

far south as Mergui, whence Dr. Anderson obtained living specimens for the Calcutta Zoological Gardens. It also occurs in Southern China, Hainan, and Formosa. Whether the bear found in the plains of Eastern Bengal and Assam is this species or the sloth-bear, I cannot state positively. I once saw a skin of *U. torquatus* obtained from an animal that I was assured had been shot in Lower Bengal; and a writer in the 'Asian' of January 21st, 1888, states that he shot one in the Terai, close to the Patli Dun, North-west Provinces.

Synonymy. The specific name *thibetanus*, although the oldest, must be abandoned, because the animal, although common on the southern slopes of the Himalaya, is never found in Tibet itself. I was misled by a discoloured skin of very small size into giving a new name, *U. gedrosianus*, to the Baluchistan bear; but remarkable as it appears that a Himalayan and Chinese species should inhabit so very different a climate as that of Baluchistan, there appears no sufficient distinction to justify the separation of the bear from the latter country.

Habits. In the Himalayas and throughout its range, except in Baluchistan, the black bear is a forest animal. In the mountains it is found at various elevations from near the base of the hills to about 12,000 feet; usually in summer it ascends to 9000 or 10,000 feet or higher, whilst in winter it descends to 5000 feet or even lower. It is found frequently about villages, and often feeds in fields of grain or in fruit orchards; it has even been known to eat the pumpkins growing on the roof of a house. In winter it subsists largely on acorns. Its food consists mainly of fruits and roots; but whilst it does not dig so much for the latter as the brown bear, it is far more in the habit of climbing trees for fruit, and is not unfrequently found in fruit-trees at night or in the morning. It is also, like most bears, fond of honey, and is said at times to attack the beehives in villages. At the same time it is the most carnivorous of the Indian bears, and not only kills sheep, goats, deer, and even cattle and ponies, but occasionally feeds on carrion.

Some observers state that black bears hibernate, whilst Adams declares they do not. The fact is doubtless, as stated by Kinloch, that they do not hibernate completely as *U. arctus* does, but that they remain in a state of semitorpor, often in a hollow tree, during the cold months, moving about and feeding a little on milder days.

By all accounts the black bear is a much more savage animal than the brown bear, and as the former lives near villages, he more frequently comes in contact with men. Many natives are killed or severely injured by black bears in the Himalayas, and some Europeans; but still it appears an exception for even a wounded bear to charge. This animal is much sharper of sight and hearing than the Himalayan brown bear, and is said by some to have remarkable powers of scent; but by other accounts its sense of smell, though fairly acute, is very inferior to that possessed by deer or especially by wild sheep or ibex. It has the usual walk and quick



but clumsy gallop of the family. It is an excellent swimmer, crossing swollen torrents with ease.

The usual den of this bear is in dense jungle, often in a cave or hollow tree amongst thick bush. As in the case of *U. arctus*, adults are generally found alone except in the pairing-season; but the cubs remain with the mother till full-grown, and those of two seasons are sometimes found with her at one time. This accounts for the parties of four or five bears occasionally noticed. The period of gestation has not been recorded, but is probably the same as in other bears; the young, usually two in number, are born in spring, and are very small, and blind for some time after birth. If captured young they are easily tamed, but are said to be less docile than the other three Indian species, and are certainly less frequently seen in captivity.

99. *Ursus malayanus*. *The Malay Bear*.

Ursus malayanus, *Raffles, Tr. Linn. Soc.* xiii, p. 254 (1822); *Blyth, Cat.* p. 76.

Helarctos malayanus, *Horsf. Zool. Journ.* ii, p. 254; *Cantor, J. A. S. B.* xv, p. 191; *Blyth, Mam. Birds Burma*, p. 30.

Helarctos euryspilus, *Horsfield, Zool. Journ.* ii, p. 221.

Wek-won, Burmese; *Bruang*, Malay.

Size small. Fur short and coarse. Claws well curved. Ears small, rounded, covered with short hair. Tongue very long.

Skull in adults very short and broad, nose short, zygomatic arches wide. Auditory bullæ more swollen than in *U. arctus* or *U. torquatus*. Incisors and canines large, premolars crowded and soon lost. Upper sectorial very small, its transverse section scarcely larger than that of the outer incisor. Molars short and very broad.

Colour. Black, brownish in parts. The muzzle including the eyes and the chin paler, often whitish; the crescentic patch on the chest white, yellow, or orange, with the two ends often broad, sometimes united into a large oval or heart-shaped spot with a black centre, and sometimes with the apex prolonged into a white streak on the abdomen. Claws pale horny, sometimes dusky.

Dimensions. Head and body about 4 feet, tail 2 inches, hind foot 7. The animal may grow to a rather larger size than this, but apparently never exceeds about $4\frac{1}{2}$ feet in length. A full-grown Bornean female only measured 36 inches from nose to rump, tail 1 inch; weight 60 lbs. The ears are quite short, not more than 2 inches long. A very old and large skull is 8.5 inches long (basal length) and 8.3 broad; in younger skulls (fig. 52, p. 194) the breadth is proportionally less.

Distribution. This bear inhabits the Malay Peninsula, Sumatra, Java, and Borneo, and extends northwards into Tenasserim, Arakan, Chittagong, and the Garo hills. Throughout Burma, indeed, I learn from Dr. Anderson, both this and the preceding species

are found. Theobald, in Mason's 'Burma,' doubts if *U. malayanus* is found in Pegu.

Habits. But little known except in captivity. This bear is a purely forest animal and an admirable climber. It is essentially frugivorous, but like other bears occasionally kills and eats animals and birds. It is said to be very fond of honey, and it probably devours insects and their larvæ. Occasionally it is said to attack man. The instances of such attacks mentioned by Dr. Mason in his work on Burma may, however, have been due to *U. torquatus* and not to the present species.

In confinement *U. malayanus* soon becomes very tame if captured young, and from its activity and antics is very amusing. Good accounts of tamed animals are given by Sir Stamford Raffles, and by Col. McMaster in his 'Notes on Jerdon.'

Genus **MELURSUS**, Meyer (1794).

Syn. *Prochilus*, Illiger (1811).

The median pair of incisors in the upper jaw are wanting even in the young. Dentition: i. $\frac{4}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{2-2}{3-3}$. All the molars and premolars very small, the latter separated from each

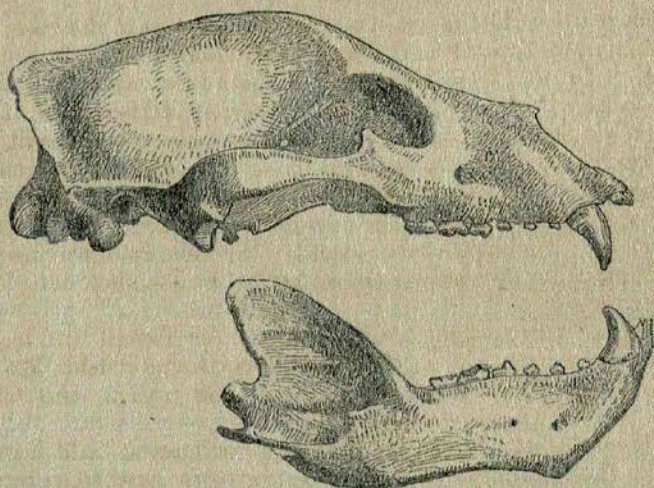


Fig. 53.—Skull of *Melursus ursinus*.

other by a considerable interval. Claws very large and powerful; snout elongate and mobile. Otherwise as in *Ursus*. Vertebrae: C. 7, D. 15, L. 5, S. 5, C. 11.

Only one species is known, and this is peculiar to the Indian Peninsula and Ceylon.

100. *Melursus ursinus*. *The Sloth-Bear or Indian Bear.*

Bradypus ursinus, *Shaw, Naturalists' Miscellany*, ii, pl. 58 (c. 1791).
Ursus labiatus, *de Blainv. Bull. Soc. Philom.* 1817, p. 74; *Sykes*,
P. Z. S. 1831, p. 100; *Elliot, Mad. Journ. L. S.* x, p. 100; *Tickell*,
Cale. Journ. N. H. i, p. 199, pl. vii; *Blyth, Cat.* p. 77; *Jerdon*,
Mam. p. 72.

Ursus inornatus, *Pucheran, Rev. Mag. Zool.* vii, p. 392 (1855).

Rinch or *Rich*, *Bhabli*, *Adam-zád*, H.; *Bhablik*, Beng.; *Riksha*, Sanscr.;
Asual, Mahr; *Yerid*, *Yedjal*, *Asol*, Gond.; *Bir Mendi*, Oraon; *Bana*,
Kol; *Elugu*, Tel.; *Kaddi* or *Karadi*, Can. and Tam.; *Pani Karudi*, Mal.;
Usa, Cingalese.

Fur long and coarse, longest between the shoulders. In the skull the palate is broad and concave, and extends back farther than in other bears, covering about two thirds of the space between the posterior molars and the hinder terminations of the pterygoids.

Colour. Black, end of muzzle dirty grey; a narrow white horse-shoe-shaped mark on the chest. Claws white.

Dimensions. Head and body 4 ft. 6 in. to about 5 ft. 8 in. long; tail without hair 4 to 5 inches. Males as a rule are larger than females. Height at shoulder 2 ft. 2 in. to about 2 ft. 9 in. Weight of a small female 170 lbs.; large males weigh as much as 20 stone (280 lbs.) or more; I find one in the 'Asian' recorded as weighing 320 lbs. A large male skull is 11 inches in basal length, and 7·8 broad across the zygomatic arches.

Distribution. The peninsula of India from near the base of the Himalayas to Cape Comorin, and Ceylon, chiefly in hilly and jungly parts. To the west this bear is found in Kattywar and has occasionally been met with in Cutch, whilst further north its range appears to be limited by the Indian desert. The eastern limit is more doubtful. The sloth-bear appears to be found, though not commonly, in Eastern and Northern Bengal; but whether the bear of the Assam plains is this species or *Ursus torquatus*, I have not been able to ascertain. Theobald even suggests that the sloth-bear may occur in Pegu, as he possessed a young animal at Toungoo with but four upper incisors.

Habits. An excellent account is given by Tickell, and numerous details have been added by Jerdon, Forsyth, Sanderson, McMaster, and others, from which and my own observations the following notes are drawn up.

The sloth-bear is still one of the commonest wild animals of India, though its numbers have been greatly diminished by sportsmen throughout the country, and in some districts, as in parts of the Deccan and Bengal, where it was common 30 or 40 years ago, it has been exterminated. Wherever it occurs its presence is shown by the holes it digs to get at termites, by marks of its claws on trees that it has ascended for honey, and by its peculiar tracks.

These animals are generally found solitary or in pairs, or three together; in the latter case a female with two cubs, often nearly or quite full-grown. Occasionally four or five are met with in



company. They inhabit bush and forest-jungle and hills, and are particularly fond of caves in the hot season and monsoon, and also when they have young. Throughout several parts of the peninsula of India there are numerous hills of a kind of granitoid gneiss that weathers into huge loose rounded masses. These blocks remain piled on each other, and the great cavities beneath them are favourite resorts of bears, as in such places the heat of the sun, and some of the insects (flies, mosquitoes, &c.) that are most troublesome in the monsoon, can be avoided. In the cold season, and at other times where no caves are available, this animal passes the day in grass or bushes or in holes in the banks of ravines. It roams in search of food at night, and, near human habitations, is rarely seen in the daytime; but in wild tracts, uninhabited by man, it may be found wandering about as late as 8 or 9 o'clock in the morning, and again an hour or even more before sunset in the afternoon. In wet or cloudy weather, as in the monsoon, it sometimes keeps on the move all day. But the sloth-bear, although, like most other Indian animals, it shuns the midday sun, appears by no means so sensitive to heat as might be expected from its black fur, and it appears far less reluctant to expose itself at noonday than the tiger is. I have seen a family of bears asleep at midday in May on a hill-side in the sun. They had lain down in the shade of a small tree, but the shade had shifted without their being disturbed. It is scarcely necessary to observe that this bear does not hibernate.

Owing to its long shaggy coarse fur, its peculiarly shaped head, its long mobile snout, and its short hind legs, this is probably the most uncouth in appearance of all the bears, and its antics are as comical as its appearance. Its usual pace is a quick walk, but if alarmed or hurried it breaks into a clumsy gallop, so rough that when the animal is going away at full speed it looks almost as if propelled from behind and rolled over and over. It climbs over rocks well, and, like other bears, if alarmed or fired at on a steep hill-side, not unfrequently rolls head over heels down hill. It climbs trees, but slowly and heavily, the unmistakable scratches left on the bark showing how often its feet have slipped back some inches before a firm hold was secured. I cannot, however, confirm the statement of some observers that this animal only ascends trees with rough bark; unless I am greatly mistaken I have seen its scratches far up the smooth stems of *kowá* trees (*Terminalia arjuna*).

The food of the sloth-bear consists almost entirely of fruits and insects. Amongst the former the jujube plum or *ber* (*Zizyphus jujuba*), the fruits of the ebony tree (*Diospyros melanoxylon*), *jamun* (*Eugenia jambulina*), *bel* (*Ægle marmelos*), and of various kinds of figs, especially *bar* or *banyan* (*Ficus indica*) and *gúlar* (*F. glomerata*), the pods of *Cassia fistula*, and the fleshy sweet flower of the *mhowa* (*Bassia latifolia*) are much eaten by these animals, each in its season, but many other wild and cultivated fruits are devoured when procurable. Beetles and their larvæ, the honey and young of bees, and above all the combs of termites or



white ants furnish food for the Indian bear. In their nocturnal rambles these animals visit many fruit-trees, sometimes climbing amongst the branches to shake down the fruit, or standing up and dragging it down with their paws; they also turn over stones to search for insects and larvæ, ascend trees to plunder bees' nests, and dig out the nests of white ants, sometimes making holes 5 or 6 feet deep for this purpose. These holes are easily recognized by the marks of the bears' claws.

Tickell says (and his views are confirmed by others):—"The power of suction in the bear, as well as of propelling wind from its mouth, is very great. It is by this means it is enabled to procure its common food of white ants and larvæ with ease. On arriving at an ant-hill the bear scratches away with his fore feet until he reaches the large combs at the bottom of the galleries. He then, with violent puffs, dissipates the dust and crumbled particles of the nest, and sucks out the inhabitants of the comb by such forcible inhalations as to be heard at two hundred yards distance or more. Larvæ, especially the large ones of the *Ateuchus sacer*, are in this way sucked out from great depths under the soil."

In Southern India bears are fond of the fermented juice of the wild date-palm, and climb the trees to get at the pots in which it is collected. The animals are said at times to get very drunk with palm-juice. They are very fond, too, of sugar-cane, and do much damage to the crops; they also occasionally eat various pulses, maize, and some other kinds of corn, and cultivated fruits such as mangoes.

According to Tickell, they rob birds' nests and eat the eggs. I have never heard an authenticated case of their killing larger animals for food, and as a rule they do not touch flesh; but Sanderson records an instance in which a muntjac that had been shot and left in the jungle was partly devoured by one, and he says that they often gnaw dry bones of cattle. McMaster also relates how the body of a bullock that had been killed by a tiger was pulled to pieces and devoured by two large bears. Young cubs reared in confinement eat flesh readily, cooked or raw.

The bears have a peculiar habit of sucking their paws and of making a humming sound at the same time, and the present species is much addicted to the practice. According to Tickell some tame young bears that he saw would suck any person's hand in the same manner as their own paws.

The eyesight of *Melursus ursinus* is by no means good, and it has a peculiarly comical way of peering about for intruders, that gives the idea of its being short-sighted. Its hearing is also, I believe, far from acute. Its sense of smell is much better; by scent it can detect honeycombs in a tree overhead, and nests of termites or larvæ of beetles at some depth below the surface of the ground. In smelling about for food, for instance when visiting fruit-trees at night, it makes a peculiar puffing sound that can be heard at a considerable distance.

Except in puffing and humming, the Indian bears are quite silent animals as a rule, and have no call for each other. Occasionally, however, they make the most startling noise, whether connected with pairing or not I cannot say. I have only heard it in the beginning of the cold season, which is not their usual pairing-time. They occasionally fight under fruit-trees, but I think the noise then made rather different.

When surprised or disturbed, and especially when wounded, a bear is generally very noisy, uttering a series of loud guttural sounds. When hit by a bullet it is far more demonstrative than a tiger; indeed I have more than once known a tiger to receive a bullet without a sound, but I never knew a bear to be hit without much howling. Besides this, when a bear is mortally wounded and lies dying he almost always makes peculiar wailing cries. This has been observed by McMaster.

If two or more bears are together and one is wounded, a fight generally ensues, which Sanderson considers due to an attack by the unwounded animal or animals; but this is not necessarily the case, as I have seen an old female when hit attack two half-grown cubs that were with her, and cuff them heartily, and in one instance, when both of two bears were hit, they stood up on their hind legs and fought till one dropped dead from the bullet-wound.

As a rule the sloth-bear is a timid animal, but occasionally it attacks men savagely, using both its claws and teeth, and especially clawing the head and face. Sometimes, especially when surprised suddenly and attempting to escape, a bear merely knocks a man down with a blow of its claws, often, however, inflicting severe wounds; but in other cases it holds its victim with its claws and bites him severely, not leaving him until some time after he ceases to struggle. Many of the most savage attacks are made by female bears that have young with them, some are by wounded animals, but occasionally the onslaught appears quite unprovoked. The story of sloth-bears hugging is, I think, unknown to the natives of India, and is only repeated by those whose ideas on the subject are derived from European folk-lore.

There are, however, many folk-lore stories connected with the Indian bear. It is a common belief in parts of India that male bears abduct women. It is possible that the name of *Adam-zád* is connected with this story. The same belief exists in Baluchistan regarding *U. torquatus*.

Sportsmen in India generally either drive patches of jungle or hills, and shoot the bears as they run out, or else mark them down in the morning, and go up to their lair on foot. Elephants are seldom used, they have a great dread of bears, and are but rarely steady with them, and the country is frequently too rough and rocky for the sport. When bears inhabit hills, sportsmen occasionally post themselves before daybreak in a commanding spot, and intercept the animals on their return from their nocturnal rambles. Bears are occasionally speared from horseback, and have sometimes been hunted with large dogs and killed with a knife



when seized. This is described by Sanderson. Jerdon gives an account of a curious method of hunting with dogs, practised by the Polygars, among the hills in the extreme south of the Peninsula. When the bear is brought to bay, the hunters each thrust a long bamboo loaded with strong bird-line into the shaggy coat of their quarry, and thus hold him firmly. Nets have also been employed.

A wounded bear usually escapes without attempting to fight, and, unless he can get into a cave, runs away until he drops, no matter what the temperature may be, frequently going many miles. Occasionally, however, he charges desperately, but a shot in the face, whether it hits or not, will almost always turn him. There is a common idea, quite unfounded, that a bear always rises on its hind legs to attack, and may then be shot in the chest. It very rarely, if ever, does this when really angry and assailing an enemy already clearly recognized. The act of rising on the hind legs is generally due to surprise, and to an endeavour, on the part of the bear, to make out his enemy better.

The pairing-time appears to vary, but is generally about June, at the commencement of the monsoon. The period of gestation is said by Tickell to be seven months; if so, it rather exceeds that of other bears. The young are born at various times from October till February, but most often in December or January; they are usually two in number, the size of Newfoundland pups, are blind for the first three weeks (18 days according to McMaster), and are covered with soft, short hair, which after a couple of months becomes rougher and coarser. After a time (2 or 3 months I believe) the mother takes them with her, carrying them on her back, where they cling to the long hair. They ride thus, at times, until of tolerable size; one cub may sometimes be seen following its mother whilst the other is carried. They take between two and three years to reach maturity, and generally remain with the mother till full-grown. Sloth-bears have been known to live in captivity for 40 years. They are, when taken young, easily tamed, and, although fretful and querulous at times, generally playful, amusing, good-tempered, and much attached to their masters.

Except *Ursus syriacus* and *U. piscator*, which are probably, like *U. isabellinus*, local races of *U. arctus*, the only other member of the *Ursidae* found in Asia is the very remarkable *Eluopus melanoleucus*, inhabiting Moupin, in Eastern Tibet. It has one premolar less than *Ursus* on each side of the lower jaw, and there is no alisphenoid canal, but otherwise the skull and dentition do not differ greatly from those of true bears. It is the size of a small brown bear; white, except the ears, a ring round each eye, the shoulders and legs, which are black. The soles of the feet are hairy.



Order INSECTIVORA.

The order next to be considered comprises the tree-shrews, hedgehogs, moles, and shrews, besides several allied groups. A very curious animal called the flying lemur is also included. All are of greatly inferior organization to the Primates and Carnivora, and appear to be less specialized than any other order of placental mammals.

The account of the Insectivora is taken almost entirely from Mr. G. E. Dobson's Monograph, and to that work, in which all Indian forms receive full notice, the reader may be referred for complete anatomical details. The following are some of the principal characters of the order, quoted from the work named.

"Terrestrial, rarely arboreal or natatorial, diphyodont, heterodont, placental mammals of small size, with plantigrade or semi-plantigrade, generally pentadactyle, unguiculate feet, with clavicles (except in *Potamogale*), with more than two incisors in the mandible, and with enamel-coated molars having tuberculated crowns and well-developed roots.

"The extremity of the muzzle projects so far beyond the end of the mandible as to be almost characteristic. The testes are inguinal or abdominal, and are not received into a scrotum; the uterus is two-horned; the placenta discoidal and deciduate; and the smooth cerebral hemispheres do not extend backwards over the cerebellum."

