



Wings from the base of the outer toe; tail not projecting beyond the interfemoral membrane. A small convex postcalcaneal lobe.

Second upper premolar slightly within the tooth-row, minute, scarcely visible without a lens.

Colour of the fur above black with pale tips; below, basal portion of the hairs black with ashy tips; membranes intensely black.

Dimensions. Head and body 1.75 inches, tail 1.5, ear from crown 0.42, forearm 1.3.

Distribution. The greater portion of the Oriental region. In the Himalayas this species has been found at Murree, Dalhousie, Simla, and Mussoorie, in Nepal, and in Sikhim, at elevations up to fully 8000 feet; also at Calcutta, in Chutia Nágpur, in Ceylon, Arakan, Tenasserim, and the Mergui Archipelago, and, outside Indian limits, in Eastern Tibet, the Malay Peninsula, Java, Sumatra, Borneo, and Celebes.

No description of this bat was given by Hodgson, and Gray's was imperfect, though it may be accepted, as a type exists in the British Museum.

Habits. According to Hutton, "this bat is early on the wing, coming out of caves and hollow trees, flying high, and is very rapid in its movements. Like *Vesperugo micropus* (*V. abramus*), when touched it opens the mouth wide, without emitting a sound, or making the least attempt to escape or bite."

Genus **CERIVOULA**, Gray (1842).

Syn. *Kerivoula*, Gray.

Muzzle narrow; skull concave between the nose and crown. Glandular region between the eye and nose small, not prominent; mouth wide, the upper lip and angle of the mouth thickly fringed with long hairs. Nostrils circular, opening sublaterally close to the margin of the upper lip. Ears with the outer margin coming forward, so as in great part to conceal the tragus when viewed from the side, and terminating abruptly in a deep lobe, not separated by a notch or concavity from the upper portion of the ear-margin, nor carried forward to near the angle of the mouth; ear-conch thin, diaphanous, studded with glandular papillæ, from which hairs arise. Tragus extremely long, narrow, and acutely pointed. Membranes of wings and interfemoral area largely developed; calcaneum long and strong, curved backwards; no postcalcaneal lobe; tail equalling or exceeding the head and body in length.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$, as in *Vespertilio*, but the upper incisors are parallel, not divergent, and the second upper premolar, though smaller than the third, is never minute.

This genus is essentially tropical, and inhabits the Oriental, Ethiopian, and Australian regions. Three species are recorded from British India and its dependencies.

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

- A. Wing-membranes particoloured orange and black *C. picta*, p. 339.
B. Wing-membranes of the same colour throughout
 a. The ear, when laid forward, does not extend to the nostril; forearm 1·4 *C. hardwickii*, p. 340.
 b. The ear extends to the nostril; forearm 1·7. *C. papillosa*, p. 341.

213. *Cerivoula picta*. *The painted Bat.*

Vespertilio pictus, Pallas, *Spic. Zool.* fasc. iii, p. 7 (1767).

Kerivoula picta, Cantor, *J. A. S. B.* xv, p. 185; Blyth, *J. A. S. B.* xx, p. 158; *id.* *Cat.* p. 34; Kelaart, *Prod.* p. 25; Jerdon, *Mam.* p. 43; Dobson, *Mon. As. Chir.* p. 146; *id.* *Cat. Chir. B. M.* p. 332; Anderson, *Cat.* p. 144.

Kehel vulha, Cingalese.

Ears moderately long, reaching when laid forward to halfway between the eye and the muzzle, bluntly but distinctly pointed, broad; inner margin very convex and coming forward above the eye, terminating in a rounded basal lobe; outer margin concave just below the tip, then coming forward with a bold convex sweep and terminating abruptly midway between the base of the tragus and the angle of the mouth. Tragus very long, the outer margin without a basal lobe, but with a projecting point opposite the base of the inner margin, from this point the outer margin slopes straight upwards to the fine pointed tip; inner margin straight throughout.

Thumb short; wings from the base of the toes. Face naked in front of the eyes, and around them and the nostrils, but densely haired on the upper lip and above the middle of the nose. Hair is thinly scattered over the wing-membranes near the body, and on the upper surface of the interfemoral; the toes are densely clad, and a thick short fringe of hair extends along the posterior margin of the calcaneum and interfemoral membrane.

Inner upper incisors long and pointed, each with a basal cusp posteriorly and externally situated; outer incisors about equal in length to the basal cusps of the inner. First and second upper premolars subequal.

Colour of fur above deep orange or bright ferruginous, below yellower and paler, the hairs the same tint throughout; ears, antebrachial and interfemoral membranes deep orange; wing-membranes black with orange spots, except along both sides of each finger, the margin of the forearm, and along the body, where the colour is orange.

Dimensions. Head and body 1·5 inches, tail 1·7, forearm 1·4, ear from crown outside 0·4.

Distribution. Widely distributed in India, Ceylon, and Burma, being recorded from Sikhim, Calcutta, Dacca, Jeypore, Bombay,

Madras and the Malabar coast, Ceylon, where it appears to be common, and Burma. Rare in the drier parts of India.

Habits. This very richly-coloured bat is said to be often found on plantain trees (*Musa*), and its Cingalese name, of which the generic term applied by Gray is probably a corruption, means plantain bat. When disturbed in the daytime, *C. picta* looks, as Jerdon remarks, more like a large butterfly than a bat. The brilliant coloration is shown by Swinhoe to be very similar to that of some dead leaves, and consequently to be protective.

214. *Cerivoula hardwickii.* *Hardwicke's Bat.*

Vespertilio hardwickii, *Horsfield, Res. Java* (1824).

Kerivoula hardwickii, *Dobson, Mon. As. Chir.* p. 148; *id. Cat. Chir.*

B. M. p. 335; *Anderson, Cat.* p. 145.

Kerivoula fusca, *Dobson, P. A. S. B.* 1871, p. 215.

Ears a little longer than in *C. picta*, but not extending to the nostrils when laid forward; tips thoroughly rounded, inner margins regularly convex from end to end; outer margins deeply concave below the tip, then much expanded, even more so than in *C. picta*. Tragus very long and much attenuated, inner margin straight, outer with a small angular projection opposite the base of the inner margin, above this convex, the upper two thirds concave, tip pointed.



Fig. 110.—Head of *Cerivoula hardwickii*. (Dobson, *Mon. As. Chir.*)

Thumb large. Wings from the base of the toes. Posterior margin of interfemoral membrane finely crenulated and fringed with very few hairs. All the membranes nearly naked, the fur being almost confined to the body.

Upper inner incisors without any posterior cusp, outer incisors scarcely half the length of the inner. First upper premolar equal to the third in height, though less in section, second premolar about one third shorter.

Colour of fur greyish brown above and below, the basal half dark brown. Membranes uniformly dark.

Dimensions. Head and body 1·5 inches, tail 1·7, ear from crown outside 0·45, forearm 1·4.

Distribution. Probably throughout the greater part of the Oriental region. A specimen, now in the British Museum, was obtained by Mr. Theobald in the Punjab on the Indus, another is from Ceylon, and others are recorded from Assam and the Khási hills, as well as from Cambodia, Java, Borneo, &c.

215. *Cerivoula papillosa*. *The papillose Bat*.

Vespertilio papillosus, Temminck, *Mon. Mam.* ii. p. 220 (1835-41).
Kerivoula papillosa, Tomes, *P. Z. S.* 1858, p. 327; *Jerdon, Mam.*
p. 43; *Dobson, Mon. As. Chir.* p. 150; *id. Cat. Chir. B. M.*
p. 337.

Ears very similar to those of *C. hardwickii* but longer, extending to the end of the muzzle, and the outer margins do not project so much in front. A dense fringe of hair on the upper lip. Wings from the base of the claws; thumbs and feet large and armed with large and strong claws. Dentition as in *C. hardwickii*, but upper incisors shorter.

Colour of fur on back glossy brown, head and lower parts paler and greyer, basal two thirds of the hair dark brown throughout.

Dimensions. Head and body 2·2 inches, tail 2·2, forearm 1·7.

Distribution. A specimen was sent from Calcutta by Mr. Pearson, and is now in the British Museum. Tomes also records one from Ceylon, but the identification is less certain, nor is it absolutely proved that the first specimen was Indian, though this is probable. The only other known localities are Java and Sumatra.

This species is easily distinguished from *C. hardwickii* by its much larger size and by its colour.

There is another species, *C. brunnea*, Dobson, *Cat. Chir. B. M.* p. 334, closely resembling *C. picta* in size and structure, but with the membranes dark brown, the fur yellowish brown above, greyish brown below, all the basal portion of the hair dark brown, and the upper incisors nearly equal in size. The type of this was presented by Sir A. Smith to the British Museum, and it is quite uncertain whether the specimen came from Madras or South Africa.

Genus **MINIOPTERUS**, Bonaparte (1837).

Crown of the head much raised above the face-line. Ears separate, short, rounded, the outer margin terminating just behind the angle of the mouth; tragus as in *Vesperugo*, of moderate



Fig. 111.—Skull of *Miniopterus schreibersi*, $\times 2$. (Blasius, Säugeth. Deutschlands.)

length, blunt, not attenuated above. Nostrils not tubular, crescentic. Muzzle broad; the median portion of the upper lip



below the nose forming a kind of depression sharply divided on each side from the more swollen lateral portions of the lip. The first phalanx (middle joint) of the third or longest finger very short, less than one third the length of the second or terminal phalanx, which is very long, and is folded in repose on the under surface of the wing, reaching beyond the middle of the metacarpal bone. The wings are attached to the inferior surface of the tibia just above the ankle, and connected with the interfemoral membrane by a band of integument passing below the tibia. Tail as long as the head and body, entirely contained within the interfemoral membrane.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{3-3}$, m. $\frac{3-3}{3-3}$.

But a single representative is found in India. This has the same range as the genus and almost the widest range of any species in the Order, being found in Southern Europe, Asia, Africa, Madagascar, and Australia.

216. *Miniopterus schreibersi*. *The long-winged Bat.*

Vespertilio schreibersi, Natterer, Kuhl, *Deutsche Flederm.* p. 41 (1817).

Vespertilio fuliginosa, Hodgson, *J. A. S. B.* iv, p. 700 (1835).

Scotophilus fuliginosus, Jerdon, *Mam.* p. 36 (description incorrect).

Miniopterus australis, Dobson, *J. A. S. B.* xl, pt. 2, p. 265, *nee* *Tomes*.

Miniopterus blepotis, Temm., Hutton, *P. Z. S.* 1872, p. 709.

