatar (Makran) but is no longer found in

the contiguous areas of Buleda and Zamran . . . it was formerly met with between Panjgur and Sohtgaon areas but is now rare'.

Status. In 1946 Sálim Ali estimated the population of the Indian Wild Ass in the Little Rann of Kutch as 3000 to 5000. Later in 1960 (*in litteris*) he considered that the estimate given by the Range (Round ?) Officer of Jhinjhuwada of 2000 animals as 'probably not unreasonable'. Wynter-Blyth (1956) described the wild ass as 'more than abundant' and 'in his thousands' and 'undoubtedly very common'. When I mentioned these figures to the DFO and RO who accompanied me on my expedition, they both expressed surprise and gave much lower estimates.

After our tour along the southern and eastern borders of the Little Rann, where the District Forest Officer, the Round Officer, and I saw a total of 214 wild asses (Kuda 36, Sultanpur 24, South Zilanand 60, East and North Zilanand 82 and Kuda 12), the three of us sat down and made an estimate. They did the actual estimating, locality by locality. I was a 'sobering influence' on them, requesting them to be careful and conservative. Their estimate, which I accept is as follows:

Khakhrechi	20
Venesar	30
Tikar	100
Malaniad	60
Kuda	60
Jesda	20
Sultanpur	50
Odu	70
Jhinjhuwada and Zilanand Bet	150
Rupen River	100
Pung Bet and Kutch Mainland	200
Total	860

To this I have tentatively added 10 for the border of the east of the Great Rann and West Pakistan, making a grand total of 870.

Grand Total	870

In the Little Rann of Kutch the wild asses appear to be secure from danger as far as molestation and killing by man are concerned. Wolves are the only potential predator enemy, and these appear to have become very rare indeed.

Wild asses show a strong partiality to crops, raiding (in order of preference) gram, wheat, cotton, millet and *jowar*. They get driven

away from the fields when they enter them at night, and an occasional ass might become temporarily lame from stone throwing.

Although they have to compete with vast numbers of domestic cattle, sheep and goats for the little grass that there is, the asses are probably accustomed to such conditions and looked rotund and healthy in condition.

Diseases. The chief danger, as I see it, to the wild asses is undoubtedly their susceptibility to diseases contracted from domestic stock. Sálim Ali (1946) stated 'No epidemics appear to be known among the wild asses'; but in August, 1960, he informed me (*in litteris*): 'One disturbing bit of information the Ranger gave me is that quite recently 25 to 50 (to his knowledge) asses had died of a mysterious illness. The animals "turned round and round and fell dead".'

While in Jhinjhuwada we checked and confirmed this occurrence of 1960. In fact one forest guard stated categorically that in April to May 1960, he saw 30 dead carcases of wild asses, and heard of about 120 more; but no report had been made to higher authority. From the symptoms described, the Veterinary Assistant at Jhinjhuwada said this disease was almost certainly *surra*, and this was later confirmed by the Veterinary Officer of Dhrangadhra. The latter officer also stated that in 1958 at Jhinjhuwada six domestic horses died of *surra* and *surra* had been confirmed in two dead wild asses which had been brought in to him for post-mortem examination. There are no large scale inoculation arrangements for combating *surra*: apparently each dose costs Rs. 3.50 and the owner has to bear the expense.

Now for South African Horse Sickness. This disease apparently swept through the area under review in November and December, 1961. Personal inquiries at some of the villages we visited revealed the following deaths:

Village	*Horses*	*Donkeys*	*Wild Asses*
Kuda . . .	—	—	2
Nirali . . .	10-11	0	3
Degam . . .	12	0	5-6
Odu . . .	15	—	—
Jhinjhuwada . .	10-15	0	1

The Veterinary Officer at Dhrangadhra stated that as far as he knew wild asses rarely get anthrax and they are not susceptible to foot and mouth disease, hæmorrhagic septicæmia or rinderpest. Also that he had records of 78 horses and 6 donkeys dying of South African Horse Sickness in November and December 1961, but no knowledge of wild asses dying of this disease as these wild animals did not come

within his purview. Now it appears that at least some wild asses died at the time that South African Horse Sickness was prevalent and that no note was taken of this by the authorities.

Future. A careful system of reporting outbreaks of diseases among domestic horses and donkeys, and deaths of wild asses at the same time, needs to be instituted. Prophylactic measures against such outbreaks require the urgent attention of the authorities. It is gratifying to learn that steps are intended to be taken to immunize horses and donkeys against South African Horse Sickness.

A census of the wild asses should be conducted every year, or at least every two years. As the country is all open and the animals easily seen, this should not be difficult. The possibility of undertaking an aerial census should not be overlooked, and the co-operation of the Indian Air Force or of private flying clubs should be sought.

Wild asses, if captured young, seem to do well in captivity. Harper (1945) records that the breeding of captive wild asses from India was successfully carried out in Paris from 1842-1849; and that out of nine foals produced during this period, six survived in 1849. I saw a male ass in the Junagadh Zoo, and suggested that a female be procured and attempts be made to get them to breed there. In the Ahmedabad Zoo I saw a pair together in one enclosure, and an odd one by itself in another. The latter could well do with a mate.

It would be a reasonable conservation measure, in my opinion, to capture departmentally a few pairs of young wild asses and keep them in good zoos with a view to studying their life history and breeding them—in case anything serious should happen to the ones in the wild state.

VIII. Recommendations

I make the following recommendations:

1. That the Indian Wild Ass be officially placed on the list of fully protected animals by the Gujarat State Government, and that it be constituted State property wherever found.

2. That permits for capture of young ones be issued only for special reasons, for good zoos, and only by the Chief Conservator of Forests, Gujarat.

3. That a physical count (census) be done as soon as possible, and repeated annually, or at least at regular intervals of two years or three years.

4. That the Veterinary Department be moved to inoculate all domestic horses and donkeys in the area against South African

Horse Sickness each year by the end of September, and also against *surra* if possible.

5. That all outbreaks of diseases or other occurrences among the wild asses be observed and reported by the authorities concerned.

6. That a few pairs of young ones be humanely captured and kept in good zoos, for study and for breeding.

7. That a complete ecological study of the Indian Wild Ass and its environment be conducted by competent persons in the near future.

IX. Acknowledgements

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A Botanical Tour to Trikuta Hills

BY

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On the north-eastern horizon of Jammu-Tawi peeps a group of three peaks, commonly known as Trikuta Hills, under which lies the cave of the sacred shrine of Shri Vaishnodevi. Situated at 5300 ft. above sea-level, the shrine is held in high esteem by the Hindus, and people from all over India come to the holy cave to worship. Devotees have to ascend to 6150 ft. and then to descend about 750 ft. on the other side of the hill, where a narrow 100 ft. long entrance leads to the Deity. The pilgrimage attended by tens of thousands of people every year continues from mid-October to December or even January, till heavy snow-fall makes access difficult.

The authors, who were on a study tour to Trikuta Hills while making their botanical collections, were asked many questions about the utility of the plants growing all along the way to Shri Vaishnodevi. This prompted them to write the present paper.

Situated at 34° N., 74° E., Trikuta Hills are included in the 'Outer Hills' division of geographical divisions of the Jammu and Kashmir State. A large portion of this 'Outer Hills' lies at an altitude between 2000 and 4000 ft., but the highest among the three peaks reaches a maximum height of 7000 ft. With such variations in altitude, wide differences in temperature are inevitable and climatic conditions differ widely. At the higher elevations on the mountain slopes and 'margs' the climate is cold, and at the lower elevations on the plains it is warmer. July-August receive the maximum rainfall, the average annual rainfall ranging between 55 in. and 60 in.

Katra, the base of the hill, is 29 miles north-east of Jammu-Tawi. It is connected by a first class tarred road with the main Jammu-Srinagar road. From Katra, two routes lead to the hill, a bridle-path (11 miles) and a foot path (7 miles) which is very steep.

The botanical tour was undertaken along the bridle-path in the month of November, 1960.

As the motor route leads from Jammu (900 ft.) to Ramnagar on the main Jammu-Srinagar road, the forest flora comes into view. The *Phulai-Khair* (*Acacia modesta* Wall.-*A. catechu* Willd.) associa-

tion dominates and at some places is interrupted by the deciduous *Kachnar* (*Bauhinia variegata* Linn.) trees. Among the other trees and shrubs which go into the formation of the forest flora are *Harsinghar* (*Nyctanthes arbor-tristis* Linn.), *Ber* (*Zizyphus mauritiana* Lamk.), and *Lantana camara* Linn. The white-flowered *Vasaka* (*Adhatoda vasica* Nees) forms the forest undergrowth, and the ground cover is composed of such herbaceous plants as *Kanjuna* (*Commelina obliqua* Buch.-Ham. ex D. Don), and *Gul-doda* (*Leucas cephalotes* Spreng.).

Nearing Nagrota (1100 ft.) the frequency of *Phulai-Khair* association is replaced by the *Khair-Tali* (*Dalbergia sissoo* Roxb.) association. Much of the greenery of this area is contributed by many large shrubs, which cover most of the otherwise naked area. Common among them are *Dhawi* (*Woodfordia fruticosa* Kurz), *Villebrunea frutescens* Blume, *Carissa opaca* Stapf, and *Colebrookea oppositifolia* Smith, while *Adhatoda vasica* Nees and *Lantana camara* Linn. grow in abundance on both sides of the road.

At Nagrota (1300 ft.) instead of much greenery there is scanty vegetation. The lower slopes, or popularly called dragon peaks all around are strewn with boulders and in between them grow *Sanatta* (*Dodonaea viscosa* Linn.) and *Carissa opaca* Stapf. The former species, which is the commonest and most conspicuous plant in the area, becomes gregarious at places, often to the exclusion of other species. *Dodonaea* and *Carissa* are abundant all around, while *Bana* (*Vitex negundo* Linn.) with its blue-purple flowers is also observed growing in small patches.

Further onwards, at Nandini (1800 ft.) the climatic conditions change to that of moist locality, where stunted trees of Chir pine (*Pinus roxburghii* Sar.) make their appearance.

Higher up about 2000 ft. above sea-level at Domel, the route deviates from the main Jammu-Srinagar road, and zigzags further in the east for about 8 miles, where Chir forms pure forest over extensive areas and is tapped for resin. While Chir pines confine themselves to the hill-tops and other similar habitats, *Wendlandia exserta* DC. grows in abundance on the steep rocky slopes. The undergrowth beneath the Chir is mainly of evergreen shrubs like *Dodonaea viscosa* Linn., *Colebrookea oppositifolia* Smith, *Carissa opaca* Stapf, and *Sakena* (*Indigofera pulchella* Roxb.), and the forest floor is covered with *Lotus corniculatus* Linn., *Desmodium triflorum* DC., and *Oxalis corniculata* Linn.

Further onwards, nearing Katra, at an altitude between 2200 and 2700 ft., the vegetation again becomes scanty and is represented by the fleshy cactus-like *Dudal-petal* (*Euphorbia royleana* Boiss.).

The town of Katra has no special features of vegetation, except for much biotic interference which has resulted in extreme dry conditions. The major components of the vegetation in this area are such armed trees and shrubs as *Zanthoxylum*, *Zizyphus*, *Euphorbia*, and *Lantana* species.

The path from Katra (2700 ft.) to the steady flowing stream Banganga (2200 ft.) is a steep descent of about 500 ft. through barren limestone rocks and, among the various sedges and grasses that line the way, the commonest are *Kai* (*Eriophorum comosum* Nees) and *Chrysopogon aucheri* (Boiss.) Stapf.

Climbing the hill begins at Banganga itself and requires about six hours' steady climb through an eleven-mile long winding path. Considerable change in the main composition of the vegetation is observed at different levels on the route. As the flora changes with the change in altitude, new and beautiful flowers come into view. The vegetation on the Banganga-Adhkanwari (2200-4300 ft.) sector shows remarkable uniformity and consists mainly of shrubs and herbs. Trees are few in this area and wherever present are represented by *Simul* [*Salmalia malabarica* (DC.) Schott. & Endl.], *Ber* (*Zizyphus mauritiana* Lamk.), and *Mallotus philippinensis* Muell.-Arg. while among the shrubby elements cactus-like *Euphorbia royleana* Boiss. grows in abundance on hilly slopes, and *Timru* (*Zanthoxylum alatum* Roxb.) along with *Berberis lycium* Royle, *Debregeasia hypoleuca* Wedd., and *Boehmeria platyphylla* D. Don, on the exposed rocky surfaces; the shrubby element is composed of the yellow-flowered *Crotalaria sericea* Retz. and the blue-flowered *Hamiltonia suaveolens* Roxb. The appearance of dense green vegetation in the locality is due to a number of climbers and twiners that interweave between the trees and shrubs, namely *Butterbail* (*Cissampelos pareira* Linn.), *Chambeli* (*Jasminum grandiflorum* Linn.), and a yellow-flowered *Clematis* Linn. Pink-flowered *Micromeria biflora* Benth. along with *Dicliptera roxburghiana* Nees, and *Galium rotundifolium* Linn., inhabit the moist crevices of the rocks, while the common lithophytes in the area are *Polygala abyssinica* R. Br., *Gidar-tamaku* (*Verbascum thapsus* Linn.), species of *Conyza* and *Lactuca* Linn., *Pennisetum orientale* L. C. Rich., *Arundinella nepalensis* Trin., and *Arundinella pumila* Steud.

As the predominantly shrubby and herbaceous vegetation of the previous area is gradually passed, at an elevation of 4400 ft. (Hathimatha-Chhangichhat sector) the Chir pines become more and more dominant. Shrubs are few and are represented by the yellow-flowered *Hypericum cernuum* Roxb. and the pale purple-flowered *Lespedeza juncea* Pers. on hill slopes, while the herbaceous elements

are represented by the cream-coloured *Dipsacus inermis* Wall., dark blue *Gentiana kurroo* Royle, along with many members of the Compositae family, the commonest among which are the white-flowered *Anaphalis triplinervis* Sims ex C. B. Clarke, purple-flowered *Artemisia roxburghiana* Besser., and the pale yellow-flowered Phoss (*Cnicus wallichii* DC.).

The path from Chhangichhat (the highest point at 6150 ft. above sea-level) to Vaishnodevi is a steady descent on the other side of the hill to 5300 ft. at Vaishnodevi. The open dry vegetation of the previous zone is gradually replaced by the moist evergreen vegetation thickly covering the soil. While the Conifer trees occupy the hill-tops, the lower slopes have a rich representation of *Ilex dipyrena* Wall., *Cedrela serrata* Royle, *Litsaea umbrosa* Nees, and many other trees of the temperate climate. *Sarcococca pruniformis* Lindl., along with *Senecio rufinervis* DC. and *Lonicera quinquelocularis* Hardw., form the undercover and common climbers like *Smilax aspera* Linn., *S. parvifolia* Wall., and *Dioscorea deltoidea* Wall. add to the density of the flora. *Hedera helix* Linn. with its green berries is a common sight on the trees. Multicoloured patches of low and prostrate herbs like *Triflora* Linn., *Wulfenia* Jacq., *Potentilla* Linn., and *Polygonum* Linn. along with abundant mosses and ferns cover the floor and the white-flowered *Pissumar* (*Boeninghausenia albiflora* Reich.) imparts a characteristic beauty to the locality.

Plants of Economic Importance

A careful perusal of the census list of the collected plants will show that about 50% of the plants growing in this region are, or are reputed to be, of economic importance.

The tubers of *Dioscorea deltoidea* contain 4.8% of Diosgenin which forms the base material for the manufacture of cortisone and other sex hormones. The tubers are in considerable demand by the pharmaceutical industry.

The roots of *Cissampelos pareira* contain among other alkaloids a working percentage of hyatin which possesses and almost equal degree of curari-form activity to that of d-tubocurarine.

The roots, leaves, and flowers of *Adhatoda vasica* are used in Indian medicine for treatment against cough, bronchitis, asthma, and phthisis. An active principle vaccine isolated from this plant is of therapeutic use. Similarly *Pinus roxburghii* is utilized for tapping resin for the manufacture of rosin and turpentine and this is a well-established industry of the State. In addition to the commercial importance of the timber, the pine needles yield an essential oil

which can be used as a disinfectant. The exhausted needles after a simple treatment can be used as fibre for making ropes, mats, etc. The flowers of *Jasminum grandiflorum*, *Nyctanthes arbor-tristis*, *Lantana camara* yield essential oils for cosmetic or other purposes. The essential oils from *Zanthoxylum alatum*, *Vitex negundo*, and *Boeninghausenia albiflora* have reputed insecticidal and insect-repellent properties which can be usefully employed as an important ingredient with other disinfectants or insecticides. Some plants, such as *Acacia* sp., yield tanning material while others such as *Rumex* sp. and *Cassia* sp. contain chrysophanic acid. The above plants have known active principles with therapeutic activities. Many others in the list which have not been worked out chemically may yield still more interesting results if systematically analysed. Plants which are of established or possible economic importance are marked with asterisks in the census list.

Systematic Census

Ranunculaceae

*** Clematis graveolens** Lindl.
Banganga-Adhkanwari zone, 2700 ft.
A climbing shrub with pale-green flowers.

Thalictrum pedunculatum Edgew.
Banganga-Adhkanwari zone, 4300 ft.
A slender herb with greenish flowers.

Menispermaceae

*** Cissampelos pareira** Linn.
Ver. Name : *Butterbail*
Banganga-Adhkanwari zone, 4300 ft.
A climbing shrub with fruits.

Berberidaceae

Berberis lycium Royle
Ver. Name : *Simblu.*
Banganga-Adhkanwari zone, 4300 ft.
An armed shrub with fruits.

Polygalaceae

Polygala abyssinica R. Br.
Banganga-Adhkanwari zone, 4300 ft.
An erect herb on rocks with purple-marked pink flowers.

Polygala erioptera DC.
Ramnagar, 1000 ft.
An erect herb with yellow flowers.

CARYOPHYLLACEAE

Silene falconeriana Benth.
Bhairoghati-Vaishnodevi zone, 5900 ft.
An erect herb with purple-marked green flowers.

HYPERICACEAE

Hypericum cernuum Roxb.
Hathimatha-Chhangichhat zone, 6150 ft.
A shrub with bright yellow flowers.

MALVACEAE

* **Salmalia malabarica** (DC.) Schott. & Endl. *Bombax malabaricum* DC.
Banganga-Adhkanwari zone, 2750 ft.
A tall deciduous tree common in the area.

TILIACEAE

* **Corchorus aestuans** Linn.
Ver. Name: *Titapat.*
Ramnagar, 1100 ft.
A tall herb with orange flowers.

GERANIACEAE

* **Oxalis corniculata** Linn.
Ver. Name: *Amlika.*
Domel, 2000 ft.
A prostrate herb among grasses with yellow flowers.

RUTACEAE

* **Boeninghausenia albiflora** Reich.
Ver. Name: *Pissumar.*
Bhairoghati-Vaishnodevi zone, 4300 ft.
A much-branched shrub with white flowers.

* **Zanthoxylum alatum** Roxb.
Ver. Name: *Timru.*
Banganga-Adhkanwari zone, 4300 ft.
A shrub armed with prickles.

MELIACEAE

Cedrela serrata Royle

Ver. Name : *Tuni.*
Bhairoghati-Vaishnodevi zone, 5900 ft.
A medium-sized tree common in the area.

ILICINEAE

Ilex dipyrena Wall.

Ver. Name : *Kanderu.*
Bhairoghati-Vaishnodevi zone, 5300 ft.
An evergreen tree with scarlet fruit.

RHAMNACEAE

* **Zizyphus mauritiana** Lamk. *Z. jujuba* Lamk.

Ver. Name : *Ber.*
Ramnagar, 1000 ft.
An armed tree common in the area.

AMPELIDACEAE

* **Leea robusta** Roxb. *L. aspera* Wall.

Banganga-Adhkanwari zone, 4600 ft.
A straggling shrub with black fruits.

SAPINDACEAE

* **Dodonaea viscosa** Linn.

Ver. Name : *Sanatta.*
Nagrota, 1200 ft.
An evergreen shrub, abundant throughout the area.

LEGUMINOSAE

* **Crotalaria sericea** Retz.

Ver. Name : *Jhunjhunia.*
Banganga-Adhkanwari zone, 2700 ft.
An erect villous herb with yellow flowers.

* **Trifolium pratense** Linn.

Bhairoghati-Vaishnodevi zone, 5300 ft.
A procumbent herb with pink flowers in terminal corymbs.

* **Lotus corniculatus** Linn.

Domel, 2000 ft.
A prostrate herb with greenish yellow flowers.

* **Indigofera pulchella** Roxb.

Ver. Name : *Sakena.*
Domel, 2000 ft.
A deciduous shrub. Common in the area.

* **Tephrosia purpurea** Pers.
Ver. Name : *Sarbank.*
Banganga-Adhkanwari zone, 3900 ft.
An undershrub with fruits.

Lespedeza juncea Pers.
Hathimatha-Chhangichhat zone, 6150 ft.
An undershrub with pale purple flowers.

* **Desmodium gangeticum** DC.
Ver. Name : *Kanthi*
Ramnagar, 1100 ft.
A slender suberect shrub, with fruits.

* **Dalbergia sissoo** Roxb.
Ver. Name : *Tali.*
Nagrota, 1100 ft.
An erect tree, with pods.

* **Cassia tora** Linn.
Ver. Name : *Herwanh.*
Ramnagar, 1100 ft.
A glabrous annual weed, with long slender pods,

* **Cassia mimosoides** Linn.
Ramnagar, 1100 ft.
A diffuse perennial herb, with orange flowers.

* **Bauhinia vahlii** W. & A.
Ver. Name : *Bari Kachnar.*
Ramnagar, 1100 ft.
A climbing tree.

* **Bauhinia variegata** Linn.
Ver. Name : *Kachnar.*
Ramnagar, 1100 ft.
A medium-sized deciduous tree.

* **Acacia arabica** (Lamk.) Willd.
Ver. Name : *Kikar.*
Ramnagar, 1100 ft.
A medium-sized tree with yellow flowers.

* **Acacia catechu** Willd.
Ver. Name : *Khair.*
Nandini, 1800 ft.
A medium-sized deciduous tree, with pods.

Acacia modesta Wall.
Ver. Name : *Phulai.*
Ramnagar, 1000 ft.
A medium-sized tree with pods.

ROSACEAE

Rubus ellipticus Smith

Banganga-Adhkanwari zone, 4200 ft.
A straggling armed shrub.

Rubus lasiocarpus Smith

Bhairoghati-Vaishnodevi zone, 5700 ft.
A straggling armed shrub.

***Potentilla supina** Linn.

Bhairoghati-Vaishnodevi zone, 5300 ft.
A weak annual herb with yellow flowers.

COMBRETACEAE

***Terminalia belerica** Roxb.

Ver. Name : *Bahera.*
Nandini, 2000 ft.
A large deciduous tree with fruits.

LYTHRACEAE

***Woodfordia fruticosa** (Linn.) Kurz. *W. floribunda* Salisb.

Ver. Name : *Dhawi.*
Ramnagar, 1100 ft.
A pubescent shrub, common on rocks.

ARALIACEAE

***Hedera helix** Linn.

Ver. Name : *Banda.*
Bhairoghati-Vaishnodevi zone, 5900 ft.
A creeping shrub with fruits, common on trees and rocks.

CAPRIFOLIACEAE

Lonicera quinquelocularis Hardw.

Bhairoghati-Vaishnodevi zone, 5700 ft.
An erect shrub, with white translucent berries.

RUBIACEAE

Wendlandia exserta DC.

Domel, 2000 ft.
An evergreen tree, abundant on steep slopes.

***Hamiltonia suaveolens** Roxb.

Ver. Name : *Fisauni.*
Bhairoghati-Vaishnodevi zone, 5400 ft.
A shrub with blue flowers.

Galium rotundifolium Linn.

Banganga-Adhkanwari zone, 4300 ft.
A decumbent herb with fruits.

DIPSACACEAE

Dipsacus inermis Wall.

Hathimatha-Chhangichhat zone, 6150 ft.
An erect herb with pale yellow flowers.

COMPOSITAE

Conyza stricta Willd.

Banganga-Adhkanwari zone, 4100 ft.
A pubescent herb with yellowish heads.

Anaphalis triplinervis Sims ex C. B. Clarke

Hathimatha-Chhangichhat zone, 6000 ft.
An erect herb with white heads.

* **Bidens pilosa** Linn.

Domel, 1700 ft.
An erect herb with yellowish heads.

* **Artemisia vulgaris** Linn.

Ver. Name: *Tithban.*
Bhairoghati-Vaishnodevi zone, 5800 ft.
A tall aromatic herb with dirty white heads.

Artemisia roxburghiana Besser.

Hathimatha-Chhangichhat zone, 6150 ft.
An erect aromatic herb with dull purple heads.

Senecio rufinervis DC.

Bhairoghati-Vaishnodevi zone, 5300 ft.
A shrub with yellow flowers in heads.

Cnicus wallichii Hook. f.

Ver. Name: *Phoss.*
Hathimatha-Chhangichhat zone, 6050 ft.
A spinescent erect herb with dull yellow heads.

Saussurea albescens Hook. f. & Th. ex C. B. Clarke

Bhairoghati-Vaishnodevi zone, 5700 ft.
An erect herb with red heads.

* **Lactuca heyneana** DC.

Banganga-Adhkanwari zone, 4500 ft.
A tall glabrous herb with yellow heads.

OLEACEAE

* **Jasminum grandiflorum** Linn.

Ver. Name: *Chambeli.*
Banganga-Adhkanwari zone, 3100 ft.
A large climbing shrub with fruits.

* **Nyctanthes arbor-tristis** Linn.
Ver. Name : *Harsinghar.*
Ramnagar, 1000 ft.
A shrub with cream-coloured flowers.

APOCYNACEAE

Carissa opaca Stapf. *C. spinarum* Auct.
Nandini, 1900 ft.
An armed shrub with fruits.

* **Nerium indicum** Mill. *N. odorum* Soland.
Ver. Name : *Kaner.*
Nandini, 2000 ft.
An erect shrub or small tree with fruits.

ASCLEPIADACEAE

* **Pergularia daemia** (Forsk.) Chiov. *Daemia extensa* R. Br.
Ver. Name : *Dodli.*
Ramnagar, 1000 ft.
A twining herb. Common in the locality.

GENTIANACEAE

* **Gentiana kurroo** Royle
Ver. Name : *Nilakant.*
Hathimatha-Chhangichhat zone, 6000 ft.
A reclining herb with blue flowers.

BORAGINACEAE

* **Trichodesma indicum** R. Br.
Ver. Name : *Chhota kulpha.*
Nandini, 1900 ft.
An annual herb with blue flowers.

SOLANACEAE

Solanum pseudo-capsicum Linn.
Banganga-Adhkanwari zone, 4200 ft.
An erect much-branched shrub with flowers.

* **Physalis minima** Linn.
Ver. Name : *Habbikaknaj.*
Ramnagar, 1100 ft.
An erect pubescent herb with yellow flowers.

SCROPHULARIACEAE

* **Verbascum thapsus** Linn.
Ver. Name : *Gidar-tamkau.*
Banganga-Adhkanwari zone, 4200 ft.
An erect herb with yellow flowers.

Wulfenia amherstiana Benth.

Bhairoghati-Vaishnodevi zone, 5600 ft.
A glabrous herb with purplish blue flowers.

ACANTHACEAE

Strobilanthes dalhousianus C.B. Clarke

Hathimatha-Chhangichhat zone, 6150 ft.
An erect shrub with dark blue flowers.

* **Barleria cristata** Linn.

Ver. Name : *Tadrelu.*
Banganga-Adhkanwari zone, 4200 ft.
An erect undershrub, with pinkish flowers.

Lepidagathis cuspidata Nees

Banganga-Adhkanwari zone, 3500 ft.
A much-branched shrub. Common in the area.

* **Adhatoda vasica** Nees

Ver. Name: *Vasaka.*
Ramnagar, 1000 ft.
An evergreen shrub. Abundant in undergrowth.

* **Dicliptera roxburghiana** Nees

Ver. Name : *Bouna.*
Banganga-Adhkanwari zone, 3700 ft.
A diffuse herb with pink flowers.

VERBENACEAE

* **Lantana camara** Linn.

Ramnagar, 1000 ft.
A large evergreen shrub with orange flowers.

* **Vitex negundo** Linn.

Ver. Name: *Bana.*
Nagrota, 1300 ft.
A large shrub with blue purple flowers.

LABIATAE

Plectranthus coetsa Buch.-Ham. ex D. Don

Banganga-Adhkanwari zone, 4300 ft.
An aromatic shrub with lavender-blue flowers.

Plectranthus rugosus Wall.

Banganga-Adhkanwari zone, 4100 ft.
An erect shrub with white flowers.

* **Colebrookea oppositifolia** Smith

Ver. Name : *Shakkardana.*
Banganga-Adhkanwari zone, 3900 ft.
An erect tomentose shrub with fruits.

* **Origanum vulgare** Linn.
Ver. Name : *Mirzanjosha.*
Banganga-Adhkanwari zone, 4500 ft.
An erect herb with purple flowers.

Micromeria biflora Benth.
Nandini, 1700 ft.
An erect shrub with pink flowers.

* **Stachys sylvatica** Linn.
Bhairoghati-Vaishnodevi zone, 5000 ft.
An erect herb with pink flowers.

* **Leucas cephalotes** Spreng.
Ver. Name : *Gul Doda.*
Ramnagar, 1000 ft.
An erect herb with white flowers.

Teucrium quadrifarium Buch.-Ham.
Banganga-Adhkanwari zone, 4200 ft.
A stout herb with pink flowers.

NYCTAGINACEAE

* **Boerhavia diffusa** Linn.
Ver. Name : *Punarnava.*
Ramnagar, 1100 ft.
A diffusely-branched shrub with reddish flowers.

AMARANTHACEAE

* **Amaranthus spinosus** Linn.
Ver. Name : *Katailichuli.*
Ramnagar, 1000 ft.
An erect, spinescent herb with spikes.

Pupalia lappacea Juss.
Ramnagar, 1000 ft.
A large straggling undershrub with fruit.

* **Achyranthes aspera** Linn.
Ver. Name : *Kutri.*
Ramnagar, 1000 ft.
A straggling undershrub, with dull green flowers.

* **Achyranthes bidentata** Bl.
Ramnagar, 1000 ft.
A straggling undershrub, with flowers on elongated spikes.

POLYGONACEAE

* **Polygonum alatum** Buch.-Ham. ex D. Don
Bhairoghati-Vaishnodevi zone, 5600 ft.
A procumbent herb with fruits in pink heads.

Rumex hastatus D. Don
Banganga-Adhkanwari zone, 4300 ft.
A much-branched herb with fruits.

LAURACEAE

Litsaea umbrosa Nees

Bhairoghati-Vaishnodevi zone, 5400 ft.
A small-sized tree.

EUPHORBIACEAE

* **Euphorbia hypericifolia** Linn.

Ver. Name : *Hazardana.*
Ramnagar, 1000 ft.
A decumbent annual with pale pink flowers.

* **Euphorbia royleana** Boiss.

Ver. Name : *Dudal petal.*
Katra, 2700 ft.
A fleshy cactus-like tree. Abundant on hill slopes.

Sarcococca pruniformis Lindl. *S. saligna* Muell.-Arg.

Ver. Name: *Sanglu.*
Bhairoghati-Vaishnodevi zone, 5300 ft.
An evergreen shrub with male and female flowers.

Mallotus philippinensis Muell.-Arg.

Ver. Name : *Kamila.*
Banganga-Adhkanwari zone, 3300 ft.
A small evergreen tree with pale green flowers.

URTICACEAE

* **Ficus rumphii** Blume

Ver. Name : *Paker.*
Nandini, 2000 ft.
A large tree with fruits.

Boehmeria platyphylla D. Don

Banganga-Adhkanwari zone, 4400 ft.
A large shrub with fruits.

Villebrunea frutescens Blume

Nagrota, 1100 ft.
A small tree.

Debregeasia hypoleuca Wedd.

Banganga-Adhkanwari zone, 4600 ft.
A softly pubescent shrub.

CONIFERAE

* **Pinus roxburghii** Sar. *P. longifolia* Roxb.

Ver. Name : *Chir.*
Nandini onwards.
A large tree with cones, abundant on hilly slopes.

DIOSCOREACEAE

* **Dioscorea deltoidea** Wall.

Ver. Name : *Kins.*
Bhairoghati-Vaishnodevi zone, 5500 ft.
A twining herb in fruit. Common, on shrubs in moist shady places.

LILIACEAE

Smilax parviflora Wall.

Bhairoghati-Vaishnodevi zone, 5600 ft.
A climbing shrub with blue-black berries.

* **Smilax aspera** Linn.

Bhairoghati-Vaishnodevi zone, 5700 ft.
A climbing shrub with blue-black berries.

* **Asparagus adscendens** Roxb.

Ver. Name : *Sansar-pawr.*
Banganga-Adhkanwari zone, 4300 ft.
A straggling shrub with red berries.

***Gloriosa superba** Linn.

Ver. Name : *Kalihari.*
Nagrota, 1400 ft.
A straggling herb with yellow flowers changing gradually to scarlet.

COMMELINACEAE

***Commelina obliqua** Buch.-Ham. ex D. Don

Ver. Name : *Kanjuna.*
Ramnagar, 1000 ft.
An erect herb, with blue flowers.

CYPERACEAE

Eriophorum comosum Nees

Ver. Name : *Kai.*
Banganga-Adhkanwari zone, 2200 ft.
A sedge in flowers. Common on dry rocks.

GRAMINEAE

Arundinella pumila Steud.

Banganga-Adhkanwari zone, 4300 ft.
An erect grass, with spikes.

***Arundinella nepalensis** Trin.

Banganga-Adhkanwari zone, 4000 ft.
A slender, erect grass.

Pennisetum orientale Rich.

Banganga-Adhkanwari zone, 4100 ft.
A perennial grass.

Apluda mutica Linn.

Banganga-Adhkanwari zone, 4200 ft.
A leafy perennial grass.

Chrysopogon aucheri (Boiss.) Stapf.

Ramnagar, 1000 ft.
A tall grass. Frequent.

Themeda anathera (Nees ex Steud.) Hack.
Ver. Name : *Babraka.*
Banganga-Adhkanwari zone, 4200 ft.
An erect grass with fruits in spikes.

Oryzopsis aequiglumis Duthie
Bhairoghati-Vaishnodevi zone, 5600 ft.
A tall perennial grass.

Arundinaria falcata Nees
Bhairoghati-Vaishnodevi zone, 5600 ft.
A tall grass. Common in forest undergrowth.

FILICINEAE

POLYPODIACEAE

* **Adiantum caudatum** Linn.
Ver. Name : *Adhsarita-Ka-Jari.*
Nandini, 2000 ft.
A common fern of moist shady places.

Onychium japonicum Kurz
Bhairoghati-Vaishnodevi zone, 5700 ft.
A common fern, on moist shady places.

Pteris cretica Linn.
Bhairoghati-Vaishnodevi zone, 5700 ft.
A fern, frequent on moist shady places.

Polystichum aculeatum Sw.
Bhairoghati-Vaishnodevi zone, 5700 ft.
A fern, abundant on moist shady places.

ACKNOWLEDGEMENT

The authors wish to express grateful thanks to Dr. I. C. Chopra, Deputy Director, Regional Research Laboratory, for his keen interest and encouragement in this project, and for providing various facilities.

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The Birds of the Maldive Islands, Indian Ocean

BY

W. W. A. PHILLIPS

(With two maps and three plates)

INTRODUCTION

Until a few years ago almost the only information available in connection with the ornithology of the Maldivian Archipelago was contained in the rather brief notes of Gadow & Gardiner (1903) where 24 species of birds were listed, some of them rather doubtfully, as occurring in the Maldives. Then, during the three months of December 1956 to February 1957, the author visited the capital, Malé, situated in North Malé Atoll and lying slightly to the north of the centre of the archipelago; as a result, an additional 39 species were added to the list of Maldivian birds (Phillips & Sims, 1958b). Furthermore, specimens of three endemic races, two of them new to science, were collected.

Subsequently, many of the atolls were visited by the Xarifa Expedition of the International Institute for Submarine Research, under the direction of Dr. Hans Haas. During this expedition, Drs. Georg Scheer and L. Franzisket devoted some of their time to collecting and observing the bird life of the atolls. Then, from May 1958 until April 1959, the author resided in Gan Island, Addu Atoll, in the extreme south. During his second stay in the Maldives, all the chief islands and reefs of Addu Atoll were visited frequently, and several brief excursions were made to Suadiva Atoll as well as a short return visit to Malé. And lastly, while this paper was being written and revised, additional notes were received from J. J. Latham (W/O., R.A.F.) who served in Addu Atoll in 1960 and 1961.

The results of the observations made on my last visit, together with those of Dr. Scheer and Mr. Latham, form the basis of this paper. Furthermore, in order to give as complete a picture as possible of the bird life of the atolls, breeding and migrations are briefly described

in addition to incorporating all available information into the Systematic List.

The 1956/57 visit increased the number of species, recorded from the Maldives, from 24 to 63; the present paper now advances the number of forms to 113 of which 73 are supported by collected specimens and the remaining 40 by sight records only. Forms peculiar to the Maldives are increased to 5 endemic races, including one of *Ardeola grayii* described by Dr. George Scheer (1960).

Geography and Ecology

The Maldivian Archipelago, consisting of upwards of 2500 small coral islands, islets, and exposed reefs, of which less than 250 are permanently inhabited, lies in the Indian Ocean over 400 miles to the west and south-west of Ceylon. It is located between 8° N. and 1° S. and between 72° to 74° E. In length, the archipelago stretches for over 470 miles, from the Eight Degrees Channel, south of the Laccadives and Minicoy (or Minikai) Island (at one period of its political history forming a part of the Maldives) to Addu Atoll, some 30 miles south of the Equator and 300 miles north of the Chagos Islands.

With the exception of a small number of isolated islets, the islands and their encircling reefs form 19 natural groups, clusters or 'atolls', of varying sizes and shapes, which in their turn form an incomplete, double chain, nowhere wider than 70 miles, running practically north and south. It would seem probable that the atolls have gradually been built up around and along the crests of a submerged, interrupted mountain range or ranges for, while within the central lagoons enclosed by the more or less circular peripheral reefs the depth of the water averages no more than 25 fathoms, it may reach 2000 fathoms in the seas close outside the islands.

In all the nineteen atolls the formation is very similar—an interrupted, peripheral reef, on the higher sections of which long, low, flat islands have been formed, encloses a wide shallow lagoon generally dotted with a varying number of small islets and coral sand-banks together with numerous flat-topped, tidal reefs. As a rule, tides of between three and four feet are normal throughout the archipelago, the reefs, dangerous in the extreme, being mostly exposed or awash during low water. Between the atolls, deep (frequently dangerous) channels of varying width and depth, in which ten-knot currents race when the monsoon winds are blowing, divide and isolate one atoll from the next.

Climatic conditions are closely similar throughout the atolls but the northerly islands are more subject to the impacts of the North-east Monsoon from November to January, and of the South-west Monsoon from April to July, and are, in consequence, perceptibly cooler at times. In the southern atolls of Suadiva and Addu, which lie close to the Equator and within the doldrums, the impact of the monsoons is very slight and the climate is more humid.

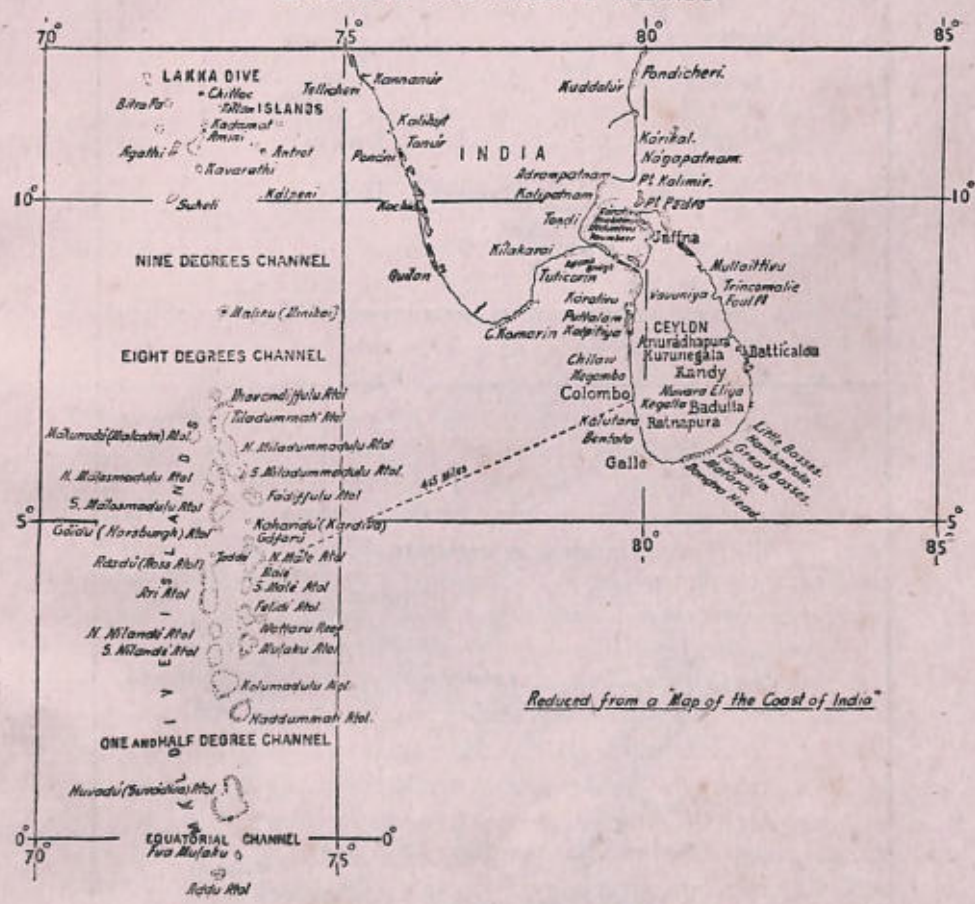
Rainfall averages, annually, between 90 and 100 inches; it is often associated, especially in the southern atolls, with sudden, severe tropical storms. Generally, however, the fall is well distributed; long droughts are rare but deluges of several inches are not infrequent. Humidity is high, especially in the southern atolls, close to the Equator. Day temperatures vary between 80° and 95° in the shade, which in conjunction with the high humidity makes the climate very trying for the average European.

None of the islands rises more than five feet above mean sea-level and many of them have marshy interiors and freshwater ponds; the water-table is rarely more than four or five feet below ground-level. Originally, the islands were composed entirely of coral sand but, in course of time through the rotting of vegetable matter and the formation of humus, they have become well clothed with luxuriant vegetation, both high and low.

Geologically, the archipelago is of comparatively recent formation; so recent, in fact, that distinct forms of animal or plant life are only just beginning to emerge. The terrestrial mammalian and reptilian fauna is very limited and is confined to a few species (Phillips, 1958; Hill, 1958) common to the Indian peninsula and/or Ceylon, except for one fruit-bat, *Pteropus hypomelanus maris* Allen, which was described from Addu Atoll but which I was unable to trace in that Atoll. Of the other mammals, only the Common Flying-fox has diverged sufficiently to be accepted as a distinct endemic form, *Pteropus giganteus ariel* Allen. None of the reptiles is distinct but, amongst the birds, five local races are considered worthy of recognition.

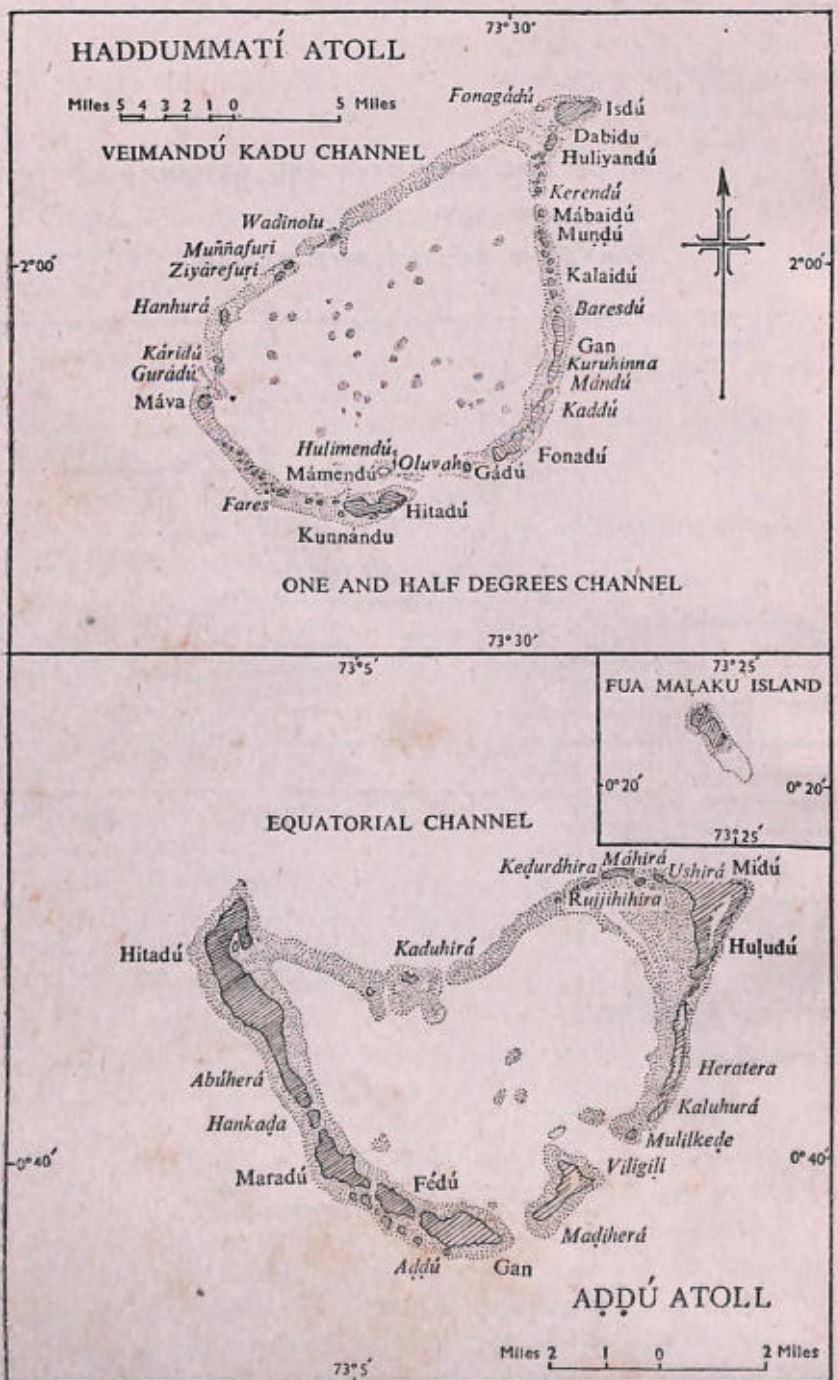
It would appear that the archipelago has been colonized by animal and plant life almost entirely from the Indian mainland and Ceylon, either by 'island hopping' down through the Laccadives or by direct drift aided by the north-easterly monsoon winds as well as, in some cases such as the small rodents and shrews, by the unintentional assistance of man and his ships. But the fact that the Double Coconut or Coco de Mer, *Lodoicea seychellarum*, has occasionally been washed ashore on the western littoral, having drifted from the Seychelles over

MAP OF SOUTHERN INDIA AND CEYLON
WITH THE
LAKKADIVE AND MÁLDIVE ISLANDS



Reduced from a "Map of the Coast of India"

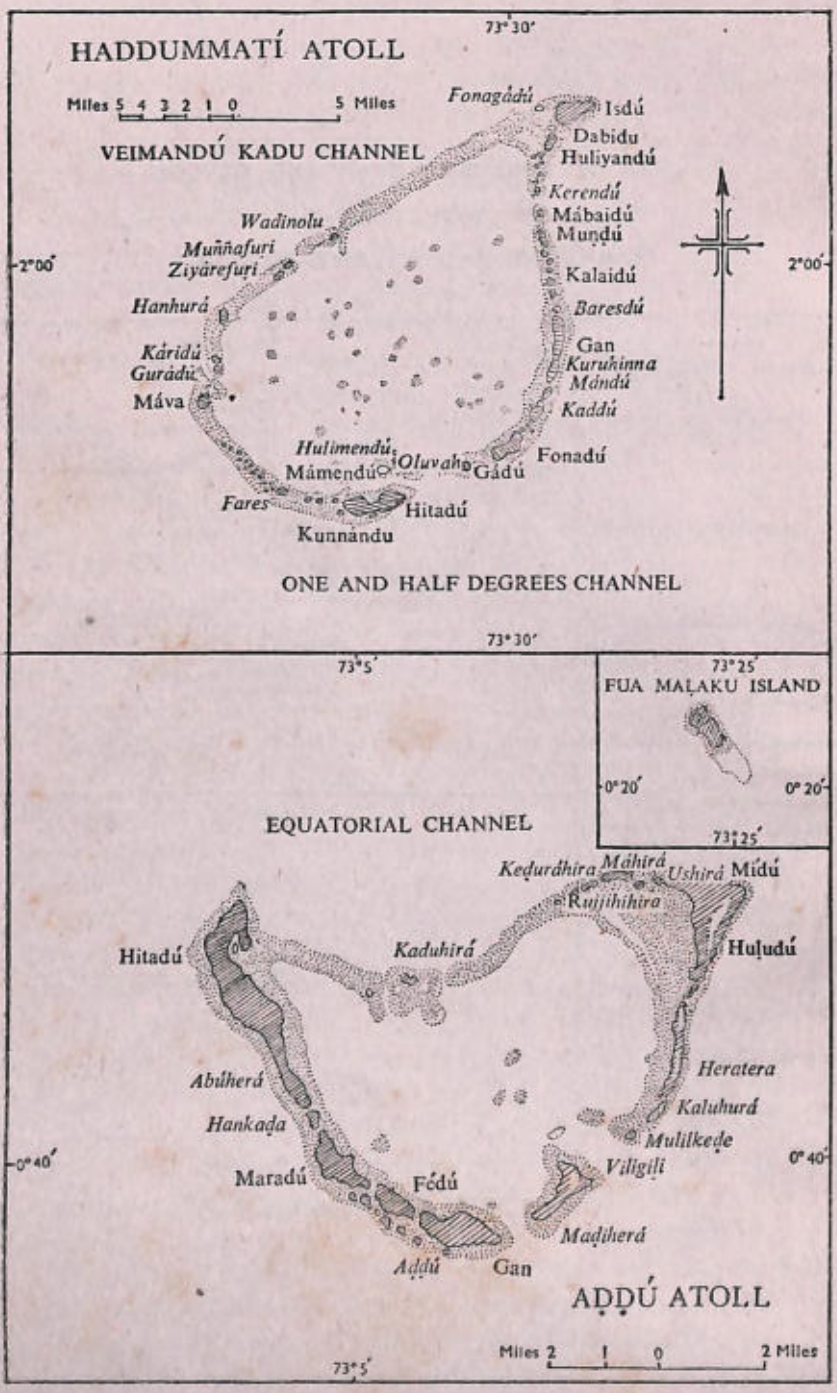
(*From H. C. P. Bell's* MONOGRAPH)


HADDUMMATÍ ATOLL
73°30′
Miles 5 4 3 2 1 0 5 Miles
VEIMANDÚ KADU CHANNEL
Fonagádhi
Isdú
Dabidu
Huliyandú
Kerendú
Mábaidú
Muṇḍú
Wadinolu
Muññafuri
Ziyárefuri
Kalaidú
Hanhurá
Baresdú
Gan
Kuruhinna
Mándú
Kárídú
Gurádú
Máva
Kaddú
Hulimendú
Oluvaho
Fonadú
Mámendú
Gádú
Fares
Hitadú
Kunnándu
ONE AND HALF DEGREES CHANNEL
2°00′
73°30′
73°5′
73°25′
FUA MAḶAKU ISLAND
0°20′
EQUATORIAL CHANNEL
Keḍurdhira
Máhirá
Ushirá
Míḍú
Ruijihihira
Huḷudú
Hitadú
Kaduhirá
Heratera
Abulherá
Kaluhurá
Hankaḍa
Mulilkeḍe
Viligili
Maradú
Fédú
Maḍiherá
Addú
Gan
ADḌÚ ATOLL
0°40′
Miles 2 1 0 2 Miles

1700 miles to the south-west, shows that there are possibilities of some colonization from the west or African zone.

As a direct result of the abundant and well-distributed rainfall, all the islands with the exception of those of very recent emergence have a luxuriant but specifically rather limited vegetation in those areas that have remained untouched by the hand of man. In the interiors of many of the larger islands, shallow brackish or freshwater pools and marshy areas occur, verged with extensive reed-beds, rank grass tracts, and matted pandanus brakes, the home of *Amaurornis phoenicurus* (the Swamp-Hen or Whitebreasted Waterhen), herons, and other marsh-loving birds, and the haunt of numerous migrant waterfowl and waders during the northern winter months. The natural vegetation clothing the remainder of the land, right down to the beaches, consists of large trees with dense, often matted, undergrowth through which it is difficult to force a passage. Most of the larger islands have however been cleared and planted with coconut palms, without which life for the Maldivians would be barely supportable. Villages and townships have been built on some of the islands, the surroundings of the houses being planted with many, large-leafed breadfruit trees, *Artocarpus incisus*, partly to give ever-welcome shade to the dwellings but chiefly to provide additional vegetable food. A few mango trees, *Mangifera indica*, areca-nut palms, *A. catechu*, drumstick trees, *Moringa* sp., tamarind, *Tamarindus indicus*, and edible pandanus are generally dotted about within the gardens or compounds, with several varieties of bananas, a few pomegranates, and large or small areas of yams as garden produce. In the open meeting places bo trees *Ficus religiosa* and banyans *F. bengalensis* are frequent. The Maldivian House Crow, *Corvus splendens maledivicus*, and an occasional Koel, *Eudynamys s. scolopacea*, are normally the only birds to be seen, except on the beaches when the tide is low.

Since under Muslim teaching only web-footed wild-birds may be used for food, Boobies, Frigate-birds, Shearwaters, Ducks, and Terns are taken as and when opportunities offer; frequently they are brought to the markets, alive but wing-clipped, for sale as food. Most of them are taken while they are nesting or roosting, for the Maldivians are adept at snaring. Other species are also taken and kept alive, with one wing clipped, as pets or playthings for the children who are without dolls or toys such as are enjoyed by those of more advanced lands. So, in the more densely populated atolls, the bird life often suffers considerably from the depredations of man, even if other enemies are few.


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Breeding Seasons

On landing in the Maldive Islands, the ornithologist is immediately impressed by the total absence of small passerine birds. No singing or cheerful chirping greets him, either in the jungles or around the dwellings—only the occasional harsh 'caw' of the House-crow, the sole resident passerine in the whole of the archipelago, welcomes him.

Of the 113 species and subspecies of birds that are now accepted as occurring in the Maldives, under 20 species are known to be truly resident in the atolls. Several more, such as the Brown Booby, *Sula leucogaster*, Crab-plover, *Dromas ardeola*, Pratincole, *Glareola pratincola*, and some of the numerous terns are suspected of breeding in the more remote atolls but further research is required before their true status can be determined. Furthermore, observations on the breeding of the resident species are still too inadequate for definite conclusions to be formed regarding their breeding seasons but it would appear most probable that most species breed, with varying intensity, throughout the greater part of the year—as might be expected in a climate where there is so little variation in the seasons, length of daylight, temperature and rainfall.

A brief summary of our present knowledge of the breeding of each of the resident species is as follows:

Audubon's Shearwater, *Procellaria lherminieri bailloni*, lays its eggs in burrows dug in the coral sand on a number of secluded islands scattered along the eastern aspect of the archipelago, from Suadiva Atoll in the south (the bird does not breed in Addu) to Fádiffolu Atoll in the north. Gardiner recorded 'great numbers' breeding on Difuri and Olivelifuri islands, in Fádiffolu Atoll and the collecting of both eggs and chicks at the end of December. I recorded fresh eggs and chicks at the end of January (1957) and the local Maldivians, who use both the eggs and the birds as food, state that breeding continues throughout the year. This requires confirmation. Owing to the depredations of the fisherfolk, this shearwater appears to be rapidly decreasing in numbers in the Maldivian area.

The beautiful Long-tailed Tropic-bird, *Phaëthon l. lepturus*, a moderately plentiful species that frequents the lagoons and sparsely populated islands in all atolls, nests in cavities in old evergreen trees, such as *Hernandia ovigera* and *Cordia subcordata*. Gardiner records both eggs and young on 24 November and young, still unable to fly, were brought to Malé in January. In Suadiva Atoll, breeding was suspected in late March but not proved and in Addu in early July. In both cases, the local Maldivians stated that breeding was in

progress. During the heat of the day in hot, sunny weather, these birds very frequently seek shade and rest in large shady trees; often several will circle round and round, calling continually for half an hour or more before making a successful landing, their feet not being developed for perching in trees.

The Lesser Frigate Bird, *Fregata ariel iredalei*, was discovered by Gardiner nesting in the tops of tall trees, *Calophyllum inophyllum* and *Terminalia catappa*, in Mahlosmadulu Atoll during October and November. Although I received rumours of breeding in other atolls, this appears to be the only authentic record available. The Eastern race of the Common Heron, *Ardea cinerea rectirostris*, a common bird throughout the archipelago, nests in the tops of coconut palms, in wild pandanus trees in swampy areas, and in small trees and large bushes overhanging lagoon shores. Gardiner records young during July and August; in Malé, two semi-fledged young were brought to me in early December and nests and young were seen in January. In Addu Atoll, I saw occupied nests early in June and the same nests were reoccupied early in December while young were in the nests during January and February. Indications are, therefore, that this heron breeds at least twice during the year, generally from June to August and from December to February. Possibly breeding may be intermittent throughout the year.

The Little Heron, *Butorides striatus*, commonly nests in bushy trees growing close to lagoons or in swamps, as well as in the tops of pandanus trees. I have observed nesting in North Malé Atoll (*B. s. didii*) during December and January and in Addu Atoll (*B. s. albidulus*) I found eggs and small young in mid-October and again towards the end of January but birds in full breeding plumage, with reddish pink legs, were noted in almost every month. It would seem probable, therefore, that although the majority breed during the period October to February, some breed at other times of the year.

The Maldivian Pond-heron, *Ardeola grayii phillipsi*, is even more plentiful in Addu Atoll than the Little Heron, *B. s. albidulus*, but nests are difficult to find. Individuals in full breeding plumage, with reddish pink legs, have been noted throughout the year; a large chick, taken from a nest, was examined on the 18 October; a pair was observed building a nest in the top of a wild pandanus on the 24 January when almost all of these birds appeared to be in breeding dress and on the 14 February a female containing 3 oviduct eggs, almost due to be laid, was collected. It seems from this evidence that this bird also breeds chiefly during the period September or October

to March or April as well as, less intensively, at other times of the year.

The Swamp-Hen or Whitebreasted Waterhen, *Amaurornis phoenicurus*, although plentiful in all the atolls is so elusive and its nests are so well concealed that it is difficult to study its breeding. Nests are concealed amongst rank vegetation and in low bushes. Gardiner recorded a young bird (*maldivus*) taken from a nest in July; in Addu Atoll birds (*phoenicurus*) were very noisy and apparently commencing to breed in June and a $\frac{3}{4}$ grown juvenile was seen on the 21 July and three well-grown chicks on the 25 August. Again, in October a $\frac{1}{2}$ grown chick was observed on the 10th and a hatchling on the 18th. From these observations it would seem that this bird breeds from about June to November or, possibly, throughout the year.

Although at least 10 species of terns are stated by the Maldivians to breed in the archipelago, we have authentic records of the breeding of only four. The Blacknaped Tern, *Sterna sumatrana mathewsi*, was said by the local Maldivians to nest in North Malé Atoll in April and May but it was not until early June that I located several breeding colonies on sandy islets in Addu Atoll. Breeding appears to be confined to the months of May, June, and July.

The Common Noddy, *Anoüs stolidus pileatus*, is exceedingly numerous, at times, in many of the atolls but although its presence within the lagoons (as well as in the seas outside) is well known to the Maldivians, they know nothing of its breeding. However, on the 28 April, I discovered a single nest, containing a newly hatched chick, on a large metal marker-buoy anchored in Addu Atoll lagoon. This appears to be the sole definite record of the breeding of this noddy in the Maldives. Gardiner states that Forster Cooper took an adult female and a nestling of the Lesser Noddy, *A. tenuirostris*, from a nest in a pandanus (Screw-pine) on Mabaru Island, South Mahlosmadulu Atoll, on 26 November 1899; he states further the Lesser Noddy is 'nowhere common, but found throughout the whole of the Maldives' but he fails to mention the presence of the Common Noddy. A search in both North Malé and in Addu Atoll failed to yield a single Lesser Noddy but showed that the Common Noddy is plentiful. It seems possible, if not probable, therefore, that this nesting record should, in fact, refer to the Common Noddy. In any case, it is interesting that one of the records should refer to a Noddy nesting in November and the other to one nesting in April, indicating that either the two species (if two species do, in fact, occur in the Maldives) breed at different times during the year or, alternatively,

that the Common Noddy (if both the records refer to that species) breeds either in the spring or in the autumn or during both these periods.

The charming White Tern, *Gygis alba monte*, breeds very freely in Addu Atoll, to which atoll it is confined. Probably owing to the presence of large numbers of House-crows, *Corvus splendens maledivicus*, it has not been able to establish itself in other atolls. Presumably, also, it is of comparatively recent arrival in Addu Atoll as it is not mentioned by Gardiner; he could hardly have overlooked it, had it been present at the time of his visit. In Addu Atoll, it is always present in the trees around the villages, flying overhead or sweeping over the central lagoon and near-by seas. In habits, it is essentially a 'tree-tern'. Moreover, though it is often active throughout the greater part of the day, it prefers the early mornings and late evenings for its foraging and is often on the move on moonlight nights. Generally, when incubating its single egg on a horizontal branch, high stump, or other lodgement in a tree or palm, it is most confiding in its behaviour towards man but it will collect in large numbers to mob to exhaustion or precipitous flight any crow, buzzard, or other potentially dangerous bird that appears in the vicinity. It is probable that pairs mate for considerable periods. Frequently a pair indulges in dual display flights over the lagoon and the land. Although only a single egg is laid at each laying, observations point to each pair raising, or attempting to raise, several young during each year. Breeding continues throughout the year but my notes show that the peak periods are during January and early February and again towards the end of May and in June.

The single resident Cuckoo, the Koel, *Eudynamys s. scolopacea*, is dependent upon the Maldivian House-crow, *Corvus splendens maledivicus* as host, so its breeding must coincide with that of the crow. An oviduct egg was taken in Malé on 11 December and a juvenile, scarcely able to flutter, was captured on another island in North Malé Atoll on 23 January when the crows were nesting. The koels of Addu Atoll are most puzzling as, although both sexes are present and courtship flights were observed, there are no crows or other suitable foster-parents present in the atoll; presumably, therefore, the koels of Addu Atoll are either of non-breeding stock or they return over 30 miles of ocean to Suadiva Atoll in order to breed.

Although Gadow & Gardiner state that the Maldivian House-crow breeds between May and September, I saw no signs of breeding in the southern atolls either at the end of May, when all crows appeared to be in moult, or in July. On the other hand, I saw nest-building in

North Malé Atoll early in December and again in January when all crows were in full plumage. It would seem probable, therefore, in spite of Gadow & Gardiner's statement, that the breeding period extends from about November to March or April if it does not continue, intermittently, throughout the greater part of the year.

TABLE SHOWING OBSERVED AND PRESUMED BREEDING OF MALDIVIAN RESIDENT BIRDS

(Unconfirmed breeding is denoted by 'P' and confirmed by 'B')

	June	July	August	September	October	November	December	January	February	March	April	May
Procellaria lherminieri bailloni	P	P	P	P	P	P	B B	B B	P	P	P	P
Phaëthon lepturus lepturus		P				B	B B	B B	P	P		
Fregata ariel iredalei					B B	B B						
Ardea cinerea rectirostris	B B	B B	B B	B			B B	B B	B B			
Butorides striatus didii							B B	B B				
Butorides striatus albidulus					B B	B P	P P	B B	B B			
Ardeola grayii phillipsi				P	B B	P P	P P	B B	B B			
Amaurornis phoenicurus	P	B B	B B	B P	P B B	P						
Sterna sumatrana mathewsi	B	B B	B								P	P B
Anoüs stolidus pileatus											B	B B
Anoüs tenuirostris ?					P B	B P						
Gygis alba monte	B	B B	B	B	B	B	B	B B	B B	B B	B	B B
Eudynamys scolopacea scolopacea						B B	B B					
Corvus splendens maledivicus	?	?	?	?		P	B B	B B	B			?

Migration

Some slight knowledge of the migratory movements in the Maldives was gained during my first visit to Malé, in North Malé Atoll, from the end of November 1956 to the beginning of February 1957. This knowledge was added to, considerably, during my subsequent residence in Addu Atoll during 1958 and early 1959 and has been further extended by the notes collected by Mr. J. J. Latham during his service on Gan (Addu) in 1961 and 1962.

The observations made in Addu Atoll confirm that considerable numbers of non-breeding visitors, of eastern European and western Asian origin, arrive from the north during October to December (a few may come in August and September) and return northwards during the following March to May; it has also been established that unexpectedly large numbers of non-breeding waders loiter in the southern Maldives throughout the northern summer months. Furthermore, evidence has been collected that tends to show that some migrants travel beyond Addu Atoll to the Chagos Archipelago, over 300 miles to the south, and return later.

Since it was stressed in 1958 (Phillips & Sims) that so very little information had been recorded from the Chagos Islands, Loustau-Lalanne has published his paper (1962) on the birds of that archipelago. In this paper, he lists, as 'migrants recorded November/December 1960', the following: *Anas* sp. seen in flocks on Diego Garcia; *Charadrius squatarola*, several of which were seen in December; *Numenius phaeopus*, often seen feeding under the coconuts in December; *Numenius arquata*, one shot on the beach in December; *Arenaria interpres*, seen in flocks on the beach on several islands; *Crocethia alba*, two of which were seen on the outer beach of Diego Garcia; *Dromas ardeola*, which is probably an itinerant resident in both the Chagos and the Maldivian archipelagos and several hirundines which, he states, were probably *Delichon urbica*. He states, further, that reports received locally show that the hirundines arrive in the Chagos Islands in November and leave again in March.

It is significant that all the migrant species mentioned were recorded in Gan (Addu) between October and March or April, in 1958/59 and again in 1961/62, indicating that they are regular annual winter visitors. On several occasions it seemed most probable that the birds seen had arrived in Gan (Addu) from the southward, instead of from the north; there are therefore strong indications, supported by Loustau-Lalanne's paper, that small numbers of migrants pass through the Maldives into the Chagos Archipelago where they spend the whole

or part of the winter before returning by the same route. Only ringing or 'banding' can confirm or disprove this theory.

The following notes briefly outline the movements of some of the more notable species that visit the Maldivian atolls but do not qualify as residents.

PROCELLARIDAE. The three regular visiting species of this family: Wilson's Petrel, *Oceanites oceanicus*, the Wedgetailed Shearwater, *Procellaria pacifica*, and the Pinkfooted Shearwater, *P. carneipes*, all appear to conform to the accepted movement pattern of southern-hemisphere-breeding species that visit the northern waters of the Indian Ocean during the southern winter. All three species are reported to arrive in the waters off the Maldives towards the end of March and in April and to leave during the following October and early November. The single Bulwer's Petrel, *Bulweria bulwerii*, taken in Addu Atoll on the 22 August, was the first of its species to be reported in the Indian Ocean.

ARDEIDAE. A Purple Heron, *Ardea purpurea*, appeared in Addu Atoll on 13 October (1958) but, being a juvenile, the race to which it is referable cannot be determined; another was observed, in Gan (Addu), by J. J. Latham on 14 July (1961). These may have come from the north, moving from atoll to atoll down the length of the Laccadives and the Maldives, but it is possible that they might have crossed over from the Chagos Islands. The early dates of arrival would seem to point to the latter. The Eastern Large Egret, *Egretta alba modesta*, did not arrive in Addu Atoll until 20 December, indicating that it had gradually worked its way southwards through the atolls; it is well known to the Maldivians as an annual visitor.

A party of Black Bitterns, *Dupetor f. flavicollis*, was observed flying south-west across Gan Island, Addu Atoll, on 4 June; no other was seen in this atoll, so this party may have gone farther south. Farther north, it is an annual visitor, in small numbers, during the northern winter. Both the Chestnut Bittern, *Ixobrychus cinnamomeus*, and the Little Yellow Bittern, *I. sinensis*, appear to be vagrants.

ANATIDAE. Wild ducks commenced to arrive in Addu Atoll with a flight of Garganey, *Anas querquedula*, on 3 October. Flights of up to 25 were frequent until the middle of January. In early November, small parties of Shovellers, *Spatula clypeata*, and a few Pintail, *Anas acuta*, were seen. These three species seem to be regular visitors from the north but the White-eyed Pochard or

Ferruginous Duck, *Aythya nyroca*, and the Cotton Teal, *Nettapus c. coromandelianus*, that appeared in Gan, Addu Atoll, early in December were probably vagrants. The Garganey is well known to the Maldivians of Addu Atoll but I heard nothing of it farther north; it is likely that the flocks of '*Anas* sp.', recorded in the Chagos Islands, were of this species.

FALCONIDAE. All members of this group are either migrants or vagrants; none is resident. The Honey-buzzard, *Pernis apivorus orientalis*, arrived in Addu Atoll on 4 December, the Buzzard, *Buteo* sp., on 14 January, and the Osprey, *Pandion haliætus*, in July; all were probably stragglers from the north, working their way southward. The Harriers, which are regular visitors to the whole of the Maldives during the northern winter months, commenced to arrive in Addu Atoll about the middle of November; they remained, feeding chiefly upon *Calotes* lizards, *C. versicolor*, and large grasshoppers, until the middle of the following March. These Harriers, *Circus macrourus* and *C. pygargus*, are well known to the Maldivians who dislike them as they take an occasional chicken. The Common Kestrel, *Falco t. tinnunculus*, is also a regular migrant to the northern atolls but it is uncommon in Addu Atoll where its place is taken by the Lesser Kestrel, *F. n. naumanni*, and the Eastern Redlegged Falcon, *F. vespertinus amurensis*. The former arrived in a small party on 12 November and the latter on 5 December. Neither of these two species has been recorded from any other atoll—like the Harriers, they probably came from the north. A single Peregrine, *F. peregrinus*, arrived in Addu Atoll in the middle of October (14th); it appeared to depart in a southerly direction and, as it was not seen in Addu again, may have passed on to the Chagos Islands.

CHARADRIIDAE. With the exception of the Caspian Plovers, *Charadrius asiaticus*, which were probably stragglers to Addu Atoll, all the representatives of this family appear to be regular annual visitors, in small or large numbers, during the northern winter period. The Lesser Sand Plovers, *C. mongolus atrifrons*, were the first to arrive in Addu Atoll; they were closely followed by the Grey Plover, *C. squatarolus*, both species commencing to fly in during the latter half of August. The Large Sand Plover, *C. leschenaultii*, came in September and the Asiatic Golden Plover, *C. dominicus fulvus*, in flocks, in early October. But it was not until the second week in November that large influxes of plovers took place. Then, in addition to the foregoing, the Ringed Plover, *C. hiaticula tundrae*, arrived on the 17th, Jerdon's Little Ringed Plover, *C. dubius jerdoni*, on the 10th

(with the two Caspian Plovers) and the Kentish Plovers, *C. alexandrinus*, on the 18th. From the middle of November to April there were always considerable numbers of plovers, of various species, to be seen in Addu Atoll where they spent the winter. A small flock of non-breeding Grey Plovers and at least two Large Sand Plovers remained the whole year on and around Gan Island.

The Turnstone, *Arenaria i. interpres*, the most abundant of all the waders that visit the Maldives, appeared in Addu Atoll at the end of May when a flock of 25 arrived; probably they were non-breeding loiterers but towards the end of June another flock of *c.* 65 appeared. Did they come from the north or did they come in from the Chagos Islands, to the south? That considerable numbers of non-breeding birds loiter in the Maldives throughout the northern summer period is certain but it is curious that large flocks should arrive in Addu Atoll in May and June.