Although the distinction of the teeth into incisors, canines, premolars, and molars is easy in some families, it is, as a rule, much less clear than in the higher Mammalia; and in many cases, as amongst the shrews, the incisors, canines, and anterior premolars can only be distinguished by their position in the jaw; the molar teeth are studded with sharp cusps.

By far the majority of the order are nocturnal, the *Tupaia* being the only exception. The food consists chiefly of insects, except in the case of the aberrant *Galeopithecus*.

By most modern naturalists the Insectivora are divided into two suborders, thus distinguished:—

- | | |
|---|-------------------|
| Upper and lower incisors conical, unicuspidate, or with basal cusps only, the lower not pectinate; limbs free..... | INSECTIVORA VERA. |
| Upper and lower incisors compressed, multi-cuspidate, the lower deeply pectinate; anterior and posterior limbs connected by a broad integumentary expansion, forming a parachute..... | DERMOPTERA. |



It has recently been proposed by Mr. Oldfield Thomas to raise the *Dermoptera* to the rank of an order.

The fossil Insectivora are not very numerous, and none of any importance have been discovered hitherto in India.

Measurements of the smaller Insectivora, as of other micro-mammalia, are mostly from specimens preserved in alcohol.

Suborder *INSECTIVORA VERA*.

This suborder contains the following nine families, four of which are found within the limits of the British Indian Empire:—

- | | |
|---|--|
| A. Upper true molars narrow, with V-shaped crowns (not Indian) .. | { <i>Chrysochloridæ</i> (Africa).
<i>Centetidæ</i> (Madagascar).
<i>Solenodontidæ</i> (West Indies).
<i>Potamogalidæ</i> (Africa and Madagascar). |
| B. Upper true molars broad, multicuspidate, with more or less well-defined W-shaped crowns. | |
| <i>a</i> . Postorbital processes present; a cæcum generally developed; symphysis pubis long. | |
| <i>a'</i> . Orbital ring encircled by bone; metatarsus moderate: animal squirrel-like, arboreal.. | <i>Tupaiidæ</i> . |
| <i>b'</i> . Orbital ring not encircled by bone; metatarsus greatly elongate: terrestrial | <i>Macroscelidæ</i>
(Africa). |
| <i>b</i> . Skull without postorbital processes; no cæcum; symphysis pubis short or wanting. | |
| <i>a'</i> . Crowns of first and second upper molars with a central fifth cusp; bullæ imperfect | <i>Erinaceidæ</i> . |
| <i>b'</i> . No central fifth cusp. | |
| <i>a''</i> . Zygomatic arches present; bullæ ossified. | <i>Talpidæ</i> . |
| <i>b''</i> . No zygomatic arches; bullæ imperfect.. | <i>Soricidæ</i> . |

Family *TUPAIIDÆ*.

"Arboreal Insectivora, with comparatively large brain-case, orbits encircled with bone, and well-developed zygomatic arches. The malar bone is perforated, the tympanics form bullæ; the pubic symphysis is long; the tibia and fibula are distinct, the metatarsus but little longer than the tarsus; the molars are broad, with W-shaped cusps; and the intestinal canal has generally a short cæcum." (*Dobson*.)

The animals forming this family have a great similarity to squirrels, which they resemble in the general form of the body and limbs, and in having a more or less bushy tail. They differ from all other Insectivora in being not only arboreal but diurnal in

their habits, feeding by day. They are generally divided into two genera: *Tupaia*, the only form found in India and Burma, and spread throughout the greater part of the Oriental region, and *Ptilocercus*, the pen-tail, which is peculiar to Borneo. By some writers another Bornean species and a Cambodian one are distinguished as *Dendrogale*.

Genus **TUPAIA**, Raffles (1820).

Syn. *Glisorer*, Desm. (1822); *Cladobates*, F. Cuv. (1825); *Hylogale*, Temm. (1827).

The general form remarkably like a squirrel. Limbs well developed; feet naked beneath, the sole furnished with projecting pads, much as in a squirrel, there being especially a long, almost linear projection on the inner sole of the hind foot. Claws moderately curved and sharp. Head pointed; ears rounded. Tail bushy, distichous, clothed with long hair above and at the sides, and with short hair on the lower surface.

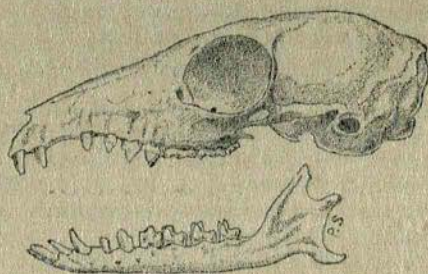


Fig. 54.—Skull of *Tupaia ferruginea*. (Anderson, An. Zool. Res. pl. vii.)

Dentition: i. $\frac{4}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$. The first or median upper incisors are at the end of the jaw, widely separated from each other and from the second incisors; the canine, which is similar in size and shape, follows after another even longer interval. The premolars increase in size backwards, the third, and in some species the second, having a well-developed inner lobe. Of the molars the first and second are nearly the same size, the third is much smaller. In the lower jaw the first two incisors are in contact, and project almost horizontally forward; the third is smaller; the canine is variable, being sometimes larger than the incisors, sometimes only the size of the third incisor.

Vertebrae: C. 7, D. 13, L. 5, S. 3, C. 23-26. Mammaræ two pairs, one inguinal, the other axillary.

A full account of the osteology, together with descriptions of all the species, is given by Anderson in his 'Zoological and Anatomical Researches.'

*Synopsis of Indian and Burmese Species.*

- A. Colour above speckled throughout; a more or less distinct shoulder-stripe.
a. Throat and breast nearly white; dorsal fur uniformly coarse *T. ellioti*, p. 209.
b. Throat and breast buff; coarser glossy hairs intermixed in dorsal fur *T. ferruginea*, p. 210.
B. Colour of lower back uniformly blackish; no shoulder-stripe. *T. nicobarica*, p. 212.

101. *Tupaia ellioti*. *The Madras Tree-Shrew.*

Tupaia ellioti, Waterhouse, *P. Z. S.* 1849, p. 107; *Blyth, Cat.* p. 82; *Jerdon, Mam.* p. 64; *Ball, P. A. S. B.* 1874, p. 95, 1877, p. 168; *Günther, P. Z. S.* 1876, p. 426; *Anderson, An. Zool. Res.* p. 124; *id. Cat.* p. 153.

Minghil anathan (bamboo-squirrel), Tam.

Hair harsh, of uniform length and thickness, without coarser or longer piles.

A small and oval perforation in the malar bone. A well-developed inner lobe to the second upper premolar, forming half the breadth of the tooth. Inner lobe of third upper premolar nearly as wide (from front to back of tooth) as outer lobe. Inner lobe of first and second upper molars as wide as the outer lobe, and with a small cusp at both of the inner angles of each tooth.

Colour. Above yellowish-brown speckled, the middle of the back, the rump, and sometimes the upper surface of the tail, tinged to a variable extent with rusty red. Tail generally the same colour as the back. Lower surface of body nearly white, and a distinct pale stripe from the throat below the ear passing obliquely up in front of the shoulder. Hairs on the upper surface blackish at the base, then pale rufous or dirty white, with a black ring near the end, and the tip black. Hairs of tail with about three pale and three black rings, the basal ring being pale.

Dimensions. Head and body 7 to 8 inches, tail without the hair about half an inch less, with hair 8 to 9 inches, hind foot without claws 1·7; extreme length of skull 1·7, basal length 1·55, zygomatic breadth ·85.

Distribution. Throughout a large part of the Indian Peninsula south of the Indo-Gangetic plain, in forest. This species has been recorded from the Karakpur hills, near Monghyr, the Satpura hills south of the Nerbudda, Matheran near Bombay, Maunbhúm, Sambulpur, Vizagapatam, the Godavary, and the hills between Cuddapah and Nellore (the original locality). I have just received a specimen obtained by Mr. W. M. Daly on the Shevroy hills, but I have not heard of any tree-shrew being found in the forests, either of hills or plains, near the Malabar coast in the Madras presidency, nor in Ceylon.

Habits. This *Tupaia*, like other species, is found in trees in forests, and closely resembles squirrels in its movements. Its food consists of insects and, probably, of fruits. It is easily tamed.

102. *Tupaia ferruginea*. *The Malay Tree-Shrew.*

Tupaia ferruginea, *Raffles, Linn. Trans.* xiii, p. 256 (1822); *Cantor, J. A. S. B.* xv, p. 188; *Horsf. Cat.* p. 131; *Blyth, Cat.* p. 81; *Günther, P. Z. S.* 1876, p. 425; *Anderson, An. Zool. Res.* p. 130; *id. Cat.* p. 156; *Thomas, P. Z. S.* 1886, pp. 67, 73.

Cladobates belangeri, Wagner, Schreb. Säugeth. Supp. ii, p. 42.

Tupaia belangeri, Günther, P. Z. S. 1876, p. 426; *Anderson, An. Zool. Res.* p. 126; *id. Cat.* p. 154; *Thomas, P. Z. S.* 1886, pp. 59, 67.

Tupaia peguana, Lesson, Nouv. Tab. Reg. An., Mam. p. 93 (1842); *Serdon, Mam.* p. 65; *Blyth, Mam. Birds Burma*, p. 31; *W. Blanf. J. A. S. B.* xlvii, pt. 2, p. 152.

Tupaia chinensis, Anderson, An. Zool. Res. p. 129; *id. Cat.* p. 155.

Kalli-tang-zhing, Lepcha; Tswai, Burmese; Tupai tana, Malay (Penang).



Fig. 55.—*Tupaia ferruginea*. (From a drawing by Col. Tickell.)

Fur soft, some of the hairs on the back coarser, longer, and distinguished by their lustre.

Perforation in the malar bone moderately large, oval. Inner lobe of second upper premolar variable, being occasionally nearly half the breadth of the tooth, but generally reduced to a very small size, and resembling a cingulum. Inner lobe of third upper premolar about half as wide (from front to back of tooth) as outer lobe. Inner lobes of first and second upper molars narrower than outer lobe, and with a small additional cusp at the posterior, but none at the anterior inner angle.

Colour. Above and on the sides varying from brown with a yellowish tinge to deep ferruginous, always speckled or grizzled, though less distinctly in ferruginous specimens. Tail and outside of limbs nearly the same as the back, except that in some ferruginous specimens the tail is less rufous. A pale oblique stripe, sometimes



indistinct, before each shoulder. Lower parts yellowish buff with more or less of a brownish tinge. Under surface of tail paler. Basal portion (generally half or more) of dorsal fur leaden black, terminal portion of shorter hairs yellowish white or pale rufous, the longer and coarser hairs having beyond the pale ring a long black tip, sometimes with a second subterminal pale ring. Long tail-hairs with alternating subequal rings of black and rufescent white, about three of each, the basal ring pale.

Dimensions. Head and body 6.5 to 7.75 inches, tail without hair 6 to 7, with hair 7 to 8, hind foot without claws 1.7; total length of skull 1.76, basal length 1.56, zygomatic breadth 0.9.

Varieties. By most writers the northern or Burmese race is distinguished, as *T. belangeri* or *T. peguana*, from that found in the Malay Peninsula and Islands, the true *T. ferruginea*, the colour of the former being yellowish brown, of the latter deep rusty brown. There appears, however, to be a passage between the two, many Tenasserim specimens being intermediate in coloration, with the lower back and rump ferruginous. Some differences in the form of the teeth and skull have been pointed out by Anderson and Thomas, but, so far as I can determine, they are not constant. A form from Yunnan and the hills of Upper Burma, near Bhamo, has been separated by Anderson as *T. chinensis*; but I feel doubtful if the characters pointed out (rather smaller size, and smaller teeth) justify specific distinction.

Distribution. Throughout Burma, extending to Assam, and along the lower slopes of the Himalayas, between 3000 and 6000 feet according to Jerdon, as far west as Nepal. To the southward the rufous form extends to the Malay Peninsula, Sumatra, Java, and Borneo. A specimen was obtained by Dr. Stoliczka on the island of Preparis, north of the Andamans.

Habits. This tree-shrew is found in tree-forest, sometimes in bamboos, in bushes, or trees about villages, and in Burma, according to both Mason and McMaster, in houses, living singly or in pairs. Both insects and fruit are eaten by it, and according to the natives of Sikkim small birds and mice. These animals are active, but McMaster considers them much less so than squirrels, and I am disposed to think he is right. Cantor, who appears to have kept several in confinement, states that they sit on their haunches when feeding, "holding their food between their fore legs, and, after feeding, they smooth the head and face with both fore paws, and lick the lips and palms. They are also fond of water, both to drink and bathe in."

According to the same observer, these tree-shrews are pugnacious, driving away all intruders of their own species from their usual hunting-grounds, and fighting each other when confined in a cage. Their call is a "short, peculiar tremulous whistling sound," when angry they utter "shrill protracted cries." Very little is known of their reproductive habits; the female is said usually to have only one young one at a time. They are easily tamed, and become at times, of their own accord, very familiar, entering houses,



climbing on the tables and beds, and helping themselves to any food they may fancy. Mason mentions one that acquired a taste for tea and coffee.

103. *Tupaia nicobarica*. *The Nicobar Tree-Shrew*.

Cladobates nicobaricus, *Zebebor*, *Novara-Reise*, *Säugeth.* p. 17, pls. i, ii (1868).

Tupaia nicobarica, *Anderson*, *An. Zool. Res.* p. 136; *id. Cat.* p. 157.

Fur with some piles longer and coarser than the rest, and highly lustrous.

Skull more elongate than in *T. ferruginea*, but not approaching *T. tana* in this respect. Teeth large.

Colour. Above brownish black on the greater part of the back and tail; the muzzle, a band from the back of the head to between the shoulders, sides of the head and neck, and outside of limbs yellowish golden brown. Lower parts pale brown; lower surface of the tail except towards the base scarcely paler than the upper. No shoulder-stripe. The blackish hairs of the back and tail not annulated; on the brown portions the hair is indistinctly ringed light and dark brown.

Dimensions. Head and body 7·5 inches, tail with hair 10; weight 6 oz. In other specimens (males in alcohol): head and body 7·1, tail without hair 8, hind foot without claws 1·77. Skull of larger male 2·2 long, 1·2 broad.

Distribution. Nicobar Islands; hitherto not found elsewhere. The habits are not recorded.

The largest species of the genus is *T. tana*, found in Borneo. *T. javanica* is a small form that inhabits the Malay Peninsula, as well as the islands, and there are a few other species known.

Family ERINACEIDÆ.

Insectivora with plantigrade feet provided with simple, not fossorial claws, with well-developed radius and ulna, but having the fibula anchylosed below to the tibia, with long slender clavicles and a bifid acromion, with a narrow pubic symphysis, with slender zygomatic arches in which the small malar bones (rarely absent) are suspended, with well-developed pterygoid fossæ, with a ridge and process in front of the orbit, but without postorbital processes, with separate nasals, and with a ring-shaped tympanic bone not forming a bulla. The first and second upper molars with five cusps; the central cusp minute, united by a ridge on each side to the bases of the two internal cusps. The form of these teeth is very characteristic of the family. (*Dobson*.) No cæcum.

This family contains two genera only, differing remarkably in external form, each forming a distinct subfamily, and both occurring



in British India and its dependencies. One of these genera (*Erinaceus*), containing the hedgehogs, is of wide distribution throughout the Palaearctic and Ethiopian regions; but in the Oriental region it is unknown east of the Bay of Bengal, although distributed over a considerable portion of India proper. The other genus, *Gymnura*, is peculiar to the south-eastern part of the Oriental region. All the forms are nocturnal.

The two subfamilies are thus distinguished:—

Back and sides covered with spines; tail very short. *Erinaceince.*
Fur without spines; tail well developed. *Gymnurince.*

Full details of the anatomy of both subfamilies will be found in Dobson's monograph.

Subfamily ERINACEINÆ.

Genus **ERINACEUS**, Linn. (1766).

Back and sides covered with spines; tail very short, without spines; caudal vertebræ rudimentary. Skull short and broad; palate-bones with two large non-ossified spaces posteriorly, in front of a transverse ridge which is just behind the last molars; pterygoid fossæ very broad; no alisphenoid canal; mesopterygoid fossa very deep, and leading posteriorly into a deep hemispherical excavation between the auditory bullæ. Pelvis wide, with the ischial tuberosities not prolonged backwards.

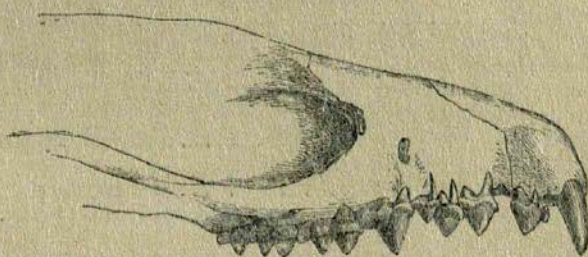


Fig. 56.—Upper jaw of *Erinaceus collaris*. (Dobson, P. Z. S. 1881, p. 403, fig. 11.)

Dentition: i. $\frac{6}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{2-2}$, m. $\frac{3-3}{3-3}$. The middle pair of upper incisors are considerably larger than the others, and are widely separated from each other; the third incisor and the canine are very similar to each other, and (except in *E. europæus*) two-rooted. The first premolar is also (with the same exception) two-rooted, the second is very variable, the third is much larger and three-rooted. The first molar is the largest tooth in the upper jaw, the second is of smaller size, the third very small.

The median lower incisors are large and conical, and directed



almost horizontally forward, then come on each side three small teeth with oblique cusps, the second of which is the canine and the third the first premolar. The next tooth, or second premolar, corresponds to the fourth lower premolar of *Gymnura*, pm. 4; the first molar is, as in the upper jaw, the largest tooth in the jaw, the second being smaller and the third very small.

The vertebral formula is C. 7, D. 15, L. 6, S. 7, C. 5-6.

All the species possess skin-muscles more developed than in any other mammals, and these muscles enable hedgehogs to roll themselves into a ball for defensive purposes, the head and feet being entirely concealed, and only spines exposed.

The spines in all hedgehogs are longitudinally marked with fine grooves (or liræ). In all the Indian species, and in some others, the ridges between the grooves bear small tubercles. On the presence or absence of tubercles Fitzinger divided the genus and called the tuberculate forms *Hemiechinus*, but the character has no generic importance.

Dr. Anderson published, in 1878 (J. A. S. B. xlvii, pt. 2), a very useful monograph of the Indian species. The distribution of the genus in India is peculiar, and confined to the north-western portion (Baluchistan, Punjab, Sind, N.W. Provinces, and neighbouring tracts), and to the Madras Presidency in the south. No species has yet been recorded from the Central Provinces or Bengal.

Synopsis of Indian Species.

A. Spines on head without a naked furrow in the middle; pm. 2 three-rooted.

a. Head and body about 7 inches; longest spines 0.75 inch

E. collaris, p. 215.

b. Head and body nearly a foot; longest spines exceeding an inch

E. megalotis, p. 216.

B. Spines on head divided into two groups by a naked furrow in the middle.

a. Colour dark; pm. 2 three-rooted

E. jerdoni, p. 216.

b. Colour pale; pm. 2 with a single root.

a'. Zygomatic arch perfect

E. pictus, p. 217.

b'. Zygomatic arch imperfect; malar absent

E. micropus, p. 218.

Very little is known of the habits of Indian hedgehogs, but they probably closely resemble the European form *E. europæus*, except in not hibernating. The European hedgehog lives on insects, worms, slugs, snails, mice, rats, and other small mammalia, lizards, snakes, and any other small animals it can kill, also birds' eggs, fruit, and roots. Blasius states that the young, from four to eight in number, are born in July or August; but Dobson found the number not to exceed four, and believes that the period of gestation does not exceed a month. He shows, too, that a second brood is sometimes produced in autumn. The young at birth are almost naked, but the spines, at first soft, soon harden and grow rapidly, and the animals attain their full growth in about nine months.

104. *Erinaceus collaris*. *Hardwicke's Hedgehog*.

Erinaceus collaris, *Gray and Hardwicke, Illust. Ind. Zool.* i, pl. 8 (1830-32); *Hutton, J. A. S. B.* xiv, p. 351; *Jerdon, Mam.* p. 62.

Erinaceus spatangus, *Bennett, P. Z. S.* 1832, p. 123.

Erinaceus grayi, *Bennett, P. Z. S.* 1832, p. 124; *Anderson, J. A. S. B.* xlvii, pt. 2, p. 204, pl. iv; *id. Cat.* p. 160; *Dobson, Mon. Ins.* p. 17.

Erinaceus blanfordi, *Anderson, J. A. S. B.* xlvii, pt. 2, p. 208, pl. v.

Kánta chua, *Kanderna, Sinh, H.*; *Khárpúsh, Jujuk, P.*; *Jaho, Tar-java*, *Sindhi*. These names are also applied to other species of the genus.

Spines of moderate length, commencing behind a line joining the anterior margins of the ears, and not divided on the middle of the head by a naked space. Each spine surrounded by from 21 to 26 finely tuberculated ridges. Ears long, subtriangular, bluntly pointed at the tip. Feet well developed, claws strong; sole of fore foot with a large bifid pad behind, sole of hind foot without any prominent median pad behind opposite the hallux.

Skull short and broad, with a strong and perfect zygomatic arch. Second upper incisor about half the size of the third; second upper premolar well developed, in the same line as the other teeth, subtriangular in section, and furnished with three roots.

Colour dark. Fur on the lower parts and limbs blackish brown to dark reddish brown; the dark hairs on the face mixed with grey or lighter brown; chin whitish, this colour sometimes running along to the mandible and up the sides of the neck, but never forming quite so distinct a collar as in *Hardwicke's* original figure of the species. Ears usually with short brown hair outside, white inside.