Miniopterus schreibersi, Dobson, *Mon. As. Chir.* p. 160; *id.* *Cat.*

Chir. B. M. p. 348; Anderson, *Cat.* p. 145; Scully, *J. A. S. B.* lvi, pt. 2, p. 256.

Miniopterus pusillus, Dobson, *Mon. As. Chir.* p. 162.

Muzzle short; glandular area between the eye and nostril extending to the upper lip, prominent, thinly clad, but bearing rather long hairs; forehead thickly clothed with long hair. Ears of a subtrigonally rounded form, only extending, when laid forwards, to just beyond the eyes; tips indistinct, blunt; inner margin of the ear-conch very convex, outer margin deeply notched



Fig. 112.—Head of *Miniopterus schreibersi*. (Blasius, Säugeth. Deutschlands.)

opposite the base of the tragus and ending in a long convex lobe that extends from the base of the tragus to the angle of the mouth. Tragus rounded above, and with the margins nearly



parallel, the inner concave, the outer convex and without any distinct lobule at the base.

Wings to the ankles or rather higher. Fur soft, dense, and long.

Colour in Indian specimens generally dark brown, varying from reddish to blackish brown above, the hairs of the same colour throughout; below rather paler and greyer, with the basal portion of the fur dark. European and North-African specimens are grey, with the membranes pale and whitish, and similar individuals may be expected to occur in Baluchistan.

Dimensions. Head and body 2·3 inches, tail 2·3, ear from crown of head 0·25, forearm 1·9. In Burmese specimens the forearm is as much as 2 inches, in Ceylon no more than 1·75, and in the variety *pusillus* only 1·6.

Distribution. Throughout Southern Europe, Southern (and great part of Central) Asia, Africa, Madagascar, and Australia. This species does not appear to be common in India: it has been recorded from Mussoorie in the Himalayas, at 2000 to 7000 feet, also from Nepal, Ceylon, and Upper Burma, and the smaller variety *pusillus* from Madras and the Andaman and Nicobar Islands.

Varieties. The small variety just mentioned was at first referred by Dobson to *M. australis*, a small species with the interfemoral membrane half covered with hair above, but subsequently regarded as a variety or subspecies of *M. schreibersi*, a view in which I agree, as the differences do not appear to me specific. There is a little more hair on the interfemoral membrane, but Himalayan specimens show an intermediate phase.

Habits. The long-winged bat is one of the swiftest fliers in the Order, according to Blasius it almost resembles a swallow in its powerful flight and graceful movements on the wing. It appears early in the evening. During the day it hides in caves, crevices in rocks, and similar retreats, such as old buildings, tombs, &c. Hutton states that he never met with a specimen that was not infested with ticks.

Family EMBALLONURIDÆ.

No nose-leaf. Ears often united; a tragus present, though it is sometimes very small; it is frequently expanded above. Two phalanges in the middle finger, besides the metacarpal bone, the first phalange folded in repose on the upper surface of the metacarpal*. Tail partially free, either perforating the interfemoral

* There are some exceptions, but not in India. In *Rhinopoma* the folding is less complete than in other Indian genera.



membrane and appearing upon its upper surface, or else produced far beyond its posterior margin.

The number of teeth varies. The muzzle is usually obliquely truncated, and projects more or less beyond the lower lip.

This family, which is generally distributed throughout the tropical and subtropical regions of the world, is represented in India, Ceylon, and Burma by the following four genera, classed in two subfamilies :—

- I. Tail emerging from the upper surface of the interfemoral membrane, legs long, fibulæ very slender; upper incisors weak. *Emballonurinae.*
 - A. Tail shorter than interfemoral membrane; index finger formed by metacarpal alone.
 - a. Incisors $\frac{2-2}{6}$, upper incisors persistent . . . EMBALLONURA.
 - b. Incisors $\frac{1-1}{4}$, upper incisors deciduous . . . TAPHOZOUS.
 - B. Tail very slender, much longer than short interfemoral membrane; index finger with a metacarpal bone and two phalanges RHINOPOMA.
- II. Tail thicker than the thigh and produced far beyond the interfemoral membrane, which it leaves at posterior margin; legs short and stout; upper incisors strong. . . . *Molossinae.*
 - A. Upper lip much wrinkled vertically NYCTINOMUS.

Subfamily EMBALLONURINÆ.

Genus **EMBALLONURA**, Temm. (1838).

Ears arising separately from the sides of the forehead; the outer margin of the ear-conch terminating below the eye and behind the angle of the mouth; tragus longer than broad. Forehead flat, not concave. Apertures of the nostrils circular or elliptical, close together at the extremity of the conical muzzle. Tail perforating the large interfemoral membrane about its centre and the tip appearing free on the upper surface; the posterior free margin of the membrane supported by long calcarina.

Dentition : i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. Upper incisors in pairs, separated from the canines and from each other.

This genus is entirely oceanic, ranging from Madagascar to the islands of Polynesia; no species has yet been found on the continent of Asia or in Australia, but one has been met with in the Mergui Archipelago.

217. *Emballonura semicaudata*. *The Polynesian sheath-tailed Bat*.

Vespertilio semicaudatus, Peale, *U. S. Expl. Exp., Quad.* p. 23 (1848).
Emballonura semicaudata, Dobson, *Cat. Chir. B. M.* p. 360.

The extremity of the narrow muzzle projects beyond the upper lip; nostrils circular, with a shallow concavity between; lower lip crossed in the middle by a furrow, which expands above. Sides of the face and the whole muzzle in front of the eyes half-naked; some long hairs on the upper lip; forehead thickly covered with

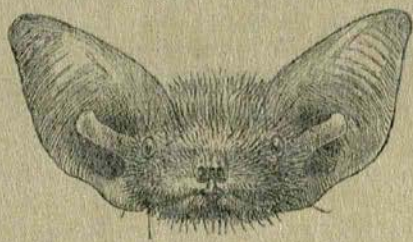


Fig. 113.—Head of *Emballonura semicaudata*.

long hair. The ears do not extend to the nostrils when laid forward, the tips are narrowly rounded off; outer margin of the ear-conch concave below the tip, slightly emarginate below the base of the tragus, and terminating in a short convex lobe; inner margin straight above, slightly convex below. Tragus almost squarely truncated above, both margins nearly straight and subparallel, the inner slightly concave, the outer convex near the end, and having a small indistinct lobe folded on itself opposite the base of the inner margin.

Wings from the ankles. Tail very slender, only the tip projects above the middle of the large interfemoral membrane. Fur long and short, but not dense.

Colour of fur reddish to blackish brown, rather paler below; the hairs a little paler towards the base.

Dimensions of a male from the Mergui Archipelago in spirit:—Head and body 1·65, tail 0·5, ear from crown of head 0·42, forearm 1·75.

Distribution. This species until lately had only been found in the islands of the Pacific, especially in the Fiji Islands. Recently a specimen was received at the British Museum from Sarawak in Borneo, and Dr. Anderson has found the same bat in the Mergui Archipelago.

Genus **TAPHOZOUS**, Geoffroy (1813).

Muzzle conical, broad behind, narrow in front, terminated by the slightly projecting inner margins of the nostrils, which are valvular and circular or elongate. Crown of head slightly raised, in



Front of it there is a deep frontal hollow between the eyes. Ears separate and of moderate length; varying but little in shape in the different species; the tips are bluntly pointed or rounded; the inner margin of the ear-conch rises as a low band from between the eye and the frontal hollow, and is straight or slightly convex, and the outer margin is faintly notched opposite the base of the tragus and ends in a convex lobe, terminating behind the angle of the mouth, and halfway between it and the base of the tragus. The tragus is short and shaped like half a dumbbell, the upper termination expanded and convex, the sides concave. The lower lip is as long as the upper and terminated by a triangular naked area more or less deeply furrowed in the middle.

The tail perforates the interfemoral membrane about the middle, and the last three or four vertebrae are usually found extending free beyond, but they are capable of being partially withdrawn as if into a sheath.

Dentition: i. $\frac{1-1}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. The premaxillaries are cartilaginous, and the upper incisors are minute and are generally wanting in adult animals. The upper canines are closer together than in most bats and separated from the second premolar on each side by a space, in the middle of which the small first premolar is seen, only just appearing above the gum. Second upper premolar higher than the molars. Last upper molar very small. Lower incisors tricuspid, overlapping slightly.

Several of the species have a glandular gular sac, in some cases confined to the male, in others occurring in both sexes, between the rami of the lower jaw, occupying about half the space. In many of the species also a small band of membrane passes from the inferior surface of the forearm near its distal extremity to the proximal extremity of the fifth metacarpal bone, so as to form with the wing-membrane a small pouch termed by Dobson the *radio-metacarpal pouch*.

The genus ranges throughout the greater portion of the Ethiopian, Oriental, and Australian regions, and the southernmost part of the Palearctic. Five species occur within Indian limits.

Synopsis of Indian, Ceylonese, and Burmese Species.

- a. A radio-metacarpal pouch present; lower lip scarcely grooved.
- a'. No gular sac in either sex.
- a''. Fur of back extending on to base of interfemoral membrane; forearm 2.5. *T. melanopogon*, p. 347.
- b''. Interfemoral membrane quite naked.
- a'''. The abdomen hairy throughout; forearm 3. *T. theobaldi*, p. 348.
- b'''. The lower abdomen naked; forearm 2.95. *T. kachhensis*, p. 349.
- U. A gular sac present in males, rudimentary but represented by a naked area in



- females; interfemoral hairy to the
exsertion of the tail; forearm 2.4 *T. longimanus*, p. 348.
b. No radio-metacarpal pouch; lower lip with
a deep median transverse groove; gular
sac in both sexes; forearm 2.9 *T. saccolemus*, p. 350.

218. *Taphozous melanopogon*. *The black-bearded sheath-tailed Bat.*

Taphozous melanopogon, *Temminck*, *Mon. Mam.* ii, p. 287, p. 60,
figs. 8, 9 (1835-41); *Cantor*, *J. A. S. B.* xv, p. 180; *Jerdon*, *Mam.*
p. 31; *Dobson*, *P. Z. S.* 1875, p. 548; *id.* *Mon. As. Chir.* p. 167;
id. *Cat. Chir. B. M.* p. 380; *Anderson*, *Cat.* p. 146.

No gular pouch; throat always hairy. Radio-metacarpal pouch
extending about one-fourth the length of the fifth metacarpal bone.
A row of small papillæ on the inner margin of the ear. Thick
hair covers the forehead to between the eyes, remainder of the
face and the sides of the head very thinly clad with short hairs.