SCOLOPACIDAE. Three species of snipe visit Addu Atoll although only one species, the Pintail Snipe, *Capella stenura*, was seen in North Malé Atoll. Swinhoe's Snipe, *C. megala*, of which a single specimen was collected on 8 November, is almost certainly a rare straggler but the Pintail Snipe and the Fantail or Common Snipe, *C. g. gallinago*, are both regular annual visitors to Addu. *C. stenura* arrived on 4 October, after which date there were always small numbers in the marshy areas until the following spring. *C. gallinago*, however, did not arrive until 15 December, after which date a few wisps were generally present. Although *C. gallinago* did not arrive until so long after the arrival of *C. stenura*, it was the former species only that Gardiner found so plentiful in Addu Atoll, in April 1900, that he thought the species must breed there.

While the Eastern Curlew, *Numenius arquata orientalis*, which did not arrive in Addu Atoll until 6 November, is a scarce visitor, the Whimbrel, *N. p. phaeopus*, is one of the most abundant of all the birds that visit the Maldives. Not only do large numbers spend the northern winter in the archipelago but many non-breeding birds remain in Addu throughout the summer as well. Some of these loiterers appear to pair and behave as though they were about to breed but none actually did. The numbers in the atoll have been observed to fluctuate from time to time so some may pass to the Chagos Islands and return or, alternatively, they may fly northwards and return. Birds intending to breed have generally left Addu by late March or early April.

A single, non-breeding Bartailed Godwit, *Limosa lapponica*, also

spent a year in Addu Atoll; presumably, it was a straggler from the north.

In 1958, the Wood Sandpiper, *Tringa glareola*, and the Common Sandpiper, *T. hypoleucos*, arrived in Addu Atoll on 12 and 10 August, respectively. These arrival dates coincide with the early arrival dates of these two species in the south of Ceylon (Phillips, 1957) and are probably normal. Both are regular visitors but whereas *T. hypoleucos* comes in considerable numbers *T. glareola* is distinctly scarce. The Eastern Redshank, *T. totanus eurhinus*, and the Greenshank, *T. nebularia*, both regular visitors, did not appear until November, the Greenshank arriving in small parties early in the month and the Redshank later. Terek Sandpiper, *Xenus cinerea*, came in about the same time (21 November); this curious little wader may be an annual visitor, in small numbers, as it is in Ceylon.

The majority of waders of the genus *Calidris* also commenced to arrive about the middle of November; the Little Stint, *C. minuta*, a regular visitor in small numbers, arrived on 11 November, the Longtoed Stint, *C. subminuta*, on the 17th and the Dunlin, *C. a. alpina*, on 25th. The occurrence of small parties of *C. subminuta* in Addu Atoll was as interesting as unexpected; hitherto the species had not been recorded from so far westwards. They remained until late February. The arrival of *C. a. alpina* was also unexpected as, although the species occurs in northern India, it has not yet been recorded from Ceylon. A single Temminck's Stint, *C. temminckii*, was seen in Addu on 5 October; another, possibly a non-breeding loiterer, was there on 26 May.

The Curlew Sandpiper, *C. testacea*, is puzzling. On 23 May a party of 8 appeared on Gan, Addu Atoll, and next day there were two parties of 5 and 7 respectively; all but one were in non-breeding plumage. On 25 June, a flock of between 45 and 50 appeared while on 16 October a large company, estimated at over 100, passed over flying westwards. Obviously, many non-breeding birds loiter in the southern Maldives during the northern summer months but from where did the parties suddenly appear in May and June? It seems reasonable to suspect that some of them may have come up from the Chagos Islands.

A single Sanderling, *Crocethia alba*, appeared on the southern beach of Gan, Addu Atoll, on 15 November and a juvenile Ruff, *Philomachus pugnax*, on 5 October; both unusual visitors from the north.

LARIDAE. At present there is insufficient information available to permit of the classification, as residents or visitors, of many of the

Maldivian terns. It is evident, however, that the single Whitewinged Black Tern, *Chlidonias leucoptera*, collected in Addu Atoll on 8 November, was a northern visitor and so were the two Tibetan Terns, *Sterna hirundo tibetana*, taken on 11 January and 22 February, respectively. A single Mesopotamian Ternlet, *Sterna albifrons praetermissa*, caught on 15 November, was also a northern visitor but the race *S. a. saundersi*, which is so plentiful in the Maldives, and several of the other species of terns are presumably residents. It is curious that the Brownheaded Gull, *Larus brunnicephalus*, which is so plentiful in India and Ceylon during the northern winter, does not visit the Maldives.

CUCULIDAE. Cuckoos are notorious wanderers so it is interesting to record that in 1959 two species arrived in Addu Atoll within a week of one another; the Common Cuckoo, *Cuculus canorus*, on 4 January and the Plaintive Cuckoo, *Cacomantis merulinus passerinus*, on 13 January. Another Common Cuckoo was seen during the first week of January 1961. Both these species are known as habitual wanderers.

APODIDAE. The occurrence of three species of swifts is of more than passing interest. An Edible-nest Swiftlet, *Collocalia brevirostris*, was seen in Malé, North Malé Atoll, on 19 December 1956 and another in 1957, while still others were observed in Gan in 1961/62 yet there are no normal roosting places available in the Maldives; so, contrary to their usual habits, these swifts must have roosted either in trees or in low buildings. It seems odd that they should have wandered into the Maldives. A common Swift, *Apus apus*, was observed flying southward over Gan, Addu Atoll, on the morning of 1 November; it disappeared in the general direction of the Chagos Archipelago. It appeared to be on passage and was not feeding, as it passed over.

MEROPIDAE. On 10 January, a party of one adult and two first-year Common Bee-eaters, *Merops apiaster*, appeared on Gan, Addu Atoll; they remained until 31 March, living chiefly on large dragonflies. Their presence in Addu Atoll was most unexpected; presumably they came from the north.

HIRUNDINIDAE. The Eastern Swallow, *Hirundo rustica gutturalis*, is well known as a winter visitor to the Maldives; a party of 3 appeared in Addu Atoll on the evening of 14 October and another party of about 20, accompanied by several Sand Martins, *Riparia riparia*, on the evening of 3 November (1958). This second party remained in

the atoll for some weeks and then disappeared. Did it (and the October birds) return northwards or did it pass on southwards to the Chagos Islands?

TURDIDAE. The most interesting of all the migrants and wanderers that appeared in Addu Atoll were the Wheatears. On the afternoon of 16 November (1958), a single Pied Wheatear, *Oenanthe leucomela leucomela*, was observed on the southern beach of Gan Island (Addu Atoll), almost the extreme southerly point of the Maldives; on the 23rd afternoon, although there were no Wheatears present in the morning, a party of one Pied Wheatear and two Isabelline *O. isabellina isabellina* was on the southern beach at 16 hours; they were just above the tide line and gave one the impression that they had just arrived from overseas. Later, on 14 December, another Pied Wheatear appeared close to where the others had been seen. All these birds gave one the impression that they had just arrived from the south but they could have come from other islands in Addu Atoll or from Suadiva Atoll to the north. As far as can be ascertained, they are the only wheatears ever to have been observed in the Maldive Islands.

MOTACILLIDAE. It has already been recorded (Phillips & Sims, 1958) that a Yellow Wagtail, *Motacilla flava*, was observed on a ship passing between Addu Atoll and the Chagos Islands on the 10 April 1957, so it was hoped that more of these wagtails would be observed passing through Addu Atoll in 1958/59. In fact, only a single Grey Wagtail, *M. cinerea*, was observed on 17 December and no Yellow Wagtails appeared that year but, in 1961, small numbers were observed in Gan (Addu) by J. J. Latham between 28 October and 18 November. All these birds disappeared almost at once, so it seems likely that they may have passed on farther south. Another Redthroated Pipit, *Anthus cervinus*, was collected in Gan (Addu) on the 8 December and several pipits were observed by J. J. Latham in 1961 on 22 September, 12 October, and 7 and 18 December, indicating that small numbers, of Pipits not only visit the Maldives annually, but that some of them pass southwards at any rate as far south as the extreme southernmost tip of the archipelago. Whether any of them (and the wagtails) pass on farther south to the Chagos Islands must await further investigation in the Chagos Islands. There is every indication that some do so.

TABLE SHOWING THE APPROXIMATE DATES OF CASUAL VISITORS TO ADDU AND NORTH MALÉ ATOLLS

'A' denotes Addu Atoll; 'M' denotes North Malé Atoll;
'S' denotes 'at Sea, close to the Maldives'

	June	July	August	September	October	November	December	January	February	March	April	May
Bulweria bulwerii			A									
Ardea purpurea		A			A	A	A	A				
Ixobrychus sinensis cinnamomeus			A		A	A	A M			A		
Botaurus stellaris							A					
Plegadis falcinellus					A			A				
Aythya nyroca							A					
Nettapus c. coromandelianus							A					
Pernis apivorus orientalis							A					
Pandion haliaetus		A										
Falco peregrinus amurensis					A	A	A					
n. naumanni					A A	A A	A A					
Charadrius asiaticus						A						
Capella megala							A					
Xenus cinerea						A	A					
Philomachus pugnax					A	A						
Himantopus himantopus						A						
Chlidonias leucoptera						A	A					

	June	July	August	September	October	November	December	January	February	March	April	May
Sterna albifrons praetermissa						A						
Cuculus canorus								A A				
Cacomantis merulinus passerinus						A		A				
Collocalia brevirostris						A	M	A				
Apus affinis							A					
apus						A						
Merops apiaster								A A	A A	A A		
Oenanthe isabellina						A						
leucomela leucomela						A	A					
Tchitrea paradisi					A							
Motacilla cinerea							A					
flava						A A	A					S
Anthus t. trivialis							M					
cervinus				A	A		A A M					
Riparia riparia						A						
Lanius cristatus						A						
Sturnus vulgaris							S					

Annotated Systematic List of the Birds of the Maldives

(including all records from and from the vicinity of the Archipelago)

The following abbreviations are used in this list: M. = Maldivian ; (P. & S.) = Phillips & Sims ; (P.) = Phillips ; (G. & G.) = Gadow & Gardiner ; (G. S. & L. F.) = Georg Scheer & L. Franzisket ; (J. J. L.) = J. J. Latham.

PROCELLARIIDAE

Oceanites oceanicus (Kuhl) : Wilson's Petrel. (M.=*Kurangee*)

Sight record only. One identified at sea (28 November 1956) less than 100 miles to the east of Malé Atoll. Well known to the Maldivians who state that large numbers frequent the sea around the atolls from April to October. Normally does not enter the lagoons.

Procellaria lherminieri bailloni Bonaparte : Audubon's Shearwater. (M.=*Hoogula*)

Collected in North Malé Atoll (P. & S.) and in Fadiffolu Atoll (G. S. & L. F.). Observed in small numbers in the Equatorial Channel between Addu and Suadiva Atolls. Breeds December and January and possibly throughout the year.

Procellaria pacifica Gmelin : Wedgetailed Shearwater. (M.=*Bodu-Hoogula*)

Sight record only. Small numbers observed in the Equatorial Channel, between Addu and Suadiva Atolls, in March (25th), May, and June 1958. Reported by the Maldivians to frequent the seas adjacent to the atolls during the period April to October but, normally, does not enter the lagoons.

Procellaria carneipes (Gould) : Pinkfooted Shearwater. (M.=*Ma-Hoogula*)

Sight record only. Several observed in the Equatorial Channel, in March (26th) and July (6th) 1958. Large shearwaters of this type are reported by the Maldivians to frequent the seas adjacent to Addu Atoll but, normally, they do not enter the lagoons. It is probable that some of the birds seen were Whitefronted Shearwaters (*P. leucomelaena* Temminck) which also occur in this area of the Indian Ocean.

Bulweria bulwerii (Jardine & Selby) : Bulwer's Petrel. (M.=*Kurangee?*)

A single female was caught, in an exhausted condition, in Addu Atoll on the evening of 22 August 1958; the first record for the Indian Ocean. The species is not known to the Maldivians.

PHAËTHONTIDAE

Phaëthon lepturus lepturus Daudin : Longtailed Tropic-Bird. (M.=*Dandfulu-Doonie*)

Collected in North Malé (P. & S.); in Addu (P.) and in Suadiva and Fadiffolu Atolls (G. S. & L. F.). Plentiful and resident throughout the

Archipelago. Breeds from November to January and probably later in the year.

SULIDAE

Sula leucogaster rogersi Mathews : Brown Booby. (M.=*Ma-Doonie*)

One female collected in Addu Atoll (P.) and a captive, from Fadiffolu Atoll, examined and measured in Malé (P. & S.). Reported by Maldivians to occur in numbers in Suadiva Atoll and observed in North Malé Atoll (P.). Specimens from the Maldives and from the Laccadives, in the British Museum, are very close to specimens from the Solomon Islands and Borneo. They have larger and heavier bills than those from Aden and the Red Sea which have been referred to the nominate race *leucogaster* (Boddaert).

Sula dactylatra Lesson : Masked Booby or Gannet. (M.=*Ma-Doonie*)

Sight record only. Two observed, end of November 1958, in North Malé Atoll (P. & S.); one observed and photographed on 28 November 1962, at Gan (Addu) (J. J. L.). Reported by Maldivians to occur, frequently, in Suadiva Atoll. Status uncertain.

FREGATIDAE

Fregata minor (Gmelin) : Larger Frigate Bird. (M.=*Hora* or *Ma-Hora*)

Sight record only. Small numbers observed over Malé, North Malé Atoll, during December 1956 and January 1957 (P. & S.). Several observed over Addu Atoll during 1958 (P.) and during May and June 1961 (J. J. L.). Appears to be a frequent visitor to the atolls but status uncertain.

Fregata ariel iredalei Mathews : Lesser Frigate Bird. (M.=*Hora* or *Ma-Hora*)

2 females collected from Mahlosmadulu (P. & S.) and 2 from Suadiva Atoll (P.). In Addu Atoll, 36 were observed hanging in the sky over a reef on the morning of 8 June 1958 (P.). Plentiful around most atolls and probably resident in some; but breeding observed only in Mahlosmadulu, during October and November (G. & G.).

ARDEIDAE

Ardea cinerea rectirostris Gould : Grey Heron. (M.=*Markana*)

Collected in North Malé (P. & S.), Addu (P.), Gaha Faro, Ari, and Addu (G. S. & L. F.). Plentiful and resident in all atolls. Breeding

observed during June, July, August, November, December, January, and February.

Ardea purpurea Linnaeus : Purple Heron. (M. = *Markana*)

Male, in sub-adult plumage, collected in Addu Atoll on 3 November, 1958 (P.). Others observed on 14 July, 23rd and 31 October, 5 November, 19 November (2), 29 December, and 18 January (J. J. L.). Status uncertain, probably a frequent visitor. Specimen is probably of the race *manilensis* Meyen but sub-adults are difficult to determine, with certainty.

Butorides striatus didii Phillips & Sims : Central Maldivian Little Heron. (M. = *Rabonde*)

Collected in North Malé Atoll; plentiful, breeds during December and January (P. & S.). A well-marked, pale race with the crest, crown-patch, and eye-stripe greatly reduced. Meets the darker form, *albidulus* to the south and a considerably darker form, more akin to *javanicus* (Horsfield), to the north. Probably *javanicus* has invaded the Laccadives from India and has spread into the northern atolls of the Maldives where interbreeding with *didii* has occurred. More collecting in the intervening atolls is necessary before the exact range of each race can be worked out.

Butorides striatus albidulus Bangs : Southern Maldivian Little Heron. (M. = *Rabulli*)

Collected in Addu and observed in Suadiva Atoll (P.). Plentiful in southern atolls but northern limits of range not ascertained. Breeding observed during January, February, September, October, and November. This race is considerably darker than *didii*; the crest, crown-patch, and eye-stripe are well defined but not as dark as in *javanicus*. Comparisons with *albolimbatus* Reichenow, from Diego Garcia in the Chagos Islands have not been made owing to lack of specimens.

Egretta garzetta (Linnaeus) : Little Egret. (M. = *Irruwar-Hudu*)

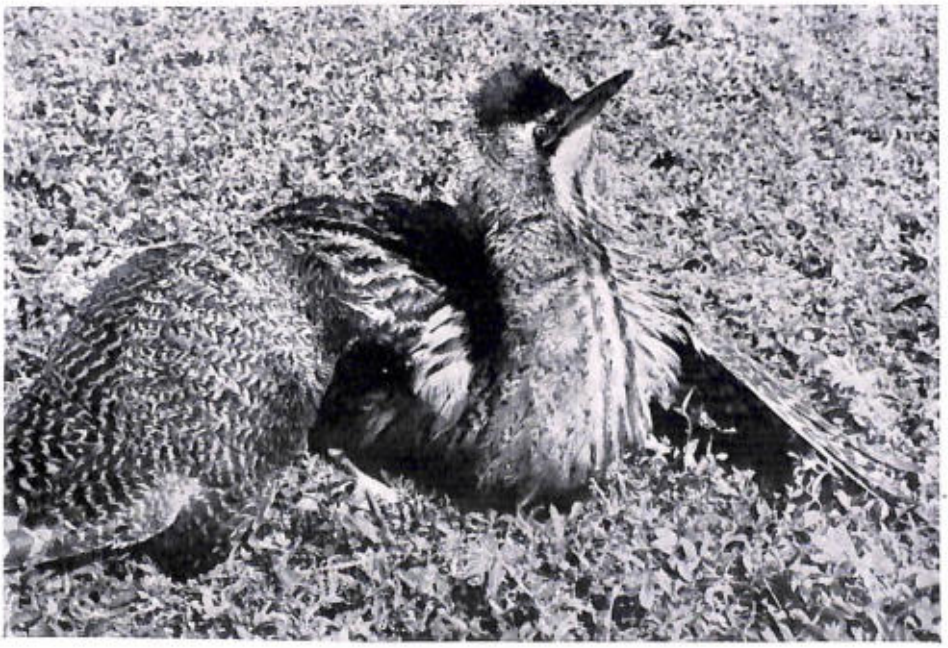
Sight record only. Two in captivity in Addu Atoll and one observed in South Mahlosmadulu Atoll (G. & G.). One observed in Addu Atoll (G. S. & L. F.). Status uncertain; probably an occasional winter visitor.

Egretta alba modesta (J. E. Gray) : Eastern Large Egret. (M. = *Hudu-Markana*)

A male collected on 20 December 1958, on Gan Addu, and



Southern Maldivian Little Heron (*Butorides striatus albidulus*), Gan, Addu Atoll, page 566



Common Bittern (*Botaurus stellaris*), Gan, Addu Atoll, page 567

Photos : A. J. H. Cobon



Whimbrel (*Numenius phaeopus*), Gan, Addu Atoll, page 573



Grey Heron (*Ardea cinerea rectirostris*), Gan, Addu Atoll, page 565

Photos : A. J. H. Cobon

another observed on 31 January 1959 (P.). Maldivians state, it is a frequent winter visitor.

Bubulcus ibis coromandus (Boddaert) : Eastern Cattle Egret. (M.= *Irruwar-Hudu*)

2 males collected in North Malé Atoll in December 1956 (P. & S.); 4 observed in Addu Atoll on 5 February 1961 were believed to have been bred, locally, in September 1960 (J. J. L.). Stated by Maldivians to be a frequent visitor.

Ardeola grayii grayii (Sykes): Indian Pond Heron. (M.=*Hudu-Rabonde*)

One collected in Fadifollu Atoll (G, S. & L. F.). Status unknown, probably a straggler.

Ardeola grayii phillipsi Scheer : Maldivian Pond Heron. (M.=*Hudu-Rabulli*)

Collected in Addu Atoll, where abundant, and observed in Suadiva Atoll (P., G. S., & L. F.). Appears to be confined, as a resident, to Addu and Suadiva atolls.

Ixobrychus sinensis (Gmelin): Little Yellow Bittern. (M.=*Rabulli* or *Rabonde*)

Sight record only. One flushed from dense reeds on Medu Island, Addu Atoll, on 8 November 1958 and another a few weeks later (P.). Status unknown.

Ixobrychus cinnamomeus (Gmelin) : Chestnut Bittern. (M.=*Ratu Rabonde*)

Male collected in North Malé Atoll in December 1956 (P. & S.). One observed in Addu Atoll on 5 March, 2 on 30 August, and one on 31 October 1961 (J. J. L.). Status uncertain; reported by Maldivians to be an occasional visitor.

Dupetor flavicollis flavicollis (Latham) : Black Bittern. (M.=*Karlu Rabonde*)

2 males collected and others observed in North Malé Atoll during December 1956 and January 1957 (P. & S.). 3 together in Addu on 4 June 1958 (P.) and one 10 March 1961 (J. J. L.). Status uncertain, probably occasional visitor.

Botaurus stellaris (Linnaeus) : Common Bittern. (M.= ? ?)

One caught and photographed on Gan (Addu) on 25 October, another on 15 November, and a third on 27 December 1961 (J. J. L.). Status uncertain, probably a rare vagrant.

PLATALEIDAE

Plegadis falcinellus (Linnaeus) : Glossy Ibis. (M.= ? ?)

Sight record only. One observed on Gan (Addu) on 10 January 1959 (P.); another on 23 October 1961. (J. J. L.). Status uncertain, probably a rare vagrant.

ANATIDAE

Anas crecca Linnaeus : Common Teal. (M.=*Ratu Rairu*)

Sight record only. Observed in South Mahlosmadulu and Miladumadulu Atolls (G. & G.). Status uncertain; probably an occasional winter visitor to the northern atolls.

Anas querquedula Linnaeus : Garganey. (M.=*Rairu*)

A captive female examined and small flocks up to 25 frequently observed in Addu Atoll from 3 October to 17 January 1959 (P.). Reported by Maldivians to be a regular visitor to Addu Atoll during the northern winter period.

Anas acuta (Linnaeus) : Pintail. (M.=*Rairu*)

Sight record only. Several observed in Addu Atoll during October and December 1958 (P.). Status unknown.

Spatula clypeata Linnaeus : Shoveller. (M.=*Rairu*)

A male, in immature plumage, collected and small parties up to 7 observed in Addu Atoll, from 5 November 1958 to 17 January 1959 (P.). Probably a regular winter visitor, in small numbers.

Aythya fuligula (Linnaeus) : Tufted Duck. (M.=*Rairu*)

2 females examined, in captivity, in North Malé Atoll, during November 1956 (P. & S.). Reported by Maldivians to be a fairly frequent winter visitor to Malé Island reefs.

Aythya nyroca nyroca (Güldenstädt) : Ferruginous Duck. (M.=*Rairu*)

A single female collected on Gan, Addu Atoll, on 5 November, 1958 (P.). Status unknown; probably a vagrant.

Nettapus coromandelianus coromandelianus (Gmelin) : Cotton Teal. (M.=*Rairu*)

A single female collected on Gan, Addu Atoll, on 8 December 1958 (P.). Status unknown; probably a vagrant.

FALCONIDAE

Buteo sp.: Buzzard. (M=*Bazzu*)

Sight record only. On 14 January 1959, a Buzzard was observed flying over Gan, Addu Atoll; it was being mobbed by 30 or more White Terns (*Gygis alba monte*) and was too far away for identification of the species (P.). Another was observed in Suadiva Atoll (G. S. & L. F.). Status unknown.

Pernis apivorus orientalis Taczanowski: Siberian Honey Buzzard. (M.=*Bazzu*)

A single male collected in Gan, Addu Atoll, on 4 December 1959 (P.). This specimen agrees well with a male in the British Museum from 'the hills south of Samarkand'. Status unknown; probably a vagrant.

Circus aeruginosus (Linnaeus): Marsh Harrier. [M.=*Bazzu* (male); *Ahunda* (female)]

Sight record only. Adult male observed in North Malé Atoll on 26 December 1956 (P. & S.); several on Gan (Addu) during 1961 (J. J. L.). Reported by Maldivians to be an occasional visitor.

Circus macrourus (S. G. Gmelin): Pallid or Pale Harrier. (M.=*Bazzu*)

A first winter female collected on Gan, Addu Atoll, on 11 January, 1959 (P.). One collected on Fadiffolu Atoll (G. S. & L. F.). Status—see under next species.

Circus pygargus (Linnaeus): Montague's Harrier. (M.=*Bazzu*)

Male and female, both in first winter plumage, collected on Gan, Addu Atoll, on 6 December 1958 and 13 January 1959, respectively. Small numbers of harriers (*C. macrourus* and *C. pygargus*) all in female or immature plumage, recorded on Gan from 12 November 1958 to 14 March 1959 (P.) and again in 1961 (J. J. L.). Gardiner recorded both this and the last species as very common 'from October to February in the northern parts of the Maldives'. Both species are regular winter visitors; the majority are in first winter plumage.

Pandion haliætus (Linnaeus): Osprey. (M.=*Bazzu*)

Sight record only. One observed fishing off the southern coast of Gan (Addu), in July 1960 (J. J. L.). Probably a vagrant.

Falco peregrinus Tunstall : Peregrine Falcon. (M=*Bazzu*)

Sight record only. A large, dark falcon, which appeared to be an immature female, observed on Gan (Addu) on 14 October 1958 (P.); others observed on 12th and 18 December 1961 (J. J. L.). Appears to be an infrequent visitor.

Falco vespertinus amurensis Radde : Eastern Redlegged Falcon. (M.=*Sirumuthi*)

Male and female collected on Gan (Addu) on 5th and 14 December 1958, respectively (P.); others seen on 26 November and 12th to 14 December 1961 (J. J. L.). Feeds upon large grasshoppers and locusts, chiefly upon *Catantops pinguis innotabilis* (P.). Appears to be a winter visitor, in small numbers.

Falco naumanni naumanni Fleischer : Lesser Kestrel. (M.=*Sirumuthi*)

First year male and a female collected on Gan (Addu) on 12th and 15 December 1958; several others observed from 12 November to 21 December (P.); others observed from 8 October to 26 November 1961 (J. J. L.). Feeds chiefly upon large grasshoppers (*C. p. innotabilis*) and small *Calotes* lizards (P.). Probably an annual winter visitor.

Falco tinnunculus tinnunculus Linnaeus : European Kestrel. (M.=*Sirumuthi*)

Female collected in North Malé Atoll in February 1957 (P. & S.); others collected in Ari Atoll, Radu Atoll, and Gaha Faro (G. S. & L. F.). Observed on Gan (Addu) from 22 October to 18 December 1961 (J. J. L.). An annual winter visitor in moderate numbers.

RALLIDAE

Amaurornis phoenicurus phoenicurus (Pennant) : Ceylon Swamp-Hen or Whitebreasted Waterhen. (M.=*Cumbilli*)

Collected in Addu Atoll (P.); in Ari, Rasdu; Gaha Faro, Miladumadulu and Fadiffolu Atolls (G. S. & L. F.). Resident in all atolls, both to the north as well as to the south of Malé Atoll. Breeds in Addu, May to September and frequently later (P.). This race appears to inhabit the whole of the Maldives with the exception of the Malé Atolls where the next race is resident. Specimens from Addu show a marked tendency towards enlargement of the white areas and frequently have odd white feathers, but most of them are so similar to typical *phoenicurus* from Ceylon that I am unable to separate them.

Amaurornis phoenicurus maldivus Phillips & Sims : Maldivian Swamp-Hen or Whitebreasted Waterhen. (M. = *Cumbilli*)

Collected in North Malé Atoll, in 1957, where it is resident (P. & S.). Breeds from May or June to August and September. This race appears to be confined to North and South Malé Atolls and to their vicinity.

Gallicrex cinerea (Gmelin) : Watercock. (M. = *Coolie-Kukulu*)

A single female was collected in North Malé Atoll (P. & S.); one seen in Addu Atoll (G. S. & L. F.). Reported by Maldivians to be resident in the more northerly atolls.

CHARADRIIDAE

Chettusia gregaria (Pallas) : Sociable Plover. (M. = ? ?)

The Sociable Plover was reported to visit the Maldives (P. & S.) but it is now considered probable that the informant confused it with the Pratincole, *Glareola pratincola* (see below). It should, therefore, be deleted from the list of Maldivian Birds, pending confirmation.

Charadrius hiaticula tundrae (Lowe) : Arctic Ringed Plover. (M. = *Findon*)

A single male collected in North Malé Atoll in December 1956 (P. & S.). 2 females collected in Gan (Addu) and several others observed from 17 November 1958 to 24 February 1959 (P.) and on 16 to 29 December 1961 (J. J. L.) The majority were in first-year plumage (P.). Appears to be an annual winter visitor, in small numbers.

Charadrius dubius jerdoni (Legge) : Little Ringed Plover. (M. = *Findon*)

One collected and several others observed in parties of 2 or 3 in Gan (Addu) from 10 November 1958 to 12 February 1959 (P.) and from 24th to 26 November 1961 (J. J. L.). Appears to be an annual winter visitor, in small numbers.

Charadrius alexandrinus Linnaeus : Kentish Plover. (M. = *Findon*)

Sight record only. Several observed on 18th and 19 November 1958 and again on 24 February 1959 on Gan (Addu) (P.). Status uncertain.

Charadrius mongolus atrifrons Wagler : Lesser Sand Plover. (M. = *Findon*)

3 collected and many observed, in small flocks, on Gan (Addu) from 24 August 1958 to 6 March 1959 (P.). One collected in North

Malé Atoll in December 1956 (P. & S.) and one in Fadiffolu Atoll (G. S. & L. F.). Appears to be a regular winter visitor, in considerable numbers.

Charadrius leschenaultii Lesson : Large Sand Plover. (M.=*Bondun*)

One collected and many observed, generally singly, on Gan (Addu), from September 1958 to March 1959; a few non-breeding birds were seen in May, June, and August (P.), and also in 1961 (J. J. L.). One collected in North Malé Atoll in December 1956 (P. & S.). A regular winter visitor, in small numbers.

Charadrius asiaticus asiaticus Pallas : Caspian Plover. (M.=*Bondun*)

A male and female collected, together, on Gan (Addu) on 10 November 1958 (P.). Status uncertain.

Pluvialis squatarola (Linnaeus) : Grey Plover. (M.=*Alaka*)

Collected in North Malé Atoll, where plentiful in winter (P. & S.). Very plentiful in Gan (Addu) from August to March but small numbers of non-breeding birds loiter throughout the year (P.). A regular winter visitor, in moderate numbers.

Pluvialis dominica fulva Gmelin : Asiatic Golden Plover. (M.=*Durrceen*)

Several collected and many observed, in flocks to about 50, on Gan (Addu) from 5 October 1958 to 21 March 1959 (P.) and from 29 December 1960 to 3 May 1961 (J. J. L.). Observed in North Malé Atoll (P. & S.), in Malé, Miladumadulu and Minicoy Atolls (G. & G.). A regular winter visitor, in considerable numbers.

Arenaria interpres interpres (Linnaeus) : Turnstone. (M.=*Ratafy*)

Very plentiful in Addu Atoll; flocks of 60+ arrive in late June and remain until the following March and April. Small numbers of non-breeding birds remain throughout the year (P.). Plentiful also in North Malé Atoll (P. & S.). Collected in Addu, Ari and Fadiffolu Atolls (G. S. & L. F.). The commonest of all the wintering waders; flocks of 150/200 in Gan (Addu) on 16 April and 13 September 1961 (J. J. L.).

SCOLOPACIDAE

Capella stenura (Bonaparte) : Pintail Snipe. (M.=*Durrceen Elolly*)

2 females collected and many more observed in Addu Atoll, from 4 October 1958 to 13 February 1959 (P.). Collected in North Malé

Atoll in December 1956 (P. & S.). Appears to be a regular winter visitor, in moderate numbers.

Capella megala (Swinhoe): Swinhoe's Snipe. (M. = *Durrceen Elolly*)

A single male collected in Medu Island, Addu Atoll, on 8 December 1958 (P.).

Capella gallinago gallinago (Linnaeus): Common Snipe. (M = *Durrceen Elolly*)

2 males and 2 females collected and several more observed in Addu Atoll from 15 December 1958 to end of January 1959 (P.). Reported to be 'extremely numerous in April 1900 on the mud-flats of Addu Atoll at low tide' by Gardiner who thought that it must breed in Addu Atoll but this is most unlikely. Appears to be a regular winter visitor.

Numenius arquata orientalis C. L. Brehm: Eastern Curlew. (M. = *Bodu Bulithumbi*)

A female collected on Gan (Addu) on 6 December 1958 and several more observed during December, and one on 9 March 1959 (P.); one on 22 March, 2 on 16 April, and others from May to November 1961 (J. J. L.). One observed in North Malé Atoll on 6 February 1957 (P. & S.). A regular winter visitor, in small numbers.

Numenius phaeopus phaeopus (Linnaeus): Whimbrel. [M. = *Bulithumbi* or (in Addu) *Bulithunga* or *Orana*]

Collected and observed in Addu Atoll where it is very plentiful, especially during the northern winter. A regular winter visitor, in large numbers; many non-breeding birds loiter throughout the year.

Limosa lapponica lapponica (Linnaeus): Bartailed Godwit. (M. = *Bulithumbi Elolly*)

A single bird observed, frequently, in Addu Atoll, from 6 June 1958 to 31 January 1959 (P.). A male collected in North Malé Atoll December 1956 (P. & S.). Appears to be a frequent visitor, chiefly during the winter.

Tringa glareola Linnaeus: Wood Sandpiper. (M. = *Findon Elolly*)

3 collected and several observed on Gan (Addu) between 12 August 1958 and 13 January 1959 (P.), 6 on Gan on 18 February 1961 (J. J. L.). Others observed in North Malé Atoll, December 1956 and January 1957 (P. & S.). Appears to be a regular winter visitor.

Tringa hypoleucos Linnaeus : Common Sandpiper. (M.=*Findon*)

Many observed in Addu Atoll from 10 August 1958 to 22 March 1959. A regular winter visitor, in moderate numbers, from August to April, to all Atolls.

Tringa totanus eurhinus (Oberholser): Eastern Redshank. (M.=*Ratafy Elolly*)

A male collected and small numbers observed in Addu Atoll between 20 November 1958 and 6 March 1959 (P.) and others observed in 1961 (J. J. L.). Collected and observed in North Malé Atoll in December 1956 (P. & S.). A regular winter visitor in small numbers.

Tringa nebularia (Gunnerus) : Greenshank. (M.=*Chunchun Elolly*)

Many small parties observed in Addu Atoll, from early November 1958 to early March 1959 (P.) and again from the 16 June 1961 to the 20 January 1962 (J. J. L.). Collected and observed in North Malé Atoll during December 1956 and January 1959 (P. & S.). Collected in Addu and Miladumadulu Atolls (G. S. & L. F.). A regular winter visitor, in moderate numbers; some non-breeding birds loiter.

Xenus cinerea (Latham) : Terek Sandpiper. (M.=*Findon*)

A male collected on Gan (Addu) on 21 November and another observed on the 7 December 1958 (P.). A winter visitor; status uncertain.

Calidris minutus (Leisler) : Little Stint. (M=*Kirru Bondun*)

2 males collected and several observed on Gan (Addu) between 11 November 1958 and 31 January 1959 (P.) and between 13 November and 16 December 1961 (J. J. L.). A single male collected and one other observed in North Malé Atoll during December 1956 (P. & S.). A regular winter visitor, in small numbers.

Calidris temminckii (Leisler) : Temminck's Stint. (M.=*Kirru Bondun*)

Sight record only. One observed closely on Gan (Addu) from 23 to 26 May 1958 and others from 5 October to 11 November (P.). Status uncertain.

Calidris subminutus (Middendorff): Longtoed Stint. (M.=*Kirru Bondun*)

4 collected and small numbers observed, frequently, on Gan (Addu) between 17 November 1958 and 24 February 1959 (P.) and also on the 26th and 27 October 1961 (J. J. L.). Appears to be a winter visitor, in small numbers, to Addu Atoll.

Calidris alpinus alpinus (Linnaeus) : Dunlin. (M.=*Kirru Bondun* or *Findon*)

3 collected and others observed on Gan (Addu) between 25 November 1958 and 24 February 1959 (P.). Probably a regular winter visitor, in small numbers.

Calidris testaceus (Pallas) : Curlew-Sandpiper. (M.=*Findon*)

3 collected and large numbers, in flocks up to 100, observed in Addu Atoll from 25 June 1958 to middle March 1959 (P.) and also in 1961 (J. J. L.). Large numbers visit the Maldives in winter and small numbers, of non-breeding birds, loiter throughout the year.

Calidris albus (Pallas) : Sanderling. (M.=*Kirru Bondun*)

A single male collected and several others observed on Gan (Addu) between 15 November 1958 and 4 January 1959 (P.) and another 6 in March 1961 (J. J. L.). Status uncertain; a winter visitor.

Philomachus pugnax (Linnaeus) : Ruff. (M.=*Findon*)

A single sub-adult male visited Gan (Addu) from 3rd to 17 October 1958 and another, also in sub-adult plumage, was collected on 5 November (P.). Appears to be an occasional winter visitor.

RECURVIROSTRIDAE

Himantopus himantopus (Linnaeus) : Blackwinged Stilt. (M= ? ?)

Sight record only; one on the southern reef of Gan (Addu) on 5 November 1961 (J. J. L.). Status unknown, probably a vagrant.

GLAREOLIDAE

Glareola pratincola (Linnaeus) : Large Pratincole. (M.=*Abularge*)

A party of 3, in sub-adult plumage, visited Gan (Addu) from 4th to 7 October 1958 and another was observed on 5 November (P.). A broken egg was found on the Air-field on 14 December 1960, a pair was in the area from 14 December 1960 to 16 March 1961 and many were observed, in flocks to 25+, from 18 October 1961 to 27 January 1962 (J. J. L.). Probably a resident, moving from atoll to atoll. The race *maldivarum* was named by J. R. Forester, in 1795, from the description given previously by Latham (1785) of a bird taken at sea in about the same latitude as the Maldives; the Addu Atoll pratincoles were probably of the same race.

DROMADIDAE

Dromas ardeola Paykull: Crab Plover. [M.=*Eshunga* (Addu) or *Tayrawa* (Malé), *Moola Lumbo* (Juvenile)]

2 observed in Addu Atoll on 8 June 1958 (P.). Male collected and others, including juveniles, observed in North Malé Atoll in December 1956 and January 1957 (P. & S.). Collected in Addu, Suadiva, and Rasdu Atolls (G. S. & L. F.). Appears widespread and resident in small numbers.

STERCORARIIDAE

Stercorarius skua Brünnich: Great Skua. (M=*Bodu Hoogula*)

Sight record only. One observed, at close range, in Addu Atoll (J. J. L.). Almost certainly an Antarctic Skua as these skuas are well known as occasional visitors to the north Indian Ocean.

LARIDAE

Larus ridibundus Linnaeus: Blackheaded Gull. (M.= ? ?)

Sight record only. One visited Gan (Addu) from the 10 to 23 December 1961 (J. J. L.). An unusual wanderer.

Chlidonias leucoptera (Temminck): Whitewinged Black Tern. (M.= *Kirru Dooni*)

Solitary, sub-adult male collected in Addu Atoll on 8 November 1958 (P.) and 3 observed, feeding over flooded areas, on 10 to 16 December 1961 (J. J. L.). Probably an infrequent winter visitor.

Gelochelidon nilotica nilotica (Gmelin): Gullbilled Tern. (M.=*Kirru Dooni Amma*)

Female collected and others observed in North Malé Atoll during December 1956 and January 1957 (P. & S.); one observed off Addu Atoll on 29 March, another from 13 to 15 September 1961, and one from 21st to 25 January 1962 (J. J. L.). Appears to be resident in small numbers but status is uncertain.

Hydroprogne caspia (Pallas): Caspian Tern. (M.= ? ?)

Sight record only. 3 observed (separately) in North Malé Atoll on 30 November 1956 (P.); one in Addu Atoll on 18 April, 4 on the 22 September, and 4 on the 18 October 1961 (J. J. L.). Status uncertain; probably an occasional visitor.

Sterna hirundo tibetana Saunders : Tibetan Tern. (M.=*Kirru Dooni*)

2 females, in worn, sub-adult plumage, collected in Addu Atoll lagoon in January and February 1959 (P.). Status unknown; probably an occasional winter visitor.

Sterna dougallii korustes (Hume) : Eastern Roseate Tern. (M.=*Kirru Dooni*)

4 collected and others observed in North Malé Atoll during January 1957 (P. & S.). Status unknown; reported by Maldivians to breed during March/May with other terns.

Sterna sumatrana mathewsi Stresemann : Blacknaped Tern. (M.=*Kirru Dooni*)

Pair collected and large numbers observed in Addu Atoll (P.). Several collected and many observed in North Malé Atoll (P. & S.). Collected and observed by various observers in Ari, Rasdu, Gaha Faro, Fadiffolu, and Miladumadulu Atolls. The most abundant and widespread tern in the Maldives; breeds in Addu Atoll during June and July.

Sterna fuscata Linnaeus : Sooty Tern. (M.=*Walla* or *Walli*)

One collected in Addu Atoll (G. S. & L. F.). Large flocks observed between Ceylon and North Malé Atoll in late November 1956 (P. & S.). Reported by Maldivians to breed during March and April. Status uncertain; occurs in the vicinity of the Maldives at various times during the year.

Sterna anaethetus Scopoli : Bridled or Brownwinged Tern. (M.=*Walla* or *Walli*)

Sight record only. One observed over the southern reef of Gan (Addu) on 15 February, 1959 (P.). Large flocks observed at sea between Ceylon and North Malé Atoll in late November 1956 (P. & S.). Status uncertain; reported by Maldivians to breed in certain atolls during March and April.

Sterna albifrons praetermissa Baker : Mesopotamian Little Tern. (M.=*Bondu* or *Bondu Dooni*)

A single male collected in Addu Atoll on 15 November 1958 (P.). Status uncertain.

Sterna albifrons saundersi Hume : Blackshafted Little Tern. (M=*Bondu* or *Bondu Dooni*)

3 collected and very large numbers observed throughout the year in Addu Atoll (P.). 3 collected and many others observed in North

Malé Atoll (P. & S.). Resident in considerable numbers throughout the Maldives; reported by Maldivians to breed, with other terns, during April.

Thalasseus bergii velox (Cretzschmar): Large Crested Tern. (M.= *Gardooni*)

Collected and observed in small numbers in North Malé Atoll (P. & S.). Observed by various observers in Addu, Ari, Gaha Faro, and Fadiffolu Atolls. Appears to be resident and widespread, in small numbers; breeding reported by Maldivians in North Malé Atoll during April.

Thalasseus bengalensis bengalensis (Lesson): Indian Lesser Crested Tern. (M.=*Iam Mutie Gardooni*)

3 collected and many observed in Addu Atoll (P.). Collected and observed in small numbers in North Malé, Ari, and Rasdu Atolls by various observers. Appears to be resident, in moderate numbers; reported by Maldivians to breed, with other terns, in North Malé Atoll during April.

Anoüs stolidus pileatus (Scopoli): Common Noddy. (M.=*Maranga*)

Several collected and many observed, in Addu Atoll, throughout the year (P.); others collected, by various collectors, in Suadiva, Gaha Faro and North Malé Atolls. Breeding (one nest) observed in Addu Atoll in April (P.). Appears to be resident in large numbers but, as Maldivians have no knowledge of its breeding, may be only a visitor rarely staying to breed.

Anoüs tenuirostris (Temminck): White-capped Noddy. (M.=*Maranga*)

Gadow & Gardiner reported this species breeding in South Mahlosmadulu Atoll in November 1899 but its presence has not been recorded since. Status unknown.

Gygis alba monte Mathews: White Tern or Fairy Tern. (M.=*Cundu Wallu Dooni*)

Collected and observed, in large numbers, in Addu Atoll to which atoll it is confined (P.). Breeds throughout the year.

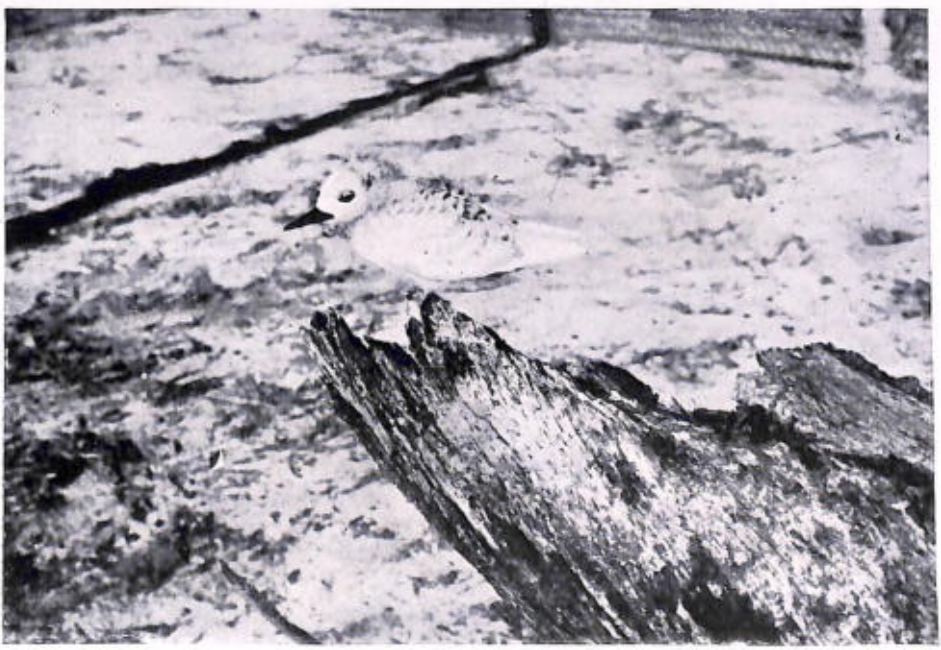
PSITTACIDAE

Psittacula calthorpae (Blyth): Emeraldcollared Parakeet. (M.= ?)

Gardiner reported seeing a pair, twice, in January 1899, on Hulule Island, North Malé Atoll. His description of 'green parakeets, a little



Lesser Frigate Bird (*Fregata ariel iredalei*), Gan, Addu Atoll, page 565



White Tern (*Gygis alba monte*) juvenile, Gan, Addu Atoll, page 578

Photos : W. W. A. Phillips

bigger than a thrush and of a brilliant green colour all over' scarcely fits *Psittacula calthorpae* which, moreover, is confined to Ceylon, so it would appear that an error in identification has occurred. Possibly the birds were a pair of Indian Parakeets or Lorikeets that had strayed or been brought over from the mainland. The bird is not known to the Maldivians.

Cuculidae

Cuculus canorus Linnaeus: Common Cuckoo. (M.=*Dindin Koel*)

Sight record only. A cuckoo, which appeared to be a sub-adult *C. canorus*, was observed on 4 and 5 January 1959, on Gan (Addu) (P.). Another, extremely tame, frequented Gan (Addu) during the last three weeks of January 1961; it appeared to be of the Asiatic race *telephonus* (J. J. L.). Status uncertain.

Cacomantis merulinus passerinus (Vahl): Indian Plaintive Cuckoo. (M= ?)

A single male, in sub-adult plumage, collected on Gan (Addu) on 13 January 1959 (P.); another observed on 9 November 1961 (J. J. L.). Appears to be a very unusual visitor.

Eudynamys scolopacea scolopacea (Linnaeus): Koel. [M.=*Karlu Koel* (Male); *Dindin Koel* (Female)]

2 males collected on Gan (Addu) and several others, both males and females, observed in spite of the total absence of House Crows (*Corvus splendens maledivicus*). Koels in this atoll must either forego breeding or return to Suvadiva Atoll, over 30 miles to the north, to breed. Resident and widespread, in moderate numbers, throughout the archipelago. Eggs are laid in the nests of the Maldivian House Crow early in the year.

Strigidae

Asio flammeus (Pontoppidan): Shorteared Owl. (M.=*Bukhamoonu*)

Gardiner recorded this owl from Goifurfehendu Atoll in October 1899; from Miladumadulu in December; from North Malé in January and February, and from Addu and Suvadiva Atolls in April (G. & G.). Well known to Maldivians. Appears to be an irregular winter visitor, often in considerable numbers.

APODIDAE

Collocalia brevirostris (McClelland) : Edible-nest Swift. (M.=*Forika*)

Sight record only. One observed flying low and feeding over Malé, North Malé Atoll on 19 December 1956 (P. & S.) and another in the same area in 1957 (G. S. & L. F.). One appeared over Gan (Addu) on the 10 November 1961 and another on the 20 January 1962 (J. J. L.). Appears to be an occasional winter visitor although there are no caves or high buildings to attract it.

Apus affinis (J. E. Gray) : Whiterumped House Swift. (M.=*Forika*)

Sight record only. Party of 7 observed over a swamp on Gan (Addu) on 16 December 1961 (J. J. L.). Status unknown.

Apus apus (Linnaeus) : Common Swift. (M.=*Forika*)

Sight record only. One observed, flying southwards, moderately low over Gan (Addu) on morning of 1 November 1958 (P.). Status unknown; an unusual visitor.

MEROPIDAE

Merops apiaster Linnaeus : European Bee-eater. (M.= ?)

Sight record only. Party of 3 (an adult and 2 sub-adults) visited Gan (Addu) from 10 January to 31 March 1959; they lived mainly upon dragonflies (P.). Status unknown.

HIRUNDINIDAE

Hirundo rustica gutturalis Scopoli : Eastern Swallow. (M.=*Forika*)

Immature male collected from a flock of 20+ on Gan (Addu) on 3 November 1958 and others observed from 14 October 1958 to 17 January 1959 (P.); others observed in Gan (Addu) from 20 October to 18 December 1961 (J. J. L.). One collected and others observed in North Malé Atoll in December 1956 (P. & S.). Recorded from Minicoy on 1 September (G. & G.). An annual winter visitor.

Delichon urbica (Linnaeus) : House Martin. (M.=*Forika*)

Sight record only. One observed over Gan (Addu) on 28 November 1961 (J. J. L.). Several seen over North Malé Atoll from end January to end February 1898 (G. & G.). An irregular winter visitor, sometimes in moderate numbers.

Riparia riparia (Linnaeus) : Sand Martin. (M.=*Forika*)

Sight record only. Several observed, flying with swallows, over Gan (Addu) on 3 and 4 November 1958 (P.). Status unknown.

TURDIDAE

Oenanthe isabellina (Temminck) : Isabelline Wheatear. (M.= ?)

A male collected and another observed on Gan (Addu) on 23 and 24 November 1958 (P.). Status unknown.

Oenanthe leucomela leucomela (Pallas) : Pied Wheatear. (M.= ?)

2 males and a female collected on Gan (Addu) on 16 and 24 November and 14 December 1958 (P.). Status unknown.

MUSCICAPIDAE

Tchitrea paradisi (Linnaeus) : Paradise Flycatcher. (M.= ?)

Sight record only. A single female or immature male was observed on Gan (Addu) on 27 October 1961 (J. J. L.). Status unknown.

MOTACILLIDAE

Motacilla cinerea Tunstall : Grey Wagtail. (M.=*Fanfoudooni*)

Sight record only. One on Gan (Addu) on the morning of 17 December 1958 (P.). Status unknown.

Motacilla flava Linnaeus : Yellow Wagtail. (M.=*Fanfoudooni*)

Sight record only. A male settled on a ship, approx.: 45 miles south of Addu Atoll on 10 April 1957; it was in fresh plumage with a bluish head and appeared to be of the race *beema* (P. & S.). An immature visited Gan (Addu) on 1 November and another, answering to the race *thunbergi*, was present on the 28th and 29 October, while 4 or 5 others appeared on the 27 October, and one on the 18 November 1961 (J. J. L.). Appears to be an irregular winter visitor, in small numbers; is well known to the Maldivians.

Anthus trivialis trivialis (Linnaeus) : Tree Pipit. (M.=*Fanfoudooni*)

A single female collected on Malé, North Malé Atoll, in December 1956 (P. & S.). Status unknown. Maldivians report that small numbers of pipits appear annually during November and December; some are probably of this species.

Anthus cervinus (Pallas) : Redthroated Pipit. (M.=*Fanfoudooni*)

An immature male collected on Gan (Addu) on 8 December 1958 (P.); and other pipits, believed to be of this species, observed on Gan (Addu) on 22 September, 12 October, and 18 December 1961 (J. J. L.). A single male collected on Malé, North Malé Atoll, in December 1956 (P. & S.). Small numbers of pipits visit the Atolls annually, during the northern winter period; it is probable that the majority are of this species but further collecting is desirable.

LANIIDAE

Lanius cristatus (Linnaeus) : Brown Shrike. (M.= ?)

Sight record only. One, in immature plumage, visited Gan (Addu) from 20 November 1961 to 2 January 1962 (J. J. L.). Status unknown.

STURNIDAE

Sturnus vulgaris Linnaeus : Common Starling. (M.= ?)

Sight record only. One identified at sea, about 40 miles to the west of Minicoy (Minikai) Island, on 10 December 1954 (Jan. 1955). Status unknown.

CORVIDAE

Corvus splendens maledivicus Reichenow : Maldivian House Crow (M.=*Karlu*)

4 collected in Malé, North Malé Atoll, and many more observed 1956/57 (P. & S.). Resident and abundant throughout the archipelago with the exception of Addu Atoll from where it is excluded by the mass attacks of the White Terns (*Gygis alba monte*). Breeds during December and January and probably during other months.

NOTE: Several other small passerine birds were seen on Gan (Addu) during 1961/62 by Mr. Latham and others but they have not been included in this paper as they were not satisfactorily identified.

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Summary

1. A short history of the ornithology of the Maldive Islands is given, together with a brief description of the atolls, their situation, climate, fauna and flora, and the general conditions governing the survival of the resident birds.

2. Some details of the breeding of 13 resident species are given, together with a table showing the approximate dates of breeding, observed and conjectured.

3. Migration to the Maldives is discussed, and details of arrival and departure dates of over 60 migrants are given, the great majority of which are winter visitors from the north. The suggestion is put forward that, for some of these migrants to the Maldives, Addu Atoll (the extreme southern-most atoll) is not the terminus of their southward flight, indications having been collected that point to some exchanges of bird life between Addu Atoll and the Chagos Archipelago to the south.

4. An annotated, systematic list of Maldivian birds, complete as far as our present knowledge permits, gives the status (known or presumed) of the 113 species and subspecies that have been recorded from the archipelago.

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The Butterflies of South Gujarat

BY

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The term South Gujarat, as used throughout this paper, comprises the Dangs and the districts of Broach and Surat. The Dangs, where the majority of species were collected, consists of a tract of hilly teak and bamboo country south of Tapti River which lies between the Nasik-Khandesh Deccan and the South Gujarat plain. This area has tropical moist deciduous and tropical semi-evergreen plant life with an annual average rainfall of 80 inches. The Dangs forest with its mountain streams, hills, valleys, and plateaux supports a wide variety of flowering plants attractive to many species of butterflies. In this pan-tropical terrain with its seasonal and altitudinal differences the writer between October 1952 and March 1963 has collected thousands of butterflies. Less intensive collecting was done between March 1946 and March 1963 jn Surat and Broach districts.

The following is a list of the species collected together with such field notes as are available. The latest work on Indian butterflies is Wynter-Blyth's BUTTERFLIES OF THE INDIAN REGION (1957); where my records appear to add anything to the information already available, I have quoted the distribution as in Wynter-Blyth in parenthesis.

DANAIDAE

Danaus aglea aglea (Cramer) : The Glassy Tiger

Fairly common throughout the year.

(South India to Poona. Himalayas east from Kashmir, Assam, Burma, Bengal.)

Danaus limniace mutina Fruh. : The Blue Tiger

Common throughout the year.

Danaus melissa dravidarum Fruh. : The Dark Blue Tiger

One netted on 18 October 1952 at Ahwa; another on 19 March 1963 at Ahwa.

(Ceylon. South India.)

Danaus genutia Cramer : The Common Tiger
Common throughout the year.

Danaus chrysippus (Linnaeus) : The Plain Tiger
Very common throughout the year.

Euploea core core (Cramer) : The Common Indian Crow
Very common throughout the year.

Euploea crassa kollari Felder : The Brown King Crow
In September and October in South Gujarat. Rare. Uncommon further south in the Konkan.

SATYRIDAE

Mycalesis perseus (Fabricius) : The Common Bushbrown
Very common throughout the year.

Mycalesis mineus polydecta Cramer : The Dark-brand Bushbrown
From July to October, fairly common. Occasionally at lights during the south-west monsoon.
(Peninsular India south of Bombay. Madhya Pradesh and Bengal, Kulu to Assam and Burma.)

Lethe europa ragalva Fruh. : The Bamboo Treebrown
September to December. Rare.

Lethe rohria nilgiriensis Guerin : The Common Treebrown
October to January. Not common.

Ypthima hubneri hubneri Kirby : The Common Fourring
Common throughout the year.

Ypthima baldus Fabricius : The Common Fivering
From July to January only; common.

Ypthima asterope Klug : The Common Threering
Common throughout the year.

Melanitis leda (Drury) : The Common Evening Brown
Common throughout the year. It has wet and dry season forms and is crepuscular in its habits. Wet season form *determinata* frequently netted at lights.

NYMPHALIDAE

Charaxes polyxena imna Butler : The Tawny Rajah
February to April. Uncommon to rare.

Charaxes fabius fabius (Fabricius) : The Black Rajah
In some years fairly common from October to April.

Eriboea athamas (Drury) : The Common Nawab
Fairly common from October to April.

Euthalia garuda (Moore) : The Baron
Common throughout the year.

Euthalia evalina laudabilis Swin. : The Redspot Duke
September and October. Not common.
(S. India.)

Euthalia nais (Forster) : The Baronet
Common throughout the year.

Neptis columella Cramer : The Short-banded Sailer
February to April. Not common.

Neptis hylas Linnaeus : The Common Sailer
Very common throughout the year. It has distinct dry and wet season forms.

Neptis jumbah Moore : The Chestnut-streaked Sailer
One captured on 14 March 1963 at Ahwa in the Surat Dangs.
(Ceylon. S. India. Bengal. Burma.)

Cyrestis thyodamas indica Evans : The Common Map
Very rare in South Gujarat.

Hypolimnas bolina (Linnaeus) : The Great Eggfly
Common throughout the year.

Hypolimnas misippus (Linnaeus) : The Danaid Eggfly
Common throughout the year.
♀ form *inaria*. August and September. Very rare.

Kallima philarchus horsfieldii Kollar : The Blue Oakleaf

Common from February to June; otherwise scarce. In April 1956 I collected forty specimens in two hours in a valley close to the mission bungalow at Ahwa.

(Confined to the western side of south India from Nasik and near Bombay southwards. Not rare from Matheran to Kanara.)

Precis hierta hierta (Fabricius) : The Yellow Pansy

Very common throughout the year. At 9.00 p.m. on 17 February 1963 I caught a female of this species flying around a petromax lamp in our mission bungalow. It is not normally crepuscular nor nocturnal in its habits.

Precis orithyia (Linnaeus) : The Blue Pansy

Very common throughout the year.

Precis lemonias (Linnaeus) : The Lemon Pansy

Very common throughout the year. I have a melanistic example of this species, caught in July 1960 at Ahwa on *Lantana* flowers, in which the ground colour on the upper surface is much darker than usual and the large ocelli on the hindwings are absent.

Precis almana almana (Linnaeus) : The Peacock Pansy

Common throughout the year.

Precis iphita (Cramer) : The Chocolate Pansy

Very common throughout the year.

Vanessa cardui (Linnaeus) : The Painted Lady

Very common throughout the year.

Vanessa indica (Herbst) : The Indian Red Admiral

Very rare in South Gujarat.

(Ceylon. Hills of South India. Coorg. Himalayas as far west as Kashmir, Hills of NE. India, Burma.)

Argynnis hyperbius (Johanssen) : The Indian Fritillary

Very rare in South Gujarat. Recorded on 9 April 1960 at Ahwa.

Atella phalantha (Drury) : The Common Leopard

Very common throughout the year.

Cirrochroa thais (Fabricius) : The Tamil Yeoman

Appearance in South Gujarat probably accidental. The sole specimen was netted on 27 September 1962 at Ahwa on *Lantana* flowers.

(Ceylon. Western Ghats. Coorg. Wynaad. Nilgiris. Palnis.)

Byblia ilithyia (Drury) : The Joker

My only record for South Gujarat is a specimen netted on 19 September 1957 in the mission garden at Ahwa.

Ergolis ariadne (Johanssen) : The Angled Castor

Fairly common throughout the year.

Ergolis merione merione (Cramer) : The Common Castor

Common throughout the year.

ACRAEIDAE

Telchinia violae (Fabricius) : The Tawny Coster

Throughout the year in the Surat Dangs but not common. Fairly common at Broach.

ERYCINIDAE

Libythea lepita lepitoides Moore : The Common Beak

Rare in South Gujarat.

(Ceylon and S. India, rare. Elsewhere common to very common.)[1]

Abisara echerius (Stoll) : The Plum Judy

Fairly common throughout the year.

LYCAENIDAE

Spalgis epius (Westwood) : The Apefly

Netted in July and August only; rare.

(Ceylon and S. India.)

[1] Wynter-Blyth does not mention this subspecies. Evans in his IDENTIFICATION OF INDIAN BUTTERFLIES says that this subspecies occurs in Ceylon and S. India and is not rare.—EDS.

Castalius rosimon rosimon (Fabricius) : The Common Pierrot
Fairly common throughout the year.

Castalius caleta decidia (Hewitson): The Angled Pierrot
Not uncommon. October to March.
(Recorded from the Western Ghats south of Bombay.)

Castalius ethion ethion (Doubleday & Hewitson) : The Banded Blue Pierrot
October and November. Not common.
(Ceylon. S. India. Assam and Burma.)

Tarucus theophrastus indica Evans : The Pointed Pierrot
Fairly common during the winter months.

Tarucus extricatus Butler : The Rounded Pierrot
Common from March to July.

Syntarucus plinius (Fabricius) : The Zebra Blue
Common from November to July.

Azanus ubaldus (Cramer) : The Bright Babul Blue
September and October. Not common.

Azanus uranus Butler : The Dull Babul Blue
November and probably other months. Not common.

Azanus jesous gamra (Lederer) : The African Babul Blue
November and probably other months. Not common.

Neopithceops zalmora (Butler) : The Quaker
Collected on 15 November 1960 and 8 December 1962 at Ahwa. Rare.
(Ceylon. South India to Bengal. Kumaon to Burma. Andamans.)

Lycaenopsis puspa gisca Fruh.: The Common Hedge Blue
November to February. Not common.

Lycaenopsis albidisca Moore : The Whitedisc Hedge Blue
November, December, and January. Not common.
(Hills of S. India.)

Chilades laius laius (Cramer) : The Lime Blue
Common throughout the year.

Zizeeria putli Kollar : The Southern Grass Jewel
Common throughout the year.

Zizeeria maha Kollar : The Pale Grass Blue
Common from November to July.

Zizeeria lysimon Hub. : The Dark Grass Blue
Common from October to April.

Zizeeria gaika Trimen : The Tiny Grass Blue
Fairly common from November to April.

Zizeeria otis Fabricius : The Lesser Grass Blue
Common from October to April.

Euchrysops cnejus (Fabricius) : The Gram Blue
Common from October to April.

Euchrysops pandava pandava (Horsfield) : The Plains Cupid
Fairly common throughout the year.

Catochrysops strabo (Fabricius) : The Forget-Me-Not
Common throughout the year.

Lampides boeticus (Linnaeus) : The Peablue
Very common throughout the year.

Lycaenesthes lycaenina Felder : The Pointed Ciliate Blue
March to May in the Surat Dangs. Not common.

Jamides celeno celeno Cramer : The Common Cerulean
Common throughout the year.

Jamides bochus bochus Cramer : The Dark Cerulean
Very common throughout the year.

Nacaduba nora nora Felder : The Common Lineblue
Found throughout the year. Not common.

Curetis thetis (Drury) : The Indian Sunbeam

Fairly common throughout the year.

Curetis acuta dentata Moore : The Angled Sunbeam

Fairly common throughout the year.

Curetis bulis (Doubleday & Hewitson) : The Bright Sunbeam

Fairly common during the monsoon season; however, the dry season form *angulata* is more common than the above from October to April.

(S. India. Pachmarhi.)

Iraota timoleon timoleon (Stoll) : The Silverstreak Blue

Collected only in July, October, and November, rare.

Amblypodia amantes amantes Hewitson : The Large Oakblue

Fairly common from September to March.

Surendra quercetorum Moore : The Common Acacia Blue

Taken only in August and September. Probably rare.

(Ceylon. S. India. Simla Hills to Assam and Burma. S. Bihar.)

Spindasis vulcanus vulcanus Fabricius : The Common Silverline

From July to April only, fairly common.

Spindasis ictis ictis Hewitson : The Common Shot Silverline

From July to April only, fairly common.

Spindasis elima elima Moore : The Scarce Shot Silverline

November and December. Not common.

Spindasis lohita Horsfield : The long-branded Silverline

Taken only in July and November; rare.

(Mussoorie to Assam and Burma. Calcutta. Ceylon and S. India.)

Zesius chrysomallus Hubner : The Redspot

One netted on 15th March 1963 at Ahwa in the Surat Dangs. Apparently rare.

Tajuria cippus cippus (Fabricius) : The Peacock Royal

From March to November only. Not common. Found on *Poinsettia* blossoms.

Rathinda amor (Fabricius) : The Monkey Puzzle

Found in South Gujarat from September to November. Not common.

(. . . up the Western Ghats to Bombay.)

Deudoryx epijarbas epijarbas (Moore) : The Cornelian

November, December and March. Not common.

Virachola isocrates (Fabricius) : The Common Guava Blue

November to March. Not common.

Virachola perse ghela Fruh. : The Large Guava Blue

Rare. 12 November 1960 on *Poinsettia* blossoms at Ahwa.
(Ceylon. S. India.)

Rapala melampus Cramer : The Indian Red Flash

Fairly common from November to April.

PAPILIONIDAE

Polydorus hector (Linnaeus) : The Crimson Rose

Rare in South Gujarat.
(Common in Bengal, S. Bihar, Orissa, S. India.)

Polydorus aristolochiae aristolochiae (Fabricius) : The Common Rose

Common throughout the year.

Chilasa clytia clytia (Linnaeus) : The Common Mime

From July to September. Uncommon and local.

Papilio polymnestor polymnestor Cramer : The Blue Mormon

Uncommon locally from July to October.

(Ceylon. S. India. Madhya Pradesh. S. Bihar. Bengal. Western Ghats to Bombay. Sikkim.)

On 8 July 1960 a large caterpillar of this species was found eating a pumelo leaf (*Citrus grandis*) in the mission school garden at Mulchond. The larva had a greatly enlarged head and was mainly green in colour. It formed a chrysalis on July 10th. The pupa was attached at one end of the base of the leaf stalk on the underside of a pumelo leaf. The male imago emerged on 30 July 1960, hatching in a box in the author's office at Ahwa.

Occasionally this magnificent butterfly measures nearly six inches from wing tip to wing tip.

Papilio helenus daksha Moore : The Red Helen

One netted on 25 October 1957 at Ahwa. Very rare or accidental in Gujarat.

(Ceylon. Western Ghats. Nilgiris. Palnis. Shevaroys. Coorg and Bangalore.)

Papilio polytes Linnaeus : The Common Mormon

The male and its three female forms are found in South Gujarat. The male is very common throughout the year.

♀ form *stichius*—very common throughout the year.

♀ form *romulus*—fairly common throughout the year.

♀ form *cyrus*—very rare.

Papilio demoleus demoleus (Linnaeus) : The Lime Butterfly

Very common throughout the year.

Graphium nomius nomius (Esper) : The Spot Swordtail

Common from February to June; rare in July and August.

Graphium agamemnon agamemnon (Linnaeus) : The Tailed Jay

Very common throughout the year.

Graphium sarpedon teredon Felder : The Common Bluebottle

Rare in September in South Gujarat. More common to the south in the Konkan.

PIERIDAE

Leptosia nina nina (Fabricius) : The Psyche

Some years common from October to March.

Delias eucharis (Drury) : The Common Jezebel

Common throughout the year. Abundant from November to February.

Cepora nerissa (Fabricius) : The Common Gull

Common throughout the year.

Anaphaeis aurota aurota (Fabricius) : The Pioneer

January to May. Not common.

Appias libythea libythea (Fabricius) : The Striped Albatross
Throughout the year. Uncommon.

Appias lyncida latifasciata Moore : The Chocolate Albatross
Throughout the year. Rare.

Appias albina darada Felder : The Common Albatross
January to March. Not common.

Ixias marianne (Cramer) : The White Orange Tip
Fairly common throughout the year.

Ixias pyrene (Linnaeus) : The Yellow Orange Tip
Fairly common throughout the year, but more common in winter.

Colotis calais (Cramer) : The Small Salmon Arab
Rare in the Dangs, but common elsewhere in South Gujarat.
♀ form *albina* at Broach. Uncommon.

Colotis vestalis (Butler) : The White Arab
Rare in the Dangs, but common elsewhere in South Gujarat.

Colotis etrida etrida (Boisduval) : The Little Orange Tip
Uncommon from January to June in the Dangs. Common in Bulsar, Surat, and Broach.

Colotis fausta (Olivier) : The Large Salmon Arab
Rare in the Dangs. Common elsewhere in South Gujarat from October to April.

Colotis eucharis (Fabricius) : The Plain Orange Tip
Rare in the Dangs. Common throughout Broach District and Surat District, especially in winter months.

Colotis danae danae (Fabricius) : The Crimson Tip
Uncommon in the Dangs, but common elsewhere in South Gujarat from October to April.

Hebomoia glaucippe australis Butler : The Great Orange Tip
Only record for the Dangs is in January 1959 at Ahwa. Fairly common in the Konkan south of Gujarat.

Parenonia valeria hippa Fabricius : The Common Wanderer

Fairly common from October to April.

♀ form *philomela* is occasionally found from October to April.

(Recorded from Assam, Calcutta, Jabalpur, the Nilgiris, and N. Kanara.)

Catopsilia crocale (Cramer) : The Common Emigrant

Abundant throughout the year having two distinct female forms, one white and the other yellow.

Catopsilia pomona (Fabricius) : The Lemon Emigrant

Very common throughout the year.

♀ form *catilla* with purple blotches below is fairly common.

Catopsilia pyranthe (Linnaeus) : The Mottled Emigrant

Found throughout the year, but more common during the monsoon.

Catopsilia florella gnoma (Fabricius) : The African Emigrant

Found throughout the year, but more common from October to April.

C. florella may be only the dry season form of *C. pyranthe*; however, this problem needs more study.

Eurema brigitta (Cramer) : The Small Grass Yellow

Common throughout the year.

Eurema laeta Boisduval : The Spotless Grass Yellow

The wet season form *venata* and the dry season form *laeta* are both very common. Wet season form rarely netted at mercury-vapour lamp; however, it is not normally crepuscular nor nocturnal.

Eurema hecabe (Linnaeus) : The Common Grass Yellow

Abundant throughout the year. Occasionally captured at mercury-vapour lamp in Ahwa and sometimes crepuscular.

Eurema blanda silhetana Wall. : The Three-spot Grass Yellow

Uncommon throughout the year.

HESPERIIDAE

Celaenorrhinus leucocera leucocera (Kollar) : The Common Spotted Flat

During the monsoon. Not common.

Celaenorrhinus ambareesa (Moore) : The Malabar Flat

February to May. Not common.

Coladenia dan dan (Fabricius) : The Fulvous Pied Flat

During the monsoon season. Rare.
(S. India. Kulu to Assam and Burma.)

Sarangesa dasahara (Moore) : The Common Small Flat

Fairly common throughout the year.

Sarangesa sati de Nicéville : The Tiny Flat

Common during the monsoon months. According to Wynter-Blyth (p. 464) *S. sati* is now considered a race of *S. purendra.*

Caprona ransonnetti (Felder) : The Golden Angle

Throughout the year, the dry season form much paler than the wet season form. Not common.
(S. India to Igatpuri, Kalka and Assam. Burma. Ceylon.)

Tapena thwaitesi hampsoni El. & Ed. : The Black Angle

Rare in February and March in the Surat Dangs. Not mentioned by Wynter-Blyth, but rare in south India according to Evans.

Spialia galba (Fabricius) : The Indian Skipper

Common throughout the year.

Chromus alexis alexis (Fabricius) (= **Hasora chromus** Cramer, according to some authors) : The Common Banded Awl

Abundant throughout the year. Occasionally attracted to lights at night in the bungalow.