Spines white for the greater part of their length, about the terminal third dark with a narrow white band near the tip, which is black. Occasionally specimens occur in which nearly the terminal half of each spine is black.

Dimensions. Head and body 6·75 inches, tail 1, ears from base 1·3 to 1·5, hind foot without claws 1·2 to 1·5, longest spines 0·75. Total length of skull 1·85 inches, basal length 1·8, zygomatic breadth 1·15.

Distribution. Throughout the Punjab, Sind, and North-western India as far east as Fatehgarh, and probably to Cawnpore, if not further. Unknown except in the plains.

Habits. According to *Hutton*, who obtained this species in Bahawalpur, *E. collaris* is found in sandy country, hiding in holes beneath thorny bushes or in tufts of grass during the day (I obtained specimens in similar places near Rohri in Sind), feeding chiefly on insects, especially a species of *Blaps*, but also on lizards and snails. It makes a grunting noise when irritated, and when touched suddenly jerks up its back so as to throw its spines forward, making at the same time a sound like a puff from a pair of bellows. *Hutton* also states that these animals bear long abstinence with apparent ease. Nothing is known of the breeding-habits of any Indian hedgehog.

105. *Erinaceus megalotis*. *The Afghan Hedgehog.*

Erinaceus megalotis, *Blyth, J. A. S. B.* xiv, p. 353 (1845); xv, p. 170; *id. Cat.* p. 80; *Anderson, Cat.* p. 163; *Scully, A. M. N. H.* ser. 5, viii, p. 223; *Dobson, Mon. Ins.* p. 18.

Size large. Spines long, each surrounded by twenty-seven to twenty-nine faintly tuberculated ridges, the spines on the head not divided by a naked space in the middle. Ears large, triangular. Feet well developed; claws strong; posterior pad of hind foot almost obsolete.

Skull larger than that of *E. collaris*, but otherwise similar. In a Kandahar specimen Scully found that the second upper premolar was two-rooted, but this is exceptional, and due to the two outer fangs being united into one.

Colour dark. Face and ears brown (cinereous according to Hutton), with a few white hairs intermixed; sides of head white, with brown hairs mixed; chin nearly white; lower parts, tail, and limbs dark sooty brown.

Spines brown at the base, then white, succeeded by a faint dusky band (occasionally absent), reaching nearly to the middle, then a broad whitish band succeeded by a narrower dark brown ring, followed by a white band and terminating in a dark brown tip. The dark ring on the proximal (or basal) half of the spine and the longer spines distinguish this form at once from *E. collaris*.

Dimensions. Length of head and body about a foot according to Hutton, tail 1·5 inches, ear from base 1·5, hind foot 1·55, longest spines 1·05; extreme length of skull 2·05 (in another skull 2·3), zygomatic breadth 1·2 (and 1·35).

Distribution. Apparently found throughout a large part of Afghanistan; the type was from Kandahar. This species has been found near Quetta by Hutton, St. John, and others.

Habits. Hutton says:—"They feed on slugs and *Helices*, with which the fields at Kandahar are overstocked; they also prey on worms, insects, and lizards. They hide during the day in holes, and come out in the evening to feed. They retire to hibernate in deep holes in the earth in the end of October or beginning of November, according to the season, and remain in a semi-torpid condition till February, when they again appear."

106. *Erinaceus jerdoni*. *Anderson's Hedgehog.*

Erinaceus jerdoni, *Anderson, J. A. S. B.* xlvii, pt. 2, p. 209, pl. v a (1878); *id. Cat.* p. 165; *Dobson, Mon. Ins.* p. 16.

Spines long, each surrounded by about nineteen tuberculated ridges, those on the forehead commencing between the ears in two belts divided by a nude area along the middle of the head. Ears large, subtriangular. Feet well developed; claws strong; hind foot with a large posterior pad in the middle opposite the hallux.

Skull more elongate than in other Indian species, with a per-



fectly formed zygomatic arch. Second upper premolar well developed, in the same general line as the other teeth, and with three roots.

Colour very dark. The head and the ears outside are grey covered with white and dark brown or black hairs mixed, the inside of the ears white. Chin, throat, and sides of neck whitish; chest whitish brown; remainder of lower parts, limbs, and tail dusky brown, darkest posteriorly.

Spines dusky at the base, then white, followed by a dark band, then another white one, and a long black tip. This is the usual coloration; but on the forehead there are, in some cases at all events, three white and three black rings; again, in some specimens the rings are less numerous than usual.

Dimensions. Head and body 7.5 inches, tail 1.25, ear from base 1.4, hind foot without claws 1.5, longest spine 1.15; extreme length of skull nearly 2, zygomatic breadth 1.1.

Distribution. The Punjab and Sind. The most north-westerly locality recorded is Thal, Karram valley. Specimens from Pind Dadun Khan, referred by Blyth to *E. collaris*, are identified with the present species by Anderson. Other localities are Rájanpur, Rohri, and Karáchi.

Nothing is known of the habits.

A form allied to *E. jerdoni*, but distinguished by its larger size and very long spines, *E. macracanthus*, has been obtained at Kandahar and at Dizak in Persian Baluchistan as well as in Persia, and will in all probability be found in Eastern Baluchistan also*. It is described and figured in 'Eastern Persia,' ii, p. 27, pl. i (see also Scully, A. M. N. H. ser. 5, viii, p. 224). The ears are large and pointed. The spines on the head are divided, and the second premolar three-rooted. The colour of the spines is usually black at the tip and for the terminal third; the basal two thirds brown, with two white rings. The face is covered with black and white hairs mixed; lower parts to breast inclusive white; abdomen brown, becoming blackish behind; tail and all limbs blackish brown. Albino individuals appear common. Head and body 9.5 inches, tail 1.25, ear from base 2, longest spines 1.5, length of skull 2.2.

107. *Erinaceus pictus*. Stoliczka's Hedgehog.

Erinaceus pictus, Stoliczka, *J. A. S. B.* xli, pt. 2, p. 223 (1872); Anderson, *J. A. S. B.* xlvii, pt. 2, p. 203, pl. iii.; *id.* *Cat.* p. 150; Dobson, *Mon. Ins.* p. 13.

Spines commencing on the forehead in front of the ears, and divided by a nude median space on the top of the head; each spine surrounded by seventeen to twenty-two finely tuberculated ridges. Ears rounded, longer than in *E. micropus*, and rising,

* Murray ('Indian Annals,' i. p. 118) states that he has this species from Zandra and Sir-i-Bolán, near Quetta.

when erect, above the spines. Feet small and short, with very short toes; nails small.

Skull short and wide across the zygomatic arches, which are perfect, with a well-developed malar bone. The second upper premolar small, externally situated and single-rooted, but by no means so minute as in *E. micropus*.

Colour pale, identical with that of *E. micropus*. Muzzle, including the eyes, and a band from the eyes to the side of the neck, lower half of fore limbs, lower abdomen, rump, tail, and hind limbs brown; forehead, sides of neck, and underparts to abdomen white.

Spines white or yellowish white, with a broad subterminal band brown. Tip white, the extreme point occasionally dusky.

Dimensions. Head and body in males 6 to 7.75 inches, in females 5 to 6, tail 0.5 to 0.8, length of ear from base 1 to 1.4, fore foot 0.7, hind foot 1, longest spine 0.75; extreme length of skull 1.6, zygomatic breadth 1.

Distribution. North-western India, the Punjab, Sind, Cutch, and Rājputāna, as far east as Agra and Goona.

Habits. This animal is usually found during the day in holes, such as deserted fox-burrows or under tufts of grass. It appears to be by no means rare in the drier parts of North-western India, but, owing to its nocturnal habits, is but rarely seen. Its food and habits in general are but little known, but doubtless resemble those of other species.

108. *Erinaceus micropus*. *The South-Indian Hedgehog*.

Erinaceus micropus, *Blyth, J. A. S. B.* xv, p. 170 (1846); xxii, p. 582; *id. Cat.* p. 80; *Jerdon, Mam.* p. 63; *Anderson, J. A. S. B.* xlvii, pt. 2, p. 200, pl. v a; *id. Cat.* p. 159; *Dobson, Mon. Ins.* p. 14.
Erinaceus nudiventris, *Horsf. Cat.* p. 136.

Mollu-yelli, Tam.

Spines commencing on the forehead in front of a line between the inner angles of the ears and divided by a nude median space on the top of the head. Each spine with seventeen to twenty-two longitudinal minutely tuberculated ridges. Ears rounded at the tip, not rising above the spines. Feet short, with short claws. Hair on lower parts thin.

The skull is distinguished from that of every other species of the genus by the imperfect zygomatic arch, the malar bone being absent and represented by cartilage. The cranium is longer and narrower than that of *E. pictus*. The second upper premolar is exceedingly small, scarcely discernible without a lens, external to the general line of the teeth, and one-rooted.

Colour pale. Muzzle, including the eyes, and a band from the eyes to the side of the neck behind the gape, lower (distal) half of fore limbs, hinder abdomen, and rump, with the hind feet and tail, brown; a broad band on the forehead, sides of neck, throat, chest, and anterior abdomen, with the sides of the body below the spines, white.



Spines white or yellow, with a dark broad subterminal band; tip white.

Dimensions. Head and body 6 inches, tail 0.5, height of ear from base 1 to 1.1, hind foot without claws 1.1, longest spine 0.8. Skull, total length 1.75 inches, basal length 1.65.

Distribution. The plains of Southern India, in the neighbourhood of Madras, Trichinopoly, Coimbatore, &c. Other localities, such as Cottyam, in Travancore, require confirmation, and the repeatedly asserted occurrence of this form on the Nilgiris is shown by Anderson to be incorrect; the animal is, however, found on the eastern slopes towards the base. The northern range of the species is not known, but if any hedgehog be found in the Bombay Deccan, as stated by Adams and apparently confirmed by later observers in the 'Bombay Gazetteer,' it is probably the present species. It is remarkable, however, that none was obtained by Sir W. Elliot in the Southern Mahratta country, and I do not remember ever seeing a hedgehog myself in the Bombay Deccan or the Central Provinces. If, as Kelaart thinks probable, there is a hedgehog in Ceylon, it is most likely to be *E. micropus*.

Nothing especial appears to have been recorded of the habits of this species.

Other Asiatic species of hedgehog are *E. auritus* from Southern Siberia, the Caspian region, and Mesopotamia, and *E. albulus* from Eastern Turkestan.

Subfamily GYMNURINÆ.

Genus **GYMNURA**, Horsf. & Vigors (1828).

Syn. *Echinorex*, Blainv. (1831); *Hylomys*, Müller and Schlegel (1839).

Fur without spines. Caudal vertebrae numerous and well developed. Head long, and nose pointed; ears rounded; feet and claws well developed; tail nearly naked. Skull long; zygomatic arches very slender; palate-bones completely ossified posteriorly, but with a transverse ridge, as in *Erinaceus*, behind the posterior molars; mesopterygoid fossa not terminating behind in a deep excavation; pterygoid fossa broad; an alisphenoid canal present. Pelvis very narrow, with the ischial tuberosities much prolonged backwards.

Dentition: i. $\frac{6}{0}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{2-3}{3-3}$. Middle upper incisors much larger than the others, and separated from each other; the next pair are smaller, the outer pair smaller still; all single-rooted. The canine is slightly larger than the first (middle) incisor, and two-rooted. The first two upper premolars are very small, the third varies in the two species; the fourth is large, and has four roots. The molars are similar to those of *Erinaceus*.

In the mandible the lower incisors diminish progressively behind; the canine is larger, and resembles the upper canine, but has only one root; the first two prepolars are small, the third larger, the fourth still larger, and higher than the molars, of which the first, as in the upper jaw, is the largest tooth in the jaw, the others diminishing in size progressively.

The vertebral formula differs considerably in the two species. Mammaræ two pairs: one thoracic, near the axilla, the other pair inguinal.

Both forms of *Gymnura* somewhat resemble large shrews. Until lately they have been placed in distinct genera, the smaller form being classed as *Hylomys*; but Dobson has united them, and although I feel some misgivings as to their being congeneric, there can be no doubt about their near relationship. Both occur in Burma, but are unknown west of the Bay of Bengal.

Synopsis of Burmese Species.

- A. Larger; head and body 12 to 14 inches; tail three fourths that length *G. rafflesi*, p. 220.
- B. Smaller; head and body about 5 inches; tail one sixth that length..... *G. suilla*, p. 221.

109. *Gymnura rafflesi*. *Raffles's Gymnura*.

Viverra gymnura, *Raffles*, *Tr. L. S.* xiii, p. 272.

Gymnura rafflesii, *Horsfield and Vigors*, *Zool. Journ.* iii, p. 248, pl. 8 (1827); *Cantor*, *J. A. S. B.* xv, p. 190; *Blyth*, *Cat.* p. 81; *W. Blanford*, *J. A. S. B.* xlvii, pt. 2, p. 150; *Anderson*, *Cat.* p. 158; *Dobson*, *Mon. Ins.* p. 3.



Fig. 57.—*Gymnura rafflesi*.

Tail about three fourths the length of the head and body, compressed towards the tip, naked, scaly, the scales small and arranged in rings, between which short hairs project, becoming coarse bristles on the under surface, where the scales are more convex and more distinctly imbricate than above. Ears short, rounded,



almost naked. Body clothed with hair of two kinds, the underfur soft and woolly, the longer hairs coarse bristles. Claws curved, not retractile.

Skull very long and narrow, third upper premolar much larger than the second, and having three roots.

Vertebrae: C. 7, D. 15, L. 5, S. 3, C. 28.

Colour. Partly white, partly black, the distribution of the two colours being somewhat variable; generally the head and neck are white, with the exception of a black patch above and in front of each eye, and often a variable proportion of black bristles is mixed with the white of the crown. The anterior portion of the back is clad with mixed white and black hairs, the proportion varying, the underfur being blackish. On the hinder back, sides, limbs, and lower parts the longer hairs are generally black, but in one specimen from Tenasserim there was a line of white down the middle of the breast and belly. Some Burmese specimens are entirely white. The woolly underfur is dusky olivaceous at the base on the upper parts, ashy on the lower, brownish or sooty black at the tips. Terminal portion of tail usually white.

Dimensions of a Tenasserim female. Head and body 12 inches, tail 8.5, ear 1, hind foot without claws 2.15, extreme length of skull 2.8. But Sumatran, and especially Bornean, specimens are considerably larger, the head and body measuring over 14 inches; skull 3 to 3.5 in length, and 1.6 across the zygomatic arches.

Distribution. The Malay Peninsula, Sumatra, and Borneo. Found in the extreme south of Tenasserim at Bankasun by Mr. Davison. The occurrence of this species in Mergui had already been shown to be probable by Mr. Blyth (see J. A. S. B. xlv, pt. 2, extra number, p. 32).

Habits. Very little is known. The species is purely nocturnal, and lives under the roots of trees. The contents of the stomach show that the food consists of insects, amongst which *Blatta*, termites, and various forms of larvæ are especially common. The animal has a peculiar offensive smell, not musky, rather alliaceous, described to me by Mr. Davison as resembling Irish stew that had gone bad.

110. *Gymnura suilla*. The smaller *Gymnura*.



Fig. 58.—*Gymnura suilla*. (Anderson, An. Zool. Res. pl. vi.)

Hylomys suillus, Müller & Schleg. *Verhandl. Mam.* p. 153, pl. xxv, figs. 4-7, pl. xxvi, fig. 1 (1839-44); Blyth, *Mam. Birds Burma*, p. 32.

Hylomys peguensis, Blyth, *J. A. S. B.* xxviii, p. 294; *id. Cat.* p. 82; Anderson, *Fr. Z. S. viii*, p. 453, pl. 64; *id. An. Zool. Res.* p. 138, pl. vi; *id. Cat.* p. 157.
Gymnura suilla, Dobson, *Mon. Ins.* p. 5.

Tail short, one sixth the length of the head and body, almost naked, and covered with small scales arranged in rings. Ears rather larger proportionally than in *G. rafflesi*, rounded, almost naked. Body clothed with hair of three kinds, the inner fine, the longer coarse and bristly. Claws stout, but little curved.

Skull not so long as that of *G. rafflesi*. Third upper premolar



Fig. 59.—Upper teeth of *Hylomys suillus* (Anderson).

scarcely larger than the second. Vertebrae: C. 7, D. 14, L. 6, S. 4, C. 14.

Colour. Above rusty brown, below pale yellowish white; the seminude portions of the limbs and tail brownish yellow. The hairs on the back are tipped with black.

Dimensions. Head and body 4.9 inches, tail 0.9, length of ear 0.6, breadth the same, hind foot 1. Length of skull 1.4, zygomatic breadth 0.75.

Distribution. Burma, Malay Peninsula, Sumatra, and Java. Within our area this animal has been hitherto found in only two localities rather distant from each other—first by Major Berdmore near Shwe Gyeng, on the Sittoung (Sitang) river; secondly by Dr. Anderson on the Kakhien hills, east of Bhamo, at an elevation of 3000 feet. Probably *G. suilla* exists in many parts of Burma.

Nothing is known of the habits of this species. The above description is taken from that by Anderson, as I have been unable to examine a specimen.

Family TALPIDÆ.

Fossorial, rarely natatorial or cursorial Insectivora, having their fore limbs more or less modified for digging, and very anteriorly placed, owing to the shortness of the clavicles and forward extension of the manubrium sterni, with which they are articulated; with a short humerus articulating with both the scapula and the clavicle; with well-developed radius and ulna, but with united tibia and fibula; without symphysis pubis, the pubic bones being widely separated, while the acetabula are approximated; with elongated skull, provided with slender zygomatic arches and

tympanic bullæ osseæ, but without postorbital processes of the frontals; and with a cæcumless intestinal canal. (Dobson.)

Although some non-Indian genera constituting the subfamily *Myogalinae* are intermediate in form between moles and shrews, the typical moles, which are the only members of the family hitherto found within Indian limits, are easily distinguished by their thick, cylindrical bodies, short legs, and enormous fore feet, and by their peculiar short, soft, velvety fur, the hairs of which are set vertically in the skin, not directed backwards.



Fig. 60.—Skull of *Talpa europæa*. (Dobson, Mon. Ins. pl. xx.)

The eyes are minute and frequently covered by the skin, the ears short and generally concealed by the fur.

The true molars have always well-defined W-shaped cusps, with horizontal internal basal processes. The front incisors above and below are unicuspidate, and the lower are not extended horizontally forward as in the shrews.

The mole family is only found in the Palearctic and Nearctic regions, and in a small portion of the Oriental region. The peculiar section said by Jerdon to occur in Africa consists of the golden moles, *Chrysochloridæ*, now placed in a distinct family. Nearly all the forms are subterranean in habit and, like most other Insectivora, nocturnal.

Genus **TALPA**, Linn. (1766).

Syn. *Parascaptor*, Gill, 1875.

Form typical. Legs and feet, the anterior pair especially, entirely modified for digging, the fore feet, which are normally turned outwards instead of downwards, being very broad and flat and furnished with large claws; the humerus, radius, and ulna very short and strong, and the clavicle, in some species, as broad as long. The great breadth of the fore feet is partly due to a peculiar development of the proximal inner wrist-bone, or radial sesamoid, which is a large curved ossicle known as the falciform bone (*os falciforme*).

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$ or $\frac{3-3}{4-4}$, m. $\frac{3-3}{3-3}$. The incisors are chisel-shaped, and arranged in a semicircular row, as in most other Mammalia (but not generally in the Insectivora), the median upper pair slightly larger than the others. Upper canines long conical, double-rooted. Three anterior upper premolars (two in *T. leucura*) small, subequal, double-rooted, the fourth larger, with three roots, followed by three large molars. Lower canines undistinguishable from incisors; first lower premolar large, resembling a canine, the next two small, the fourth again larger.

Vertebrae: C. 7, D. 13, L. 6, S. 5, C. 8-12. Mamme 6.

Moles are more completely fitted for a subterranean life than any other known mammals, the whole organism being adapted for burrowing. Three species have been recorded from the Himalayas, Khâsi Hills, and Burma.

Synopsis of Indian and Burmese Species.

Tail subcylindrical, one fourth length of head and

body; pm. $\frac{4-4}{4-4}$ *T. europæa*, p. 224.

Tail very short, concealed by the fur; pm. $\frac{4-4}{4-4}$.. *T. micrura*, p. 225.

Tail club-shaped, about one twelfth of total length;

pm. $\frac{3-3}{4-4}$ *T. leucura*, p. 226.

111. *Talpa europæa*. *The European Mole.*

Talpa europæa, *L. Syst. Nat.* i, p. 73 (1766); *Dobson, Mon. Ins.* p. 137.

Talpa macrura, *Hodgs. J. A. S. B.* xxvii, p. 176; *Jerdon, Mam.* p. 51.

Tail about one fourth to one fifth the length of the head and body, slender, nearly of the same thickness throughout, clad with hair. Feet thinly clad with hair above.

The fourth upper premolar without any distinct internal basal process. The fourth lower premolar decidedly smaller than the first.

Colour. Black, varying to bluish black or sooty black, and occasionally to grey, yellow or even white. The basal portion of the hairs is dark leaden grey, the extreme tips often more or less grey. There is scarcely any difference in tint between the upper and lower parts.

Dimensions. In an adult European male, head and body 5.5 inches, tail 1.35, fore foot and claws 0.9 long, 0.7 broad, hind foot and claws 0.85 long. Basal length of skull 1.25, total length 1.4.