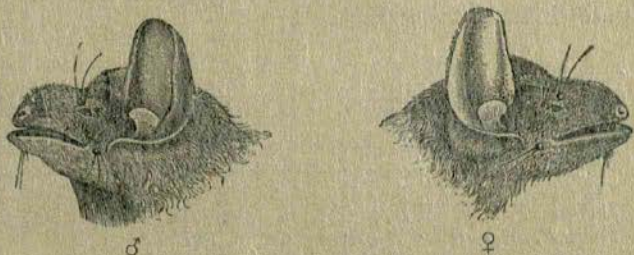


Fig. 114.—Head of *Taphozous melanopogon*, male and female.
(Dobson, *P. Z. S.* 1875.)

Wings from the tibiæ above the ankles. The fur extends about
one-third down the upper surface of the humerus and femur and
very slightly upon the membrane between them. The inter-
femoral is thinly covered almost as far as the point where the
tail perforates it.

Colour of the fur smoky brown to greyish brown, the basal
portion white. There is not much difference between the upper and
lower surfaces. Some specimens are blackish brown. In males
there is sometimes a large patch of long black hairs on the throat
(fig. 114), but this character, from which the species has been
named, is not always present and may, as Dobson suggests, be
assumed at the breeding-season.

Dimensions. Head and body 3.1 inches, tail 1, ear from crown
0.55, forearm 2.5.

Distribution. Probably throughout the greater part of the
Oriental region. Recorded from Lower Bengal, Chutia Nagpur,
Sambalpur, Canara (Malabar Coast), Trichinopoly, Upper Burma,
and Tenasserim; also from Cochin China, Java, Borneo, and the
Philippine Islands.

219. *Taphozous theobaldi*. *Theobald's sheath-tailed Bat*.

Taphozous theobaldi, Dobson, P. A. S. B. 1872, p. 152; *id.* P. Z. S. 1875, p. 550; *id.* Mon. As. Chir. p. 168; *id.* Cat. Chir. B. M. p. 381; Anderson, Cat. p. 147.

No gular pouch. Ears larger than in any other species, the inner margins papillate. Radio-metacarpal pouch larger even than in *T. melanopogon*. No black beard has been observed.

The wing and interfemoral membranes are quite naked above; the limit of the body-fur in the lumbar region is defined by a well-marked line convex inwards (in *T. melanopogon* and *T. nudiventris* the convexity is outwards). In other respects, except size, this species does not appear to differ from *T. melanopogon*.

Dimensions. Head and body 3.35 inches, tail 1.35, ear from base of outer margin 1.1, forearm 3.

Distribution. Tenasserim. One specimen from Bushire, Persian Gulf, is identified with the species in Anderson's Catalogue.

I have been unable to examine a specimen, and the above description is taken from Dobson's.

220. *Taphozous longimanus*. *The long-armed sheath-tailed Bat*.

Taphozous longimanus, Hardwicke, Tr. L. S. xiv, p. 525 (1823); Blyth, J. A. S. B. x, p. 974, xiii, p. 490, xx, p. 156, xxi, p. 348, xxii, p. 414, xxiv, p. 711; *id.* Cat. p. 29; Jerdon, Mam. p. 31; Dobson, P. Z. S. 1875, p. 551; *id.* Mon. As. Chir. p. 170; *id.* Cat. Chir. B. M. p. 384; Anderson, Cat. p. 147.

Taphozous fulvidus and *T. brevicaudus*, Blyth, J. A. S. B. x, pp. 975, 976.

Taphozous cantori, Blyth, J. A. S. B. xi, p. 784.

Taphozous longimanus and *T. brevicaudus*, Kelcart, Prod. p. 12.

A well-developed gular sac in males, in females it is represented by a fold of the skin and the absence of hair in the area between the fold and the chin. Radio-metacarpal pouch moderately large. Inner margin of ear smooth, not papillate.

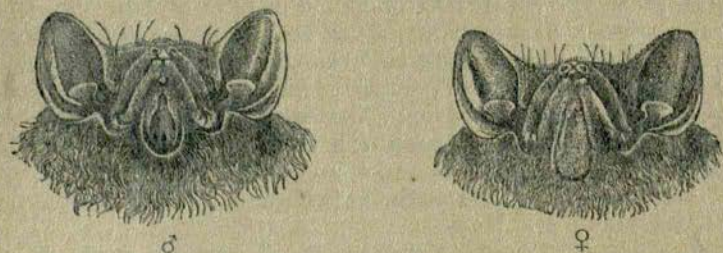


Fig. 115.—Head of *Taphozous longimanus*, male and female. (Dobson, P. Z. S.)

Wings from the tibiæ just above the ankles. On the upper surface of the wing-membrane the hair extends as far as a line joining the middle of the humerus with that of the femur; on the



interfemoral as far as the point of exertion of the tail; a few scattered long hairs on the free part of the tail itself. The hair extends farther on the wing-membrane below than above, whilst the interfemoral is almost naked on its lower surface. Muzzle almost naked.

The upper incisors are generally absent, in young individuals they are small and slender.

Colour of fur reddish brown to black, nearly the same above and below; the hairs paler, often whitish at the base. Blyth observed that young individuals are pale fulvescent and that they grow gradually blacker with age.

Dimensions. Head and body 3 inches, tail 1.1, ear from crown 0.5, forearm 2.4.

Distribution. Throughout the greater part of the Indian Peninsula, Ceylon, and Burma, extending to Tenasserim and Malacca; common about Calcutta (whence originally described), Madras, and other large towns. Not yet recorded from Northern or North-western India, but found in parts of the Southern Central Provinces (Chanda, Bilaspur); also near Bombay and Travancore.

Habits. This species is probably a cave-dweller and inhabitant of rock-fissures; it is frequently found in old temples, cellars, out-houses, &c. It was, however, once observed by Blyth on the stem of a palm-tree. The same observer noticed that individuals in confinement could cling to the vertical smooth mahogany back of a cage, and creep up it by means of their claws. In pregnant females a single young one was found early in August in Calcutta.

221. *Taphozous kachhensis.* *The Cutch sheath-tailed Bat.*

Taphozous kachhensis, Dobson, *P. A. S. B.* 1872, p. 152; *id. J. A. S. B.* xli, pt. 2, p. 221.

Taphozous nudiventris subsp. *kachhensis*, Dobson, *P. Z. S.* 1875, p. 554; *id. Mon. As. Chir.* p. 172; *id. Cat. Chir. B. M.* p. 388; Anderson, *Cat.* p. 148.

No gular sac, but its position is slightly indicated in males, not in females. Radio-metacarpal pouch small. Ear-conch with papillæ on the inner margin.

Wings from the tibiæ above the ankles. The muzzle is nearly naked. The wing and interfemoral membranes are quite naked above, as are the arms and legs, the hair terminates abruptly on the lower part of the back. Beneath, the proximal portion of the humerus and the wing-membrane as far as a line from the middle of the humerus to the pubis are hairy, but the lower abdomen, legs, and interfemoral membrane are quite naked. There are large deposits of fat about the root of the tail.

Colour not recorded, probably greyish brown as in *T. nudiventris*.

Dimensions. Head and body in a female 3.6 inches, tail 1.25, forearm 2.95; in a male 3.35, 1.15, and 2.65. The ear from the base of the outer margin measures 0.9.



Distribution. Sind and Cutch. This species is closely allied to *T. nudiventris* of Africa and South-western Asia, only differing in the want of a gular sac in the male and to some extent in measurement. In his last works Dobson has classed the present form as a variety of *T. nudiventris*, and it is very probable that the two are not specifically distinguishable.

222. *Taphozous saccolaimus*. *The pouch-bearing sheath-tailed Bat.*

Taphozous saccolaimus, *Temm. Mon. Mam.* ii, p. 285, pl. 60, figs. 1-6 (1835-41); *Cantor, J. A. S. B.* xv, p. 180; *Blyth, J. A. S. B.* xxi, p. 348; *id. Cat.* p. 28; *Jerdon, Mam.* p. 32; *Dobson, P. Z. S.* 1875, p. 555; *id. Mon. As. Chir.* p. 172; *id. Cat. Chir. B. M.* p. 388; *Anderson, Cat.* p. 149.

Taphozous crassus, *Blyth, J. A. S. B.* xiii, p. 491.

Taphozous pulcher, *Elliot, ib.* p. 492.

Ears short. Gular sac well developed in both sexes, but much larger in the male. No radio-metacarpal pouch. Inner margin of ear-conch smooth. Lower lip with a deep transverse median groove.

Wings from the ankles. The muzzle, including the eyes and the sides of the head, nearly naked. The tragus is hairy posteriorly, and there is some short hair on the inner surface of the ear-conch. Above, the fur extends on to the proximal half of the humerus, but the wing-membrane, the interfemoral, and the legs are naked; there are a few isolated long hairs on the free portion of the tail. Beneath, the wing-membrane near the body is hairy, the interfemoral naked except at the base of the tail.

Colour of fur various shades of brown—pale, ferruginous, and blackish, in some cases mottled with spots of white, the hairs paler at the base. The lower surface scarcely paler as a rule, though Blyth describes a form from Southern India said to be white beneath, like the Malayan *T. affinis*.

Dimensions. Head and body 3·5, tail 1·3, ear from crown 0·48, forearm 2·9 inches. Some specimens are smaller; in one I find the forearm only 2·5 inches long.

Distribution. Peninsula of India (Mirzapur, Madras), Ceylon, Sylhet, Burma, the Malay Peninsula, Sumatra, and Java. Remains of this species have been found fossil in the Pleistocene cave-deposits of Kurnool in the Madras Presidency.

Habits. This, like other species of the genus, inhabits caves and masonry buildings during the day. Like them, too, it has a very disagreeable smell. It is said to utter a very shrill cry.

Genus **RHINOPOMA**, Geoffroy (1813).

Crown of head convex, not greatly raised; a deep frontal hollow; ears with their inner margins united by a band across the hollow; tragus of moderate size. Muzzle thick, obliquely truncated, projecting considerably beyond the lower lip; nostrils placed some



distance above the lip, in the front surface of the muzzle, they are valvular and open with a narrow transverse slit. Index finger with

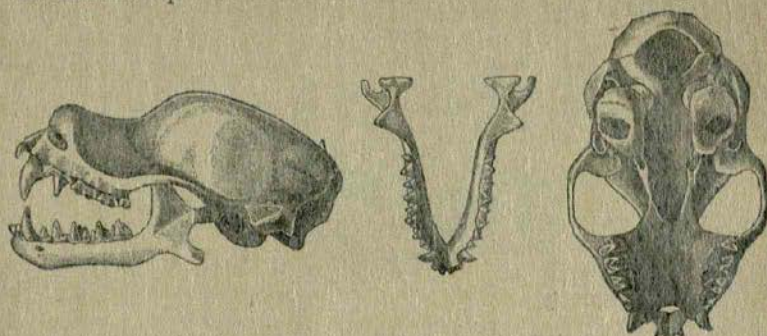


Fig. 116.—Skull of *Rhinopoma microphyllum*, $\times 2$. (Dobson, Mon. As. Chir.)

two phalanges besides the metacarpal bone; the third or longest finger with the first phalanx bent upwards in repose, but not resting on the dorsal surface of the metacarpal, being prevented by the great length of the index finger. Tail very long and slender, produced far beyond the posterior border of the short interfemoral membrane.