Badamia exclamationis (Fabricius) : The Brown Awl

Fairly common throughout the year.

Suastus gremius (Fabricius) : The Indian Palm Bob

Fairly common in September and October at Waghai, but rare elsewhere.

Arnetta vindhiana (Moore) : The Vindhyan Bob

September and October in the Surat Dangs. Not common.

Matapa aria (Moore) : The Common Redeye

In some years common from September to January; one taken on

16 March 1963. Usually flies early in the morning and at dusk; however, I have netted it at midday on *Lantana* flowers.
(Ceylon. S. India to Matheran and Calcutta. Dun to Assam and Burma.)

Taractrocera ceramas nicevillei Watson : The Tamil Grass Dart
During the monsoon season. Not common.

Telicota ancilla = Astychus augias (Linnaeus), and **A. pythias** (Mabille):
The Pale Palm Dart and The Dark Palm Dart
Common from November to May, especially the Dark form.

Potanthus pseudomaesa cato Evans : The Indian Dart
Common from December to March.

Pelopidas conjuncta Hewitson : The Conjoined Swift
December to March. Not common.

Caltoris kumara Moore : The Blank Swift
Fairly common on *Lantana* bushes and in nullahs during October and November.
(Ceylon. Western Ghats to N. Kanara. Palnis, Nilgiris, Bangalore and High Wavys. Calcutta. Sikkim to Assam and Burma.)

Pelopidas mathias mathias Fabricius : The Small Branded Swift
Common throughout the year.

Borbo bevani Moore : The Bevan's Swift
Fairly common throughout the year.

Udaspes folus Cramer : The Grass Demon
Fairly common throughout the year.

Iambrix salsala (Moore) : The Chestnut Bob
Fairly common from October to March.
(Ceylon. S. India. Sikkim to Calcutta, Assam and Burma.)

SUMMARY

From March 1946 to March 1963 the writer collected thousands of butterflies in the Dangs and the Broach and Surat districts. In all, one hundred and forty-five species and seven additional female forms were collected. Only in a few cases have the dry and wet

season forms been mentioned. Completeness is not claimed in this report, for additional species and races will no doubt be found or may have been overlooked.

Data on the distribution of the butterflies presented in this paper should help to clarify the range of thirty or more species, races, and rare female forms. Many species and races from south India are now extended considerably north of Bombay. From this study it is clear that South Gujarat has a very rich butterfly fauna.

Acknowledgements

The writer is indeed grateful to Mr. N. T. Nadkerny, Entomologist of the Bombay Natural History Society, for help with the identification of some difficult species; and to Mr. Humayun Abdulali, the then Honorary Secretary of the Society, for suggestions and encouragement in the preparation of this paper.

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On the Occurrence of *Thalassina anomala* (Herbst), a burrowing crustacean in Bombay waters, and its burrowing methods

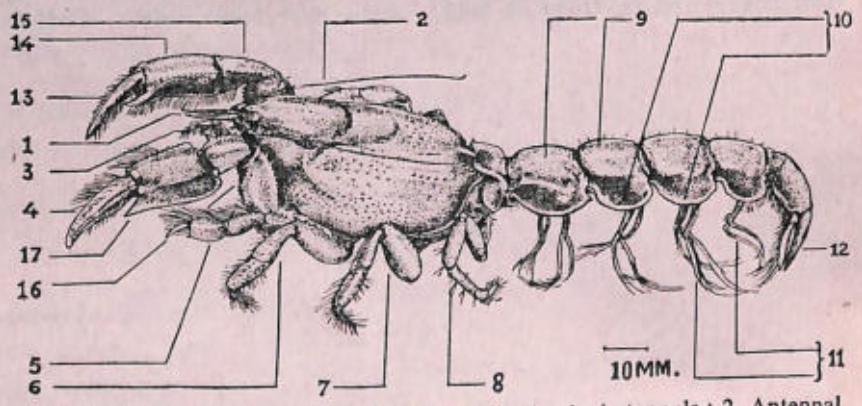
BY

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(With two plates and one text-figure)

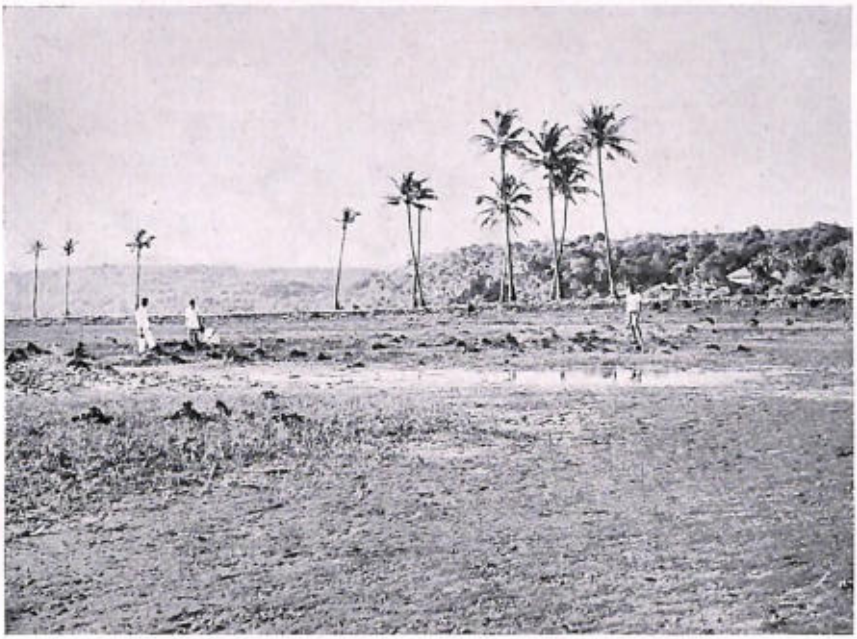
During a shore collection trip along the coast of Ratnagiri, I saw some mounds of mud (Plate I) not far from the low-tide water mark, in the swamps of Karla, a fishing village. These mounds, different from those generally made by crabs, were made by 'scorpion-like' animals according to the villagers. On digging, I found that the 'scorpion-like' animal was *Thalassina anomala* (Herbst) (Text-figure) locally called *angde khod* (*angde* means fingers, and *khod* means to dig, in Marathi). This is the first record of the species from Bombay waters.



The body parts of *Thalassina anomala* (Herbst) : 1. Antennule ; 2. Antennal flagellum ; 3. Endopodite of third maxilliped ; 4. First leg ; 5. Second leg ; 6. Third leg ; 7. Fourth leg ; 8. Fifth leg ; 9. Abdominal terga ; 10. Abdominal pleurites ; 11. Pleopods ; 12. Telson ; 13. Dactylus ; 14. Propodus ; 15. Carpus ; 16. Merus ; 17. Fixed finger

The genus *Thalassina* is monotypic. de Man (1928) recognizes two varieties, *T. a. gracilis* Dana and *T. a. squamifera* de Man. In India,

Thalassina anomala (Herbst)



Colonies of mounds near the bund and the houses situated on the edge of the creek



A closer view of the mounds. The arrow indicates the presence of a freshly formed top layer of mud on the entrance of the mound.

Photos : K. N. Sankolli

Thalassina anomala (Herbst)



Dorsal view of animal coming out of burrow during the carrying process. The mud is held from above by the third maxillipeds.



Dorsal view showing widening out of first two pairs of legs and bent condition of third maxillipeds during process of dumping.



Dorsal view of animal pushing away excavated mud after dumping. Note bent condition of third maxillipeds.



The animal retreating into the burrow.

Photos : K. N. Sankolli

so far this species has been recorded only from Mysore [Geelvink-bay, as cited by de Man (op. cit.)].

Observations on the habitat and habits of *T. anomala* are few. Pearse (1911) described its burrowing habits and, on the basis of the examination of the stomach-contents of a single specimen, suggested that the animal is vegetarian in diet. According to Marshall & Orr (1960) the species feeds on land vegetation. Johnson (1961) made detailed observations on the food and feeding habits and concluded that *T. anomala* is not a vegetarian, but a mud-feeder. Observations made by me on the feeding habits, mouth parts, and alimentary tract of the animal are more or less similar to those made by Johnson.

The mounds of *T. anomala* range from 1 ft. to 2½ ft. in height, and are so abundant that they form a distinct topographic feature of the mangrove swamps of the Karla creek. The colonies of these mounds often extend beyond the high-tide mark, even into the back-yards of the houses on the edges of the creek.

The entrance leading to the main burrow is generally plugged with layers of earth; a freshly formed topmost layer indicates the presence of the animal inside, irrespective of whether this is observed during the day or at night. Burrows dug in the mud flats near low-water mark slope down gradually; those above high-water mark often go almost vertically down until they reach the water level. The main burrow ranges in depth from 4 ft. to 8 ft. and has 6 or 7 side tunnels, of which 3 or 4 may terminate blindly, the blind ends being broader than the tunnels. Several mounds are generally grouped together; in such cases the tunnels of one burrow are often inter-linked with those of the other burrows and make the collection of the animal a difficult task. During a period of one and half years I never came across a specimen outside the burrow, even at night, though I had several reports from local people about the animals having been seen outside the burrows, mostly on moonlit nights.

Method of Burrowing (Plate II)

It is difficult to observe the burrowing of *T. anomala* in its natural habitat, hence the only possibility of recording its behaviour was by allowing it to make burrows in the mud under laboratory conditions.

For this, a wooden tub 2 ft. long, 3 ft. high, and 1½ ft. broad was filled with soft dark mud to a depth of 2 ft. to 2½ ft. and over it a layer of yellow mud of about 6 in. to 8 in. depth was spread. The two types of mud were collected from the locality where *Thalassina* was abounding. An adequate quantity of water was splashed on to

the mud as repeated experience showed that the animal refused to make its burrow when kept on wet mud alone.

When the animal was introduced in the tub, it first crawled for a while. Then, as it came across some soft portion in the mud, it pushed in its second pair of legs inside the soil as if to loosen it. Simultaneously, from the front, the first pair of legs was also introduced in the soil and the digging began. While loosening the soil, nearly the entire propodus together with the whole of the dactylus of the second pair and more than one-half of the propodus of the first pair went inside the mud. The action of the first two pairs of legs while loosening and collecting the mud was like that of a spade in action. During this process, the endopodite of the third maxilliped was also used to a certain extent to manipulate the gathering of the mud in between the first two pairs of chelipeds. The mud was held from either side by the first pair of legs, from below by the second pair held almost in a horizontal plane, and from above by the third maxilliped. After collecting a sufficient load of mud the animal carried the load either forward or backward, in the manner of a tractor, away from its prospective burrow. The way the first two pairs of legs act while holding the mud has been well expressed by Pearse (op. cit.): 'the first two pairs of legs form a sort of basket'. Outside the opening of the newly started burrow, its grip was loosened by widening out the chelipeds—in this process of dumping the mud the endopodite of the third maxilliped played an important role. It was first bent downwards and then moved outwards so as to push the mud away from the burrow. The dumping was also shared by both the chelipeds. Along with the endopodite of the maxilliped, the propodus and dactylus of the chelipeds also moved in an outward direction so that the mud should not fall back into the burrow. After dumping the mud the animal returned to the burrow and recommenced burrowing.

It was interesting to observe the reaction when a small piece of stone was thrown into the burrow while the animal was retreating. It would simply pick up the stone and bring it towards the mouth of the burrow and store it away in the usual manner but, if this was repeated four or five times, the animal would come out farther and push the stone along with the already excavated mud quite far from the previous position. During the digging the animal used to freely bend its abdomen in various postures.

Ecological adaptations. The range of occurrence of the mounds inhabited by these animals is from the low-tide level where they are more or less completely submerged under sea-water, or little above the

splash zone of the high tide, where they are subject to dessication. However, the animals living at the higher level, as mentioned earlier, have access to water under the ground through their main burrows.

Of the first two pairs of legs performing the work of excavation and dumping of the mud, the first pair has the major role. Accordingly these two appendages are modified for digging. The fixed finger does not extend beyond half the length of the dactylus; hence it is strengthened and is capable of digging deep in the mud. The inner and outer lateral surfaces of the propodus and dactylus are quite smooth, i.e. without any rough tuberculations, and these two surfaces converge on the ventral margin. The inner lateral surface of the merus is more flattened than that of the carpus. The inward deflexed nature of the fingers, and the smooth and more or less flattened inner lateral surface of the carpus and merus are useful in holding the excavated mud between the chelipeds and in dumping it. The first pair is less hairy than the second, and is so massive and stout that it can bear the weight of the mass of mud which the animal carries during its burrowing operations.

The dactylus, propodus, carpus, and merus of the second leg are flattened from either side. The dactylus is comparatively flat, the flattening being more steep towards the ventral margin. The propodus is produced into a blade-like form and its sub-chelate fixed finger is equally efficient in digging, as it is short and stumpily flat. The ventral surface of the merus is slightly flattened. The ventral margin of the propodus and merus is provided with fringes of bristles. The entire second leg moves in a plane at an angle of less than 90° to the horizontal. Hence, the flattened and fringed nature of its segments offers help in holding and lifting the mass of mud held between the chelipeds and thus provides additional support from below.

The tip of the dactylus of the remaining legs is bent slightly outside, and is provided with some tooth-like spines to have a firm hold on the walls of the burrow during the operations.

The ventral surface of the segments of the endopodite of the third maxilliped is flattened and is fringed with tufted bristles on either side. This facilitates drawing in the mud towards the animal, holding the mud from above during the carrying process, and pushing out the mud, when the grip of both the chelipeds is loosened.

As the abdominal terga are loosely jointed, the animal can easily bend its abdomen beneath the thorax and slightly sidewards, a property of immense importance to a burrowing animal like this thalassinid.

The last three pairs of legs are rather poorly developed, and as

such the animal can only crawl sluggishly on land. The pleural plates, because of their lateral extensions, offer protection to the abdomen from its ventral side.

Considering the differences in the range of occurrence of these animals, from low-tide level to far above high-tide level, and the extreme changes in salinity prevailing in the creek during the monsoon and summer, it was found necessary to study the effect of submersion, dessication, and salinity changes, since in nature the animal is exposed to these conditions in the creek.

Under normal conditions of room temperature (25° to 27° C.) the animal, when kept outside the water, could survive for only 14 to 16 hours; when submerged in fresh water or in sea water separately for 15 days, it lived equally well.

The structural peculiarities and tolerance to dessication and extreme changes in salinity indicate that the animal, morphologically and physiologically, is well adapted for its burrowing mode of life in the swamps of the creeks.

The local people are afraid of *T. anomala* because of its grotesque look and its way of spreading out its chelipeds on the slightest disturbance very much like that of a terrestrial scorpion. Also the first pair of chelipeds and the abdomen closely resemble the corresponding parts of a terrestrial scorpion, but there is no poison fang in the terminal segment of its abdomen.

Economic importance. Johnson quotes Dammerman (1929) who states that *T. anomala* is destructive to Nipah seedlings without specifying whether the destruction is caused as the result of feeding activity or other activities of the animal.

I have seen the colonies of *Thalassina* mounds in Karla, Sakhartar, and Mazagaon in Ratnagiri, at Vengurla in the Ratnagiri district, and at Versova and Navha in the Bombay suburban area. The animal is notorious for causing severe damage to bunds by its burrowing activities. The paddy fields and backyards of houses in the proximity of the creeks are also subject to this sort of damage.

Acknowledgements

I am greatly indebted to Dr. L. B. Holthuis of Leiden for his guidance in identifying the animal and for sending me a photocopy of the Pearse paper. My grateful thanks to Dr. C. V. Kulkarni for constant encouragement, to Dr. H. G. Kewalramani for his personal guidance, and to Mr. M. R. Ranade for helpful suggestions.

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* Not referred to in original.

Mosses of Eastern India—IV. Eubryiidae

Series II. DICRANALES (Contd.): *Family* LEUCOBRYACEAE, and Series III. POTTIALES: *Family* CALYMPERACEAE[1]

BY

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(*With twenty text-figures*)

Series II. DICRANALES (Contd.)

Of the three families representing the series DICRANALES in India, Ditrichaceae (Gangulee 1959) and Dicranaceae (Gangulee 1960) have already been dealt with. The last family Leucobryaceae is taken up here.

The family Leucobryaceae is distinguished from the other two families by the broad costa where one layer of small, green *chlorocyst* cells is sandwiched between two or more layers of large, hyaline *leucocyst* cells. This is a tropical and subtropical family of epiphytes represented in eastern India by 10 species in 5 genera which are enumerated below with their geographical distribution. All these have been examined by the author and are described and illustrated in this paper.

Family LEUCOBRYACEAE

KEY TO THE GENERA

1. Midrib prominent with median stereid strand .. *Leucophanes*
   Midrib not prominent, without stereid 2

2. Chlorocysts in 3 layers: dorsal, ventral, and central; irregularly 3-4-sided. Leaves in several ranks, narrow above from a broad sheathing base, highly papillose. Capsule erect .. .. *Exodictyon*

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[1] The three earlier parts in this series appeared in the *Bull. Bot. Soc. Bengal*:
I. Eubryinales. Series I. Fissidentales. Vol. 11, No. 2, 1957, pp. 59-84;
II. Eubryiidae. Series II. Dicranales. Family Ditrichaceae. Vol. 13, Nos. 1 & 2, 1959, pp. 1-9;
III. Eubryiidae. Series II. Dicranales (contd.). Family Dicranaceae. Vol. 14, 1 & 2, 1960, pp. 10-57.—EDS.

	Chlorocysts in a single central layer with 1 or more layers of leucocysts on each side. Hyaline lamina forming a narrow border	3
3.	Leaves more or less flat above ; chlorocyst cells 3-sided at least in upper half of leaf ; capsule erect, symmetrical	*Octoblepharum*
	Leaves canaliculate above ; chlorocyst cells 4-sided, each at the junction of 4 leucocysts	4
4.	Capsule on extended seta, ovoid, inclined, asymmetrical. 16 dicranate peristome teeth	*Leucobryum*
	Capsule immersed on short seta, hemispherical. Peristome absent. Leaves smaller	*Ochrobryum*

In the following drawings of the species described, the undermentioned symbols have been used : P_1 = natural-sized plant ; P_2 = magnified plant ; P_D = dry plant ; L = leaf ; L_A = leaf apex ; L_B = leaf base ; L_{BC} = leaf base cells ; $L_{t.s.}$ = t.s. of leaf at middle height ; $L_{Bt.s.}$ = t.s. of leaf base ; L_P = perichaetial leaf ; Chl = chlorocyst cell ; C = capsule ; op = operculum ; P_T = peristome teeth ; S_P = spore.

I. Subfam. LEUCOPHANOIDEAE

LEUCOPHANES Hampe

Whitish green tropical epiphytes with crowded spreading leaves. Stem without central strand. Leaf with a prominent ' midrib ' because of the presence of a median stereid band. Costa shows one layer of 4-angled chlorocyst cells between 2 layers (there may be more layers near base) of larger leucocyst cells. Leaf bordered throughout by 2 or 3 rows of very narrow, greatly elongated cells. Lamina wings of hyaline cells confined to the leaf base only. Fruiting condition rare. Seta slender, terminal, soon becoming lateral ; capsule erect, cylindrical ; peristome teeth 16, not cleft or striped, papillose ; operculum conic-rostrate ; calyptra cucullate with entire base.

1. **Leucophanes octoblepharoides** Bridel in *Bryol. Univ.* **1** : 763, 1826.

Syrrhopodon octoblepharis Nees in *Schwaegr. Suppl.* **4** : t. 311a, 1842.
Octoblepharum octoblepharoides Mitten in Voy. Challenger, Bot. **3** : 259.

Short, glossy, whitish green, epiphytic plants turning brown, densely covered with leaves and forming tufts. Stem without central strand, ±2 cm. long, usually single, sometimes branched. Leaves erect-spreading, linear lanceolate, slightly concave at base and nearly flat above, not much changed when dry, up to 4 mm. long. Wide costa completely covers the whole of the leaf in the upper part, becomes narrower at base (less than ¼ of total leaf length) where only it is flanged by a hyaline lamella ; t.s. of costa shows one layer of 4-angled chlorocysts between

2 rows of larger colourless leucocyst cells and a median dorsal stereid band which is prominent as a 'mid-rib'. Leucocysts at leaf base

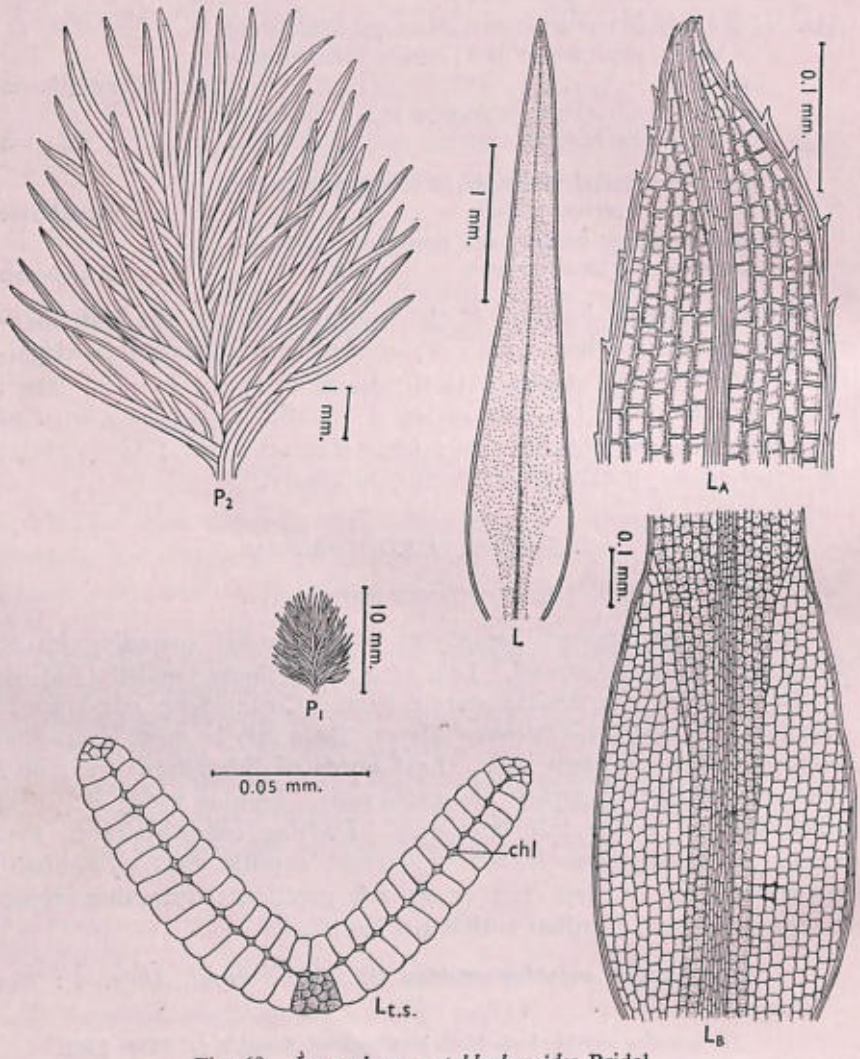


Fig. 69. *Leucophanes octoblepharoides* Bridel

measure ±18×17 μ. Leaf bordered all round with 2 to 3 rows of very long, narrow cells having yellowish, thickened walls. Leaf apex toothed with the percurrent stereid band. Lamina cells hyaline, quadrate to short rectangular, ±24 μ wide. Fruiting plants not seen.

Distribution. Nepal, *Wallich*; NEFA, *Bor* 63; East Bengal, *Brühl, & Sarkar.*

Tropical countries spreading from Nepal eastwards to Pacific Islands.

II. Subfam. LEUCOBRYOIDEAE

LEUCOBRYUM Bridel

General characters as in *Leucophanes* but without any stereid band in costa so that there is no prominent ' mid-rib '.

KEY TO THE SPECIES

1.	Mature vegetative leaves auriculate at base ..	2. *L. sanctum*
	Leaves not auriculate	2
2.	Leaves smooth on back	3
	Leaves strongly scabrous on back	4
3.	Silky plants with slender flexuose leaves up to 10 mm. long. Leaf lamina cells elongated and pitted ..	3. *L. bowringii*
	Coarse plants with shorter leaves (up to 7 mm.). Leaf lamina cells not pitted, elongated only in the border rows	4. *L. nilghiriense*
4.	Large plants with leaves 10 mm. or more in length and more than 1 mm. wide	5. *L. javense*
	Smaller plants with dense leaves less than 3 mm. long and with characteristic pattern on back	5
5.	Leaves broader at tip, chlorocyst cells broader, scabrous cells on back less raised	6. *L. aduncum*
	Leaves narrower and more pointed at tip, chlorocyst cells narrower (± 6 μ wide), scabrous cells on back more prominent	7. *L. scalare*

2. **Leucobryum sanctum** (Brid.) Hampe in *Linnaea* **13** : 42, 1839.

Dicranum glaucum var. *sanctum* Bridel in *Bryol. Univ.* **1** : 811, 1826.
Dicranum sanctum Nees in *Schwaegr. Suppl.* 2 : 121, 1826.
Octoblepharum sanctum Mitt. in *Proc. Roy. Soc.* (1879): 99, 1879.
Leucobryum auriculatum C. Muell. (*fid.* Geheeb) in *Bibl. Bot.* : 2, 1889.

Comparatively robust, brownish pale green epiphytic plants in tufts. Stems up to 3 cm. long, usually branched, without central strand. Leaves erect to erect-spreading, flexuose to secund, not much changed when dry ; abruptly lanceolate-subulate from a ± rectangular base, canaliculate above, shortly apiculate ; mature leaves on vegetative shoots distinctly auriculate, up to 4 mm. long (known to be much longer, up to 7 mm. in Java and Philippine specimens) and about 1 mm. wide at base. Leaves at top and base of vegetative shoots and most leaves on fertile shoots do not show auricles. Wide costa scabrous on back flanged by a narrow lamina only at the basal part. T.s. of leaf shows costa with inner 4-angled chlorocysts sandwiched between 2 layers of leucocysts.

Leucocysts become several-layered on the dorsal side and 2-layered on the ventral side at leaf base near attachment with stem. Leucocyst

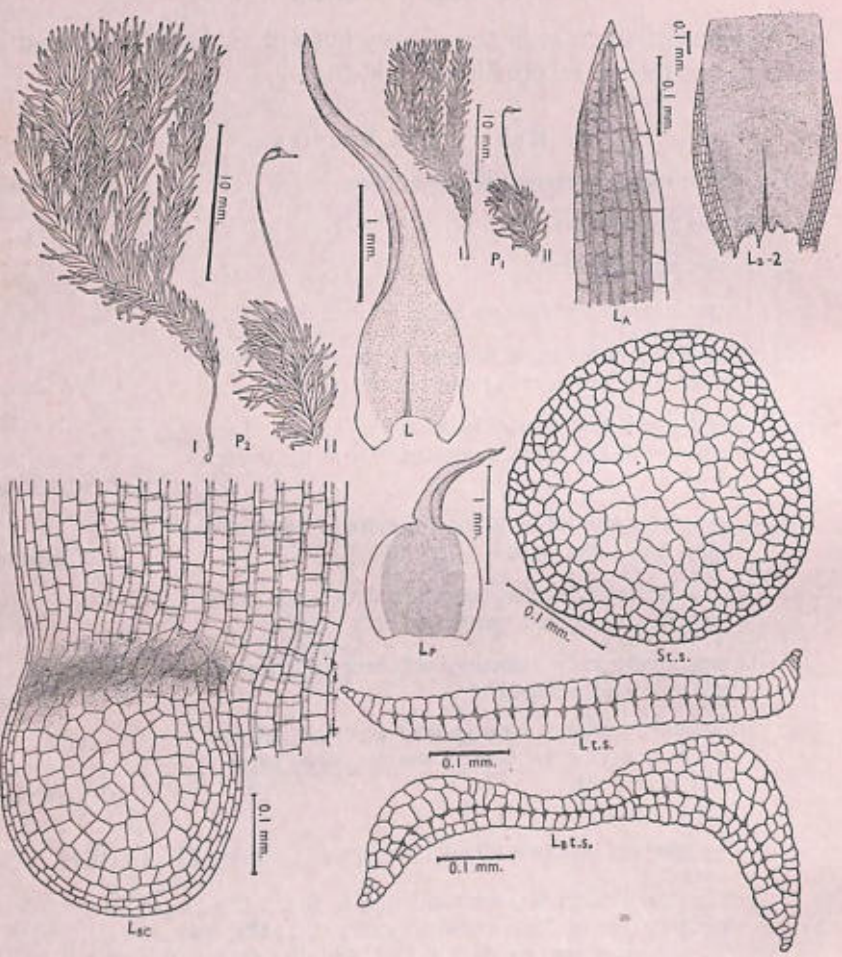


Fig. 70. *Leucobryum sanctum* Hampe

(*Kurz* 2231 and fruiting plant *Griffith* 39 from Moluccas). L_{B_8}-2 = base of a leaf not showing development of auricle. I = sterile plant ; II = fruiting plant.

cells ±48×33 μ at upper part of leaf base becoming smaller towards base and towards margin. Lamina cells hyaline, rectangular, smaller than leucocyst cells, narrower and slightly more elongated at the border. Cells round the auricle smaller and 2-layered. Perichaetial leaves not auriculate, much smaller, ±2 mm. long and 1 mm. broad at base, suddenly tapering from an ovoid base. Terminal, reddish brown seta becomes lateral by further growth, ±1.5 cm. long with an inclined, strongly strumose, more or less sulcate, asymmetrical capsule ±1 mm.

long and 0.75 mm. in diameter. Peristome teeth 16, dicranate, finely papillose with vertical stripes. Operculum conic-rostrellate, bent to one side. Spores smooth, 10-12 μ in diameter.

Distribution. Nepal, *Wallich* ; Sikkim, *Kurz* 2231.
Malaysia, Java, Borneo, Philippines, New Guinea, Fiji, Samoa.

3. **Leucobryum bowringii** Mitten in *Musc. Ind. Or.* 26, 1859.

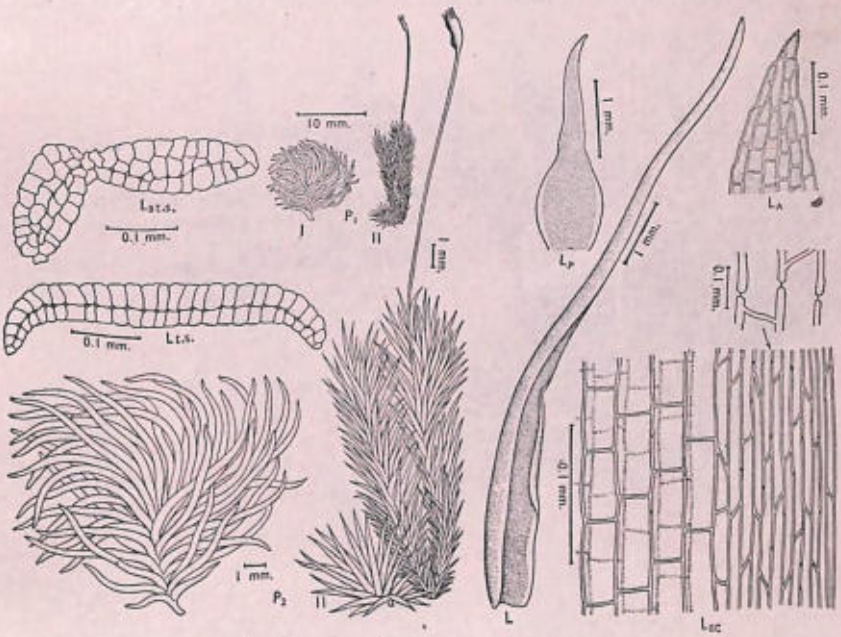


Fig. 71. *Leucobryum bowringii* Mitten
(I. *Gangulee* 757 ; II. Fruiting plant from Japan)

Epiphytic silky plants forming dense tufts with branched stems ±1.5 cm. long and densely covered with narrow elongated leaves. Leaves up to 1 cm. long, patent to flexuose, gradually narrowed to a long, narrow, tubular, acute tip from a wider concave base. Costa wide, smooth at back, showing one layer of 4-angled chlorocysts between 2 layers of leucocysts in the upper part ; leucocysts become multi-layered (2 layers on dorsal side and 1 or 2 layers on the ventral) near the base. Leucocyst cells measure up to 70×28 μ. Lamina cells narrow, elongated, somewhat incrassate with pitted walls, up to 12 rows at the basal region, gradually narrowing and ultimately vanishing upwards. Perichaetial leaves smaller (±3 mm. long) with ovate base. Reddish slender seta ±1.6 cm.

long, lateral by further growth of branches. Capsule inclined, strumose, asymmetrical, ±1.2 mm. long, lightly plicate.

Distribution. Khasia, *J.D.H.* & *T.T.* 1272, 1275; *Gangulee* 757; NEFA, *Bor* 227.

South India, Ceylon, Malaysia, Borneo, China, Japan, Formosa, Philippines.

4. **Leucobryum nilghiriense** C. Mueller in *Bot. Zeit.* 32: 556, 1854.

L. vulgare Wilson in Hook. *J. Bot. & Kew Gard. Misc.* **9** : 293, 1857.

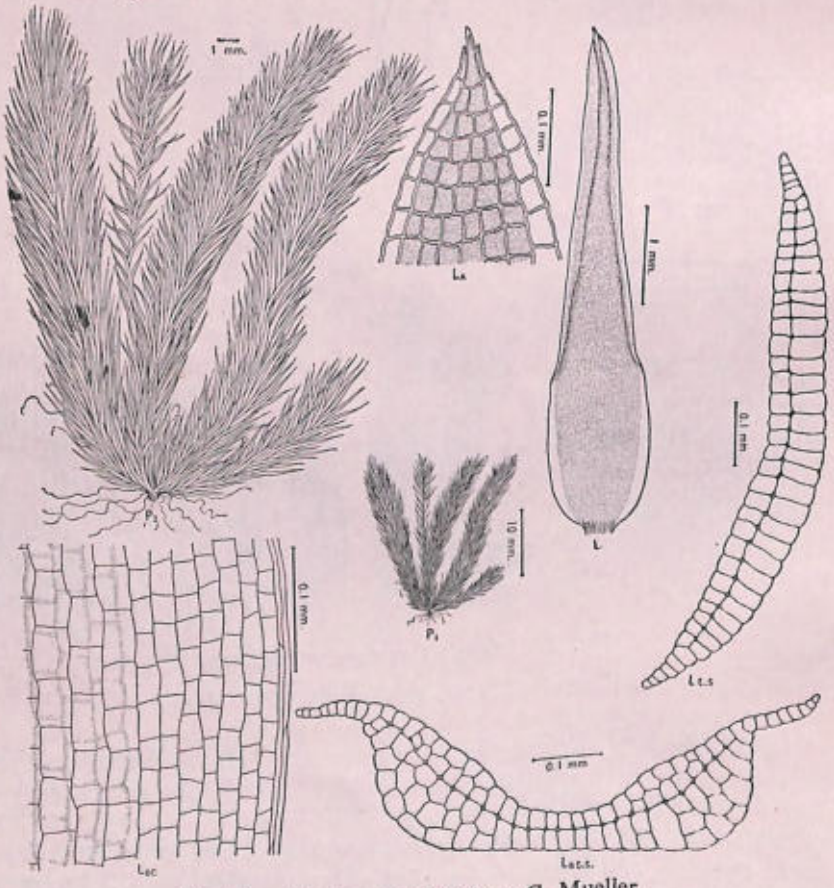


Fig. 72. *Leucobryum nilghiriense* C. Mueller

(*Foreau* 19 from South India)

Dull whitish green plants on tree trunks forming dense tufts with branched or single stems up to 2.5 cm. long densely covered with usually erect, sometimes erect-spreading, more or less rigid leaves up to 6 mm. long. Leaves gradually narrowing from a comparatively broad (±

1 mm. wide), ovate, concave base to a rigid, canaliculate, minutely apiculate apex. Costa wide, smooth on back, with one layer of 4-angled chlorocysts between 2 layers of leucocysts, the latter becoming multilayered (usually 3 layers on the dorsal and 2 on the ventral side—excepting the median region where the layers do not increase) at the base. Leucocysts ± 42 × 28 μ at leaf base. Lamina cells hyaline, 9 to 12 rows at base, gradually decreasing in width towards top ; inner cells rectangular but 2 or 3 marginal layers at base formed of narrow, elongated cells ; not incrassate or pitted. Fruiting plants not seen.

Distribution. Sikkim, *J.D.H.*; Bhutan, Khasia, *J.D.H.* & *T.T.* 1277; Manipur, *Deb B*/62.

South India, Ceylon, Sumatra, Java, Celebes, Borneo, Philippines, Tonkin, China, Korea, Japan.

5. **Leucobryum javense** (P. Beauv.) Mitten in *Musc. Ind. Or.* 25, 1859.

Sphagnum javense P. Beauv. in *Prodr.* 88, 1805.
Leucobryum falcatum C. Mueller in *Syn.* **1** : 79, 1848.

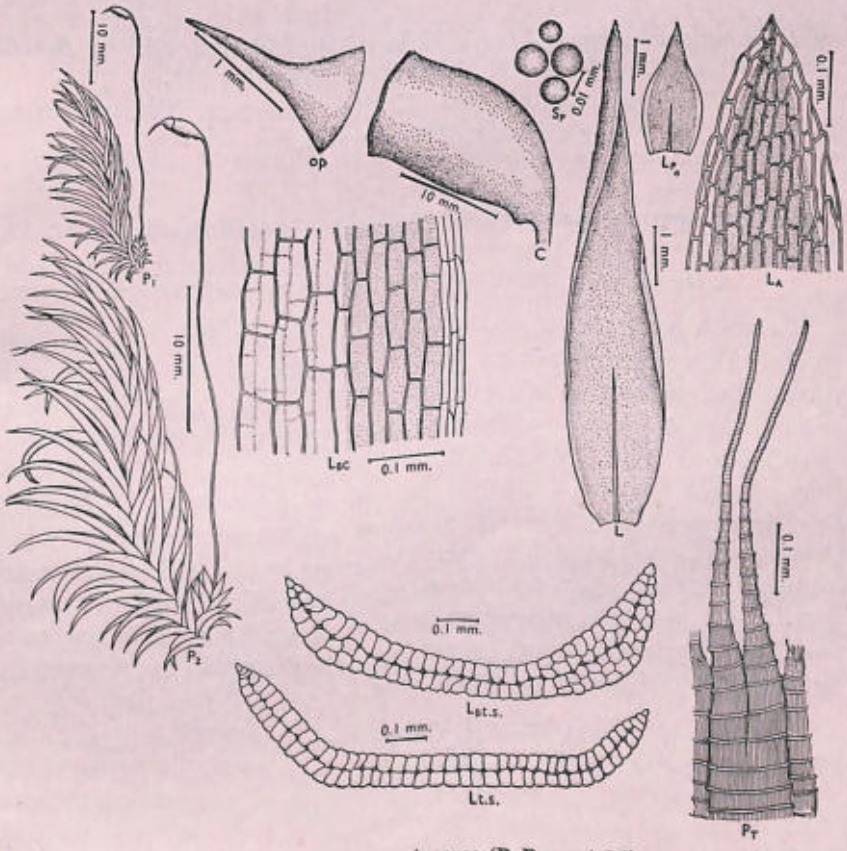


Fig. 73. *Leucobryum javense* (P. Beauv.) Mitten
(*Burkill* 36345)

Comparatively large greenish white plants on tree trunks forming tufts. Stems up to 3 cm. long in these specimens, crowded with falcato-secund leaves up to 10 mm. long and 1.7 mm. broad at base which do not change much when dry. Leaves gradually lanceolate from a broader concave base, tapering into a canaliculate, minutely apiculate point. Costa wide, scabrous on back in the upper half, with one layer of 4-angled chlorocysts between 2 rows of leucocysts except at base where leucocysts on both sides become 2- to 3-layered except at the median furrow. Lamina cells at base formed of 4 to 5 rows of rectangular cells next to costa and with 2 to 3 rows of narrow, elongated cells forming a border; gradually narrowing upwards but persisting up to the tip. Perichaetial leaves much smaller, ± 2.3 mm. long and 1.1 mm. wide at base. Seta red, apical but pushed to a side by growing branches, ±3 cm. long. Capsule short oblong, a symmetrical, almost horizontal, strumose, somewhat sulcate when dry. Peristome teeth red, ± 730 μ long, dicranate to two-thirds of length, vertically striped, papillose at tips. Spores round, smooth, brown, 10 to 15 μ in diameter. Calyptra conic-rostrate, bent to one side.

Distribution. Nepal, *J.D.H.* 1270, 1271 ; Sikkim, NEFA, *Burkill* 36345 ; Khasia, *J.D.H. & T.T.* 1276 ; Naga Hills, *Bor* 363.

NW. Himalayas, south India, Ceylon, Malaysia, Yunnan, Hong Kong, Java, Borneo, Philippines, New Guinea.

6. **Leucobryum aduncum** Dozy et Molkenboer in *Bryol. Jav.* **1** : 13, 1855-61.

L. brachyphyllum Wilson in Hook. *J. Bot. & Kew Gard. Misc.* **9**: 293, 1857.

Greenish brown plants on tree trunks forming tufts. Stem without central cylinder, branched, up to 2.5 cm. long, densely covered with leaves. Leaves erect, up to 3 mm. long, iridescent and somewhat falcato-secund when dry, narrowed from an oval concave base (up to 0.7 mm. broad) into a short, canaliculate tip. Costa wide, prominently scabrous on back showing a distinct pattern, with one layer of 4-angled chlorocysts between 2 layers of leucocysts which later become 4-layered (2 layers on each side) at leaf base. A narrow lamina of 3 to 4 rows of hyalocysts at base which become narrower but still persist in the upper part. Leucocyst cells at base up to 67 × 20 μ ; lamina cells also rectangular but smaller, becoming narrow and rhomboid at the margin, not incrassate. Fruiting plants not seen.

Distribution. Nepal, *Hooker, Gollan* 2115.
South India, Malaysia, Java, Borneo.

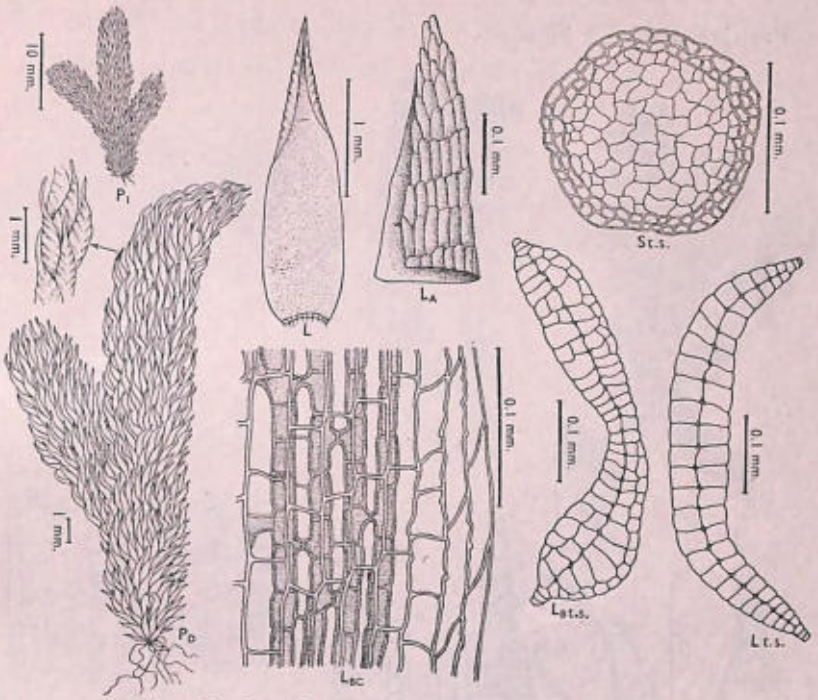


Fig. 74. *Leucobryum aduncum* Dozy et Molkenboer (*Gollan* 2115). P (inset) and L_A show pattern on leaf back due to scabrous nature.

7. **Leucobryu scalare** C. Mueller in Micholitz, *Musci Philipp.* No. 173 & Paris, *Index Bryol. Suppl.* 230, 1900.

Light yellow-green plants on tree trunks forming dense tufts. Stem usually with several branches, densely covered with leaves, up to 2 cm. long. Leaves more or less bent to one side (sometimes erect), more strongly so when dry ; up to 2.45 mm. long and 0.74 mm. wide at middle ; leaf base elongated, elliptical, suddenly narrowed from middle to a canaliculate tip which is more pointed than in *L. aduncum*. Narrow transparent lamina on both sides become narrower towards base and apex, shows 5 to 6 rows in the middle of the leaf of which the outermost 2 to 3 layers are of long ($\pm$ 159 μ), narrow prosenchymatous cells with perforated walls, while the inner 2 to 3 layers are rectangular (up to 35 $\times$ 20 μ) with irregularly thickened walls. All the inner part of the leaf is formed of the broad costa with two layers of leucocysts (cells $\pm$ 44 $\times$ 29 μ) sandwiching one layer of narrow, chlorocyst cells as in *L. aduncum* but narrower ($\pm$ 6 μ wide) in this case. Leaf base shows more layers of such leucocysts. Costa back prominently scabrous with the cells on back much more raised than in *L. aduncum* so that the leaf tip looks toothed.

Fruiting plant not known.

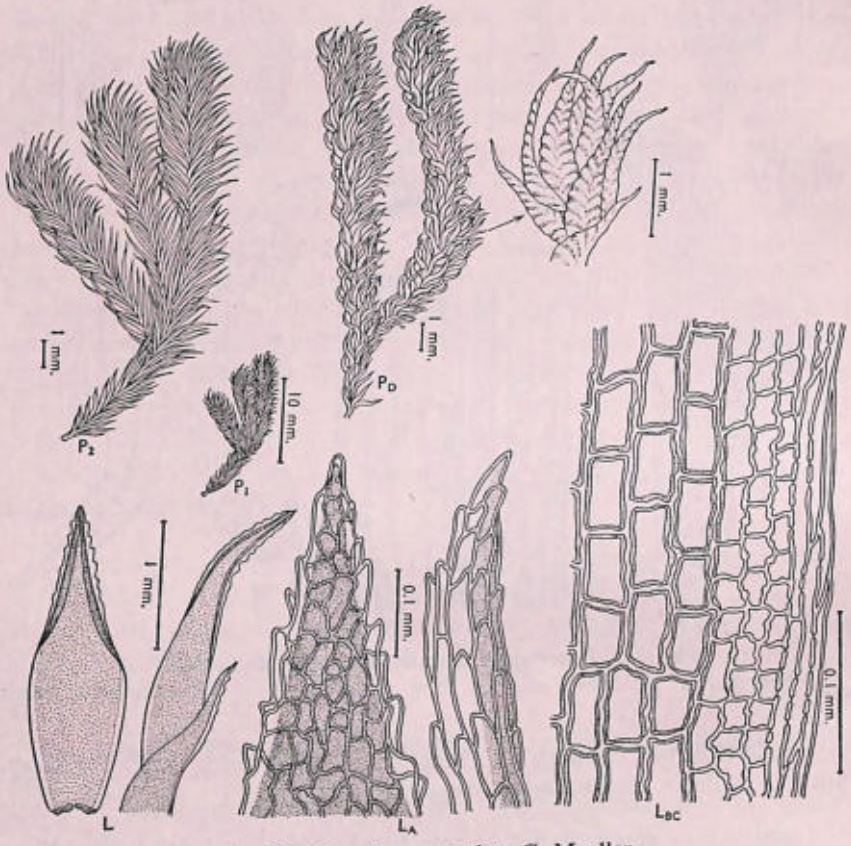


Fig. 75. *Leucobryum scalare* C. Mueller

(Foreau from Palni Hills). P_D (inset) shows scabrous pattern on dry leaf back and L_A shows the elevated cells on back.

Distribution. Manipur, *Deb B*/109.

South India, Malacca, Singapore, Java, Borneo, Philippines, New Caledonia.

Ochrobryum Mitten

Dioicous, whitish green, tufted plants with stems devoid of central strand. Leaves erect, formed mainly of a broad multi-layered costa showing one layer of chlorocyst cells (4-angled as in *Leucobryum*) between two layers of leucocysts, bordered by a hyaline lamina. Seta apical, very short with an immersed, erect, hemispherical capsule. Peristome absent. Calyptra frilled at base.

8. **Ochrobryum nepalense** Bescherelle in *J. de Bot.* **11** : 144, 1897.

Schistomitrium gardnerianum Mitten p. p. in *Musc. Ind. Or.* 26, 1859.

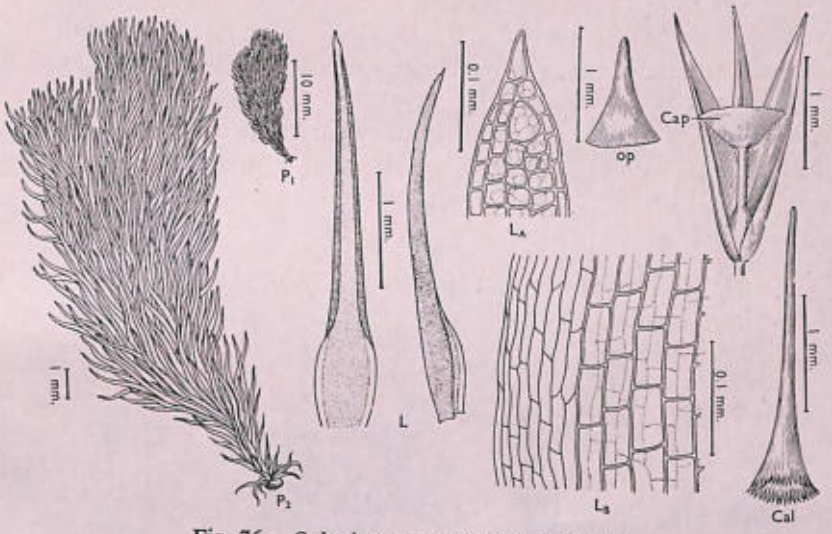


Fig. 76. *Ochrobryum nepalense* Bescherelle

(Poilane from Cambodia). Capsule, operculum and calyptra from Bescherelle's figures after Wilson

Caespitose erect plants, simple or branched, up to 2 cm. long and 0.5 cm. wide with leaves, densely covered with whitish green, imbricate, erecto-patent (not much changed but more appressed when dry) leaves. Leaves up to 3.75 mm. long, with a broad, ovate, sheathing, concave, ± 0.4 mm. wide base which is about ¼ of the total leaf length ; narrowing into a lanceolate upper part with inflexed, concave margin becoming almost tubular at tip ; apex narrow with a small apiculus. A hyaline lamina of thin-walled (sometimes porose), elongated, rectangular cells (± 70 μ long) extends on both sides of costa from base to at least the middle of the leaf, 7 to 8 rows of these cells are seen at the leaf base. Costa flat, brownish green, occupying most of the leaf at base and all of it at the tip with two layers of leucocyst cells (up to 56 × 23 μ) at leaf base. These cells are smaller at leaf apex. Perichaetial leaves shorter. Seta very short (± 1 mm. long), apical, erect, reddish at base, with a stout vaginula. Capsule immersed, hemispherical, cup-shaped, without peristome. Operculum conic-rostrate. Calyptra narrow, very much elongated, base fimbriate.

Differs from *O. kurzianum* in the shorter operculum and from other species in the narrow leaf apex.

Distribution. Nepal, *Wallich.*
Cambodia.

Subfam. OCTOBLEPHAROIDEAE

OCTOBLEPHARUM Hedwig

Autoicous, greenish white, tufted, epiphytic plants with stem devoid of central strand. Leaves formed mainly of a broad, thick (multi-layered) costa formed of one layer of chlorocyst cells (3-angled, at least in upper parts) between several layers of leucocysts ; bordered with a narrow, hyaline lamina only at base. Capsule erect, symmetrical. Peristome teeth 8 or 16 (8 pairs). Calyptra cucullate, entire at base.

9. **Octoblepharum albidum** Hedwig in *Sp. Musc.* 50, 1801.
Bryum albidum Linn. Sp. Pl. 1583, 1762-1763.

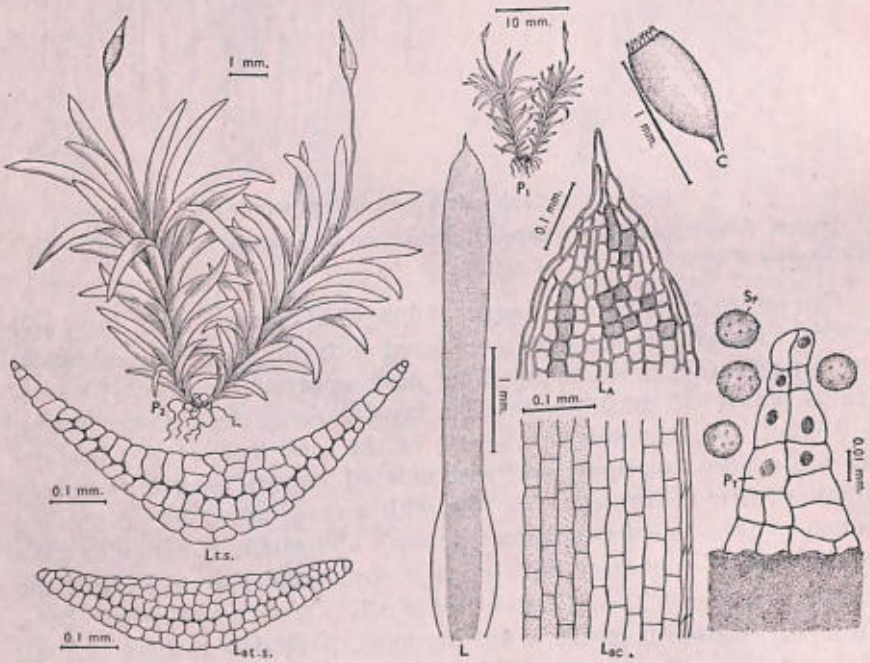


Fig. 77. *Octoblepharum albidum* Hedwig
(*Gangulee* 3004)

Autoicous, greenish white plants up to 2 cm. high, forming tufts on tree trunks. Stem usually only 5 mm. and not branched but may be longer, without central strand. Leaves more or less crowded, erect-spreading, rigid, not changed when dry, usually forming a rosette near tip, ± 5 mm. long, ligulate from a wider and concave ± sheathing base, more or less flat above, apiculate at tip where it may be minutely serrulate. Costa wide, smooth on back, with a median row of triangular chlorocyst

cells between 5 to 6 layers of leucocysts in the middle of the leaf and 2 such layers on the sides. Leaf base flanked by 5 to 9 rows of hyaline laminar cells of which inner rows are rectangular (about 30 μ wide) like the leucocyst cells and the border 2 rows are narrow linear to rhomboidal. The outer linear rows persist to the tip of the leaf. Seta straight, apical, $\pm$ 5 mm. long. Capsule erect, oblong-ovoid, symmetrical ; urn $\pm$ 0.8 mm. long $\times$ 0.45 mm. in diameter ; 8 yellowish peristome teeth, not split but showing longitudinal line of fissure, each 110 μ long and 67 μ wide at base, formed of short rectangular cells. Operculum conical, $\frac{1}{2}$ to $\frac{2}{3}$ of urn in height. Calyptra cucullate, entire at base, reaching about two-thirds down the urn. Spores light brown, finely papillose, 19.5 to 21 μ in diameter. Fruiting in October.

Distribution. Nepal, *Wallich, Jap. Expdn.* 65721 ; Sikkim, *Hooker* 1280, *Gammie* 24, *Dr. King* ; West Bengal Himalayas, *Kurz* 2479, *Gangulee* 741, 3004 ; Lower Bengal, *Gangulee* 3079, 3096 ; NEFA, *Burkill* 37027, *Bor* 154 ; Manipur, *Deb B*/125.

Cosmopolitan all over the tropics.

Subfam. ARTHOCORMOIDEAE

EXODICTYON Cardot

Dioicous, tufted whitish green plants with stems devoid of central strand. Leaves narrow from a broader sheathing base, spread out in several rows, formed mainly of thick costa rounded at back, triangular at apex, usually papillose showing three layers (dorsal, ventral, and median) of chlorocysts and several layers of leucocysts in between ; bordered by a hyaline lamina which is very narrow above. Seta slender, capsule erect cylindrical. Peristome of 16 undivided papillose teeth. Calyptra cucullate, entire at base.

10. **Exodictyon blumii** (C. Muell.) Fleisch. in *Musci Archi. Indici* No. 58, 1899.

Leucophanes blumii C. Muell. in Syn. **2** : 537, 1851.

Branched or unbranched whitish green plants in loose tufts. Stems greenish, 1 to 3 cm. long and up to 0.7 mm. wide with the evenly spread and feathery (but in several ranks) erecto-patent leaves which are not much changed when dry. Leaves up to 3.6 mm. long, linear from an erect, concave, sheathing, elongated-oval base (about $\frac{1}{3}$ of leaf length), $\pm$ 0.33 mm. wide ; leaf margin serrulate, spinously serrate at leaf shoulder ; leaf apex blunt, often showing filamentous gemmae ($\pm$ 165 μ long) on the tip. Leaf bordered from base to apex by 2 to 4 rows of very

elongated, narrow, incrassate cells ; the teeth, where present, are outside this border—these cells are wider at the leaf shoulder while the lumens are almost non-existing near the tip. Brownish green costa narrow (± 66 μ broad) at base, spinose on both surfaces and shows three layers of 3-to 4-angled chlorocysts with hyaline cells in between in cross section. Hyaline lamina cells 6 to 8 rows (± 33 × 10 μ) at base ; somewhat wider (± 16.5 μ wide) at the shoulder, smaller (± 24.5 × 9.5 μ) and gradually reduced to only one row near tip. Seta red-brown, erect, ± 4 μ long.

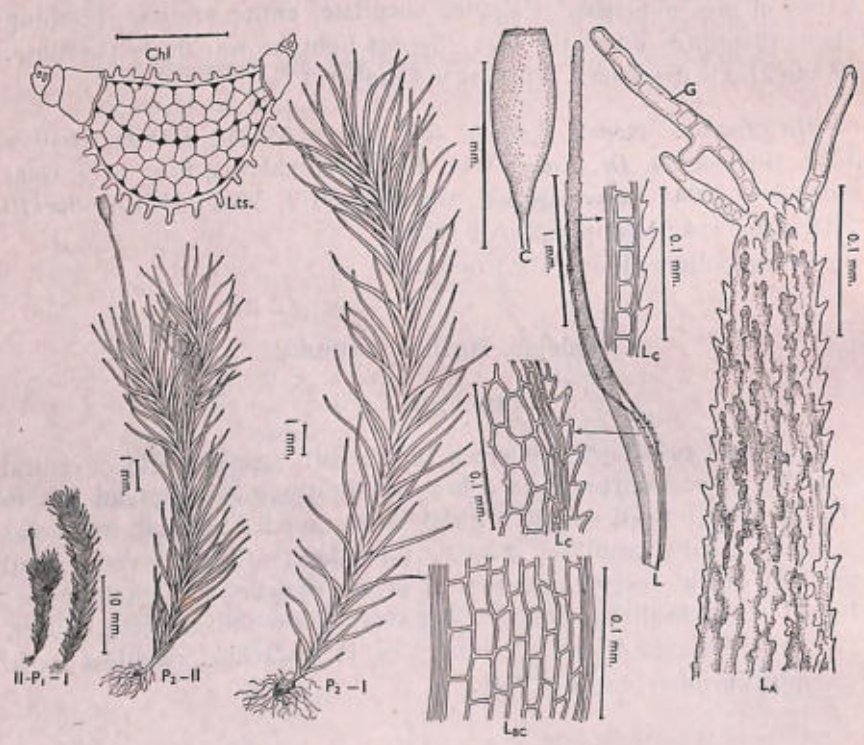


Fig. 78. *Exodictyon blumii* Bescherelle

Sterile plant from Type (*Fleischer* 58 from Java). Fertile plant *Everett* from East Indies

Erect, ovate, red-brown capsule ± 0.8 mm. long and 0.3 mm. in diameter with a distinct apophysis 0.2 mm. long.

The external and internal appearance of the costa is a distinctive feature.

Distribution. NEFA, *Bor* 21*b*.

China, Malay, Java, Borneo, Celebes, Philippines, Oceania.

Series III. POTTIALES

Family CALYMPERACEAE

The third series POTTIALES in PFLANZENFAMILIEN (Brotherus 1924) is represented by the families Calymperaceae and Pottiaceae in eastern India.

The family Calymperaceae is identified by the large hyaline cells in the inner leaf base forming the 'cancellinae'. Capsules are erect. Peristome missing or with 16 teeth. Calyptra completely covering capsule. The family is represented in eastern India by 10 species in 3 genera which are enumerated below. All these (including one new species) have been examined by the author and are fully dealt with here.

Family CALYMPERACEAE

KEY TO THE GENERA

1.	Leaves with a hyaline border, peristome present ..	2
	Leaves without hyaline border, peristome absent ..	*Calymperes*
2.	Hyaline border narrow, seta terminal	*Syrrhopodon*
	Hyaline border broad, seta terminal on side branches	*Thyridium*

In the following drawings, in addition to those used in the previous family, the following symbols have been used: G=gemmae; L_G=leaf bearing gemmae ; cal=calyptra.

SYRRHOPODON Schwaeg.

Small to medium-sized epiphytes with more or less erect main stems. Leaves linear-lanceolate to lingulate from an erect sheathing pale base, usually with a narrow, hyaline or thickened border. Upper leaf cells small, papillose ; inner basal cells large, hyaline, forming *cancellinae*. Perichaetia not differentiated. Capsule erect, cylindrical. Peristome of 16 papillose teeth. Calyptra cucullate.

KEY TO THE SPECIES

Cancellinae extending to above midleaf	1. *S. rufescens*
Cancellinae confined to leaf base	2. *S. gardneri*

1. **Syrrhopodon rufescens** Hooker et Greville in Brewster, *Edinb. J. Sci.* **3** : 227, 1824.

Leucophanella rufescens (Hook. et Grev.) Fleischer in *Musc. Flor. Buitnz.* **1** : 200, 1902.

S. revolutus Dozy et Molkenboer fide Mitten in *Musci Ind. Or.* 39, 1859 but considered different by subsequent authors.

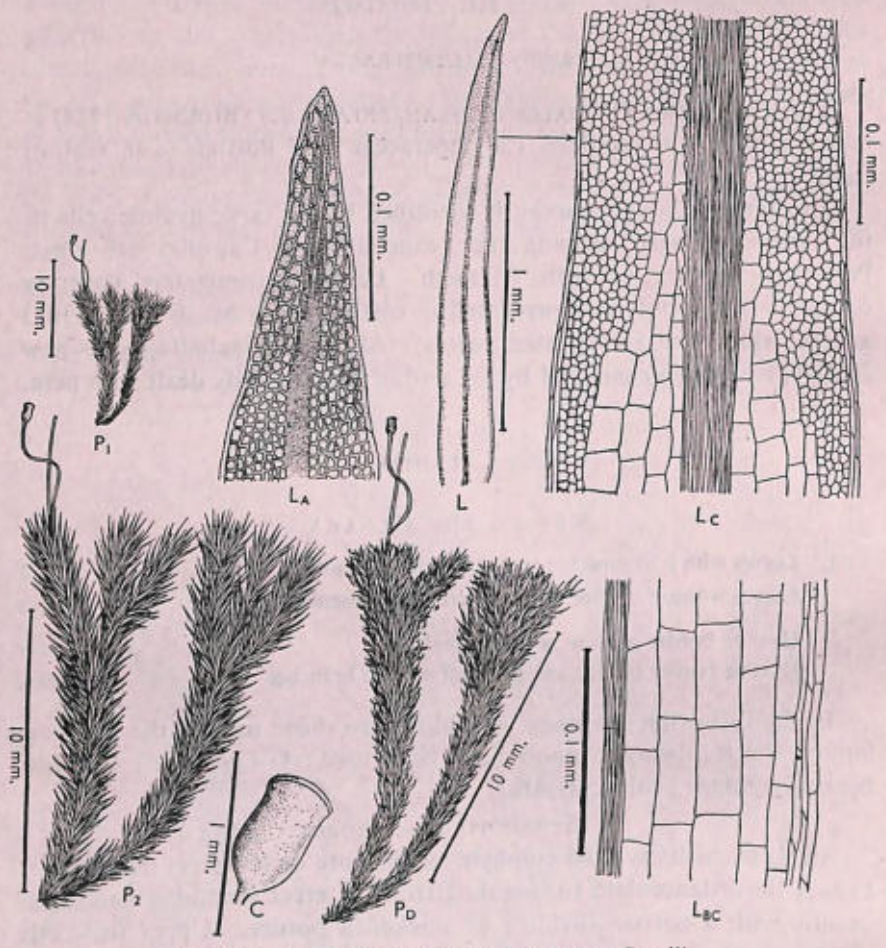


Fig. 79. *Syrrhopodon rufescens* Hooker et Greville
Wallich from Nepal

Subgenus *Orthophyllum* C. Mueller=Section *Leucophanella* Bescherelle=Genus *Leucophanella* Fleischer. Dioicous, glossy, greenish brown, dichotomously branched (stem up to 1.5 cm. long) plants with a reddish (rufescent) tint and white leaf bases forming epiphytic tufts and densely covered with erect leaves whose tips become flexuose and contorted when dry. Leaves up to 2 mm. long and 0.22 mm. wide at base, narrow lanceolate, gradually acuminate from the hyaline base, carinate-concave ; bordered all round with 3 to 1 row of elongated, narrow, hyaline cells ; margin ± flat and entire. Costa without deuter, rough at top of cancellinae, narrow, percurrent. Cancellinae of large (up to 60×28 μ), rectangular, hyaline cells reaching very near tip covering more than $\frac{3}{4}$ of leaf length. Chlorophyllose cells at tip subquadrate, incrassate,

papillose. Seta terminal, very slender, 6 to 7 mm. long, usually straight, sometimes sinuous. Capsule erect, small, oval, ±0.65 mm. long and 0.36 mm. in diameter. Fruiting about February.

Distribution. Nepal, *Wallich.*
Malay, Indian Archipelago, Java, Philippines.

2. **Syrrhopodon gardneri** (Hooker) Schwaeg. in *Suppl.* **2** (2) : 110, 1826.

Calymperes gardneri Hooker in *Musc. Exot. Pl.* 146, 1818.
Syrrhopodon curranii Brotherus in *Philip. J. Sci.* C5 : 142, 1910.
Cleisostoma gardneri Bridel in *Bryol. Univ.* **1** : 155, 1826.
Weisia macclellandi Griffith in Not. 408, 1849, and *Icon. Plant. Asiat.* **2** : t. 78, 1849.

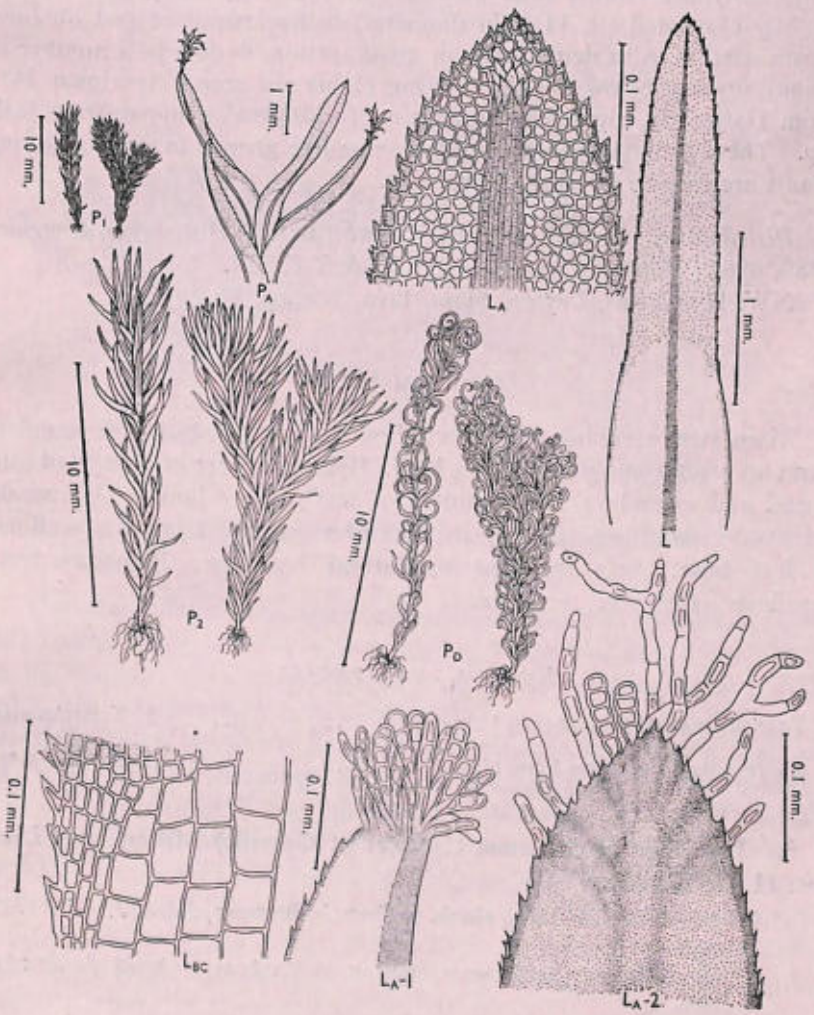


Fig. 80. *Syrrhopodon gardneri* (Hooker) Schwaeg.

(*Gangulee* 2480). P_A = plant apex with sprouting plants on leaf-tips ; L_A-1 = gemmae on leaf-tip ; L_A-2 = protonema-like germination of such gemmae. L_{BC} shows top of cancellinae and leaf margin. Papillae not shown.

Subgenus *Orthotheca* Bridel, Section *Paracalymperes* Fleischer. Dioicous. Tufted, dull green, epiphytic plants with usually single, sometimes dichotomously branched stems without any central strand and up to 1.3 cm. high. Leaves rigidly erect spreading from a slightly wider sheathing base into a ligulate, carinate lamina; up to 3.5 mm. long and 0.7 mm. broad at base; tip acute. Leaf margin sharply serrate from slightly above base to apex. Leaf-edge with a triangularly thickened, double-toothed border from top of base to a little below tip but the border cells are similar to lamina cells. Cancellinae of about 8 to 10 rows of hyaline rectangular cells on each side of costa filling most of the leaf base, except a narrow border of 3-6 rows of smaller hyaline cells, to a height of about $\frac{1}{3}$ the leaf length with a rounded acute-angled top. Chlorophyllose lamina cells quadrate to ovate, $\pm$ 8.5 μ in diameter, slightly elongated ($\pm$ 11 μ in diameter) below, papillose and obscure. Costa narrow, with deuter cells in cross section, ending in a number of spines slightly below apex. Fruiting plants not seen. Specimen 2480 from Darjeeling copious development of elongated gemmae from leaf-tip. These gemmae also show protonema-like growth *in situ* and young plants are seen to develop on leaf-tips.

Distribution. Nepal, *Gardner, Wallich*; Bengal Himalayas, *Gangulee* 2480, 4965; Bhutan; Khasiya, *J.D.H. & T.T.* 124.

NW. Himalayas, Ceylon, Siam, Java, Borneo, Philippines.

Thyridium Mitten

Main stem creeping with erect shoots. Leaves oblong or lingulate from an erect, sheathing, hyaline base. Hyaline border of elongated cells broad and extending above middle of leaf; upper lamina cells small, incrassate, papillose, distinct from border and the hyaline cancellinae at leaf base. Seta terminal on lateral branches. Peristome teeth papillose. Calyptra cucullate.

Key to the Species

Fasciculated plants more than 1 cm. high	3. *T. fasciculatum*
Shorter plants less than 1 cm. high	4. *T. piluliferum*

3. **Thyridium fasciculatum** (Hooker et Greville) Mitten in *J. Linn. Soc.* **11**: 189, 1869.

Syrrhopodon fasciculatus Hook. et Grev. in Brewster, *Edinb. J. Sci.* **3**: 225, 1824.

Codontoblepharon fasciculatum Dozy et Molkenboer in *Bryol. Jav.* **1**: 53, 1856.

Calymperes fasciculatum Mitten (*non* Dozy et Molk.) in *Musc. Ind. Or.* 41, 1859.