The type of Mr. Hodgson's *T. macrura* measured: head and body 4 inches, tail $1\frac{1}{8}$ without hair, $1\frac{1}{4}$ with, fore foot and nails $\frac{3}{4}$. These measurements were perhaps taken on the skin.

Distribution. The greater portion of the Palearctic region from England to Japan. There are specimens from the Altai mountains in the British Museum. A solitary example was procured by Mr.



Hodgson at Darjiling. I cannot see any evidence in Mr. Hodgson's description or in his MS. notes, now in the Zoological Society's Library, that he examined this mole in the flesh; and as not one of the numerous collectors in Darjiling, since Mr. Hodgson's time, is known to have come across a second specimen, I cannot help doubting whether the type of *T. macrura* may not be a European skin, accidentally mixed with Mr. Hodgson's collection. A second specimen in spirits has been found amongst the collections of the Indian Museum, now added to the British Museum, but no locality is recorded. It is worthy of note that, as I am informed by Mr. Oldfield Thomas, a skull from the Altai shows a slight difference in the form of one of the upper molars from European specimens, whereas the supposed Himalayan skull exhibits no such distinction.

Habits. Moles live in burrows dug by themselves, and of complicated form. These have been described by many writers. The abode itself is usually under a hillock, or beneath roots of trees, and consists of a central chamber with passages leading to two circular galleries, one higher in position and smaller in diameter than the other. Several diverging runs lead from the larger gallery, one alone (the main run) being of great length, and conducting to the burrows dug in various directions for the purpose of procuring food. The last are extended daily, and their presence indicated on the surface by small piles of earth, the well-known mole-hills.

The principal food of the mole consists of earthworms, insects and their larvæ, snails and slugs; mice, shrews, and even frogs are also devoured. No animal is more voracious. Males are more numerous than females and fight for the possession of the latter. The pairing-time is about March in Europe, the period of gestation six weeks, and from four to six young are usually produced at once. Moles take to water readily and swim well.

112. *Talpa micrura*. *The short-tailed Mole.*

Talpa micrura, *Hodgs. J. A. S. B.* x, p. 910; *Blyth, J. A. S. B.* xi, p. 95; xix, p. 215, pl. iv, fig. 2 (skull); *id. Cat.* p. 88; *Jerdon, Mam.* p. 51; *Dobson, Mon. Ins.* p. 139.

Talpa cryptura, *Blyth, J. A. S. B.* xii, pp. 177, 928.

Pariam, Lepcha; *Biya-kantym*, Bhot.

Tail extremely short, nearly naked, and completely concealed by the fur; caudal vertebræ 8. Feet nearly naked above. Eyes covered by skin.

Fourth upper premolar with a large internal basal process. Fourth lower premolar as large as the first or larger.

Colour uniform velvety black when fresh, with a more or less silvery grey gloss; basal portion of fur leaden grey to leaden black. Dried skins are often brown. Snout and feet whitish or pale flesh-colour.

Dimensions in spirit: head and body 4.75 inches, tail 0.2, fore

foot and claws 0·9, hind foot and claws 0·8. In fresh specimens the head and body measure 5 to 6 inches. Length of skull 1·37 inches. Weight 2½ oz.

Distribution. The south-western Himalayas, especially Nepal and Sikkim, and the hills south of Assam. About Darjiling this animal occurs at a moderate elevation, 5000 or 6000 to 8000 feet,

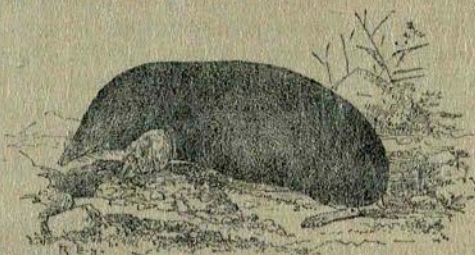


Fig. 61.—*Talpa micrura*. (From Hodgson's drawings.)

and is common near the station. It may be found at lower levels. Dobson gives Kashmir amongst the localities, perhaps on the authority of Mountstewart Elphinstone ('Caulbul,' p. 142); but in this case, and in Kumaon, where also moles have been said to occur (As. Res. xvi, p. 153), it is possible that piles of earth thrown out by *Nesokia* have been mistaken for mole-hills. The instances mentioned are quoted by Blyth (J. A. S. B. xi, p. 95).

Habits. Around Darjiling the short-tailed mole inhabits the deep bed of black vegetable mould found wherever the original forest has not been destroyed. This mould contains earthworms and larvæ of insects, the chief food of moles, in abundance. Jerdon noticed that the runs of *T. micrura* often proceeded from the base of one great oak to that of another. Such runs are not marked by mole-hills, as in the case of the European species. Nothing is known of the breeding of *T. micrura*.

113. *Talpa leucura*. *The white-tailed Mole.*

Talpa leucura, Blyth, J. A. S. B. xix, p. 215, pl. iv, figs. 1, 1 a (skull & tail) (1850); xx, p. 518; xxviii, p. 294; *id.* Cat. p. 88; *id.* Mam. Birds Burma, p. 33; Anderson, Cat. p. 170. *Parascaptor leucura*, Dobson, Mon. Ins. p. 140.

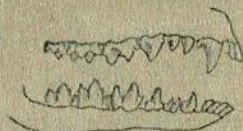


Fig. 62.—Dentition of *Talpa leucura*. (Dobson, Mon. Ins. pl. xx.)

Smaller than *T. micrura*, and muzzle shorter. Tail about one twelfth of total length or rather more, club-shaped, being thicker towards the end than near the base, thinly clad, the hairs coarser and longer than those of the body. Caudal vertebræ 8. Eyes covered.



Upper premolars only three (so that there are six teeth only behind the canine instead of seven as in the other moles), third with a large internal basal process. In the lower jaw the second and third premolars are small and very closely packed, the fourth is equal in size to the first.

Colour uniform brown in all skins I have examined, but described as black by Anderson, perhaps variable. Basal portion of fur leaden black. Tail-hairs whitish or white.

Dimensions. An adult female in spirit measured: head and body $4\frac{1}{8}$ inches, tail $\frac{3}{8}$. Total length of skull 1.2 inches, basal length 1.

Distribution. Sylhet and the Khâsi and Naga hills, south of Assam; found up to 10,000 feet above the sea. This species was also obtained by Major Berdmore in the valley of the Sittoung river, near Shwegyeng, and probably exists in places throughout Burma.

Nothing is known of the habits of this mole.

Some years since, the Rev. H. Baker found black velvet-coated animals that he took for moles in Malabar (J. A. S. B. xxviii, p. 286); but although it is difficult to say what they were, especially as the feet were mole-like, the coloration (black above, white below) is remarkable in the genus *Talpa*. No animal hitherto described from Malabar coincides with Mr. Baker's description.

Two remarkable genera of *Talpidae*, each represented by a single species—*Scaptomyx fuscicaudatus* * and *Uropsilus soricipes* †—have been described from Eastern Tibet by A. Milne-Edwards. The first is about the size of a common mole, but with narrower fore feet, the colour is brown. The second is smaller, and has the feet of a shrew, whilst its dentition is somewhat intermediate between a shrew's and a mole's.

Other Asiatic genera are *Myogale*, *Scaptochirus*, and *Urotrichus*.

Family SORICIDÆ.

Terrestrial, rarely natatorial Insectivora, with narrow elongated skulls, without postorbital processes or zygomatic arches. The tympanics are annular, not forming bullæ; there is no symphysis pubis ‡, the tibia and fibula are united; and the molars have well-developed W-shaped cusps. (Dobson.)

All shrews are covered with hair, generally very soft; the head is long, the eyes small, the snout very pointed and projecting very considerably beyond the lower lip; the ear-conch, when present, rounded and somewhat resembling the human ear in shape. The pointed nose, rounded appressed ears, and the teeth at once distinguish shrews from rats and mice, with which the former are often popularly confounded.

The dentition is characteristic of the family. Dobson has

* Recherches Mam. p. 278, pl. 38 n, fig. 4, and pl. 40 n, fig. 2.

† *Ibid.* p. 272, pl. 40, fig. 1, and pl. 40 n, fig. 1.

‡ Anderson describes *Anurocorea* as having a short symphysis pubis.



ascertained (Journ. An. Phys. xx, p. 359) that there are no lower canines. The two front teeth in each jaw (median incisors) differ from all the others; in the upper jaw they are curved, and bear a more or less prominent posterior basal cusp; in the lower jaw they are long, they project horizontally forward, and are sometimes slightly curved upwards at the end. Behind the anterior pair of upper incisors come a variable number of small incisors and premolars, amongst which the small canines can be recognized only by their position immediately behind the premaxillary suture, which, however, is only visible in very young animals. The last premolar is large, and there are always three upper molars on each side, the hinder much smaller than the others. There are always 12 teeth in the lower jaw—4 incisors, 2 premolars, and 6 molars; whilst the number in the upper jaw varies from 14 to 20. Some genera are distinguished by having the teeth tipped with brown, in others the teeth are white throughout.

Shrews have the widest distribution of any family of Insectivora, being found throughout the temperate and tropical portions of Europe, Asia, Africa, and North America, with many of the adjacent islands.

The following account of the shrews of India is in great part derived from Mr. Dobson's notes, prepared for the third part (not yet published) of his Monograph of the Insectivora. The classification and most of the synonymy are his, and I am greatly indebted to him for the assistance he has given to me in dealing with one of the most difficult groups of Indian mammals.

A monograph of the Indian forms known to him was published by Blyth in 1855 (J. A. S. B. xxiv, p. 24), and Anderson has published two papers on the subject (P. Z. S. 1873, p. 227, and J. A. S. B. xlv, pt. 2, p. 261).

The Indian genera of shrews may be thus distinguished:—

- | | |
|--|---------------|
| A. Teeth tipped with reddish brown | SORICULUS. |
| B. Teeth entirely white. | |
| a. Tail without inferior fringe of white hairs: terrestrial. | |
| a'. 16 or 18 teeth in upper jaw; ear-conch and tail well developed | CROCIDURA. |
| b'. 14 upper teeth; ear-conch small; tail very short | ANUROSOREX. |
| b. Tail with an inferior fringe of white hairs: aquatic. | |
| a'. Ear-conch developed | CHIMARROGALE. |
| b'. Ear-conch wanting | NECTOGALE. |

Genus **SORICULUS**, Blyth (1855).

Terrestrial. Ears small, hairy, more or less hidden by the fur. Tail hairy, but not provided with any scattered long hairs, nearly cylindrical and tapering very gently, greatly resembling that of a mouse. Fur soft and velvety.



Teeth tipped with reddish brown; this wears off to a great extent in old animals and sometimes disappears entirely, but traces can generally be detected: i. $\frac{3-3}{2-2}$, c. $\frac{1-1}{0}$, pm. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3-3}=30$. Middle upper incisors with the anterior cusp bifid, the inner point short

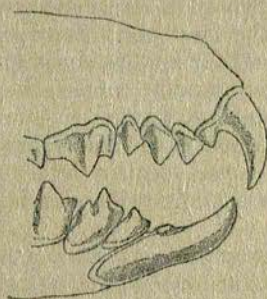


Fig. 63.—Incisors, canine, and premolars of *Soriculus nigrescens*. (Dobson, Mon. Ins., from an unpublished plate.)

and small, lateral incisors and canine subequal in size, anterior premolar minute. Lower anterior incisors elongate, running back beneath the two next teeth and bearing a small projecting knob above, just in front of the next incisor; lower premolar bicuspid.

Vertebrae: C. 7, D. 12, L. 6, S. 5, C. 17. The osteology is briefly described by Anderson in his Catalogue of the Mammalia. He shows that *Soriculus* presents some resemblance to *Talpa*, although the pelvis resembles that of *Crocidura*, not that of *Anurosorex*.

Soriculus is the only representative in India of the brown-toothed shrews, which are, with this exception, confined to the Palearctic and Nearctic regions, and include *Sorex*, *Crossopus*, and *Blarina*.

Synopsis of Indian and Burmese Species.

- A. Second upper incisor smaller than third; tail about half the length of the head and body.. *S. nigrescens*, p. 229.
- B. Second upper incisor larger than third.
 - a. Length of tail about equal to that of head and body *S. caudatus*, p. 230.
 - b. Length of tail about half as much again as that of head and body..... *S. macrurus*, p. 231.

114. *Soriculus nigrescens*. The Sikkim brown-toothed Shrew.

Corsira nigrescens, Gray, A. M. N. H. x, p. 261 (1842).

Sorex aterrimus, Blyth, J. A. S. B. xii, p. 928 (no description); xxiii, p. 733.

Soriculus nigrescens, Blyth, J. A. S. B. xxiii, p. 733; xxiv, p. 36; Jerdon, Mam. p. 59; Anderson, Cat. p. 204.

Sorex sikkimensis, Hodgson, A. M. N. H. ser. 2, iii, p. 203 (1849) (no description); xvi, p. 111 (1855); Horsfield, Cat. p. 136.



Sorex oligurus and *S. holosericeus*, *Hodgs. Cat. Mam. &c. Nepal & Tibet B. M.* 2nd ed. 1863, pp. 8, 9 (no descriptions).

Tang-zhing, Lepcha; *Chika*, Newari.

Muzzle thickly furred. Ears small, hairy, completely hidden by the fur. Feet very thinly clad above and scaly. Claws long and straight, especially on the fore feet. Tail varying from one half of the head and body, or rather less, to about three fifths; round (or tetragonal), tapering very gently, thinly covered with short hairs, arising from between small scaly rings. Fur soft, dense, velvety.

The third upper incisor is a little larger than the second, the canine or third single-cusped tooth a little smaller. The minute fourth single-cusped tooth or first premolar is only just visible from the side.

Colour deep glossy brown, almost sooty black in some cases, dark glossy rufescent brown in others, almost the same throughout, scarcely paler below, a greyish tinge on the abdomen; basal three fourths of hairs leaden black. Feet brown above; tail dusky above, scarcely paler below.

Dimensions. In a large female, snout to vent 3·4 inches, tail 1·65, hind foot 0·54; in another specimen these measurements are 3, 1·82, and 0·55. Basal length of skull 0·8.

Distribution. This shrew has hitherto only been found in Sikkim and Nepal. It is common near Darjiling at elevations of about 4000 to 6000 feet, and perhaps higher. I learn from Mr. Dobson that he has received a *Soriculus* from Manipur, possibly referable to this species, but probably distinct, being smaller, with a proportionally longer tail. The genus will doubtless be found in the hills south of Assam.

Nothing is known of the habits of *S. nigrescens*; it is probably a burrower, living in the forest soil.

115. *Soriculus caudatus*. *Hodgson's brown-toothed Shrew.*

Sorex caudatus, *Hodgson, A. M. N. H.* ser. 2, iii, p. 203 (1849) (no description); *Horsfield, Cat.* p. 135 (1851).

Sorex leucops, *Hodgson, Horsf. A. M. N. H.* ser. 2, xvi, p. 111 (1855); *Jerdon, Mam.* p. 56.

Corsira caudata, *Blyth, J. A. S. B.* xxiv, p. 37.

Corsira alpina, *Tomes, A. M. N. H.* ser. 2, xvii, p. 27 (1856); *Blyth, Cat.* p. 86; *Jerdon, Mam.* p. 61.

Sorex homoiurus?, *Hodgs. Cat. Mam. &c. Nepal & Tibet B. M.* 2nd ed. 1863, p. 8 (no description).

Soriculus gracilicauda, *Anderson, J. A. S. B.* xlv, pt. 2, p. 282.

Soriculus caudatus, *Anderson, Cat.* p. 206.

Body shorter, but limbs longer proportionally than in *S. nigrescens*. Muzzle very thinly clad with hair. All the lower portions of the limbs nearly naked. Hind feet slender. Claws short. Tail long and slender, about the same length as the head and body, varying from a little less to a little more, round or tetragonal,



thinly clad with short bristly hairs. Ears hairy, partially hidden in the fur. The second upper incisor is distinctly larger than the third, which again exceeds the canine.

Colour brown, blackish to reddish, basal portion of fur dark leaden black.

Dimensions. Snout to vent, in one specimen, 2.46 inches, tail 2.57; in another, 2.35 and 2.15; hind foot 0.52; basal length of skull 0.66. According to Hodgson's measurements some individuals are as much as 3 inches from snout to vent.

Distribution. Sikkim, near Darjiling, and in the interior of the hills, but not, as Jerdon supposed, at a great elevation, the locality Kedam, whence, in Hodgson's MS. notes, *S. leucops* is said to have been brought, being only 6000 feet above the sea.

116. *Soriculus macrurus*. *The long-tailed Shrew.*

Sorex macrurus, Hodgson, *Cat. Mam. &c. Nepal & Tibet B. M.* 2nd ed. 1863, p. 9 (no description).

Body and limbs slender. Muzzle hairy, well clad. Limbs thinly furred. Tail round, thin, very long, about half as long again as the head and body together, thinly clad with short hair. Ears hairy, partially concealed by the fur, which is long and soft.

Second upper incisor distinctly larger than the third, which exceeds the canine in size in about the same proportion. Anterior upper premolar very small.

Colour uniform blackish brown, basal portion of hairs slaty.

Dimensions of an adult male from Darjiling: snout to vent 2.1 inches, tail 3.4, hind foot 0.57, ear from orifice 0.28, basal length of skull 0.58. Hodgson gives measurements of larger individuals, one 2.75 inches from snout to vent, tail 3.75, another 2.5 and 3.75.

Distribution. The types came from Darjiling; I once picked up in the station a dead specimen, that of which the measurements are given above. Hodgson's types appear to be lost, but his drawings and notes are sufficient for identification.

Genus *CROCIDURA*, Wagler, 1832.

Syn. *Pachyura*, Selys-Longchamps; *Feroculus*, Kelaart.

The head is long, the snout pointed, the sides of the muzzle more or less swollen and covered with numerous long vibrissae; the nostrils open laterally. The eyes are small and nearer to the orifice of the ear than to the end of the snout. Ears of considerable size. The tail is well developed, and in most species tapering and clothed with short hairs, amongst which are scattered much longer hairs.

On each side of the body there is a gland varying greatly in development in different species, and absent in the females of some. The orifice of this gland is surrounded by short stiff hairs directed

inwards. The secretion has a strong smell of musk and appears to be produced in much greater abundance during the rutting-season. In some of the smaller *Crocidura*, indeed, the gland cannot be detected at other times.

The genito-urinary and anal orifices both open into a shallow cloaca. There are 6 mammae, all inguinal, and situated very far

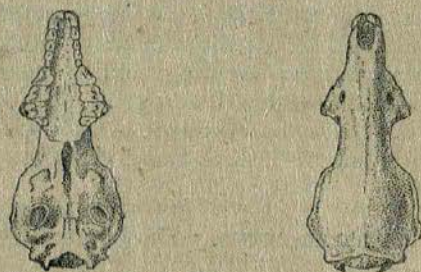


Fig. 64.—Skull of *Crocidura murina*.

back. The sexes are often very difficult to distinguish if the mammae are not developed, the male organ being retractile and the testes internal. The teeth are white throughout, the total number 28 or 30: i. $\frac{3-3}{2-2}$, c. $\frac{1-1}{0}$, pm. $\frac{1-1 \text{ or } 2-2}{1-1}$, m. $\frac{3-3}{3-3}$. The anterior incisors are strongly hooked and have a basal cusp of moderate size; the next incisor on each side is larger than the two or three following teeth, the first two of which, the third incisor and the canine, do not differ greatly in size: whilst the anterior premolar is small in some species (*Pachyura*), absent in others (*Crocidura*); when present it is the smallest tooth in the jaw. All the teeth enumerated are conical except the first. The second premolar is a broad tooth with several cusps, and approaches the molars in shape.

This genus is widely spread in Asia, Africa, and Europe, and has several representatives in India, but the species are very variable and difficult to discriminate. One principal reason, besides variability, for the large number of nominal species in this genus lies in the fact that it is frequently impossible by external characters, and even by an examination of the teeth, to ascertain whether individuals are adult. The teeth are fully developed and the animals breed freely long before they attain their full growth. Most of the sutures of the skull, too, are ankylosed at an early age, the premaxillary suture (which in most mammals does not disappear before maturity) being closed in shrews at birth or very soon after. The best test of full growth in a shrew's skull is the ankylosis of the basi-occipital suture, lying just between the annular bullæ; the epiphyses of the limb-bones, too, would doubtless serve to show whether an animal is mature or not.

*Synopsis of Indian, Ceylonese, and Burmese Species.*

- A. Four small conical teeth, the hindmost very small, behind each anterior upper incisor. (*Pachyura*.)
- a. Size large, rarely in adults less than 4 inches from snout to vent *.
 - a'. Ears almost naked, fore and hind claws subequal.
 - a". Feet brown above, hair on their upper surfaces brown *C. murina*, p. 233.
 - b'. Feet flesh-coloured or yellowish white, naked or clothed with white hair *C. cærulea*, p. 236.
 - b'. Ears covered with hairs; fore claws twice the size of hind claws *C. macropus*, p. 237.
 - b. Size moderate, snout to vent 2.5 to 3.5 inches.
 - a'. The hind foot from heel double the length of the fore foot from wrist *C. bidiana*, p. 238.
 - b'. The hind foot about $1\frac{1}{2}$ times the length of the fore foot.
 - a". Snout to vent * about 3.4 inches, hind foot 0.64 *C. rubicunda*, p. 239.
 - b". Snout to vent about 3 inches, hind foot 0.5 *C. leucogenys*, p. 239.
 - c". Snout to vent about 2.75 inches, hind foot 0.6 *C. dasy*, p. 240.
 - c. Size very small, snout to vent rarely exceeding 2 inches.
 - a'. Tail more than two thirds the length from snout to vent *C. hodgsoni*, p. 240.
 - b'. Tail less than two thirds the length from snout to vent *C. perrotti*, p. 241.
- B. Three small conical teeth behind each anterior upper incisor. (*Crocidura*.)
- a. Tail very thinly clad with hair, scales distinct.
 - a'. Snout to vent about 3 inches; tail and feet dark *C. fuliginosa*, p. 242.
 - b'. Snout to vent 2 to 2.4 inches *C. horsfieldi*, p. 242.
 - b. Tail well clad, scales concealed by the hair.
 - a'. Fur dark throughout, or nearly so *C. fumigata*, p. 243.
 - b'. Fur of lower surface always pale and often white *C. aranea*, p. 244.