Dentition : i. $\frac{1-1}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{1-1}{2-2}$, m. $\frac{2-3}{3-3}$. Upper incisors rudimentary. The small premaxillary bones are united in the middle, and connected by curved lateral processes with the maxillary bones. Nasal bones much expanded laterally and vertically; frontal bones depressed, forming a shallow concavity in the forehead.

This genus contains a single species ranging from Egypt and Kordofan to the Malay Peninsula.

223. *Rhinopoma microphyllum*. The long-tailed Bat.

Rhinopoma microphyllum, Geoffroy, *Descr. de l'Egypte, Hist. Nat.* ii, p. 123 (1813); *Blyth, J. A. S. B.* xiii, p. 492.

Rhinopoma hardwickii, Gray, *Zool. Misc.* p. 37; Cantor, *J. A. S. B.* xv, p. 178; Elliot, *Mad. Jour. L. S.* x, p. 97; *Blyth, Cat.* p. 28; Jerdon, *Mam.* p. 29; Dobson, *J. A. S. B.* xli, pt. 2, p. 221.

Rhinopoma microphyllum, subsp. *hardwickii*, Dobson, *Mon. As. Chir.* p. 176.

Rhinopoma microphyllum, Dobson, *Cat. Chir. B. M.* p. 400; Anderson, *Cat.* p. 149.

From the frontal hollow crossed by the band connecting the ears a deep furrow leads to the nose and terminates behind the fleshy prominence that forms the upper part of the truncated muzzle. The bluntly pointed tips of the ears laid forwards just extend to the edge of the muzzle; the margins of the ear-conch are convex, the outer terminating behind the angle of the mouth just in front of the base of the tragus. The tragus is much longer than wide, the tip very obtuse, outer margin slightly convex with a lobe at the base, inner margin forming an ogee curve, the concavity above.

Face almost naked; no fur on the wing-membrane or the interfemoral; the lower portions of the back and abdomen and the legs are also naked.

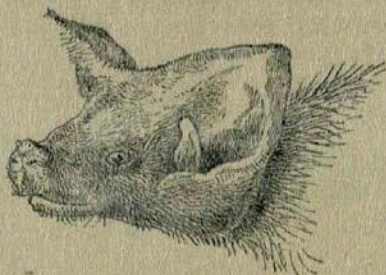


Fig. 117.—Head of *Rhinopoma microphyllum*.

Colour of fur dull greyish brown, nearly the same above and below; the hairs paler at the base.

Dimensions. An adult male measures: head and body 3 inches, tail 2·35, ear from crown 0·6, forearm 2·6. But many specimens are considerably smaller, with a forearm 2·1 or even less.

Distribution. Egypt and Kordofan in Africa; South-eastern Asia, India generally, Burma and the Malay Peninsula. Not recorded from the Himalayas or Ceylon.

Habits. This species is common in North-western India, and hides during the day in caves, clefts in rocks, old ruins, and similar places. In Cutch it takes up its abode in wells. Jerdon relates that in Madras, in 1848, many were captured in a house for three successive nights, having probably been blown by strong westerly winds from the rocky hills to the westward. The species is not of common occurrence in Madras. According to Blyth this species abounded formerly in the Tāj at Agra (it may still be found there), and Cantor found numbers inhabiting the subterranean Hindu place of worship within the Fort at Allahabad.

This species may be distinguished from all other bats by the very long slender free tail. In the cold season there is an enormous accumulation of fat, sometimes exceeding the remainder of the body in weight, under the skin below the anus. The fleshy point above the truncated muzzle is sometimes called a nose-leaf, but incorrectly.

Subfamily MOLOSSINÆ.

This subfamily includes the genera of *Emballonuridæ* with short and strong legs and feet and well-developed fibulæ. All have callosities at the base of the thumbs, and the feet free from the wing-membrane, whilst the interfemoral membrane is partially retractile. The species of this subfamily are thus evidently better fitted than any other bats for terrestrial progression, and the habits



of the few species on which observations have been made agree with their structure.

The majority of the species are American: one genus, *Mystacina*, is peculiar to New Zealand; another, *Chiromeles*, with a single species *C. torquatus*, a large bat almost entirely naked, is found in the Malay Peninsula and islands and may very possibly inhabit Tenasserim; whilst the only species yet recorded within Indian limits are two forms of *Nyctinomus*.

Genus **NYCTINOMUS**, Geoffroy (1813).

Syn. *Dinops*, Savi; *Dysopes*, Rüppell *nec* Illiger.

Muzzle thick, obliquely truncated, projecting considerably beyond the lower jaw; nostrils circular or subcircular, directed outwards, forwards and downwards, with slightly projecting margins. Upper lip very thick and vertically wrinkled. Ears thick, large and broad, more or less united on the forehead in front of the eyes; a straight thickened basal lobe inside the ear-conch. Tragus small, subquadrate. Basal portion of the tail as thick as the thigh. Legs very short; feet broad, each outer and inner toe thickened on its exterior side by a lateral pad, furnished with a dense tuft of long curly hair. Middle finger much lengthened, its metacarpal bone equal to the whole length of the fifth finger, its first phalanx folded backwards in repose. A well-marked callosity at the base of the thumb.

Dentition: i. $\frac{2}{6}$ or $\frac{2}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. A few species, not Indian, have pm. $\frac{1-1}{2-2}$.

The interfemoral membrane, as in all allied genera, forms a sheath to the base of the tail and can be moved up or down the latter, thus increasing or diminishing the membranous surface.

The genus *Nyctinomus* is found in the warmer parts of both hemispheres, one species occurring in Southern Europe.

Synopsis of Indian and Burmese species.

Ears not quite united at base; about half the tail free *N. tragatus*, p. 353.
Ears united at base; more than half the tail free .. *N. plicatus*, p. 354.

224. *Nyctinomus tragatus*. Dobson's wrinkled-lipped Bat.

Nyctinomus tragatus, Dobson, *J. A. S. B.* xliii, pt. 2, p. 143; *id.* *Mon. As. Chir.* p. 181; *id.* *Cat. Chir. B. M.* p. 424; Anderson, *Cat.* p. 150.

Ears arising close together from the anterior part of the forehead, but not joined by a band; they extend when laid forward to the extremity of the muzzle or a little beyond it; upper portion of the ear-conch regularly convex, almost semicircular; outer margin separated from the terminal lobe or antitragus by a deep notch.

From inside the inner margin a thick prominent basal lobe runs directly across the inside of the conch and covers the eye. Tragus small, subquadrate, convex above.

Thumb short with a small claw. Wings from just above the ankles. Calcaneum elongate, extending nearly three quarters of the distance from ankle to tail. Only about half the tail extends beyond the end of the membrane.

Lower incisors 6, the median pair smaller and shorter than the others. Upper incisors nearer to each other than to the canine on each side. The first upper premolar very small.

The face and ears nearly naked; proximal portions of upper arms and thighs and the wing-membrane close to the body hairy. The interfemoral membrane only hairy near the base of the tail. Some long hairs on the toes.

Colour of fur greyish to blackish brown, nearly the same above and below; basal portion of hairs paler.

Dimensions. Head and body 2.9 inches, tail 1.75, forearm 2, tibia 0.6, ear from crown of head 0.6.

Distribution. Specimens have been obtained from Rajanpur (S.W. Punjab), Nasirabad (Rajputana), Malabar, Jashpur (Chutia Nagpur), and Calcutta; so this form, although not common, has evidently a wide range in the Peninsula of India.

225. *Nyctinomus plicatus*. *The Indian wrinkled-lipped Bat.*

Vespertilio plicatus, Buchanan, *Tr. L. S.v.*, p. 261, pl. 13 (1800); *Geoffr. Descr. de l'Egypte, Hist. Nat.* ii, p. 130 (1813).

Nyctinomus tenuis, Horsfield, *Zool. Res. Java*; Cantor, *J. A. S. B.* xv, p. 179.

Dysopes murinus, Gray & Hardwicke, *Ill. Ind. Zool.* vol. i, pl. i.

Dysopus plicatus, Blyth, *J. A. S. B.* xx, p. 517, xxii, p. 410, xxv, p. 440.

Nyctinomus plicatus, Blyth, *Cat.* p. 29; Jerdon, *Mam.* p. 33; Dobson, *Mon. As. Chir.* p. 182; *id. Cat. Chir. B. M.* p. 425; Anderson, *Cat.* p. 151.



Fig. 118.—Head of *Nyctinomus plicatus*.

Ears distinctly joined by a band connecting their inner margins on the muzzle about halfway between the eyes and the end of the nose. They are large, though barely extending to the nostrils when laid forward, subtrapezoidal, upper margin not regularly convex; outer margin separated from the antitragus or terminal



lobe by a deep notch. The thickened horizontal basal lobe commences some distance inside the inner margin, and extends nearly across the ear-conch inside, covering the eye. Tragus very small, subtriangular, truncated above. Muzzle broad, lips very thick, the upper overhanging the lower, both wrinkled, but the upper more so.

Wings from tibia, the point of junction varying. Calcaneum short, scarcely extending half the distance from the ankle to the tail. The free portion of the tail longer than that contained in the membrane. Distribution of the fur as in *N. tragatus*.

Lower incisors 4, first upper premolar small.

Colour of fur brownish black to greyish brown above, sometimes the same but generally paler below, basal portion of the hair lighter in colour.

Dimensions of an adult male: head and body 2·7 inches, tail 1·55, forearm 1·95, tibia 0·65, ear from crown 0·5.

Distribution. Generally distributed throughout India, Burma, and the Malay countries, but not recorded from Ceylon or the Himalayas.

Habits. This bat is found during the day in caves, deserted masonry buildings, &c. Tickell met with it in countless myriads inhabiting limestone caves at Phagat, 30 miles from Moulmain. It has, like others of the genus, a steady powerful flight high in the air, effected by sweeps of its long narrow wings. An allied species, *N. cestoni*, has the power of sinking its eye in the socket and thrusting it out again.