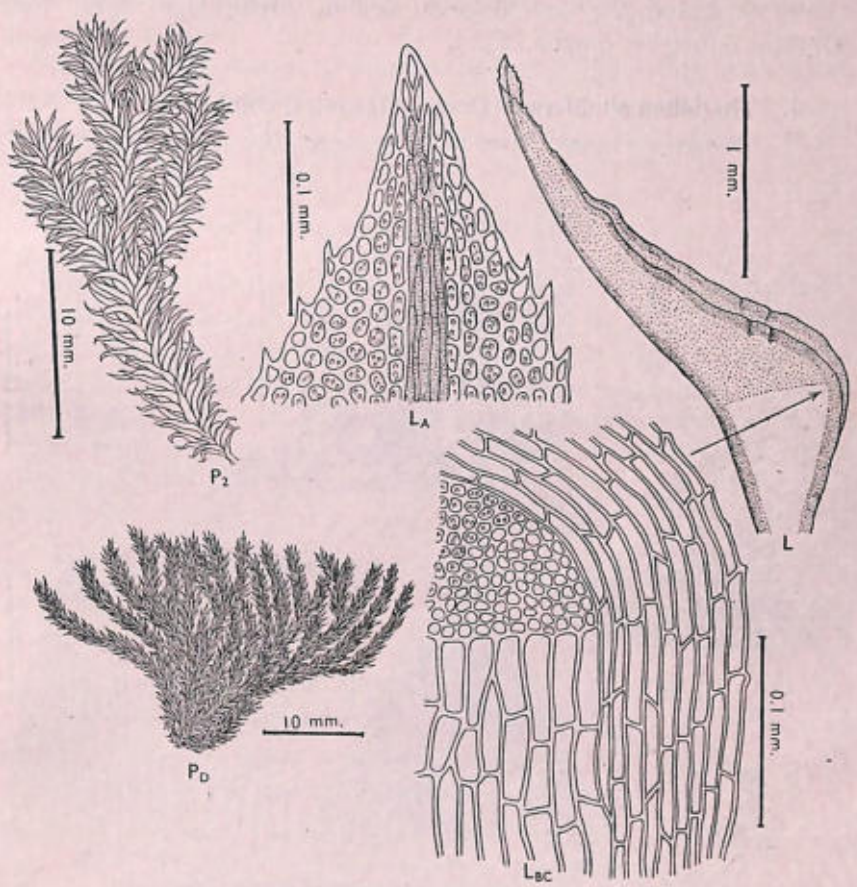


Fig. 81. *Thyridium fasciculatum* (Hooker et Greville) Mitten *Wallich* from Nepal

Dioicous. Epiphytic, more or less robust plants in fascicles. Shoots up to 2 cm. long. Leaves erecto-patent, ± 3 mm. long and 1.5 mm. broad in the widest region ; canaliculate and slowly tapering from a wide, sheathing, concave base ; tip acute and somewhat flexuose when dry ; margin undulate but almost flat. A wide border (± 90 μ broad at leaf base) of about 9 rows of elongated (± 56 × 10 μ at base), hyaline cells is prominent. It narrows gradually and vanishes quite near leaf-tip. Triangular cancellinae of about 24 rows of hyaline, elongated cells, longer ones up to 56 × 17 μ, ± 0.75 mm. high and 0.55 mm. wide at top on each side of costa. Chlorophyllose cells small, oval to subquadrate, incrassate, multipapillate, ± 5 μ wide. Leaf margin denticulate at sheath, serrate near tip. Costa narrow, percurrent, rough on back near tip. Fruiting plants not seen.

Distribution. Nepal, *Wallich.*

South India, Ceylon, Malacca, Indian Archipelago, Java, New Guinea, Australia, Samoa, Chili.

4. **Thyridium piluliferum** (Dixon) Gangulee, comb. nov.

Syrrhopodon pilulifer Dixon in *J. Bombay nat. Hist. Soc.* **39** : 769-795, 1937.

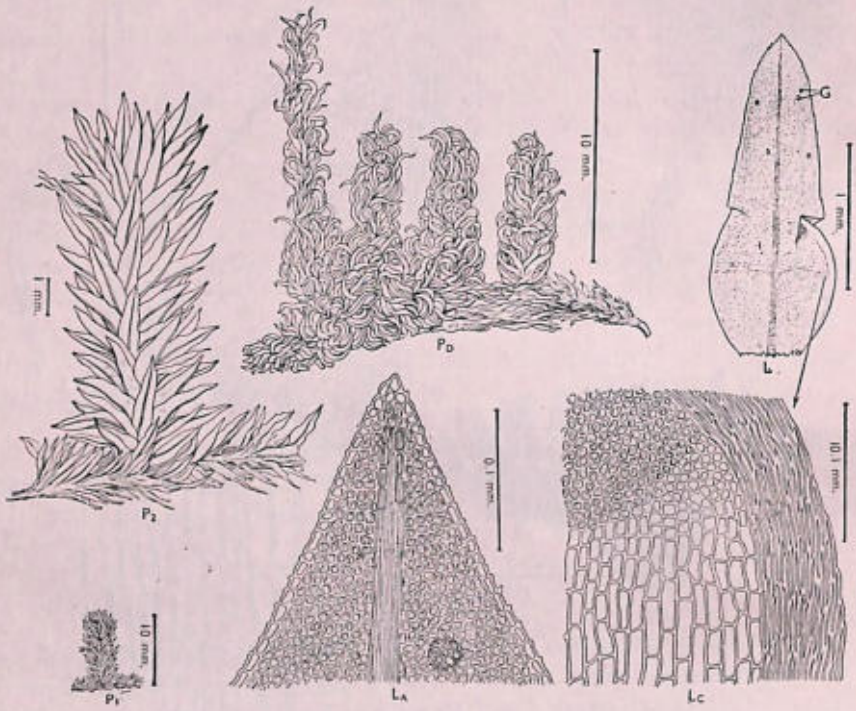


Fig. 82. *Thyridium piluliferum* (Dixon) Gangulee (*Bor* 46—Type). G shows gemmae

Corticolous olive-green plants ramifying on bark giving rise to erect shoots 3 to 7 mm. high and ± 4 mm. wide with leaves. Dense erecto-spreading leaves, oblong lanceolate, up to 2.5 mm. long and 0.87 mm. wide at the wider base ; margin wavy, almost smooth, apex acute, minutely denticulate. Dry leaves curled or falcate. Costa brownish at base, yellowish above, smooth, ± 55 μ wide at top of cancellinae. Broad margin ± 60 μ wide at top of cancellinae showing 14 to 16 rows of narrow, elongated, incrassate, cartilaginous cells, ± 45 μ long ; this broad border spreads from base to a little below tip, narrowing at both ends. Transparent cancellinae horizontal on top, ± 550 μ high, formed of large, thin-walled rectangular cells up to ± 45 × 12 μ. Chlorophyllose cells above small (± 5 μ wide), oval to subquadrate, somewhat incrassate, papillose though not obscure. Spherical multicellular gemmae 20 to

30 μ in diameter on upper leaf surface, specially on the upper half. Small fusiform apical gemmae as well as filamentous growth noticed on tips of some mature leaves.

Fruiting plant not seen. Dixon reports seta ± 5 mm. long and minute, erect to nodding capsule.

Distribution. NEFA, *Bor* 46.

Calymperes Swartz

Epiphytic plants forming tufts. Leaves lanceolate or ligulate, curled when dry. Costa stout, usually gemmiferous in the tips of upper leaves which are longer and narrower than the lower. Chlorophyllose lamellar cells small. Border usually thicker and often with submarginal elongated cells forming tenioli. Cancellinae of lax, hyaline cells prominent in leaf base. Seta and capsule erect. Peristome absent. Calyptra large, covering complete capsule, pleated, often scabrous on top, usually persistent.

Key to the Species

1.	Sturdy plants ± 3 cm. high	10. *C. heterophyllum*
	Slender plants usually up to 1.5 cm. high	2
2.	Tenioli not developed on lamina	5. *C. tenerum*
	Tenioli prominent on lamina	3
3.	Cancellinae top scalariform, dry leaves falcate inflexed..	6. *C. burmense*
	Cancellinae top rounded or rectangular, dry leaves curled	4
4.	Base of normal leaf rounded oval, broader than lamina; apex broadly pointed or rounded	7. *C. hampei*
	Base of normal leaf rectangular, as wide as lamina ; apex rounded	8. *C. calcuttense*
	Base of normal leaf narrower than lamina ; apex rounded	9. *C. noakhalensis*

5. **Calymperes tenerum** C. Mueller in *Linnaea* **37** : 174, 1871.

C. dozyanum Bescherelle (*non* Mitt.) in *Ann. Sci. Nat. Bot.*, Ser. 8,1: 264 & 283, 1896.

Subgenus *Hyophilina*. Section *Stenocycla*. Dioicous. Plants forming tufts of green epiphytic plants with stiff leaves which soften on getting wet. Plants usually short with rosette-like spreading of leaves on top ; stem simple, may be up to 6.5 mm. long with erect leaves ± 2.5 mm. long and 0.5 mm. broad which are curled and incurved when dry. Normal leaves lingulate, base not broader than lamina, apex obtuse. Upper

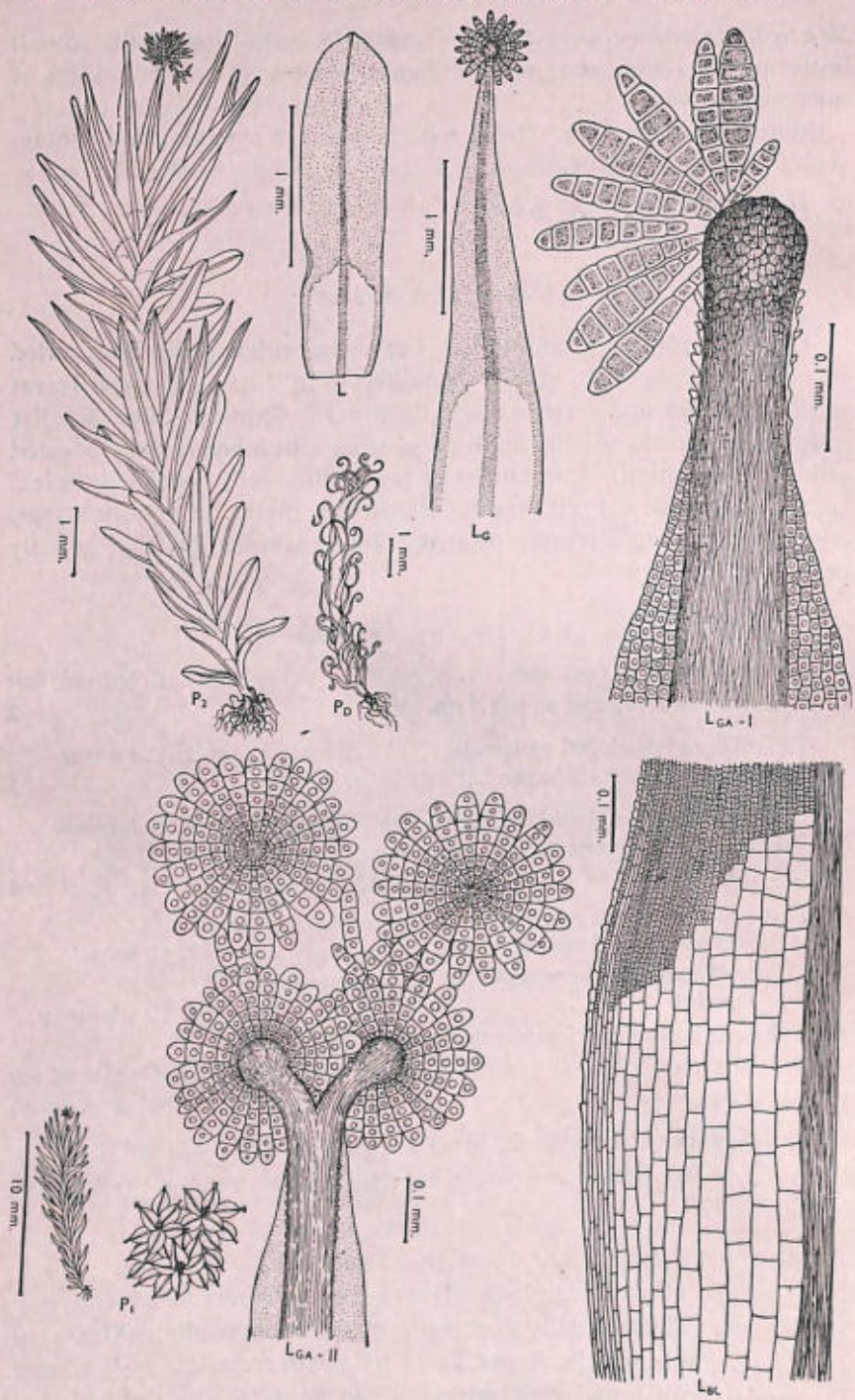


Fig. 83. *Calymperes tenerum* C. Mueller

(*Gangulee* 774). L_{GA}-I & L_{GA}-II show normal and abnormal tips of gemmiferous leaves. Right hand P_1 figure shows top view of a cluster of plants.

gemmae leaves longer and narrower at top, ± 3 mm. long and 0.7 mm. broad at base (sometimes even broader). Chlorophyllose lamina cells hexagonal to quadrate, swollen with one or several coarse papillae, ± 5.5 μ wide, 5.5.-7 μ long. Leaf margin smooth at tip, may be slightly denticulate at base. Cancellinae within leaf base, ± 0.75 mm. high, of about 10 rows of pellucid, elongated, rectangular cells on both sides of costa ; cells very large (± 130×37 μ) near costa gradually becoming narrower towards margin and bordered by about 6 rows of elongated, very narrow cells at the margin, 2 rows of these cells may extend to a little above the base as very short tenioli. Costa prominent, percurrent in normal leaves but excurrent into a club-like structure (which may branch by splitting in some cases) in gemmiferous leaves bearing the radiating brood bodies in star-like clusters. Gemmae 134×36 μ, green, germinating from tip forming a protonemous hypha. Not known in fruiting condition in this area.

Distribution. Bengal, *Kurz* ; *Gangulee* 774, 2436, 3057, etc. all from Calcutta and its suburbs.

Malay, Sumatra, Java, New Caledonia.

6. **Calymperes burmense** Hampe ex Bescherelle in *Ann. Sci. Nat. Bot.*, Ser. 8, **1** : 279, 1896.

C. crocatum Hampe *nom. nud.* ex Bescherelle in *Ann. Sci. Nat. Bot.*, Ser. 8, **1** : 281, 1896.

Subgenus *Hyophilina*. Section *Climacina*. Epiphytic plants with usually unbranched, erect stems up to 1.25 cm. long. Normal leaves carinate-lingulate with an acute, acuminate apex, up to 2.75 mm. long ; erect when moist, when dry convolute, falcate-inflexed and twisted. Leaf base oblong, concave, broader in the upper ones. Chlorophyllose lamella cells small, quadrate, ± 7×6 μ, papillose but not obscure; marginal row of same width but slightly longer and denticulate. Cancellinae 1 to 1.2 mm. high, formed by about 9 rows of pellucid, quadrate to rectangular cells (larger ones about 38×30 μ) descending like a staircase and becoming smaller towards the margin, then bordered by about 7 rows of hyaline, elongated cells and a marginal layer of small, denticulate cells. The inner rows of the border extend into *tenioli* of 2 to 3 rows of elongated cells, 2 to 3 layers in thickness and reaching almost the apex of the leaf. Lower immature leaves ovate with rounded tip and ovate-topped cancellinae. Upper gemmiferous leaves more elongated, with narrower limb, canaliculate, ± 4.5 mm. long but the topmost one may be as long as 6.5 mm. and with a spoon-like extension of the lamina at the tip. Costa narrow, about 70 μ broad, rough on top back, percurrent in lower leaves but excurrent in a gemmiferous tip in the upper leaves. Seta apical, straight, short (± 3 mm. long). Capsule permanently and

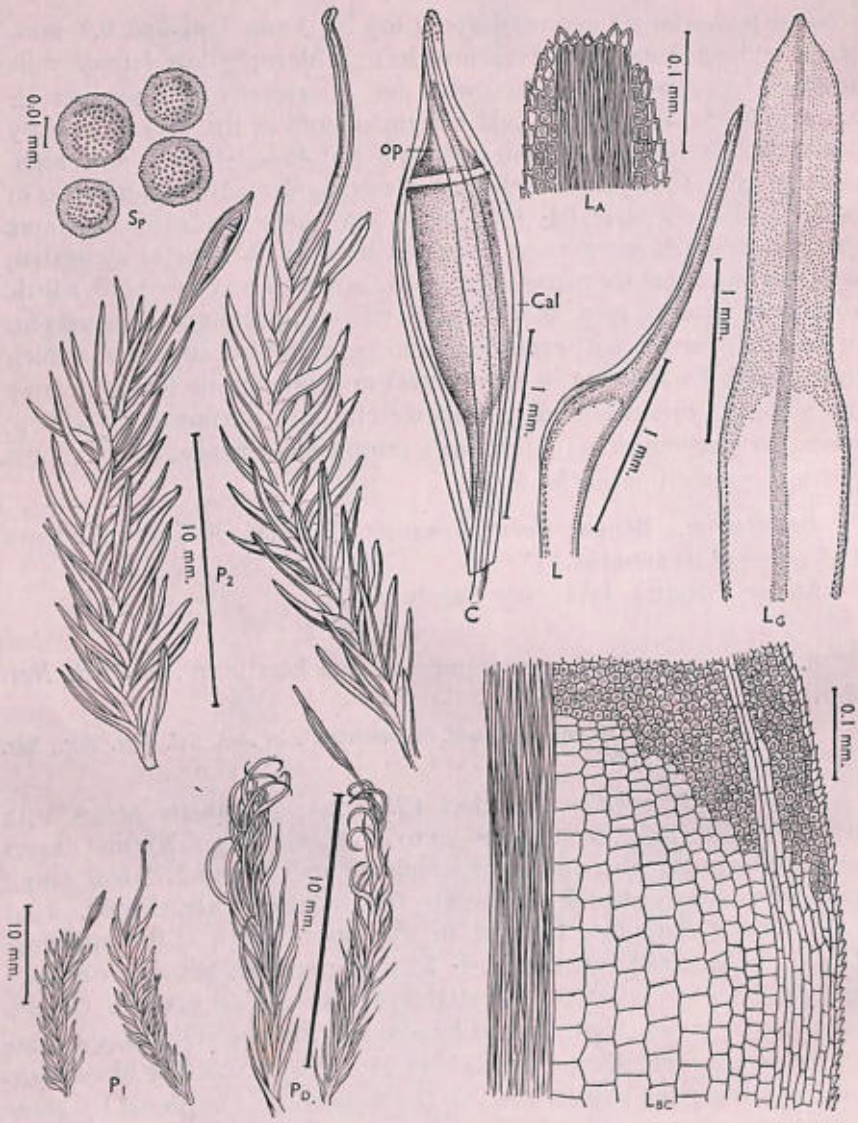


Fig. 84. *Calymperes burmense* Hampe
(*Gargulee*, 3005)

completely covered by a pleated hood-like calyptra the top of which is rough and reddish and the base narrow. Capsule cylindrical, ± 1.62 × 0.72 mm., with a conic-rostrate operculum about ⅓ the capsule in height. Peristome absent. Spores light pellucid brown, papillose, 21 to 28 μ in diameter. Fruiting in October.

Distribution. Bengal Himalayas, *Gangulee* 3005; NEFA, *Bor* 2. Burma.

7. **Calymperes hampei** Dozy et Molkenboer in *Bryol. Jav.* **1** : 48, 1856.

Calymperes sandeanum Besch. in *Ann. Sci. Nat. Bot.*, Ser. 8, **1** : 303, 1896.
Calymperis naumanni Besch. ibid. : 294.
Calymperes varium Mitt. in Mason, Burmah, its People & Products, ed. 2 : 50, 1883 *nom. nud.*

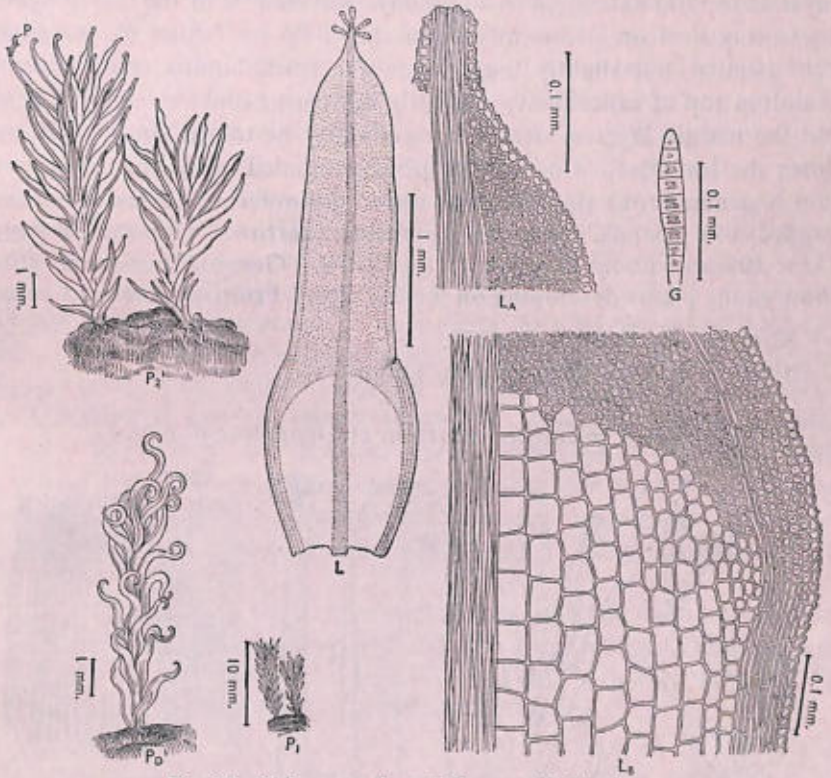


Fig. 85. *Calymperes hampei* Dozy et Molkenboer

(*Fleischer* No. 64 from Java). P in P_2 shows a young plantling developing at leaf tip. L_B is leaf base at top of cancellinae.

Subgenus *Hyophilina*, section *Eurycycla*. Caespitose, green, epiphytic plants with usually unbranched dark brown stems ; most plants up to 1 cm. long but some old plants up to 2 cm. long, covered with erecto-patent leaves which are strongly curled when dry. Leaves up to 3.25 mm. long ; sheathing leaf base broad (up to 1 mm. wide), whitish, carinate ovate, about $\frac{1}{3}$ of total leaf length ; upper lamina broadly lanceolate, margin finely denticulate, apex usually broadly rounded and then pointed with the excurrent vein. Chlorophyllose lamina cells very small ($\pm$ 5 μ wide), irregularly quadrate, slightly incrassate, with short coarse papillae ; marginal row of cells longer ($\pm$ 12 μ high) and

causing serration almost throughout the leaf length. Cancellinae ± 1 mm. high with rounded ovate top, formed of up to 13 layers of hyaline, wide lighted, thin-walled, rectangular to square cells (up to 69 × 34 μ at middle near costa), somewhat irregular at top where it meets lamina cells. Tenioli extend to near leaf apex, formed of 2 to 3 layers of elongated, narrow, hyaline cells at top of cancellinae, reduced to one layer at top but extending to 7 or 8 layers at middle of leaf base, again narrowing to 4 or 5 rows at extreme base. 6 or 7 rows of marginal cells (similar but slightly bigger than the small lamina cells) beyond tenioli at top of cancellinae, gradually decreasing and vanishing at base but the margin layer of denticulate cells may be traced almost halfway down the leaf base. Costa light brown, rounded in lamina, excurrent into a gemmiferous tip. Tips of upper gemmiferous leaves often expanded like spoons. Gemmae elongated, narrowly club-shaped ; ± 133 × 10 μ with about 10 cells in a linear row. Gemmiferous leaves also show young plants developing on the leaf tips. Fruiting plants not seen.

Distribution. NEFA, *Bor* 173.
Burma, Sumatra, Java, Borneo, Timor.

8. **Calymperes calcuttense** Bartram et Gangulee sp. nov.

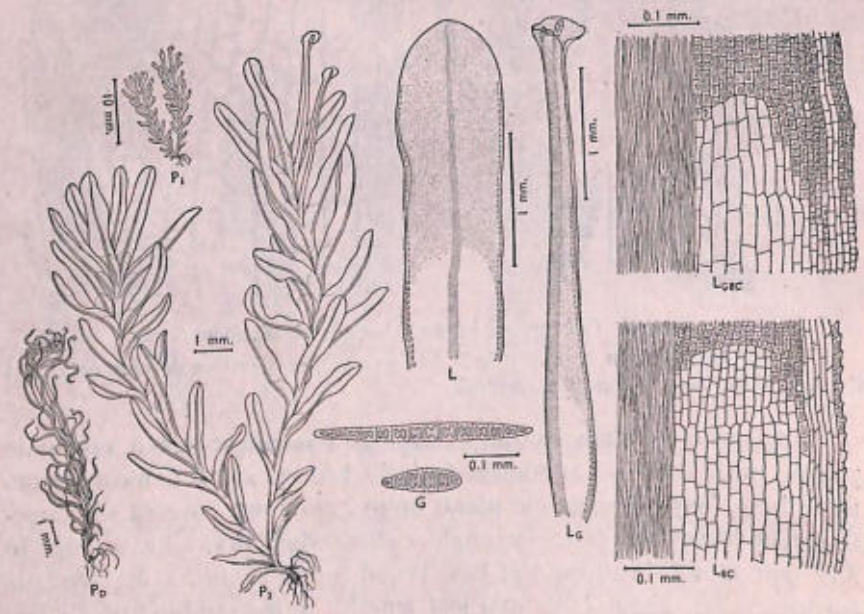


Fig. 86. *Calymperes calcuttense* Bartram et Gangulee sp. nov. (*Gangulee* 3067)

Pertinet ad subgen. *Hyophilina*, sect. *Eurycycla*. Herba laxa, viridis, epiphytica, culmis ad 1.2 cm. longis, crescens simul cum *Taxithelium*

nepalense (Schwaegr.) Broth. Folia ordinaria erecta vel erecto-patentia cum madida, inflexa et curvata cum sicca, ad 3.5 mm. longa, 0.75 mm. lata, late ligulata ex basi concava, quae lamina latior non est, marginibus plus minusve planis, minute denticulatis, apicibus latis et rotundatis. Tenioli eminentiores in inferioribus foliis, apicem fere attingentes. Cancellinae ± 0.75 mm. altae, apice rotundato vel ovato, efformatae seriebus 12 ad 14 cellularum rectangularium hyalinarum magnarum (usque ad 49 × 18 μ) ad utrumque latus costae ; cellulae minores evadunt in apice ipso atque admixtae sunt cellulis superioribus chlorophyllosis lamellatis, circumdatae seriebus ± senis cellularum hyalinarum elongatarum, quarum eae ad seriem marginalem tantum pertinentes breviores sunt atque denticulatae. Costa angusta, ± 85 μ lata, percurrens, papillosa ad dorsum. Laminarum cellulae minutae, quadratae, ± 8 μ latae, densae et papillosae. Folia gemmifera angustiora atque plus elongata, canaliculata per totum, usque ad 4.8 mm. longa, 0.36 mm. lata ad basin, quae est latior, fastigata supra ; apices dilatantur ad modum cochlearis, ibique gemmae includuntur ; cancellinae cellularum magnarum (ad 85 × 20 μ) hyalinarum rectangularium ad utrumque latus costae, ovatae supra, margine constante e sena vel septenta serie cellularum nonnihil elongatarum et serie marginali cellularum minutarum denticulatarum. Tenioli unius seriei ex superiore parte cancellinarum fere ad apicem. Cellulae superiores chlorophyllosae quadratae, ± 9 μ longae, gradatim minores ex costa ad marginem, densae, papillosae. Gemmae ± 158 × 38 μ, sed nonnullae ad 425 μ longae. Capsulae ignotae hoc in loco.

Typus lectus ab H.C. Gangulee ad Sonarpur prope Calcuttam mense novembri anni 1957 et positus in Presidency College, Calcutta sub numero *Gangulee* 3067; isotypus positus in herbario Bartrami in U.S.A. sub eodem numero *Gangulee* 3067.

Subgenus *Hyophilina* ; Section *Eurycycla*. Lax green epiphytic plants with stems up to 1.2 cm. long, simple or branched, growing mixed with *Taxithelium nepalense* (Schwaegr.) Broth. Normal leaves erect to erecto-spreading when moist, curled and twisted when dry; up to 3.5 mm. long and 0.75 mm. wide, broadly ligulate from a concave, rectangular base which is not broader ; margin more or less flat, minutely denticulate ; apex broad and rounded. Tenioli more prominent in lower leaves, reaching almost the apex. Cancellinae ± 0.75 mm. high, top rounded to ovate, formed of 12 to 14 rows of hyaline rectangular cells (up to 49 × 18 μ) on both sides of costa, cells becoming smaller just at the top and merging with the upper chlorophyllose lamellar cells, bordered by about 6 rows of elongated hyaline cells of which the border row cells are shorter and denticulate. Costa narrow, ± 85 μ wide, percurrent papillose back. Lamina cells small, quadrate, ± 8 μ wide, dense and papillose and subobscure. Gemmiferous leaves narrower and more

elongated, canaliculate throughout, up to 4.8 mm. long and 0.36 mm. wide at base which is broader, tapering above ; the tip widens out like a spoon within which the gemmae are wholly or partly enclosed ; cancellinae of about 9 rows of large rectangular hyaline cells (up to 85 × 20 μ) on each side of costa with ovate top, border of 6 or 7 rows of somewhat elongated cells and a marginal row of small denticulate cells ; tenioli of one row from top of cancellinae almost to tip ; upper chlorophyllose cells quadrate, ± 9 μ long progressively smaller from costa to margin, dense, papillose. Gemmae ± 158 × 38 μ but there are a few as long as 425 μ. Capsules not formed in this locality.

Differs from *C. hampei* in the oblong-ligulate leaves broadly rounded at apex and not wider at base.

Collected by author from Sonarpur near Calcutta in November 1957 and named by E. B. Bartram.

Distribution. Lower Bengal, *Gangulee* 3067.

9. **Calymperes noakhalensis** Brühl & Sarkar in *J. Dept. Sci. Cal. Uni.* **10** : 3, 1929.

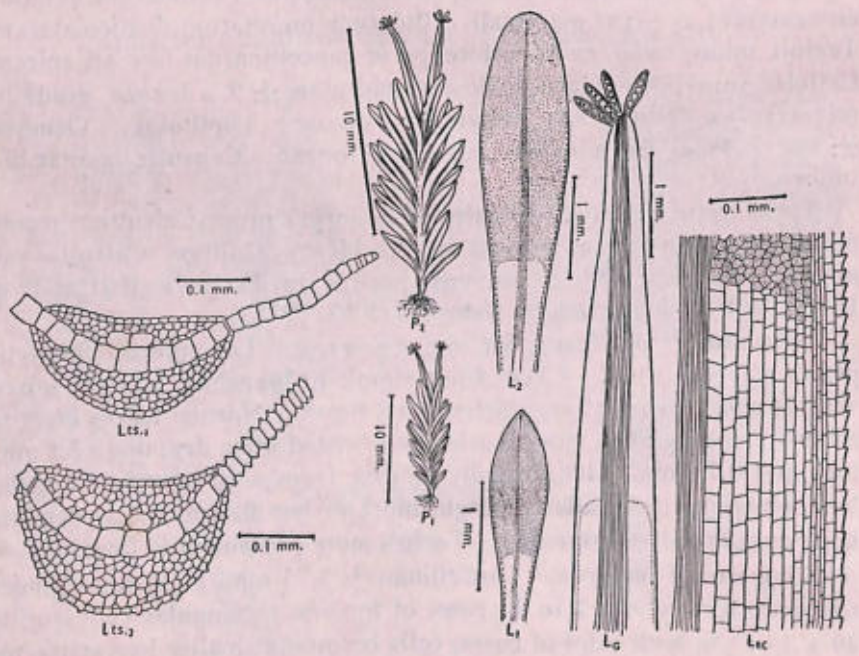


Fig. 87. *Calymperes noakhalensis* Brühl et Sarkar

(After Brühl & Sarkar). L_1=lower leaf, L_2=upper normal leaf, L_G=upper gemmiferous leaf, $L_{ts.1}$=t.s. of leaf base, $L_{ts.2}$=t.s. of upper leaf.

Hyophilina. Plants in cushions of *Octoblepharum albidum* Hedw. associated with *Leucophanes octoblepharoides* Brid. growing on palm

trees. Stems 10-15 mm. long, densely foliose. Leaves erecto-patent, flexuose or variously twisted when dry; lower leaves oblanceolate-spathulate, submucronate at apex due to slightly excurrent costa, ± 2 mm. long and 0.5 mm. broad above middle ; middle and upper normal leaves narrow spathulate or lingulate, rounded at apex, narrow at base, 3.3 to 4 mm. long, 0.6-0.9 mm. broad at upper half, 0.3-0.4 mm. broad at base ; leaf margin entire or minutely serrulate, undulate, sheathing part $\frac{1}{3}$ of whole leaf. Abnormal gemmiferous leaves 5-6 mm. long, ± 0.1 mm. broad at upper part. Costa $\frac{1}{3}$ of lamina broad at base, bearing a cluster of small, spindle-shaped gemmae at leaf tip. Costa of normal leaves not reaching leaf tip. Deuter cells in a median row, accompanied on the ventral side by two or three similar deuter cells ; cells on both sides of deuter numerous, much smaller, peripheral cells on costa papillose on upper half. Boundary between cancellinae and laminal cells not step-like, cancellinae more or less rectangular, large transparent cells near costa 38-44 μ long, upper crosswalls more or less oblique, cells broad near costa but the breadth gradually diminishes towards margin, uppermost cells distinctly shorter. Laminar cells irregularly quadrate, 8 to 10 μ in diameter, papillose. Tenioli extending from above base to $\frac{3}{4}$ of leaf length, 3 to 2 rows of 30-40 × 6-10 μ cells. Marginal cells in two rows, somewhat longer than broad, outer row slightly serrulate by projection of upper corners.

Differs from *C. hampei* and *C. moluccense* by the leaf base, midrib not excurrent in normal upper leaves and tenioli of not more than 3 rows.

As the type specimen could not be traced, the description and figures are based on those given by the authors.

Distribution. East Bengal, *Sarkar.*

10. **Calymperes heterophyllum** (Mitten) Bescherelle in *Ann. Sci. Nat. Bot.*, Ser. 8, **1** : 286, 1896.

Syrrhopodon heterophyllus Mitt. in *Musc. Ind. Or.* 40, 1859.

Eucampylopus. Lax caespitose, comparatively sturdy plants with branched stems up to 3 cm. long, uniformly covered with erecto-patent leaves which are curled to falcate when dry. Leaves carinate-lanceolate with a broad apex, up to 3.2 mm. long and 0.25 mm. wide in the comparatively broader, oblong, sheathing, concave base which is about $\frac{1}{6}$ of the total leaf length. Upper leaves longer, up to 3.6 mm. long and 0.36 mm. broad in the base which is more abruptly wider in these leaves. Chlorophyllose lamina cells very small, quadrate, 3 to 5 μ wide, densely papillose with many blunt papillae and obscure ; marginal row of cells bigger (up to 11.2 μ in height), clearer and causing a serrate

margin of the leaf from tip almost to base. Cancellinae ± 1.22 mm. high in lower leaves and 0.9 mm. in the upper leaves formed of up to 9 rows of thin-walled, quadrate to rectangular, hyaline cells which are

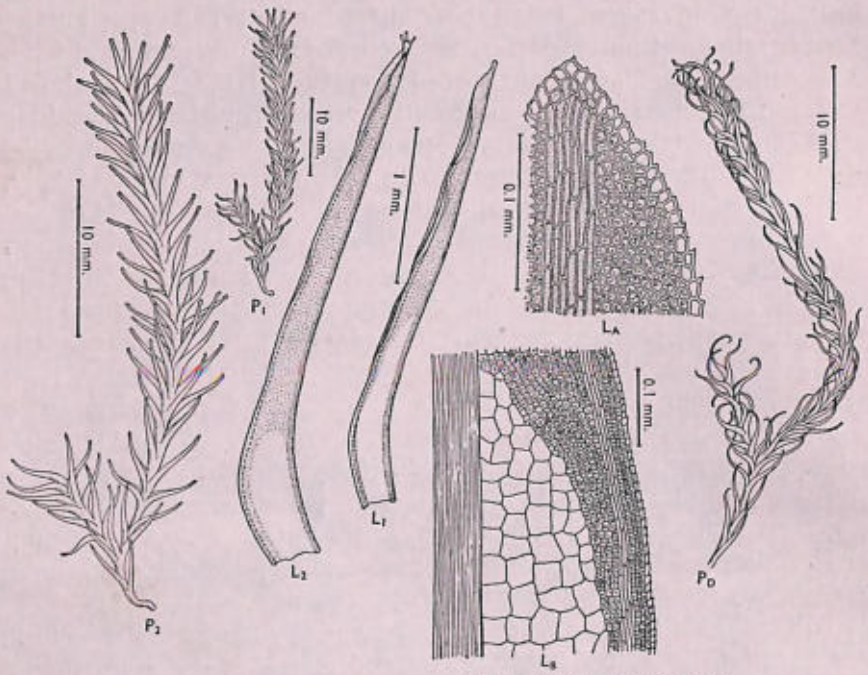


Fig. 88. *Calymperes heterophyllum* (Mitten) Bescherelle (*Gardner* from Ceylon). L_B at top of cancellinae. L_1 and L_2 show two different types of leaves.

up to 42 × 33 μ near costa. Cancellinae top obovate to slightly pointed ; the hyaline cells are bordered by the tenioli of transparent, narrow, elongated cells, 3 rows at top of cancellinae, extending to about 8 rows below. The tenioli bordered on the margin by 4 or 5 rows of smaller cells as on top lamina, the outermost row of which is the serrulate outer margin. The tenioli becomes narrower (2 or 1 layer) above the cancellinae and extends to a little below tip. Costa rough on back, light brown, about 61 μ wide at base, excurrent into a gemmiferous tip in all the upper leaves. The gemmae germinate by forming protonema-like filaments.

Distribution. Nepal, *Wallich.*
Ceylon.

ACKNOWLEDGEMENTS

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Summary

This fourth paper of the series dealing with the mosses of eastern India describes the families Leucobryaceae (last family of the series DICRANALES) and Calymperaceae (first family of the series POTTIALES). Leucobryaceae are represented in this area by 10 species in 5 genera, viz. *Leucophanes* (1 sp.), *Leucobryum* (6 spp.), *Ochrobryum* (1 sp.), *Octoblepharum* (1 sp.), and *Exodictyon* (1 sp.). Calymperaceae are represented by 10 species in 3 genera, viz. *Syrrhopodon* (2 spp.), *Thyridium* (2 spp.), and *Calymperes* (6 spp. including a new one). All these species (including the new species *Calymperes calcuttense* Bartram et Gangulee) are described and illustrated here. Necessary identification keys are also provided.

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The Birds of Nepal

PART 11

BY

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[*Continued from Vol.* **60** (2) : 399]

Family DICRURIDAE

748. **Dicrurus macrocercus albirictus** (Hodgson). Himalayan Black Drongo.

DUN : Hitaura : 1 imm. ♂ (May 14). CHITLANG VALLEY : Chitlang : 1♂ (March 14). NEPAL VALLEY : Maharajganj, Kathmandu, Patan, Bandegaon, Thankot : 4 ♂♂, 3 imm. ♂♂, 3 ♀♀, 2 imm. ♀♀ (March 21, April 4-14, May 5, 17).

The Black Drongo is very common in central Nepal from about 455 m. up to at least 1370 m. It occurs in and about villages, gardens, cultivation, light woods, open fields, etc.

It has also been recorded in eastern Nepal by Ripley (1950b, p. 413) and Biswas (1960a), and in west-central and eastern Nepal by Rand & Fleming (1957, pp. 104-105).

The males were noticed to chase females in the Nepal Valley from early April and they were fully breeding from the beginning of May. By the third week of March the gonads had already started swelling and in May they were fully developed. Thus, an adult male taken March 21, had slightly swollen testes, measuring R : 6.5×4, L : 7×4 mm.; another adult male on April 8 had them more developed (R : 11×6 mm., L : damaged); the adult male shot on May 5 had enormous testes (R : 17×11.5, L : 19.5×9 mm.); and an adult female taken May 17 was actually laying, there being a broken shelled egg in the oviduct.

Colours of soft parts : Iris blood red to deep crimson (reddish brown to brownish red in first year birds) ; bill, legs, feet and claws black ; pads grey.

Immature specimens:

All the six specimens referred to above as immature are first year birds. Their plumage corresponds with the description of first year

birds as given by Whistler (1935, p. 316). Two of the April specimens, both females taken April 4 and 13, are very similar and appear younger than the immature May birds. They have the upper side with very little gloss; rump greyish; upper tail coverts tipped white; primaries brown; axillaries greyish; under wing coverts tipped white; underside brownish; abdomen, vent and under tail coverts fringed with white; irides reddish brown; and non-breeding condition of the ovaries.

The first year birds of May 5 and 17 are in similar plumage. They have blacker and more glossy upper parts and sides of the breast; almost black but not glossy rump; reduced white on the tips of upper tail coverts; brownish primaries; blacker axillaries; under wing coverts blacker and with reduced amount of white on the tips; blacker underside, the May 17 specimen being more so; reduced white on abdomen and vent, more reduced on the May 17 specimen; irides brownish red; testes enlarged (May 5: R: 8×5, L: 8×4.5; May 17: R: 8×5.5, L: 10.5×4.5 mm.). The May 5 specimen was seen chasing a female in full adult plumage.

It would appear that corresponding with the gradual loss of brown and white in attaining the glossy black adult dress, there is a change in the colour of iris from brown of juvenile to blood red or deep crimson of adult through the addition of increased amount of red to brown in first year birds (reddish brown, brownish red). It would further appear that older first year birds (? all, or ? some) do breed. These factors seem analogous to those of the Blackheaded Oriole, *Oriolus x. xanthornus* (see Vol. **60** (2) p. 398).

Measurements :

	Wing	Tail		Bill
		length	depth of fork	
5 ♂♂:	153, 154, 155 (2), 156	159, 166, 167, 169, 172	51, 55, 59, 63 (2)	25, 25.5, 26, 27, 27.5
3 ♀♀:	149, 151, 153	159, 164, 166	48, 55, 56	26 (2), —

Ripley (1961, p. 287) prefers to combine the Asian *D. macrocercus* with the African species *D. adsimilis*.

749. **Dicrurus leucophaeus longicaudatus** A. Hay. Indian Grey Drongo.

DUN : Bhimphedi : 2 imm. ♂♂ (March 12, June 18). CHITLANG VALLEY: Chandragiri above Chitlang : 1 ♀ (April 18). NEPAL VALLEY : Kathmandu, Godavari, Thankot : 13 ♂♂, 1 imm. ♂, 3 ♀♀ (March 21-April 14, May 10, 20).

The Grey Drongo is very common in central Nepal, more so above *c.* 1065 m. It occurs about villages and towns, in gardens and groves, as well as in light forests.

It was preparing to breed from the third week of March. The specimens from this period onwards had their gonads in different progressive stages of enlargement, until the third week of May when specimens with fully breeding condition of gonads (e.g. ♂ with 16×10 mm. testes) were obtained.

Colours of soft parts : Iris blood red (brownish red in first year birds) ; bill, legs, feet and claws black ; pads grey.

Immature specimens:

All the three immature specimens are males in first year plumage. Of them, the June 18 specimen appears oldest from the amount of gloss and white fringes to the posterior ventral feathers. This specimen had brownish red iris and somewhat enlarged testes (R: 5×3, L: 9×5 mm.); it probably had already bred. The May 10 specimen looks a little younger. It also had brownish red iris, and enlarged testes (R: 9×6, L: 12×6 mm.). The other specimen (March 12) appears still younger. No notes on the coloration of its iris and the condition of its gonads are available.

As in the Black Drongo, *Dicrurus macrocercus albirictus* (p. 639), this species also appears to breed in the first year plumage.

Unusual behaviour of a first year specimen:

The oldest of the specimens in first year plumage, a male (Bhimphedi, June 18), indulged in what appeared to be an unusual behaviour. Three fledglings of the Lesser Racket-tailed Drongo (*Dicrurus remifer tectirostris*) were huddled close together on the branch of a tree, and the first year Grey Drongo was engaged in aerobatics before them (time: about 9 a.m.; air temperature: about 35° C.). The aerial display consisted of upward flights, followed by sudden somersaults in midair with dexterous twists and turns, and finally return to perch on the same branch on which the Racket-tailed Drongos were perched or on an adjacent branch of the tree. Each flight was short and in full view of the tiny spectators, and it was almost constantly uttering a harsh call. From time to time it also performed the normal sallies for hunting insects. I am unable to account for the aerobatic flights with certainty. Was it because the bird (which appeared to have bred for the first time in its life) for one reason or the other was in a gay mood that it was happily showing off all it knew about flying to the only spectators it could find—three baby Lesser Racket-tailed Drongos?

Measurements:

		13 ♂♂	4 ♀♀
	Wing :	137, 138 (2), 139, 140 (3), 141 (2), 141.5, 142, 143, 147	134, 135, 136 (2)
Tail	length :	157, 159, 160 (2), 161, 162, 163, 166, 167 (2), 170, 175,—	153, 155, 163,—
Tail	depth of fork :	60, 61, 64 (2), 65, 68 (2), 71, 72, 74, 75, 82,—	59, 62, 68,—
	Bill :	26 (2), 26.5 (2), 27 (3), 27.5 (3), 28 (2),—	25.5, 26, 26.5, 27

750. **Dicrurus caerulescens caerulescens** (Linnaeus). Whitebellied Drongo.

DUN : Hitaura : 1 ♂ (June 6).

The Whitebellied Drongo appeared rather scarce in central Nepal. The single example listed above was the only one found by us.

While Scully (1879, pp. 271-272) found it common in the central dun in winter, Ripley (1950b, p. 414) and Rand & Fleming (1957, p. 105) reported it from the western tarai only.

This species was not mentioned in the catalogues of Hodgson's collections, but two skins presented by Hodgson to the British Museum, one from Nepal and the other from 'Behar' were listed by Sharpe (1877, p. 253).

My specimen is very worn.

Measurements : 1 ♂ : Wing 126+.

751. **Dicrurus annectans** (Hodgson). Crowbilled Drongo.

DUN : Hitaura, Paharé Ghat : 1 ♂, 4 imm. ♀♀ (May 18-June 12).

The Crowbilled Drongo did not appear to be common in central Nepal. We came across it only occasionally in the deeper parts of forests of the Hitaura dun, and we found it only singly.

This species does not seem to have been reported from Nepal since Hodgson's time, save for the present record.

The immature birds listed above are in the first year plumage. The May 29 specimen appears to be the youngest of the lot. Its bars on the underside are broad and very conspicuous. It had, however, a somewhat enlarged ovary (7.5×5 mm.) with two or three 1.5 mm. ova. The June 12 specimen had a more enlarged ovary (8×6 mm.) with the largest ova measuring 2.5 mm.

Colours of soft parts (of first year birds) : Iris dark brown ; bill, legs, feet, and claws black ; pads yellowish grey.

Measurements : 1 ♂ : Wing 148 ; tail : length 121, depth of fork 20 ; bill 30.

In addition to the characters that separate this species from *D. macrocercus*, as given by Baker (1924, p. 354), the bill of

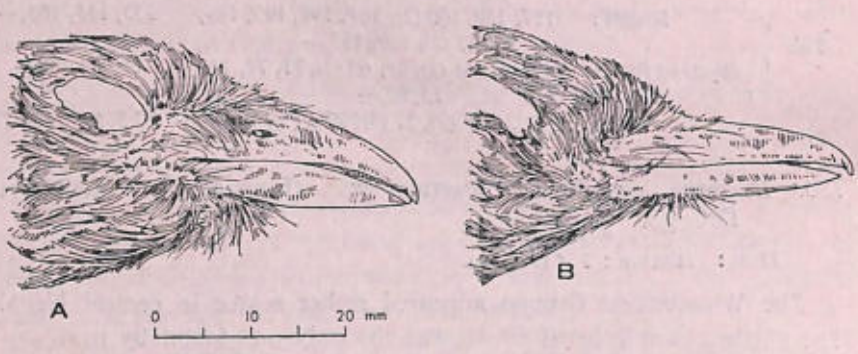


Fig. 3. Bills of *Dicrurus annectans* (**A**) and *Dicrurus macrocercus albirictus* (**B**) showing their characteristic shapes

D. annectans, which is large, heavy (Vaurie, 1949b, p. 266) and more crow-like, will prove a characteristic feature of distinction (Fig. 3).

752. **Dicrurus aeneus aeneus** Vieillot. Indian Bronze Drongo.

BHABAR : Amlekhganj : 1 ♂ (March 8). DUN : Hitaura, Bhimphedi : 2 ♂♂, 1 subad. ♂, 1 ♀, 2 imm. ♀♀ (March 12, May 12-15, June 17). NEPAL VALLEY : Thankot : 1 ♂, 1 ♀ (March 25, 28).

The Bronze Drongo is occasionally seen in the forests of central Nepal. During spring and summer, it occurs singly or in loose parties.

Scully (1879, p. 272) who obtained specimens from the central dun, noted that 'it was never observed in the valley of Nepal, but Mr. Hodgson seems to have obtained it there in summer.' Ripley (1950b, p. 414) found it from the tarai up to *c.* 1220 m. (his single specimen was taken at Chisapani, *c.* 275 m., western Nepal). Rand & Fleming's (1957, p. 105) examples were taken in western and west-central Nepal at *c.* 915-1065 m. in winter.

The two immature females (Hitaura, May 12, 13) were evidently born early that season. They still have some sooty black down on the ventral side, and have grown only a few metallic feathers on the breast.

The Bronze Drongo was breeding in the Nepal Valley late in March, when males were seen chasing females, and a male specimen (March 28) had quite swollen testes (R: 9.5×6, L: 11.5×6 mm.). By June, breeding was over: one male taken June 17 at Bhimphedi (Dun) had almost non-breeding gonads.

Measurements :

	Wing	Tail		Bill
		length	depth of fork	
4 ♂♂ :	125, 127, 128(2)	119, 120, 123, 126	29 (2),31, 33	22, 23, 24 (2)
2 ♀♀ :	125, 126	122, 126	32, 34	23, 23.5

753. **Dicrurus remifer tectirostris** (Hodgson). Indian Lesser Racket-tailed Drongo.

DUN : Bhimphedi : 2 ♂♂, 2 fledgling ♂♂, 1 nestling ♂, 2 ♀♀, 1 fledgling ♀, 1 nestling unsexed (May 4-12, June 18). MARKHU VALLEY : Deorali : 3 ♂♂, 2 ♀♀, 1 subad. ♀, 1 imm. ♀ (April 28, 29).

The Lesser Racket-tailed Drongo is occasionally seen in central Nepal. We noted it in small numbers between *c.* 1220 and 1830 m. on Mahabharat Range about clearings in the forests.

Scully (1879) and Ripley (1950b) were both unable to locate it in Nepal, but Rand & Fleming (1957, p. 106) reported it from the western tarai and the Nepal Valley in January, and Biswas (1960a) from Ramechhap district, eastern Nepal, at *c.* 1220 m. in January.

The immature female specimen (April 28) is in the first annual plumage, and the subadult female (April 28) is in the second annual plumage as described by Vaurie (1949b, p. 271). The three fledglings (2 ♂♂, 1 ♀, June 18) were huddled close together on the branch of a tree and evidently belonged to the same brood.

Measurements :

		5 ♂♂	4 ♀♀
	Wing :	140, 142, 144 (2), 149	139, 140 (2), 141
Tail	central feather :	121, 122, 123, 126, 129	118, 120, 125, 126
	outer feather[1] (L/R) :	397/401, —/444, —/457, 423/—, 439/443	388/—, —/324+, —/353, —/—
	bare shaft (L/R) :	185/186, 206/202, 206/—, —/210, 240/227	162/—, —/137, —/140, —/—
	length of racket (L/R):	90/—, 91/95, —/95, 100/—101, —/105	96/—, —/81+, —/84, —/—
	width of racket (L/R) :	19/18, 20/—, —/21, —/23, 22/22	23/—, —/25, —/25, —/—
	Bill :	26, 26.5, 27, 27.5, 29	26.5, 27, 27.5, 28

[1] Up to the base of the shaft

754. **Dicrurus hottentottus hottentottus** (Linnaeus). Indian Haircrested Drongo.

TARAI : Simra : 2 ♂♂ (March 5). BHABAR : Amlekhganj : 1 subad. ♂, 1 ♀ (March 7, 9). DUN : Hitaura, Paharé Ghat : 2 ♂♂, 1 imm. ♂, 1 nestling ♂, 1 subad. ♀, 3 imm. ♀♀ (May 27-June 13). NEPAL VALLEY : Godavari : 1 ♂ (May 13).

The Haircrested Drongo is not uncommon in central Nepal. We observed it to be commoner in the Hitaura dun than in the lower

regions (the tarai and bhabar) and the higher regions (Bhimphedi dun upwards). In the Nepal Valley, however, it was seen only once, and the only other record of its occurrence there is by Rand & Fleming (1957, p. 106) who obtained a single juvenile female on Nagar Jong in February. It occurs singly in forests.

Rand & Fleming (loc. cit.) have also found it in western, west-central and eastern Nepal.

My nestling specimen (♂, June 13) has black down feathers on the body. Of my immature specimens, the one taken June 13 (♀) appears to be the youngest: it has downy feathers on the underside. Two other specimens (♀, June 7, ♂, June 11), which have all their remiges and rectrices still growing, are similar to those of adults in coloration. The female has no crest, very short hackles, almost bare axilla, tips of outer tail feathers not curling, brown iris, bill horny black with whitish on the tip, and had non-breeding gonad. The male appears a little older. It has started getting the crest which consists of five rudimentary filamentous feathers. Further, it has short hackles, uncurled outer tail feathers, a few white-tipped axillaries, dark brown iris, and had non-breeding testes.

The specimen from the Nepal Valley (♂, May 13) had slightly enlarged testes (R: 7.5×3, L: 6.5×3 mm.), but the adults taken in the duns late in May and early in June, had fully developed gonads.

Colours of soft parts : Iris brownish red to blood red ; bill, legs, feet and claws black ; pads dark grey.

Measurements :

	Wing	Tail	Bill
5 ♂♂ :	166.5, 168, 169 (2), 169.5	143, 144, 146, 147.5, 149	39, 41 (2), 42, 43
1 ♀ :	168	148	42.5

755. **Dicrurus paradiseus grandis** (Gould). Northern Large Racket-tailed Drongo.

TARAI : Simra : 1 ♂ (March 5).

We found the Large Racket-tailed Drongo rather uncommon in central Nepal. Our only specimen was taken in the dense forest of the tarai.

Scully (1879, p. 272) recorded only a captive bird from the lower hills of central Nepal; Ripley (1950b, p. 414) found it 'throughout the Terai', presumably including that of central region; and Rand & Fleming (1957, p. 106) had specimens from the lower regions of western, west-central and eastern Nepal.

Measurements : 1 ♂ : Wing 177 ; central tail feathers 160 ; outer tail feathers : left 463, right 468 ; length of racket : left 99, right 100 ; width of racket : left 27, right 28 ; bill from the anterior edge of nostril 25.

Family ARTAMIDAE

756. **Artamus fuscus** Vieillot. Ashy Swallow-Shrike.

DUN: Hitaura : 8 ♂♂, 5 ♀♀ (May 19-25, June 1).

The Ashy Swallow-Shrike did not appear to us to be particularly common in central Nepal, except about the Hitaura village in the central dun, where small parties consisting of two to six individuals were commonly met with. Isolated trees in cultivated fields (of maize at that time of the year) were noted to be its favourite launching base in that area.

Our specimens seem to be the only ones collected in Nepal since Hodgson's time. It has not been recorded by Scully (1879) or Rand & Fleming (1957), but Ripley (1950b, p. 383) who did not collect any example, found it to be common 'in the Terai, in open areas, and up to Bhimphedi' in central Nepal dun.

My specimens do not fully agree with the description given by Baker (1924, p. 348), especially in the coloration of the forehead, chin and throat, and wing. Rather, Deignan's (1945, p. 516) description seems to fit them well.

The specimens under report are all more less worn. The tail of a female (May 22), and the forehead, chin and throat of a male (June 1) are in moult.

Examples taken on June 1 (♂♂) had near breeding gonads, R: 8.25×7, 6×4.5; L: 5.5×3, 6×4.5 mm.

Colours of soft parts : Iris reddish brown to blood red (♂); bill bright mauve-blue with black tip (♂); legs and feet slaty, bluish slaty on the back of legs and sides of feet; claws dark horny ; pads white.

Measurements :

	8 ♂♂	5 ♀♀
Wing :	132 (2), 136, 137, 138, 138+, 139, 140	132+, 133+, 134, 138,—
Tail :	56+, 57, 58 (2), 58.5, 61, 62, 64	53+, 54, 56, 57, —
Bill :	22 (3), 22.5 (3), 23, —	21 (2), 22 (2), 23

Family CORVIDAE

757. **Garrulus glandarius bispecularis** Vigors. Western Himalayan Jay.

Garrulus bispecularis Vigors, 1831, *Proc. zool. Soc. Lond.* (1) : 7. (Himalayas, restricted to Murree, West Pakistan, by Baker, 1922d, p. 63.)

758. **Garrulus glandarius interstinctus** Hartert. Eastern Himalayan Jay.

DUN: Bhimphedi: 1 ♂ (March 14). MARKHU VALLEY: Deorali : 1 ♂, 1 juv. ♀ (May 2, July 2). CHITLANG VALLEY : Chitlang, Chandragiri above Chitlang:

4 ♂♂ (March 15, April 18-21). NEPAL VALLEY : Thankot, Crest of Chandragiri : 4 ♂♂, 8 ♀♀ (March 23-April 14).

The Himalayan Jay is a common bird of central Nepal between *c.* 1220 and 2285 m. in pine and oak forests.

The earlier Nepali records of the species are all from central Nepal, except Stevens's (1923a, p. 515) who reported it from the Mai Valley, eastern Nepal, at *c.* 2590 m. in March, and Biswas's (1960a) who observed it in Ramechhāp district, eastern Nepal, at *c.* 1830 m. in January.

The juvenile specimen (♀, July 2) is darker than the adults, and has some downy feathers on the abdomen and vent.

It was breeding on the Chandragiri during mid-April. One of the female examples collected there on April 14 had a somewhat exhausted ovary with a 13 mm. ovum. Another female taken the same day had its ovary only partially mature, its largest ovum being only 3 mm. in a 12×6.5 mm. ovary. This was, however, an anomalous ovary, being located on the right side instead of the left (see Biswas, 1961a).

Colours of soft parts : Iris brownish pink ; edges of eyelids dull pink ; bill dull black with whitish tip ; legs fleshy ; feet yellowish fleshy ; claws pale horny with whitish on bases ; pads white.

Measurements :

	10 ♂♂	8 ♀♀
Wing :	158, 164, 165, 166(2), 167, 168, 169(2), 171	158, 162(2), 163(2), 164(3)
Tail :	142, 143, 144, 145, 147, 148, 149, 150(2), 153	135, 139, 140(2), 143, 144, 145,—
Bill :	32(5), 33(4),—	30.5(3), 31(2), 31.5(2), 32

Ripley (1950b, p. 416) and Rand & Fleming (1957, p. 114) have identified their birds from central Nepal (Nepal Valley) as *bispecularis*. Examination of large series from central Nepal shows, however, that this area lies in the zone of intergradation between the western *bispecularis* and eastern *interstinctus*, all gradations between the two being found here. While Biswas did not obtain any specimen from eastern Nepal, Stevens's examples from that area have been identified as *interstinctus*. I am not aware of any known specimen of the species from western Nepal, but birds from that area will, in all probability, prove to be *bispecularis*, for the few skins from eastern Kumaon not far from western Nepal border, that I have examined, no doubt belong to the western subspecies.

759. **Garrulus lanceolatus** Vigors. Blackthroated Jay.

DUN : Bhimphedi : 1 ♂ (March 12). CHITLANG VALLEY : Chitlang : 1 ♂, 1 ♀ (April 17, 19).

The Blackthroated Jay was met with by us only on a few occasions between *c.* 1370 and 1830 m. in central Nepal. It was found singly in thinner parts of oak and pine forests.

Scully (1879) was unable to locate it in Nepal. Ripley (1950b, p. 416) and Rand & Fleming (1957, p. 113) recorded it also from western Nepal.

Our specimens are worn, those taken in April being more so.

Measurements :

	Wing	Tail	Bill
2 ♂♂ :	155+, 158	141,—	28(2)
1 ♀ :	151+	—	27.5

*760. **Cissa flavirostris cucullata** (Gould). Western Yellowbilled Blue Magpie.

*761. **Cissa flavirostris flavirostris** (Blyth). Eastern Yellowbilled Blue Magpie.

Scully (1879, p. 328) found the Yellowbilled Blue Magpie in the Nepal Valley and Nawakot district, central Nepal. Ripley (1950b, p. 415) reported it from the Tamur Valley, eastern Nepal, at *c.* 2440 m. upwards. Smythies (1950, p. 513) found it on Phulchauki Danda, Nepal Valley, at *c.* 2440 m. Proud (1952a, p. 361) observed it in the Gandak-Kosi watershed, central Nepal, at *c.* 2745 m. Rand & Fleming (1957, p. 110) recorded it from the Kali Gandak Valley, west-central Nepal, at *c.* 2135-2440 m., and in the Maulung Valley, eastern Nepal, at *c.* 3050 m.

The few central Nepali skins (Hodgson's earlier collection, as well as Scully's and Bailey's) of this magpie that I have been able to examine indicate that this area falls in the zone of intergradation between the western and eastern subspecies, the specimens showing a great deal of variation among them. This intergrading zone surely extends eastward up to at least the Maulung Valley, for Rand & Fleming's single specimen thence has been identified as belonging to the western race. Further eastward, probably from the Arun Valley, the birds are *flavirostris* (one Hodgson specimen presented to the British Museum in 1859, and Ripley's skins).

It may be pointed out here that Baker's (1922d, p. 43) description of *flavirostris* is not quite accurate for all characters. Thus, the nape is very pale bluish lilac and not white; the crown feathers are tipped very pale bluish lilac instead of white in the majority of specimens. In worn specimens the tips wear off and the feathers appear wholly black. Furthermore, the culmen cannot be 'about 65 mm.' when the bill from skull in 10 ♂ ♀ measures 37-42 (av. 40.4) mm.

762. **Cissa erythrorhyncha occipitalis** (Blyth). Redbilled Blue Magpie.

BHABAR : Amlekhganj : 1 ♂ (March 9). DUN : Hitaura : 2 juv. ♂♂, 2 ♀♀, 1 juv. ♀, 1 nestling ♀ (May 12, 15, June 13-16, July 14). NEPAL VALLEY : Godavari, Thankot : 3 ♂♂, 2 ♀♀ (April 14, May 10-13).

The Redbilled Blue Magpie is common in certain parts of central Nepal. Thus, we found a single specimen at Thankot for some days early in April, while during that period several parties were seen on the Chandragiri above Thankot. It was, however, very common at Godavari and above it on Phulchauki Danda during the second week of May. About Bhimphedi in the dun only a few parties were found, while it was common in a patch of forest situated between the Karra and Rapti rivers near Hitaura.

It occurs usually in small parties of four to six birds. It frequently feeds on the ground, walking awkwardly with such a long tail (*cf.* Rattray's observation mentioned by Baker, 1922d, p. 42). At Godavari a party was seen pecking at a baby Himalayan Cuckoo, *Cuculus saturatus*, see Part 2 of this series in the *Journal* 1960 (1961), **57** (3): 541-542, presumably stolen, and on examination it was found to have severe injuries on its head and abdomen caused by the predators' beaks.

Lowndes (1955, p. 29) reported it from the Marsiyandi Valley, central Nepal, at *c.* 915 m. in September; Rand & Fleming (1957, p. 109) found it in west-central Nepal at *c.* 610-915 m., and in eastern Nepal at *c.* 290 and 915 m. in winter; and Biswas (1960a) observed it in the Tamur Valley, eastern Nepal, at *c.* 1525 m. in June.

The two juvenile male specimens (June 15, 16) have no white spots on the forecrown, have the crown feathers sooty, centre of crown to nape white, and the tail growing. The juvenile female (July 14) is similar but with a longer tail. The nestling is also similarly coloured, but has down on abdomen and vent, and is smaller in size.

The May and June birds are worn.

In May the birds were very noisy and were chasing one another, presumably males chasing the females. The gonads were nearly ready in specimens taken May 10-13.

Colours of soft parts : Iris dark brown ; eyelids brownish yellow ; bill, legs and feet deep orange-red (in a female more orange, less red) ; claws horny, yellowish ochre on base ; pads deep orange-red.

Measurements :

	Wing	Tail	Bill
4 ♂♂ :	200, 202, 204, 207	440, 461, 464, 469	39, 41, 42(2)
4 ♀♀ :	194+, 198, 199,—	414+,—(3)	39, 40, 41, 42

763. **Cissa chinensis chinensis** (Boddaert). Green Magpie.

DUN : Hitaura : 2 ♂♂, 5 ♀♀ (May 17-30).

The Green Magpie is not uncommon in the duns of central Nepal. It occurs in dense forests.

Scully (1879) did not record it from Nepal, and Ripley (1950b, p. 415) and Rand & Fleming (1957, p. 110) found it only in western Nepal.

The characteristic change of coloration of its plumage from green to blue in museum skins is commonly believed to be a post-mortem change. But surely it is not always so. Baker (1922d, pp. 45-46) noted that such changes might occur in live birds in ill-health or in captivity. It may be noted here that many specimens even in wild state (freshly killed) have varying amount of blue on their plumage. Thus, four of the seven specimens under report had already some blue on them when alive, and the following notes were made at the time of skinning:

1. ♂, May 17: Crown clear blue; slight blue wash on breast and abdomen.
2. ♂, May 30: Head pale blue; underparts washed with blue.
3. ♀, May 23: Crown clear blue; slight bluish wash on breast and abdomen.
4. ♀, May 30: Head pale blue; bluish band across breast.

All those skins were re-examined two years afterwards and were found to have changed considerably in coloration by becoming more or less completely blue.

The specimens are more or less worn.

Measurements:

	Wing	Tail	Bill
2 ♂♂ :	157,—	202+,—	39, 41
5 ♀♀ :	146+, 147, 149,—(2)	199, 202, 203,—(2)	35, 36, 38(2), 39

764. **Crypsirina vagabunda vagabunda** (Latham). Indian Tree Pie.

TARAI: Simra: 2 ♀♀ (March 4).

The Tree Pie did not appear to be common in central Nepal. We were unable to locate it in the Nepal Valley or in the areas south of it, except in the tarai and probably also in the Hitaura dun. In the last-named area once some tree pies were seen at a great distance nearly at dusk, and am not sure of their identity. Their pale coloration suggested that they were probably the Indian Tree Pie.

Scully (1879, pp. 328-329) found it fairly common between the bhabar and Hitaura dun. Ripley (1950b, p. 415) reported it from the tarai. Rand & Fleming (1957, p. 110) recorded it from *c.* 275-1370 m. in west-central and *c.* 275 m. in eastern Nepal.

Our specimens are worn, one being very much so.

Measurements: 2 ♀♀: Wing 142+, 150; tail 210+, 222; bill 30.5, 31.

Three other skins, all unsexed, from central Nepal (two Hodgson skins in the British Museum from 'Kachar' and Nepal Valley according to Kinnear's corrections

made on the labels, and one in the Zoological Survey of India, taken by the Museum Collector) measure : Wing 147, 152(2) ; tail 226, 227,—; bill 30+, 31, 34.

As Ripley (loc. cit.) has pointed out, the central Nepal birds are close to *vagabunda* in coloration, but a little larger, thus leaning towards *pallida*.

765. **Crypsirina formosae himalayensis** (Blyth). Eastern Himalayan Tree Pie.

Dendrocitta himalayensis Blyth, 1865, *Ibis* (2)1 : 45. (Himalayas, restricted to Sikkim by Ticehurst, 1925, p. 22.)

Dendrocitta formosae sarkari Kinnear & Whistler, 1930, *Bull. Brit. orn. Cl.* **51** : 17. [Anantagiri, Vishakhapatnam (= Vizagapatam) district, Andhra Pradesh.]

DUN : Hitaura, Kusumtar, Bhimphedi : 4 ♂♂, 1 juv. ♂, 1 ♀ (March 12-14, May 10-12, June 2, 3). NEPAL VALLEY : Godavari, Phulchauki Danda above Godavari, Thankot : 6 ♂♂, 5 ♀♀ (March 23-April 13, May 10-13).

The Eastern Himalayan Tree Pie is a common bird of central Nepal from the dun up to the Nepal Valley. A few were also observed at Amlekhganj in the bhabar. During spring and summer it occurs singly or in pairs in fairly dense, as well as lighter parts of forests.

Lowndes (1955, p. 29) found it in the Marsiyandi Valley, central Nepal, at *c.* 915 m. in September. Rand & Fleming (1957, p. 111) recorded it from west-central Nepal at *c.* 915-1370 m. in winter. In eastern Nepal, Biswas (1960a) came across it in the Irkhua Valley at *c.* 1220-1525 m. and in the Tamur Valley at *c.* 1525 m. during June.

My May and June specimens are worn.

Birds were chasing one another (presumably males chasing females) in April and May. The gonads of specimens taken April 1 (Thankot) and May 10-13 (Godavari) were approaching breeding condition, and that of June 2 (Kusumtar) was fully developed.

Colours of soft parts : Iris deep crimson or crimson-brown ; bill black (once with the tip of the upper mandible horny) ; legs, feet and claws very deep horny or black ; pads grey.

Measurements :

	10 ♂♂	6 ♀♀
Wing :	132+, 138, 144 (2), 145 (2), 146 (2), 147,—	136, 141 (2), 142, 146, 148
Tail :	205, 213, 215, 218, 222, 232, 235, 243,—(2)	202, 210, 212, 215, 221, 223
Bill :	34 (3), 35 (3), 36 (4)	33, 34 (2), 35 (3)

The isolated population of *C. formosae* in the northern Eastern Ghats described by Kinnear & Whistler (loc. cit.) as *sarkari* (with Anantagiri, Andhra Pradesh, as the type locality) and admitted by Ripley (1961, p. 311) and Vaurie (1962, p. 248), is said to differ from *himalayensis* only by having a smaller bill. This is not, however, borne out by my examination of the material of the species

contained in the British Museum, the American Museum of Natural History and the Zoological Survey of India. This material includes three paratypes (with a topotype) of *sarkari*. The standard measurements of this material are as follows:

		Wing	Tail	Bill
W. Himalaya (Chenab Valley to Kumaon):	4 ♂♂ :	147-156	243-260	35-375.
[= *occidentalis* Ticehurst, 1925].		(152.5)[a]	(253.5)	(36.5)
	7 ♀♀ :	149-156	241-261	35-40
		(152.4)	(249.7)	(37.4)
	7 unsexed :	146-155	231-253	37-40
		(150.9)	(241.3)	(38.4)
E. Himalaya (Nepal to Assam) :	30 ♂♂ :	137-151	194-228	34-39.5
[= *himalayensis* Blyth, 1865].		(142.7)	(211)	(36.5)
	20 ♀♀ :	137-148	192-230	33.5-39
		(141.8)	(207.3)	(36.1)
	32 unsexed :	138-150	192-227	33-39
		(141.9)	(209.4)	(36.5)
N. Eastern Ghats[1] (Jeypore to Anantagiri) :	2 ♂♂ :	137, 142	203, 209	34, 35
[= '*sarkari*' Kinnear & Whistler, 1930].	1 ♀ :	143	201	35

[a]Average measurements are given in parentheses.

[1] Whistler & Kinnear (1932a, p. 517, note), and Abdulali (1949, p. 391) mention a specimen ex Horsfield collection from Madras. This specimen, an unsexed adult, collected by Wight (or ? Wright) is now in the British Museum. It measures : wing 151, tail 233, bill 37, and matches the western Himalayan *occidentalis*. Evidently, there must have been some error in the locality of the specimen.