117. *Crocidura murina*. *The brown musk Shrew.*

Sorex murinus, *L. Syst. Nat.* ed. xii, p. 74 (1766).

Sorex myosurus, *Pallas, Act. Acad. Petrop.* 1781, pt. 2, p. 337, pl. iv (1785).

Sorex serpentarius, *Is. Geoffroy, Bélanger, Voy. Zool.* p. 119.

Sorex nemorivagus and *soccatus* †, *Hodgson, A. M. N. H.* (1), xv, p. 269 (1845).

Sorex murinus, *griffithii*, and *niger*, *Horsfield, Cat.* pp. 134, 135.

Sorex kandiannus, *montanus*, and *ferrugineus*, *Keluart, Prod.* pp. 30, 31.

Sorex saturator, *Hodgson, A. M. N. H.* ser. 2, xvi, p. 110 (1855).

* This measurement in shrews is always to the posterior margin of the anal orifice.

† The type sent under this name to the British Museum was *Soriculus nigrescens* (see Blyth, *J. A. S. B.* xxiii, p. 733, note).

- Sorex murinus*, *serpentarius*, *soccatus*, *nemorivagus*, *heterodon*, *niger*, *ferrugineus*, and *montanus*, *Blyth, J. A. S. B.* xxiv, pp. 28-32.
Sorex serpentarius, *viridescens*, *soccatus*, and *tytleri*, *Blyth, J. A. S. B.* xxviii, pp. 284, 285.
Sorex albinus, *murinus*, *griffithii*, *serpentarius*, *soccatus*, *heterodon*, and *niger*, *Blyth, Cat.* pp. 83, 84.
Sorex murinus, *nemorivagus*, *serpentarius*, *saturator*, *tytleri*, *niger*, and *soccatus*, *Jerdon, Mam.* pp. 54, 55, 56, 57.
Crocidura (*Pachyura*) *blythii*, *pealiana*, and *blanfordii*, *Anderson, J. A. S. B.* xvi, pt. 2, pp. 264-269.
Crocidura murina and *montana*?, *Anderson, Cat.* pp. 180, 193.

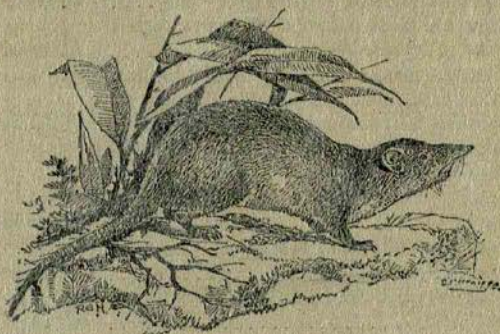


Fig. 65.—*Crocidura murina*. (From a drawing by Col. Tickell.)

Teeth in upper jaw 18. Size large, but varying considerably. Snout hairy, not much swollen at the sides. Ears large, rounded, almost naked or thinly clad with short hairs. Feet covered with hair above, the pes or hind foot from the heel about one and a half times the length of the manus or fore foot from the wrist; claws well developed, those of the fore and hind extremities differing but little in size. Tail thick at the base and tapering, varying from $\frac{2}{3}$ to $\frac{3}{4}$ the length of the head and body, thinly covered with short hair, amongst which a few very long hairs are interspersed. Fur of the body rather coarse. Lateral glands well developed, round.

The basal cusp of the anterior upper incisor, the third incisor, and the canine are of very nearly the same size; sometimes the canine is larger than the third incisor, sometimes the two are equal. As a rule, about half of the small first upper premolar is visible from the outside between the canine and the second premolar, but there is some variation. The second upper incisor is approximately of the same height as the middle cusp of the second or large premolar.

Colour either some shade of brown throughout, the lower parts being a little paler and greyer, and the basal portion of the fur dark slaty, or else dark ashy grey, sometimes blackish, with more or less developed ferruginous or brown tips to the fur. The brown form varies from light to very dark blackish brown. The ears, feet, and tail brown, the skin of those parts dusky, not flesh-coloured as in *C. cœrulea*.

Dimensions. A large male from Nepal measured from snout to vent 5·5 inches, tail 3·4, height of ear from orifice 0·38, hind foot from heel (claws not included) 0·9. In a large female from Darjiling the corresponding dimensions were 5·3, 3·2, 0·43, and 0·78. In a smaller, perfectly adult, female from Mari (Punjab) the measurements were 4, 2·7, 0·4, and 0·72. With this and other species, it must be borne in mind, as already mentioned in the description of the genus, that immature specimens cannot be distinguished by their external characters.

Varieties. The common Himalayan form (*S. griffithi*, Horsf., and *S. saturation*, Hodgson) is deep brown in colour, with longer and thicker hair than the form occurring in the plains of India. The latter is often lighter brown in colour (*Sorex tytlteri*, Blyth, and *Crocidura blanfordi*, Anderson), but the deep rich brown variety

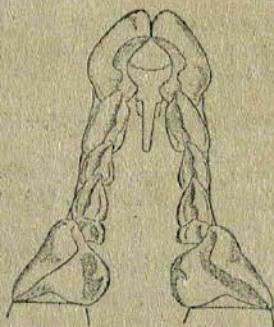


Fig. 66.—Upper incisors, canines, and premolars of *Crocidura murina*, var. *montana*, from below. (Dobson, Mon. Ins., unpublished.)

is prevalent in Burma and the Malay countries and may be considered typical; the most important of the other varieties is the dark ashy grey type (*Sorex serpentarius*, *S. kandianus*, &c.), often with brown or ferruginous tips to the fur (*S. ferrugineus*). A blackish-brown variety has been named *S. niger*. It is possible that some of the names quoted above as synonyms of *C. murina* should have been referred to the next species, *C. cerulea*; but the latter is doubtfully distinct, and there can be no question that intermediate forms (probably hybrids) are met with. The type of *S. nemorivagus*, Hodgson, is an immature specimen. I doubt the distinctness of the small Ceylon shrew called *C. montana* by Anderson, and I am not convinced that it is the same form as *Sorex montanus* of Kelaart.

Distribution. Probably throughout the whole of India, Ceylon, Burma, and the Oriental Region generally; certainly throughout the Himalayas from Kashmir to Assam, up to an elevation of 7000 or 8000 feet, and in many parts of the Indian peninsula and Burma. Specimens are recorded from Calcutta, Ajmere, Khadala near Bombay, Malabar, and Madras, also from Ceylon, Assam, the Khási hills, Arakan, and Tenasserim, besides many parts of the Malay peninsula and archipelago, and from China.

Habits. The brown musk shrew is chiefly found in woods, but occasionally enters houses, and specimens have been captured about stables and similar buildings in some of the Himalayan stations. The musky smell, although very strong in adults, is not, as a rule, so powerful and offensive as that of *C. cærulea*. The food consists of various insects, larvæ, worms, and probably of any smaller mammal or bird. I have taken one in a rat-trap baited with meat.

The natives in parts of India regard this shrew as poisonous, but there is no foundation for the belief.

118. *Crocidura cærulea*. *The grey musk Shrew.*

Sorex cæruleus, Kerr, *An. King*. p. 207 (1792).

Sorex pilorides, Shaw, *Mus. Lever.* ii. p. 31 (1796), nec *Mus pilorides*, Pallas.

Sorex cærulescens, Shaw, *Gen. Zool.* i. p. 533 (1800); Blyth, *J. A. S. B.* xxiv. p. 25; *id. Cat.* p. 82; Jerdon, *Mam.* p. 53.

Sorex indicus and capensis, Geoffr. *Ann. du Mus.* xvii. pp. 183, 184 (1811).

Sorex sonneratii and giganteus, Is. Geoffr. *Mém. du Mus.* xv. pp. 132, 137 (1827).

Sorex myosurus, Gray & Hardw. *Ill. Ind. Zool.* i. pl. ix, nec Pallas.

Sorex murinus, Hodgson, *A. M. N. H.* (1) xv. p. 269 (1845); Kelaart, *Prod.* p. 30, nec L.

Crocidura (Pachyura) waldemarii, ceylanica, and media, Peters, *MB. Ak. Berl.* 1870, pp. 590, 591, 592.

Crocidura (Pachyura) fulvo-cinerea and sindensis, Anderson, *J. A. S. B.* xlv. pt. 2, pp. 263, 266.

Crocidura cærulescens and beddomei, Anderson, *Cat.* pp. 171, 179.

Chachundar, H.; *Chundi*, Kol; *Sondeli*, Can.; *Kandeli*, Mal.; *Kunemiyo*, Cingalese; *Anachiwa-gagur*, Kashmiri; *Kywek-tsút*, Burmese; *Musk-rat*, of Anglo-Indians.

Upper teeth 18. This, the common musk shrew (or, as it is usually called, musk-rat) of India, only differs from *C. murina* in larger size and in coloration, and it is very doubtful if either of these distinctions is constant. The fur is short, the tail thick at the base, and both it and the feet very thinly clad with hair, a few scattered longer hairs on the tail.

Colour usually bluish grey, paler below, the fur sometimes with ferruginous brown tips, especially on the hinder part of the back. Occasionally specimens are found of a rufous-fawn tint above, grey below. Young specimens are dark slate-grey. Skin of the snout, ears, feet, and tail flesh-coloured, and hairs on the feet and tail white or nearly white.

Dimensions. A full-grown male measures about 6 inches from nose to vent, tail 3.5, hind foot 1, basal length of skull 1.4. Females are considerably smaller in general. A very large male measured about 7 inches from snout to vent, tail 5½. The tail varies in length considerably.

Varieties. Anderson classes as distinct varieties the form originally named by him *C. sindensis*, which is smaller than the typical



Bengal form, and also the var. *fulvo-cinerea*, from Assam and Arakan, equal in size to typical *C. caerulea*, but fawn-coloured above.

Distribution. India, Ceylon, and Burma, in towns and about human habitations; also in some of the other ports on the Indian Ocean, probably carried thither in ships. There is in the British Museum a specimen of a musk shrew, probably *C. caerulea* or *C. murina*, obtained on board ship by Sir John Kirk.

Habits. It appears doubtful whether this shrew is ever found away from human habitations, and Mr. Dobson has suggested to me the idea that *C. caerulea* is merely, like the cockroaches on which it feeds, a semi-domesticated variety, *C. murina* being the original wild type. I think this view very probable. It is, in some cases, very difficult to determine to which of the two forms specimens should be referred, and in all probability wherever they meet they breed together.

Like all other shrews, the common musk shrew is nocturnal, frequenting houses at night and hunting about rooms for cockroaches and other insects, uttering at times a sharp squeaking cry, and hiding during the day in holes, drains, &c. It is a harmless inoffensive animal, and does much service to man by destroying insects. Its diurnal haunts are liable to smell strongly of the secretion* from the lateral glands, but it does not communicate the smell to anything it merely passes over, unless it is disturbed or frightened.

The food of this shrew consists mainly of insects, but meat is occasionally eaten by it. Sterndale quotes from the 'Asian' an account of one that attacked a large frog, and McMaster met with another feeding upon a scorpion. The latter also relates that he has known this shrew to eat bread. It is commonly accused in India of feeding on rice and pulse; but experiments made by Anderson on individuals kept alive by him showed that they refused to touch any kind of grain, but devoured insects, especially cockroaches, freely, and he found no vegetable food of any kind in the stomachs of several he examined.

I can find nothing recorded as to the breeding-habits of this species. The young are born blind.

119. *Crocidura macropus*. *The long-clawed Shrew.*

Sorex macropus, *Blyth, J. A. S. B.* xx, p. 163 (1851).

Corsira newera ellia, *Kelaart, A. M. N. H.* ser. 2, viii, p. 338 (1851).

Feroculus macropus, *Kelaart, Prod.* p. 32; *Blyth, J. A. S. B.* xxiv, p. 35.

Upper teeth 18. Size moderately large; tail tapering, thinly

* The absurd story that wine or beer becomes impregnated with a musky taste in consequence of this shrew passing over the bottles (a story related with implicit faith, together with many other marvellous fables, by the naturalists of the last century) is less credited in India than it formerly was, owing to the discovery that liquors bottled in Europe and exported to India are not liable to be tainted.



clad, with longer hairs intermixed; feet large, the fore feet with very large claws, which are nearly twice as long as those on the hind feet. Fur moderately long and soft. Ears small, hairy, scarcely visible beyond the fur. Upper surface of the feet hairy.

Lower front incisors slightly serrated above. The dentition generally is very similar to that of *C. murina*.

Colour dark slaty grey above, with rufous-brown tips to the hair of the back, below rather paler; tail and feet dark; in the type specimen the tip of the tail was whitish. Claws white.

Dimensions. Head and body $4\frac{1}{4}$ inches, tail $2\frac{1}{4}$, hind foot with claws $\frac{7}{8}$, claw of middle finger $\frac{1}{4}$ inch long according to Blyth. A not quite mature female in spirit measures:—snout to vent 3.5 inches, tail 2.25, hind foot (without claws) 0.65, middle fore claw 0.2, height of ear from orifice 0.3.

Distribution. This well-marked shrew was first found by Kelaart at Nuwera Ellia, in Ceylon. Recently a specimen has been received at the British Museum from the Palni hills in Southern India.

Habits. Kelaart suggests that *C. macropus* may be a water-shrew; but there is nothing apparent in the structure to support this view. The long fore claws do not appear particularly adapted for digging. A shrew belonging to this species was kept alive by Kelaart for some time and fed upon earthworms.

120. *Crocidura bidiana*. *Bidie's Shrew*.

Crocidura (*Pachyura*) *bidiana*, *Anderson, J. A. S. B.* xlv, pt. 2, p. 276 (1877); *id. Cat.* p. 185.

Crocidura (*Pachyura*) *stoliczkana*, *Anderson, J. A. S. B.* xlv, pt. 2, p. 270.

Upper teeth 18. This is very like a small *C. murina*, but is distinguished by the pes or hind foot from the heel being double the length of the manus or fore foot from the wrist, instead of only one and a half times the length, as in all allied forms. Ears moderate, round, and rather hairy. Tail long, not much swollen at the base. Fur long, fine, and dense. Through the remarkably wide space between the canine and the second premolar nearly the whole of the small first premolar is visible. There is a small tubercle inside the basal cusp of each anterior upper incisor.

Colour reddish brown above and below, the under surface with a greyish gloss, basal portion of all hairs dark slaty. Snout, ears, and feet pale reddish brown, tail darker.

Dimensions of a nearly adult male: snout to vent 3.2 inches, tail 2.6, hind foot 0.8, height of ear 0.37.

Distribution. The type was from Madras, and a young specimen from Bombay, originally distinguished as *C. stoliczkana*, was afterwards referred to this species by the describer.

The description is taken from Anderson's and from some notes given to me by Dobson. I have not examined the specimens.

121. *Crocidura rubicunda*. *The Pareshnāth Shrew.*

Crocidura (*Pachyura*) *rubicunda*, *Anderson, J. A. S. B. xlv, pt. 2, p. 277 (1877); id. Cat. p. 190.*

Upper teeth 18. Size moderate. Snout long, pointed, hairy. Ears large, round, very sparsely haired; rather long white hairs on the flaps. Feet slender, covered with short, nearly white hairs. Tail slightly swollen at the base, round, and rather thinly clad with longish pale yellow, almost white hairs, long white hairs being intermingled. Fur rather long and soft. Lateral gland small, but distinct.

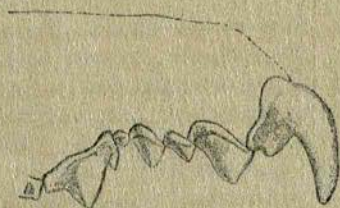


Fig. 67.—Anterior upper teeth of *Crocidura rubicunda*. (Dobson, *Mon. Ins.*, unpublished.)

No tubercle inside the basal cusp of the anterior upper incisor. First premolar largely visible from outside, between the canine and second premolar.

Colour pale rusty fawn above, grey suffused with fawn below, all the basal portions of the hairs dark slaty; muzzle, ears, feet, and tail pale yellowish.

Dimensions of an adult female: snout to vent 3·4 inches, tail 2·3, hind foot 0·64, height of ear 0·33, length of skull 0·93.

Distribution. The only known locality is Pareshnāth hill, east of Hazáribāgh, in Bengal.

This species is very nearly allied to *C. bidiana*, but differs in having much smaller and shorter feet. The above description, like the last, is taken from Anderson's and Dobson's notes.

122. *Crocidura leucogenys*. *The white-cheeked Shrew.*

Crocidura leucogenys, *Dobson, A. M. N. H. ser. 6, i, p. 423 (1888).*

Upper teeth 18. Size moderate. Snout hairy. Ears nearly naked. Feet hairy above; claws of moderate size. Tail thick, gradually tapering, covered with hair of moderate length, with longer hairs interspersed. Fur short. A large lateral gland.

The upper canine and second premolar are only separated by a short interval outside, through which a portion of the first premolar is visible. No inner process to basal cusp of first upper incisor.

Colour light sandy rufescent brown above, whitish grey below. Cheeks pale-coloured. Hair nearly the same colour throughout,



that on the back a little paler towards the base. Tail light sandy brown above, whitish below.

Dimensions of the type, an old female with worn teeth: snout to vent 3 inches, tail 2, hind foot 0·5, basal length of skull 0·75.

Distribution. But a single specimen is known; this was obtained by Sir O. B. St. John in Ajmere.

This species is near *C. rubicunda*, but smaller in all its dimensions.

123. *Crocidura dayi*. *Day's Shrew*.

Crocidura dayi, *Dobson, A. M. N. H.* ser. 6, i, p. 438 (1888).

Upper teeth 18. Size rather small. Snout hairy. Ear not large, nearly naked. Feet thinly covered with hair above. Tail long, thinly covered with short hairs (no longer hairs interspersed in the solitary specimen known). Fur long and close.

There is a distinct pointed internal lobe, posteriorly situated, to the basal cusp of each anterior upper incisor. The first or small premolar is (in the type) unusually large, but little inferior to the third incisor in section, though less high; the height, however, exceeds that of the anterior cusp of the second premolar. Lower anterior incisors serrated above.

Colour deep rich brown above, slightly paler and greyer below; the basal two thirds of all hairs blackish. Feet and tail dark.

Dimensions. Hind foot without claws 0·6 inch, basal length of skull 0·67. The length of the head and body in a dried skin is about 2½ inches; tail approximately the same, but no dependence can be placed on these measurements.

Distribution. The only specimen known is a dried skin with a skull in the British Museum. This skin was obtained by Dep. Surgeon-General F. Day in the Madras Presidency, and in all probability from the Palni or Travancore hills.

The hind foot is longer than in *C. leucogenys*, although the skull is smaller.

124. *Crocidura hodgsoni*. *The Himalayan pigmy Shrew*.

Sorex pygmaeus, *Hodgson, A. M. N. H.* xv, p. 269 (1845), *nec Pallas*.
Sorex pygmaeus, *micronyx*, *hodgsoni*, and *atratus*, *Blyth, J. A. S. B.* xxiv, pp. 32, 33, 34; *id. Cat.* p. 85.

Sorex hodgsoni and *micronyx*, *Jerdon, Mam.* pp. 57, 58.

Crocidura (Pachyura) pygmæoides, *Anderson, J. A. S. B.* xlvi, pt. 2, p. 279; *id. Cat.* p. 194.

Chupechi, Bhot.

Upper teeth 18. Size very small, but larger than that of *C. perroteti*. Ears large, nearly naked. Tail about three quarters the length of the head and body, or more, thinly clad with short hair, amongst which long hairs are scattered. Feet with short hair above. Lateral gland only developed at the rutting-season, when it becomes large.



Colour brown, varying from light sandy to dark and almost black; lower parts paler, the extreme tips of the hairs on the underparts, especially on the throat, greyish.

Dimensions of a large female: snout to vent 1·85 inches, tail 1·4, hind foot 0·37, height of ear 0·2, basal length of skull 0·5. Other specimens are somewhat smaller.

Distribution. Probably throughout the Himalayas and in the ranges south of the Assam valley. I cannot, however, find any locality recorded west of Mussooree. Dobson refers to the same form a specimen of a pigmy shrew from Ajmere, and another from Sind.

125. *Crocidura perrotteti*. *The Indian pigmy Shrew.*

Sorex perrotteti, Duvernoy, *Mag. Zool.* 1842, p. 29, pl. 47.

Sorex melanodon, *perrotteti*, and *nudipes*, Blyth, *J. A. S. B.* xxiv, pp. 33, 34; *id.* *Cat.* pp. 84, 85.

Sorex perrotteti and *melanodon*, Jerdon, *Mam.* p. 58.

Pachyura assamensis, Anderson, *P. Z. S.* 1873, p. 234.

Crocidura (*Pachyura*) *macrotis*, *nitidofulva*, *nilgirica*, and *travancorensis*, Anderson, *J. A. S. B.* xlvi, pt. 2, pp. 271-275.