Two other species of *Nyctinomus*, *N. mops* and *N. johorensis*, are found in the Malay Peninsula and islands, as is also *Ohiromeles torquatus*, already mentioned.



Order RODENTIA.

The Orders hitherto noticed follow each other in fairly natural sequence. The Rodents, comprising squirrels, marmots, rats and mice, jerboas, porcupines, hares and their allies, have no connexion with the Chiroptera, and but little with any other order of mammals. Like the Insectivora and Chiroptera, the Rodentia are mostly animals of small size.

Rodents can be readily distinguished by their dentition. There are no canines, and there are always two large, chisel-shaped rootless incisors, with the anterior surface curved, in front of each jaw. There are never more than two incisors in the lower jaw; in the upper there are, in one suborder, additional small incisors behind the anterior pair, not at the side of them as usual. The large incisors, or "rodent tusks" as they are sometimes termed, grow throughout the lifetime of the animals, and have long basal portions extending into deep alveoli. The incisors are widely separated from the grinding-teeth. Premolars may be present or absent. There are almost always three true molars in each side of each jaw; the crowns of these molars are in most cases tubercular, and, when worn, traversed by laminae of enamel.

The most important character of the skull is the large size of the premaxillary bones, which contain the elongate basal portions of the upper incisors, and completely separate the nasals from the maxillaries. The orbits are never circumscribed by bone, and post-orbital processes are generally wanting. A zygomatic arch is always present. The condyle of the mandible is longitudinal, so that the lower jaw works backwards and forwards.

The mouth is divided into an anterior cavity containing the incisors, and a posterior cavity containing the molars, the two connected by a constricted orifice, lined partially or wholly by the hairy integument of the face. The feet are plantigrade, or semi-plantigrade, usually pentadactyle, and unguitate. The intestine has a large caecum (except in *Myoxidae*); the uterus is double or two-horned, and the placenta discoidal and deciduate. In many families the females have an elongated perforate clitoris in front of the genital orifice, and may easily be mistaken for males. The testes in most rodents (not in the *Duplicidentata*) are retained in the abdomen, except in the rutting-season, when they become greatly enlarged. The cerebral hemispheres are smooth and do not extend back over any part of the cerebellum.

Rodents are cosmopolitan in distribution, and comprise more species than any other Mammalian order. Nearly all are exclusively



vegetable feeders. They are divided into two suborders, thus distinguished :—

- Two incisors in upper jaw SIMPLICIDENTATA.
Four incisors in upper jaw (two of them small
and placed behind the others) DUPLICIDENTATA.

Suborder *SIMPLICIDENTATA*.

Only two incisors in the upper jaw; enamel confined to the anterior surface. Anterior palatine foramina small or moderate, and distinct from each other. Bony palate well developed. The fibula does not articulate with the *os calcis*. Testes generally contained within the abdomen, and only descending in the rutting-season, when they form a great protuberance in the inguinal region.

To this suborder belong by far the greater number of rodents, divided into the following sixteen families, of which only five are represented in India.

A. Angular portion of mandible arising from lower edge of bony socket of incisor.

a. Fibula distinct; zygomatic arch slender, chiefly formed by malar, which is not supported by a long maxillary process beneath it

Skull with distinct postorbital processes; pm. $\frac{2}{1}$

SCIUROMORPHA.

1. Sciuridæ.

Anomaluridæ (Africa).

Haplodontidæ

(N. America).

Castoridæ (N. Europe, Asia, and America).

b. Fibula united to tibia; zygomatic arch slender; the malar rarely extending far forwards and usually supported by a long process from the maxillary; no postorbital processes

MYIOMORPHA.

a'. Form slender, hind limbs greatly elongate, metatarsals often united; infraorbital foramen very large, rounded; tail long, hairy.

2. Dipodidæ.

b'. Infraorbital foramen large, usually high, narrow below; lower root of zygomatic maxillary process flattened

3. Muridæ.



c. Form heavy, cylindrical, mole-like; limbs short, tail short or rudimentary; infraorbital foramen small, lower maxillary zygoma-root not flattened

4. **Spalacidae.**

Myoxidae (Palearctic and Africa).

Lophiomyidae (Africa).

Geomyidae (America).

B. Angular portion of mandible arising from outer side of bony socket of incisor. Fibula distinct. Zygomatic arch stout

Body more or less covered with spines.

(South America.)

HYSTRICOMORPHA.

5. **Hystricidae.**

Octodontidae.

Chinchillidae.

Dasyproctidae.

Dinomyidae.

Caviidae.

Family SCIURIDÆ.

The squirrels, flying-squirrels and marmots, forming the present family, are distinguished by the following characters:—Tail hairy. Skull with distinct postorbital processes; infraorbital foramen

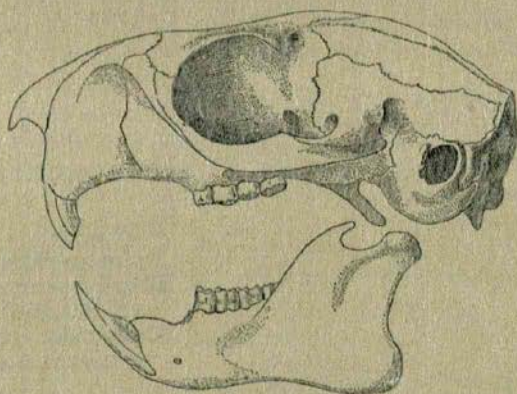


Fig. 119.—Skull of *Sciurus bicolor*, $\times \frac{3}{4}$.

small; palate broad; premolars $\frac{2-2}{1-1}$, the anterior upper premolar small, sometimes deciduous; molars rooted, tubercular in young animals, the crowns when worn exhibiting deep and often wavy folds of enamel.

There are two subfamilies thus distinguished:—

A. Form slender, tail long, incisors compressed; chiefly arboreal

Sciurinae.

B. Form stout, tail generally short, incisors not compressed; terrestrial.....

Arctomyiinae.

Subfamily SCIURINÆ.

Of this subfamily, which inhabits all the great zoological regions except the Australian, the following four genera occur within Indian limits.

- A. Limbs connected by a membrane or parachute.
 - a. Hypsodont: inner borders of upper molars proximally subangulate, their upper surface flat EUPETAURUS.
 - b. Brachyodont: inner borders of upper molars rounded, their upper surface irregular.
 - a'. An interfemoral membrane attached to the tail, which is bushy, not distichous PTEROMYS.
 - b'. No interfemoral membrane; tail distichous SCIUROPTERUS.
- B. Limbs free, not connected by membrane SCIURUS.

All the Indian forms of these genera (except *Eupetaurus*, which is a recent discovery) were described and a full synonymy given by Dr. Anderson in his 'Anatomical and Zoological Researches.'

Genus EUPETAURUS, O. Thomas (1888).

Hypsodont, the molars having high crowns, with the grinding-surface perfectly flat and not very complicated. Upper molars peculiarly shaped, the crowns almost semi-oval, with a subangular

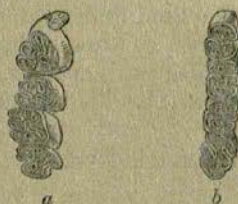


Fig. 120.—Crowns of right cheek-teeth of *E. cinereus*; a, upper; b, lower. $\times 1$.

apex inside, placed at the proximal extremity of each tooth, so that the greatest breadth of the tooth is oblique. Interfemoral membrane rudimentary or wanting. Cartilage supporting the lateral membrane short. In other characters this genus resembles *Pteromys*.

Only a single species is known.

226. *Eupetaurus cinereus*. The woolly Flying-Squirrel.

Eupetaurus cinereus, Thomas, J. A. S. B. lvii, pt. 2, p. 258, pls. xxii, xxiii (1888).

Claws blunt. Single metatarsal pad small, oval, isolated. Ears moderate, densely hairy outside, more thinly inside the conch. Fur very long, thick and soft, underfur dense and woolly. Tail cylindrical.



Colour dull greyish brown to brownish grey above, paler, sometimes ashy brown, below. Feet darker, sometimes blackish brown. Basal half or more of dorsal fur leaden grey, terminal portion white brown with a dusky ring near the end. Ventral fur ashy with white-brown tips.

Dimensions not accurately known. Skins measure, head and body about 18 inches, tail with hair about 22; basal length of skull about 2.7, zygomatic breadth 1.8.

Distribution. Gilgit, about 6000 feet; probably also found at higher elevations. A skin was obtained by the late Mr. Mandelli, probably from some part of Tibet.

Habits unknown. The blunt claws probably show that the animal lives on rocks, perhaps amongst precipices, whilst the dense fur indicates a very cold climate.

Genus **PTEROMYS**, Cuv. (1800).

Limbs united by a membrane or parachute extending to the toes and supported by a bony cartilage attached to the ulnar (outer) side of the wrist, and usually long enough when laid back to extend to the elbow or beyond. There is an antebrachial membrane from the fore limb to the side of the neck, and an interfemoral membrane extending down the hind limb to the heel, and attached to the first two or three inches of the tail, which is bushy, cylindrical, and as long as the head and body or longer. Fur soft and rather long on the back.

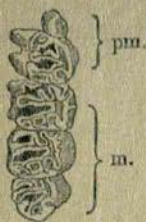


Fig. 121.—Right upper cheek-teeth of *P. magnificus*. $\times \frac{1}{2}$.

Dentition : i. $\frac{2}{2}$, pm. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3-3}$, as in *Sciurus*; molars large, crowns much complicated. Vertebrae (in *P. magnificus*): C. 7, D. 12, L. 7, S. 3, C. 30. Three pairs of mammae, pectoral and ventral, none inguinal.

The large flying-squirrels constituting this genus comprise several closely allied forms, some of which are probably not entitled to specific rank. The following occur within our area. All flying-squirrels are, so far as is known, nocturnal animals.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Lower surface white or grey, upper brown. *P. oral*, p. 361.
- B. Lower surface rufous; no white spots on back.
 - a'. Head above coloured like the back.
 - a". A short clearly defined black tip to tail.
 - a'''. Back paler in colour than parachute. *P. inornatus*, p. 363.
 - b'''. Back deeper in colour than parachute *P. magnificus*, p. 364.



- 6". Tail-tip not black, or long and ill-defined *P. gymnarensis*, p. 364.
6'. Head much greyer than back *P. caniceps*, p. 365.
C. Lower surface rufous; white spots on back.. *P. punctatus*, p. 365.

227. *Pteromys oral*. *The large brown Flying-Squirrel.*

Pteromys philippensis P, Gray apud Elliot, *Madras Jour. L. S.* x, p. 217 (1839).