It would appear from the measurements that *sarkari* fits in well within the subspecies *himalayensis*.

Baker's (1922d, p. 53) measurements of wing (132-140) and tail (200-210) of '*himalayensis*' (=*occidentalis*+*himalayensis*) are not correct, as may be seen from the measurements presented above.

*766. **Crypsirina frontalis frontalis** (Horsfield). Blackbrowed Tree Pie.

The only record of the occurrence of the Blackbrowed Tree Pie in Nepal is based on Hodgson's later collection (Horsfield & Moore, 1854, p. 570; Sharpe, 1877, p. 78).

*767. **Nucifraga caryocatactes macella** Thayer & Bangs. Eastern Nutcracker.

Scully (1879) did not find the nutcracker in Nepal. Stevens (1923a, p. 516) came across it on the Nepal side of the Singalila Range, eastern Nepal, at *c.* 2895-3505 m. in March-May. Ripley (1950b, p. 416) noted it in the Tamur Valley, eastern Nepal, at *c.* 2590 m. upwards in winter. Polunin (1955, p. 887) reported it

from the Langtang Valley, central Nepal, up to *c.* 3960 m. in summer. Lowndes (1955, p. 29) found it in Manangbhot, central Nepal, at *c.* 3655 m. in summer. Rand & Fleming (1957, p. 111) recorded it from the Kali Gandak Valley, west-central Nepal, at *c.* 2590-2805 m. in winter, and in the Maulung Valley, eastern Nepal, at *c.* 3505 m. in winter. Biswas (1960a) heard it at *c.* 3505 m. in the Dudh Kosi Valley, eastern Nepal, in February.

Biswas (1950a) has shown that the Nepal birds belong to the eastern subspecies. Vaurie (1959a, p. 159; 1962, p. 257) has come to the same conclusion. However, Ripley (1961, pp. 312-313) has referred the Nepal birds to the western race *hemispila*.

*768. **Pyrrhocorax pyrrhocorax himalayanus** (Gould). Himalayan Redbilled Chough.

Like us, Scully (1879) and Ripley (1950b) were unable to find the Redbilled Chough in Nepal. Polunin (1955, p. 887) reported it from the Langtang Valley, central Nepal, at *c.* 3350 m. upwards in summer. Lowndes (1955, p. 30) noted it in Manangbhot, central Nepal, up to *c.* 4875 m. in summer. Rand & Fleming (1957, p. 111) recorded it from the Kali Gandak Valley, west-central Nepal, at *c.* 2745-2805 m. in winter. Biswas (1960a) found it in Khumbu, eastern Nepal, at *c.* 3655-4570 m. during February-April.

*769. **Pyrrhocorax graculus digitatus** Hemprich & Ehrenberg. Eastern Yellowbilled Chough.

The first record of the Yellowbilled Chough from Nepal was furnished by Stevens (1923a, p. 517) from the Nepal side of the Singalila Range, eastern Nepal, at *c.* 3610 m. in March. It has subsequently been reported by Lowndes (1955, p. 30) from Manangbhot, central Nepal, up to *c.* 4875 m. in summer, and Biswas (1960a) from Khumbu, eastern Nepal, at *c.* 3655-5425 m. during February-May.

770. **Corvus splendens splendens** Vieillot. Indian House Crow.

DUN : Hitaura : 1 ♂ (June 24). NEPAL VALLEY : Thankot : 4 ♂♂, (June 29).

The House Crow is very common in and around all the villages and towns of Nepal from the plains up to about 1525 m.

It was breeding in June.

Measurements : 5♂♂ : Wing 285, 287, 288, 290 (2) ; tail 174, 177, 178, 180, 186 ; bill 50, 51 (2), 55, 56.

771. **Corvus macrorhynchos intermedius** Adams. Himalayan Jungle Crow.

MARKHU VALLEY : Kulikhani, Deorali : 2 ♂♂, 1 ♀ (April 27-May 2). CHITLANG VALLEY : Chitlang : 1 ♂, 1 ♀ (April 19, 25). NEPAL VALLEY : Thankot : 1 juv. ♂ (May 20).

The Himalayan Jungle Crow is not uncommon about 1220 m. upwards. It is usually found in pairs or small parties, frequently away from human habitation. From April 13 to April 22, three or four birds were found every afternoon circling round above the pass on the crest of Chandragiri, with outstretched wings, sometimes diving down a little, flying up again, and cawing harshly all the time. This aerial display would go on for some time; then the party would break up, or the birds would fly normally down the northern or southern sides of the mountain out of sight. Scully (1879, p. 325) described similar flights, but had seen larger flocks of 50-60 birds.

Scully (loc. cit.) reported it from the Nepal Valley; Stevens (1923a, p. 513) from the Mai Valley, eastern Nepal, below *c.* 3505 m. in March-April; Ripley (1950b, p. 414) from the tarai 'up to the highest elevations'; Proud (1952a, p. 361) from the Gandak-Kosi watershed, central Nepal, at *c.* 3350-3655 m. in spring; Polunin (1955, p. 887) from the Langtang Valley, central Nepal, up to *c.* 3350 m. in summer; Rand & Fleming (1957, p. 108) in winter from the western tarai, the Kali Gandak Valley in west-central Nepal at *c.* 2745 m., and the Maulung Valley in eastern Nepal at *c.* 3505 m.; and Biswas (1960a) from the Sun Kosi Valley in central Nepal at *c.* 1370-2285 m. in January, Khumbu in eastern Nepal at *c.* 3655-4570 m. in February-May, and the Arun and Tamur valleys in eastern Nepal at *c.* 1220-1830 m. in June.

Measurements :

	Wing	Tail	Bill
3 ♂♂ :	316[a], 341, 350	199+[a], 218, 219+	61.5,62[a],—
2 ♀♀ :	310, 311+	178, 195+	60,—

[a]This specimen has brownish primaries and may be a first year bird.

All the specimens listed above, and those taken by Scully in the Nepal Valley (now partly in the British Museum and partly in the Zoological Survey of India) have white bases of nape feathers, bill 56-65, and are not as black or as glossy as birds from Tibet or high Sikkim, thus differing from *tibetosinensis* Kleinschmidt & Weigold, 1922, as discussed by Vaurie (1954a, pp. 17-19). See also Rand & Fleming (op. cit., pp. 108-109) for comments on their specimens.

772. **Corvus macrorhynchos** (? subspecies).

DUN : Hitaura : 1 juv. ♂ (May 26).

Subspecific identification of such a young specimen was not possible for me.

It has, however, raised a question: What is the Jungle Crow that is found in the lower regions of Nepal?

All the jungle crows that were seen in the bhabar and the Hitaura dun looked distinctly smaller, in life, than the birds higher up (=*intermedius*), and their call was not quite so deep or loud. Moreover, juvenile *intermedius* has the bases of nape feathers white, but the juvenile specimen under report has them grey. Rand & Fleming's (1957, p. 109) specimen from Bilauri, western Nepal (*c.* 275 m.), which they placed under *intermedius*, also has them greyish.

Although nothing definite could be said until adult specimens are examined, the evidences presented above would indicate that the breeding birds of the lower regions of Nepal (below 600 m.) are not *intermedius*. They may possibly be, as Baker (1922d, p. 29) had indicated, intermediate between *intermedius* and the birds found in the plains immediately to the south of Nepal, which, curiously, are themselves intermediate between *culminatus* and *levaillanti* according to Whistler & Kinnear (1932a, p. 512). They advised to treat those birds as *culminatus*. An examination of carefully sexed series of the Jungle Crow from the lower regions of Nepal should yield interesting findings.

[**Corvus corax tibetanus** Hodgson. Tibetan Raven.

Lowndes (1955, p. 29) records the raven, *Corvus corax* (presumably the Tibetan Raven, *C. c. tibetanus* Hodgson) by sight in Manangbhot, central Nepal, between *c.* 4265 and 4570 m. in July-August.

No specimen of the species seems to have been taken in Nepal so far, although it is likely to occur in the plateau region north of the main Himalayan axis. In this connexion, it is interesting to note that both Baker (1922d, p. 23) and Ripley (1961, p. 318) have included Nepal within the range of the species, so has Vaurie (1962, p. 281) by implication.

A word of caution may here be said about sighting of the raven. From a distance, many specimens of the Himalayan Jungle Crow (*Corvus macrorhynchos intermedius*) in areas where the raven is likely to occur, look large enough to pass for the raven. It is only after collecting such specimens that their true identity is revealed. The characteristic neck hackles of the raven may not be clearly visible from a distance unless one pays particular attention to them through field glasses.]

(To be continued)

Copepods parasitic on South Indian Fishes: Family Anthosomidae—1

BY

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(*With seven text-figures*)

Anthosomid copepods of the genus *Lernanthropus* Blainville are extremely common gill parasites of the teleostean food fishes of this region but very few have so far been described. During the course of a year I have been able to collect a large number of species, of which eight are described here; four of them are new. In a previous publication (Pillai 1962) I described three species, one belonging to *Lernanthropus* and two to *Lernanthropodes* Bere.

Genus **Lernanthropus** Blainville

Lernanthropus giganteus Kroyer

Lernanthropus giganteus Kroyer, 1863, p. 280, pl. 8, figs. 1a-e; Wilson, 1913, p.227, pl. 33, figs. 148-150; Delamare-Doubouttevillé & Nunes-Ruivo, 1954, p.141.

Remarks. Wilson has given a detailed description and Delamare-Doubouttevillé & Nunes-Ruivo a detailed synonymy of this species and hence variations observed in my specimens alone are presented. Wilson has shown the posterior border of the dorsal plate of the female as faintly bilobed but described it as straight; it is straight in the present specimens. The antero-lateral lobes of the carapace reach the level of the antennal lobe and not beyond the latter as shown by Wilson. The long triangular postero-lateral processes of the anterior division of the trunk easily distinguish *L. giganteus*.

Length 7.1 mm.

38 females were collected by the author from the gills of *Caranx* sp. at Trivandrum.

Lernanthropus trifoliatus Bassett-Smith

Lernanthropus trifoliatus Bassett-Smith, 1898, p. 11, pl. 7, f. 3. nec *Lernanthropus trifoliatus* Kirtisinghe, 1956, p. 18, f. 11.

Text-fig. 1

Material. 2 females from *Polynemus plebeius* (Broussonet), 8 females from *Polynemus sextarius* Bloch, and a large number of

females and males from *Polynemus heptadactylus* Cuvier were collected by the author at Trivandrum.

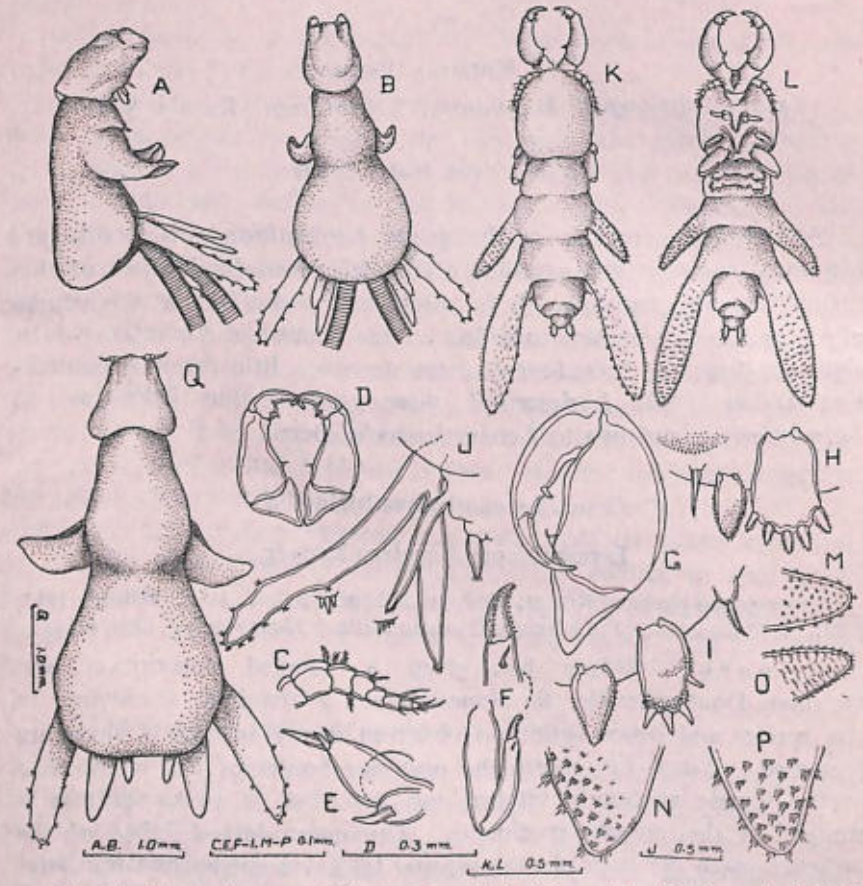


Fig. 1. *Lernanthropus trifoliatus* Bassett-Smith : A-J. female: A. lateral view ; B. dorsal view; C. antenna 1 ; D. antenna 2 ; E. maxilla ; F. maxilliped 1 ; G. maxilliped 2 ; H. leg 1 ; I. leg 2 ; J. posterior part of body showing legs 4, 5, and anal lamina. K-P. male : K. dorsal view ; L. ventral view ; M. tip of leg 3, dorsal view ; N. tip of leg 4, dorsal view ; O. tip of leg 3, ventral view ; P. tip of leg 4, ventral view. Q. female from *Polynemus plebeius*

Female. Carapace longer than broad and posteriorly rounded, antennal area ill defined, antero-lateral parts produced into two prominent prolongations, lateral parts bent downwards. Anterior division of trunk rectangular, as long as carapace, with a slight bulging behind the position of the second legs. Dorsal plate rounded, longer than broad and demarcated from the anterior division of trunk by comparatively shallow lateral incisions. Genital segment fused with

the fifth trunk segment, abdomen small. Anal laminae long ovate, with a row of apical spinules.

First antenna seven-segmented. Second antenna prehensile, its basal segment with a proximal spine-tipped papilla, distal segment with a swollen base carrying a claw. Maxilla bilobed, inner lobe ovate and with a stout spine, outer lobe large, with three spines, one of them stout. Basal segment of first maxilliped not much stouter than distal, latter with a claw, unguis barbed on both edges. Basal segment of second maxilliped with a spine-tipped papilla, distal segment long and strongly falcate, with a claw-like spine in the middle.

First pair of legs with stout exopod carrying five teeth, endopod small, ovate and spiny, inner spine on basipod large, with a patch of spinules near its base. Second pair of legs with rectangular spiny exopod carrying four teeth, endopod similar to that of first leg, outer spine on basipod pectinate. Third leg uniramous and rolled up, directed at right angles to the long axis of the body and apically curved forwards. Fourth pair of legs biramous, exopod longer and stouter than endopod, its distal half with several groups of small teeth, endopod with an apical bunch of spines. Fifth leg uniramous, slender and tipped with a row of spines.

Length 3.4 mm.

Male. Carapace longer than broad and clearly demarcated from the trunk. Trunk segments indicated by lateral incisions and dorsal grooves. First two segments fused, equal to third, third and fourth segments subequal and rectangular. Fifth segment roughly squarish, with a pair of spine-tipped papillae. Genital segment small, immersed in fifth segment. Abdomen very small. Third pair of legs short, as long as the width of the segment. Fourth pair large, remotely club-shaped, both pairs with spiny surface. Anal laminae ovate, longer than broad.

Total length 1.2 mm.

Remarks. Bassett-Smith's description of this species was based on females and to my knowledge the male has not been described so far. As pointed out by Kirtisinghe, Bassett-Smith mistook the fifth leg for a third ramus of the fourth leg. The specimens Kirtisinghe assigned to this species are, however, totally different from those described by Bassett-Smith. A very prominent character of this species is the spinulation of the exopod of the fourth leg of the female. The groups of spines make the border so irregular that it is surprising that Bassett-Smith makes no mention of them. During the present investigation *L. trifoliatus* was found to parasitise three different but closely related species. The one figured here was from

P. heptadactylus. The size of the parasite was found to vary proportionately to the size of the host. In the large specimens, collected from *P. plebeius*, the exopod of the fourth leg is club-shaped. This species is apparently slightly variable.

Lernanthropus cornutus Kirtisinghe

Lernanthropus cornutus Kirtisinghe, 1937, p. 448, figs. 88-98 ; Capart, 1953, p. 649; Delamare-Douboutteville & Nunes-Ruivo, 1954, p. 141.

Text-fig. 2

Material. Four females from the gills of *Tylosurus crocodilus* (Le Sueur) and 2 females and 1 male from the gills of *Belone* sp. were collected by the author at Trivandrum.

Female. Carapace roughly equal in length and breadth, regularly broadening backwards and postero-laterally produced into triangular apically blunt processes inclined backwards. Antennal area broad and folded downwards. Anterior division of trunk slightly longer than broad, roughly oblong, antero-median part produced into a conical prominence overlapping the carapace and continued backwards as a high median ridge reaching the hind border of the dorsal plate, the ridge progressively narrowing backwards. Dorsal plate demarcated from the anterior division of trunk by a mere lateral sinuosity, regularly broadening up to the middle, distal border roughly semicircular. Genital segment large, twice as broad as abdomen, abdomen slightly longer than broad.

First antenna small and indistinctly segmented. Second antenna strong, subequal in size to the second maxilliped, basal segment with the usual tubercle, distal segment stout, with a basal claw. Maxilla two-lobed, inner lobe not very much smaller than outer, prolonged into a conical spine, outer lobe with two spines. Unguis of first maxilliped with one inner and several outer rows of spines. Basal segment of second maxilliped oblong, claw of distal segment hook-like.

Exopod of first leg comparatively very large, with five dissimilar teeth, endopod small, with a long spine, setae on basipod large. Second leg very small, endopod larger than exopod. Third leg comparatively small, uniramous and folded as usual. Fourth leg biramous, not reaching the distal border of the dorsal plate, rami subequal, fusiform. Anal laminae ovate, with a spine-like apex.

Total length 4.2 mm.

Male. Cephalothorax almost equal in length and breadth, slightly broadening backwards and constricted in front to form an antennal area and behind to form a neck. First two trunk segments

indistinct, genital segment and abdomen together forming a narrow conical indistinctly segmented lobe. Anal laminae longer than broad, with two pectinate and three non-pectinate setae. Third leg

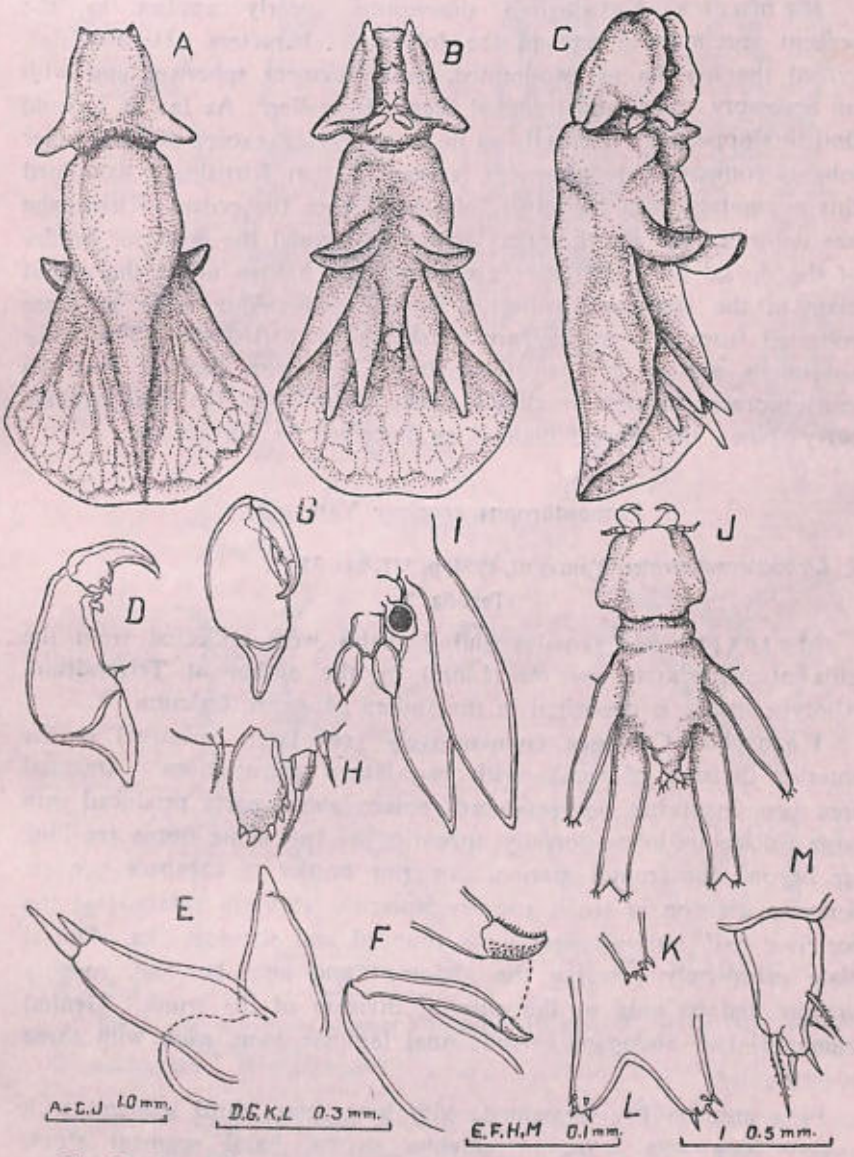


Fig. 2. *Lernanthropus cornutus* Kirtisinghe : A-I. female : A. dorsal view ; B. ventral view ; C. lateral view ; D. antenna 2 ; E. maxilla ; F. maxilliped 1 ; G. maxilliped 2 ; H. leg 1 ; I. posterior part of body showing leg 4 and anal laminae. J-M. male : J. dorsal view ; K. tip of leg 3 ; L. tip of leg 4; M. anal lamina.

long, tapering distally, base with one and apex with a bunch of short teeth. Fourth leg as long as third, parallel-sided and apically bifid, each ramus with an apical bunch of teeth.

Total length 2.1 mm.

Remarks. Kirtisinghe's description clearly applies to the present specimens except in the following characters. He has described the maxilla as two-jointed, basal segment spherical and with an accessory spine, and terminal segment smaller. As far as I could find this appendage is exactly as in other species, except that the inner lobe is comparatively large. It is possible that Kirtisinghe examined this appendage with the inner lobe lying over the outer. Kirtisinghe has described the fourth leg as projecting beyond the posterior border of the dorsal plate, but they are completely hidden under the dorsal plate in the specimens collected from *T. crocodilus* while in those collected from *Belone* they are as shown by Kirtisinghe. The latter specimens are larger than those from *Tylosurus*. Except that the third thoracic segment is clearly indicated and that the anal laminae carry spines, the present male is as described by Kirtisinghe.

Lernanthropus corniger Yamaguti

Lernanthropus corniger Yamaguti, 1954, p. 387, figs. 35-41.
Text-fig. 3

Material. 43 females and 2 males were collected from the gills of *Megalaspis cordyla* (Linn.) by the author at Trivandrum. Allotype, male, is deposited in the Indian Museum, Calcutta.

Female. Carapace comparatively very large, subequal to the anterior division of trunk, with two lateral constrictions. Antennal area prominent but not produced, antero-lateral parts produced into large foliaceous lobes dorsally appearing as two acute horns reaching far beyond the frontal margin, posterior border of carapace convex. Anterior division of trunk roughly squarish, abruptly enlarged at the posterior half, antero-lateral parts rounded and shoulder-like. Dorsal plate completely covering the abdomen and anal laminae, roughly circular and as long as the anterior division of the trunk. Genital segment large, abdomen narrow, anal laminae long, each with three to four setae.

First antenna five-segmented, with long setae, third segment with a very long seta. Second antenna strong, basal segment stout, with a spine-tipped papilla, distal segment half as long as basal, with two claws, inferior distal part produced below the unguis into a flattened lobe with irregular border, unguis claw-like. Maxilla two

lobed, inner lobe with one and outer with three spines, one of the latter very large. Basal segment of first maxilliped stout, distal

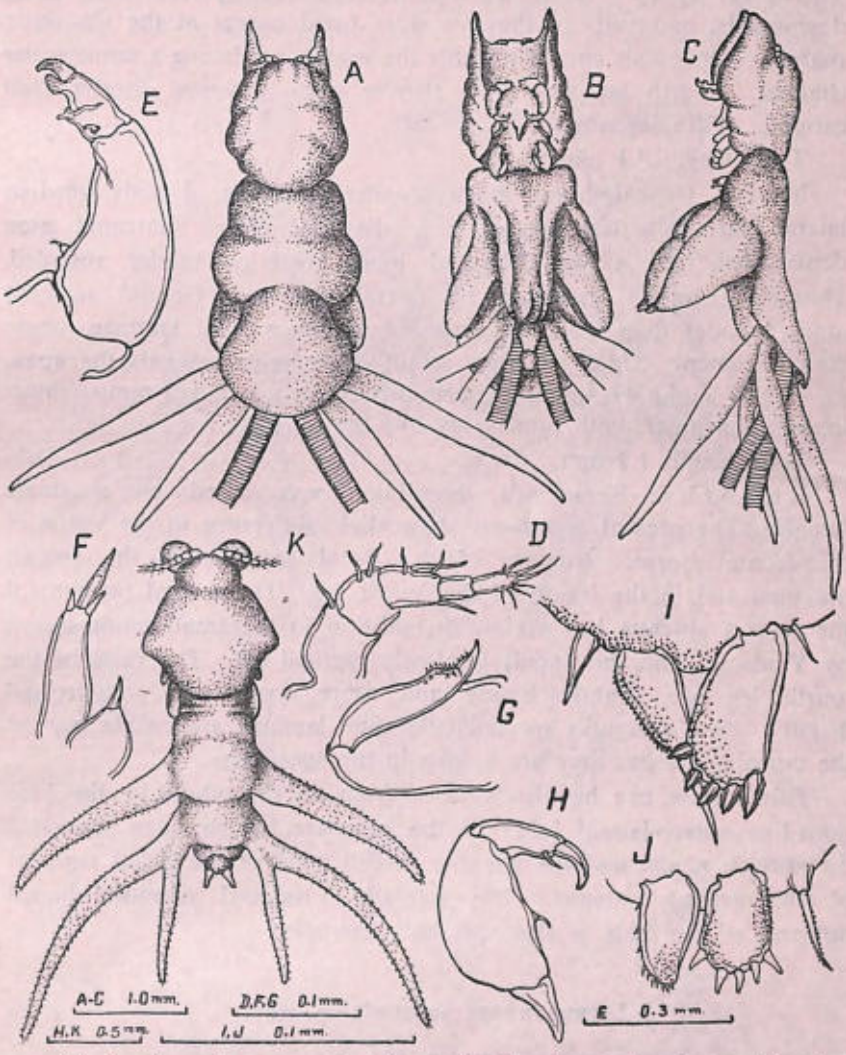


Fig. 3. *Lernanthropus corniger* Yamaguti: Female. A. dorsal view; B. ventral view; C. lateral view; D. antenna 1; E. antenna 2; F. maxilla; G. maxilliped 1; H. maxilliped 2: I. leg 1; J. leg 2. K. male

segment as long as basal, with a few sharp teeth at its inner distal part, unguis not clearly separated, with two to three teeth. Second maxilliped, as usual in the genus, uncinate, unguis strongly curved.

First pair of legs with a large exopod carrying five strong winged teeth, endopod with a stout spine, inner seta on basipod broad, outer

seta small, basipod and the rami spiny. Basipod of second leg with stout outer seta, exopod with five teeth, endopod spiny but without the apical spine. Third leg biramous, exopod folded and facing downwards, endopods of the two sides fused except at the tip, outer margin of endopods curved towards the venter, producing a semicircular channel. Fourth leg with long slender rami, endopod shorter than exopod. Fifth leg absent.

Total length 3.1 mm.

Male. Cephalothorax much broader than rest of body, median lateral parts angular, producing a diamond shape, antennal area demarcated into a well-delimited lobe, posterior border rounded. Thoracic segments indicated by dorsal grooves. Genital segment much broader than the one-segmented abdomen, anal laminae longer than abdomen. Third leg long, steadily narrowing towards the apex, its surface minutely spiny. Fourth leg biramous, outer ramus much longer than inner, both rami spiny like the third leg.

Total length 1.9 mm.

Remarks. Yamaguti's description was based on a single female. The present specimens show slight difference in the shape of the frontal horns, structure of the distal segment of the second antenna, and in the length of the fourth leg. The second segment of the second antenna has a claw in addition to the small tooth shown by Yamaguti and the unguis is clearly marked off. The rami of the fourth leg are slightly longer and more conspicuously narrowed distally. In Yamaguti's specimen the anal laminae are visible beyond the dorsal plate but they are hidden in my specimens.

This species can be distinguished from all the others by the long horn-like antero-lateral lobes of the carapace, which have suggested the specific name, and the peculiar modification of the distal segment of the second antenna. The laterally produced diamond-shaped carapace of the male is also very characteristic.

Lernanthropus secutoris sp. nov.

Text-fig. 4

Material. 33 females were collected from the gills of *Secutor insidiator* (Bloch) by the author at Trivandrum. Holotype, female, is deposited in the Indian Museum, Calcutta (Reg. No. C. 4343/1).

Female. Body demarcated into three subequal parts, carapace, anterior division of trunk and dorsal plate. Carapace roughly triangular, narrowing backwards, antennal region demarcated by two shallow dorsal grooves, antero-lateral regions prominent and produced

into rounded lobes not much folded downwards. Anterior division of trunk broader than long, demarcated from the dorsal plate by shallow lateral incisions. Dorsal plate slightly longer than broad, as broad as thorax and posteriorly rounded, anal laminae projecting beyond

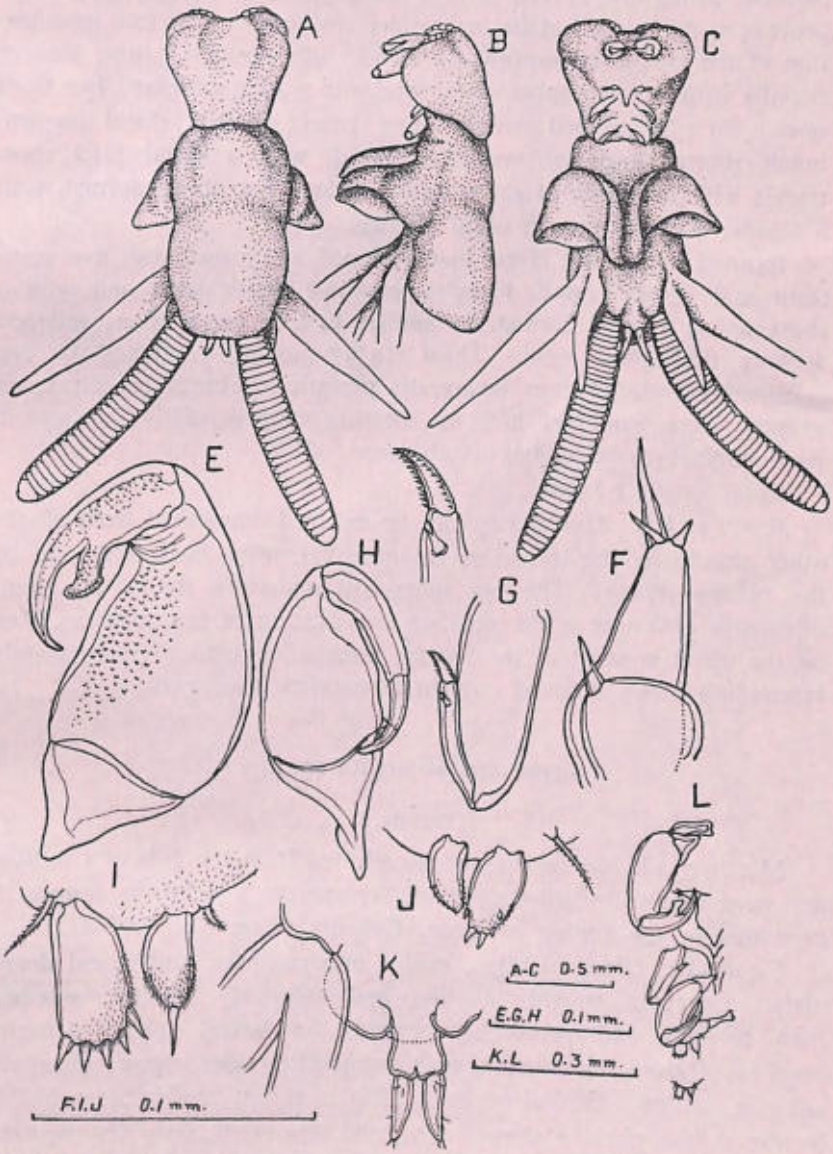


Fig. 4. *Lernanthropus secutoris* sp. nov.: Female. A. dorsal view; B. lateral view; C. ventral view; E. antenna 2; F. maxilla; G. maxilliped 1; H. maxilliped 2; I. leg 1; J. leg 2; K. posterior part of body; L. cephalic appendages

its posterior border. Genital segment very large, about three times as broad as abdomen. Egg sacs short and stout, with large eggs.

First antenna indistinctly seven-segmented. Second antenna with a large massive basal segment, its distal inner part pustulose, second segment strong and curved, with a large cylindrical and apically flared process at the middle of its inner side, obviously an extreme modification of the simple claw normally seen in this position. Inner lobe of maxilla with a sharp spine, outer lobe with a long spine and two short ones. First maxilliped with a stout basal segment, distal segment much shorter and narrower than basal, with a distal bifid claw, unguis with two rows of sharp teeth. Second maxilliped normal, with a slender strongly curved distal segment.

Exopod of first leg larger than endopod and armed with five sharp teeth and several small denticles, endopod denticulated and with a short apical spine. Second leg similar to first but smaller, endopod lacking the apical spine. Third leg uniramous, composed of two contiguously placed cups facing the posterior. Fourth leg biramous, exopod large, endopod half as long as exopod. Fifth leg absent. Anal laminae twice as long as abdomen.

Total length 1.3 mm.

Remarks. *L. secutoris* can be easily distinguished from all the other species by the triangular carapace narrowing backwards and by the oblong thorax. The egg tubes are unusually stout. The most distinctive character is the peculiar modification of the accessory claw on the distal segment of the second antenna, something even remotely resembling which is found only in *L. corniger* Yamaguti.

Lernanthropus otolithi sp. nov.

Text-fig. 5

Material. 34 females were collected from the gills of *Otolithus argenteus* Cuvier by the author at Trivandrum. Holotype, female, is deposited in the Indian Museum, Calcutta (Reg. No. C.4344/1).

Female. Body clearly divisible into carapace, trunk, and dorsal plate. Carapace roughly circular and anteriorly trilobed, antennal lobe broader and projecting beyond the lateral lobes. Anterior division of trunk cylindrical, with subparallel sides, dorsal plate circular in outline. Genital segment, abdomen, and anal laminae hidden by the dorsal plate, abdomen long and two-segmented, first segment longer and broader than second. Genital segment short but broader than abdomen. Anal laminae long and slender, with two apical and two outer setae.

First antenna clearly seven-segmented, accessory process at its base strongly curved and with swollen base. Second antenna with stout basal segment, distal segment short, with a basal inner spine.

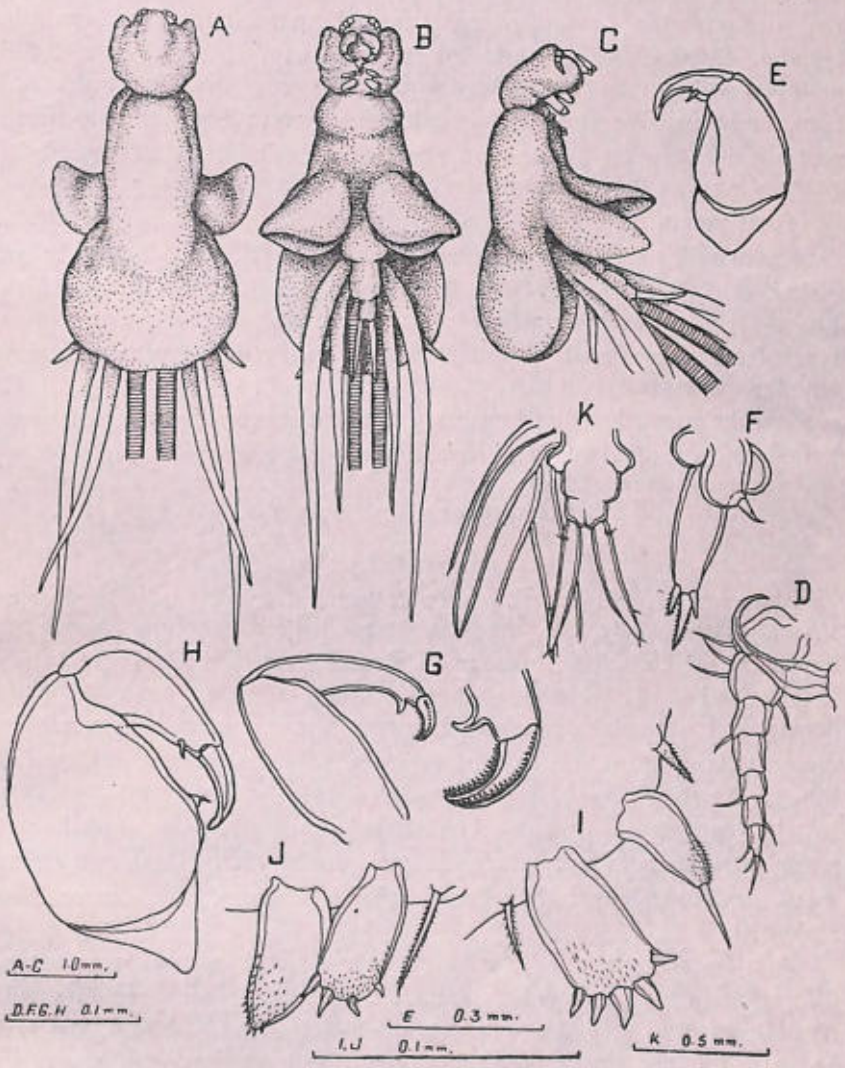


Fig 5. *Lernanthropus otolithi* sp. nov.: Female. A. dorsal view; B. ventral view; C. lateral view; D. antenna 1; E. antenna 2; F. maxilla; G. maxilliped 1; H. maxilliped 2; I. leg 1; J. leg 2; K. posterior part of body.

Inner lobe of maxilla small, with one spine, outer lobe long, with one long and two short spines. First maxilliped with segments subequal in length, distal segment with a strong claw-like accessory

process below the unguis, unguis with prominent marginal teeth. Second maxilliped with a very stout basal segment, distal segment proximally expanded, unguis distinct.

First leg with outer and inner pectinate setae, exopod stout, with five teeth, endopod with a single apical spine, both rami sparsely spinose. Second leg without inner seta, exopod with four teeth, endopod without spine, rami subequal in size. Third leg with rami completely fused and folded lengthwise. Fourth leg biramous, long and slender, exopod longer than endopod. Fifth leg uniramous, about half as long as the endopod of the fourth leg.

Total length 3.0 mm.

Remarks. This species shows the closest resemblance to *L. gisleri* van Beneden (1852) as described by Yamaguti (1936), which like the present is a parasite of sciaenid fishes. Both have the same type of carapace and trunk but in *L. otolithi* the dorsal plate is nearly circular while it is roughly parallel-sided in *L. gisleri*. Also in *L. otolithi* the exopod of the fourth leg is much longer than the endopod, but almost subequal in *L. gisleri*.

Lernanthropus sillaginis sp. nov.

Text-fig. 6

Material. 41 females were collected from the gills of *Sillago sihama* (Forskal) by the author at Trivandrum. Holotype, female, is deposited in the Indian Museum, Calcutta (Reg. No. C. 4345/1).

Female. Body stout, carapace nearly rounded, with distinctly demarcated antennal area, lateral parts forming prominent ventrally directed flaps projecting beyond the antennal area as small triangular lobes. Anterior part of trunk regularly widening backwards, as long as the carapace. Dorsal plate large, transversely expanded and roughly ovate, with evenly convex posterior border. Genital segment small, abdomen longer than broad, anal laminae slightly shorter than abdomen.

First antenna distinctly seven-segmented, with a few stout setae, fifth segment with a long stout seta, first segment large, seventh small. Basal segment of second antenna comparatively slender, with a proximal and a distal tubercle carrying a spinule, distal segment with a swollen base carrying a claw-like spine. Maxilla with a small inner and large swollen outer lobe, latter with one large and one small distal spine. First maxilliped slender, distal segment with a small spine, unguis with serrate edge. Second maxilliped with a comparatively very stout basal segment with one papilla, distal segment slender, with two spines, unguis very distinct.

First leg with large exopod carrying five spines, endopod oblong, with a long spine. Exopod of second leg with five spines, three of them very small, endopod considerably larger than exopod, with a

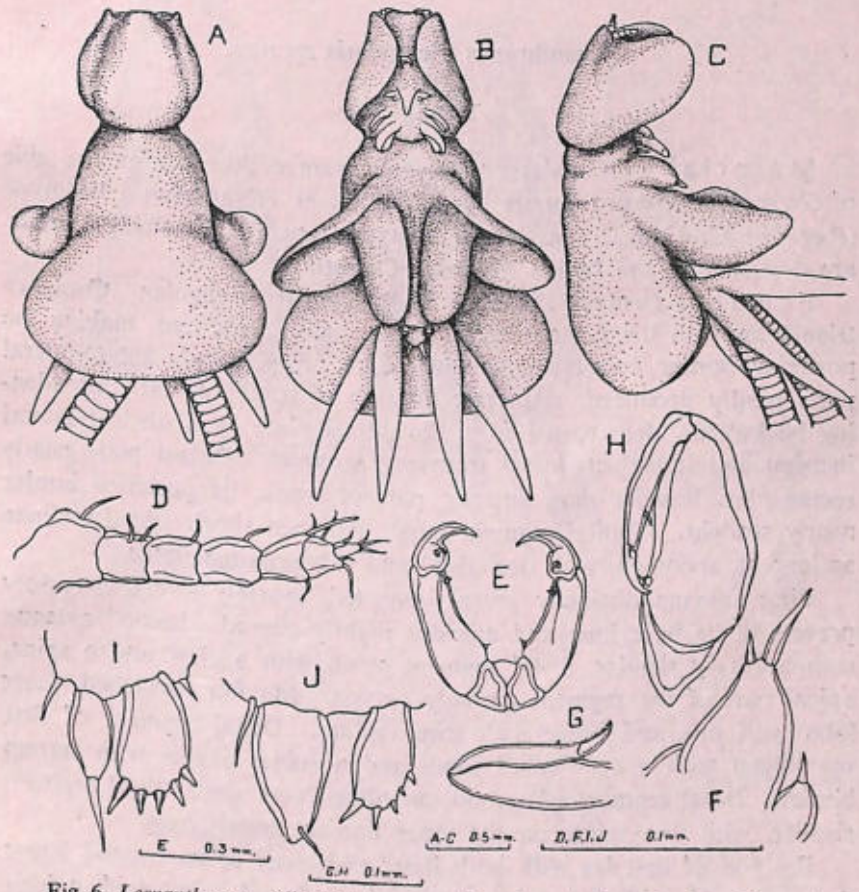


Fig. 6. *Lernanthropus sillaginis* sp. nov.: Female. A. dorsal view; B. ventral view; C. lateral view; D. antenna 1; E. antenna 2; F. maxilla; G. maxilliped 1; H. maxilliped 2; I. leg 1; J. leg 2.

slender seta. Third leg distinctly biramous, rami foliaceous, exopod folded over the linguiform endopod. Fourth leg comparatively short, with subequal rami, half of the rami projecting beyond the dorsal plate. Eggs comparatively large.

Total length 2.5 mm.

Remarks. In general appearance and in the structure of the appendages this species resembles *L. villiersi* Delamare-Deboutteville & Nunes-Ruivo (1954), but in the latter species the dorsal plate has a very distinct postero-median incision and the endopods of the third

pair of legs are fused. In *L. sillaginis* the dorsal plate has an entire posterior border and the endopods of the third pair of legs are completely free.

Lernanthropus triangularis sp. nov.

Text-fig. 7

Material. 2 females and 1 male were collected from the gills of *Gerres filamentosus* Cuvier by the author at Trivandrum. Holotype (Reg. No. C. 4346/1), female and allotype (Reg. No. C. 4347/1), male, are deposited in the Indian Museum, Calcutta.

Female. General shape of body elongate-triangular. Carapace triangular, with the postero-lateral parts slightly produced, making the posterior border concave. Antennal area fairly broad, antero-lateral parts hardly produced. Anterior division of trunk regularly broadening backwards, demarcated from the dorsal plate by a distinct lateral incision and indistinct dorsal transverse grooves. Dorsal plate nearly rectangular, broader than anterior part of trunk, its posterior border nearly straight. Genital segment large, abdomen short. Anal laminae as long as abdomen, with one distal and two proximal setae.

First antenna distinctly seven-segmented, sparsely setose, accessory process at its base long and apically slightly curved. Second antenna comparatively slender, distal segment stout, with a claw and a spine, apical part of the segment strongly curved. Maxilla two-lobed, inner lobe with one and outer with three spines. Distal segment of first maxilliped with a very small tooth and a spine, unguis with serrate border. Basal segment of second maxilliped very stout, distal segment slender, with two spines on the inner border, unguis long.

Basipod of first leg with both inner and outer setae, exopod larger than endopod, with five subsimilar teeth, endopod spiny, with a long apical spine. Second leg with subequal spiny rami, exopod with four teeth, endopod with a very small spine seta. Third leg small, rami partially fused, exopod facing forwards and endopod backwards. Fourth leg biramous, reaching beyond the dorsal plate by about half their length, exopod slightly longer than endopod. Fifth leg absent.

Total length 2.4 mm.

Male. Body subcylindrical, carapace ovate, narrower in front, antennal area slightly indicated. Trunk demarcated into four indistinct thoracic segments, genital segment and abdomen partially fused. First antenna prominently setose. Second antenna slender and very long, strongly prehensile. Third leg biramous, endopod indicated by

a mere lobe. Fourth leg twice as long as third, endopod half as long as exopod.

Total length 2.4 mm.

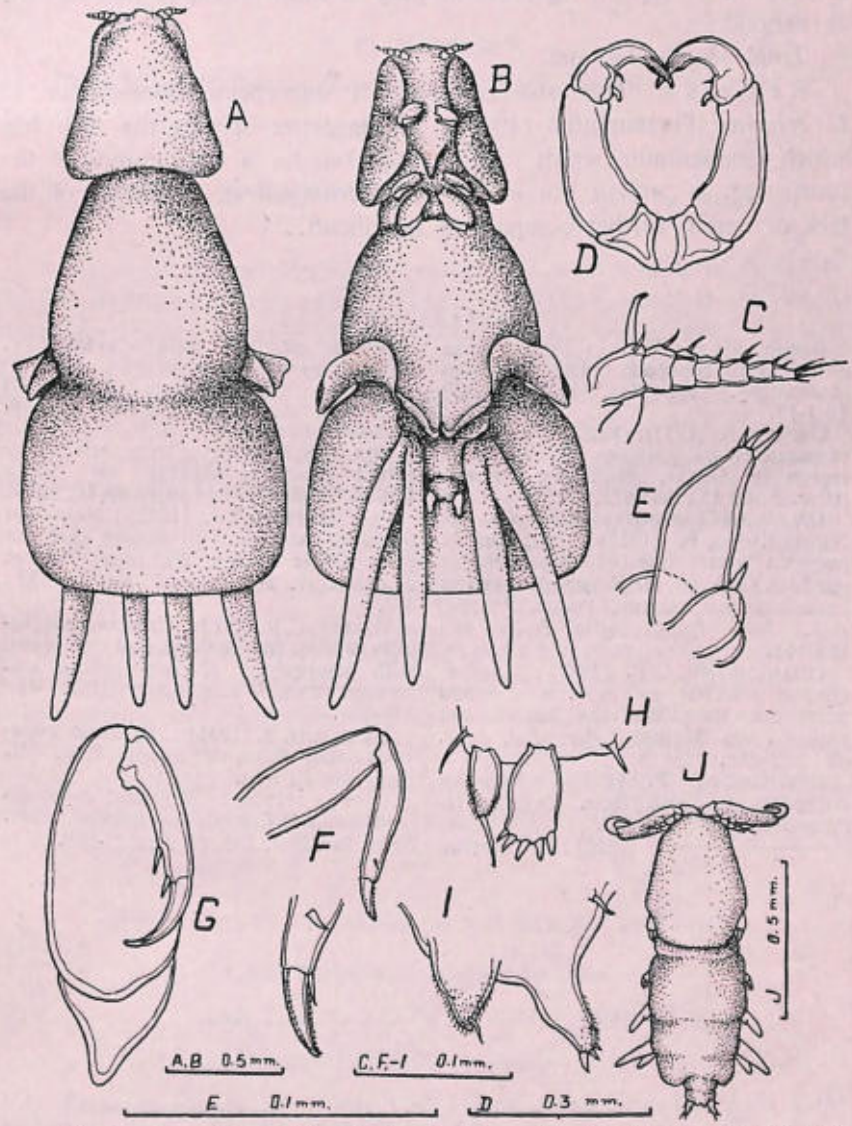


Fig. 7. *Lernanthropus triangularis* sp. nov.: A-I. female: A. dorsal view; B. ventral view; C. antenna 1; D. antenna 2; E. maxilla; F. maxilliped 1; G. maxilliped 2; H. leg 1; I. leg 2. J. male

Male. Body subcylindrical, carapace ovate, narrower in front, antennal area slightly indicated. Trunk demarcated into four indis-

tinct thoracic segments, genital segment and abdomen partially fused. First antenna prominently setose. Second antenna slender and very long, strongly prehensile. Third leg biramous, endopod indicated by a mere lobe. Fourth leg twice as long as third, endopod half as long as exopod.

Total length 0.9 mm.

Remarks. This species shows a superficial resemblance to *L. sciaenae* Gnanamuthu (1947). In the latter species the fifth leg, which Gnanamuthu seems to have mistaken for a third ramus of the fourth leg, is present but absent in *L. triangularis*. Because of the lack of details further comparison is difficult.

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More Cyanophyceae of Hoshiarpur: II

BY

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(*With two plates*)

[*Continued from Vol.* **58**(1) : 146]

In the first two papers on the systematics of Cyanophyceae of Hoshiarpur [*J. Bombay nat. Hist. Soc.* **57** (3) and **58**(1)] the author described 73 species belonging to 28 genera, including two new species, two new varieties, and seven new forms. The present paper which is the third in the series further adds to our knowledge of the blue-green algae of Hoshiarpur, and 41 species belonging to 17 genera have been recorded herein. This brings the total to 114 species belonging to 32 genera. Six new varieties have been included in the present work.

Phormidium mucosum Gardner, *P. hieronymusii* Lemm., *Scytonema millei* Bornet, and *Microchaete tenera* var. *major* Moebius have been, to the best of author's knowledge, reported for the first time from the Indian soil.

Cyanophyceae described in the present paper have been mainly collected from freshwater and terrestrial habitats. Freshwater forms are important as lithophytes and epiphytes, whereas some live in or on the bottom of deep or shallow water ponds. There are a limited number of Cyanophyceae that constitute a conspicuous element of the plankton at different times of the year. Some of the lithophytes grow commonly in fast flowing streams.

SYSTEMATIC ENUMERATION OF THE SPECIES OBSERVED

Order CHROOCOCCALES Wetstein

Family CHROOCOCCACEAE Nägeli

CHROOCOCCUS Nägeli

1. **Chroococcus minor** (Kütz.) Näg. Gatt. Einzell. Algen 47, pl. 1 A, fig. 4, 1849; Desikachary, Cyanophyta 105, pl. 24, fig. 1, 1959.

Diameter cell without sheath = 3-3.4 μ ; diameter cell with sheath = up to 4.3 μ.

Habitat: Mixed with other algae in a stagnant water pond situated by the side of a railway track near village Singriwala, Hoshiarpur.

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2. **Chroococcus limneticus** Lemm. in Bot. Cbl. 76 : 153, 1898 ; Desikachary 107, pl. 26, fig. 2, 1959.

Diameter cell without sheath=6.6-10.5 μ ; diameter cell with sheath=7.6-12.1 μ ; cells spherical or sub-spherical, 16-32 in a colony.

Habitat : Planktonic in an old tank at Bhadarpur, Hoshiarpur. Mixed with *Synechococcus cedrorum* Sauv.

GLOEOCAPSA Kützing

3. **Gloeocapsa quaternata** (Breb.) Kütz. Tab. Phycol. 1 : 5, pl. 20, fig. 1, 1846 ; Desikachary 120, pl. 20, fig. 9, 1959.

Diameter cell without sheath=3.4-4.7 μ ; diameter cell with sheath=7.6-11.5 μ ; diameter colony=11.5-19.2 μ ; sheath usually red, sometimes colourless, cells 2-4-8 in a colony.

Habitat : Forming blackish green encrustation on tree trunks, Hoshiarpur.

4. **Gloeocapsa violacea** (Corda) Rabenh. Fl. Eur. Alg. 2 : 41, 1865 ; Desikachary 123, 1959.

Diameter cell without sheath=3.4-3.8 μ ; diameter cell with sheath=9.5-13.4 μ ; diameter colony=76.8-102.1 μ ; sheath violet and unlamellated.

Habitat : On the moist stones of a rivulet at Bharwain, Hoshiarpur.

5. **Gloeocapsa sanguinea** (Ag.) Kütz. Phyc. Gen. 175, 1843 ; et Tab. Phyc. 1 : pl. 22, 1846 ; Desikachary 121, pl. 27, fig. 7, 1959.

Diameter cell without sheath=3.8-6.6 μ ; diameter cell with sheath=7.6-11.5 μ ; diameter colony=38.4-46 μ.

Habitat : Mixed with *G. quaternata* Kütz., Hoshiarpur.

6. **Gloeocapsa kuetzingiana** Näg. Gatt. Einzell. Algen 50, 1849 ; Desikachary 118, pl. 23, fig. 4 & pl. 24, fig. 12, 1959.

Diameter cell without sheath=3.8-4.7 μ ; diameter cell with sheath=5.7-7.6 μ ; diameter colony=38.4-76.8 μ ; sheath yellowish brown and unlamellated.

Habitat : Forming blue-green to brownish encrustation on bricks and stones at the bottom of an irrigation channel passing through village Rihana, Hoshiarpur.

MERISMOPEDIA Meyen

7. **Merismopedia aeruginosa** Breb. in Kützing, Spec. Alg. 472, 1849 ; Desikachary 156, pl. 20, fig. 3, 1959.

Lat. colony=34.5-50 μ ; lat. cell=4.7-5.1 μ.

Habitat : In a roadside pond, Phagwara road, Hoshiarpur.

SYNECHOCYSTIS Sauv.

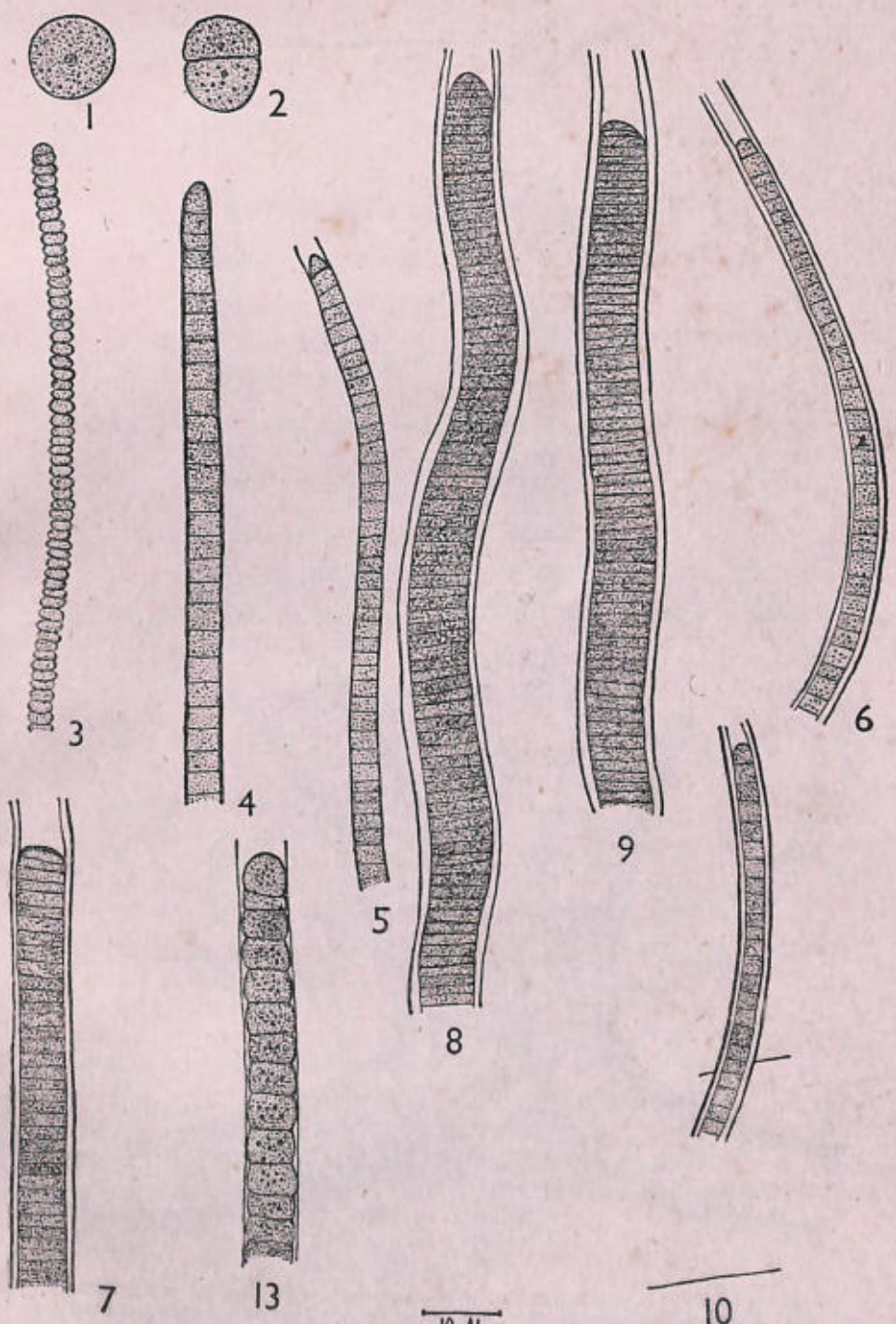
8. **Synechocystis aquatilis** Sauv. var. **major** var. nov. (Plate I, Figs. 1-2)

Cellulae sphaericae, 7.6-8.5 μ diam., singulae vel binae immediate post divisionem ; contenta caeruleo-viridia, granularia. Typus lectus 8 junii, 1960, et positus in Hoshiarpur herbario Collegii Gubernii sub numero *Vasishta* 10.

Cells spherical, 7.6-8.5 μ diam., single or in twos after division, contents blue-green, granular.

Habitat : Planktonic in a stagnant water pond, Phagwara road, Hoshiarpur. Collected on June 8, 1960. Deposited in Government College, Hoshiarpur herbarium under reference number *Vasishta* 10.

The variety differs from the type in possessing the greater dimensions of the cell.



Figs. 1-2. *Synechocystis aquatilis* var. *major* var. nov. : Fig. 1. A single cell; Fig. 2. A cell after division. Fig. 3. *Oscillatoria foreaui* Fremy. : A portion of the trichome. Fig. 4. *Oscillatoria subuliformis* Kütz. ex Gom. : Portion of the trichome. Fig. 5. *Phormidium rubroterricola* var. *major* var. nov. : Portion of the filament. Fig. 6. *Phormidium mucosum* Gardner : Portion of the filament. Fig. 7. *Phormidium stagninum* var. *minus* var. nov. : Portion of the filament. Figs. 8-9. *Phormidium hieronymusii* Lemm. : Portions of two filaments. Fig. 10. *Lyngbya kuetzingii* Schmidle. : Portion of the filament. Fig. 13. *Lyngbya cryptovaginata* Sch. : Portion of the filament

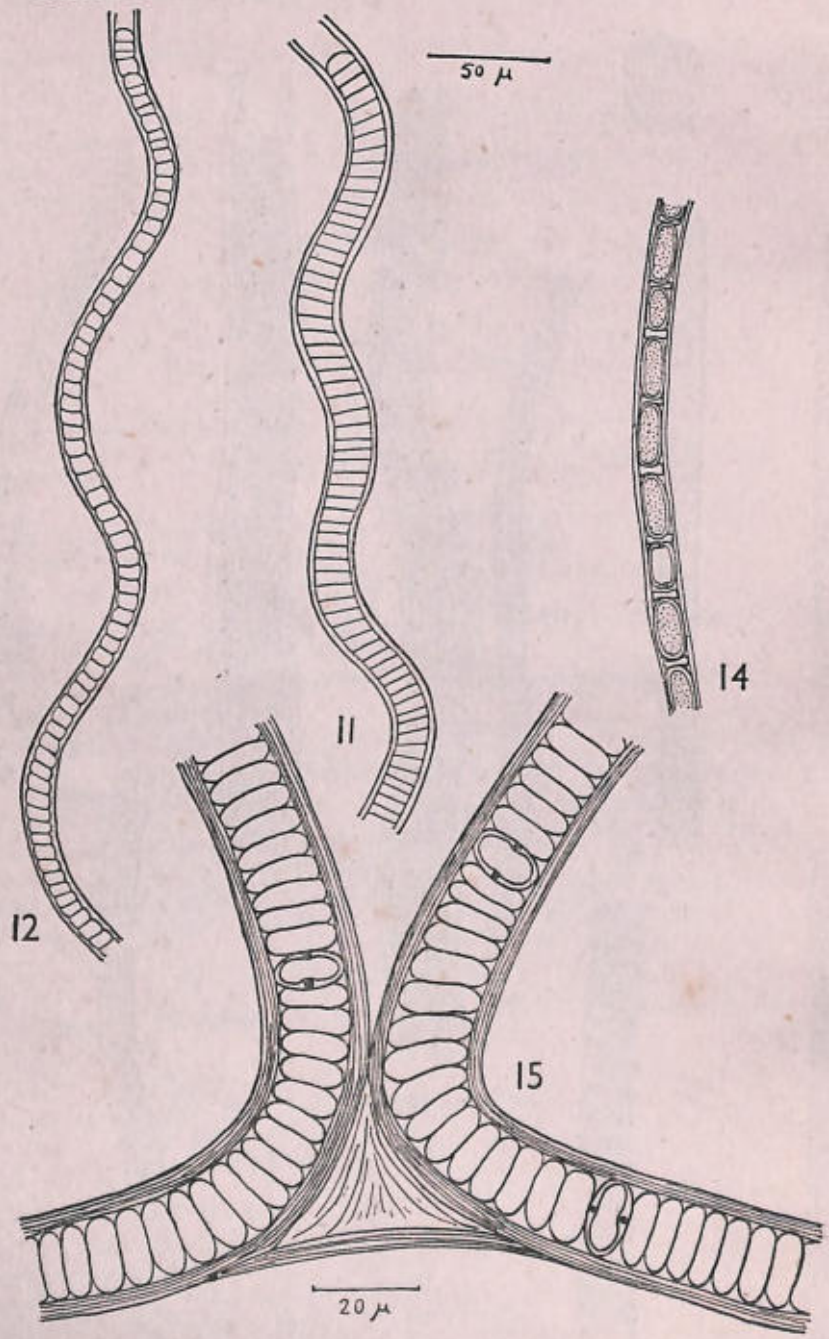


Fig. 11. *Lyngbya spirulinoides* var. *minor* var. nov. : Portion of a filament. Fig. 12. *Lyngbya laxespiralis* var. *major* var. nov. : Portion of the filament. Fig. 14. *Aulosira fertilissima* var. *hoshiarpurensis* var. nov. : Portion of a fertile filament showing series of spores interrupted by dead cells. Fig. 15. *Scytonema millei* Bornet ex Born. et Flah. : A portion of the filament showing false branches

SYNECHOCOCCUS Näg.

9. **Synechococcus cedrorum** Sauv. in Bull. Soc. Bot. France 39 : 115, pl. 6, fig. 1, 1892 ; Desikachary 144, 1959.

Lat. cell=3.4-4.2 μ ; long. cell=6.6-8.5 μ.

Habitat : Planktonic in an old tank, Bhadarpur, Hoshiarpur. Mixed with *Chroococcus limneticus* Lemm.

Order PLEUROCAPSALES Geitler

Family PLEUROCAPSACEAE Geitler

MYXOSARCINA Printz.

10. **Myxosarcina spectabilis** Geitler in Arch. Hydrobiol. 12 : 624, 1933 ; et 14 : 387, fig. 14, 1935-36 ; Desikachary 178, pl. 30, figs. 1-5, pl. 31, figs. 17-22, 1959.

Diameter cell=5.7-8.5 μ ; diameter endospore=3.8-4.7 μ.

Habitat : Forming a deep blue-green thallus on tree trunks, Hoshiarpur.

Order NOSTOCALES Geitler

Family OSCILLATORIACEAE Kirchner

SPIRULINA Turpin ex Gardner

11. **Spirulina gigantea** Schmidle in Bot. Jahrb. 32 : 59, pl. 1, fig. 5, 1902 ; Desikachary 197, pl. 36, figs. 12, 14-17, 1959.

Lat. trichome=3.8-4 μ ; breadth of spiral=11.3-15.3 μ ; spirals 7.6-11.3 μ distant.

Habitat : Among other algae in a pond, Hoshiarpur.

OSCILLATORIA Vaucher

12. **Oscillatoria princeps** Vauch. [Hist. Conf. Eau Douc. 190, pl. 15, fig. 2, 1803] ex Gomont, Monograph Oscill. 206, pl. 6, fig. 9, 1892 ; Desikachary 210, pl. 37, figs. 1, 10, 11, 13, 14, 1959.

Lat. trichome=26.8-49.9 μ ; long. cell=5.7-7 μ.

Habitat : In slowly running water of a watercourse at Una, Hoshiarpur.

13. **Oscillatoria formosa** Bory [Dict. Class. Hist. Nat. 12 : 474, 1827] ex Gomont, loc. cit. 230, pl. 7, fig. 16, 1892 ; Desikachary 232, pl. 40, fig. 15, 1959.

Lat. trichome=4-6.6 μ ; long. cell=3.8-5.1 μ.

Habitat : Forming a blue-green thallus attached to the walls of a water reservoir, Government College, Hoshiarpur.

14. **Oscillatoria animalis** Ag. [Aufzah. Fl. 10 : 632, 1827] ex Gomont 227, pl. 7, fig. 13, 1892 ; Desikachary 239, pl. 40, fig. 4, 1959.

Lat. trichome=3.4-4 μ ; long. cell=1.7-3.4 μ.

Habitat : Forming a blue-green thallus at the bottom of a pond at village Purhiran, Hoshiarpur.

15. **Oscillatoria foreaui** Fremy in Blumea, Suppl. II : 23, fig. 2, 1942 ; Desikachary 219, pl. 40, fig. 18, 1959. (Plate I, Fig. 3)

Lat. trichome=2.5-3 μ ; long. cell=1.5 μ ; trichomes constricted at the joints.

Habitat : From the bottom of a pond, village Purhiran, Hoshiarpur.

76.8-107 μ distant : septa not granulated : cells 3.4-4.7 μ long ; end cell round ; calyptra absent.

Habitat : Free floating in a tank containing *Utricularia* sp., Hoshiarpur. Collected in October 12, 1959. Deposited in Government College, Hoshiarpur herbarium under reference number *Vasishta* 12.

The variety differs from the type in possessing narrower filaments and trichomes.

30. **Lyngbya laxespiralis** Skuja var. **major** var. nov. (Plate II, Fig. 12)

Filamenta spiraliter curvata, 11.5-12.1 μ lata ; vagina tenuis, firma, incolora, non-lamellata ; trichomata constricta, 9.5-11.5 μ lata ; cellulae 5.7-7.6 μ longae ; contenta granularia, caeruleo-viridia ; parietes transversi non-granulati ; cellula apicalis rotundata ; spiris 100-115 μ distantibus. Positus in Government College, Hoshiarpur herbario sub numero *Vasishta* 13.

Filaments spirally coiled, 11.5-12.1 μ broad ; sheath thin, firm, colourless, unlamellated ; trichomes contricted, 9.5-11.5 μ broad ; cells 5.7-7.6 μ long, cell contents granular, blue-green, cross walls not granulated ; apical cell rotund ; spirals 100-115 μ distant.

Habitat : Among other algae on moist soil, Hoshiarpur. Collected on September 20, 1960. Deposited in Government College, Hoshiarpur herbarium under reference number *Vasishta* 13.

The variety differs from the type in possessing broader filaments and trichomes.

31. **Lyngbya cryptovaginata** Schkorb. in Arch. Russ. Protistologia 6(-4) : 125, pl. 8, figs. 14-16, 1927 : Desikachary 297, pl. 50, fig. 6, 1959. (Plate I, Fig. 13)

Filaments single, free floating, straight or curved, 7.6-8.5 μ broad ; sheath colourless ; trichomes constricted, 6.6-7.6 μ broad, blue-green ; cells quadratic or up to $\frac{1}{2}$ as long as broad, 3.8-5.7 μ long ; contents granular, pseudovacuoles present ; end cell round.

Habitat : In water course, village Sham Chaurasi, Hoshiarpur.

MICROCOLEUS Desmaziers

32. **Microcoleus sociatus** West et West in Jour. Bot. Lond. 35 : 272, 1897 ; Desikachary 346, 1959.

Lat. trichome=2.7-3.4 μ ; lat. filament=38.4-76.8 μ ; long. cell=3.8-7.6 μ.

Habitat : On moist soil, village Purhiran, Hoshiarpur.

Family NOSTOCACEAE Kützing

Subfamily ANABAENOIDEAE

CYLINDROSPERMUM Kützing

33. **Cylindrospermum licheniforme** Kütz. [in Bot. Zeitung, 5 : 197, 1847 ; Tab. Phycol. 1 : 53, pl. 98, fig. 6, 1849] ex Born. et Flah. Rev. Nostoc. Heterocyst. 253, 1888 ; Desikachary 366, pl. 65, fig. 8, 1959.

Lat. trichome=3.4-4.2 μ ; long. cell=3.4-5.1 μ ; lat. heterocyst=4.7-6.6 μ ; long. heterocyst=7.6-11.5 μ ; lat. spore=11.5-15.3 μ ; long. spore=19.2-30.7 μ.

Habitat : Free floating in a stagnant water tank at Bhadarpur, Hoshiarpur.

NOSTOC Vaucher

34. **Nostoc spongiaeforme** Ag. [Syst. Alg. 22, 1824] ex Born. et Flah. Rev. Nostoc. Heterocyst. 197, 1888 ; Desikachary 380, 1959.

Lat. trichome=3.8-4 μ ; long. cell=5.7-7.6 μ ; lat. heterocyst=5.7-7.6 μ ; long. heterocyst=7.6-9.5 μ ; lat. spore=6.6-7.6 μ ; long. spore=7.6-10.5 μ.

Habitat : Floating in a stagnant water pond, Phagwara road, Hoshiarpur.

var. **tenue** Rao in Proc. Indian Acad. Sci. 3 : 170, Fig. 2 F, 1936.

Lat. trichome=3.4-3.8 μ ; long. cell=3.8-5.7 μ ; lat. heterocyst=4.7-6.6 μ ; long. heterocyst=5.7-9.5 μ ; lat. spore=4.7-6.6 μ ; long. spore=5.7-9.5 μ.

Habitat : On moist soil, Guru Nanak Nagar, Hoshiarpur.

ANABAENA Bory

35. **Anabaena iyengarii** Bharadwaja in Proc. Indian Acad. Sci. B, 2 : 105, fig. 6 H-K, 1935 ; Desikachary 406, pl. 78, fig. 2, 1959.

Lat. trichome=5.6-6.6 μ ; long. cell=3.8-4.7 μ ; lat. heterocyst=7.6-8.5 μ ; long. heterocyst=7.6-8.5 μ ; lat. spore=9.5-11.5 μ ; long. spore=11.5-19.2 μ.