Crocidura macrotis, *perrotteti*, and *travancorensis*, Anderson, *Cat.* pp. 180-189.

Upper teeth 18. Size very small. Ears large, covered with very short hair. Feet thinly clad above. Tail not swollen at the base, thin, tapering towards the end, about two thirds the length of the head and body, or rather less, sparsely covered with very short hairs, amongst which longer hairs are scattered. Fur short. Lateral glands well developed.

Colour reddish brown to dark brown, nearly black above, paler and greyer below. Tail dark above, light-coloured beneath.

Dimensions of an adult male: snout to vent 1·78 inches, tail 1·12, hind foot 0·35, height of ear from orifice 0·15, basal length of skull 0·45.

Distribution. Southern India, especially the Nilgiri hills and Travancore, Bengal, Assam, and Tenasserim. Not reported from Ceylon.

Habits. Nothing has been recorded about this, one of the very smallest of all Mammalia. In a female Anderson found five fetuses.

This species Dobson considers doubtfully distinct from the South European *C. etrusca*. I cannot help suspecting either that *C. hodgsoni* is not really different from *C. perrotteti*, or else that the number of Indian pigmy shrews must be more than two. The geographical distribution of these two forms, as given above, is quite anomalous.

Another shrew belonging to the section with 18 upper teeth has been described by Anderson under the name of *C. subfulva* (*J. A. S. B.* xlvi, pt. 2, p. 278; *Cat.* p. 192). The types are, however, immature, and it is quite uncertain what the adults may prove to be. Two specimens were found in Cutch by Dr. F. Stoliczka; the

older of the two measures: snout to vent 1·9 inches, tail 1·3, hind foot 0·42, basal length of skull 0·62. Colour pale fawn above, silvery grey below.

126. *Crocidura fuliginosa*. *Blyth's Shrew*.

Sorex fuliginosus, *Blyth*, *J. A. S. B.* xxiv, p. 362; *id.* *Cat.* p. 84.

Crocidura rubricosa and *kingiana*, *Anderson*, *J. A. S. B.* xvi, pt. 2, pp. 280, 281.

Crocidura rubricosa and *fuliginosa*, *Anderson*, *Cat.* pp. 196, 197.

Upper teeth 16. Size rather small. Muzzle thinly clad. Ears large, nearly naked. Feet thinly clad above. Tail long, three fourths the length of the head and body, or more, subcylindrical, very gently tapering (except in the rutting-season, when the basal

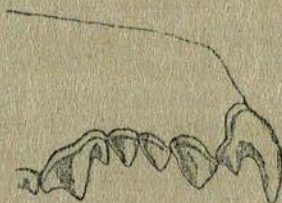


Fig. 68.—Anterior upper teeth of *Crocidura fuliginosa*. (Dobson, *Mon. Ins.*, unpublished.)

portion is thickened), nearly naked, being thinly clad with very short hair, amongst which a few longer hairs are interspersed in the basal half only. Lateral gland small and elongate, present in the male only. The small first premolar is wanting, but otherwise the teeth, though much smaller, are similar to those of *C. murina*.

Colour deep rich reddish brown above, ashy brown to ashy grey below, basal half of fur throughout slaty. Tail and upper surface of feet dark brown.

Dimensions. An adult male measures: snout to vent 3·1 inches, tail 2·7, hind foot 0·55; an old female, 2·9, 2·5, and 0·57. Basal length of skull in each 0·75.

Distribution. Eastern Himalayas, at an elevation not exceeding 5000 or 6000 feet, Assam, and Tenasserim. Common in Sikkim.

127. *Crocidura horsfieldi*. *Horsfield's Shrew*.

Sorex horsfieldi, *Tomes*, *A. M. N. H.* ser. 2, xvii, p. 23 (1856).

Crocidura retusa, *Peters*, *MB. Akad. Berl.* 1870, p. 585; *Anderson*, *Cat.* p. 199.

Upper teeth 16. Size small. Muzzle thinly clad. Ears of moderate size, nearly naked. Feet thinly clad above; of the proximal pair of pads on each hind foot the outer is further from the heel. Tail thick at the base and tapering, but little shorter than the head and body, thinly clad with short hair, a few longer hairs interspersed in the basal half only. Lateral gland large, nearly circular, present in both sexes, but less developed in females than in males.



Colour bright ferruginous brown above, light yellowish grey below, basal portion of the fur light grey. Some specimens are reddish brown above, light brown below, with the basal portion of the hairs slaty. Feet and tail flesh-coloured in many cases, but dusky in others.

Dimensions. Snout to vent in a large female 2.25 inches, in a male 2.1, tail 2 and 1.95, hind foot 0.45, basal length of skull 0.6.

Distribution. This species has hitherto only been found in Ceylon, where, however, it escaped the notice of Kelaart. Specimens have been sent from Paradinia, so this form is probably an inhabitant of the hills. It should be looked for in the Travancore ranges also.

128. *Crocidura fumigata.* *De Filippi's Shrew.*

Sorex (*Crocidura*) *fumigatus*, *De Fil. Arch. per la Zool. Genova*, ii, p. 379; *id. Viag. in Persia*, p. 343; *Blanford, Eastern Persia*, ii, p. 24.

Upper teeth 16. Size small. Muzzle thickly clad with hair. Ears of moderate size, nearly naked. Feet thinly clad above, proximal pair of pads on hind foot parallel in the only specimen I have access to, that from Simla; in all other species the outer of the two is much more distant from the heel. Tail remarkably thick in the male, thin in the female, about two thirds the length of the head and body, well clad with coarse hair of moderate length throughout, with long fine hairs interspersed on the basal half. A small pencil of hair at the end of the tail. No lateral gland has been detected.

Colour reddish brown above, greyish brown below, basal portion of fur on both surfaces slaty. Tail dark brown throughout, feet paler brown above.

Dimensions. Snout to vent 2.75 inches, tail 1.9, hind foot 0.55.

Distribution. Originally described from Northern Persia. Mr. Dobson tells me he has seen specimens from Kiangsi, and he has identified with this form a shrew sent to me by Mr. Hume from Simla.

129. *Crocidura aranea.* *The spider Shrew.*

Sorex araneus, *L. Syst. Nat.* ed. xii, p. 74, *partim*; *Schreber, Säugeth.* iii, p. 573, pl. 160.

Sorex russulus and leucodon, *Herm. Zimm. Geog. Gesch.* ii, p. 382.

Sorex myoides, *Blanford, J. A. S. B.* xliv, pt. 2, p. 106; *id. Yark. Miss., Mam.* p. 16, pls. i, ia.

Upper teeth 16. Snout, upper surface of feet, and tail fairly clad with hair, the latter not swollen at the base, nearly cylindrical, about half as long as the head and body, or rather more, covered with rather short hair, with a few long hairs intermixed. Lateral gland small and elongate in males, wanting in females.

Colour brown above, usually fawn-coloured or greyish brown;



below pale grey or white; fur slaty at the base throughout; upper surface of tail darker than the lower.

Dimensions of an adult Ladák female: snout to vent 2.1 inches, tail 1.5, hind foot 0.5, extreme length of skull 0.75.

Distribution. Central and Southern Europe, Northern Africa, and Central Asia, extending to North-eastern Siberia. It has been obtained in Ladák.

Habits. In Europe this shrew is commonly found about cultivated ground and is often met with in houses. It lives on insects, worms, young mammals of small size, and young birds, and will eat meat and fat. It has from 5 to 10 young, which are born in summer, and which attain their full growth in about 6 weeks.

Sorex kelaarti, Blyth, J. A. S. B. xxiv, p. 32; Cat. Mam. p. 84 (*Crocidura kelaarti*, Anderson, Cat. Mam. p. 200), is founded, Mr. Dobson informs me, on a very young female, with the teeth imperfectly grown, although the inguinal teats are fully developed. Despite the circumstance that there are but 28 teeth, this shrew may be a young specimen of *C. murina*. The small premolars are wanting in a half-grown skull of that species from Darjiling.

Genus **ANUROSOREX**, A. Milne-Edwards (1870).

Syn. *Pygmura*, Anderson (1873).

Head large in proportion to the body. Eyes very small. No external ear-conch; ears valvular. Feet short, scaly. Tail very short, naked, and scaly. Fur dense, velvety.

Teeth entirely white; there are 14 in the upper jaw, only two conical teeth lying between the upper anterior incisor and the single multicuspitate premolar on each side: i. $\frac{2-2}{2-2}$, c. $\frac{1-1}{0}$, pm. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3}$ = 26.

A full description of the skull and skeleton is given by Anderson (An. Zool. Res. p. 151). The structure of the pelvis shows some resemblance to that of *Talpa*.

Two species are known, one of which occurs in Assam.

130. **Anurosorex assamensis.** *The Assam short-tailed Shrew.*

Anurosorex assamensis, Anderson, A. M. N. H. 1875, ser. 4, xvi, p. 282; Anat. Zool. Res. p. 150, pl. v, figs. 1-16 (skeleton); id. Cat. p. 171.

Snout semi-nude. Feet naked, scaly, the hind foot from the heel $1\frac{1}{2}$ times the length of the fore foot from the wrist. Tail about one-sixth the length of the head and body, naked and scaly. Numerous thicker hairs project beyond the velvety fur, which is nearly erect on the skin (as in moles), and is longest on the rump, so as to conceal the greater part of the tail.

The skull is nearly half as long as the vertebral column from the atlas to the end of the sacral vertebrae. There is a distinct inner



talon to the basal cusp of each upper anterior incisor. The outer upper incisors are larger than the canines. The anterior lower incisors are long and their points turn upwards; they are not serrated above.

Colour dark slaty, faintly washed with brownish rusty on the hairs of the rump; the longer hairs brown, with obscure pale tips. Snout, limbs, and tail flesh-coloured; claws yellow. The fur exhibits violet iridescence when wet.

Dimensions of a female: snout to vent 2.92 inches, tail 0.5, basal length of skull 0.92. Another specimen is 3.1 inches from snout to vent, tail 0.5, hind foot without claws 0.62.

Distribution. The only specimens known (a female and young) were obtained by Mr. S. E. Peal between Sibságar and Jaipur, in Assam.

Habits. This is probably from its structure a burrower, with habits similar to those of a mole.

An allied species, *A. squamipes*, the type of the genus, occurs in Eastern Tibet and Se-chuan. In this the tail is still shorter than in the Assam form.

Genus **CHIMARROGALE**, Anderson (1877).

Form adapted for an aquatic life. Ear-conch present but small. Feet scaly, broad, with a fringe of short coarse flat white hairs along their margins and on each side of every toe. Toes not

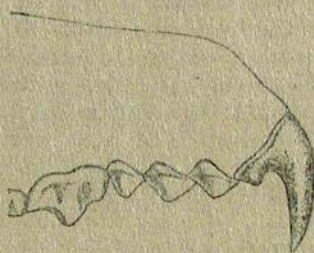


Fig. 69.—Anterior upper teeth of *Chimarrocale himalayica*. (Dobson, Mon. Ins., unpublished.)

webbed. Tail long, the under surface covered with white hairs, similar to those that fringe the feet.

Teeth white. Dentition: i. $\frac{3-3}{2-2}$, c. $\frac{1-1}{0}$, pm. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3}$ = 28, as in *Crocidura*.

Two species are known, one being found in the Himalayas. The osteology is described by Anderson in his 'Anatomical and Zoological Researches.'

131. *Chimarrocale himalayica*. *The Himalayan Water-Shrew.*

Crossopus himalayicus, Gray, *A. M. N. H.* x, p. 261 (1842); *Blyth*, *J. A. S. B.* xxiv, p. 37; *Jerdon*, *Mam.* p. 60.

Crocidura himalayica, *Anderson*, *P. Z. S.* 1873, p. 231.



Chimarrogale himalayica, Anderson, *J. A. S. B.* xlv, pt. 2, p. 232;
id. An. Zool. Res. p. 139, pl. v, figs. 17-83 (skeleton); *id. Cat.*
p. 208.

Ung lagnyu, Lepcha; *Chupitsi*, Bhutia.

Snout densely furred and with numerous vibrissæ. Eyes very minute. The small ear-conch is hairy and entirely concealed by the fur. Feet scaly; toes naked; upper surface of metacarpus and metatarsus thinly clad with short flat bristly hairs. Tail thinly clad above, thickly below, with short flat hairs. Fur soft and dense, with a few longer hairs on the back and sides, becoming numerous on the rump.

Upper anterior incisors each with a lateral expansion on the inner side of the anterior cusp so as to meet, the proximal surface of the cusp being concave; the notch between the anterior and basal cusp very deep. The three intermediate conical teeth on each side nearly of equal size. Premolar about equal in section to the anterior molar, and having the inner ridge of the crown divided into two cusps. In the lower jaw the anterior incisors are elongate and much turned up at the end, and the crown of the premolar distinctly bifid at the summit.

Colour dark slaty grey above, with the tips of the hairs rich blackish brown, the terminations of the scattered longer hairs shining white. Lower parts pale brownish grey, basal portion of hair ashy grey below, dark leaden grey above. Hair on the upper surface of the feet brown. Tail dark brown above, white below.

Dimensions. An adult female measured: snout to vent 4.35 inches, tail 3.05, hind foot without claws 0.75, height of ear from orifice 0.27. Jerdon gives larger measurements, head and body 5 and 6 inches, and I possess skins that measure this. The skull of a small female measured 0.94 inch in basal length.

Distribution. South-eastern Himalayas, and the Khakhyen hills north of Burma, at elevations, so far as is known, of from 3000 to 5000 feet. Not recorded further west than Sikkim, where it is not rare.

Habits. The Himalayan water-shrew inhabits the banks of streams, and has been observed by Anderson running over the stones in the stream-bed and plunging freely into the water. It doubtless swims well. It is said to feed on water insects, aquatic larvæ, tadpoles, small fish, &c., like *Crossopus fodiens* of Europe.

The other species of this genus, *C. platycephalus*, inhabits Japan. A black shrew was noticed swimming in water by Col. McMaster near Nagpur, but no specimen collected (see 'Notes on Jerdon's Mammals,' appendix, p. 215). The animal is probably an undescribed form.

Genus **NECTOGALE**, A. Milne-Edwards (1870).

Aquatic. No external ear-conch; ears valvular. Feet large, broad, scaly, fringed with coarse white hairs; toes webbed; pads



on the soles of the feet enlarged into broad disks. Tail long, with fringes of white hairs on the sides and lower surface and on the terminal portion of the upper surface; last third of tail compressed.

Teeth white: i. $\frac{3-3}{2-2}$, c. $\frac{1-1}{0}$, pm. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3} = 28$, as in *Crocidura*.

This is a more thoroughly aquatic form than its near ally *Chimarrogale*. Only one species is known.

132. *Nectogale elegans*. *The Tibetan Water-Shrew*.

Nectogale elegans, A. Milne-Edwards, *Comptes Rendus*, lxx, p. 341 (1870); *id. Rech. Mus.* p. 266, pls. 39, 39 A; W. Blanford, *P. A. S. B.* 1875, p. 198.

Eye very small. Snout covered with fur as thick as that on the body. Hind feet large and broad, double the length of the fore feet, naked above, only the terminal phalanges free from the web and fringed with hairs like those on the sides of the feet, white, coarse and flattened, and nearly $\frac{1}{10}$ inch long, or twice the length of those in *Chimarrogale*. A few scattered coarse hairs on the upper surface of the metacarpus. Hair fringing the fore feet short, and no fringes to the toes, but the disks beneath the sole are similar to those on the hind feet. Tail well clad above with short flat hairs, densely clad with similar flat hairs below, which form fringes. There is one along each side of the basal third of the tail, the two unite and form a median inferior fringe for the remaining two thirds, along each side of which is a lateral fringe, dying out towards the end, where the tail is distinctly compressed, whilst on the terminal portion there is an upper median fringe. Fur extremely dense, soft, and long, evidently adapted for a cold climate, with conspicuous longer hairs on the back and sides, becoming most numerous on the rump.

Colour rich dark brown above, the longer hairs glistening white; upper lip, chin, throat, and breast whitish, passing into light brown on the abdomen and flanks, but the line of division well marked in front of the fore limbs. Tail whitish brown above, white below. The fur when wet is iridescent.

Dimensions. Head and body 3.6 inches, tail 4, hind foot 1, extreme length of skull 1.

Distribution. Tibet. First found by Père David in Eastern Tibet, then a specimen was procured by Mr. Mandelli from the Sikhim frontier. I once saw a small mammal, probably this species, swimming in a deep stream at 15,000 feet above the sea, near Momay Sandong in Sikhim. This shrew is evidently an inhabitant of high elevations, and may hereafter be found in other parts of the high Himalayas and Tibet.

Habits. Evidently *Nectogale*, from its structure, is thoroughly aquatic. The enlarged disk-like pads of the feet are believed by A. Milne-Edwards to be employed as suckers, and to enable the animal to hold on to smooth rocks or stones in a stream-bed.

Suborder *DERMOPTERA*.

This suborder contains but a single family, represented by only one genus. The connexion with the Insectivora is not very obvious, and the view, already noticed, that the Dermoptera should rank as a distinct order has much in its favour.

Family GALEOPITHECIDÆ.

Genus **GALEOPITHECUS**, Pallas (1780).

It will be convenient to give all the characters of this anomalous mammal under the head of the genus. The flying lemurs, as they are called, are animals about the size of a small domestic cat, having a rather long head, well-developed tail, and slender limbs.

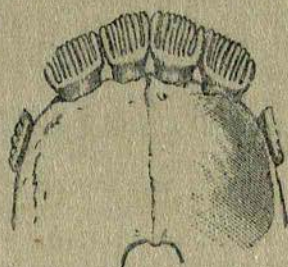


Fig. 70.—Lower incisors of *Galeopithecus*. (Guide to the Galleries of Mammalia, British Museum, 1885.)

An expansion of the skin connecting the limbs begins from the side of the throat, extends all along the neck, body, and tail to the tip, and forms a web between all the toes which are included in it to the base of the claws. The whole forms a parachute, by the aid of which the animal glides from tree to tree. Something similar is found in flying squirrels and in some other mammals and a few lizards, but in none is it so fully developed as in the present genus.

Dentition: i. $\frac{4}{3}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. The upper incisors are quite at the side, all the terminal portion of the upper jaw being toothless. The anterior pair of incisors are compressed and subpectinate, with one root. The second incisor and the canine are similar to each other in shape, both being compressed and two-rooted, with a triangular crown terminating in a median point. Premolars and molars three-rooted. Anterior premolar with two principal cusps. Second premolar and all the molars similar in shape; the crown semioval in section, with the convex side inwards, and sharply tuberculate around a central hollow.



Lower incisors pectinate, the two median pairs very deeply cleft like combs; outer pair much less deeply cut. Lower canine and anterior premolar much like upper canine; second premolar elongate and tuberculate; lower molars very similar to the upper, but with the convexity towards the outside of the jaw.

Skull broad, muzzle rounded and blunt, rim of orbits projecting, postorbital processes broad, zygomata strong; palate terminating posteriorly in a median point, from which a ridge runs backwards in continuation of the nasal septum and divides the mesopterygoid fossa. The bullae are completely ossified.

The radius and ulna are united distally, the tibia and fibula distinct throughout. The vertebral formula is: C. 7, D. 13-14, L. 5-6, S. 5, C. 15-17.

The ears are rounded and of moderate size. The feet have a naked, very flat, non-tuberculate sole. Claws sharp, much compressed, and curved. Mammary 4, all pectoral. There is a large caecum.

This remarkable animal has been referred by different naturalists to the bats and lemurs; but it has really no affinity with the former, and but little with the latter, from which it is separated by the form of its brain, the structure of the skull and teeth, and the deciduate discoidal placenta.

Two species are known—one, *G. philippinensis*, peculiar to the Philippine Islands; and the original type, *G. volans*.

133. *Galeopithecus volans*. *The flying Lemur*.

Lemur volans, *L. Syst. Nat.* i, p. 45 (1776).

Galeopithecus volans, *Pall. Acta Acad. Sc. Petrop.* iv, p. 208, pls. vii, viii (1780); *Horsf. Cat.* p. 26; *Blyth, J. A. S. B.* xxi, p. 433, xxii, p. 411; *id. Cat.* p. 19.

Galeopithecus temminckii, *Waterhouse, P. Z. S.* 1838, p. 119; *Cantor, J. A. S. B.* xv, p. 177.

Kubong, Malay.

Fur short, very fine and soft. Canines and the outer upper incisor and first lower premolar with low crowns. Anterior upper incisors trilobate (sometimes with four lobes).

Colour above varying from dark greyish brown to pale chestnut, always overlaid, mottled, and blotched with silvery white; lower parts light brown, more or less rufous. Younger animal much variegated, and with well-defined white spots on the side. The dorsal fur is generally (not always) dusky at the base; the greater part of the length is whitish, a subterminal ring blackish brown (varying to chestnut), and the tip white.

Dimensions. A male measured, head and body 16 inches, tail 9. A skull is 2.75 inches long in basal, 2.9 in extreme length, zygomatic breadth 2.

Distribution. The Malay peninsula, extending north to Mergui in Tenasserim, where it was obtained by Capt. Berdmore, and to Siam, also Sumatra, Java, and Borneo.



Habits. This species is of course arboreal, and by means of its parachute can throw itself from one tree and glide through the air to another at a considerable distance. Wallace relates that he saw one pass from one tree to another 70 yards distant, with a fall of only one in five; and he remarks that the animal must



Fig. 71.—*Galeopithecus volans*. (From a drawing by Col. Tickell.)

have some power of guiding itself in the air, as otherwise it could not alight on the trunk of the tree to which its flight is directed. It is entirely nocturnal in its habits, and is said to remain hanging on the stem or branch of a tree head downwards during the day, its peculiar mottled coloration being very similar to that of the bark.