Pteromys oral, Tickell, *Calc. Jour. N. H.* ii, p. 401, pl. xi (1842); Kelaart, *Prod.* p. 55; Anderson, *An. Zool. Res.* p. 279; Sterndale, *Jour. Bombay N. H. Soc.* i, p. 70.

Pteromys petaurista, Pallas, *Blyth, J. A. S. B.* xvi, p. 865, xxviii, pp. 276, 286; *id. Cat.* p. 94; Jerdon, *Mam.* p. 174; *nec Sciurus petaurista*, Pallas.

Pteromys petaurista, var. *cineraceus*, *Blyth, J. A. S. B.* xvi, p. 865.

Pteromys cineraceus, *Blyth, J. A. S. B.* xxviii, p. 276; *id. Cat.* p. 94; *id. Mam. Birds Burma*, p. 35; Anderson, *An. Zool. Res.* p. 281; Blanford, *J. A. S. B.* xlvii, pt. 2, p. 165.

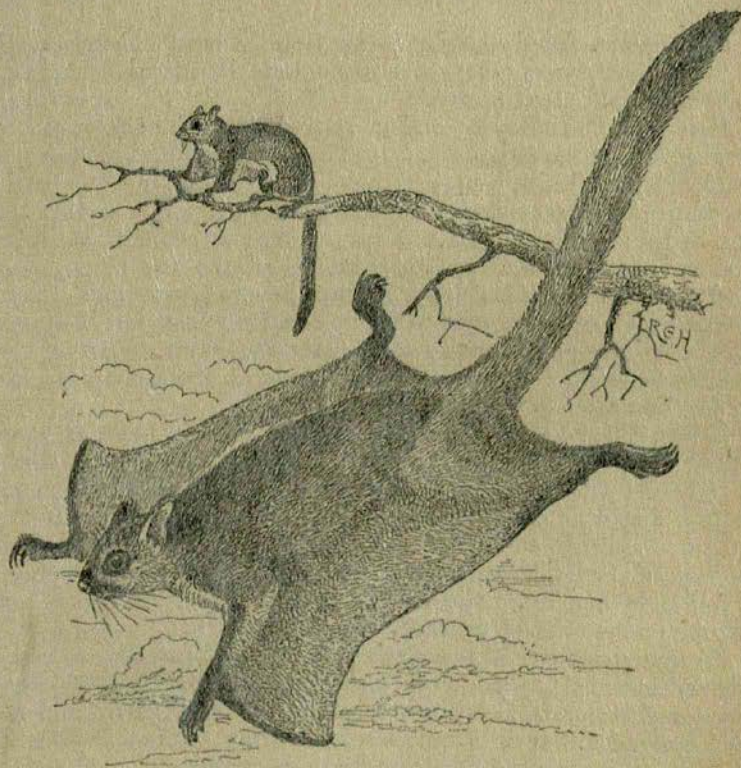


Fig. 122.—*Pteromys oral*.

Ural, Kol.; Pakya, Mahr.; Parachaten, Mal.; Egala-dandolena, Cing.; Shu-byan, Burmese.

Ears moderate, covered with short hair that becomes longer



towards the base outside; a large tuft of long hair behind each ear. On the fore foot are 3 toe- and 2 subequal metacarpal pads; on the hind foot 4 toe-pads, a large pyriform inner metatarsal pad, and a small supplementary pad behind the outer toe-pad.

Colour above grizzled brown, varying from deep chestnut to greyish brown in one direction and to sooty black in the other, the longer hairs partly white, producing a hoary appearance, especially on the head and body, less on the membrane and limbs; dorsal fur dark ashy blackish or brown towards the base, then brown or deep red or black, the longer hairs white for a distance near the end, extreme tips black. Feet dark, often black; tail sometimes black, brownish towards the base, in other skins light or dark grey with a black tip. Lower parts white, sometimes pure, more often greyish or brownish, especially on the membrane and around the vent.

Dimensions. Head and body 16 to 18 inches; tail without hair 22, with hair 24 to 25. Some published measurements are longer. Hind foot without claws 2.75 to 3; weight 5 lbs. A skull measures 2.5 in basal, 2.85 in extreme length, and 1.9 in zygomatic width.

Distribution. All the larger forests of the Indian Peninsula south of the Ganges, also Ceylon, and throughout Burma to Tenasserim and the Mergui Archipelago.

Varieties. The ordinary Indian form is dark brown, with the greater part of the tail black. *P. cineraceus*, the Burmese form, is much greyer, the upper parts ashy throughout, and the white speckling more conspicuous on the parachute than is usually the case in Indian skins. The tail too is grey or whitish, the hairs having long white terminations, the tip of the tail alone being black. Ceylonese skins from Kandy, however, are quite intermediate, and so is one sent to me by Mr. Daly from the Shevaroy hills. Travancore specimens often have the upper surface of the membrane bright chestnut. Bombay skins, on the other hand, are said by Sterndale to be grey.

Habits. The large Indian flying-squirrel lives in holes of trees during the day and comes out to feed, as a rule, quite in the dusk. It inhabits tree-forest, but in forest-tracts it may be found about villages, in mango-groves and similar places. It feeds like ordinary squirrels on fruits and nuts, also, according to Tickell, on the bark of certain trees, and on beetles and larvæ, but not on grain. It drinks by lapping. The voice is described by Tickell as a low soft monotone quickly repeated.

The flying-squirrel sleeps during the day, sitting, like so many arboreal mammals, with its back bent into a circle and its head thrust inside; or, in hot weather, lying on its back with the parachute extended. It is not so active as other squirrels, either on trees or on the ground, the parachute impeding its movements. When passing from one tree to another at a distance, it leaps, with its parachute extended, from the higher branches, and descends, at first more directly, then, apparently, by availing itself of the resistance of the air, more and more obliquely, until its flight, gradually



growing slower, becomes horizontal and finally terminates in an ascent to the trunk or branch of the tree to which its flight is directed. The movement of a flying-squirrel through the air must be similar to that of *Galeopithecus*, and in both cases the power of directing and, so to speak, steering its course must be possessed by the animal. Jerdon states that he has seen *P. oral* traverse a distance of sixty yards from tree to tree, and McMaster records a flight across the Prome road, near Rangoon, of nearly eighty yards.

Flying-squirrels are said to breed in holes of trees, but very little is known of the breeding-habits. These animals are easily tamed, but they are delicate, and but rarely live long in confinement. Most of the above details are from Tickell.

The name *philippensis* must have been given to the present species under the supposition that a Philippine flying-squirrel is identical. As this is not the case, the name is misleading and cannot be used.

228. *Pteromys inornatus*. *The large red Flying-Squirrel.*

Pteromys albiventer, Gray, *Charlesworth's Mag. N. H.* i, p. 584 (1837); *Blyth, J. A. S. B.* xvi, p. 865, xvii, p. 84; *Anderson, An. Zool. Res.* p. 286; nec Gray and Hardwicke, *Ill. Ind. Zool.*

Pteromys inornatus, Geoffroy, *Jacquemont, Voyage*, iv, *Mam.* p. 62, *Atlas*, ii, pl. iv (1844); *Blyth, J. A. S. B.* xxviii, p. 277; *id. Cat.* p. 95; *Jerdon, Mam.* p. 176.

Pteromys magnificus, Hodgson, *apud Selater, P. Z. S.* 1872, p. 635, pl. 1, nec Hodgson.

Rusi gugar, Kashmiri.

Structure very similar to that of *P. oral* and skull of the same form. The large metatarsal pad joins the inner toe-pad on the hind foot. No supplementary pad.

Colour above chestnut, sometimes nearly uniform, sometimes the back and head much paler than the parachute, owing to the longer hairs being in part pale rufous or white. Dorsal fur at base dark ashy to blackish, then pale rufous passing into deep ferruginous, many of the longer hairs white or pale bright rufous for some distance near the end, and tipped black. Feet often black, also the orbits, whiskers, and a narrow band across the nose. Cheeks below the eyes grey or white. Tail rufous or brownish rufous, with a well-defined black tip, the hairs towards the base of the tail often with black terminations. Lower parts pale rufous.

Dimensions. Head and body 14 inches, tail 16, according to Jerdon. I believe, however, this squirrel grows nearly if not quite to the same size as *P. oral*. An adult skull is 2.85 inches long in extreme length and 1.85 broad across the zygomatic arches.

Distribution. The Western Himalayas, from 6000 to 10,000 ft., extending west to Murree, common in Kashmir and about Simla, found in Kumaon and in Nepal (Katmandu).

Habits. Precisely similar, so far as known, to those of *P. oral*. In Kashmir *P. inornatus* inhabits fir-trees and is said to hibernate.

**229. *Pteromys magnificus*. Hodgson's Flying-Squirrel.**

Sciuropterus magnificus, Hodgson, *J. A. S. B.* v, p. 231 (1836).

Pteromys magnificus, Blyth, *J. A. S. B.* xvi, p. 866, xxviii, p. 277;
id. *Cat.* p. 95; Jerdon, *Mam.* p. 177; Anderson, *An. Zool. Res.*
p. 285.

Sciuropterus nobilis, Gray, *A. M. N. H.* x, p. 263 (1842).

Sciuropterus chrysothrix, Hodgson, *J. A. S. B.* xiii, p. 67, pl. i,
fig. 1 (1844).

Surāj-bhāgat, H.; *Bijom*, Lepcha.

Ears thinly clad, of moderate size. Skull shorter and broader than in *P. oral* and *P. inornatus*, and with the snout blunter. Hind foot as in *P. inornatus*.

Colour above varying, probably with the time of year. In *P. nobilis* or *chrysothrix*, which I suppose to be the summer garb, the body, neck, and head above are deep maroon, generally with a more or less well-marked yellow median line, commencing with a broad spot on the forehead. Sides of the neck and inner border of parachute, where it joins the body, yellowish buff, remainder of parachute rufous, often chestnut.

In the other phase, probably winter fur (*P. magnificus*), there is no median dorsal line, the body and head are chestnut above, more or less grizzled by some of the longer hairs being whitish near the tip, but the body above is always darker than the parachute. The dorsal hairs are dark ashy at the base. The feet are chestnut or black; the tail rufous with a well-defined black tip, the lower parts pale rufous.

Dimensions. Head and body 16 inches, tail 18 to 22, hind foot 3, ear $1\frac{1}{2}$; weight $3\frac{1}{4}$ lbs. Basal length of a skull 2.5, extreme length 2.8, zygomatic breadth 1.95.

Distribution. The Himalayas from Nepal eastwards and the ranges south of the Assam valley, at elevations from 6000 to 9000 feet.