Habitat : Floating on the surface of water, Dholbaha, Hoshiarpur.

36. **Anabaena vaginicola** Fritsch et Rich. forma **fertilissima** Prasad in Journ. Indian Bot. Soc. 31 : 361, figs. 14-17, 1952 ; Desikachary 401, pl. 73, fig. 3, 1959.

Lat. filament=11.2-15 μ ; lat. trichome=4.6-5.6 μ ; long. cell=3.7-7.5 μ ; lat. heterocyst=5.6-7.5 μ ; long. heterocyst=7.5-12.1 μ ; lat. spore=4.6-8 μ ; long. spore =5.6-11.2 μ.

Habitat : In stagnant water of a crop field, Phagwara road, Hoshiarpur.

Subfamily AULOSIRAE Born. et Flah.

AULOSIRA Kirchener

37. **Aulosira fertilissima** Ghose var. **hoshiarpurensis** var. nov. (Plate II, Fig. 14)

Plantarum massae fibrosae, luteolo-brunneae vel luteolo-virides ; trichomata recta vel paulum flexuosa, 5.7-7.6 μ lata ; vaginae crassae, firmae ; filamenta 7.6-10.4 μ lata ; cellulae doliiformes vel cylindricae, 4-11.5 μ longae, contentis granularibus ; ramis falsis brevibus ; heterocysta intercalaria, 5.7-8.5 μ lata, 11.5-13.4 μ longa, oblonga vel elliptica ; sporae seriatae, ubique alternantes cellulis mortuis, 9.5-11.5 μ latae, 15.3-19.2 μ longae, oblongae vel ellipticae. Positus in Government College, Hoshiarpur herbario sub numero *Vasishta* 14.

Plant mass fibrous, yellowish brown to yellowish green ; trichomes straight or a little flexuous, 5.7-7.6 μ broad ; sheath thick, firm ; filaments 7.6-10.4 μ broad ; cells barrel-shaped or cylindrical, 4-11.5 μ long, contents granular ; false branches short ; heterocysts intercalary, 5.7-8.5 μ broad, 11.5-13.4 μ long, oblong or elliptical ; spores in series, 9.5-11.5 μ broad, 15.3-19.2 μ long, always alternating with dead cells, oblong or elliptical.

Habitat : In a stagnant water pond, Phagwara road, Hoshiarpur. Collected on September 12, 1959. Deposited in Government College, Hoshiarpur herbarium under reference number *Vasishta* 14.

The variety resembles the type in the shape of cells, heterocysts and spores ; the spores are formed in long series alternating with dead cells ; but differs in the smaller dimensions of the cells, heterocysts and spores.

This variety differs from the var. *tenuis* Rao (1937) in possessing (a) broader filaments and trichomes, (b) broader heterocysts, and (c) broader spores. The Hoshiarpur alga is intermediate between the type and variety *tenuis* Rao. It suggests the merger of the variety *tenuis* Rao with the type.

16. **Oscillatoria amphigranulata** Van Coor in Rev. Trav. Bot. Neerl. 15 : 255, pl. 2, fig. 2, 1918 : Desikachary 226, pl. 37, fig. 4, 1959.

Lat. trichome=2-3 μ ; long. cell=4.7-5.1 μ ; one vacuole on either side of the septum.

Habitat : Planktonic in a pond situated by the side of a railway track near village Singriwala, Hoshiarpur.

17. **Oscillatoria mougeotii** Kütz. [Tab. Phycolog. 1 : 30, pl. 41, fig. 10, 1849] ex Desikachary 222, 1959.

Lat. cell=5.1-8.5 μ ; long. cell=3.4-4.2 μ ; gas vacuoles present.

Habitat : Planktonic in a pond, village Singriwala, Hoshiarpur.

18. **Oscillatoria subuliformis** Kütz. [in Oster-progress. 7, 1863] ex Gomont 226, pl. 7, fig. 10, 1892 ; Desikachary 213, pl. 49, fig. 10, 1959. (Plate I, Fig. 4)

Lat. trichome=4.7-6.6 μ ; long. cell=4.7-6.6 μ.

Habitat : Forming a pale yellow or yellowish green thallus attached to *Hydrilla* plants in a pond, Hoshiarpur.

PHORMIDIUM Kützing

19. **Phormidium fragile** (Menegh.) Gomont, loc. cit. 163, pl. 4, figs. 13-15, 1892 ; Desikachary 253, pl. 44, figs. 1-3, 1959.

Lat. trichome=1.7-2.5 μ ; long. cell=1.7-3.4 μ.

Habitat : On the walls of Botanical tank, Government College, Hoshiarpur.

20. **Phormidium molle** (Kütz.) Gomont 163, pl. 4, fig. 12, 1892 ; Desikachary 255, pl. 59, fig. 8, 1959. Forma **tenuior** W. & G. S. West in Bot. Trans. York. nat. Union 5 : 146, 1902.

Lat. trichome=2-2.7 μ ; long. cell=2.7-3.8 μ.

Habitat : Forming a thin, mucilaginous and light blue-green thallus on the sides of Botanical tank, Government College, Hoshiarpur.

21. **Phormidium rubroterricola** Gardner var. **majus** var. nov. (Plate I, Fig. 5)

Trichomata 2.5-3.4 μ lata, non constricta ad septa. Cellulae 1.7-3.4 μ longae ; cellula terminalis conica ; vagina distincta. Positus in Government College, Hoshiarpur herbario sub numero *Vasishta* 17.

Trichomes 2.5-3.4 μ broad, not constricted at the septa ; cells 1.7-3.4 μ long ; end cell conical ; sheath distinct.

Habitat : In crop field soil cultures, Botanical laboratory, Government College, Hoshiarpur, September 15, 1960. Deposited in Government College, Hoshiarpur herbarium under reference number *Vasishta* 17.

The variety differs from the type in possessing broader filaments and trichomes.

22. **Phormidium mucosum** Gardner in Mem. N. Y. Bot. gard. 7 : 43, pl. 9, fig. 84, 1927 ; Desikachary 265, p. 43, figs. 6, 7, 1959. (Plate I, Fig. 6)

Lat. trichome=2.7-3.4 μ ; long. cell=3.4-5.1 μ ; lat. filament=4.8-6.7 μ ; crass. vag.=0.85-1.7 μ.

Habitat : From the inner sides of a water pipe, Government College, Hoshiarpur. The type is being reported for the first time from the Indian soil.

23. **Phormidium stagninum** Rao var. **minus** var. nov. (Plate I, Fig. 7)

Thallus caeruleo-viridis vel pallide viridis ; filamenta longa, recta vel curvata, 8.5-9.5 μ lata ; trichomata non constricta, pallide caeruleo viridia, 6.8-7.6 μ lata ; vaginae hyalinae, firmae, distinctae ; cellulae 1.7-2 μ longae ; cellula terminalis late rotundata ;

calyptra adest. Typus lectus mense maio 31, 1960, et positus in Hoshiarpur Collegio Gubernii sub numero *Vasishta* 11.

Thallus blue-green or pale green, mucilaginous ; filaments long, straight or curved, 8.5-9.5 μ broad ; trichomes unconstricted, pale blue-green, 6.8-7.6 μ broad ; sheath hyaline, firm, distinct ; cells small, 1.7-2 μ long ; end cell broadly rounded ; calyptra present.

Habitat : On the inner sides of a water pipe, Government College, Hoshiarpur, May 31, 1960. Deposited in Government College, Hoshiarpur herbarium under reference number *Vasishta* 11.

The variety differs from the type in possessing narrower filaments and trichomes.

24. **Phormidium ambiguum** Gomont 178, pl. 5, fig. 10, 1892 ; Desikachary 266, pl. 44, fig. 16 & pl. 45, figs. 5-8, 1959.

Lat. trichome=4.7-6.6 μ ; long. cell=3-3.4 μ.

Habitat : On moist soil, village Purhiran, Hoshiarpur.

25. **Phormidium corium** (Ag.) Gomont 172, pl. 5, figs. 1-2, 1892 ; Desikachary 269, pl. 44, figs. 10-11, 1959.

Lat. trichome=3.8-4.7 μ ; long. cell=3-8-7.6 μ.

Habitat : On stones in swiftly flowing water of a rivulet at Dholbaha, Hoshiarpur.

26. **Phormidium hieronymusii** Lemm. in Ark. Bot. 2 : 104, 1903, et Abh. Nat. Ver. Bremen 14 : 259, pl. 1, figs. 5-7, 1934 ; Desikachary 269, 1959. (Plate I, Figs. 8-9)

Thallus olive-green to yellowish brown ; filaments usually regularly spirally coiled, 8.5-10.2 μ broad ; sheath distinct, firm, thin or thick, not lamellated, not coloured violet by chlor-zinc-iodide ; trichomes not constricted, slightly attenuated at the ends, blue to yellowish green, 6.8-7.6 μ broad ; cells very short, 1.72 μ long ; cross walls sometimes granulated ; end cell rounded, rarely slightly capitate.

Habitat : On the moist sides of a hillock at Dholbaha, Hoshiarpur. The type is being recorded for the first time from the Indian soil.

LYNGBYA Agardh

27. **Lyngbya lachneri** (Zimm.) Geitler, Kryptogamenfl. 1037, fig. 655, 1932 ; Desikachary 281, 1959. *Oscillatoria lachneri* Zimm. in Zeitschr. Bot. 20 : 18, pl. Id, II e, 1928.

Lat. trichome=1.9-3.4 μ ; long. cell=1.7-3.4 μ.

Habitat : Attached to the leaf segments of *Utricularia*, Hoshiarpur.

28. **Lyngbya kuetzingii** Schmidle in Allg. Bot. Zeutschr. 58, 1896 ; Desikachary 282, pl. 48, fig. 2, 1959. (Plate I, Fig. 10)

Long. filament=38.4-76.8 μ; lat. trichome=1.7-2.5 μ ; long. cell=0.85-1.5 μ.

Habitat : On *Spongomorpha* sp. in a watercourse near village Sham Chaurasi, Hoshiarpur.

29. **Lyngbya spirulinoides** Gomont var. **minor** var. nov. (Plate II, Fig. 11)

Filamenta laxe spiraliter curvata, libere natantia, singula, 12.4-15.3 μ lata ; vagina tenuis, indistincte lamellata ; trichomata non-constricta, 10.5-11.3 μ lata ; spiris 76.8-107 μ distantibus ; septa nongranulata ; cellulae 3.4-4.7 μ longae ; cellula terminalis rotunda ; calyptra nulla. Positus in Government College, Hoshiarpur herbario sub numero *Vasishta* 12.

Filaments loosely spirally coiled, free floating, single, 12.4-15.4 μ broad ; sheath thin, indistinctly lamellated ; trichomes unconstricted, 10.5-11.3 μ broad ; spirals

76.8-107 μ distant : septa not granulated : cells 3.4-4.7 μ long ; end cell round ; calyptra absent.

Habitat : Free floating in a tank containing *Utricularia* sp., Hoshiarpur. Collected in October 12, 1959. Deposited in Government College, Hoshiarpur herbarium under reference number *Vasishta* 12.

The variety differs from the type in possessing narrower filaments and trichomes.

30. **Lyngbya laxespiralis** Skuja var. **major** var. nov. (Plate II, Fig. 12)

Filamenta spiraliter curvata, 11.5-12.1 μ lata ; vagina tenuis, firma, incolora, non-lamellata ; trichomata constricta, 9.5-11.5 μ lata ; cellulae 5.7-7.6 μ longae ; contenta granularia, caeruleo-viridia ; parietes transversi non-granulati ; cellula apicalis rotundata ; spiris 100-115 μ distantibus. Positus in Government College, Hoshiarpur herbario sub numero *Vasishta* 13.

Filaments spirally coiled, 11.5-12.1 μ broad ; sheath thin, firm, colourless, unlamellated ; trichomes contricted, 9.5-11.5 μ broad ; cells 5.7-7.6 μ long, cell contents granular, blue-green, cross walls not granulated ; apical cell rotund ; spirals 100-115 μ distant.

Habitat : Among other algae on moist soil, Hoshiarpur. Collected on September 20, 1960. Deposited in Government College, Hoshiarpur herbarium under reference number *Vasishta* 13.

The variety differs from the type in possessing broader filaments and trichomes.

31. **Lyngbya cryptovaginata** Schkorb. in Arch. Russ. Protistologia 6(-4) : 125, pl. 8, figs. 14-16, 1927 : Desikachary 297, pl. 50, fig. 6, 1959. (Plate I, Fig. 13)

Filaments single, free floating, straight or curved, 7.6-8.5 μ broad ; sheath colourless ; trichomes constricted, 6.6-7.6 μ broad, blue-green ; cells quadratic or up to $\frac{1}{2}$ as long as broad, 3.8-5.7 μ long ; contents granular, pseudovacuoles present ; end cell round.

Habitat : In water course, village Sham Chaurasi, Hoshiarpur.

MICROCOLEUS Desmaziers

32. **Microcoleus sociatus** West et West in Jour. Bot. Lond. 35 : 272, 1897 ; Desikachary 346, 1959.

Lat. trichome=2.7-3.4 μ ; lat. filament=38.4-76.8 μ ; long. cell=3.8-7.6 μ.

Habitat : On moist soil, village Purhiran, Hoshiarpur.

Family NOSTOCACEAE Kützing

Subfamily ANABAENOIDEAE

CYLINDROSPERMUM Kützing

33. **Cylindrospermum licheniforme** Kütz. [in Bot. Zeitung, 5 : 197, 1847 ; Tab. Phycol. 1 : 53, pl. 98, fig. 6, 1849] ex Born. et Flah. Rev. Nostoc. Heterocyst. 253, 1888 ; Desikachary 366, pl. 65, fig. 8, 1959.

Lat. trichome=3.4-4.2 μ ; long. cell=3.4-5.1 μ ; lat. heterocyst=4.7-6.6 μ ; long. heterocyst=7.6-11.5 μ ; lat. spore=11.5-15.3 μ ; long. spore=19.2-30.7 μ.

Habitat : Free floating in a stagnant water tank at Bhadarpur, Hoshiarpur.

NOSTOC Vaucher

34. **Nostoc spongiaeforme** Ag. [Syst. Alg. 22, 1824] ex Born. et Flah. Rev. Nostoc. Heterocyst. 197, 1888 ; Desikachary 380, 1959.

Lat. trichome=3.8-4 μ ; long. cell=5.7-7.6 μ ; lat. heterocyst=5.7-7.6 μ ; long. heterocyst=7.6-9.5 μ ; lat. spore=6.6-7.6 μ ; long. spore=7.6-10.5 μ.

Habitat : Floating in a stagnant water pond, Phagwara road, Hoshiarpur.

var. **tenue** Rao in Proc. Indian Acad. Sci. 3 : 170, Fig. 2 F, 1936.

Lat. trichome=3.4-3.8 μ ; long. cell=3.8-5.7 μ ; lat. heterocyst=4.7-6.6 μ ; long. heterocyst=5.7-9.5 μ ; lat. spore=4.7-6.6 μ ; long. spore=5.7-9.5 μ.

Habitat : On moist soil, Guru Nanak Nagar, Hoshiarpur.

ANABAENA Bory

35. **Anabaena iyengarii** Bharadwaja in Proc. Indian Acad. Sci. B, 2 : 105, fig. 6 H-K, 1935 ; Desikachary 406, pl. 78, fig. 2, 1959.

Lat. trichome=5.6-6.6 μ ; long. cell=3.8-4.7 μ ; lat. heterocyst=7.6-8.5 μ ; long. heterocyst=7.6-8.5 μ ; lat. spore=9.5-11.5 μ ; long. spore=11.5-19.2 μ.

Habitat : Floating on the surface of water, Dholbaha, Hoshiarpur.

36. **Anabaena vaginicola** Fritsch et Rich. forma **fertilissima** Prasad in Journ. Indian Bot. Soc. 31 : 361, figs. 14-17, 1952 ; Desikachary 401, pl. 73, fig. 3, 1959.

Lat. filament=11.2-15 μ ; lat. trichome=4.6-5.6 μ ; long. cell=3.7-7.5 μ ; lat. heterocyst=5.6-7.5 μ ; long. heterocyst=7.5-12.1 μ ; lat. spore=4.6-8 μ ; long. spore =5.6-11.2 μ.

Habitat : In stagnant water of a crop field, Phagwara road, Hoshiarpur.

Subfamily AULOSIRAE Born. et Flah.

AULOSIRA Kirchener

37. **Aulosira fertilissima** Ghose var. **hoshiarpurensis** var. nov. (Plate II, Fig. 14)

Plantarum massae fibrosae, luteolo-brunneae vel luteolo-virides ; trichomata recta vel paulum flexuosa, 5.7-7.6 μ lata ; vaginae crassae, firmae ; filamenta 7.6-10.4 μ lata ; cellulae doliiformes vel cylindricae, 4-11.5 μ longae, contentis granularibus ; ramis falsis brevibus ; heterocysta intercalaria, 5.7-8.5 μ lata, 11.5-13.4 μ longa, oblonga vel elliptica ; sporae seriatae, ubique alternantes cellulis mortuis, 9.5-11.5 μ latae, 15.3-19.2 μ longae, oblongae vel ellipticae. Positus in Government College, Hoshiarpur herbario sub numero *Vasishta* 14.

Plant mass fibrous, yellowish brown to yellowish green ; trichomes straight or a little flexuous, 5.7-7.6 μ broad ; sheath thick, firm ; filaments 7.6-10.4 μ broad ; cells barrel-shaped or cylindrical, 4-11.5 μ long, contents granular ; false branches short ; heterocysts intercalary, 5.7-8.5 μ broad, 11.5-13.4 μ long, oblong or elliptical ; spores in series, 9.5-11.5 μ broad, 15.3-19.2 μ long, always alternating with dead cells, oblong or elliptical.

Habitat : In a stagnant water pond, Phagwara road, Hoshiarpur. Collected on September 12, 1959. Deposited in Government College, Hoshiarpur herbarium under reference number *Vasishta* 14.

The variety resembles the type in the shape of cells, heterocysts and spores ; the spores are formed in long series alternating with dead cells ; but differs in the smaller dimensions of the cells, heterocysts and spores.

This variety differs from the var. *tenuis* Rao (1937) in possessing (a) broader filaments and trichomes, (b) broader heterocysts, and (c) broader spores. The Hoshiarpur alga is intermediate between the type and variety *tenuis* Rao. It suggests the merger of the variety *tenuis* Rao with the type.

Family **SCYTONEMATACEAE** Rabenhorst

SCYTONEMA Agardh

38. **Scytonema hofmanni** Ag. [Synop. Algar. Suec. 117, 1817] ex Born. et Flah. Rev. Nostoc. Heterocyst. 97, 1887 ; Desikachary 476, pl. 91, fig. 2, 1959.

Lat. filament=11.3-13.4 μ ; lat. trichome=7.6-9.5 μ ; long. cell=7.6-15.3 μ ; lat. heterocyst=9.5-15.3 μ ; long. heterocyst=11.3-23 μ ; crass. vag.=1.7-2.7 μ.

Habitat : Forming cushion-like, broadly expanded thallus of blackish blue-green colour on moist sandy soil mixed with clay, Hoshiarpur.

39. **Scytonema ocellatum** Lyngbye [Hydroph. Danica 97, pl. 28 a, 1819] ex Born. et Flah. Rev. Nostoc. Heterocyst. 95, 1887 ; Desikachary 467, pl. 92, fig. 3, 1959.

Lat. filament=15.3-19.2 μ ; lat. trichome=9.5-11.5 μ ; long. cell=3.8-7.6 μ ; lat. heterocyst=11.5-13.4 μ ; long. heterocyst=11.5-15.3 μ ; crass. vag.=3.8-4 μ.

Habitat : On moist soil, Hoshiarpur.

40. **Scytonema millei** Bornet [in Bornet et Thuret, Not. Algol. 2 : 147, 1880] ex Born. et Flah. 93, 1887 ; Desikachary 460, pl. 93, fig. 2-3, 1959. (Plate II, Fig. 15)

Thallus woolly, expanded, light blue-green and yellowish brown ; filaments interwoven, 15.3-22 μ broad ; sheath thick, lamellated, firm, brownish, 3.4-5.1 μ thick ; trichomes constricted ; cells discoid in young and healthy trichomes, 11.5-14.3 μ broad, 4.7-9.5 μ long, becoming more or less quadrate in old trichomes, contents blue-green, granular ; heterocysts discoid, usually broader than the cells ; reproduction by hormogones ; false branches in pairs or even single.

Habitat : On moist soil near Model Town, Hoshiarpur. The type is being reported for the first time from the Indian soil.

Family **MICROCHAETACEAE** Lemm.

MICROCHAETE Thuret

41. **Microchaete tenera** Thuret var. **major** Moebius in Abh. Seuckenb. naturf. Ges. 343, pl. 2, figs. 2-4, 1894.

Lat. filament=11.5-13.4 μ ; lat. trichome=7.6-9.5 μ ; long. cell=8.5-11.5 μ ; diameter basal heterocyst=8.5-9.5 μ ; lat. intercalary heterocyst=7.6-9.5 μ ; long. intercalary heterocyst=11.5-19.2 μ.

Habitat : On submerged plant parts of *Trapa bispinosa*, Hoshiarpur. This variety is being reported from the Indian soil for the first time.

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Comments on Ripley's

A SYNOPSIS OF THE BIRDS OF INDIA AND PAKISTAN

BY

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(*With a Supplement by Sidney Dillon Ripley II*)

After Baker's FAUNA OF BRITISH INDIA, BIRDS (1922-1930), Ripley's A SYNOPSIS OF THE BIRDS OF INDIA AND PAKISTAN (1961) is the most important and standard reference work on Indian ornithology. In view of its importance, it is proposed to publish, from time to time, notes and comments on the contents of the book. It may be mentioned at the outset that I have no serious criticism of the volume, and the following notes are more in order to supplement the information already contained therein. Since the question of recognition of one subspecies or the other is largely a matter of opinion of individual zoologists, it is not proposed to discuss that aspect, except in very obvious cases.

Drs. Sálim Ali, K. K. Tiwari, Charles Vaurie, S. Dillon Ripley, and Ernst Mayr read a draft of this paper and offered helpful advice. I must, however, specially mention that Dr. Ripley has been kind enough also to point out to me some omissions and commissions in his book that escaped my notice ; and that Dr. Mayr, in spite of his extremely busy hours, has greatly helped me in the interpretation of certain articles of the new code of zoological nomenclature. To all of them I express my grateful thanks. I am also thankful to Mr. F. C. Sawyer, Librarian, Zoological Library, British Museum (Natural History), London, for his invaluable help in finding out the correct dates of publication of certain books and periodicals.

1. Map between pp. viii and ix. Despite the caption ' India and Pakistan before the 1956 re-organization of Indian States', it shows India as it was before the reorganization of Provinces in 1937, for no boundaries between India and Pakistan or Bihar and Orissa are given.

   Further, in place of ' N.W.F.D.' read ' N.W.F.P.'

2. p. 2, no. 4. As per no. 706 of the OFFICIAL LIST OF SPECIFIC NAMES IN ZOOLOGY, *Podiceps nigricollis* Brehm is the correct name for this species.

3. p. 12, no. 33. The name should be *Ardea insignis* Hume. Hume's name is available, since its citation as a synonym of *Ardea nobilis* Blyth and *Ardea sumatrana* Raffles are based on misidentification.

4. p. 13, no. 38. The name should be *Butorides striatus chloriceps* (Bonaparte), as has been shown by Biswas (1959, p. 288).

5. p. 21, no. 64. The name should be *Ciconia ciconia boyciana* Swinhoe, for Severtzov's *asiatica* is scarcely valid and is best synonymized with the nominate *ciconia* (see Baker, 1929, p. 321).

6. p. 49, no. 156. It also occurs in Nepal in winter (Scully, 1879, p. 225 ; Rand & Fleming, 1957, p. 54).

7. p. 52, no. 165. There is no recorded evidence of its breeding in Nepal.

8. p. 52, no. 166. The correct name is *Aquila chrysaetos daphanea* Severtzov, 1888, for it is not preoccupied by *A.* [*quila*] ? *Daphanea* Hodgson, 1844, which is a *nomen nudum* and hence has no nomenclatural standing. Ticehurst (1932) renamed this bird as *A. c. hodgsoni* because he thought that since Severtzov's name was cited in the synonymy it was not available. This was, however, unnecessary in reference to Art. 16 (b) (ii) of the New Code.

9. p. 72, no. 236. The type locality, Srinagar, as given by Hellmayr, is in Dehra Dun district, U.P., and not in Kashmir.

   Watson (1962) has recently shown that *Alectoris graeca* (Meisner) and *Alectoris chukar* (J. E. Gray) are distinct species.

10. p. 73, no. 238. Scully (1879, p. 348) reported it also from Nepal at *c.* 6000 ft.

11. p. 116, no. 383. The author of the name *Charadrius placidus* is J. E. Gray alone.

    The first (1846) edition of the CATALOGUE of Hodgson's collection was published under the joint authorship of J. E. and G. R. Gray (see announcement at the back of the second edition), although G. R. Gray alone was responsible for all new names proposed therein (see pp. iv-v of the first edition). The second (1863) edition was, however, all J. E. Gray's own work.

12. p. 122, genus *Capella* Frenzel. As per no. 58 of the OFFICIAL LIST OF GENERIC NAMES IN ZOOLOGY, *Gallinago* Brisson is the correct generic name for the snipes.

13. p. 156, no. 501. Robinson & Kloss's name was originally printed as *Treron bisincta praetermissa.*

    It occurs also in Nepal.

14. p. 162, no. 524. Blyth's name originally appeared as *C.* (*Alsocomus*) *puniceus.*

    It occurs also in south-eastern Bihar and southern West Bengal although rather scarce there.

15. p. 172, no. 562. Occurs below 2000 ft. also, for example, 800 ft. reported by Biswas (1961b, pp. 537-538).

16. p. 172, nos. 562 and 563. Husain (1959) has shown that *Psittacula himalayana* (Lesson) and *P. finschii* (Hume) are distinct species.

17. p. 173, no. 566. Hodgson obtained two specimens in Nepal (J. E. & G. R. Gray, 1846, p. 113).

18. p. 175, no. 572. Occurs also in Orissa (Mayurbhanj district, reported by Mukherjee, 1953, pp. 157, 160).

19. p. 205, no. 682. The subspecific name should be corrected to *monticola.*

20. p. 210, no. 700. The type locality of *Cypselus leuconyx* Blyth is Calcutta.

21. p. 217, no. 729. Occurs also in southern West Bengal.

22. p. 224, no. 755. In the reference mentioned, Stresemann refers only to the specimen(s) of *Coracias benghalensis* (L.) collected by P. Poivre, which did not form the basis of Linnaeus's description of the species.

    Regarding designation of a neotype for *Corvus benghalensis* Linnaeus, see Biswas (1961a), and for the Ruling (Opinion 663) given on the case by the International Commission on Zoological Nomenclature, see *Bull. zool. Nomencl.* **20**(3) : 195-196, April 1963.

23. p. 233, no. 783. Recorded also from Dehra Dun district, U.P. (Mukherjee, 1956, pp. 162-163 ; Rand & Fleming, 1957, p. 88).

24. p. 233, no. 784. Bonaparte's name was originally spelt as *Megalaima hodgsoni.*

25. p. 235, no. 792. Latham's name *Bucco indicus* occurs on page 205 of INDEX ORNITHOLOGICUS, vol. 1 (1), and its type locality is India.

26. p. 236, no. 793/794. No specimen of *Indicator xanthonotus* has yet been taken in Nepal. It is not known, therefore, if

the subspecies *radcliffi* or the nominate *xanthonotus* or both occur there.

27. p. 245, no. 827. The original name was published as *Picus* (*Chrysonotus* Swainson) *Grantia*, and its author is Horsfield.

28. p. 261, no. 877. The year of publication of Blyth's name is 1845, although it was due in 1844.

Under Range : delete ' western ' from Bihar.

29. p. 264, no. 888. It occurs in Nepal also (Sharpe, 1890, p. 585).

30. p. 271, no. 912. J. E. Gray's name *Hirundo chinensis* was published in 1830 in the ILLUSTRATIONS OF INDIAN ZOOLOGY, vol. 1, pt. 2, pl. 35, fig. 3.

31. p. 300, no. 1002. In the reference cited, Stresemann refers to *Sturnus Capensis* Linnaeus, 1766, and not to *Sturnus Contra* Linnaeus, 1758.

32. p. 305, no. 1020. The type locality of *Garrulus bispecularis* Vigors was earlier restrieted to Murree by Baker (1922, p. 63).

33. p. 310, line 19. Delete ' Nepal ' from the range of the species *Dendrocitta frontalis* Horsfield.

34. p. 340, no. 1133. The type locality of *Trichophorus striatus* Blyth is Darjeeling.

35. p. 341, no. 1140. The type locality of *Trichophorus flaveolus* Gould was originally given as Himalaya Mountains, Nepal, etc. Baker's restriction to Cachar (Assam) cannot stand, for Cachar is neither in the Himalayas, nor in Nepal. It has, however, been restricted to Nepal by Koelz (1954, p. 10).

36. p. 343, no. 1146. Horsfield's name originally appeared as *Hypsipetes McClellandii*.

37. p. 366, no. 1228. The type locality of Tickell's *Motacilla rubricapilla* is not Manbhum, but 'Borabhum' (=Barahabhum, Purulia district, West Bengal).

38. p. 367, no. 1231. The year of publication of Gmelin's name *Parus sinensis* is 1789.

39. p. 370, no. 1241. Hodgson's specimen on which Sharpe named *Suthora humii* came from Darjeeling (Gray, 1863, p. 37). The restriction of the type locality to eastern Nepal is, therefore, unnecessary.

40. p. 382, no. 1279. Vigors's name was originally published as *Garrulus striatus*.

41. p. 383, no. 1280. Whistler died in 1943, and *vibex* was described in 1950. Naturally, he could not possibly write in his MS. notes anything about its occurrence in eastern Kumaon. However; he thus referred to the British Museum series from Nepal : ' These are called intermediate by B.M. but seem to me, particularly Scully's birds, close to typical race.'

42. p. 417, no. 1397. Lowndes (1955, p. 31) found it as far up as 10,500 ft. in Nepal.

43. p. 417, no. 1399. Koelz's restriction of the type locality of *Hypsipetes gracilis* Horsfield to Naga Hills may not be valid, for there is nothing to show that McClelland (the collector) ever visited that part of the country.

44. p. 433, no. 1447. Moore's name originally appeared as *Nemura Hodgsoni*.

45. p. 439, no. 1465. It occurs in Nepal also (J. E. & G. R. Gray, 1846, p. 93 ; Biswas, 1963a, p. 807).

46. p. 443, nos. 1477 & 1478. *Sylvia montana* Horsfield, 1821, is older than *Horornis fortipes* Hodgson, 1845. The names of nos. 1477 and 1478 should, therefore, be changed to *Cettia montana pallidus* (Brooks) and *Cettia montana fortipes* (Hodgson), respectively.

47. p. 457, no. 1528. *Prinia catharia* Reichenow, 1908, is an older name for this bird.

48. p. 459, no. 1534. The type locality of *Graminicola bengalensis* Jerdon is Cachar. Although Jerdon (1863, p. 177) mentioned 'Ganges' first, he (loc. cit., note) clearly stated that he did not procure any specimen there, and that his first specimens were taken in Cachar. The type locality being the place of origin of the first specimen (type), only Cachar can qualify.

49. p. 471, no. 1570. Biddulph (1881, p. 67) obtained a specimen of *Sylvia alathaea* in Gilgit in May, and Scully (1881, p. 450) recorded it breeding there.

50. p. 478, no. 1592. The type locality of *Regulus inornatus* Blyth is Darjeeling.

    Proud (1955, p. 63) reported it also from Nepal.

51. p. 487, no. 1620. *Seicercus poliogenys* (Blyth) has also been known from Nepal (Gray, 1863, p. 32 ; Proud, 1955, p. 65).

52. p. 488, no. 1622. According to Art. 58 (8) of the International Code of Zoological Nomenclature (1961), *Abrornis albigularis* Blyth, 1861, is preoccupied by *Abrornis albogularis* Moore,

1854. The next name available, *Abrornis flaviventris* Jerdon, 1863, should, therefore, be used for this form.

It has also been known from Nepal (Gray, 1863, p. 33 ; Biswas, 1962b, p. 423).

53. pp. 496-497, no. 1647/1648. Summer birds from Manangbhot, northern central Nepal, taken between 13,000 and 15,000 ft. by Lowndes (1955, p. 32) have been identified as nominate *pectoralis*.

54. p. 503, no. 1671. The description of *Ruticilla phoenicuroides* Moore occurs in vol. 1 of Horsfield & Moore's work.

55. p. 506, no. 1678. Moore's name originally appeared as *Ruticilla Vigorsi*.

56. p. 507, no. 1680. It occurs much below 6000 ft., for example, Stevens's (1925, p. 358) report from Bhutan Duars (500 ft., O'Donel coll.) and from Nurbong (2000 ft.); Biswas's (1962a, p. 662) record from central Nepal at *c*. 1000 ft.

57. p. 514, no. 1700. The author's name Sykes should not be enclosed in parentheses.

58. p. 543, no. 1785. The subspecific name was originally published as *sushkini*.

59. p. 557, no. 1823. Also reported as far west as the Gandak-Kosi watershed, central Nepal (Proud, 1952, p. 362).

60. p. 571, no. 1865. The author of the name *Anthus pelopus* is G. R. Gray (see remark on no. 383).

61. p. 576, no. 1883. Hodgson's name was originally published as *Motacilla* (*Budytes*) *Calcarata*.

62. p. 583, no. 1906. The date of publication of Baker's name *Chalcoparia singalensis rubinigentis* in his FAUNA OF BRITISH INDIA, BIRDS vol. 7, as given, that is, 14 May 1930, does not seem to be correct. This date has presumably been obtained from the set of Baker's work in the Zoological Library of the British Museum. Inserted in the vol. 1 of that set is a hand-written memorandum from the publishers addressed to the late Sir Norman Kinnear, giving the actual dates of publication of the various volumes. In it the date for vol. 7 is written as 14 May 1930 which is obviously a slip of the pen (probably intended to be 14 March 1930), for the copy of vol. 7 of the same set is datestamped 23 April 1930 by the Library ! Again, the publishers have recently informed me that the date on the title pages of the volumes are the dates on which they

were published and were available for sale to the public, which, for vol. 7, is March 1930. Baker's name should, therefore, have priority over Kloss's, and the Indian Rubycheek should be known as *Anthreptes singalensis rubinigentis* (Baker).

63. p. 611, no. 1989. Reported also from Nepal (Lowndes, 1955, p. 34, from Manangbhot, northern central Nepal, at *c.* 10,000-13,000 ft., in summer).

64. p. 616, no. 2004. Recorded also from eastern Nepal (Biswas, 1963b, p. 194).

65. p. 634, no. 2055. Sharpe's name was published in 1888.

It has also been known from Nepal (Gray, 1863, p. 57).

66. Various pages. Add Andaman Islands in the ranges of :

nos. 14 (p. 5), 17 (p. 7), 44 (p. 15), 49 (p. 16), 114 (p. 37), 133 (p. 43), 147 (p. 47), 175 (p. 55), 191 (p. 60), 193 (p. 60), 222/223 (p. 68), 337 (p. 101), 346 (p. 103), 371 (p. 112), 379 (p. 115), 409 (p. 124), 418 (p. 128), 424/425 (pp. 129-130).

Add Nicobar Islands in the ranges of :

nos. 18 (p. 7)—definite records ; 49 (p. 16)—probable records ; 52 (p. 17)—definite record ; 418 (p. 128)—doubtful record.

Add Andaman and Nicobar Islands in the ranges of :

nos. 21 (p. 8), 37 (p. 13), 48 (p. 16), 57 (p. 18), 373 (p. 113), 374 (p. 114), 385/386 (p. 117), 387/388 (p. 117), 393/394 (p. 119), 396 (p. 120), 406 (p. 123), 422 (p. 129), 434 (p. 133).

(See Ball, 1873 ; Hume, 1873, 1874, 1876 ; Butler, 1899-1900 ; Kloss, 1903 ; Osmaston, 1906).

67. Various pages. The author of the following names is Horsfield :

Hirundo brevirostris (p. 205, no. 683) ; *Coracias affinis* (p. 225, no. 757) ; *Phaenicornis elegans* (p. 325, no. 1080) ; *Hypsipetes gracilis* (p. 417, no. 1399).

The author of *Spizaetus rufitinctus* (p. 46, no. 144) and *Ianthocincla gularis* (p. 385, no. 1288) is McClelland.

The date of publication of all the abovementioned names and of *Mirafra Assamica* Horsfield (p. 260, no. 873), *Hirundo brevicaudata* Horsfield (p. 271, no. 912), *Dendrocitta frontalis* Horsfield (p. 310, no. 1035), *Muscicapa*? *capitalis* Horsfield (p. 320, no. 1064), *Phaenicornis affinis* McClelland (p. 326, no. 1084), *Saxicola*? *olivea* McClelland (p. 441, no. 1472), and *Cinnyris labecula* Horsfield (p. 590, no. 1928) is best given as 1839 (1840).

68. Various pages. The author of the following names is Moore (*in* Horsfield & Moore) :

Delichon nipalensis (p. 277, no. 932), *Pnoepyga longicaudatus* (p. 358, no. 1202), *Accentor rubeculoides* (p. 542, no. 1781).

69. Various pages. The authorship of J. E. Gray's ILLUSTRATIONS OF INDIAN ZOOLOGY (London, 1830-1835) has been given to Hardwicke as well as to Gray & Hardwicke. A perusal of the title page of the work leaves one without doubt that the author is J. E. Gray alone.

Kinnear (1925) and Sawyer (1953) have written on the dates of publication of the various plates.

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SUPPLEMENT

Additions and corrections to A SYNOPSIS OF THE BIRDS OF INDIA AND PAKISTAN, and a comment. By Sidney Dillon Ripley II.

p. 5. Add species 13a :

Bulweria fallax Jouanin

Small Black Petrel

Northern Indian Ocean.

13a. **Bulweria fallax** Jouanin

Bulweria fallax Jouanin, 1955, *L'Oiseau* **25** : 156. (Near Socotra, 12° 30′ N., 55°E.)

Range.—Northern Indian Ocean (see Jouanin, 1957, L'Oiseau **27** : 12-27), wandering perhaps as far east as the western coast of India. The record of the Mascarene Black Petrel, *Bulweria aterrima*, should be treated as unresolved until fresh specimens come to hand to determine to which species birds near the coast might be assigned.

p. 14. no. 42. This should be read as :

Ardeola grayii grayii (Sykes)

and ' Maldive ' deleted from its Range.

p. 14. Add race 42a :

42a. **Ardeola grayii phillipsi** Scheer

Ardeola grayii phillipsi Scheer, 1960, *Senck. biol. Frankfurt am Main* **41** : 145. (Hitadu, Addu-Atoll, Maldives.)

Range.—Southern Maldive Islands, Addu and Suadiva.

p. 122. Genus **Capella** Frenzel :

The International Commission of Zoological Nomenclature (1957) have decreed that the snipe species at present included in the genus *Capella* should be transferred to ' *Gallinago* Brisson 1760 ', and this is what Dr. Biswas is referring to in his comments on my treatment of these species in the SYNOPSIS. However, Dr. Alexander Wetmore, (1958, *Ibis* **100** : 125-127) has shown that the Commission has attempted to validate as a genus a term that does not have generic status. Thus current standard lists such as the American Ornithologists ' Union CHECK LIST (1957) and the South African CHECK LIST (1952) as emended by the Seventh Report (1963, *Ostrich* **34** : 40) as well as my SYNOPSIS continue to recommend the use of the genus *Capella* pending further study.

p. 205. Add species 683a :

Collocalia maxima Hume

Low's Swiftlet

Bhutan, southeast Tibet, east to Thailand, Viet Nam, Malaya, Sumatra, Java and Borneo.

683a. **Collocalia maxima maxima** Hume

Collocalia maxima Hume, 1878, *Stray Feathers* **6** : 49. (Tenasserim.)

Range.—Eastern Bhutan and southeast Tibet (skins in B.M.) from 7000 to 12,750 feet, *vide* Medway, 1961, J.B.N.H.S. **59** : 149.

p. 206, no. 685. This should be listed as a species :

Collocalia unicolor (Jerdon)

Indian Edible-nest Swiftlet

Southern India and Ceylon.

685. **Collocalia unicolor** (Jerdon)

Hirundo unicolor Jerdon, 1840, *Madras Jour. Lit. Sci.* **11** : 238. (Coonoor.)

Range.—as stated.

p. 206, the citation **Collocalia inexpectata** ume, Hand no. 686 following it should be read as :

Collocalia fuciphaga (Thunberg)

Greyrumped or White-nest Swiftlet

Andaman and Nicobar islands east into the coastal Indochinese and Malaysian subregions, Philippines and Lesser Sunda Islands.

686. **Collocalia fuciphaga inexpectata** Hume

Collocalia inexpectata Hume, 1873, *Stray Feathers* **1** : 296, in text. (Andaman Islands.)

Range.—as seated.

p. 325. Add race 1080a :

1080a. **Pericrocotus flammeus andamanensis** Beavan

Pericrocotus andamanensis 'Tytler'=Beavan, 1867, *Ibis* : 322. (Andaman Islands.)

Range.—Andaman Islands.

p. 599, no. 1954. Additional note to range, **Montifringilla ruficollis :**

Sight record, Bass (1963, pers. comm.), Jalapahar, Darjeeling *c.* 7500 ft., Oct. 12, 1956.

Field Guide to the Amphibians of Western India

PART 2

BY

J. C. DANIEL

Curator, Bombay Natural History Society

(With two plates and four text-figures)

[*Continued from Vol.* **60** (2) : 438]

Family MICROHYLIDAE: Narrow-mouthed Frogs

These frogs are easily distinguished by the smallness of the head in relation to the body. They are not uncommon but, being fossorial forms, are rarely seen except during the breeding season. Many species live more or less exclusively on ants and termites and are often seen in association with termite colonies. The family is widely distributed and occurs in the tropics of both hemispheres.

The narrow-mouthed frogs differ from the frogs (Ranidae) and tree frogs (Rhacophoridae) by the absence of teeth in the upper jaw and the entire nature of the tongue, and are distinguished from the toads (Bufonidae) by the circular or oval tongue, the circular or vertical pupil, and the smooth skin of the body. Within the family, two characters are of importance in separating the genera, the presence or absence of ridges on the palate in front of the pharynx and the presence or absence of disc-like dilatations on the finger tips. In all Indian microhylids, the tympanum is hidden or absent and the first finger is shorter than the second. The tadpoles lack teeth rows on the lips. Five genera with nine species occur in India.

KEY TO THE GENERA OF MICROHYLIDAE

1. Tips of fingers not dilated .. 2
   Tips of fingers dilated into discs .. 4
2. Palate without ridges .. *Melanobatrachus*
   Palate with ridges .. 3

3. No papillae behind internal nares. Size small, when adult less than 35 mm. from snout to vent .. *Microhyla*

   Papillae present below internal nares. Size large, when adult over 40 mm. from snout to vent .. *Uperodon*

4. A bony ridge immediately below internal nares .. *Kaloula*

   A fleshy ridge some way below internal nares .. *Ramanella*

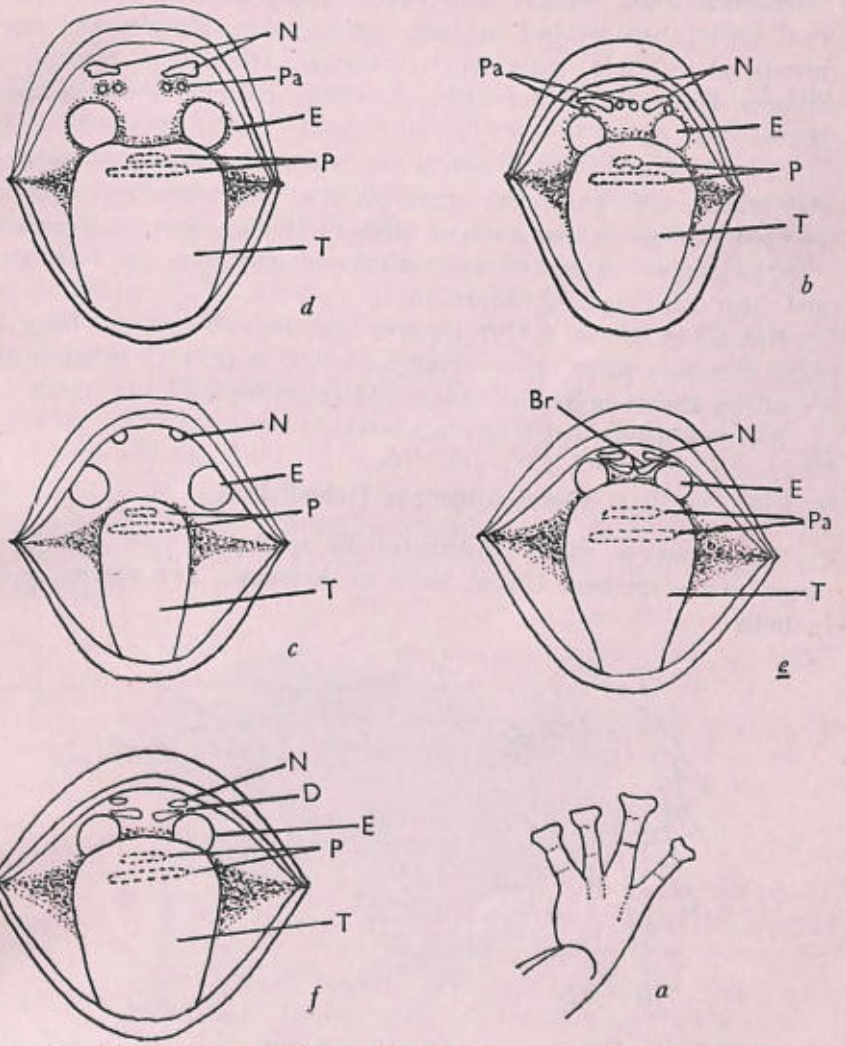


Fig. 15. *a.* Hand of *Ramanella montana*; Mouth of : *b. Uperodon systoma* ; *c. Microhyla ornata* ; *d. Uperodon globulosum* ; *e. Kaloula pulchra taprobanica* ; *f. Ramanella montana.*

N : internal nares ; Pa : papilla ; E : inner bulge of eye ; P : dotted lines on tongue indicating position of palatal ridges ; T : tongue ; Br. Bony ridge ; D. dermal ridge

Genus **Melanobatrachus** Beddome 1878

Restricted to south-west India. One species.

Melanobatrachus indicus Beddome 1878 : Black Microhylid

Diagnosis[1]. Distinguished from other species of the family by the absence of palatal ridges. Size small, 34 mm. in snout-to-vent length. Interorbital width broader than upper eyelid; pupil circular; tongue oval entire; toes webbed at base; sub-articular tubercles and inner metatarsal tubercle indistinct; tibio-tarsal articulation reaches to midway between shoulder and eye. Skin pustular above, smooth below.

Colour. Black. Thigh with a continuous or interrupted quarter-inch-broad scarlet band near groin. A few scarlet blotches on chest, between forelegs, and on lower portions of hindlegs sometimes present.

Distribution. A rare species. Collected only from the Anamalais and other hill ranges in Kerala.

Habits. Beddome (1878) remarks that he collected the frogs in moist evergreen forest at an elevation of 4000 ft. (*c*. 1219 m.), torpidly curled up almost into a ball under old rotten logs.

Breeding habits and larvae unknown.

Genus **Microhyla** Tschudi 1838

The genus is widely distributed in south-east Asia and from Brazil to the southern United States of America. Two species occur in India.

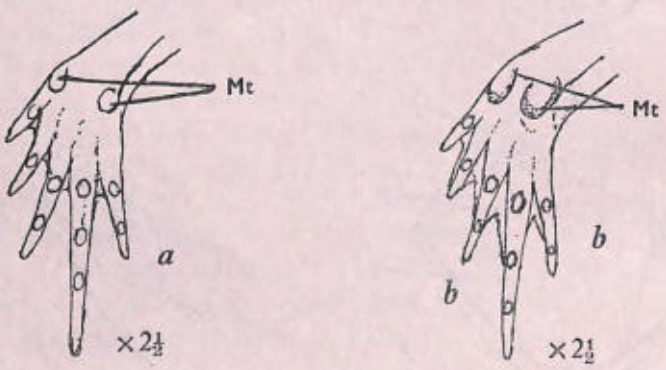


Fig. 16. Hindfoot of : *a. Microhyla ornata* ; *b. Microhyla rubra* (both ventral views)

Mt : metatarsal tubercle

[1] Based on Beddome, Lt.-Col. R. H. (1878) : Description of a new Batrachian from South India belonging to the family Phryniscidae. *Proc. Zool. Soc. London* : 722-3.

KEY TO THE SPECIES OF *MICROHYLA* TSCHUDI 1838

Habit slender, two normal metatarsal tubercles	.. *ornata*
Habit stout, two shovel-shaped metatarsal tubercles	.. *rubra*

Microhyla ornata (Dum. & Bibr.) 1841 : Ornate Microhylid

(Text-fig. 15*c*, 16*a*, 17)

Diagnosis. A small slender microhylid rarely exceeding 25 mm. in snout-to-vent length. The colour pattern of the back is distinctive. Interorbital width nearly twice as broad as upper eyelid. Toes with a rudiment of web. Two prominent metatarsal tubercles. Tibio-tarsal articulation reaches to the shoulder or to slightly beyond the anterior border of eye. The heels meet when the legs are held at right angles to the body. Skin smooth or slightly tubercular.

Colour. The characteristic pattern on the back, which may be bright pink or brown of varying shades, begins between the eyes where it extends to both eyelids, narrows on the nape, widens above the shoulder, narrows again, and finally broadens out sending a stripe to the groin and the thigh. A dark streak from behind the eye to the shoulder, limbs crossbarred. White below, throat and chest may be stippled with brown. Throat in breeding male black.

Distribution. India, Ceylon, south-east Asia, south China, and Formosa.

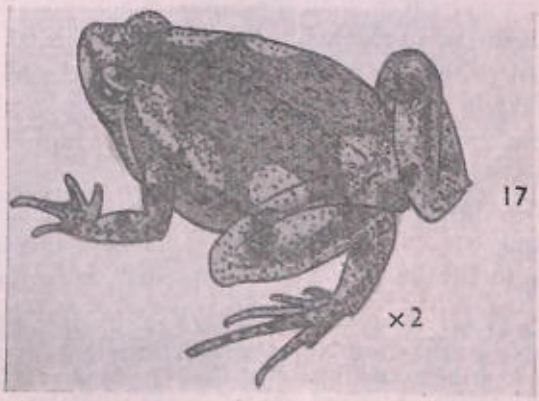


Fig. 17. *Microhyla ornata* × 2

Breeding. The breeding season commences once the monsoon rains have well set in and occurs throughout the monsoon period in south-western India. The period varies with the rainy season in different

areas of its distributional range. Flower (1899)[1] records tadpoles between December and February in Malaya. The male can be heard calling at night near temporary rainwater pools and similar situations. Several males may call from the same area but, though the call is startlingly loud for an animal of its size, it is ventriloquistic and makes location of the small frog sitting in the midst of grass or among stones extremely difficult. In this, as in some other species of *Microhyla*, I believe the male remains stationary and is located by the female by its call. McCann (1940)[2] records the number of eggs in a female collected in September as approximately 200. Earlier (1932)[3] he opines that eggs are laid singly in separate mucilaginous envelopes. However, Ferguson (1904)[4] states that the eggs which measure 2 mm. in diameter are laid in flat transparent masses. I have, unfortunately, no personal record. The tadpoles are transparent and have a diamond-shaped mark of almost gold colour on the head. The head and body are massive and the tail which is half as long as the head and body ends in a short terminal flagellum. They move in shoals just below the surface of the water or at the surface. According to C. R. Narayan Rao (1917)[5] the large air spaces which occur in the gill chambers provide the necessary buoyancy and the offensive secretion of two cephalic glands makes them unpalatable to fishes and other aquatic life thus offering them protection in spite of the exposed nature of their movements. The tadpoles are microphagus. Parker (1928)[6] suggests that the flagellated tail helps the tadpole to maintain a stationary position while feeding by counteracting the forward thrust of the water taken in through the mouth and filtered out by the gills through the spiraculum. When feeding the tail is bent back almost parallel to the body and the flagellum at the tail tip vibrated rapidly. Unlike in the adult the toes when they appear are completely webbed. Development is rapid and the young measure *c.* 9 mm. at metamorphosis.

Habits. This pretty little microhylid is the commonest species of the family and one of the smallest of Indian amphibians. It has adapted itself to life in different biotopes, and occurs in desert areas

[1] Flower, S. S. (1899) : Notes on a second collection of Batrachians made in the Malay Peninsula and Siam, from November 1896 to September 1898, with a list of species recorded from those countries. *Proc. Zool. Soc. London* : 885-966.

[2] McCann, C. (1940) : A Reptile and Amphibian Miscellany. *J. Bombay nat. Hist. Soc.* **42** (1) : 45-64.

[3] ———— (1932) : Notes on Indian Batrachians. ibid. **36** (1) : 152-180.

[4] Ferguson, H. S. (1904) : A list of Travancore Batrachians. ibid. **15** (3) : 499-509.

[5] Rao, C. R. N. (1917) : On the occurrence of iridocytes in the larva of *Microhyla ornata* Boul. *Rec. Indian Mus.* **13** : 281-92.

[6] Parker, H. W. (1928) : The Brevicipitid frogs of the genus *Microhyla*. *Ann. Mag. Nat. Hist.* **2**, 10th series, 473-99.

like Cutch and areas of heavy rainfall as Kerala and Assam. It is found in the plains and to about 5000 ft. (1524 m.) in the hills. While it aestivates when conditions are unsuitable, it may be found throughout the year in suitable areas with cover and moisture. The juvenile frogs may be seen for a short period in the dried-up but still moist beds of temporary rainwater pools well after the monsoon season. The dispersal of young which occurs among toads from the breeding area apparently does not happen to a similar extent in this species. Unlike many microhylids this frog is quite agile and difficult to capture. It feeds mainly on ants and other small-sized insects.

Microhyla rubra (Jerdon) 1854: Red Microhylid

(Text-fig. 16*b*, 18)

Diagnosis. A stout small frog distinguished from *Microhyla ornata* by its well-developed shovel-shaped metatarsal tubercles and more webbed toes, the web reaching the last row of tubercles in the male and midway between the first and second row of tubercles in the female. Sub-articular tubercles prominent. Tibio-tarsal articulation reaches to between the shoulder and the eye. Skin smooth or slightly warty above; a fold from eye to shoulder. Smooth below except anal region which is granular. Heels may or may not meet when the legs are held at right angles to the body.

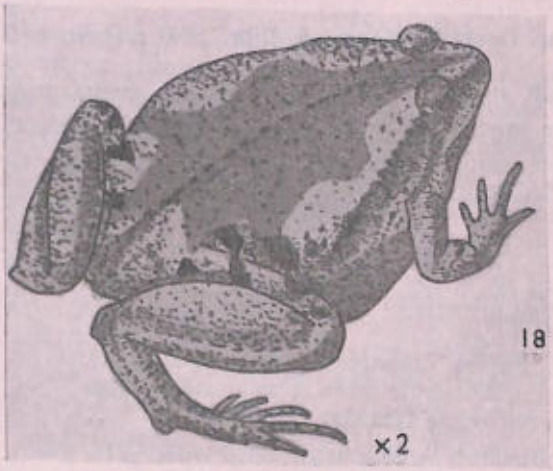


Fig. 18. *Microhyla rubra* × 2

Colour. Head and back red bounded by two dark bands along flanks from tip of snout to groin. Back with or without traces of dark

pattern, usually broken-up. Limbs indistinctly crossbarred; white below, throat and chest light brown. Male with subgular vocal sac which area is black in the breeding season.

Distribution. South India, Ceylon, Assam. Not recorded north of Malabar in western India and Bangalore in the Peninsula. This species is likely to be more widespread than the collection records indicate.

Breeding. The breeding season coincides with the monsoon and in areas which receive both the south-west and the north-east monsoons tadpoles may be seen from June to November. The eggs are laid in flat transparent masses as in *M. ornata* but are of large size, 5 mm. in diameter (Ferguson op. cit.). Tadpoles similar to those of *M. ornata* but have a longer tail, over twice the length of head and body. Transparent with reddish pink tint according to Ferguson (op. cit.) but noted as olive above beautifully marbled by C. R. N. Rao (1915)[1]. Parker (op. cit.) suggests that the difference in colour may be due to local variation. The spawn is laid in rainwater pools. Tadpoles similar in habit to *M. ornata* tadpoles. Development is rapid.

Habits. A fossorial species unlikely to be seen except during the breeding season. The specimens collected by me were from sandy river beds and according to Ferguson (op. cit.) the species is fairly common in the low country of Kerala. C. R. N. Rao (op. cit.) states that the call is akin to the chirping of crickets but can be distinguished from a cricket's as it is interrupted and not continuous.

Genus **Uperodon** Dum. & Bibr. 1841 : Balloon Frogs

The rotund shape of the species of this genus makes them distinctive. The mouth has a short ridge ending in one or two papillae behind or between the internal nares. The genus is restricted to India. Two species are known.

Key to Species of the Genus *UPERODON*

A pair of 'papillae' together below internal nares. Interorbital width nearly thrice upper eyelid. Colour uniform brown or grey (Text-fig. 15*d*). ..	*globulosum*
A pair of 'papillae' between the internal nares and a papilla below each internal nare. Interorbital width about twice upper eyelid. Back marbled (Text-fig. 15*b*)..	*systoma*

[1] Rao, C. R. N. (1915): Some south Indian Batrachia. *Rec. Indian Mus.* **11** : 31-8.

Uperodon globulosum (Günther) 1864 : Balloon Frog

(Plate III, Text-fig. 15*d*)

Diagnosis. Head small with rounded snout and beady eyes; interorbital width 2½ to 3 times the breadth of the upper eyelid. Hindlegs short with two large shovel-shaped metatarsal tubercles. Toes with a rudiment of web, tibio-tarsal articulation does not reach the shoulder.

Skin smooth above and smooth or wrinkled below. Anal region granular. An occipital fold and an indistinct fold from eye to shoulder, uniform brown or grey above, white below with tinges of yellow during the breeding season. Throat black in the breeding male.

Distribution. Bengal (Calcutta, Jalpaiguri), Orissa (Russelkonda), Madhya Pradesh (Berar), Gujarat (Surat Dangs)[1], Maharashtra (Bombay), Mysore (Khanapur).

Breeding. The breeding season coincides with the onset of the monsoon in western India. This species was first recorded breeding in cisterns in rock near Kanheri caves, Salsette Island, Bombay; however, later observations have shown that the species breeds in any standing water, even temporary rainwater pools which may dry up in a few days. The call is a loud grunting *oink* and helps the female to locate the male. Tadpoles are active swimmers. In colour they are olive-brown above with a whitish tail which is striped longitudinally with dark blotchy lines. Flanks and below spotted with dark. The tadpoles are microphagus.

Habits. This species was considered to be rare but recently Abdulali (1962)[2] found them at Khanapur, in Mysore, in large numbers in the month of May. The species has, perhaps, a wider distribution than what the collection records indicate, but as a completely fossorial species it is not seen above ground except during the breeding season. Apart from collections made at breeding spots the species has been seen mainly in termite nests, and it would appear that this sedentary species restricts its movements to finding and burrowing into the nests of their main food, termites and, perhaps, ground-dwelling ants. They are excellent burrowers and in loose soil using their powerful metatarsal tubercles quickly burrow and disappear underground. While burrowing the soil is dislodged by sideways movements of the legs and the animal literally subsides into the ground; the eyes disappear last, leaving no trace above of its presence inside. In clayey

[1] *infra* page 742.

[2] Abdulali, Humayun (1962) : An account of a trip to the Barapede Cave, Talewadi, Belgaum District, Mysore State, with some notes on Reptiles and Amphibians. *J. Bombay nat. Hist. Soc.* **59** (1) : 228-37.

soil, however, an opening to the outside may be seen. Dampness of the soil is essential for their well-being and they live at considerable depths in the dry months—one specimen has been collected at a depth of eight feet and lived for about 13 months without food, showing no effects of starvation during the first nine months (D. D. Mukerji, 1931)[1]. The globular shape is partly due to the enormously distensible lungs which when inflated rise above the level of the back-bone. The skin exudes a sticky secretion when the animal is kept above the soil. On land they move with short hops or slow walk. In water they float and are at the most feeble swimmers.

Uperodon systoma (Schneider) 1799 : Marbled Balloon Frog

(Plate III, Text-fig. 15*b*)

Diagnosis. Distinguished from *U. globulosum* by its coloration, its smaller size, and the interorbital width being narrower—1¾ to twice the width of the upper eyelid, and the papillae in the mouth consisting of a pair between the internal nares and one below each nare.

Colour. Olive to fawn or pinkish above, marbled or spotted with dark brown. Below white, throat often mottled with brown. Breeding male has the vocal sac area black and lower lip tinged with yellow.

Distribution. Agra, Allahabad in the Gangetic plain, south India (common at Madras). In western India only recorded in south Kerala. The species may prove to be more widespread than recorded.

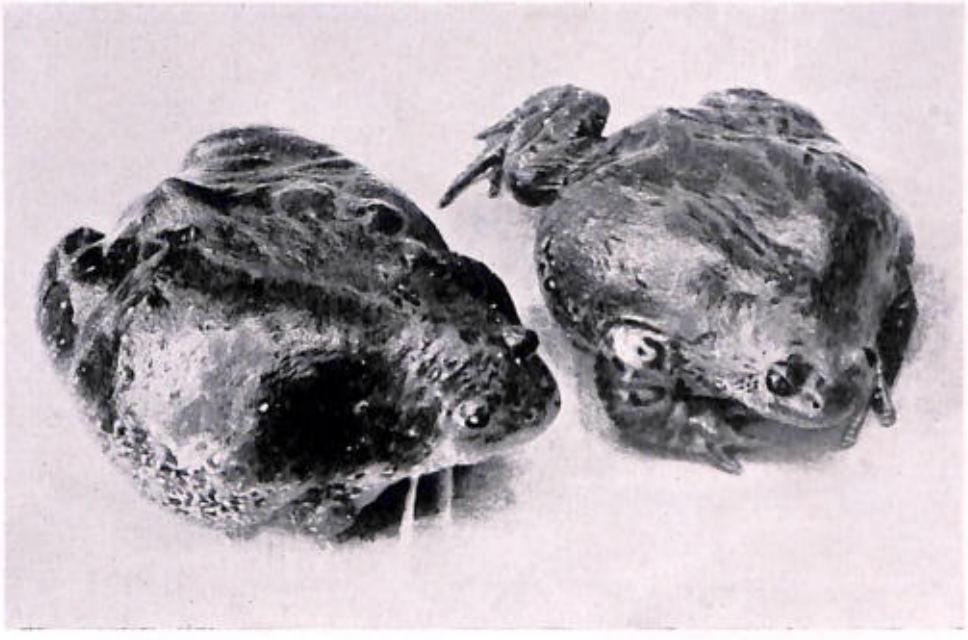
Breeding. Ferguson (op. cit.) recorded it as breeding in Trivandrum in June and July. Like other species of Indian Amphibia breeding coincides with the rainy season and would vary with the advent of the rainy season in different areas of its distribution. The call has been compared to the bleating of a goat (C. R. N. Rao, 1918)[2]. The vocal sac distends enormously and looks more like a float than a resonator while the animal is calling from water. The eggs are laid in masses. The tadpole is indistinguishable from that of *U. globulosum.*

Habits. Similar to *U. globulosum.*

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[1] Mukerji, D. D. (1931) : Some observations on the burrowing toad *Cacopus globulosum* Günth. *J. Proc. Asiatic Soc. Bengal*, N.S., **27** : 97-100.

[2] Rao, C. R. N. (1918) : Notes on the tadpoles of Indian Engystomatidae. *Rec. Indian Mus.* **15** : 41-5.



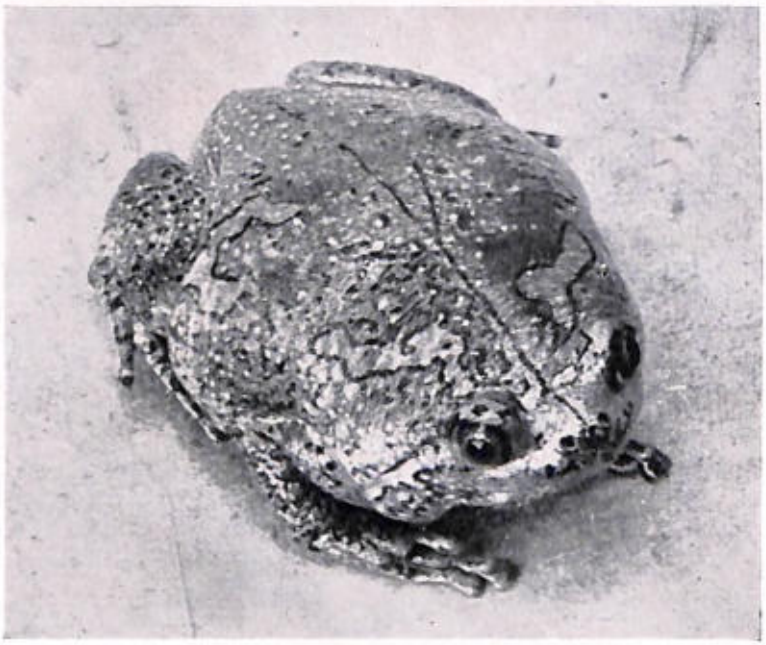
Balloon Frog, *Uperodon globulosum*

(*Photo : J. C. Daniel*)



Marbled Balloon Frog, *Uperodon systoma*

(*Photo : S. R. Sane*)



Ceylon Kaloula, *Kaloula pulchra taprobanica*

(Photo : J. C. Daniel)



Jerdon's Ramanella, *Ramanella montana*

(Photo : S. R. Sane)

Genus **Kaloula** Gray 1831

(Text-fig. 15*e*)

Diagnosis. A strong bony ridge behind opening of internal nares; tip of fingers dilated into discs, toes webbed. A single species in India.

Kaloula pulchra taprobanica Parker 1934 : Ceylon Kaloula

(Plate IV, Text-fig. 15*e*)

Diagnosis. A medium-sized stout microhylid immediately distinguished from all other Indian frogs and toads except *Ramanella* by having only the finger tips dilated into discs. Distinguished from *Ramanella* by the presence of bony ridges immediately below choanae.

Head short, rounded, with indistinct canthus rostralis; interorbital space broader than upper eyelid; fingers with well-developed truncate discs which are twice as wide as the last phalange; toes about ⅓-webbed; two strong compressed metatarsal tubercles; tibio-tarsal articulation reaches to the shoulder.

Colour pattern is distinctive and consists of blackish brown and bright red areas. A wide median blackish brown area bordered by two dorso-lateral bands of red and narrow interorbital band of red. In addition there are spots and patches of red within the black pattern. Light grey below, spotted or marbled with brown. Chin and throat black in breeding male.

Distribution. South India (Cauvery River), Calcutta, Ceylon; in western India collected at Khanapur, North Kanara.

Habits. Very little information is available on the habits of this microhylid. Breeding habits unknown but they have been observed in copula in temporary rainwater pools in May at Dandeli by Abdulali (op. cit.), who records the call as shriller than that of the smaller *Ramanella montana*. The nominate race *Kaloula pulchra pulchra* Gray is widely distributed in south-east Asia.

Genus **Ramanella** C. R. N. Rao & B. S. Ramanna 1925

The genus is found only in peninsular India and Ceylon. Three species occur in India.

Key to the Species of the Genus *RAMANELLA*

1.	Belly immaculate white ..	*variegata*
	Belly brown or black spotted or marbled with white ..	2
2.	Toes free ..	*triangularis*
	Toes webbed ..	*montana*

Ramanella variegata (Stoliczka) 1872 : Variable Ramanella

(Text-fig. 19)

Diagnosis. A small microhylid, less than 40 mm. in snout-to-vent length. Post-narial ridges sometimes pigmented; finger discs triangular



Fig. 19. *Ramanella variegata* nat. size.
(After Günther 1875)

nearly twice the width of penultimate joint; toes with rudimentary web; two metatarsal tubercles; tibio-tarsal articulation reaches shoulder. Skin smooth.

Colour. Brown with lighter marblings or spots, no stable pattern. White below, chin and throat may be brown stippled.

Distribution. Mainly recorded from eastern peninsular India, up to Chanda in Madhya Pradesh.

Breeding. Very little information is available on the breeding habits. C. R. Narayan Rao (1918, op. cit.) syllabilises the call as *ghauy, ghauy* usually heard after heavy rainfall. The tadpoles are brown or grey with minute black spots and occasionally a blue spot on each side of the body. They are bottom dwellers and development is rapid being completed within a month.

Habits. On its habits Narayan Rao & Ramanna (1925)[1] state that it is most often found in termitaries or under stones in association with large black scorpions *Heterometrus* sp. When disturbed they briskly crawled over the scorpions but when the scorpions went over them in turn flattened out and froze. In soft soil they burrow well but usually remain with the nose above ground probably related to their habit of living under stones which makes deep burrows unnecessary. They

[1] Rao, C. R. N. & Ramanna, B. S. (1925) : On a new genus of the Family Engystomatidae (Batrachia). *Proc. Zool. Soc. London* : 587-97.

can climb well. The specimens housed in the Society were collected by Humayun Abdulali while they were climbing on the walls of a well at Chanda.

Ramanella triangularis (Günther) 1875 : Triangle-Spotted Ramanella

Diagnosis. Size small, 40 mm. in snout-to-vent length; post-narial ridges strong, narrowly separated from each other; finger discs less than twice width of penultimate joint; toes free; two metatarsal tubercles; tibio-tarsal articulation reaches shoulder or between shoulder and eye. Skin smooth.

Colour. Pattern distinctive consisting of a lateral streak, a dorsal patch breaking into two stripes at the loins at right angles to the length of the animal, and a triangular patch enclosing the anus. Fore- and hind-limbs banded. Ventrally spotted with white on a brown ground colour.

Distribution. Malabar (Kerala) and Nilgiri Hills (Madras).

Breeding. The tadpoles are transparent but become brown when the front limbs emerge. Metamorphosis completed within a month (C. R. N. Rao, 1918, op. cit.).

Habits. Little known. Have been collected under logs and stones in forest.

Ramanella montana (Jerdon) 1854 : Jerdon's Ramanella

(Plate IV, Text-fig. 15*a*, 15*f*)

Diagnosis. Size small, about 35 mm. in snout-to-vent length. Post-narial ridges well marked and nearly in contact on mid-line; finger discs twice as broad as penultimate joint. Toes webbed, webbing more extensive in the male than the female; two metatarsal tubercles; tibio-tarsal articulation reaches to shoulder or between shoulder and eye. Skin smooth.

Colour. Brown of varying shades, uniform or with darker spots, the pattern varies. Below dark brown, almost blackish, with white spots or blotches.

Distribution. South-west India from the Dangs (*infra* p. 742) to south Kerala.

Breeding. Coincides with the monsoon. The call is recorded by Abdulali (1962, op. cit.) as deeper in tone than that of the larger *Kaloula p. taprobanica.* The tadpoles have been described by Ferguson (1904, op. cit.) as greenish brown, mottled darker above

Tail pinkish spotted with brown. Length of larval period and breeding habits not recorded.

Habits. This species is not uncommon in the Bombay area and was first reported by McCann (1932, op. cit.). It has since been collected occasionally on Salsette Island during and after the monsoons, though the tadpoles have so far not been reported. Recently the distribution of the species has been extended to the Dangs. Little is recorded of their habits. They apparently aestivate after the rains. McCann (1946)[1] records a male and female dormant with their legs tucked in, in the hollow of a tree.

(To be continued)

[1] McCann, C. (1946) : Aestivation of the frog *Ramanella montana* (Jerdon). *J. Bombay nat. Hist. Soc.* **46** : 404-5.