Galeopithecus is said to be purely herbivorous, feeding on leaves and fruits. It has but one young one at a time.

Order CHIROPTERA.

Volant mammals, having their fore limbs specially modified for flight. The forearm consists of a rudimentary ulna, a long curved radius, and a carpus of six bones supporting a thumb and four greatly elongated fingers, between which, the sides of the body, and the hinder extremities a thin expansion of the integument (the *wing-membrane*) is spread out. The knee is directed backwards, owing to the rotation of the hind limb outward by the wing-membrane; a peculiar elongated cartilaginous process (the *calcaneum*), rarely rudimentary or absent, arising from the inner side of the ankle-joint, is directed inwards and supports part of

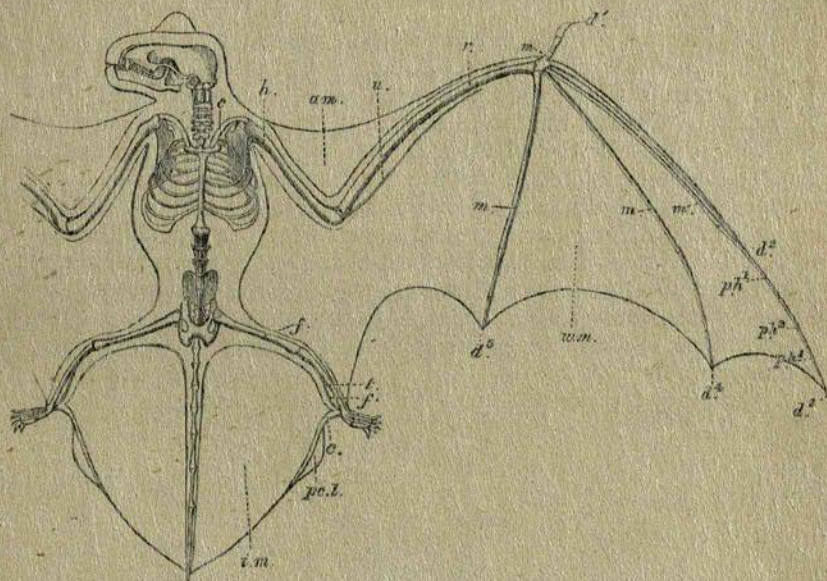


Fig. 72.—Skeleton and Volar Membranes of the Noctule (*Vesperugo noctula*), half nat. size. (Flower, Art. Mammalia, 'Encyclopædia Britannica'.)

c., clavicle; h., humerus; r., radius; u., ulna (rudimentary); d.¹, first digit or pollex; d.², d.³, d.⁴, d.⁵, other digits supporting w.m., the wing-membrane; m., m., metacarpal bones; ph.¹, ph.², ph.³, first, second, and third phalanx of third digit; am., antibrachial membrane; f., femur; t., tibia; f., fibula (rudimentary); c., calcaneum or calcar supporting i.m., the interfemoral membrane; p.c.l., post-calcaneal lobe.

the posterior margin of an accessory membrane of flight, extending from the tail or posterior extremity of the body to the hinder limbs (the *interfemoral membrane*). The penis is pendent, the

testes abdominal or inguinal; the mammary glands thoracic, and generally post-axillary; the uterus simple or two-horned; the placenta discoidal and deciduate; and the smooth cerebral hemispheres do not extend backwards over the cerebellum. The dental series consists of four kinds of teeth: incisors, canines, premolars, and molars; and the dental formula never exceeds i. $\frac{4}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$ m. $\frac{3-3}{3-3}$ = 38 teeth (*Dobson*).

Besides the "wing-membrane" and "interfemoral membrane," there is a smaller membrane in front of the humerus and forearm called the "antebrachial membrane." The relative position of the different membranes, and of the bones supporting the wing-membrane, is shown in the accompanying woodcut (fig. 72). The manus or hand is always composed of five digits; of these the first (or thumb), fourth, and fifth consist each of a metacarpal and two osseous phalanges, in the second and third the number of phalanges varies slightly. The first digit or thumb is partly free from the wing and always terminates in a claw. The hind limb is but poorly developed.

Few, if any, animals have so delicate a sense of touch as bats. In Spallanzani's experiments, bats deprived of the power of seeing, hearing, or smelling, flew through a room, carefully avoiding the numerous threads that were stretched across it. This sense of touch, so acute as to feel the slightest movements of the air, is probably chiefly exercised by the wing-membrane, the greatly developed ear-conch, and, in the leaf-nosed bats, by peculiarly formed expansions of integument around the nostrils. In several families of insectivorous bats, a process called the tragus arises inside the inner or anterior margin of the ear (fig. 73), whilst a lobe at the base of the outer margin opposite the tragus, and known as the antitragus, is sometimes of considerable dimensions. The ears are extremely mobile.

Bats vary in their powers of flight almost as greatly as birds do,

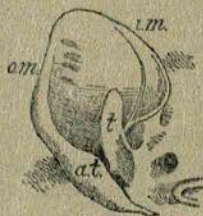


Fig. 73.—Ear of *Vesperugo abramus*.

o.m., outer margin; *i.m.*, inner margin; *t.*, tragus; *a.t.*, antitragus.

those with long narrow wings being much swifter than the short-winged forms. The species of stronger flight appear, as a rule, earlier in the evening, even in some cases before sunset, and may often be seen hawking insects in company with swallows and



swifts, high in the air. Several kinds of *Vesperugo*, *Miniopterus*, *Megaderma*, and *Nycticejus* may be cited amongst the swifter flying forms. On the other hand, the species of *Rhinolophidae* and those belonging to the genus *Vespertilio* have a comparatively slow flight and rarely rise far from the ground. They appear as a rule later in the evening, and only in fine weather. Some of the longer-winged bats, especially the species of *Vesperugo*, are easily distinguished on the wing by the quickness with which they change the direction of their flight. More observations of the flight and habits in general of Indian bats are needed.

From the weakness and reversed position of the hind limbs, bats are unable to walk like other mammals, and when, from any cause, they are induced to descend to the ground, they make most awkward attempts to progress on all fours, their thumbs being mainly used in locomotion. By means of the claws on the toes and that on the thumb, they can climb up any uneven sloping or vertical surface. When at rest they suspend themselves by their hind feet to trees, or in caves, old buildings, &c., and remain hanging head downwards. When moving about, they also hang by their thumbs. The young one is carried by the mother until nearly her own size. Usually one is produced at a birth, but at most two. Amongst many bats the sexes live apart except at the pairing-season. As in the *Primates*, the females have only two pectoral teats, but in certain families a pair of nipple-shaped appendages are developed in the inguinal region.

In temperate regions bats hibernate in the winter, a number of them being frequently found huddled together. Some observers have supposed that no hibernation takes place in India; but the insectivorous forms, in Northern India at all events, are but rarely seen abroad during the cold season, though the *Pteropidae* are as active as at other times.

Bats were by Linnaeus classed amongst the *Primates*, and, until recently, many naturalists assigned to the *Chiroptera* a very high position amongst *Mammalia*. It has, however, been shown that the true position of bats is next to the *Insectivora*, and that both, with their poorly developed brains, are of inferior grade.

A complete account of the order has been published by Dobson in his 'Catalogue of the Chiroptera in the Collection of the British Museum,' from which work and the same author's 'Monograph of the Asiatic Chiroptera' the following descriptions of the Indian members of the order are chiefly taken.

The bats are by Dobson and others classed in two principal divisions called suborders, but not distinguished by characters of similar importance to those which serve to separate the *Pinnipedia* from *Fissipedia* in *Carnivora*, and the *Dermoptera* from the true *Insectivora*. The first of these suborders includes a single family of frugivorous bats; to the other belong the five families of insectivorous Chiroptera. All are thus discriminated:—



A. Crowns of the molar teeth with a longitudinal furrow, not tubercular; second or index finger with three phalanges besides the metacarpal bone, and generally terminating in a claw (in all Indian genera except *Eonycteris*); the two margins of each ear-conch meeting at the base. Frugivorous

I. MEGACHIROPTERA.
Pteropodidæ.

B. Crowns of the molar teeth acutely tubercular, with transverse furrows; second or index finger with a single rudimentary phalanx (in *Rhinopoma* only with two phalanges) and clawless; the two margins of each ear-conch arising from the head separately. Carnivorous, and, for the most part, insectivorous

II. MICROCHIROPTERA.

a. Tail contained within the interfemoral membrane, or very little produced beyond its hinder margin. First phalanx of middle finger extended, in repose, in a line with the metacarpal bone.

a'. Tragus none, a complicated nose-leaf

b'. Tragus present, a nose-leaf

c'. Tragus present, no nose-leaf

b. Tail perforating the interfemoral membrane and appearing on its upper surface, or produced considerably beyond the truncated membrane; first phalanx of middle finger folded, in repose, on the dorsal surface of the metacarpal bone.

a. Two osseous phalanges (besides metacarpal bone) in middle finger. Tragus distinct, no nose-leaf

b. Three phalanges in middle finger.

Rhinolophidæ.

Nycteridæ.

Vespertilionidæ.

Emballonuridæ.

Phyllostomatidæ

(American).

All of the families except the *Phyllostomatidæ* are represented in India.

The measurements of bats are in almost every case taken from specimens preserved in alcohol. Like all other mammals, bats vary considerably in their dimensions, the figures quoted being, when several measurements are available, those of an average specimen.

Bats are known generally as *Chamgudur* in Hindi; *Shab-par* or *Shab-parak* in Dakhani; *Chamguddri*, Bengali; *Chidgu* at Bhagulpur; *Chûti bardwi* in Ho Kol; *Gabbelai* or *Jiburai*, Telegu; *Kanka-pati*, Canarese; *Vulhá*, Cingalese; *Phiyu longtá*, Bhotia; *Brin*, Lepcha; *Soshiro*, *Phakarang*, and *Sepcha*, Naga. These names are used for all species of Microchiroptera.

Suborder *MEGACHIROPTERA*.

Family PTEROPODIDÆ.

This family consists of the fruit-eating bats, the largest of which are commonly known in India as flying-foxes. Some smaller forms, of less conspicuous coloration, are also comprised. All are distinguished from other bats by the characters of the molar teeth, with longitudinally grooved crowns, by the bony palate being continued, narrowing slowly backwards, behind the last molars, and especially by the form of the ear, the margins of which meet before they reach the head, so that the whole margin forms a more or less regular oval ring, whilst in all insectivorous bats the margins arise independently from the head. As a rule, too, the index finger terminates in a claw, *Eonycteris spelæa* being the only exception to the rule found in the territory of British India.

The following genera occur within the Indian area :—

- A. Tongue moderate ; inner margin of nostril projecting ; a claw to index finger.
 - a. No tail, hind neck and shoulders generally much paler than back PTEROPUS.
 - b. A tail generally present ; upper parts of one colour throughout.
 - a'. 5 teeth in upper molar series, 6 in lower XANTHARPYIA.
 - b'. 4 teeth in upper molar series, 5 in lower CYNOPTERUS.
- B. Tongue very long ; no projecting margin to nostril.
 - a. A claw to index ; wing from base of 4th toe ; tail rudimentary CARPONYCTERIS.
 - b. No claw to index ; wing from base of 1st toe ; tail distinct EONYCTERIS.

All the *Pteropodidæ* are limited to the tropical and subtropical regions of the Eastern hemisphere with Australia, none being found in America.

Genus PTEROPUS, Brisson (1756).

Size large, exceeding all other bats. Muzzle long ; nostrils projecting by their inner margins, between which is a deep furrow leading to a vertical groove that divides the upper lip, and has on each side a naked swollen border. Second * or index finger with a distinct claw ; metacarpal bone of third or middle finger shorter than second finger. Wing-membrane from the sides of the hairy

* The thumb, which is free, being classed as the first finger.



back, and the back of the second toe. Tail none. Hair of the hind neck and shoulders different in quality from that of the back, and generally much brighter in colour.

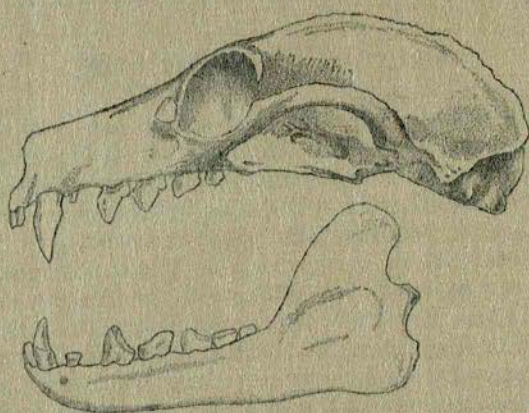


Fig. 74.—Skull of *Pteropus medius*.

Dentition: i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{2-2}{2-3}$. Upper incisors in a semicircular row, separated on each side from the canines; lower outer incisors close to the canines, the inner pair generally separated by a slight interval and smaller; first upper premolars generally very small and deciduous.

This genus contains the large fruit-bats commonly known in India as flying-foxes.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Forearm (radius) in adults less than 7 inches long.
- a. Ears pointed, longer than distance from eye to muzzle. *P. medius*, p. 257.
 - b. Ears rounded, shorter than distance from eye to muzzle. *P. nicobaricus*, p. 260.
- B. Forearm in adults more than 8 inches long; ears pointed *P. edulis*, p. 259.

Beyond India the genus *Pteropus* has a remarkable geographical distribution. The majority of the species inhabit the Malay Archipelago, on both sides of Wallace's line; the range of the genus extending eastward to Samoa, south throughout a considerable part of Australia (not to New Zealand or Tasmania), and eastward to Madagascar and the Comoro Islands, but not to Africa.

134. *Pteropus medius*. *The Indian Fruit-Bat or Flying-Fox.*

Pteropus medius, Temm. *Mon. Mam.* i, p. 176 (1827); Dobson, *J. A. S. B.* xlii, pt. 2, p. 196, pl. xiv, fig. 1 (ear); *id.* *Mon. As. Chir.* p. 18; *id.* *Cat. Chir. B. M.* p. 51; Blyth, *Mam. Birds Burma*, p. 14; Anderson, *Cat.* p. 101; Scully, *J. A. S. B.* lvi, pt. 2, p. 236. *Pteropus edwardsi*, Horsfield, *Cat.* p. 28; Kelaart, *Prod.* p. 27; Adams, *P. Z. S.* 1858, p. 512; Blyth, *Cat.* p. 20; Jerdon, *Mam.* p. 18; Hutton, *P. Z. S.* 1872, p. 691; *nec* Geoffr.

Pteropus leucocephalus, Hodgson, *J. A. S. B.* iv, p. 700 (1835).

Pteropus assamensis, McClelland, *P. Z. S.* 1839, p. 148.

Pteropus kelaartii, Gray, *Cat. Monkeys, Lemurs, and Fruit-eating Bats B. M.* p. 104 (1870).

Gadāl, *Barbagal*. *Bādūr*, *Pata debli*, H.; *Bādāl*, Beng.; *Warbagāl*, Mahr.; *Toggal bāwuli*, Can.; *Sikat yelle*, Wadari; *Sikurayi*, Tel.; *Barvalu*, Mal.; *Loco-vaola*, *Wawal*, Cing.; *Leng-tshwai*, *Leng-nek*, Burmese.

Ears naked and acutely pointed, their length exceeding the distance from the eye to the end of the nose; the outer margin concave near the tip. Nose naked above. Fur of hind-head, neck all round, shoulders, and breast woolly, coarser and longer than that of the back. There is a narrow hairy band above the wing-membrane behind the humerus and part of the forearm, and the interfemoral membrane is covered with hair above except near the edge. In males there is generally a circular tuft of rigid greasy hairs, bright reddish in colour, on each side of the neck.

Colour. This is variable, as in all bats. The head is generally reddish brown, the muzzle often darker and sometimes black; the hind neck and shoulders paler, generally pale brownish yellow to straw-colour; back behind the shoulders dark brown or black, occasionally with a few white hairs interspersed. Lower parts yellowish brown, chin and fore neck usually darker, as are the region about the vent and the flanks; sometimes the whole lower breast and abdomen are dark brown or black.

Dimensions. Head and body about 9 inches (varying from 7·5 to 10·5), length of ear from orifice 1·45, forearm 6·6; basal length of skull 2·7, extreme length 2·9, zygomatic breadth 1·7. The expanse of the wings is about 4 feet. Weight 20 to 22 oz.

Distribution. Throughout India, Ceylon, and Burma. Not found in the Himalayas except near the base, or as a visitor from the plains. Rare in Western Rajputana, Cutch, and Sind, and not known to occur in the Punjab. Not recorded east or south of Burma.

Habits. Jerdon's account is good. He says:—"During the day they roost on trees*, generally in large colonies. Many hundreds often occupy a single tree, to which they invariably resort if not driven way. Towards sunset they begin to get restless, move

* Tickell notices their preference for tamarind trees, and I think he is right. In Bengal they sometimes remain on bamboos. They hang head downwards, wrapped in their wings, and precisely resemble large dead leaves.



about along the branches, and by ones and twos fly off for their nightly rounds. If water is at hand—a tank, a river, or the sea—they fly cautiously down and touch the water, but I could not ascertain if they took a sip, or merely dipped part of their bodies in. They fly vast distances occasionally to such trees as happen to be in fruit. They are fond of most garden fruit (except oranges, &c.), also the neem, jamoon, ber, and various figs*. About the early dawn they return from their hunting-grounds, and the scene that then takes place is well described by Tickell in an excellent memoir published in the ‘Calcutta Journal of Natural History’ †, from which I extract the following: ‘From the arrival of the first comer until the sun is high above the horizon, a scene of incessant wrangling and contention is enacted amongst them, as each endeavours to secure a higher and better place, or to eject a neighbour from too close vicinage. In these struggles the bats hook themselves along the branches, scrambling about “hand over hand” with some speed, biting each other severely, striking out with the long claw of the thumb, and shrieking and cackling without intermission. Each new arrival is compelled to fly several times round the tree, being threatened from all points, and when he eventually hooks on has to go through a series of combats, and be probably ejected two or three times before he makes good his tenure. The “alarums-excursions” continue till 8, 9, or 10 A.M., when the bats get sleepy, and hang side by side in peace, fanning themselves with their wings, which in repose they wrap round the head.’”

According to Dr. Shortt, P. Z. S. 1863, p. 438, these bats capture small fish, but Jerdon suspects, and probably with reason, that the habit of skimming water in the evening has been mistaken for fishing. I have often observed this habit: the head is lowered, the animal pauses in its flight, and the water is just touched, I believe, by the tongue or lower jaw. I have no doubt that some water is drunk, and this is the opinion of both Tickell and McMaster. The former says that flying-foxes in confinement drink at all hours, lapping with their tongues. The latter has noticed many other bats drink in the evening as well as the flying-foxes.

The process of eating is also described by Tickell. The bats hang, head downwards as usual, by one foot, and hold the fruit with the other, not by grasping, but by striking the claws in like a fork. The jaws are moved slowly up and down, and the food

* They are also fond of the fruit of *Terminalia catappa*, and are said by Day to extract the kernels, often utilizing the verandahs of houses as a resort whilst thus engaged, and alarming the inhabitants by sounds suggestive of house-breaking. The same writer states that these bats often drink toddy (palm-juice) from the pots attached to the trees from which it is collected, and are consequently found intoxicated and helpless beneath the trees in the morning (‘Land of the Permauls,’ p. 439).

† Vol. iii. p. 29.



bitten off in large mouthfuls, both cheeks being crammed full and the tongue protruded.

The numbers in a colony are at times very great, and the trees on which the bats perch are frequently injured and sometimes killed. *Pteropi* fly singly, never in a flock, with a steady but not very rapid flight. Anderson counted, in Calcutta, 70 passing per minute, for about half an hour, over a breadth of about 250 yards, but others could be seen on all sides as far as the eye could detect them. This was in the twilight immediately after sunset. McMaster, at Rangoon, counted, with the help of a friend, 600 passing in five minutes.

Jerdon relates an instance, in the Ghazipur district, of several individuals being killed by a hot dry wind, and McMaster states the same has been observed at Madras.

P. medius has a peculiar offensive musky smell, by which its presence in the neighbourhood may often be detected. This smell Dobson attributes to the secretion from the glands marked by coarse hair on each side of the neck. But these glands are said to be peculiar to the male, whilst, according to Tickell, the female has an equally evil odour.

The power of flight in this species is sufficient to enable it to visit fruit-trees many miles distant from its resting-place. Sterndale records having captured one alive, though tired, at sea, 200 miles from the nearest land.

The common Indian flying-fox is easily tamed. The flesh is eaten by many classes of natives of India, and is said by some Europeans, who have tried it, to be well flavoured and delicate.

The female has but one young (as have most other bats) at a birth, usually born, according to Tickell, about the end of March or in April, and carried about by the mother until the end of May or the beginning of June, by which time the young animal is nearly as large as its parent.

135. *Pteropus edulis*. *The Malay Flying-Fox*.

Pteropus edulis, Geoffroy, *Ann. Mus.* xv, p. 90 (1810); Cantor, *J. A. S. B.* xv, p. 186; Blyth, *Cat.* p. 20; Dobson, *J. A. S. B.* xlii, pt. 2, p. 199, pl. xiv, fig. 3 (ear); *id.* *Mon. As. Chir.* p. 20; *id.* *Cat. Chir. B. M.* p. 49; Anderson, *Cat.* p. 100.

Kluang, Malay.