Habits. So far as known similar to those of *P. oral*. Hodgson's flying-squirrel is said by Jerdon to live on acorns, chestnuts, and other hard fruits, also on young leaves and shoots. Hodgson states that *P. magnificus* breeds in the rains in hollows of trees, and that it seems to produce but a single young one. The young are tolerably independent of the mother in September, but the parachute is much less developed than in adults.

230. *Pteromys yunnanensis*. Anderson's Flying-Squirrel.

Pteromys yunnanensis, Anderson, *A. M. N. H.* (4) xvi, p. 282 (1875);
id. *An. Zool. Res.* p. 282, pl. xxii.

Similar in form to *P. magnificus* but apparently with larger feet.

Colour above bay, the fur of the head and body more or less thickly sprinkled over with white tips, giving a hoary appearance; the white tips are almost or quite wanting on the parachute, which



is rather more rufous. Lower parts white, tinged with rufous near the parachute border and in the median line. Feet a little darker than body, not black. Tail rufous grey, becoming darker and blackish towards the end, but with no defined black tip.

Dimensions. Hind foot without claws 3.25 inches. In skins the head and body measure 18, tail 22.

Distribution. Hills south of Assam valley, extending eastward to Yunnan.

The specimen above described was from Cachar. The typical form from Yunnan has the tail black almost throughout. It is possible that this form passes into the Eastern Tibetan *P. alborufus*, to which Mr. W. L. Sclater informs me that he refers specimens from Assam and Burma.

231. *Pteromys caniceps.* The grey-headed Flying-Squirrel.

Sciuropterus caniceps, Gray, *A. M. N. H.* x, p. 262 (1842); *Blyth*, *J. A. S. B.* xvi, p. 866; *id. Cat.* p. 96; *Jerdon, Mam.* p. 178.

Sciuropterus senex, *Hodgson, J. A. S. B.* xiii, p. 68, pl. i, fig. 2 (1843).

Pteromys caniceps, Gray, *Cat. Mam. &c. Nepal & Thibet*, 1846, p. 21; *Anderson, An. Zool. Res.* p. 287.

Ears large, thin, almost naked. Skull smaller than in *P. oral* or *P. magnificus*. Metatarsal pad not in contact with toe-pad.

Colour above nearly uniform rufous-brown, the dorsal fur dark ashy at the base, then brown, pale rufous towards the end, and the tip black. Head throughout ashy grey or dull brown, finely speckled. Lower parts rufous, sometimes light chestnut, generally paler. Feet dull rusty red. Tail reddish brown like the back, the tip sometimes, not always, dusky or black.

Dimensions. Head and body 14 inches, tail without hair 16, with hair 18, ear $1\frac{1}{4}$, hind foot $2\frac{2}{3}$; weight 2 lbs. Basal length of skull 2.2, extreme length 2.6, zygomatic breadth 1.6.

Distribution. Nepal and Sikhim, ranging west as far as Landour at a lower elevation than *P. magnificus*, about 4000 to 6000 feet.

The true *P. pataurista* of Pallas (*P. nitidus* of most authors), from the Malay peninsula and islands, may extend its range to Tenasserim. *P. melanopterus* and *P. alborufus* are found in Eastern Tibet and Southern China. All are closely allied to *P. magnificus*.

232. *Pteromys punctatus.* The spotted Flying-Squirrel.

Pteromys punctatus, Gray, *A. M. N. H.* xviii, p. 211 (1846); *Blyth*, *J. A. S. B.* xxviii, p. 277.

Ears almost naked except towards the base.

Colour. Upper parts rich yellowish brown, darker on the head, more rufous on the parachute and limbs; back and crown with small irregular white spots, composed of hairs that are white throughout, basal portion of all other hairs on upper parts dusky. Lower parts and sides of head pale rufous, deeper towards the edge of the parachute. Tail light rufous brown throughout.



Dimensions. A much smaller animal than *P. magnificus*, head and body (in a dried skin) about 14 or 15 inches. Basal length of skull about 2 inches, zygomatic breadth 1·7.

Distribution. A male specimen was obtained by L. Fea in Karennee, at about 4000 ft. The original type is more rufous, being bay above, and came from Malacca. I am indebted to Mr. Thomas for information about the discovery of this species in Burma.

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

Interfemoral membrane rudimentary, not including any portion of the tail. Lateral membrane less broad than in *Pteromys*, and the supporting cartilage shorter, not extending to the elbow.

Dentition: i. $\frac{2}{2}$, pm. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3-3}$, as in *Sciurus* and *Pteromys*; the molars, however, are much less complicated than in *Pteromys*, and more like those of *Sciurus*; they wear, as a rule, into very strongly marked transverse ridges. The postorbital processes of the skull are directed somewhat backwards, as in *Sciurus*. Vertebrae: C. 7, D. 12, L. 7, S. 3, C. 27 (in *S. alboniger*).

In other respects the genus resembles *Pteromys*. In some species, as *S. alboniger* and *S. lepidus*, the mammae are inguinal and ventral, in others pectoral and ventral, and always in three pairs.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. No pencils of long hair at base of ear-conch.
a. Light brown above; head and body 10 inches. *S. fimbriatus*, p. 366.
b. Hoary or blackish above; head and body 8·5. *S. alboniger*, p. 367.
c. Yellowish brown above; head and body 6. *S. sagitta*, p. 367.
d. Chestnut above; head and body 5 inches. *S. spadiceus*, p. 368.
B. Pencils of hair, longer than ear, at base of conch.
a. Head and body 10–12 inches; hind foot over 2. *S. fuscicapillus*, p. 368.
b. Head and body 8 inches; hind foot 1·5. *S. pearsoni*, p. 369.

233. *Sciuropterus fimbriatus*. The smaller Kashmir Flying-Squirrel.

Sciuropterus fimbriatus, Gray, *Charlesworth's Mag. N. H.* i, p. 584 (1837); *id.* *P. Z. S.* 1837, p. 67; Blyth, *J. A. S. B.* xvi, p. 866; *id.* *Cat.* p. 96; Jerdon, *Mam.* p. 178; Scully, *P. Z. S.* 1881, p. 204. *Pteromys fimbriatus*, Anderson, *An. Zool. Res.* p. 296; Alston, *P. Z. S.* 1879, p. 665.

Ears large, bluntly pointed, thinly clad, without any pencils of long hair at their base. The fringe of soft hair to the parachute and feet well developed. Tail slightly flattened. Skull elongate. A small supplementary pad on outer side of planta behind pad of 5th toe; metatarsal pad elongate, distant from toe-pads.

Colour above on the head, body, and membrane light brown, more or less mixed with black on the back. In rare cases the



colour is rufous brown. Basal three fourths or more of the dorsal hair dark ashy, terminal portion light brown, extreme tip of longer hairs black. Lower parts white, sullied and brownish beneath the parachute. Tail brown, the hairs ashy at the extreme base, and with long black tips.

Dimensions. Head and body 10 inches long, tail without hair 10.5, with hair 12, ear outside 1.5, hind foot from heel 2.1; basal length of skull 2, extreme length 2.3, zygomatic breadth 1.4.

Distribution. Throughout the North-western Himalayas from Simla, and in all probability Kumaon to Kashmir, Gilgit, and Chitral, at considerable elevations, 6000 to 12,000 feet in Gilgit. Also found in Afghanistan, a specimen having been brought from Peiwar Kotal. This species is probably that named *S. baberi* by Blyth (J. A. S. B. xvi, p. 866) from Nijrow.

Habits. So far as is known, similar to those of *Pteromys*. Four young have been found in a female of this species.

234. *Sciuropterus alboniger*. *The particoloured Flying-Squirrel.*

Sciuropterus alboniger, *Hodgson, J. A. S. B.* v, p. 231 (1836); *Blyth, J. A. S. B.* xvi, p. 866; *id. Cat.* p. 97; *Jerdon, Mam.* p. 179; *Thomas, P. Z. S.* 1886, p. 59.

? *Pteromys leachii*, *Gray, Charlesworth's Mag. N. H.* i, p. 584 (1837). *Sciuroptera turnbulli*, *Gray, P. Z. S.* 1837, p. 68; *Blyth, J. A. S. B.* xii, p. 928.

Pteromys alboniger, *Anderson, An. Zool. Res.* p. 298.

Ears large, thinly clad, without pencils at the base. Tail flat, distinctly distichous; hair on lower surface short. No supplementary pad on planta. Incisors pale yellow.

Colour above greyish brown, varying to rufous-brown, but hoary or much mixed with black from the dark underfur; the base of the hairs ashy passing gradually into black, only the ends light brown or grey, some of the longer hairs with black tips. Feet dark brown. Lower parts white; the fur dark grey at the base. Tail brown, the hairs frequently black-tipped. Young animals are black above, white below.

Dimensions. Head and body of a large specimen 11 inches long, tail without hair 8.25, with it 9; weight 9 oz.; others measure less. Extreme length of skull 1.9, zygomatic breadth 1.2.

Distribution. The Himalayas from Nepal eastward, at an elevation of 3000 to 5000 feet. Found also in the hills south of Assam, in Manipur, Yunnan, and Siam. Some skins in the British Museum from Borneo are also referred to this species.

235. *Sciuropterus sagitta*. *Horsfield's Flying-Squirrel.*

Sciurus sagitta, *L. Syst. Nat.* i, p. 88 (1766).

Pteromys horsfieldii, *Waterhouse, P. Z. S.* 1837, p. 87; *Anderson, An. Zool. Res.* p. 299.

Sciuropterus horsfieldii, *Cantor, J. A. S. B.* xv, p. 253.

Sciuropterus sagitta, *Blyth, J. A. S. B.* xxiii, p. 731, xxiv, p. 187, xxvii, p. 281; *Thomas, P. Z. S.* 1886, p. 75.



Sciuropterus playrei, *Blyth, J. A. S. B.* xxviii, p. 278 (1859); *id. Cat.* p. 97; *id. Mam. Birds Burma*, p. 35.

Ears large, without pencils of hair at the base. Tail flat and distichous. Fur short and dense.

Upper parts throughout brown with a yellow tinge, the head coloured precisely like the back, and the tail scarcely differing. Fur ashy at the base, still darker on the parachute. Lower parts white or yellowish white. Tail brown above, redder beneath.

Dimensions of an adult male in spirit: head and body 6.25 inches, tail without hair 5, hind foot 1.25.

Distribution. Southern Pegu, Tenasserim, Cambodia, the Malay Peninsula, Java, and some of the other Malay islands. The most northern locality recorded is Shwe Gyeng, on the Sittoung River.