Ornithological Notes of a second trip to the Gulf of Kutch

BY

HUMAYUN ABDULALI

In the *Journal* for August 1962 (**59** : 655-658) I gave a short account of an attempt to visit some of the islands in the Gulf of Kutch. This year again, with the assistance of the Department of Fisheries (Survey & Research), Government of Gujarat, another attempt was made from the 3rd to the 6th August. Together with M. J. Pereira, Field Assistant, Bombay Natural History Society, I drove from Jamnagar to Salaya, and on the way stopped at Sikka to pick up Mohamed (who was with us on the last trip) and Dost Mohamed who has spent many years as a shikari in the Jamnagar Darbar. The latter's fund of interesting stories relating to the 'good old days' helped to while away the time. A pair of crow-pheasants seen from the car produced the following: 'The bird known as *hook-ah* builds large globular nests in inaccessible places in thorn clumps. The nests are lined with a valuable kind of grass, which thrown into a stream floats against the current!' Dost Mohamed had no personal experience of this strange 'fact' and did not know any particular use for the grass, but he had no doubt about its value. One can only wonder how such a story started[1].

The launch *Moti* which had left the previous day was to pick us up on arrival and leave on the midday tide. When we reached Salaya, there was no trace of the boat. It came in at about 3, when we were taking our lunch. I immediately sent a man down to the wharf to ensure that the boat anchored some distance off-shore but, when we walked down with our luggage a little later, we found her prow stuck in the mud and the boat rendered immobile. The next high tide was at midnight.

We spent the evening walking the shore and obtained specimens of the Lesser Flamingo (*Phoeniconais minor*) and the Reef Egret (*Egretta asha* = *E. gularis schistacea* in Ripley's SYNOPSIS). The flamingo

[1] Our editorial assistant, J. S. Serrao, informs us of a similar belief in South Kanara. According to this belief a valuable component of the crow-pheasant's nest known as *sanjivana kaddi* (life-giving herb), is separated from the other nest material by throwing the nest into a stream, whereupon the former flows upstream while the latter flows down.—EDS.

was alone, busily feeding on the mudflats from which the tide had ebbed and which though wet only held water irregularly in small puddles. Its crop was packed with algae and held no mud.

About midnight, after much pushing and pulling, we took off and hoped to reach Baida by 9 a.m. At dawn I woke to find that we had anchored at the mouth of the Salaya Creek and the tindal explained that as he had no compass he could not navigate on a cloudy night. As it was now daylight I suggested that we start off, only to find that we were again stuck in the mud. Again we lost a couple of hours and reached Baida about noon. This is a large island, mainly mangrove forest with many nullahs and creeks running into it. We waded on to a small sandy beach at one end and crossed over a low ridge on to open mudflats. A flock of Large Flamingos (*Phoenicopterus roseus*) stood on the edge of the incoming tide, while a mixed lot of ibises, egrets, grey herons, and other waders were bunched together some distance away. The creeper *Ipomoea pes-caprae* covered the sand-banks, while on the drier mudflats *Arthrocnemum indicum* Moq. and *Asparagus racemosa* grew together with mangroves.

Three large skeletons were noticed lying on the island, probably of the Hawksbill Turtle *Eretmochelys imbricata* (Linn.), the species from which the tortoise-shell of commerce is derived, but the carapaces were missing. Did they come ashore to lay their eggs?

As the tide moved in large areas were flooded and the boat was run into one of the many creeks flowing into the mangrove forest, where only the tops now showed above water. Numerous Darters (*Anhinga rufa melanogaster*), Grey Herons (*Ardea cinerea*), Reef Egrets (*Egretta gularis schistacea*), White Egrets (*Egretta* sp.), and Night Herons (*Nycticorax nycticorax*) were crowded on the trees, but there was no evidence of their nesting here. The many Reef Egrets seen were all of the dark variety, as illustrated in Plate 11 in Sálim Ali's THE BIRDS OF KUTCH (1945). Their dark legs and yellow (not *black* as in the illustration referred to) feet reminded me of the Little Egret (*E. garzetta*) which was not noted in the area—see Berlioz (1956): The Dimorphic Egrets (*J. Bombay nat. Hist. Soc.* **54** : 188-190). The (light) slaty ashy-grey birds (Sykes's *asha* from the Deccan, illustrated on Plate 52, Sálim Ali's THE BOOK OF INDIAN BIRDS, 1961), seen around Bombay (25 August to 25 May) and southwards, were said by Jerdon (1870, THE BIRDS OF INDIA : 789) to be in winter plumage, while Blanford (1895, FAUNA—Birds **4** : 391) thought they were birds of the year. In Ceylon it has not been found breeding since Layard noted it about a hundred years ago. K. M. Kirkpatrick found them breeding in the 'slaty blue phase of plumage' along the east coast near

Pulicat Lake. It is difficult to say if these were light or dark, and I think it is still to be decided if these two forms are the same or different birds.

In the mangrove we heard the Great Indian Reed Warbler (*Acrocephalus stentoreus*) calling loudly and, if we had had the time to wait and investigate, it should not have been difficult to find their nests, if they were breeding.

In the distance we saw a low mudbank, just above water, crowded with hundreds of curlew, whimbrel, and other water-birds.

On the mangroves, a little above the high waterline, there were many globular 'nests' (over a foot in diameter) made of mangrove leaves; according to a local guide they were the 'nests' of a water-rat. Here again it was not possible to stop and investigate.

We then turned towards Ajar which was now visible. Here also we landed (*c.* 4 p.m.) on a sandy beach, but the boat was almost alongside and it was possible to jump ashore. This island is about 2 miles long by three-quarters of a mile wide and rises to a height of perhaps a hundred feet. The higher areas are relatively flat and cultivated with bajri (*Pennisetum typhoideum*), and there is a permanent settlement of about six houses. A few water-birds, already mentioned, were feeding along the shore all around and the following land-birds were noted:

Nectarinia asiatica, Purple Sunbird (one male)

Pycnonotus leucotis, White-cheeked Bulbul (several)

Corvus splendens, Common House Crow (frequent, with pale necks)

Streptopelia decaocto, Ring Dove (several)

Streptopelia senegalensis, Little Brown Dove (several)

Columba livia, Blue Rock Pigeon (several)

Vanellus indicus, Red-wattled Lapwing (several)

Zosterops palpebrosa, White-eye (2 pairs in *Salvadora persica* on edge of shore)

Galerida cristata, Crested Lark (the single specimen obtained seems greyer above than any of those available for comparison in the Society's collection)

A darter flew towards us and settled on a rock 200 yards away. There was something very odd about the coloration and I saw that the underparts from chin to vent were white with three oval patches of black, arranged in a triangle, on its breast. When approached with lethal intentions, it flew away and the upper surface showed the normal colour of a darter, except that it appeared paler. I put this down to some form of albinism. A little

later, I was able to collect a female which also was all white from chin to vent, excepting the sides of the belly which were dark and had slight extensions which formed two blobs of black on the belly. There was a slight trace of the white line down the sides of the neck and the upper plumage was paler and grey rather than the normal black of the adult. This specimen was perhaps a variation of the earlier bird. It contained 4 fish (*Platyglossus marginatus* and *Therapon quadrilineatus*) each about 3 inches long, and there was nothing to suggest that they had been pierced by the bill.

Further sea-ward, and not far away, lay another island Chusna, which rose high out of the water and, being uninhabited, appeared to provide possible nesting sites for gulls, terns, and other water-birds. We decided to lie alongside during the evening and to make a landing in the morning.

When we got back to the boat at dusk, she was again high and dry and the tindal was firm that it would not be possible to make a landing and take off on the same tide. My enthusiasm had ebbed with every tide and I was not inclined to risk another day. So, when we floated off in the night we made towards two low islands towards the Kathiawar shore, also visible from Ajar, with the tindal's assurance that we would be able to examine both. Here again the tide prevented our reaching them, but we landed on an exposed coral reef which lay between. Numbers of starfish both chestnut and dark brown (*Astropecten indica*) lay in the water near sea-anemones (*Stoichactis* sp.) of many colours, which when disturbed threw out fine jets of water and folding up almost disappeared into the mud. Crinoids (*Lamprometra* sp.) of various colours lay around and an orange-and-black Mantis-Shrimp (*Gonodactylus chiragra*) was picked up. An octopus disgorged several crabs, and puffer fish (*Tetrodon* sp.) swam about in pools with sandy floors. When approached, they buried themselves in the sand and could be picked up with a handful of sand. When handled, they puffed out and a companion related how, as schoolboys, they had burst the fish underfoot, making loud noises!

Except for a couple of dark reef egrets, a pair of oyster-catchers, and a Caspian tern that looked as big as a gull, there were few birds. Across a nullah which we could not cross, and perhaps a quarter of a mile away, was a large expanse of mud left uncovered by the tide. Though wet, it held no continuous sheets of water on the surface. On this mud were 20/30 each of the Large and the Lesser Flamingos, all busily feeding. The Lesser were perhaps more sociable, keeping near to another of either species. The two species have basically different diets and it was difficult to imagine how each was picking up what

it wanted. The liquid mud between us prevented a closer approach for examination.

As we passed through the creek approaching Salaya, we saw many pairs of Little Terns (*Sterna albifrons*). Earlier we had seen small parties but failed to obtain specimens. One specimen shot has brownish white shafts to the primaries and is of the typical race (*S. a. albifrons*). On the last trip I obtained 3 specimens which are *S. a. saundersi*.

We reached Salaya in the afternoon and, as we decided to take the bus back to Jamnagar on the following (7th) morning, I had the evening free. The House Crows appeared to have paler necks than those in Bombay and I collected a couple. Having been told about a jheel on the other side of the town, I walked over to investigate. A large sheet of water bordered with tall weeds is separated from a tidal creek by a large bund over which runs a motor-road. Close by is a Jain temple and apparently shooting is prohibited. Several flamingos (Large) were feeding in the tidal nullah, while a party of about 15 stood together in the lake some 30 yards from the road. Those feeding in the creek constantly tapped the bottom with their feet, presumably to disturb their food at the bottom. A man with a *lota* walked to less than 20 yards of a flamingo and squatted, each unmindful of the other.

As we watched, a considerable stream of Common Sandgrouse (*Pterocles exustus*) in twos and small parties of 8 to 10 flew chuckling overhead. On the lake were many Spotbill Duck in pairs, often several together. In the shelter of the reeds I walked to within 20 yards before they rose, the larger drakes quacking while the ducks were silent. There were many Purple Coots (*Porphyrio poliocephalus*) which ran along the shore and flew on to the reeds when disturbed. They settled sideways on the reeds, behaving like gigantic warblers. One bird with a grey head and without the red patch on the crown was apparently a full-fledged young.

The lake also held many Dabchicks (*Podiceps ruficollis*), some Common Coot (*Fulica atra*), a few Whistling Teal, and a single Cotton Teal drake (*Nettapus coromandelianus*). The Coot were a little earlier than the first recorded by Sálim Ali at Bhuj, Kutch (12 August), but Dharmakumarsinhji has taken nests with eggs at Bhavnagar in August.

A single Yellow Bittern (*Ixobrychus sinensis*) flew from one patch of grass into another. A number of large terns were seen settled on the mud in the tidal area. I walked up and most of them, all Gull-billed Terns (*Gelochelidon nilotica*), flew away leaving half-a-dozen birds behind. These when glassed were seen to have brown wings and

large red bills. As they flew away, their long pointed wings confirmed that they were Skimmers (*Rhynchops albicollis*). This species is not included either in Sálim Ali's BIRDS OF KUTCH or in his paper 'The Birds of Gujarat' (*J. Bombay nat. Hist. Soc.* **52** : 374-458, 735-802) but M. K. Himmatsinhji of Kutch saw it in Laija Creek west of Mandvi in August 1957 (*J. Bombay nat. Hist. Soc.* **54** : 190) and Dharmakumarsinhji has several records in his BIRDS OF SAURASHTRA, p. 222. As I returned to the bund to watch the duck and other birds, several parties of 10/15 Skimmers flew leisurely across the lake, some 10 feet above the water.

A single swallow (*Hirundo rustica*) flew past. Though this did not 'produce winter' or even autumn, there can be little doubt that many of these 'winter' visitors arrive much earlier than is generally believed. I was unable to obtain evidence of any of them staying over or breeding in the area, but it was not possible to visit all the islands, nor to be certain that some of the water-birds did not nest there during May, June, and July. If a research scholar were placed on Ajar for the duration of the monsoon, he would undoubtedly get some useful information. Sailing boats are available and, with no need to worry about a tide or two, it should be possible to visit all the islands. The cost would be small but time and effort must be forthcoming. The island of Ajar also appeared to be of just the right size and character to permit a really accurate census of its birds and an assessment of the relations between individuals of the same and different species. Ecological work would also be of almost laboratory convenience and yet under entirely natural conditions.

During the two days we were actually in the field, Pereira worked hard. Three flamingos, two Reef Egrets, and several other birds are not easily skinned in a small and crowded cabin. The Lesser Flamingo is an addition to the Society's collection, no other specimen being available.

The Fisheries Department of the Government of Gujarat was helpful and co-operative, and I must record my thanks and gratitude to them. I am sure that they will extend their co-operation to any person who makes another effort in that direction. If a longer trip is envisaged, it would be worthwhile working together with somebody who can handle the invertebrate fauna of the coral reefs and the mudflats. There appear to be unlimited possibilities in this direction, where almost no work has been done. I would advise that a small boat be kept available—a rubber dinghy may be sufficient. It will permit movement and work during many hours which are otherwise spent waiting for the tide.

Obituaries

B. B. OSMASTON, C.I.E.

We record with regret the death on the 5th September 1961 of Bertram Beresford Osmaston.

Bertram Beresford Osmaston, known to many in India as 'B.B.', was born at Yeldersley Hall, Derbyshire, in 1867, the ninth of a family of fifteen, two of whom survive him. He was educated at Harborne Vicarage Private School, Trent and Cheltenham Colleges, and the Royal India Engineering College at Cooper's Hill, where those entering the Indian Forest Service were trained in those days. Passing in and out the first of his year, he was made a Fellow of the College.

B.B. came out in the Service in 1888, served in the United Provinces (including Dehra Dun Forest College), Bengal, the Andaman Islands, and Burma, and retired as Chief Conservator of the Central Provinces. His meritorious service was acknowledged by Government by the award of the C.I.E.

After retirement he lived with his family for some time at Srinagar in Kashmir, and for the remainder of his life at Oxford.

One of the band of distinguished officers of the Indian Forest Service whose interests covered almost every aspect of Indian natural history, B.B. was primarily an ornithologist and recorded his observations of bird life in several regions of India in numerous papers contributed to the Society's journal.

Not knowing what it was to be afraid, B.B. had more than his share of dangerous encounters with wild animals. The first came at the age of 21, when he had not yet seen a tiger outside a zoo. With Hansard, an equally young companion, he 'stalked' a man-eating tigress in the afternoon, imagining that she would be asleep. Instead, the tigress did the stalking and jumped on Hansard. B.B.'s first shot turned her attention to him and a fortunate shot from his second barrel killed her in the midst of a furious charge.

In 1892, B.B. married Catherine Mary, daughter of General and Mrs. Hutchinson, and they had a long and happy married life till her death in 1960. One son was killed in the First World War. Two sons and three daughters survive.

A list of his contributions to the *Journal* is given below:

On the nidification of certain birds not previously recorded. Vol. **9** : 190.
Birds nesting in the Tons Valley. Vol. **13** : 542.
Curious course taken by the Hyoid Cornua or tongue muscles in certain woodpeckers. Vol. **14** : 587.
Notes on the nidification of some birds, the nests and eggs of which have not been previously described. Vol. **14** : 815.
The Himalayan Nutcracker. Vol. **14** : 818.
The Chestnutheaded Shortwing (*Oligura castaneicoronata*). Vol. **14** : 819.
Notes on the breeding of certain birds near Darjeeling. Vol. **15** : 510.
A visit to Narcondam. Vol. **16** : 620.
Notes on the Andaman Island birds with accounts of the nidification of several species whose nests and eggs have not been hitherto described. Vol. **17** : 156, 486.
Mangroves and Paroquets. Vol. **17** : 240.
A visit to Barren Island, Andamans. Vol. **18** : 357.
Strange behaviour of certain birds when in possession of strong smelling insects. Vol. **19** : 752.
The supply of water to young birds in the nest. Vol. **19** : 753.
The Himalayan Greenfinch (*Hypacanthis spinoides*). Vol. **20** : 852.
Notes on the cuckoos in Maymyo. Vol. **24** : 359.
Nidification of the Green Shrike-Tit (*P. xanthochloris*). Vol. **24** : 593.
Pied Crested Hawk-Cuckoo (*C. jacobinus*). Vol. **24** : 821.
Owl caught on a thorn. Vol. **24** : 822.
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EDITORS

R. F. STONEY

It is with deep regret that the death is recorded of R. F. (Dick) Stoney, an old and valued member of the Society, at Ootacamund on the 27th of August 1963.

Dick Stoney was born at Coonoor in the Nilgiris in 1876 and was educated at Cheltenham College, England. The name Stoney has long been associated with engineering, Dick's father E. W. being at one time the Chief Engineer of the old Madras Railway, whilst the 'Stoney Patent Sluice' may be found on the various River Nile projects. Following this tradition, Dick was posted in 1896 as Executive Engineer, P. W. D., Madras, from which Service he finally retired as Chief Engineer. The most notable of his works are the Mettur Dam and the Observatory at Kodaikanal.

It was always a pleasure to sit in Committee with Stoney, a man of many parts and varied interests, be the subject wild life control, the local library, or any of the many public bodies on whose committees he served. A concise analytical mind, a very dry sense of humour, the gift of Irish ancestry, and a fund of anecdotes always rendered discussion of the driest balance sheet or administrative problem a rare form of relaxation rather than a tedious duty.

Recognised throughout the philatelic world, Stoney was a member of the Indian Philatelic Advisory Committee and a Committee Member of the Philatelic Society of India. At an Exhibition held in connection with the centenary of the Indian Post Office in 1954, he was awarded the President's Gold Medal for the best collection of stamps of the Indian States.

An authority on Indian mythology, he was justifiably proud of his collection of bronzes portraying the many deities and symbolical figures associated with this time-old subject. The collection, worthy of a place in the best of Museums, was not just an accumulation of items gathered at random. The various pieces were the subject of loving care in selection, each with a purpose. To the untutored eye many had a sameness, but it was fascinating indeed to hear unfolded the various aspects of design, ornamentation, purpose, and even manufacture by an undoubted master of his subject. Greater interest was added by the fact that Stoney respected the beliefs which prompted the creation of such objects of beauty.

My personal association with him commenced only some fifteen years ago when, as a newcomer to Ootacamund, I had occasion to seek his guidance, as the local authority, on the chances of obtaining some woodcock and duck shooting. Without stint, I was given the

benefit of years of experience with regard to the best waters and how to tackle them. If woodcock were in the Hills, Stoney knew of it and the location was freely given to me and others and not kept a closely guarded secret. Subsequently, I enjoyed many hours of unforgettable sport in the company of this grand, unselfish, old-timer.

In 1959 Stoney had to have his right leg amputated and, as may be expected of his type, the inability was regarded as tedious but no real detriment to the pursuit of his favourite sport. A special swivel chair was constructed and he continued to shoot the Mysore and Gundalpet tanks right up to his last trip in April 1963, some four months before his death.

We, of a younger generation, feel deeply the passing of such men for, without doubt, we shall never see their like again.

Gentleman, scholar, sportsman, friend, Dick Stoney will be missed by Indians and Europeans of all stations alike.

Stoney leaves a son and a daughter to whom, we of the Society and on behalf of mutual friends offer our sincere condolences.

H.L.T.



Reviews

1. BIRDS OF THE WORLD. By Hans Hvass. Translated into English by Gwynne Vevers. pp. 211 (22.5×16 cm.). Over 1100 birds illustrated in full colour by Wilhelm Eigener. London, 1963. Methuen & Co. Ltd. Price 21*s*.

The earliest known students of bird life are perhaps the neolithic men who painted the Spanish caves over 8000 years ago. From the time of Aristotle onward, this interest in the winged world helped men in interpreting the basic principles of evolution, for birds are extremely sensitive to their surroundings and a comparative study of the birds of the world offers valuable clues to anyone studying the mysteries of speciation.

Hans Hvass's BIRDS OF THE WORLD is a positive step towards a sound understanding of the feathered world. Of about 8600 living species, the book deals with 1100, some common and some rare, drawn from all over the world and from all of the 27 living natural orders. They are split up into some 120 families and arranged from the highest developed species downward. The chapter on each order opens with an account of the general characteristics, number of species, and centres of abundance of the order. This is supplemented by a brief discussion of the range, relationship, and special adaptation of each family. The English and Latin names of the birds along with the total body length in inches of each bird are given. All the birds discussed are illustrated. The text is limited to a few lines on the range and food for most of the species, but more detailed information about the appearance, calls and breeding habits, etc., is provided for some of the lesser-known birds.

The author has given prominence to the birds of Europe and the New World, touching about 200 and 300 species respectively from these regions. Tropical birds are represented by the characteristic species.

The primary object as stated in the foreword is to show the enormous range of form and colour in birds. This is achieved in a simple and efficient manner refreshingly free of many technical terms.

The illustrations generally are good in spite of a tendency of many to look too dark in the reproduction. The usefulness of the book as a field-guide could have been enhanced by bringing more of the habitat into the pictures.

D. N. MATHEW

2. FOREVER FREE : ELSA'S PRIDE. By Joy Adamson. pp. 192 (24×17 cm.). Numerous photographs in colour and black and white. London, 1962. Collins & Harvill Press. Price 30*s*.

BORN FREE told how the lion cub Elsa grew to maturity under the fostering care of the author Joy Adamson and her husband George. LIVING FREE continued the story. Elsa, now living free and mated to a wild lion, brought her cubs to the Adamsons. Thereafter Elsa and her cubs gravitated between the wild and the camp of the Adamsons, Elsa mixing freely with them as before, her cubs living on the fringe with only Jespah reconciled to their presence and the other two fighting shy and at most tolerating them. When FOREVER FREE begins the cubs are a little over a year old and the peace of the 'family' has been disturbed. The African District Council has decided that lions, so used to human company, may become a danger and has directed that they must be removed from the area in which, with the approval of the local authorities, Elsa was released two and a half years before. After a prolonged search George Adamson reported a possible though not very inviting home in the region of Lake Rudolf, which involved the construction of a sixty-mile road to carry the lions there. While the Adamsons were contemplating this possibility and Joy Adamson was prospecting the south for something more suitable, Elsa complicated matters by dying. It now became difficult to keep in touch with the cubs. They wandered and, driven by hunger, attacked the goats of the tribesmen. The Adamsons saved their lives by liberally and frequently compensating the tribesmen, and with immense pains attracted the cubs back to the camp. With Elsa's death the idea of a home in the wild had to be given up, and the Adamsons accepted gladly the offer of a home in the Serengeti National Park. With what patience and perseverance the cubs were captured, how they were transported by road over 700 miles of difficult country, how they were released at Serengeti and found a place to their liking, how for some months the Adamsons fed them with game killed outside the Park, how their continued presence in the Park and their tending of the cubs was forbidden, how Joy Adamson stayed on as an ordinary visitor to watch over the fortunes of the cubs, and how the Adamsons made frantic but unsuccessful efforts to persuade the Park authorities to permit an operation to remove from Jespah's rump a tribesman's arrow-head which remained stuck in it all this time make absorbing

reading. A lover of wildlife and a keen observer, Joy Adamson has much else to tell that is of interest to us. The book is illustrated with beautiful and numerous photographs of the lion cubs and other wild animals.

D.E.R.

3. BEE KEEPING IN INDIA. By Sardar Singh, PH.D. (Cornell). pp. 214 (22×14.5 cm.). New Delhi, 1962. Indian Council of Agricultural Research. Price Rs. 8.

Bee keeping received a great fillip in India when the Village Industries Association gave it a high place among village industries. No doubt bee keeping has been practised in India for a very long time but it was carried on haphazardly by a few in an unorganised manner. A fairly good literature was available on the subject such as Bulletin No. 10 of the Mysore Agricultural Department, 1933, and Miscellaneous Bulletin No. 6 of the Imperial Council of Agricultural Research, New Delhi, 1936. In more recent years the *Indian Bee Journal* published in Ramgarh (U. P.) has been doing very useful work in this field, giving information regarding the latest methods of bee keeping, honey disposal, statistical data, etc. In spite of these and other such books and journals bee keepers often found themselves at a loss, in the midst of their success, by the puzzling behaviour of bees, and because of this one will find bee keeping being given up in villages where it had become very popular a few years back. Yet bee keeping can be a steady and more profitable industry if properly looked after, as shown by the statistics in the book under review. There seems to be good scope for improvement and for increasing one's income through this source in India. Any help in achieving this result should be welcome to the bee keeper.

The author treats the subject fairly thoroughly giving his reader an idea of what the bee is, its general way of life, its temperament, and its whimsicalities. The anatomy and physiology of the insect, the various species of bees available with the temperament of each and their economic values, the castes into which a bee colony is divided, the duties of each caste and how to recognise them from the younger stages to the adult, as treated in this publication are all useful information. Chapters dealing with how to acquire bees, their seasonal

management, and miscellaneous manipulation will help bee keepers in dealing with their difficulties. A bee keeper's knowledge will be incomplete without knowing the enemies and diseases of bees and their combs, how the honey and bees-wax are formed and how they can be gathered and disposed of. All these subjects are treated. Additional knowledge about the usefulness of bees as pollinating agents will make the bee keeper proud that by keeping bees he is helping nature to perpetuate its species. All this information, along with the chapter on bee pasture, consolidated in one place in fairly great detail with appropriate illustrations makes this publication very useful to amateur and professional bee keepers alike. While going through the chapter on pasturage one feels disappointed that the flowering plants and trees that we ordinarily have in our areas are not sufficient to keep the bee colony going throughout the year. The suggestions given at the end of the chapter, however, are heartening and worth trying.

The reviewer, however, would like to suggest a few points for incorporation in the next revised edition, as he feels that they would enhance the usefulness of the book. They are: (*a*) in fig. 13 the worker, drone, and queen cells are not distinguished by any signs or marks: this should be done; (*b*) in figs. 29 and 30 photographs of different appliances and equipment are shown without indicating which is which: they should be pointed out; (*c*) in fig. 80 the stigma is shown by an arrow mark and the explanation on it says 'anthers ready to discharge pollen dust upon waiting stigmatic surface which is sticky when ripe': rather it ought to read 'Stigmatic surface which is sticky when ripe waiting to receive pollen dust from the anthers'; (*d*) a few contradictory statements will have to be rectified, e.g. (i) on page 20 it is said that the differentiation in the workers and queens is not due to quality but quantity fed to the larva and on page 28 a statement says that the composition of food given to the grubs destined to be queens, workers, and drones is somewhat varied; (ii) on page 176 the first paragraph contradicts the views expressed in the last paragraph about honey as food; and (*e*) the scientific names of two insects are misspelt on pages 167, 168, etc.—the 'death's head' moth is *Acherontia* and not *Achrontia* and the praying mantis is *Creoboter* and not *Creobrator* as spelt by the author.

Recently Phadke & Sinha have stated in the *Indian Journal of Entomology*, Vol. 25, p. 86 (March 1963), that the eggs of *Apis indica* Fabr. laid in an artificial comb foundation are nonviable. This factor will have to be studied carefully as a bee keeper has to depend on artificial comb foundations for his hive.

The Appendix at the end of the book is full of very useful informa-

tion. It mentions, with addresses, Indian and foreign (1) bee keeping organisations, (2) bee keeping periodicals and books, (3) bee supply organisations, (4) courses of training in bee keeping, and (5) suppliers of containers for honey.

In short the book serves as a handy reference book for those interested in bee keeping.

The price of only Rs. 8/- is very reasonable.

N.T.N.

4. PROCEEDINGS OF THE SUMMER SCHOOL OF BOTANY—DARJEELING 1960. Edited by P. Maheshwari, B. M. Johri, and I. K. Vasil. pp. viii+522 (23×16 cm.). 8 photographs. New Delhi, 1962. Ministry of Scientific Research & Cultural Affairs, Government of India. Price Rs. 25.

This is a report of the first Summer School in Botany in the series of Summer School meetings in various subjects initiated by the Ministry of Scientific Research & Cultural Affairs, Government of India. The Summer School under review was held at Darjeeling from 2 to 15 June 1960. The inauguration was graced by the presence of the Chief Minister of West Bengal and the Deputy Minister as well as the Joint and Deputy Secretaries of the Government of India, Ministry of Scientific Research & Cultural Affairs. The proceedings as a whole are reviewed here, not the individual papers which are admirably edited by a most capable team of Indian botanists.

The Summer School was directed by Prof. P. Maheshwari and organised by Dr. B. M. Johri. Thirty-six botanists attended, including two foreign delegates, one from the U.S. Embassy, the other a visiting Professor from Argentina. Almost the whole of India was represented, four delegates from Delhi University (including the Director and the organiser), three each from the Botanical Survey of India and Andhra and Utkal universities, two from Madras, and one each from the universities of Agra, Allahabad, Bombay, Calcutta, Gauhati, Gorakhpur, Gujarat, Karnatak, Kerala, Lucknow, Mysore, Patna, Poona, Punjab, Rajasthan, Saugor, Sri Venkateshwar, and Vallabh Vidyapeeth. The Indian Botanical Garden, Sibpur, was also represented. Institutions like the Indian Botanical Society, the Botanical Society of Bengal, Bombay Natural History Society, the National Botanical Garden, Indian Agricultural Research Institute, and Birbal Sahni Institute of Palaeobotany were not officially represented.

The delegates who attended sacrificed their vacations for the stimulating but heavy work of lecturing and discussing, presumably as

guests of the Government of India. They stayed in the same hotel which allowed them 'long informal and group discussions which were very helpful'. According to the programme given in Appendix II, there were 59 talks, 3 film shows, 3 excursions, 1 at-home (Governor's), and 1 dinner (farewell), and 7 hours of special discussions. By any standard, this is an achievement which speaks very highly of the organising talent of those who were in charge. This publication is another proof of the tremendous amount of work involved. In all 48 papers and one report of the discussions (Appendix III) have been published. Of the 11 which were not published, 6 were after-dinner talks. The papers on tissue culture and embryology stand out by their brilliance, and those on algae and micro-organisms by the ingenuity and the scope of application of the scientific principles involved. All the other papers, embracing various topics in plant-physiology, anatomy, ecology, geography, viruses, cytology, genetics, systematics and morphology of angiosperms, pteridophytes, fossils, etc., are well written and more or less represent the current trends of botanical research in India.

Some of the papers took as much as two hours and two instal-ments, and at times there were as many as nine papers or talks a day. No wonder 'coffee' figures as a separate item in the programme. Barring the two Sundays, this stimulant was consumed on eleven of the twelve working days; curiously, it was not needed after the talk on 'Botanical Nomenclature'! Although a tea estate (Happy Valley) was visited, there is no evidence of tea consumption by the botanists —perhaps by its sheer abundance it did not call for special mention!

Eleven senior botanists graced the chair, several of them more than once except the seniormost (the Director), who never accepted this honour!

The serious student of botany feels very happy to go through these very valuable papers but sadly misses the most interesting dis-courses that followed the reading. The majority of such reports from abroad are accompanied by lively (and duly edited) post-mortems. The views and sentiments expressed as a result of two days of solid discussions concerning teaching and research in Botany in India are admirable. One would have liked to know if effective machinery was established to bring these laudable objectives to fruition. The delegates seem to have noted several institutions in the U. K. and Germany dedicated to research in plant physiology, genetics, mycology, etc., but they failed to take note of the applied aspects of the research programmes undertaken there and of the innumerable short courses in applied botany such as in horticulture, plant protection, forestry,

conservation, quality control of vegetable produce, etc., that would in effect promote the employment potential and attract better talent to take up the study of Botany.

This reviewer agrees with the delegates that the Darjeeling Summer School stimulated interest in the work of delegates who attended. It therefore served its purpose very admirably. It is earnestly hoped that the subsequent reports of the Summer Schools in Botany will be similarly published for the benefit of those who cannot be invited. It may even be a good idea if these meetings can be thrown open to the 'unprivileged', at their own expense, to attend as observers, without being allowed to participate in the proceedings.

P. V. BOLE

5. THE ASCLEPIADACEAE & PERIPLOCACEAE OF BOMBAY. By H. Santapau and N. A. Irani. pp. iv+118 (24.5×16.5 cm.). 12 plates. Bombay, 1960. University of Bombay. Botanical Memoir No. 4. Price Rs 7.

This is an excellent little publication that gives a short sketch of this group of plants since its inception in '*Pentandria monogyna* and *P. digyna*' of Linnaeus to the present-day concept. It gives the synopsis of the record of this group in the region under survey, viz. the former Presidency of Bombay which included parts of the present States of Gujarat and Mysore. It also gives a brief account of the economic uses of a few of these plants as recorded in literature.

The main part of the publication consists of carefully drawn diagnostic characters with appropriate comments about 25 genera of the Asclepiadaceae and 3 of the Periplocaceae. The specific descriptions of 61 taxa are very critical and are based on literature study as well as on careful analyses of the plants in the field and the laboratory. All the data given in the book are authentic as they are derived from personal observation and based on examinations of collections from various herbaria, a list of which is appended under each species. In most cases, critical notes regarding nomenclature, description, and uses are also included with appropriate references.

The keys to genera and species are artificial and are meant to assist the systematist to arrive at the correct identity of the taxa of this difficult group of plants. Line drawings of 12 species, executed to scale, are highly commendable. It seems a great pity that all the 61 taxa could not be represented by diagrams, perhaps in consideration of the high cost of printing.

This is a very ideally executed project in systematic Botany as a partial revision (in preparation to a complete revision) as stated by the authors. It has certainly brought our knowledge of this group of plants up to date. A more complete and broad-based revision could be best achieved by compiling such limited revisions of various botanical or geographical areas. It is often thought that partial revisions are not wise to undertake (hazardous to reputation!) on account of their intrinsic limitations. It is also said that full facilities and the required critical materials may not be available at university level. However, as long as these limitations are recognised and appreciated, it is safe to take up this type of project. Many young workers can be trained in methods of plant taxonomy and many significant facts can accrue out of repeated field studies on smaller numbers of species in limited areas. This publication is an eminent example of such efforts and is worthy of emulation by other workers in different parts of India. Data brought out in such studies form a good basis for further work in the field of morphological, ecological, physiological, and genetical studies. It can also be added that such studies will play an important role in evolving quantitative surveys of plant species if and when necessary.

The senior author and his students have carried out similar studies of several other families, notably Apocynaceae, Convolvulaceae, Solanaceae, Rubiaceae, and Verbenaceae. Many of the plants of these families are proved to be of economic value and the others may have potential interest in view of the gradual realisation of the relationship of plant taxonomy and chemical constituents. It is earnestly hoped that all this work will also be published by the University of Bombay. Such studies are no doubt a great service to the cause of science and the utilisation of national wealth. Both the authors and the publishers deserve our thanks for bringing out this excellent little book.

P. V. BOLE

6. NAMING THE LIVING WORLD : AN INTRODUCTION TO THE PRINCIPLES OF BIOLOGICAL NOMENCLATURE. By Theodore Savory. pp. xiii+128 (22×14 cm.). London, 1962. The English Universities Press Ltd. Price 12*s.* 6*d.*

One of the primary requisites for a student of biology is at least a basic knowledge of the principles of nomenclature, a subject, as the author rightly states, so often overlooked by authors of biology text books. Many mistakes which editors so frequently come across in notes

on taxonomy could have been avoided if the authors had an adequate knowledge of these principles. This need is fulfilled comprehensively by this small and well-written book.

The three sections of the book cover the principles of Nomenclature, Codes of Nomenclature, and Practice of Nomenclature. In the first section are described the need for names, the languages in use, the nature of the names in use, and the methods for forming new names. The second section describes the rules of nomenclature and the codes of several disciplines of biology. The third section describes the mistakes to be avoided, and the methods to be used in the practice of nomenclature.

Taxonomists would do well to refresh their memory occasionally with a reading of the last section of the final chapter describing the 'Essentials of a Code'.

A book which should find a place in the libraries of all institutions teaching and doing research in Biology.

J.C.D.

Miscellaneous Notes

1. NOTE ON THE BREEDING SEASON OF *RHINOPOMA HARDWICKEI* GRAY

Little is known about the breeding of the bat *Rhinopoma hardwickei* Gray in India. Brosset (*J. Bombay nat. Hist. Soc.*, 1962, **59** : 27) says of this species: 'No young were seen in October, November, December, February, March or April. Females dissected in March or April had no fœtuses . . . From these negative observations we can infer that pregnancy and birth takes place between the end of April and the end of September, June being the time of parturition. The existence of young obviously born in June, in the B. N. H. S. collections, supports this deduction. Reproduction, however, appears to be very restricted.'

In view of the scarcity of information about the breeding of this species, it seems worthwhile to record the following observations.

There is a colony of *Rhinopoma hardwickei* in a cave on a hill just outside Vellore, North Arcot District. On the 1st July 1963, 25 specimens were captured from this colony in a mist net. Of these 17 were adults, 12 females and 5 males, and 8 were young, 3 females and 5 males. The eight young were roughly one-third to one-half the size of the adults and were clinging to their mothers in an inverted position. On a previous occasion, in December 1962, 7 individuals were captured, 5 females and 2 males. None of the females was carrying young on this occasion. Brosset's assumption that parturition takes place in or about June is therefore supported for this part of the country at least.

R. REUBEN

VELLORE FIELD STATION OF THE
VIRUS RESEARCH CENTRE, POONA,
CHRISTIAN MEDICAL COLLEGE HOSPITAL,
VELLORE,
November 13, 1963.

2. BAT *MEGADERMA LYRA* GEOFFROY CAUGHT IN A *ZIZYPHUS* BUSH

In May 1962 I was looking for bears along a rocky hill-side in the Wamanpalli Forest Block, Central Chanda Division, Maharashtra. I was accompanied by Humayun Abdulali and two men, and our tactics

were to work along rocky hill faces searching for caves and hollows where bears might be lying up in refuge from the extreme afternoon heat. Any likely caves or hollows were stoned in hopes of flushing a bear. The hill-sides were excessively hot, uncomfortable, and thorny. At the entrance of one low horizontal cave we saw a bat (*Megaderma lyra* Geoffroy) whose wings were caught on the curved thorns of a small bush of *Zizyphus* sp. about two feet above ground level.

THE BRITISH COUNCIL,
21, JOR BAGH,
NEW DELHI 3,
June 25, 1963.

JOHN GOATLY

[Among other prey this species feeds on terrestrial vertebrates and its hunting flight is low 'almost touching the ground' (A. Brosset, 1962, *J. Bombay nat. Hist. Soc.* **59** : 591). This may explain how this bat got caught in the bush. It is interesting to note in some parts of India bats are caught by suddenly thrusting into their roosting places sticks with *Zizyphus* twigs tied on them. G. M. Allen (1939, BATS, p. 291) says that several cases are on record of bats perishing by flying too close to the hooked burrs of burdocks and getting hopelessly entangled in them.—EDS.]

3. OCCURRENCE OF THE EUROPEAN FREETAIED BAT [*TADARIDA TENIOTIS* (RAFINESQUE)] (CHIROPTERA: MOLOSSIDAE) IN INDIA

Previous records of the molossid genus *Tadarida* from the Indian sub-continent refer only to *T. aegyptiaca*, *T. tragata*, and *T. plicata*. Through the courtesy of Mr. J. C. Daniel, Curator, Bombay Natural History Society, I am able to report the occurrence of *T. teniotis* (Rafinesque) in India. The specimen on which this report is based was obtained by Brother A. Navarro, S.J., of St. Xavier's High School, Bombay, at Kurseong, Darjeeling District, at an altitude of 5454 ft., on 10 March 1963, and will remain in the possession of the Bombay Natural History Society. Mr. J. C. Daniel considered that this specimen represented *T. teniotis*, but in the absence of comparative material submitted it to the British Museum (Natural History) for further examination, which has confirmed this identification. This species differs from *T. aegyptiaca*, *T. tragata*, and *T. plicata* in greater size, with the forearm 57-64

mm. in length [Lewis & Harrison, 1962 : 479 (in part)] : in *T. aegyptiaca*, the largest of the species hitherto recorded, the length of the forearm does not exceed 54 mm. (Siddiqi, 1961 : 118; Hill, 1961 : 36; Brosset, 1962 : 707). It may be distinguished from *T. aegyptiaca* and *T. plicata* by the usual presence of six and not four lower incisors, although occasionally one or both members of the outer pair may be absent. The anterior upper premolar (pm^2) in *T. teniotis* is comparatively large and is situated more nearly in the line of the tooth row than is the small anterior upper premolar of *T. aegyptiaca*. The palatal branches of the premaxillae are absent in *T. teniotis* and the palate conspicuously emarginated anteriorly while in *T. plicata* the palatal branches of the premaxillae are present and the palate has no conspicuous anterior emargination. In the details of its dentition *T. teniotis* resembles *T. tragata*, which on this account was referred by Wroughton (1919 : 731) to a *teniotis* section of *Tadarida* distinct from an *aegyptiaca* section and which was thought by Hill (1961 : 35) to be possibly related to *T. teniotis*. However, from the measurements given by Dobson (1876 : 181; 1877 : 721; 1878 : 424) and as represented in the collections of the British Museum (Natural History) by the specimen listed from the Malabar coast by Dobson (1878 : 425), *T. tragata* is considerably smaller than *T. teniotis*, with a forearm approximately 50 mm. in length (from Dobson). Assessment of the affinities of *T. tragata* requires further study of the type specimen and of the other specimens listed by Dobson (1874 : 143) in the original description, all preserved in the Indian Museum, Calcutta.

It is difficult to allocate the Indian specimen to any one of the currently accepted subspecies of *T. teniotis*. Although known from a number of localities in southern Europe, Egypt, south-western Asia, and the Far East, records from the central part of this wide range are few. The nominate subspecies *T. t. teniotis* (Rafinesque) is found in southern Europe and according to Ellerman & Morrison-Scott (1951 : 134) extends to the Caucasus and Turkestan, although Kuzyakin (1944 : 108) made no subspecific allocation of central Asian specimens. The slightly paler and greyer subspecies *T. t. rueppelli* (Temminck) occurs in Egypt and south-western Asia (Lewis & Harrison, 1962 : 476). A very dark subspecies, *T. t. coecata* Thomas is known from Yunnan, while the dark subspecies *T. t. insignis* (Blyth) occurs in eastern China, Korea, and Japan and has been quoted from as far north as Vladivostok (Satunin, 1914 : 44). Dorsally, the Indian specimen is brownish and is similar to *T. t. teniotis* or to *T. t. insignis*. Ventrally, however, it lacks the brownish tinge evident in these subspecies and is paler and more greyish, in this respect resembling *T. t. rueppelli* but slightly

darker. It is much lighter in colour both dorsally and ventrally than the type specimen of *T. t. coecata* and it seems evident that determination of the subspecific status of *T. teniotis* in the Indian sub-continent must await the advent of adequate series of specimens. Measurements (in mm.) of the Indian specimen (the skull has been damaged and the entire base of the braincase is missing): length of forearm 64, interorbital width 4.9, m^3-m^3 (outside alveoli) 9.5, c^1-c^1 (outside alveoli) 5.9, c-m^3 (alveoli) 8.8.

DEPARTMENT OF ZOOLOGY,
BRITISH MUSEUM (NAT. HIST.),
CROMWELL ROAD,
LONDON, S. W. 7,
November 19, 1963.

J. E. HILL

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4. DO GOATS EAT CRABS ?

The Andaman and Nicobar Islands are noted for the paucity of indigenous mammalian life and, barring the native pig, no other large mammals are known to occur there. Therefore, when these islands caught the eye of civilisation, man tried to fill the faunal lacuna left by Nature! New creatures were introduced for food and fun. Among the wild animals introduced in these islands, the most important is the spotted deer, a few of which released over a hundred years ago have

now multiplied to such an extent as to be a nuisance to cultivation and forestry. The spotted deer is now a pest in the Andamans as much as the rabbit in Australia.

More interesting, however, is the domestic goat, small herds of which were left on Barren Island, a volcanic island about 50 miles east of the main group, and other tiny isolated islands in the Duncan Passage. These islands do not have any permanent source of fresh water, and have little vegetation to support the goats, with the result (it is said) that their dietary habits are considerably modified.

The goats left on these islands, it is stated by the inhabitants of Port Blair, have taken to drinking sea-water, and a friend informs me that the flesh of these goats tastes different from that of the fresh-water-drinking goats. It is further alleged that the goats of Barren Island, which was active till the beginning of the present century, eat crabs! The crab-eating trait of these goats, if confirmed by authentic evidence, should prove of great biological interest.

Changes in the dietary habits of animals occur frequently in nature. Literature is full of instances (mostly of insects) of such changes. Thus, most of the dangerous insect pests of cultivated plants originate through changes in food preferences of formerly harmless species. E. Mayr (1942, SYSTEMATICS AND ORIGIN OF NEW SPECIES, p. 209) cites the case of an English willow bug (*Plesiocoris rugicollis*) which turned to apples in 1918 and has become a serious pest. Sometimes the introduction of a new faunal element in an area affects the dietary habits of some of the original inhabitants of that area. The case of New Zealand Parrot, the Kea (*Nestor notabilis*), is famous in this connection. This species fed largely on insects and vegetable matter before the island was colonised by the Europeans. After sheep had been introduced in the island, the Kea developed a taste for their meat by feeding on dead sheep. Later, it began to attack live animals.

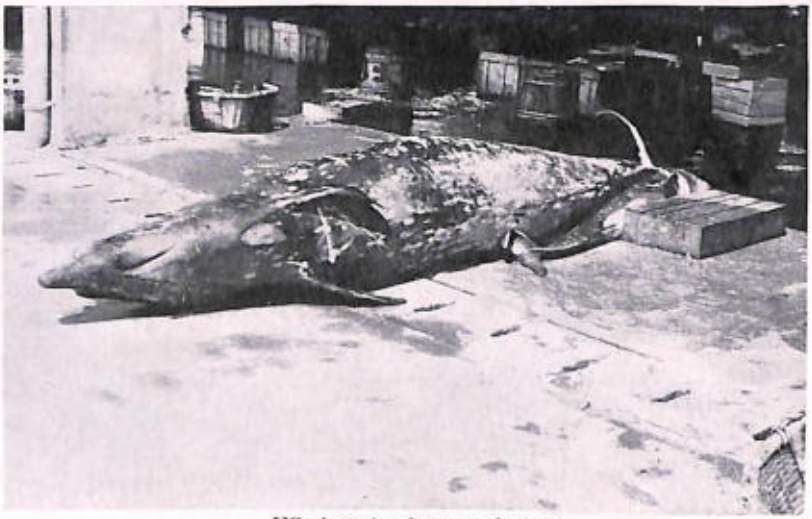
More interesting, in the present context, is the case of the Spotted Deer (*Axis axis*) in the Sunderbans feeding on crabs (*Uca* sp?) cited by J. K. Stanford (1951, Crab-eating Chital. *J. Bombay nat. Hist. Soc.* **50** : 398-9). It should not, therefore, be surprising if under force of circumstances, the goats of Barren Island, have modified their dietary habits to include crabs also on their menu!

Any light on the food habits of these goats, based on direct observation, will be very welcome.

ZOOLOGICAL SURVEY OF INDIA,
CALCUTTA 12,
March 15, 1963.

K. K. TIWARI

Mesoplodon densirostris (Blainville), adult male

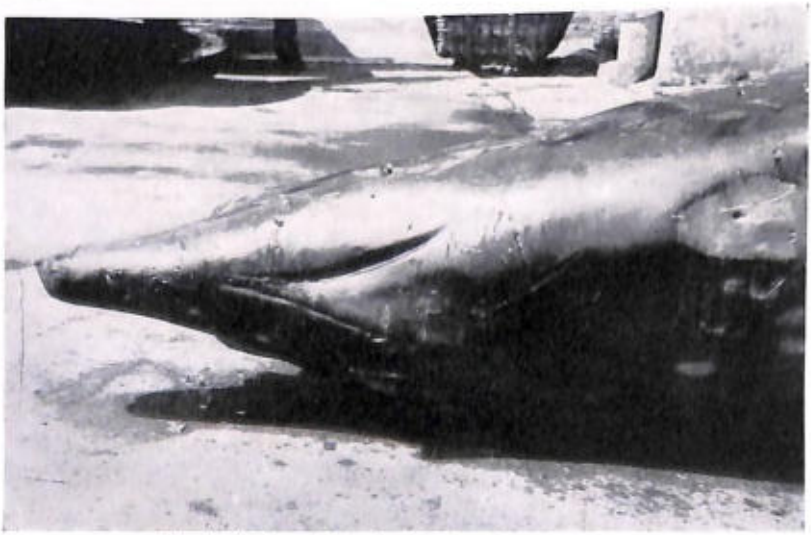


Whole animal, ventral view.



Dorsal view. Note the enormous dental eminences and teeth.

Photos :
Courtesy Yaichiro Okada



Ventral view. Note the V-shaped gular groove.

[B. B. Osmaston (1907, A Visit to Barren Island in the Andamans, *J. Bombay nat. Hist. Soc.* **18** : 357-9) recorded that goats on Barren Island drink salt water, and William Beebe (1947, BOOK OF BAYS) speaks of goats on Guadalupe Island that drink sea-water and eat kelp exposed at low tide. In this connection reference may also be made to Dr. Alain Bombard who, in his lone venture across the Atlantic, sustained life for two months on sea-water (not more than one and a half pints per day), plankton collected with a small net trailed behind his craft, and such fish as he caught from time to time (1956, Alain Bombard: THE BOMBARD STORY. Penguin Books).—EDS.]

5. OCCURRENCE OF BLAINVILLE'S BEAKED-WHALE [*MESOPLODON DENSIROSTRIS* (BLAINVILLE)] IN THE INDIAN OCEAN[1]

(With one plate and two text-figures)

Dr. Yaichiro Okada, Director of the Fisheries Research Laboratory, Tokai University, Shizuako, Japan, sent me some photographs of a beaked-whale for determination. The specimen had been caught about the middle of June 1963 in the Indian Ocean, in the vicinity of the Seychelle Islands, 5° S.×65° E., by one of the Japanese Tuna fleets of the Faiyo Fishing Company operating in the Indian Ocean.

The photographs clearly indicated that the specimen was an example of an adult male Blainville's Beaked-Whale, *Mesoplodon densirostris* (Blainville), one of the least recorded members of the genus. Unfortunately, the specimen was cut up for food, but the photographs leave no doubt of its identity.

Mesoplodon densirostris is one of the rarer species of the genus *Mesoplodon*; only twelve or thirteen specimens have been recorded since it was first described in 1817, and that from a mere fragment of the rostrum measuring only 225 mm., without locality. This, the type, is in the Paris Museum. In addition, a skull obtained in the Seychelle Islands in 1839 is also in the same museum.

The majority of the known specimens have been recorded from the Atlantic coasts of North America, including Canada. One stranded in eastern Australian waters (Queensland) and another on Lord Howe Island. Three specimens have been recorded from South Africa.

[1] The author is engaged on a revision of the genus *Mesoplodon*.

Blanford (1888-91 : 573) recorded no Ziphioids as definitely occurring wthin the limits of his FAUNA, but suggested the possible occurrence of *Ziphius cavirostris* Cuvier and *Mesoplodon densirostris* (Blainville) in India Seas. The former ranges very widely and has been caught or stranded in widely separated parts of the world, between the northern and southern tropics.

The Ziphiidae comprise a family of smaller whales, *Ziphius*, *Hyperoödon*, *Mesoplodon*, *Berardius*, and *Tasmacetus*. With the exception of *Tasmacetus*, the other four genera have one (*Ziphius*, *Hyperoödon*, and *Mesoplodon*) or two (*Berardius*) pairs of large mandibular teeth only, situated either at the extremity of the rami (one in each) or at some distance behind the tip, near or at the posterior union of the mandibular symphysis. With the exception of *Berardius*, the males alone erupt these mandibular teeth. The shape of the teeth is characteristic of the species. These functional teeth of the males are used as weapons of offence or defence in much the same manner as a boar uses its tusks. The males fight much among themselves and, at times, inflict severe linear scars on each other. In the females the corresponding teeth are present in the alveoli but are

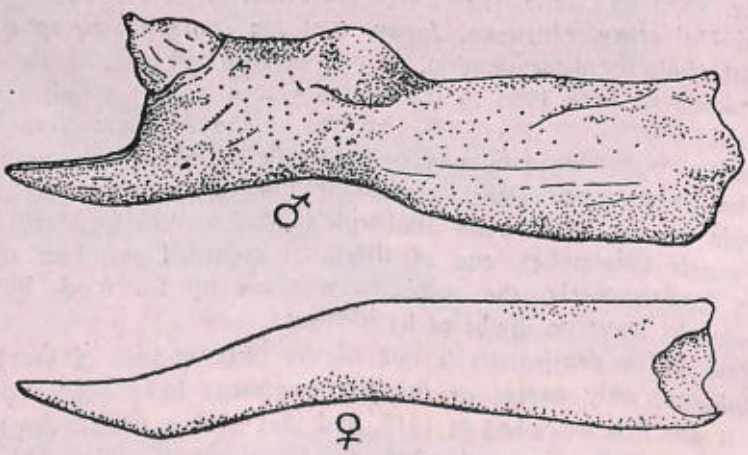


Fig. 1. Rami of *Mesoplodon densirostris* (Blainville)
Top : male ; bottom : female

normally not erupted. Because of the close similarity in external form the females of *Mesoplodon* are sometimes difficult to determine correctly, when in the flesh.

In the genera *Ziphius*, *Hyperoödon*, and *Tasmacetus* the teeth are circular or ellipsoid in transverse section but in *Mesoplodon* and *Berardius* the teeth are strongly, laterally compressed. In *Tasmacetus*

functional teeth are present in both jaws. Rudimentary teeth occasionally occur in some of the genera, but they are normally not socketed in alveoli.

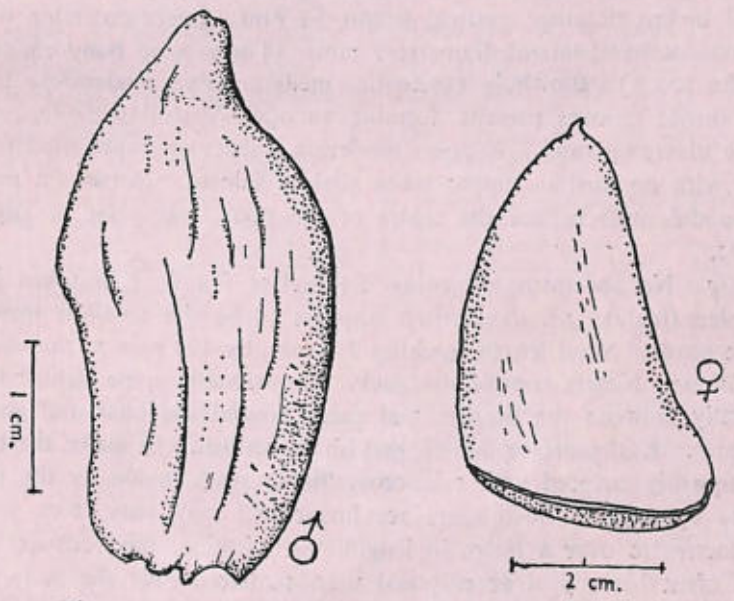


Fig. 2. Teeth of *Mesoplodon densirostris* (Blainville)
Left : male ; Right : female

The genus *Mesoplodon* comprises eight species not exceeding 6 metres (20 ft.). Some are confined to the Northern Hemisphere while others are restricted to the Southern Hemisphere, but occasionally one or the other of the species may be found a long way from its known territorial waters. Very little is known of the habits and movements of the various species. Of all the species *M. densirostris* appears to visit intertropical waters more frequently than do any of the others.

Blainville's Beaked-Whale. *Mesoplodon densirostris* (Blainv.)

Delphinus densirostris Blainville, 1817, Nouv. Dict. Hist. Nat., 2nd ed., **9** : 178. (Type loc. unknown.)

Mesoplodon densirostris Flower, 1872, *Trans. Zool. Soc. Lond.* **8** : 11.

Description. Head and body fusiform, deepest in the middle, strongly compressed caudally. Head moderate, not well defined by a nuchal depression; rostrum prominent, subacute, posteriorly concealed in lateral view between the dental eminences of the mandibles carrying the teeth; mandible slightly longer than the rostrum. Mandibular teeth in male large, attaining a vertical height of 150 mm., antero-

posterior width 85 mm. and a lateral diameter of 44 mm., teeth obliquely ovate-lanceolate in shape, with furrows and striae on the lateral faces; obliquely set in the jaw with the apex directed forwards. In the female, teeth unerupted, somewhat ligulate in shape with a minute apical mucro or cusp; vertical height 54 mm., antero-posterior width 30 mm., at base; lateral diameter 7 mm. (There is no bony eminence for the tooth.) Blowhole crescentic, median. Eye moderately large. Two throat grooves present, forming an open V, following the angle of the diverging rami. Flippers moderate, subacute; flukes moderately large with no median notch; lobes slightly falcate. Dorsal fin nearer the caudal, well behind the centre of the body, triangular or slightly falcate.

Size. No specimen exceeding 4.4 metres (14 ft. 8 in.) has been recorded (male). *M. densirostris* appears to be the smallest member of the genus. Skull length reaching 770 mm. by 494 mm. at the widest.

Colour. Nearly completely black. Occasionally some lighter spots ventrally between the flippers and paler around the anal and genital openings. Undersurface lighter, greyish or whitish. In males the body is frequently covered with criss-cross 'battle scars' made by the teeth of the opponents. Such scars are linear and may vary from a few centimetres to over a metre in length. In addition, the body of both sexes often bears oval or elliptical scars scattered over the body, but particularly in the vicinity of the vent. These scars are often caused by parasitic and epizoic animals. However, it must be remembered that the colour of cetaceans alters very rapidly after stranding and the skin turns black.

ACKNOWLEDGEMENTS

I wish to express my thanks to Dr. Y. Okada for his kind permission to reproduce the photographs accompanying this article.

17, CLARKE STREET,
KHANDALLAH,
WELLINGTON N. 5,
NEW ZEALAND,
November 18, 1963.

CHARLES McCANN

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6. OCCURRENCE OF THE WHITERUMPED SWIFT [*APUS PACIFICUS* (LATHAM)] AT HINGOLGADH, JASDAN, GUJARAT

On 25 August 1963 while watching the small flock of House Swifts (*Apus affinis*) which are always wheeling about this ancient fort on a hill which is over a 1000 feet high and rises out conspicuously from the surrounding low hills and plain, I saw a single Whiterumped Swift. This bird wheeled about at great speed for a few minutes before disappearing again. I can trace no previous record of its occurrence in Gujarat.

THE PALACE,
JASDAN,
August 27, 1963.

YUVRAJ SHIVRAJKUMAR

7. OCCURRENCE OF THE LARGE WHITERUMPED SWIFT [*APUS PACIFICUS LEUCONYX* (BLYTH)] IN BOMBAY

On 11 November 1957, Bombay city was threatened by a storm which failed to show up, but two swifts *Apus pacificus* and *Apus affinis* were blown into houses facing the sea at Walkeshwar and Colaba respectively. The Regional Meteorological Centre stated that the storm initially formed as a depression in the south-east Arabian Sea and moved in a north-north-easterly direction. The birds were sent to Br. A. Navarro of St. Xavier's High School, who in his turn

forwarded them to the Bombay Natural History Society for subspecific identification. Both the birds were new to Bombay and, owing to lack of suitable material here, were sent to the British Museum (Natural History) where Mr. J. C. Macdonald identified the former as *Apus pacificus leuconyx* (Blyth). Though Ripley (SYNOPSIS : 210) refers to the occurrence of this race 'south in winter to Bombay, Hyderabad, Kanara, Malabar (once) and possibly Madras', it may be worthwhile drawing attention to the fact that no one appears to have recorded it in peninsular India after Davidson (1898, *J. Bombay nat. Hist. Soc.* **12** : 47-48) who said 'this is the common Kanara swift . . . . it appears in large flocks occasionally at Karwar during the rains and all along the coast it may be found in the cold weather'.

With the recognition of *kanoi* (Yamashina) in 1942, we have no specimen from India or Burma in the Bombay collection which can be said to be typical *pacificus*, which according to Deignan (1956, *Bull. Raffles Museum* **27** : 147-148) has a white rump averaging 20 mm. in breadth. Perhaps, it may be worthwhile ascertaining if typical *pacificus* has a place in the Indian avifauna. Dr. Charles Vaurie in a letter dated 27 March 1962 very kindly gave me the following wing measurements which may be worth recording.

10 males of *leuconyx*: 155-171, avg. 158.5 mm.

10 males of *kanoi*: 176-188, avg. 181.6 mm.

The present specimen B.N.H.S. No. 20055 is a female with the wing measuring 158 mm. and the white of the rump 13 mm. broad. In spite of the name the claws are not white.

Mr. Macdonald was unable to identify the other swift racially, but I have had opportunity of comparing it with fresh material and a separate note on the races of *Apus affinis* is under preparation.

I must draw attention to the paucity of bird skins available for comparison and work in Bombay. While our collection is among the best in the country, it is not sufficiently representative and large gaps become apparent as soon as one attempts subspecific identification. Regional collections were made either by the Society or with its collaboration during the pre-war years, but the taxonomic work was carried out abroad and the type specimens and others of particular interest were retained by the workers or by the British Museum. I have no statistical information but have gained the impression that many of the key specimens referred to in relevant literature are not available here. The last word regarding the taxonomy of Indian birds has not yet been said and I hope it will be possible, with the assistance of members resident in different parts of the country, to build up a really representative collection within a reasonable time so that the

racial differences, at least of the forms resident in India, can be satisfactorily studied and finalised here.

MESSRS. FAIZ & CO.,
75, ABDUL REHMAN STREET, HUMAYUN ABDULALI
BOMBAY 3,
September 4, 1963.

[In the BOMBAY GAZETTEER, 1880, at page 97, *Cypsellus leuconyx* is included as a doubtful entry in Captain E. A. Butler's 'A catalogue of the birds of the southern portion of the Bombay Presidency'.—EDS.]

8. OCCURRENCE OF THE BLACKCAPPED KINGFISHER [*HALCYON PILEATA* (BODDAERT)] NEAR MADURAI, MADRAS STATE

Unfortunately the trees in and around the tank at Uthamapalayam were felled this year and the Blackcapped Kingfishers which were observed there in 1961 [vide my note in Vol. **59** (2) of the *Journal*, August 1961] appear to have left the place.

However I have further observations of this species to report:

(*a*) On 23 December 1962 I observed a single bird at a tank near the village of Yelangapatti not far from Madurai, Madras State.

(*b*) On 27 April 1963 I saw a pair in a deserted well-wooded creek on the upper reaches of the Periyar Lake, Kerala State. I could not ascertain if these birds were nesting in the area but as the place where I saw them is very secluded there is hope that they may become resident there.

Yelangapatti must be at least 80 miles from the nearest sea coast on the east and still further on the west, and Periyar Lake is approximately 60 miles from the Kerala coast line. The occurrence of these birds so far inland would seem to be very unusual.

PAMBANAR ESTATE,
PEERMADE P. O., M. C. A. JACKSON
KERALA STATE,
SOUTH INDIA,
June 28, 1963.

[There are several records of the occurrence of the Blackcapped Kingfisher far inland. It has so far been recorded in south India from Coimbatore, Cumbum Valley (Madras State). and as nesting at Gersoppa (Mysore) and in Travancore.—EDS.]

9. RE-APPEARANCES OF THE HAIRCRESTED, OR SPANGLED, DRONGO [*DICRURUS HOTTENTOTTUS* (LINNAEUS)] IN KUTCH

I have been watching with great interest the more or less regular appearances of *Dicrurus hottentottus* (Linnaeus) in Kutch during the last few years. Since I collected the first bird on December 29, 1956 [*J. Bombay nat. Hist. Soc.* **55** (3) : 575] I have come across the Haircrested Drongo on 25 December 1958 and 30 January 1959, and in December 1961 and January 1962. I have toured the whole district off and on during the last four years but curiously enough I have not come across this bird anywhere except at Mandvi. While on a visit to Mandvi from 24 December 1962 to 7 January 1963 I once again saw my old friends. At first I saw only two birds on 24 December from the back verandah of Vijaya Vilas Palace, but later on when I went into the garden to have a closer look at them I saw one more bird and noticed that all the three more or less kept together. During the whole of my stay at Mandvi I heard them calling and saw them practically every day; but they were absent when I went there again in the middle of February.

JUBILEE GROUND,
BHUJ, KUTCH,
October 20, 1963.

M. K. HIMMATSINHJI
Member of Parliament (*Lok Sabha*)

10. ANGRY BEHAVIOUR OF HOUSE CROW *CORVUS SPLENDENS* VIEILLOT

I work in an office in a street just off Sir Pherozeshah Mehta Road. A few days ago, when I was relaxing on the terrace, a house crow (*Corvus splendens* Vieillot) alighted on the parapet. The bird was very agitated, and was cawing loudly. The reason was evidently the feather that had been passed through its nostrils by some practical joker. For some minutes the crow fluttered up and down, trying to wipe off the feather against the edge of the expanding metal awning over my head. It then tried the metal supports of the awning, where two strips of metal came together, and soon managed to get the feather caught in the chink between them and so drew it out. It proceeded to make a determined attack on the feather. For some time, continuing its frenzied cawing, it worried the feather, trying repeatedly to push it back into the chink, dropping it and catching it as it fell—almost as if it wanted to punish the feather. At last

an irate peon rushed out and drove away the crow, but its outraged voice was heard for a long while afterwards, from the tops of neighbouring buildings.

49, PALI HILL,
BANDRA, BOMBAY 50, IRA REUBEN
August 9, 1963.

11. OCCURRENCE OF THE BLACKHEADED CUCKOO-SHRIKE [*CORACINA MELANOPTERA* (RÜPPELL)] IN KUTCH

While out on my usual round of bird watching in the grounds of Vijaya Vilas Palace, Mandvi, on 4 April 1963, I came across a male Blackheaded Cuckoo-shrike [*Coracina melanoptera* (Rüppell)]. I observed him for quite some while in the *jamun*, mango, and other trees in the garden. During the period I watched him, he gave me the opportunity of studying his typical undulating flight more than once. I had seen this bird in the same place during the cold weather of 1962-63, but was able to catch a mere fleeting glimpse and hence a definite identification was not possible then. Unfortunately, I did not record the date, but it was seen during my stay at Mandvi between 24 December 1962 and 7 January 1963.

The Blackheaded Cuckoo-shrike is found in many places in India, including Gujarat, but according to R. S. Dharmakumarsinhji (BIRDS OF SAURASHTRA) it is uncommon in Saurashtra. In view of the fact that this bird has been neither seen nor mentioned by Dr. Sálim Ali, Capt. Lester, or any other ornithologist, my sight record can be considered a very rare occurrence of this bird in Kutch. It is easy to miss this bird owing to its habit of keeping absolutely silent and also because of its preference for remaining in the thick foliage of trees.

I might also mention here the Whitebrowed Fantail Flycatcher (*Rhipidura aureola* Lesson) which I saw at a village called Rav near Rapar on 3 February 1962. This bird also seems to be a very rare cold weather visitor to Kutch. Lester mentions it, but the Sálim Ali Survey did not meet with it and this was the first time I came across the bird in Kutch.

JUBILEE GROUND,
BHUJ, KUTCH, M. K. HIMMATSINHJI
October 11, 1963. *Member of Parliament (Lok Sabha)*

12. RECOVERY OF RINGED BIRDS

Ring No.	Species	Date of Ringing	Place of Ringing	Recovered on	c covery	Remarks
A—992	*Emberiza melanocephala*	26.9.1959*	Changalra, Bhuj, Kutch (*c.* 23° 18′ N., 69° 43′ E.)	Found dead, 26.5.1961	Temizkhbekshaia, Kavkazskaia Dist., Krasnodar (*c.* 45° 30′ N., 40° 45′ E.), *c.* 3730 km. NW. of Kutch	Reported by the Bird-Ringing Bureau, USSR Academy of Sciences, Commission for Nature Protection, Moscow, USSR
A—4777	*Motacilla alba*	16.3.1961*	Asambia Kutch (*c.* 22° 51′ N., 69° 32′ E.)	Found sick or wounded and perished, 11.7.1961	Zimnyatsky Dist., Volgograd Region (=Stalingrad), *c.* 38 km. SSW. of Mikhailovka (*c.* 49° 35′ N., 43° 07′ E.), *c.* 3660 km. NW. of Kutch	do.
A—19082	*Motacilla flava thunbergi*	19.12.1962*	Edanad, Chengannur, Kerala (*c.* 9° 20′ N., 76° 38′ E.)	Shot by man, 8.9.1963	14 km. south of Kara-Balty, Kirghiz SSR. (*c.* 42° 50′ N., 73° 50′ E.), *c.* 3700 km. north of Edanad	do.
C—382	*Anas querquedula*	4.4.1962*	Bharatpur, Rajasthan (*c.* 27° 13′ N., 77° 32′ E.)	Shot by man, 15/18.8.1962	Chernobyl Dist., Kiev Region (*c.* 51° 19′ N., 30° 14′ E.), *c.* 4760 km. NW. of Bharatpur	do.

* These were ringed in the course of BNHS/WHO Bird Migration Field Project.

BOMBAY NATURAL HISTORY SOCIETY,
91, WALKESHWAR ROAD,
BOMBAY 6-WB,
November 27, 1963.

EDITORS

13. SECOND RECORD IN INDIA OF THE GECKO *GEHYRA MUTILATA* (PEROPUS)

During a tour to Kottayam, Kerala, in May 1963, Mr. S. R. Sane of Messrs Sachetan, Bombay, collected and presented a few specimens of Geckos to the Society, which were later identified as *Gehyra mutilata* (Peropus).

Though very widely distributed in the Oriental and Australian regions, there is only a single record of its occurrence in India (Cochin, Kerala) [Smith, F. B. I. Rep. & Amph. **2** : 106]. According to Mr. Sane the gecko is very common on trees in gardens along with *Hemidactylus frenatus* and is nocturnal in habit. The species is known to be transported in cargoes which may explain its occurrence in Cochin. The present record further south indicates that it has now established itself in south-west India.

BOMBAY NATURAL HISTORY SOCIETY,
91, WALKESHWAR ROAD,
BOMBAY 6-WB,
October 16, 1963.

P. W. SOMAN
Research Assistant

14. A LIST OF THE REPTILES AND AMPHIBIANS OF THE SURAT DANGS, SOUTH GUJARAT

The Surat Dangs area of south Gujarat where the Western Ghats dovetail with the Satpura range of hills is of considerable interest faunistically being the northernmost limit in the range of many species, for instance of birds (Ali, Sálim 1954)[1] previously believed to be restricted to the more humid regions of the southern ranges of the Western Ghats. The collections reported here are not extensive, made as they were when opportunities offered, by one of us (E. M. S.) during several years' stay at Ahwa, the Dangs District Headquarters, and together in July 1963 when J. C. D. visited the Dangs for a short period. The list can be considered only as a preliminary survey and we are confident that many species, now considered to be confined to the southern areas of the Western Ghats, would be recorded from the Dangs if an extensive survey were made of the herpetology of the area. Distributional records are mentioned only for species whose occurrence in the Dangs is an extension of the known range in the case of

[1]Ali, Sálim (1954) : The Birds of Gujarat. Pt. I. *J. Bombay nat. Hist. Soc.* **52** : 374-458.

amphibia and for reptiles, as given by Smith in the FAUNA OF BRITISH INDIA, Reptilia and Amphibia **1**, **2** and **3**.

REPTILIA

Family CROCODILIDAE

1. Crocodilus palustris Lesson 1834

The Marsh Crocodile has been recorded at Mahal, Waghai, and Mulchond. The largest, approximately 10 to 12 ft. in length, was seen at Waghai. In March 1954 a small specimen about 1½ to 2 ft. in length was seen on the road near Mulchond but escaped capture by running into the grass by the side of the road. The nearest pool of water was about a furlong away. Formerly the *mugger* was quite common in the Dangs but in the past ten years or so it has become uncommon.

Family EMYDIDAE

2. Geomyda trijuga Schweigger 1814

Uncommon. A female collected on a road at night on 11 August, 1956 contained several oval hard-shelled eggs, and was perhaps in search of a suitable site to lay.