The largest bat known, the size being larger than that of *P. medius*. Ears naked, acutely pointed, longer than the distance from the eye to the end of the nose, narrower than those of *P. medius* (the breadth being only half the length), upper outer margin but slightly concave. The wing-membrane arises farther from the middle of the back, and the hairy back is much broader, otherwise the distribution of the fur is similar.

Colour generally similar to that of *P. medius*, but rather darker. Head and breast rufous-brown, varying in tint; hind neck and

back between the shoulders paler yellowish or rufous-brown, or sometimes bright rufous; back dark brown or black with a mixture of grey hairs; lower parts either rufous-brown throughout, or the lower breast and abdomen nearly black with an intermixture of grey. Some specimens are black throughout.

Dimensions. Head and body 12 inches, ear from orifice 1.75, forearm 8.8; basal length of skull 3, zygomatic breadth 1.75. The expanse of the wings is fully 5 feet.

Distribution. The Indo-Malayan subregion (Malayan Peninsula, Sumatra, Java, Borneo, Philippines, &c.), extending, it is said, to the Nicobar and Andaman Islands, and perhaps into Southern Tenasserim, a specimen from Mergui, in bad condition however, having been referred to this species by Blyth. This species was obtained by Anderson in the Mergui Archipelago.

The habits are similar to those of *P. medius*.

136. *Pteropus nicobaricus*. *The Nicobar Flying-Fox.*

Pteropus nicobaricus, *Fitzinger, Sitzb. Wien. Ak.* xlii, 1861, p. 389 (no description); *Zebebor, Novara, Reise, Südgeh.* p. 11 (1868); *Dobson, J. A. S. B.* xlii, pt. 2, p. 198, pl. xiv, f. 2 (ear); *id. Mon. As. Chir.* p. 17; *id. Cat. Chir. B. M.* p. 54; *Anderson, Cat.* p. 102.

Pteropus melanotus, *Blyth, Cat.* p. 20 (1863) (no description).

Size of *P. medius*. Ears naked, short, rounded at the tip, their breadth when laid flat about three-quarters of the length, which is less than the distance from the eye to the end of the nose. Wing from the back and distribution of fur as in *P. medius*. Skull rather shorter and broader.

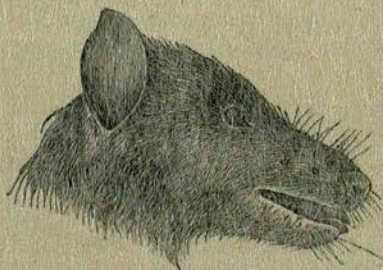


Fig. 75.—Head of *Pteropus nicobaricus*. (Dobson, *Mon. As. Chir.*)

Colour. In males the coloration is sometimes as in *P. medius*, but generally darker; head dark brown above and below; hind neck and between shoulders rufous to yellowish brown; back dark brown; lower parts brown, paler in the middle of the abdomen. Young males and females often intensely black throughout, or with only an indication of the pale collar.

Dimensions. Head and body 9 inches long (varying from 8 to 10.5), ear 1.05, forearm 6.5; total length of skull 3, basal length 2.7, zygomatic breadth 1.4 (*Zebebor*).



Distribution. Andaman and Nicobar Islands; a variety (*P. condorensis*, Peters) from Pulo Condore; Java is also given by Dobson. A skull is recorded in Anderson's 'Catalogue' from Mergui, but the locality is very doubtful, as the history of the specimen is unknown.

Genus **XANTHARPYIA**, Gray (1843).

Syn. *Eleutherura*, Gray (1844); *Cynonycteris*, Peters (1852).

Size moderate, muzzle long; nostrils projecting by their inner margins, between which is a wide furrow, leading to a broad groove across the upper lip; the margins of this groove are naked, but less swollen than in *Pteropus*. Second or index finger with a distinct claw; metacarpal bone of the middle finger as long as the index finger or longer. Wings from the sides of the hairy back and from the base of the second toe. Tail short but distinct, partially included in the narrow interfemoral membrane. Fur of the back and shoulders of the same colour and quality throughout.

Dentition: i. $\frac{4}{2}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{2-2}{3-3}$.

This genus and the next three are distinguished from *Pteropus* by smaller size and duller coloration.

Only a single species is known within Indian limits. The genus ranges throughout Southern Asia, extending eastward into the Malay Archipelago and westward into Africa.

137. **Xantharpyia amplexicaudata.** *The fulvous Fruit-Bat.*

Pteropus amplexicaudatus, Geoff. *Ann. Mus.* xv, p. 96 (1810).

Pteropus leschenaultii, *Desm. Mam.* p. 110 (1822); *Kelaart, Prod.* p. 27; *Blyth, Cat.* p. 21; *Jerdon, Mam.* p. 19.

Pteropus pyrivorus, *Hodgs. J. A. S. B.* iv, p. 700 (1835).

Cynonycteris amplexicaudata, *Peters, M.B. Akad. Berl.* 1867 p. 865; *Dobson, P. A. S. B.* 1872, p. 154; *id. J. A. S. B.* xlii, pt. 2, p. 202, pl. xiv, fig. 8 (ear); *id. P. A. S. B.* 1873, p. 110; *id. Mon. As. Chir.* p. 29; *id. Cat. Chir. B. M.* p. 72; *Anderson, Cat.* p. 103; *Scully, J. A. S. B.* lvi, pt. 2, p. 237.

Ears almost naked, oval, rounded at the tip; outer margin with a distinct though small convex lobe at the base. Fur short. First upper premolar minute, equally distant from the canine and the second premolar.

Colour of fur brown, varying in tint, the lower parts duller than the upper.

Dimensions. Length of head and body 5 inches, tail 0.7, forearm 3.35, ear from orifice 0.75; total length of skull 1.5, zygomatic breadth 0.9.

Distribution. Throughout the greater part of India, Ceylon, and Burma. This species is recorded from the Himalayas (base only), Sind, Singhbhoom, Madras, Trichinopoly, Ceylon, Pegu, and Moulmein, but it is not commonly



Fig. 76.—Ear of *X. amplexicaudata*. (Dobson, *Mon. As. Chir.*)



met with and appears to be of local distribution. It extends on the west to the Persian Gulf, where I obtained specimens, on the east and south-east throughout the Malay Archipelago to the Philippines and Timor.

Habits. This is, in many cases at all events, a cave-haunting bat. I shot several in the large salt-caves of Kishm Island, Persian Gulf, where it abounded, and Mr. Murray found it in old tombs and in caves near Karachi. An allied species, *X. ægyptiaca*, inhabits the chambers of the Pyramids and has been found in a cave in Palestine.

Like the other fruit-bats, this animal is very voracious and possesses great powers of flight. According to Hodgson, it has been known to travel 30 or 40 miles and to return in a single night. Scully has shown that bats of this species, visiting the Nepal Valley, probably come from the Nowakot district, only 16 miles distant, not from the plains, as Hodgson supposed. Dobson was informed that near Moulmein a colony of *X. amplexicaudata* was found to feed on mollusca left exposed by the tide.

Genus **CYNOPTERUS**, F. Cuv. (1825).

Syn. *Pachysoma*, Geoffr. (1828).

Muzzle much shorter and blunter than in *Pteropus* or *Xantharpyia*; nostrils projecting by their inner margins, between which is a broad furrow. A shallow vertical groove crosses the middle of the upper lip and has broad naked margins. Index finger with a distinct claw; metacarpal bone of the middle finger as long as the index finger or longer; wings from the sides of the hairy back and from the base of the first toe.

Dentition in all Indian forms: i. $\frac{4}{2}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{2-2}$, m. $\frac{1-1}{2-2}$.

This genus is found throughout the Oriental region.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Tail present.

a. Base of outer margin of ear-conch straight or faintly convex.

a'. Ears nearly double the length of the muzzle and margined with white . . .

C. marginatus, p. 263.

b'. Ears not much longer than muzzle and with white borders

C. brachyotus, p. 264.

c'. Ears not much longer than muzzle, without white border

C. scherzeri, p. 264.

b. Base of outer margin of ear-conch forming a distinct rounded projection

C. brachysoma, p. 264.

B. No tail

C. blanfordi, p. 265.

138. *Cynopterus marginatus*. *The short-nosed Fruit-Bat*.*Pteropus marginatus*, Geoff. *Ann. Mus.* xv, p. 57 (1810).*Cynopterus marginatus*, Blyth, *J. A. S. B.* xiii, p. 479; *id. Cat.* p. 22; *id. Mam. Birds Burma*, p. 15; Elliot, *Mud. Jour.* L. S. x, p. 96; Cantor, *J. A. S. B.* xv, p. 187; Kelaart, *Prod.* p. 23; Jerdon, *Mam.* p. 20; Hutton, *P. Z. S.* 1872, p. 693; Dobson, *J. A. S. B.* xlii, pt. 2, p. 200, pl. xiv, f. 4 (ear); *id. Mon. Asiat. Chir.* p. 24; *id. Cat. Chir. B. M.* p. 81; Anderson, *Cat.* p. 104; Scully, *J. A. S. B.* lvi, pt. 2, p. 230.*Cham-gadili*, Beng.; *Chota badur*, H.; *Lenzwe*, *Lenwet*, Burm.

Ears nearly naked, rounded at the tip, about twice the distance from eye to nostril in length, without any prominent basal lobe to

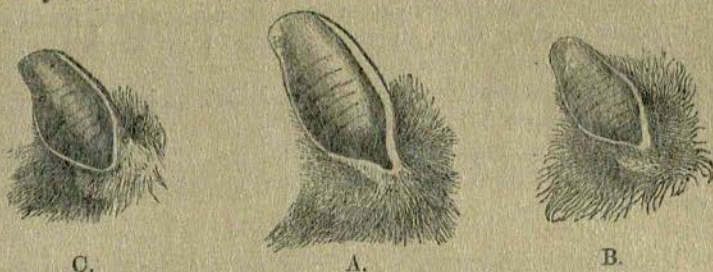


Fig. 77.—Ears of: A, *Cynopterus marginatus*; B, *C. brachyotus*; C, *C. scherzeri*. (Dobson, *Mon. As. Chir.*)

the outer margin. First upper premolar minute, in the middle of the space between the canine and the second premolar, and slightly on the outer side of the tooth-row.

Colour brown, very variable in tint, generally snuff-brown or umber-brown, but some individuals are ferruginous or yellowish brown, others dull grey-brown. Males, especially in the breeding-season, have a collar of stiff reddish-yellow or rusty-brown hairs. Outer and inner margins of ear-conch and sometimes the whole margin to the tip white.*Dimensions*. Head and body 4·4 inches, tail 0·4, ear from orifice 1, forearm 3; skull, total length 1·45, zygomatic breadth 0·95.*Distribution*. Common throughout India from the base of the Himalayas to Lake Comorin; also Ceylon, Burma, the Malay Peninsula and Archipelago to the Philippines. Not known to occur west of Sind, where, however, it is by no means rare.*Habits*. This bat is found on trees in the daytime. I have observed it solitary in forest, but Jerdon states that it roosts in companies on the folded leaves of plantains, Palmyra palms, and other trees. Tickell records having occasionally met with it in caverns and in hollow trees. It lives entirely on fruit and is extremely destructive to plantains, guavas, and mangoes. Its voracity is mentioned by almost every observer. One instance will suffice. Dobson gave to an individual in Calcutta a plantain weighing, with the skin removed, two ounces. The whole fruit was consumed in three hours, whilst the bat, when killed next morning, weighed only one ounce.



Blyth notes that the flight of this species is particularly light and buoyant, very different from the direct heavy flight of *Pteropus*, but the general manners and voice of the two are very similar.

139. *Cynopterus brachyotus*. *The Andaman short-nosed Fruit-Bat.*

Cynopterus brachyotis, S. Müller, *Tijdsch. Naturw. Gesch.* v, p. 146 (1839).

Cynopterus marginatus, var. *andamanensis*, Dobson, *J. A. S. B.* xlii, pt. 2, p. 201, pl. xiv, fig. 5 (ear).

Cynopterus brachyotus, Dobson, *Mon. As. Chir.* p. 26; Scully, *J. A. S. B.* lvi, pt. 2, p. 239.

This resembles the previous species in all respects except in having much smaller ears, which measure from the orifice 0·7 instead of 1 inch.

Dimensions of a female: head and body 3·7 inches, tail 0·4, ear as above 0·7, forearm 2·6.

Distribution. Andaman Islands and Borneo. Scully states that two specimens, obtained by him in Nepal, agree with this form in the size of the ears.

140. *Cynopterus scherzeri*. *The Nicobar short-nosed Fruit-Bat.*

Pachysoma scherzeri, Fitzinger, *Sitzungsb. Wien. Akad.* xlii, p. 390 (1861) (no description); Zelebor, *Novara, Reise, Säugeth.* p. 13 (1868).

Cynopterus scherzeri, Dobson, *J. A. S. B.* xlii, pt. 2, p. 201, pl. xiv, fig. 6 (ear); *id.* *Mon. As. Chir.* p. 26; *id.* *Cat. Chir. B. M.* p. 84; Anderson, *Cat.* p. 106.

Ears naked, rounded at the tip, without any distinct basal lobe to the outer margin, and but slightly exceeding in length the distance from the eye to the nostril. Muzzle broader than in *C. marginatus*, and frontal region narrower.

Colour dark brown. According to Dobson the ears have no white edges, but I think there are traces of white on the inner margins of the ears in a British Museum specimen.

Dimensions. Head and body of a female 3·7 inches long, tail 0·55, ear from orifice 0·6, forearm 2·7.

Distribution. The types were from Car-Nicobar Island, where the species was found on the leaves of cocoa-nut palms by the 'Novara' Expedition and subsequently by Dr. Stoliczka and others. Another specimen, apparently of this form, from Timor, is in the British Museum.

141. *Cynopterus brachysoma*. *The thick-bodied Fruit-Bat.*

Cynopterus brachysoma, Dobson, *J. A. S. B.* xl, pt. 2, p. 260 (1871), xlii, pt. 2, p. 202, pl. xiv, fig. 7 (ear); *id.* *Mon. As. Chir.* p. 27; *id.* *Cat. Chir. B. M.* p. 85; Anderson, *Cat.* p. 106.

Ears rounded at the tip, and furnished with a prominent rounded lobe at the base of the outer margin; their length from



the orifice slightly exceeds that of the muzzle from the eye to the nostril. Body very short and thick. Tail very short and slender and completely concealed by the fur, which is long and dense.

Colour slaty blue with a greyish or silvery tinge, tips of the hairs sooty brown.

Dimensions of an adult female: head and body 2.9 inches, tail 0.25, ear from orifice 0.6, forearm 2.2.

Distribution. South Andaman Island, whence a single specimen, the only one hitherto recorded, was obtained by Dr. Stoliczka.

142. *Cynopterus blanfordi*. *The tailless short-nosed Fruit-Bat.*

Cynopterus blanfordi, Thomas, *Ann. Mus. Civ. Genova*, ser. 2 a, x (1891).

No tail. Only a trace of an interfemoral membrane. Ears naked, rounded at the tip, a distinct lobe at the base of the outer margin. Fur long on the body and legs and especially between the legs.

Colour dark brown with a greyish tinge, inner margin of the ear whitish.

Dimensions of an adult female in spirit: head and body 2.5 inches, ear from orifice 0.6, forearm 2.

Distribution. Karennee, where specimens were obtained by Mr. Fea.

Genus **CARPONYCTERIS**, Lydekker (1891).

Syn. *Macroglossus*, F. Cuv. (1825); nec *Macroglossa*, Ochs. (1816).

Muzzle cylindrical, very long and narrow; nostrils with the margins not projecting, though a shallow groove divides them. In some cases this is continued as a fine vertical impressed line across the upper lip, but generally the upper lip is not grooved; it is naked and convex in the middle. Tongue very long and attenuated, covered with numerous long brush-like papillæ. Index finger with a claw, metacarpal bone of middle finger equal to the index finger or longer than it. Wings from the sides of the hairy back and from the base of the fourth toe; tail very short, quite rudimentary or wanting.

Dentition: i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{2-2}{3-3}$. The incisors small and rather wide apart from each other, the molars very small and weak with low crowns, the first upper premolar scarcely inferior in size to the second.

But a single species is known.

143. *Carponycteris minima*. *The small long-tongued Fruit-Bat.*

Pteropus minimus, Geoff. *Ann. Mus.* xv, p. 97 (1810).

Macroglossus minimus, Blyth, *J. A. S. B.* xxviii, p. 293; *id. Cat.* p. 21; *id. Mam. Birds Burma*, p. 15; Dobson, *J. A. S. B.* xlii, pt. 2, p. 205, pl. xiv, fig. 11 (ear); *id. Mon. As. Chir.* p. 34; *id. Cat. Chir. B. M.* p. 96; Anderson, *Cat.* p. 107.



Fig. 78.—Ear
of *C. minima*.
(Dobson, Mon.
As. Chir.)

Ears rather longer than from the eye to the nostril, naked, rounded at the end, the outer margin with a small pointed basal lobe. Nostrils not prominent. Lower jaw projecting slightly beyond the upper. Eyes large. Interorbital membrane very narrow. Fur long.

Colour light brown, more or less rufous above, rather paler and greyer below.

Dimensions of an adult female: head and body 2·3 inches, ear 0·6, forearm 1·35. A skull measures 1·05 in total length and 0·6 in zygomatic breadth. This is the smallest of all known fruit-bats.

Distribution. Common in the warm valleys of Sikhim and extending thence through Burma to the Malay Archipelago and North and West Australia.

Habits. This small fruit-bat remains suspended to branches of trees during the day, and is occasionally found in old houses and sheds. It lives on fruit of every description.

Genus **EONYCTERIS**, Dobson (1873).

Muzzle long; nostrils not projecting, a shallow furrow between them, and a narrow vertical groove across the middle of the upper lip, which is naked throughout the area below the nostrils and the space between them. Index finger without a claw; metacarpal bone of the middle finger as long as the index finger. Wing from the side of the hairy back and from the base of the first toe. Tail short, distinct, the base contained in the narrow interfemoral membrane. Tongue very long and armed with long recurved papillæ.

Dentition: i. $\frac{4}{2}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-3}{2-3}$, m. $\frac{2-2}{2-2}$. First upper premolar minute. Incisors small, subdistant, and molars small, scarcely elevated above the gum, as in *Carponycteris*.

A single species is known.

144. *Eonycteris spelæa*. Dobson's long-tongued Fruit-Bat.

Macroglossus spelæus, Dobson, J. A. S. B. xl, pt. 2, p. 261, pl. x, figs. 3, 4 (1871), xli, p. 334.

Eonycteris spelæa, Dobson, J. A. S. B. xlii, pt. 2, p. 204, pl. xiv, fig. 10 (ear); *id. Mon. As. Chir.* p. 33; *id. Cat. Chir. B. M.* p. 94; Blyth, *Mam. Birds Burma*, p. 15; Anderson, *Cat.* p. 106.

Ears moderately large, the tips but little rounded, a small projecting basal lobe to the outer margin. Thumb short, the base of the terminal phalanx included in the membrane. Fur short and thin. On each side of the anal orifice and a little behind it is a small subcutaneous glandular body. The tongue can be drawn nearly half an inch from the mouth in spirit specimens; the papillæ near the tip are very long.

Colour dark brown throughout, the lower portions sometimes a little paler.



Dimensions of an adult male: head and body 4·5 inches, tail 0·55, ear from orifice 0·75, forearm 2·85; total length of skull 1·45, zygomatic breadth 0·8.

Distribution. The types came from the Farm Caves, Moulmein. Specimens have also been recorded from Cambodia and Java (Dobson, P. Z. S. 1878, p. 877).

Habits. This appears to be a cavern inhabitant like *Xantharpyia amplexicaudata*. Nothing more is known of its habits, and the uses to which the peculiar extensile tongue of this genus and of *Caronycteris* is applied are unknown.

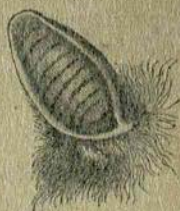


Fig. 79.—Ear of *E. spelæa*. (Dobson, Mon. As. Chir.)

Suborder MICROCHIROPTERA.

Family RHINOLOPHIDÆ.

A well-developed nose-leaf, consisting of foliaceous skin-¹ around the nostrils, which are situated in a depression on the surface of the muzzle. Ears large, generally separated; no tragus. Two phalanges in addition to the metacarpal bone in the middle finger, index finger consisting only of the metacarpal. Premaxillary bones rudimentary and suspended from the nasal cartilages.

The upper incisors, two in number, are quite rudimentary; the first upper premolar minute; the molars well developed, with acute **W**-shaped cusps. The lower incisors are tricuspid. The milk-teeth are absorbed before birth.

The skull is large, the nasal bones much expanded. The females have two nipple-shaped prominences in front of the pubis*. Tail distinct, produced to the posterior margin of the interfemoral membrane.

The very complicated nasal appendages consist of three parts, generally to be traced (fig. 80, p. 268). (1) The flat anterior nose-leaf, generally horseshoe-shaped, which more or less covers the sides and anterior extremity of the muzzle, and includes the nasal apertures, between or behind which (2) a median process or ridge, the central nose-leaf or *sella*, is placed; whilst more posteriorly on the face (3) the terminal or posterior nose-leaf arises vertically from the forehead, or extends backwards between the ears. The surface of the posterior nose-leaf is generally divided into celis by ridges, transversely arranged in *Rhinolophus*, longitudinally in *Hipposiderus*.

These are the most highly organized of insectivorous bats.

* These probably represent the inguinal teats of other Mammals. Cantor, A. S. B. xv, p. 182, records that a female *Hipposiderus*, during lactation, of these inguinal warts much larger than the other. The young