Family GEKKONIDAE

3. Hemidactylus maculatus Dum. & Bibr. 1836

Two specimens, one collected from the wall of an outhouse in 1958 and another inside the hollow of a tree at Ahwa in 1963. Near Bombay the species is most often seen on rocks and in rock-cut caves. The recorded distribution is Bombay District, Malabar, Salem, and Tinnevelly in south India. Anderson (1871)[1] records a specimen from Berar in the collection of the Indian Museum but this has not been included either by Boulenger or Smith in their volumes of the FAUNA.

4. Hemidactylus brooki Gray 1845

Common under stones and on trees. Those seen on stones in stream beds were invariably blackish.

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[1]Anderson, John (1871) : On some Indian reptiles. *Proc. Zool. Soc. London*: 149-211.

5. **Hemidactylus leschenaulti** Dum. & Bibr. 1836

Common, one or two always on the wall near the mercury vapour lamp at the Ahwa Bus Depot, feeding on the enormous number of insects, mostly moths, attracted by the light. The geckos keep to the darker face of the wall away from the light.

6. **Hemidactylus flaviviridis** Rüppell 1835

One specimen taken off a trellis overgrown with jasmine vine in the mission compound.

Family AGAMIDAE

7. **Calotes versicolor** (Daudin) 1802

Common. We noticed one specimen fast asleep, clinging to the wire mesh on a window adjoining the mercury vapour lamp at the Bus Depot at Ahwa oblivious of the insect food fluttering around. A clutch of 15 eggs found buried in loose soil in the Mission Garden in July 1955 began hatching on 7 September 1955. One of us (E. M. S.) has observed this species eating unripe pods with soft seeds of the *Lima* bean.

8. **Sitana ponticeriana** Cuvier 1844

One specimen at Waghai, the brown of the back was almost golden.

Family CHAMAELEONIDAE

9. **Chamaeleon zeylanicus** Laurenti 1768

Fairly common.



Family SCINCIDAE

10. **Mabuya carinata** (Schneider) 1801

Common.

11. **Riopa guentheri** (Peters) 1879

The extension of the range of this species to the Dangs has been already reported (J. C. Daniel, 1962)[1].

Family TYPHLOPIDAE

12. **Typhlops braminus** (Daudin) 1803

Common, often seen under logs and stones. Two were collected from a compost pit probably attracted by insect larvae and imagos.

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[1]Daniel, J.C. (1962) : Extension of range of the skink *Riopa guentheri* (Gray). *J. Bombay nat. Hist. Soc.* 59(3) : 965.

Family BOIDAE

13. **Eryx conicus** (Schneider) 1801
Fairly common, often mistaken for Russell's Viper.

14. **Eryx johni** Russel 1801
Common.

15. **Python molurus** (Linnaeus) 1758
Not uncommon. A 10 ft. long specimen was shot at Mulchond in 1959. An 8½ ft. long female collected in June 1954 at Ahwa contained sixty eggs.

Family COLUBRIDAE

16. **Ptyas mucosus** (Linnaeus) 1758
Common.

17. **Oligodon arnensis** (Shaw) 1802
One specimen. The scalation and markings agree with Smith's data for specimens from India south of lat. 20° N.

18. **Ahaetulla tristis** (Daudin) 1803
One specimen; not uncommon.

19. **Sibynophis subpunctatus** (Dum. & Bibr.) 1854
One specimen collected at Mulchond, 5 miles from Ahwa. The species is believed to occur north of lat. 18° and has been recorded in the Nasik District of Maharashtra adjoining the Dangs. There appears to be confusion in collection records between this species and *S. sagittarius*.

20. **Natrix piscator** (Schneider) 1799
Common, especially during and after the monsoon.

21. **Natrix stolata** (Linnaeus) 1758
Common.

22. **Macropisthodon plumbicolor** (Cantor) 1839
Common. The habit of erecting the forebody and flattening the head like a cobra was noticed in one specimen.

23. **Boiga trigonata** (Schneider) 1802
One specimen, on a jasmine vine in the Mission compound.

24. **Boiga forsteni** (Dum. & Bibr.) 1854

A correction is necessary to the earlier report on this species where it was recorded that the specimen collected by McCann at Mt. Abu was not reported earlier (Daniel 1962)[1]. McCann recorded this specimen in the *Journal* **43** : 645 (1946). The specimen from Ahwa was collected while it was trying to swallow a juvenile myna.

25. **Dryophis nasutus** Lacépède 1802

Fairly common.

Family ELAPIDAE



26. **Bungarus caeruleus** (Schneider) 1801

Fairly common.

27. **Naja naja** (Linnaeus) 1758

Fairly common.

Family VIPERIDAE

28. **Vipera russelli** (Shaw) 1797

Common. Every year during the grass-cutting season after the monsoon a few are seen and killed.

29. **Echis carinatus** (Schneider) 1801

Fairly common.

30. **Trimeresurus gramineus** (Shaw) 1802

Fairly common at Ahwa, usually seen on hedges. A Rhode Island Red cock bitten by one died in about 20 minutes.

AMPHIBIA

The amphibians unless otherwise mentioned were collected in the last week of July 1963.

Family BUFONIDAE

31. **Bufo melanostictus** Schneider 1801

Specimens collected: Ahwa 1 ♂, 2 juv.; Waghai 1 juv.

The male has the throat yellow but the nuptial pads on the fingers are peeling. Of the juveniles the two collected at Ahwa (22 mm., 25 mm.) appear to be of an earlier brood and the Waghai specimen

[1] Daniel, J.C. (1962) : Extension of the known range of the Catsnake, *Boiga forsteni* (Dum. & Bibr.). *J. Bombay nat. Hist. Soc.* 59(3) : 966-7.

(10 mm.) of the current season. Breeding was over in July. No tadpoles were seen nor was any breeding activity noticed among the adults. The call was not heard. Several were seen below lights feeding on insects.

Family MICROHYLIDAE

32. **Microhyla ornata** (Dum. & Bibr.) 1841

Common. The male was heard calling and four were located in grass with some difficulty. Average size 23 mm. A shoal of tadpoles were seen in a rainwater pool overgrown with grass.

33. **Uperodon globulosum** (Günther) 1864

Specimens collected: Ahwa 1 ♂, 1 ♀ July; 1 ♂, 1 juv. August 1963.

A male was located by its distinctive call in a small cement cistern on the evening of 30 July. When sighted it dived into the water and in searching we missed the male but collected a female. The male was caught later in the night by E. M. S., when it resumed calling. The call was not heard before the 30th but was heard on subsequent days at Ahwa and at Waghai. The breeding season is apparently later in the Dangs than in Bombay (June). Tadpoles were not seen. The species has not been recorded north of Bombay on the west coast.

34. **Ramanella montana** (Jerdon) 1854

Specimens collected: Ahwa 1 ♂, June 1963.

A specimen was collected in June while calling from a small cavity containing water on a mango tree. Its occurrence at Ahwa marks the northernmost range of its distribution. The species has so far been reported from Bombay to Trivandrum in the coastal and hill areas.

Family RANIDAE

35. **Rana cyanophlyctis** Schneider 1799

Very common, calling at Ahwa and Waghai. In this species however the calling is not restricted to the breeding season. One specimen was rufescent brown in colour.

36. **Rana limnocharis** Boie 1835

Common. Three males were collected from a dry nullah after a shower of rain. The smallest breeding male measured 28 mm. and had a broad light-coloured band on the back. The specimens collected resemble the var. *syhadrensis* of Annandale.

37. **Rana tigrina** Daudin 1803

Common. A juvenile collected has three yellowish green lines on the body, one median and two lateral from behind the eye to the groin with a branch to the shoulder. Adults seen were not breeding.

38. **Rana breviceps** Schneider 1799

A male (45 mm.) was collected while calling. The call is a soft *awang* which can be heard at considerable distances. The tibio-tarsal articulation lacks the tubercle noticed in some south Indian specimens. Though robust they are not toad-like as are specimens from the south (Trivandrum), resembling in this character specimens from Bombay. Tadpoles were collected from a hill-stream as well as just metamorphosed young which measure *c.* 10 mm.

39. **Rana leithii** Boulenger 1888

Several tadpoles were collected at a hill-stream off rocks wetted by spray. Very active and the coloration so well matches the dark grey of the rocks that it is very difficult to distinguish them. The recorded distribution of the species is from Panchgani to Bombay.

Family RHACOPHORIDAE

40. **Rhacophorus leucomystax maculatus** Gray 1832

Common, heard at night on trees surrounding a small rainwater pool.

BOMBAY NATURAL HISTORY SOCIETY,
91, WALKESHWAR ROAD,
BOMBAY 6-WB, J. C. DANIEL
Curator

CHURCH OF THE BRETHREN MISSION,
AHWA, VIA BILLIMORA,
DANGS DISTRICT, GUJARAT STATE, E. M. SHULL
November 27, 1963.

15. OCCURRENCE OF THE FUNGOID FROG *RANA MALABARICA* (BIBR.) AT JAGDALPUR, BASTAR DISTRICT, M. P.

Recently one of us (T. G. S.) collected a frog at Jagdalpur, Bastar District, M. P., which was later identified as the Fungoid Frog [*Rana malabarica* (Bibr.)]. The species is not uncommon in the Bastar area of Madhya Pradesh. *Rana malabarica* has so far been reported only from the Western Ghats from Kasara Ghat near Igatpuri (Abdulali

in V. K. Chari, 1962) to central Kerala where specimens have recently been collected by P. B. Shekar of the Society's staff at Edanad, Alleppey District. The species has also been reported from the Nilgiri Hills.

Instances are available of bird species with Indo-Malayan affinities, occurring only in the Western Ghats in peninsular India, being reported from Bastar (Ali, Sálim 1951). The Satpura trend of hills have been postulated as the route of migration of these elements of the Indo-Malayan fauna to the Western Ghats. However, the affinities of *Rana malabarica* which is endemic are with the African fauna where there exists a very closely allied species. It is likely that the species may occur in suitable biotopes in other areas of peninsular India.

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J. C. DANIEL
Curator

GOVERNMENT DEGREE COLLEGE,
JAGDALPUR,
BASTAR DISTRICT, M. P.,
October 20, 1963.

T. G. SELUKAR
Lecturer in Zoology

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16. OCCURRENCE OF THE CEYLON KALOULA, *KALOULA PULCHRA TAPROBANICA* H. W. PARKER (FAMILY MICROHYLIDAE) AT JAGDALPUR, BASTAR DISTRICT, M.P.

In October 1963 one of us (K. K. V.) collected a specimen of *Kaloula pulchra taprobanica* H. W. Parker in the compound of his residence at Jagdalpur, Bastar, M.P. Parker (1934) in A MONOGRAPH OF THE FROGS OF THE FAMILY MICROHYLIDAE: 87, gives the range of this species as 'India South of the Ganges' though specimens were seen by him only from Cauvery River, Madras, and Calcutta. Recently Abdulali (1962) reported the species from Dandeli in North Kanara, Mysore. The genus *Kaloula* is Indo-Malayan and is represented in India solely by this species and its occurrence in Bastar is significant in view of several other Indo-Malayan forms previously recorded from the area (S. L. Hora 1949; Sálim Ali 1951).

It is interesting to note that the distributional records of another genus of Amphibia *Philautus* with Indo-Malayan affinity also relates to the Western Ghats, Eastern Ghats, and eastern India. One species *P. variabilis* has been reported from the Western Ghats and from Golconda in the Eastern Ghats. Recently one of the Society's staff, P. B. Shekar, collected this species in the Shevaroy Hills also. Hora (1949) and Abdulali (1949) have suggested the Eastern Ghats as an alternative route to the Satpura trend of hills for migration of terrestrial Indo-Malayan species to Western India which these records seemingly substantiate. However, it must be noted that the Amphibian fauna of the Satpura Hills is more or less unknown.

BOMBAY NATURAL HISTORY SOCIETY,
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JAGDALPUR, DIST. BASTAR, M. P.,
November 1, 1963.

K. K. VERMA
Assistant Professor

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———— (1949) : Climates as affecting the Satpura Hypothesis. ibid.: 361-64.

17. OCCURRENCE OF THE BUTTERFLIES *NEPTIS HORDONIA HORDONIA* STOLL, AND *ISSORIA SINHA PALLIDA* EVANS IN MUSSOORIE : NEW ALTITUDE RECORDS

In the *J. Bombay nat. Hist. Soc.* (Vol. **11**, 1898) Mackinnon & de Nicéville published a 'List of the Butterflies from Mussoorie and the Dun Valley'. Since the publication of this list Brigadier W. H. Evans (1932), Lt.-Col. H. D. Peile (1937), and Mr. M. A. Wynter-Blyth (1957) have added a number of species to this area. As there is a great deal of difference in the altitude of Dehra Dun (2300 ft.) and that of Mussoorie (3000 to 8000 ft.) some species recorded in Dehra Dun are not found in Mussoorie and vice versa.

During nine years of collecting butterflies in Mussoorie (largely confined to the months of May and June and rarely in October), the writer has collected only two species which represent a considerable change in altitude. These two are of the family Nymphalidae and are as follows:

Neptis hordonia hordonia Stoll : The Common Lascar

Mackinnon & de Nicéville found this species in the Dun only (never in Mussoorie) during April, May, September, and October.

Evans gives its range as: 'S. India; Dun—Burma' (p. 172).

Peile records its range as: 'S. India; Dun to Dawnas' (p. 131).

Wynter-Blyth gives its range as: 'S. India; Dehra Dun to Assam and Burma', and limits its altitude 'to 7000 feet in the hills of the south; to about 2500 feet in the north' (p. 197).

On 20th May 1963 the writer caught a perfect Common Lascar at the famous Pumping Station (alt. 5600 ft.) in Mussoorie. As Mussoorie is situated in the north-west Himalayas this record constitutes an altitudinal range extension in the north of 3300 ft.

Issoria sinha pallida Evans : The Vagrant

Mackinnon & de Nicéville refer to this species as *Vagrans egista* (*sinha*) and report it as rare in the Dun in August and December. (See Peile's *Appendix B*, p. 228.)

Evans gives its range as: 'Dun-Kumaon' (p. 187).

Wynter-Blyth gives its range as: 'Dehra Dun to Sikkim, Bengal, Orissa, Assam and Burma' (p. 226). He states further that it is found 'at low or moderate elevations in the hills . . .' (p. 226).

The writer has collected several Vagrants at much higher elevations, as follows:

25th May 1963: one in the Kolti Valley (alt. 3500 ft.) near Mussoorie;

3rd June 1963: three at the Pumping Station (alt. 5600 ft.) in Mussoorie;

4th June 1963: one more in the Kolti Valley;

12th June 1963: five at Kempti Falls (alt. 4500 ft.) in Mussoorie.

The above records considerably extend the altitudinal ranges of the Common Lascar and the Vagrant in the north-west Himalayas.

DANGS RURAL BOARDING SCHOOL,
CHURCH OF THE BRETHREN MISSION, ERNEST M. SHULL
AHWA, VIA BILLIMORA,
DANGS DIST., GUJARAT STATE,
September 20, 1963.

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18. BUTTERFLIES: HESPERIIDAE: *POLYTREMIS MINUTA* EVANS

(*With a text-figure*)

Figured in colour in Evans's CATALOGUE OF THE HESPERIIDAE OF EUROPE, ASIA AND AUSTRALIA 1947 with genitalia on his Plate 53. But his drawing is that of a broken clasp. The figures below are correct, taken from a male captured at Pathechaung, Karens, in December 1926 and found by me in a tin of the Tytler collection in the British



Genitalia of *Polytremis minuta* Evans

Museum (Nat. Hist.) and dissected because I was unable to identify it by facies. In front of the uncus are two non-chitinous membraneous processes, transparent in liquid (I dissected by the wet method) but opaque when dry (Evans dissected by the dry method). Being flexible in liquid, they can be partially unrolled from the interior edges. They are shown in outline by me by discontinuous streaks to indicate transparency. No such processes are found in any other Hesperiid. This is a worn DSF; two of the normal 3 apical spots are missing as also the discal spot in 4 and there are no spots UPH or UNH and no ochreous-green scales UNH. But it has two cell spots UPF; a surprising character as the others have only a lower spot. Only 3 males and 2 females are in the British Museum.

5, UPPER WIMPOLE STREET,
LONDON, W. 1.
July 25, 1963.

KEITH CANTLIE, C.I.E.

19. USE OF VERTEBRATE FAECES BY THE SPHECOID WASP *CHALYBION BENGALENSE* DAHLB.

Chalybion bengalense Dahlb. [*Sceliphron violaceum* (Fabr.)] (FAUNA OF BRITISH INDIA, Hymenoptera **1** : 240) is a metallic bluish-black, so-called domestic, wasp which puts several spiders, to one of which an egg is attached, into pre-existing holes or cavities, which she then seals. The finished lid to the cell, in the majority of cells we have seen, is white. Maxwell-Lefroy (1909)[1] states that these wasps use lime or plaster to seal such holes.

However, we have observed that these wasps, having provisioned their cells, first make a lid of mud (in this part of India, reddish brown to brown). Having made this lid which requires several loads, they then proceed to coat it with a white substance which is carried in the mouth, as mud is brought. The first load is spread all over the red mud which thus becomes pinkish. A further load, or loads, completely obliterates any underlying colour. On three occasions, wasps so covered the red mud lids which had been built and left as finished by wasps of the Vespoid species *Antodynerus flavescens*, which nests in similar holes. Therefore the covering with white is an act independently stimulated by a mud lid, not part of an inevitable sequence of actions. We have observed one *C. bengalense* collecting this white substance from the faeces of our pet tortoises (*Testudo elegans*). Another individual used bird faeces. This is probably what they usually employ for this purpose.

Having made this smooth white concave or flat lid to the cell, the wasps sometimes go on to put several loads of a black substance on it, though this may be delayed and the black put on several lids at the same time. This does not usually cover completely the white, as the white covers the mud, but is put in the centre of the lid leaving an annular white margin. We have seen one wasp collecting this black substance, partly from the black portion of the tortoise faeces and partly from the encrustation on the cement lining of a drain. In another example, we did not see the wasp working, but only two finished cells. The topmost layers here looked crystalline, and consisted of many fragments of insect cuticle (among which head capsules were conspicuous) stuck on to the white. These may, of course, be from the faeces of any insectivorous reptile, bird, or mammal, but after inspecting the faeces of a *chuchunder* (*Suncus murinus*), we have little

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[1] Maxwell-Lefroy, H. (1909): Indian Insect Life. Agricultural Research Institute, Pusa.

doubt that this is what was used. These shrews are very common in the yard from which the wasps collected material.

It is not clear under what stimuli these wasps do, or do not, blacken a lid, but all the above cells were in a disused wooden fitment in a not very well-illuminated bath-room.

This faeces-using habit makes *C. bengalense* a possible vector for diseases of those insectivorous vertebrates which prey upon them.

GENETICS AND BIOMETRY LABORATORY,
GOVERNMENT OF ORISSA,
BHUBANESWAR 3,
October 1, 1963.

S. D. JAYAKAR
H. SPURWAY

20. THE INDIAN HIVE BEE *APIS INDICA* FABR. (HYMENOPTERA) AND *SAPINDUS EMARGINATUS* VAHL WITH A NOTE ON *ACARAPIS WOODI* (RENNIE) (ACARINA)[1]

Storey (1890) reported that honey bees (*Apis indica* Fabr.) were attracted by the blossoms of *Lapindus emarginatus* (=*Sapindus emarginatus* Vahl?) and after drinking the nectar died in large numbers at Oodeypore. This has not been queried by any subsequent observer. It is therefore of interest to mention that honey bees do gather honey from this tree, and that a sample of such honey was exhibited by the Entomology Division of the Andhra Pradesh Agricultural Department at the World Agricultural Fair, New Delhi.

The latter part of the observation made by the author is also of interest, namely: 'the effect produced appears to be that of a powerful purgative and there are now numbers of bees buzzing about on the ground unable to fly'. The symptoms described are like those produced by the scutacarid mite, *Acarapis woodi* (Rennie).

Baker *et al.* (1952) state that *Acarapis woodi* (Rennie) is the cause of 'Isle of Wight' disease found in Europe. The mites harbour in the tracheal tubes and cause the death of the host, death being due to: (1) the parasite living upon the host fluids and causing active injury, or (2) possibly, toxic secretion, or (3) mechanical stoppage of the tracheae which prevents air from reaching the individual organs or cuts off the air supply to the nerve centres that control the bee's activities. Recently, Singh (1957) recorded this disease in India in Kulu and Kangra valleys and Simla Hills. He observes that a number

[1] Communicated by Dr. K. K. Tiwari, Zoological Survey of India, Calcutta.

of parasitised bees come out of the hive on a warm day, particularly after a cold and rainy spell and fail to return to the hive, as they are unable to fly and merely hop about. They crawl up blades of grass and form small groups. The front and hind wings get unhooked and have a 'K' wing appearance. The abdomen gets distended. The inside and outside of the hive and the ground in front of its entrance are plastered with yellow faeces indicating dysentery. The mites harbour in the anterior thoracic tracheae, which appear either bronzed or brown. He says that it has still to be ascertained whether the disease is already widespread in distribution and has assumed an endemic status or is only a recent introduction in this country.

I was recently in charge of examining the several hundreds of randomised samples of honey bees from different districts of Andhra Pradesh to find out the incidence of this disease in that State. Different methods of dissection were tried, but the one described below was found to be the most useful. A microscalpel is made out of a triangularly-cut edge of a new razor blade, fixed in a match-stick or discarded camel-hair brush. The specimen is decapitated a little below the neck. Another cut is made a little above the petiole and the sectioned thoracic part is transferred to a clean cavity block containing sterilised water. The contents of the thorax, i.e. muscles, gut, etc., are removed with the help of a fine forceps (watch repairer's NN and BB were used) under a stereoscopic microscope. This leaves the body wall with the tracheal tubes *in situ* for examination. With a little practice the method will be found quite comfortable. No instance of the mite was found.

My thanks are due to Dr. Md. Qadiruddin Khan and Shri C. Krishnamoorthy, the successive Entomologists of the Government of Andhra Pradesh, and Shri P. V. Ranga Rao, Assistant Entomologist, Regional Research Unit, Bapatla, for facilities and encouragement, and to the Director, Botanical Survey of India, Calcutta, for necessary information on the nomenclature of the host plant.

ZOOLOGICAL SURVEY OF INDIA,
34, CHITTARANJAN AVENUE,
CALCUTTA 12,
May 6, 1963.

K. V. LAKSHMINARAYANA

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21. *LENSIA GNANAMUTHUI*,[1] A NEW SIPHONOPHORE FROM THE MADRAS PLANKTON

(*With a text-figure*)

Material

2 anterior nectophores from an open haul from 0 to 25 metres off the Madras coast on 26.9.1952.

4 anterior nectophores from surface plankton off the Madras coast on 4.12.1952.

2 anterior nectophores from surface plankton off Madras coast on 8.1.1960.

Diagnosis

Anterior nectophore small, 3.8 mm. in length and 1.8 mm. in breadth; 5 distinct non-crested complete ridges; somatocyst placed near the mouth of the nectosac, characteristically minute with a stalk and a minute globular tip. Hydroecium in level with the velum.

Size

Anterior nectophore: length 3.8 mm., breadth 1.8 mm.

Somatocyst: length 0.32 mm.

Description

Anterior nectophore very small, pyramidal in shape with five complete non-crested longitudinal ridges extending from apex to base; ventrobasal margin or corner slightly rounded. Hydroecium shallow, level with mouth of nectosac. Mouth plates large and divided. Somatocyst characteristically very small and situated on the summit of the hydroecium very near base of nectosac; with thread-like, minute, curved stalk (0.2 mm. in length) and a globular tip (0.1 mm. in diameter).

Stem and posterior nectophore not collected.

Type Material

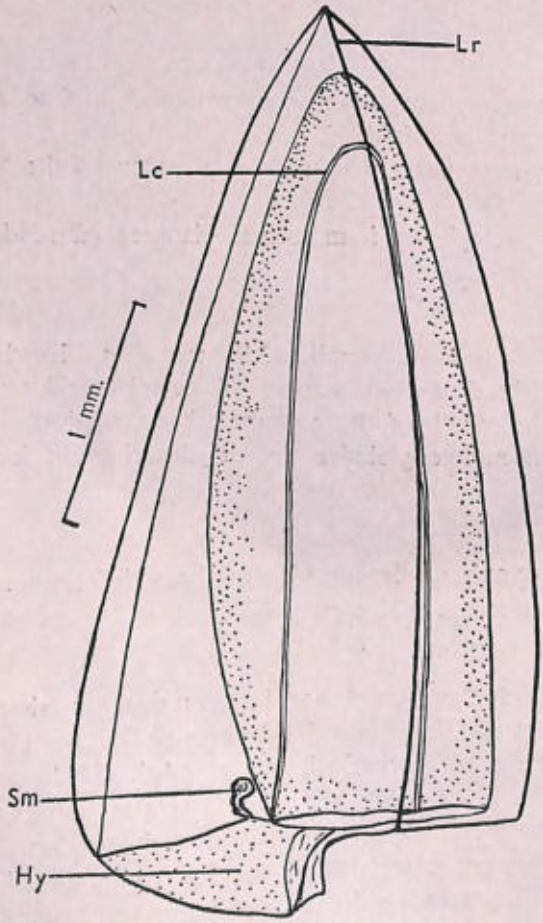
The holotype and paratypes will be deposited in the collections of the Zoological Survey of India, Calcutta. An anterior nectophore collected on 26.9.1952 from 0 to 25 metres off the Madras coast has been designated as the holotype. 2 anterior nectophores from surface plankton of the Madras coast collected on 8 January 1960 have been designated as paratypes.

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[1] Named after Prof. C. P. Gnanamuthu, Director, Zoological Research Laboratory, Madras.

Comparison

The genus *Lensia*[1] includes the following twenty-two valid species: *grimaldii*[2], *exeter*[3], *ajax*, *hostile*, *lelouveteau*, *meteori*[4], *reticulata*[5],



Lensia gnanamuthui sp. nov.

Lc—Lateral canal; Lr—Lateral ridge; Sm—Somatocyst; Hy—Hydroecium

subtilis[6], *cossack*, *multicristata*[7], *hunter*, *havock*, *subtiloides*[8], *conoidea*, *fowleri*[9], *campanella*, *achilles*, *hardy*, *hotspur*, *challengeri*, *leloupi*, and *tottoni*[10]. The present species differs from all the other species hitherto described in the minute size of the somatocyst, its position near the mouth of the nectosac, and its shape, and in the rounded margin of the ventral corner of the nectophore.

Notes on Siphonophores: The Siphonophora includes 150 valid species of which 80 are known to occur in the Indian Ocean. We

have recorded 29 species in the limited area of the Madras coast (Daniel & Daniel, 1963*b*).

The Siphonophores are wholly holoplanktonic agreeing well in their distribution with the holoplanktonic surface medusae. A great majority are epiplanktonic. During our studies on the Siphonophore fauna of the Madras coast during 1952-54 and 1956-60, 23 species were taken from surface plankton hauls. As typical examples of epiplanktonic forms *Diphyes truncata, D. monoica,* and *D. dispar* may be mentioned. Among Physophorae, *Agalma okeni* and *Anthophysa* are surface forms. *Velella, Porpita,* and *Physalia* in the adult stage are known from the surface only, though the larvae are sometimes seen in the lower regions also. No Siphonophore has adopted the ocean floor as its usual habitat and none are parasitic.

Although Siphonophores are known to occur in a wide range of temperature, they are absent (or at least uncommon) in regions of low salinity. None has penetrated into brackish or fresh water, and they are uncommon in Ocean regions of low salinity. In the Madras coast where the salinity varied from 30°/$_{oo}$ to 35°/$_{oo}$ during our studies the Siphonophores were found in abundance in the plankton hauls throughout the year, whereas in the adjoining brackish waters at the mouths of the rivers Adyar and Cooum they were not collected.

Siphonophores are very delicate animals and usually during collection and transferring, the different parts of the colony become detached. In the case of Diphyids the anterior and posterior nectophores are easily detached and as such, in the genus *Lensia* except for a few forms the posterior nectophores have not yet been matched or described.

This work was done in the Zoological Research Laboratory, University of Madras. We are grateful to Prof. C. P. Gnanamuthu, Director of the Laboratory, for his helpful suggestions.

ZOOLOGICAL SURVEY OF INDIA,
INDIAN MUSEUM,
CALCUTTA, 13,
April 11, 1963.

A. DANIEL
(MRS.) R. DANIEL

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22. ON THE DISTRIBUTION OF *GYMNOSPORIA BAILADILLANA* NARAYAN & MOONEY

Kapoor & Srivastava in *J. Bombay nat. Hist. Soc.* **59** (2) : 685-686, 1962, have reported *Gymnosporia bailadillana* Narayan. & Mooney from Mahendragiri Hills of Orissa, extending its range of distribution eastwards to 18° 58′ N.×84° 26′ E. The plant was originally collected by Mooney from Bailadilla Hill (Bastar State) between 1000-1200 m. Later on Mooney reported it also from Karlapet (Kalahandi State).

The authors seem to have overlooked a paper by R. Seshagiri Rao on 'Observations on the Vegetation of the Rampa and Gudem Agency Tracts of the Eastern Ghats' published in *J. Bombay nat. Hist. Soc.* **55** (3) : 429-449, 1958. *Gymnosporia bailadillana* Narayan. & Mooney, therein, is already reported as a new record for the N. Circars of Andhra Pradesh. Rao mentions it as one of the common shrubs near the deserted village of Nilavaram and the Ebul Reserve Forest in the Gudem Agency at about 1800 m.

The present authors have also collected the plant from Sankarimetta at about 900 m. in the Vizag Agency on 11 May 1956 with dehisced carpels. (The specimens *Santapau* 20551 and *Wagh* 2562, 2563 are preserved in the Blatter Herbarium, Bombay.) This extends the range of distribution still southwards, i.e. up to 18° 30′ N. and 82° 27′ E.

BOTANICAL SURVEY OF INDIA,
CALCUTTA 13,
October 19, 1963.

H. SANTAPAU, S.J., F.N.I.
S. K. WAGH, PH.D.

23. DESCRIPTION OF *TEPHROSIA COLLINA* SP. NOV. AND TWO NEW VARIETIES[1]

(With a plate)

The author, while investigating the flora of Ajmer (Rajasthan), came across an interesting, hitherto unknown species of *Tephrosia*, together with a variety of the same. Both are being described in the present communication.

[1] Communicated by the Director, National Botanic Gardens, Lucknow.

Tephrosia collina sp. nov.

Affinis nulli speciei indicae generis *Tephrosiae*, haec species distinguitur habitu simplici vel paulum ramoso, foliis paucioribus, racemis terminalibus vel oppositifoliis, laxis, elongatisque; corolla cremea et praesertim legumine longo, 8-11-sporo, marginibus valde crassis ornato.

Herba annua, erecta, 30-60 cm. alta. *Caulis* simplex vel paulum ramosus, rarius suffrutescens, teres et tenuiter pubescens ad basin, supra vero angularis vel nonnumquam subteres, griseo-sericeus vel nonnumquam villossus et striis brunneis ornatus, tandem minus pilosus. *Folia* imparipinnata, laxa et vulgo pauca; basalia quidem multo breviora, foliolis 3-7, quorum infima decidua. *Stipulae* subulatae, ad 8 mm. longae, trinerviae, argenteo-hirsutae extus, persistentes. *Foliorum rachis* ad 15.5 cm. longa, abaxialiter sulcata, obscure pulvinata ad basin; *petioli* 2-5 cm. longi, saepe ad basin aeque crassi ac pedunculi, gradatim sursum fastigati. *Foliola* (3-7-) 9-17 (-19), opposita vel nonnulla alterna, (1-) 2-6 cm. longa, 0.5-1.2 cm. lata, terminalia quidem vulgo paulo longiora caeteris, atque rachis apici fixa; lateralia vero aequalia inter se, vel gradatim decrescentia sursum, elliptico-oblonga, paulum angustata ad basin vel saepius ad utrumque apicem, sericea infra, glabra supra, apice obtuso vel truncate emarginato, mucronulato; nervus medius eminens infra, laterales vero obliqui, secundum marginem decurrentes; *petioluli* ± 2 mm. longi, argenteo-hirsuti. *Racemi* terminales vel oppositifolii, valde elongati, 10.30 cm. longi, pedunculati, laxe 5-12-flori vulgo supra medium vel paulo altius floribus 1-3 ad singulos nodos, rarius ad nodum infimum suffultis uno folio parvo; *bracteae* longiores pedicellis, deciduae, ternatae, quarum inferior quidem paenitus stipulis similis, interiores vero laterales angustiores sed fere exteriorem aequantes. *Flores* cremei, 1.5-1.7 cm. longi pedicello incluso; *pedicelli* 1.5-3 mm. longi, dense argenteo-canescentes, tandem crassi sub fructu. *Calyx* dense argenteo-hirsutus extus; tubo 3-4 mm. lato, 1.5-3 mm. longo; lobis subaequalibus, lanceolato-subulatis, acuminatis, tubo longioribus, infimo quidem omnium longissimo, ± 5 mm. longo, lateralibus vero ± 3.5 mm. longis, superioribus binis connatis et distincte brevioribus, ± 2 mm. longis. *Vexillum* late obovatum, ± 1.5 cm. longum, 1.2 cm. latum, punctatum, unguiculatum, ungue 2-3 mm. longa, apice retuso apiculo minuto ornato, extus adpresse sericeo-brunneum, pilis densis et longioribus ad medium, marginibus ciliolatis supra basin. *Alae* ± 1.4 cm. longae, usque ad 4 mm. latae, punctatae, auriculatae supra unguem. *Carina* ± 1.5 cm. longa, usque ad 5 mm. lata, punctata, glabra, apice retuso et intus inclinato, marginibus exterioribus fere rectis. *Vagina staminalis* 1.2 cm. longa, 3 mm. lata ad basin, supra basin

dilatata; filamenta 2.5-3.5 mm. longa; antherae 0.5 mm. longae, 0.2 mm. latae; *filamentum vexillare* liberum usque ad basin, paulum dilatatum supra basin. *Ovarium* sessile, dense argenteo-hirsutum. *Stylus* 2.5 mm. longus, incurvatus, barbatus secundum faciem complanatam interiorem, tenuiter pubescens in facie exteriore; *stigma* minutum, glabrum. *Legumen* pallide brunneum, 6.5-8.5 cm. longum, 6-7 mm. latum, compressum, seminibus 8-11, rectum vel paulum falcatum ad apicem, glaucum inter semina, fortiter rostratum, rostro acuto et calloso, 2-4 mm. longo, fere recto vel paulum curvato; suturae valde crassae ad efformandum marginem eminentem ± 1 mm. latum, valvulis post dehiscentiam spiraliter convolutis, spiris 3-4; legumen tenuiter argenteo-canescens secundum suturas et ad utramque faciem. *Semina* oblonga, glabra, brunneola, nigro-punctata, strophiolo albo, 4-4.8 mm. longa, 2.5-3 mm. lata aliquantum reniformia.

Typus, *Sharma* 551-A, lectus ad Happy Valley in Rajasthan a me die 22 augusti 1959; isotypi, *Sharma* 551 *B-C*, lecti eodem loco ac tempore. Typus et isotypi positi in Herbario National Botanic Gardens ad Lucknow.

Tephrosia collina sp. nov.

This species does not appear to be allied to any other Indian species of the genus *Tephrosia*. It is characterised by simple or little-branched habit with fewer leaves; terminal or leaf-opposed, laxly-flowered, elongate racemes; creamy corolla and chiefly by few, 8-11-seeded long pods, bordered by much thickened sutures.

Annual herb, erect 30-60 cm. high. *Stem* simple or branching a little quite above the base, rarely suffrutescent, terete and thinly pubescent towards base, angled or occasionally subterete, grey-sericeous or sometimes villous and brown-striped above, at length less hairy. *Leaves* imparipinnate, lax and usually few; basal much shorter with only 3-7 leaflets, the lowermost one or two soon falling. *Stipules* subulate, up to 8 mm. long, 3-nerved, argenteo-hirsute outside, persistent. *Leaf-rachis* up to 15.5 cm. long, abaxially furrowed, obscurely pulvinate at base; *petiole* 2-5 cm. long, often at base as thick as the peduncle, tapering gradually upwards. *Leaflets* (3-7-) 9-11 (-19), opposite or a few casually alternate, (1-) 2-6 cm. long, 0.5-1.2 cm. broad, terminal usually a little longer than laterals and jointed to rachis-apex extending 1-2 mm. beyond the upppermost pair; lateral leaflets apparently equal or gradually decreasing in size downwards, elliptic-oblong, slightly narrowed towards base or frequently at both ends, sericeous beneath, glabrous above, apex obtuse or somewhat truncately emarginate, mucronulate; midvein prominent beneath with lateral nerves oblique—the ends running along the margins to some distance; *petiolules* ± 2 mm. long,

argenteo-hirsute. *Racemes* terminal or leaf-opposed, much elongate, 10-30 cm. long, pedunculate. laxly 5-12 flowered from usually above the middle or still higher up, flowers 1-3 at each node, very rarely at the lowermost node subtended by a small leaf; *bracts* longer than the pedicels, deciduous, ternate—the lower exactly similar to stipules, the two inner laterals (bracteoles) narrower but almost equalling the outer. *Flowers* creamy, 1.5-1.7 cm. long (including pedicel); *pedicels* 1.5-3 mm. long, densely argenteo-hirsute later thickened in fruits. *Calyx* densely argenteo-hirsute outside; tube 3-4 mm. wide, 1.5-3 mm. long; lobes subequal, lanceolate-subulate, acuminate, longer than the tube, the lower longest, ± 5 mm. long, laterals ± 3.5 mm. long, upper two connate and conspicuously shorter, ± 2 mm. long. *Vexillum* broadly obovate, ± 1.5 cm. long, 1.2 cm. broad, punctate, unguiculate, the claw 2-3 mm. long, apex slightly retuse with a minute apiculum, back adpressedly silky-brown with hairs dense and longer along the middle, margins ciliolate above the base. *Alae* ± 1.4 cm. long, 0.4 mm. wide at its broadest, punctate, eared above the claw. *Carina* ± 1.5 cm. long, 0.5 cm. wide at its broadest, punctate, glabrous; apex retuse and pointing inwards, the outer margins almost straight. *Staminal-sheath* 1.2 cm. long, 0.3 cm. broad at base when explanate, dilated above the base; filaments 2.5-3.5 mm. long; anthers 0.5 mm. long, 0.2 mm. wide; *vexillary-filament* free down to the base, thinly widened, dilated above base as in sheath. *Ovary* sessile, copiously argenteo-hirsute. *Style* ±2.5 mm. long, incurved, bearded along the inner flattened face, thinly pubescent on outer; *stigma* minute, glabrous. *Pods* light-brown, 6.5-8.5 cm. long, 0.6-0.7 cm. broad, compressed, 8-11-seeded, straight or slightly falcate towards apex, glaucous within between the seeds, strongly beaked, the beak pointed and callose, 2-4 mm. long, almost straight or slightly curved; sutures much thickened to form ± 1 mm. broad prominent border, valves on dehiscence twisting completely by 3-4 turns; on faces and along sutures thinly argenteo-canescent with forwardly adpressed short hairs in var. *collina*; in var. *lanuginocarpa* at faces villous and along the sutures conspicuously fringed with dull-brown, stiff and almost erect short hairs of nearly equal length. *Seeds* oblong, glabrous, brownish and flecked with black, strophiole white; in var. *collina* seeds 4-4.8 mm. long, 2.5-3 mm. broad, somewhat reniform, in var. *lanuginocarpa* 5-6 mm. long, 3-3.2 mm. broad, at one or both ends nearly truncate.

Flowering and Fruiting : August to October.

Habitat : India : Ajmer district (Rajasthan), on hills throughout the district, chiefly among montane grasses.



T. collina var. **collina**

(Figs. A-H)

Pods on faces and along the sutures thinly argenteo-canescent with forwardly adpressed short hairs. Seeds 4-4.8 mm. long, 2.5-3 mm. broad, somewhat reniform in outline.

Flora of Ajmer, Rajasthan, India : *Sharma* 551-A, Happy Valley (Taragarh Mt.), alt. 450-550 m., Fl. & Fr. 22-8-1959, open hills (*type*) ; *Sharma* 551 *B-C* (*isotypes*): *Sharma* 586-*A*, Ajayasar Gate, above Happy Valley, Fl. & Fr. 17-9-1958 : *Sharma* 990, Nagpahar Mt., under shade of forests, Fl. & Fr. 23-8-1959: *Sharma* 1805, Todgarh, on way to Bhim, Fl. & Fr. 1-9-1961.

Type is deposited in the Herbarium National Botanic Gardens, Lucknow.

T. collina var. **lanuginocarpa** var. nov.

(Fig. I)

Legumina villosa ad facies, ad suturas vero pilis obscurate brunneis, rigidis, fere erectis, brevibus aequalibus ornata; semina 5-6 mm. longa, 3-3.2 mm. lata, truncata ad unum vel ad utrumque apicem.

Typus, *Sharma 1130-A*, lectus a me ad Nagpahar Mt. die 4 octob. 1959; isotypi, *Sharma 1130 B-C*, lecti eodem die ac loco.

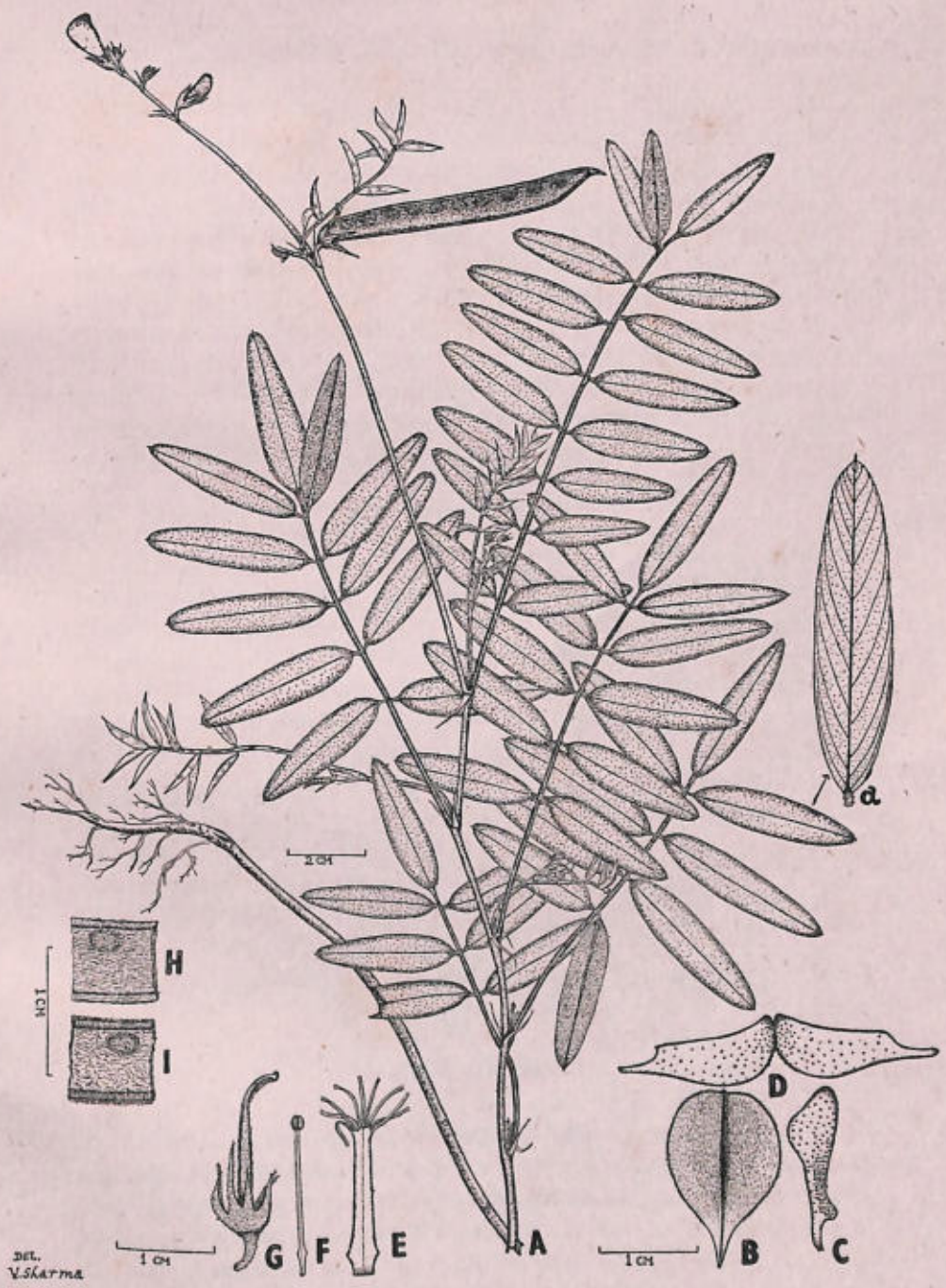
Typus et isotypi positi in Herbario National Botanic Gardens ad Lucknow.

Pods on faces villous and along the sutures conspicuously fringed with dull brown, stiff and almost erect short hairs of nearly equal length. Seeds 5-6 mm. long, 3-3.2 mm. broad, at one or both ends nearly truncate.

Flora of Ajmer, Rajasthan, India: *Sharma 1130-A*, Nagpahar Mt., alt. 370-550 m., Fr. 4-11-1959 (*type of variety*); *Sharma 1130 B-C* (*isotypes of variety*); *Sharma 586-B*, Ajayasar Gate, above Happy Valley, Fl. & Fr. 17-9-1958.

Type of variety is deposited in the Herbarium National Botanic Gardens, Lucknow.

As is evident from the above data, the present species is well distributed throughout Ajmer district which stretches to about 130 kilometres. The type as well as the var. *lanuginocarpa* may occur together within a small area confined to hills where they are chiefly seen among the montane grasses. It is fairly common at Todgarh and because of the identical topographical features of the adjoining area,



Tephrosia collina var. *collina* : A. Entire plant (*drawn from type-specimen*), a. leaflet showing venation; B. Vexillum expanded (*dorsal view*); C. Ala ; D. Carina (*spread out*) ; E. Staminal-sheath (*expanded*) ; F. Vexillary stamen ; G. Flower, showing calyx and pistil ; H. Pod, a portion showing indumentum. *Tephrosia collina* var. *lanuginocarpa* : I. Pod, a portion showing indumentum

there is every possibility that the species may extend beyond this region.

The above described variety appears to be a slightly more robust plant and is more hairy in all parts than the type form. It is mainly distinguishable by the kind of indumentum on the faces and sutures of the pods which persist even when the valves have separated. The character of the seed as keyed out above for the identification of the two forms, has been derived on the study of seeds from a few available mature pods. Unless more material is studied, the reliability of this character cannot be stressed.

It may be of some interest to record here that in one of the specimens the lowermost leaf showed reduction to the extent that it was represented only by a single leaflet, measuring 8×0.8 cm. with rachis (petiole) about 0.6 cm. in length.

ACKNOWLEDGEMENTS

I am grateful to Rev. Fr. H. Santapau for valuable suggestions and the Latin diagnoses. I am also thankful to my teacher Dr. B. Tiagi for encouragement, Dr. J. B. Gillett, Kew Herbarium, for the scrutiny of the material and helpful comments, Shri M. B. Raizada for the facilities of work at Forest Research Institute Herbarium, Dehra Dun, and the Curator, Central National Herbarium, Calcutta, for the loan of herbarium sheets of *Tephrosia*.

GOVERNMENT COLLEGE,
AJMER,
RAJASTHAN,
June 6, 1963.

V. S. SHARMA[1]

24. *SOLANUM ACULEATISSIMUM* JACQ. : A NEW RECORD FOR NORTHERN INDIA[2]

(*With a plate*)

While collecting some *Solanum* species from Jorhat and its neighbourhood (Assam), we came across this species which does not seem to have been recorded from northern India. C. B. Clarke, who wrote the Solanaceae in Hooker's FLORA OF BRITISH INDIA, cites only Thomson's specimen from Singapore for this species, with a note that

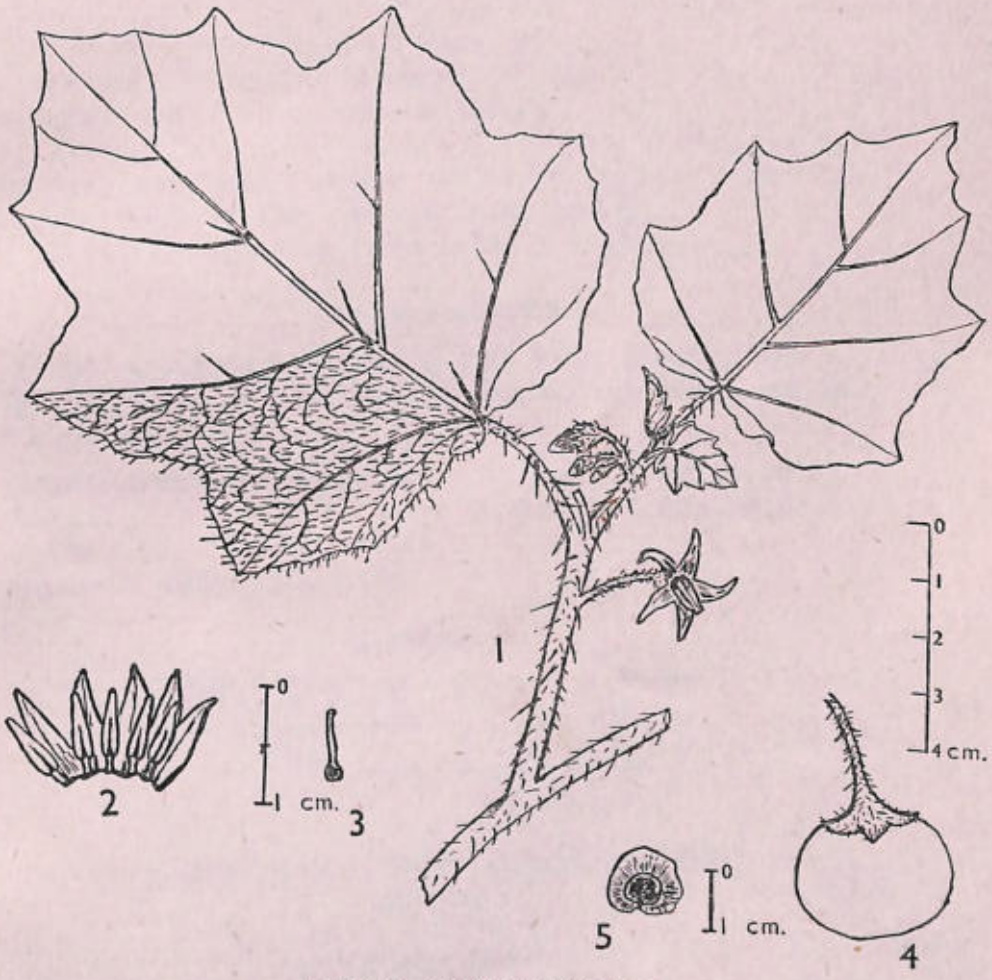
[1] Present address : National Botanic Gardens, Lucknow.
[2] Communicated by Rev. H. Santapau, Director, Botanical Survey of India, Calcutta.

his specimen in fruit is identical with the type specimen of *Solanum aculeatissimum* var. *denudatum* Dunal. J. S. Gamble in his FLORA OF MADRAS records this plant from Quilon in Travancore. But he does not give any description of the species beyond the statement that it is a prickly shrub.

Our correspondence with Dr. S. K. Mukerjee, Keeper, Central National Herbarium, brought to our notice the collection of this species by Rama Rao from Tharayanukka in 1912, from Trivandrum in 1913, and from Quilon in 1913. It is apparent that this species has not been recorded anywhere else in India.

Solanum aculeatissimum Jacq. Collect. Bot. 1 : 100, 1786.

Shrub about 1 m. tall; older branches brown, terete, glabrous; branchlets green, pubescent, spiny; spines tender, green, sharp, straight, varying in length from 0.2 to 1 cm.; hairs about 3 mm. long, rather sparse, stiff, erect. *Leaves* simple, alternate, distichous, exstipulate and petiolate; petioles green, tinged with purple in upper leaves in the grooves, 2-4 cm., terete, grooved above, pubescent, spiny; spines and hairs like those on the branchlets; lamina ovate, 8-10-lobed, entire at margins, acute at apex, somewhat cordate at base, hairs on the lower surface 2-3 mm. long, only on veins, hairs on the upper surface 1-2 mm., found all over, dense, spines only on the veins on both the surfaces, like those on the branchlets, sometimes tinged with purple when mature on the upper surface of the upper leaves; lateral nerves 3-4 on either side of the midrib, lowermost pair arising from the base of the midrib, extending laterally, nerves impressed on upper surface, prominent on lower. *Inflorescence* of helicoid cymes, generally in the axils of upper leaves, or extra-axillary, ebracteate, pedunculate; peduncles 5-7 mm. long, green, terete, very slightly tinged with purple, pubescent with stiff erect hairs which are almost like spines. *Flowers* regular, bisexual, ebracteate, pedicellate; pedicels like the peduncles. *Calyx* green, cup-shaped, persistent, 5×4 mm., slightly accrescent, pubescent with stiff erect hairs which are almost like spines, 5-toothed; teeth triangular, nearly 2 mm., entire at margins, acute at apex. *Corolla* 0.7×1.4 cm., rotate; tube about 2 mm. long, greenish, glabrous, hidden by the calyx; lobes 5, elliptic-lanceolate, about 7×2 mm., white, entire at margins, acute at apex, glabrous on both surfaces. *Stamens* 5, equal; filaments whitish green, less than 1 mm., arising from the base of the corolla, glabrous; anthers dorsifixed, yellow, lanceolate, about 5 mm. long. *Ovary* 2-celled with many ovules in each cell, arranged on an axile placenta, green, glabrous. *Stigma* green, otherwise undistinguishable from the style. *Fruit* a



Solanum aculeatissimum Jacq.

1. Twig; 2. Dissected flower; 3. Pistil; 4. Fruit; 5. Seed.

berry, spherical, 2.5 cm. or more in diameter, white with greenish streaks at the base when young, bright orange when ripe, glabrous and shining. *Seeds* numerous, winged, pale brown coloured, about 4 mm. in diameter, including the wings; wings circular, going all round the seed.

Flowering: More or less throughout the year.

Fruiting: More or less throughout the year.

Distribution: Tropical Asia and America.

Remarks: This species occurs wild in Assam on roadsides and in damp waste places, growing side by side in some places with *Solanum khasianum* Clke., which it closely resembles.

Chemical investigations on the species is in progress.

ACKNOWLEDGEMENTS

Our grateful thanks are due to Rev. Fr. H. Santapau, Director, Botanical Survey of India, for confirming our identification and also for guidance.

REGIONAL RESEARCH LABORATORY,
JORHAT,
ASSAM,
October 8, 1963.

H. P. BEZBARUAH
BALAMANI BEZBARUAH

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25. *HYPHAENE INDICA* BECC. ALONG THE WEST COAST OF INDIA

(With a plate)

GICAL GARDEN ALCUTTA

Burkill (1908), in *J. Bombay nat. Hist. Soc.* **18** : 929, recorded a few interesting points of the Indian Doum Palm, *Hyphaene indica* Becc. besides other African species of the genus on the basis of Beccari's work. During the study of the flora of western India, the present writer collected and studied this species in further detail and found that the species is quite distinct from *H. thebaica* (Linn.) Mart., the Egyptian Doum Palm, which is only cultivated in a few gardens of India particularly of the west coast and the Indian Botanic Garden,

Calcutta. *H. indica*, however, is the only species indigenous to the west coast of India.

H. indica grows along the sandy coast of western India almost adjoining the sea ranging from 18° to 23° N. lat. The areas newly recorded now, from which actual notes or collections have been made after study by the author, are coastal areas opposite Nagaon (on way to Revdanda from Alibag), Dahanu (only one broken tree and a seedling), Daman Grande (Jampore village, opposite market) (Plate, fig. 1), and small Daman. On the available information it can be noted that this palm grows at Shirgaon (beyond Palghar) and Okamandal, Diu (Saurashtra coast). It is also very likely that this species may occur along suitable sandy coastal belt further south of Alibag area and also along Daman-Diu range of the Gujarat State.

It is normally considered that all plants of *Hyphaene* growing in Indian gardens are *H. thebaica*. At Bombay, it is found that there is only one clump of well-grown plants of *H. thebaica* in Mazagaon hill garden (with pumping station), Bombay-10, and the small immature plant (about 7-8 metres) in the Victoria Gardens, Bombay, as kindly shown by Shri Irani in charge of the Botany section of the Gardens, may be either *H. thebaica* or *H. indica*, and the correct identity will be decided when the fruits of this plant are available. It is normally considered that the branched palms in the public garden of Baroda belong to *H. thebaica*, but the material sent from Baroda by Prof. A. R. Chavan of M. S. University, Baroda, is found to be *H. indica*. The author's recent scrutiny of the various palms of *Hyphaene* growing in the Indian Botanic Garden, Calcutta, reveals that there are three young fruiting palms of *H. indica* growing on a mound near the old, tall palms of *H. thebaica*. There is, however, no entry of *H. indica* in the Garden records. It is, therefore, of considerable interest that the indigenous species of *H. indica* has also found a place in the gardens of Baroda and Calcutta, possibly introduced inadvertently from the seed material of the palms growing along the Gujarat Coast or other parts of the western coast of India. It is necessary to check up whether all the *Hyphaene* plants growing in the Baroda gardens belong to *H. indica* only, or *H. thebaica* was also introduced in an earlier period, as in the Calcutta Garden, when such distinction between the two species was not clearly known.

It is difficult to distinguish the two doum palms, the Indian and the Egyptian, from vegetative characters. The fruit and the axis of female inflorescence provide distinct features (Plate, fig. 2). In *H. indica* the fruit (B_1) has a characteristic ovate shape with a distinct stalk (b_1, 10-15 mm.) covered by fine hairs and with rough cracked



Fig. 1. Several trees of *Hyphaene indica* growing along the coast of Daman Grande, India

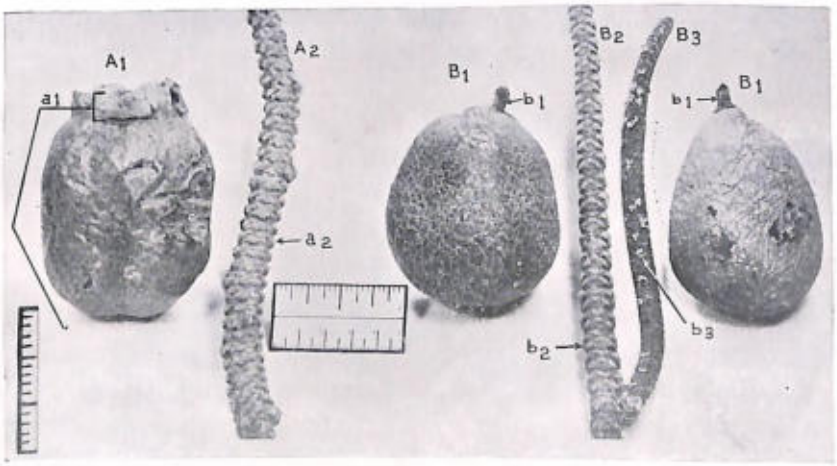


Fig. 2. Fruit and inflorescence of *Hyphaene thebaica* and *H. indica*

A. *H. thebaica* : A_1 fruit ; A_2 female inflorescence axis ; a_1 pedicel (much enlarged) ; a_2 tomentose cushion. B. *H. indica* : B_1 fruit ; B_2 female flowering axis ; B_3 male ditto ; b_1 pedicel ; b_2 tomentose cushion ; b_3 male flowers.

(Photos : Seshagiri Rao Rolla)

exocarp, and the axis of female inflorescence (B_2) is less hairy with a few rhomboid tomentose cushion-like structures (b_2) in each spiral not quite prominent. In *H. thebaica*, the fruit (A_1) has an irregular oblong shape with an indistinct stalk surrounded by a thick bushy hairy cushion thus making it broader than high (a_1) and a smooth and glossy exocarp; the axis (A_2) is more hairy with larger number of rhomboid tomentose cushions (a_2) in each spiral distinctly protruding out. The internal structure of the fruit of both the species is mostly identical without any distinct variation.

It would be a good and interesting botanical acquisition if *H. indica* which is propagated by seed is introduced in the gardens and parks along the west and east coasts of India.

The author wishes to express his thanks to Prof. A. R. Chavan for kindly sending the material from Baroda.

BOTANICAL SURVEY OF INDIA,
WESTERN CIRCLE,
POONA, 1,
July 16, 1963.

SESHAGIRI RAO ROLLA

26. A NEW SPECIES OF *LASIURUS* FROM WESTERN RAJASTHAN[1]

(*With a plate*)

During a reconnaissance survey of the flora of Jodhpur district, the authors came across an interesting species of *Lasiurus*, a genus which is found commonly growing all over western Rajasthan. It was provisionally listed as *Lasiurus hirsutus* but examination in the herbarium showed that it is a distinct species.

At the outset, it should be stated that there are two recorded species of *Lasiurus* in north-west India, namely *Lasiurus hirsutus* (Forsk.) Boiss. and *L. sindicus* Henr., the latter being differentiated from the former solely on the basis of indumentum on the internode and peduncle.

The *Lasiurus* species collected by us did not agree with the description of the above two species although the inflorescence had some morphological similarities with that of *Lasiurus sindicus*. The specimen was sent to Kew Gardens, where Dr. Bor after studying the

[1] Communicated by the Director, Central Arid Zone Research Institute, Jodhpur, Rajasthan.

specimen, observed that the absence of tail to the lower glumes of the sessile and pedicelled spikelets is an important taxonomic character that distinguishes it from *Lasiurus sindicus*. In all the Indian sheets at Kew, the long tail is a very conspicuous feature in both species of *Lasiurus*. It was, therefore, considered that this plant merited specific rank by itself.

Lasiurus ecaudatus sp. nov.

It is distinguished by its large leaves, 3 to 4 racemes per culm, absence of tail to the lower involucral glume and absence of nerves on the lower floral glume.

Gramen perenne, fasciculatum plus minusve ramosum et lignosum infra, surculis intravaginalibus. *Culmi* pubescentes, 80-108 cm. alti, nodis 3.8-5 cm. inter se distantibus. *Vaginae* arctae, glabrae. *Ligula* contracta in fimbriam capillorum. *Foliorum* lamina linearis pulchre acuminata, ± 26.9 cm. longa, 4 cm. lata, glauca, glabra vel capillis nonnullis e tuberculo oriundis ornata prope ligulam.

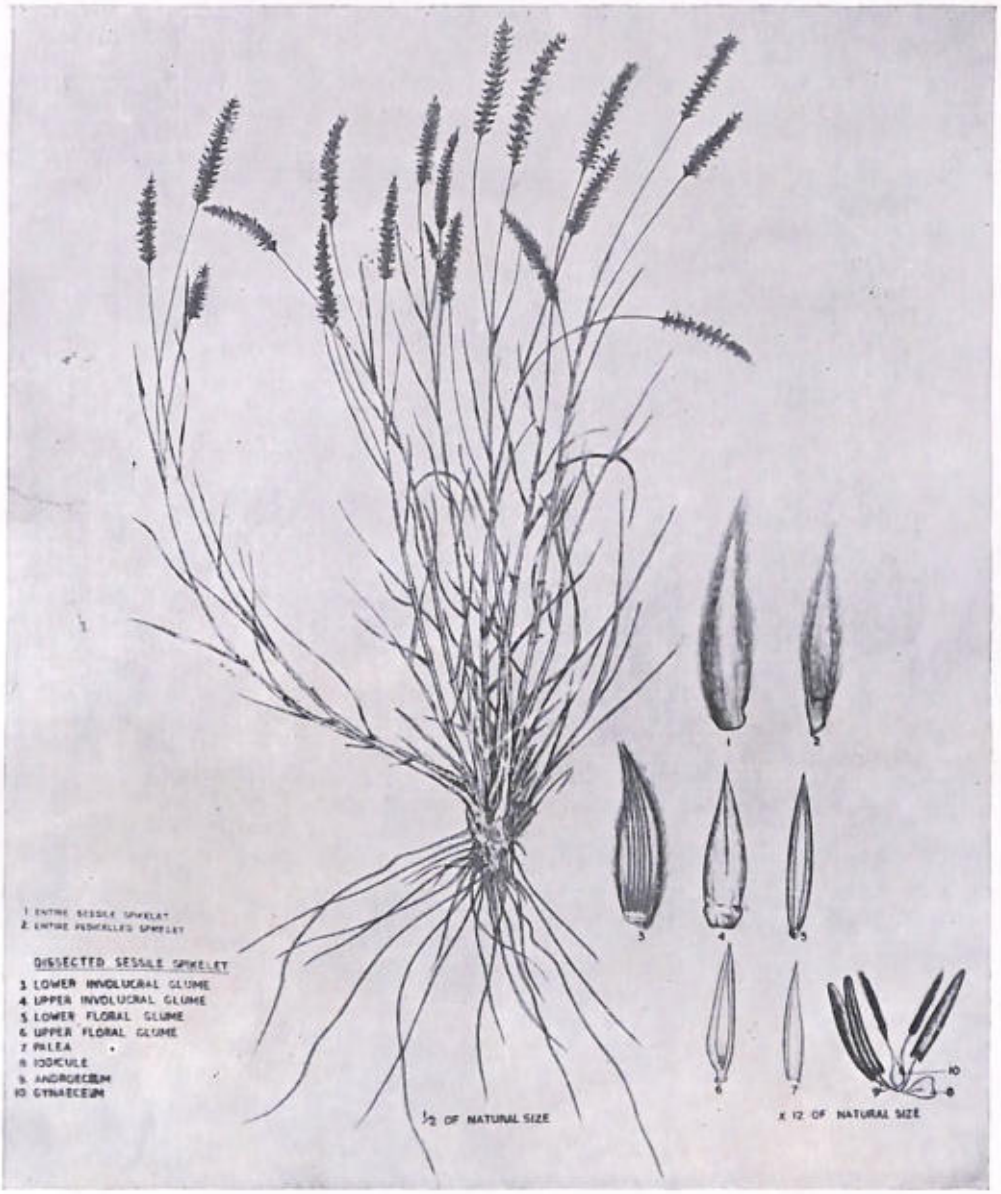
Racemi spicati 3-4 in singulis culmis, terminales et axillares; *pedunculi* dense pubescentes; *spicae* argenteae sericae, ad 11 cm. longae, 1 cm. latae, fragiles, articulis linearibus, 5-7 mm. longis, 2 mm. latis dorsaliter compressis, paene complanatis carina ornatis ad faciem interiorem.

Spicula sessilis lanceolata, 3-4.5 mm., rachis nodis barbatis; flosculi bini, quorum inferior masculus, superior vero hermaphroditus, arista nulla; gluma inferior 9 mm. longa, 59-nervia, ecaudata, ovata, fastigata supra, dense ciliata et membranacea; *superior gluma* carinata, 8-9 mm. longa, membranacea; *gluma floralis inferior* hyalina, 6 mm. longa, nervo nullo, ovata, acuta; *palea* hyalina, ovata, acuta, nervo nullo distincta, 3.9-4.9 mm. longa. *Lodiculae* 2, cuneatae; *stamina* 3, antherae 2.9 mm. longae. *Ovarium* 0.5 mm. longum; stylus 1.5 mm., stigmatibus linearibus exsertis 1.25 mm. longis.

Spiculae pedicellatae eis sessilibus similes callo indistincto glabro, utroque flore masculo vel reducto.

Holotypus: C.R. Farm, Central Arid Zone Research Inst., Jodhpur, Rajasthan, 250 m., 7 januarii 1962, *Y. Satyanarayan & K. A. Shankarnarayan* 719. In Herbario eiusdem instituti ad Jodhpur.

Perennial, tufted more or less branched and woody below with intravaginal shoots. Culm pubescent, height of culms varies from 80 to 108.8 cm. The distance between nodes 3.8-5 cm. Leaf sheaths closely clasping the culm, glabrous. Ligule a fringe of hairs. Leaf blade linear, finely acuminate, the average length being 26.9 cm., and



Lasiurus ecaudatus sp. nov.

width 4 cm., glaucous, glabrous or with a few tubercle-based hairs towards the ligule.

Spike-like racemes 3 to 4 per culm, terminal and axillary. The peduncle is densely pubescent and the spike silvery silky all over. The spikes are up to 11 cm. long and 1 cm. wide, fragile, joints linear 5.0-7 mm. long, 2 mm. wide, dorsally compressed, almost flat with a keel on the inner surface.

Sessile spikelet lanceolate 3-4.5 mm.; nodes or rachis bearded all round. Florets two, lower male, upper hermaphrodite awnless; lower involucral glume 9 mm. long, 5-nerved with no cauda, ovate, tapering above, densely ciliate and membranous; upper involucral glume boat-shaped, 8-9 mm. long, membranous; lower floral glume hyaline, 6 mm. long, nerveless, ovate, acute, palea hyaline, ovate, acute, nerveless, 3.9-4.9 mm. long. Lodicules 2, cuneate; stamens 3, anthers 2.9 mm. long. Ovary 0.5 mm. long; style 1.5 mm. while stigmas are linear, exserted 1.25 mm. long.

The pedicelled spikelets are similar to the sessile ones with a glabrous indistinct callus and with both florets male or reduced.

Holotype. C. R. Farm, Central Arid Zone Research Institute, Jodhpur, Rajasthan, 250 mm., 7th January 1962, *Y. Satyanarayan and K. A. Shankarnarayan* 719, deposited in the Herbarium, Central Arid Zone Research Institute, Jodhpur.

Lasiurus ecaudatus sp. nov.

1. Leaves 15-27 cm.
2. Racemes at least 3 to 4 per culm
3. Lower involucral glume 9 mm. long
4. Tail or cauda absent in the lower involucral glume
5. Lower floral glume nerveless
6. Pedicellate spikelet similar in size to sessile spikelet
7. Pedicels 3 mm. long

Lasiurus sindicus Henr.

1. Leaves 7.5-15 cm.
2. Racemes solitary
3. Lower involucral glume 10 mm. long
4. Tail present in the lower involucral glume
5. Lower floral glume 3-5-nerved
6. Pedicellate spikelet shorter than sessile spikelet
7. Pedicels 4 mm. long

Acknowledgements

We thank Dr. P. C. Raheja, Director, Central Arid Zone Research Institute, Jodhpur, for evincing keen interest. To the Director, Royal Botanic Gardens, Kew, and Dr. N. L. Bor we express thanks for confirming the identification of this taxon. We are grateful to Rev.

Fr. H. Santapau S.J., Director, Botanical Survey of India, for the Latin diagnosis. We also thank Prof. P. V. Bole, St. Xavier's College, Bombay, for supplying literature on the genus.

CENTRAL ARID ZONE RESEARCH INSTITUTE,
GOVERNMENT OF INDIA,
JODHPUR, RAJASTHAN,
August 26, 1963.

Y. SATYANARAYAN
K. A. SHANKARNARAYAN

Gleaning

The Description and Naming of New Species

In view of the gleaning at page 705 of the *Journal* for April 1962, Vol. **59** (2), our readers may be interested to read the following extract from a paper by B. H. Hodgson published in the *Journal of the Asiatic Society of Bengal*, Vol. **5** (1836), describing sundry animals enumerated in the Catalogue of Nepalese Mammals.

'The whole of the above animals were discovered by me several years back (1823-1829), and might have been described much sooner, had I not deemed it improper to hazard the multiplication of imaginary species by characterising from one or two specimens. There is not one of these species of which I have not procured several specimens at all seasons, and either alive or just killed. The indications of the catalogue are such as to entitle me to date from its publication (originally in 1829). But in truth, my object has been, and is, much less to share in the scramble of nomenclature, than to ascertain the habits and structure of species.

'Nothing is so vague at present as the true limits of species and as my *first* aim was rather to find resemblances than differences, so perhaps it might wisely have been my *last*.

'If, however, any person who chances to lay hold upon a single shrivelled skin, may forthwith announce a new animal, the real student of nature must be content to leave what is called discovery to the mere nomenclator; and the science must continue to groan under an increasing weight of fictitious species.'

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