236. *Sciuropterus spadiceus*. *The pigmy Flying-Squirrel.*

Sciuropterus spadiceus, *Blyth, J. A. S. B.* xvi, p. 867, pl. xxxvi, fig. 1 (1847); *id. Cat.* p. 97; *id. Mam. Birds Burma*, p. 35.

Pteromys spadiceus, *Anderson, An. Zool. Res.* p. 300.

Kywek-shu-pyan, Arrakan.

Size very small. No pencils of hair at the base of the ears; tail distichous, flat, acuminate. Metatarsal pad oval.

Colour above chestnut, basal three fourths of dorsal fur sooty black, tips red. Membranes and limbs darker, tail dark brown, rufous below near the base. Lower parts white.

Dimensions. Head and body about 5 inches, tail $4\frac{1}{2}$, tarsus $1\frac{1}{4}$. Skull 1.25 inches long (extreme length), zygomatic breadth 0.8.

Distribution. Arrakan, Moulmein, and Cochin China.

Thomas, P. Z. S. 1886, p. 75, advocates the amalgamation of *S. spadiceus* with *S. lepidus*, a very small Javan form. There appears to me, however, too much difference in colour and in the form of the tail, which in *S. lepidus* is webbed like a feather.

237. *Sciuropterus fuscicapillus*. *The small Travancore Flying-Squirrel.*

Sciuropterus fuscicapillus, *Jerdon, Blyth, J. A. S. B.* xvi, p. 867 (1847), xxviii, p. 286; *id. Cat.* p. 97; *Jerdon, Mam.* p. 180.

Sciuropterus layardi, *Kelaart, Blyth, J. A. S. B.* xx, p. 165 (1851); *Kelaart, Prod.* p. 56.

Pteromys fuscicapillus, *Anderson, An. Zool. Res.* p. 294.

A pencil of soft hairs, greatly exceeding the ear in length, at each base of the ear-conch, which is short and almost naked. Tail flat, bushy. Metatarsal pad very elongate, no supplementary outer pad. Fur long, soft. Skull broader than that of *S. fimbriatus*.

Colour above reddish brown, the dark underfur showing, especially on the parachute. Dorsal hair dark ashy at the base and for the greater part of its length, becoming blackish towards the end; terminal portion rufous-brown, extreme tips of longer hairs black. On the parachute the hairs, except the brown tips, are black throughout. Sides of face whitish. Feet pale rufous-brown.



Lower parts rufescent white, the hairs dark grey near the skin. Tail rufous-brown, the hairs sometimes with black terminations. The extreme tip of the tail is sometimes white.

Dimensions. Head and body of an adult male in spirits 12 inches, tail without hair 9, with hair 10·5, hind foot 2·1, ear from crown 0·8, extreme length of skull 2·25, zygomatic breadth 1·45. Some individuals are possibly larger.

Distribution. Hills of Travancore and Ceylon, at moderate elevations. Anderson also gives the Nilgiris as a locality.

238. *Sciuropterus pearsoni*. *The hairy-footed Flying-Squirrel.*

Sciuropterus pearsonii, Gray, *A. M. N. H.* x, p. 263 (1842); *Thomas*, *P. Z. S.* 1886, p. 60.

Sciuropterus villosus, Blyth, *J. A. S. B.* xvi, p. 866 (1847); *id.* *Cat.* p. 96; *Jerdon*, *Mam.* p. 179.

Pteromys pearsonii, *Anderson*, *An. Zool. Res.* p. 293.

A pencil of soft hairs, greatly exceeding the ear in length, at each base of the ear-conch, which is small and fairly well clad. Tail flat, bushy. Toes with long hair, partly concealing the claws. No supplementary pad on planta; metatarsal pad oval. Fur long.

Colour above brown, frequently rufous-brown, grizzled by pale tips; dorsal hair sooty black for the greater part of its length, becoming ashy at the base, and tipped with ferruginous red, pale rufous, or light brown; extreme tip of some of the longest hairs black. Fur on upper surface of parachute black, with but few pale tips. Feet paler. Lower parts fulvescent white; more rufous, and sometimes brown or ferruginous beneath the parachute. Tail rufous-brown, paler below, sometimes tipped blackish.

Dimensions. Head and body 8 inches, tail 8, ear 0·6, hind foot and claws 1·5; zygomatic breadth of skull 0·9.

Distribution. Sikhim, Bhutan and the Eastern Himalayas, Assam, hills south of Assam, Cachar, Manipur, and Yunnan; also, according to Anderson, Formosa. In Sikhim this species inhabits a zone from 3000 to about 6000 feet.

Genus **SCIURUS**, L. (1766).

Limbs free, not connected by membrane; tail long, bushy. Hind feet with five toes, fore feet with four toes and a rudimentary thumb. No cheek-pouches.

Dentition: i. $\frac{2}{2}$, pm. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3-3}$. Anterior upper premolar soon lost in some species, but not in others. Postorbital processes moderate, and generally directed backwards. The small infraorbital foramen is in front of the zygoma-root, and close to the anterior premolar. Palate broad and flat. Vertebrae: C. 7, D. 12-13, L. 6-7, S. 3, C. 21-32.

Squirrels are mainly arboreal and diurnal, they feed on fruit, seeds, nuts, leaf-buds, and sometimes it is said on insects and birds' eggs. They hold their



Fig. 123.—Right upper cheek-teeth of *S. erythraeus*, $\times 2$.



food between their fore feet when eating. They build large nests of leaves, grass, &c. in trees, and usually produce three or four young. The Indian and Burmese species are numerous, but fall into three groups, easily recognized by size and other characters.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Large squirrels; nose to vent not less than 12 inches; lower surface of tail with short hair; usually 4 teeth in upper molar series on each side.
- a. Outside of all limbs coloured like upper parts, which are generally blackish..... *S. bicolor*, p. 373.
 - b. Outside of hind limbs like back, wholly or partly maroon, of fore limbs buff like abdomen *S. indicus*, p. 371.
 - c. Outside of all limbs pale like abdomen. *S. macrurus*, p. 374.
- B. Medium-sized squirrels; nose to vent 7 to 10 inches; lower surface of tail with long hair; no pale longitudinal bands on back or sides; usually 5 teeth in upper molar series.
- a. Colour throughout body above and below red or reddish brown *S. ferrugineus*, p. 375.
 - â. Colour not uniform, back finely speckled.
 - a'. Longer dorsal hairs with but one pale ring; a small white or whitish spot behind each ear.
 - a''. Abdomen rufous *S. locria*, p. 376.
 - b'. Abdomen white *S. rufigenis*, p. 376.
 - b'. Longer dorsal hairs with two pale rings; no white spots behind ear.
 - a''. Neither a black dorsal patch nor white whiskers.
 - a³. Abdomen chestnut or bay .. *S. erythræus*, p. 377.
 - b³. Abdomen longitudinally banded white and black *S. quinquestriatus*, p. 378.
 - c³. Abdomen pale rufous or isabelline or grey.
 - a⁴. A distinct black tail-tip.
 - a. A black or blackish band on each side of abdomen *S. phayrei*, p. 379.
 - â. No black lateral bands.
 - a'. Abdomen pale rufous. *S. pygerythrus*, p. 379.
 - â'. Abdomen pale grey .. *S. caniceps*, p. 380.
 - b⁴. Either no black tail-tip or a very ill-defined one.
 - a. Feet whitish..... *S. griseimanus*, p. 381.
 - â. Feet the same colour as the sides *S. locroides*, p. 381.
 - b''. Either a black dorsal patch or white whiskers, or both * *S. atridorsalis*, p. 382.

* A rufous variety of this occurs with black whiskers, and no black on the back. This is scarcely distinguishable from some forms of *S. erythræus*.



- C. Small striped squirrels; nose to vent 5 to 7 inches; back with pale longitudinal bands; upper cheek-teeth generally 5.
- a. A pale line in middle of back; ears not pencilled.
- a'. Pale dorsal stripes distinct, extending throughout the back.
- a''. Pale stripes subequal, each more than $\frac{1}{16}$ inch broad; skull 1.8 inch long *S. palmarum*, p. 383.
- b'. Pale stripes subequal, each less than $\frac{1}{16}$ inch broad; skull 1.55 long *S. tristriatus*, p. 384.
- c'. Middle pale stripe broader and much more distinct than lateral *S. layardi*, p. 385.
- b'. Pale dorsal stripes narrow, indistinct, confined to the middle of back *S. sublineatus*, p. 385.
- b. A black line in middle of back; head and body 5 inches; ears pencilled... *S. maclellandi*, p. 386.
- c. No pale line in middle of back; head and body 7 inches; ears not pencilled *S. berdmorei*, p. 387.

The group of medium-sized squirrels contains so many variable races, and intermediate forms between some of them are so frequently met with, that the key here given may not always suffice to distinguish individual specimens. It is doubtful whether some of the small striped squirrels have any genetic connexion with the others similarly marked.

239. *Sciurus indicus*. *The large Indian Squirrel*.

Sciurus indicus, *Erxleben, Syst. Regn. An.* p. 420 (1777); *Anderson, An. Zool. Res.* p. 222; *Thomas, P. Z. S.* 1886, p. 60.

Sciurus purpureus, *Zimmermann, Spec. Zool. Geog. Quad.* p. 518 (1777); *Blyth, J. A. S. B.* xvi, p. 868.

Sciurus malabaricus, *Scopoli, Del. Faun. Flor. Ins.* ii, p. 85 (1786); *Schinz, Syn. Mam.* ii, p. 32; *Jerdon, Mam.* p. 166.

Sciurus maximus, *Schreber, Säugth.* iv, p. 784, pl. cxcvii B (1784); *Elliot, Mad. Jour. L. S.* x, p. 217; *Blyth, J. A. S. B.* xxviii, p. 287; *id. Cat.* p. 98; *Jerdon, Mam.* p. 166; *Ball, P. A. S. B.* 1877, p. 170; *Anderson, An. Zool. Res.* p. 223.

Sciurus elphinstonii, *Sykes, P. Z. S.* 1831, p. 103; *Jerdon, Mam.* p. 167.

Karrát, Rasu, Ratuphar, Jangli gilheri, H.; *Kát berral*, Beng.; *Hondeng*, Kol.; *Shekra*, Mahr.; *Kes annahu*, Can.; *Bet udata*, Tam.

Ears with long dense tufts. Skull with the muzzle broader and teeth larger than in *S. bicolor*.

Colour. The upper parts, including the ears and nape, are either wholly ferruginous red (rich chestnut or maroon), or the red is more or less replaced by black on the shoulders, middle of the back, rump, thighs, and tail. There is always a pale band across



the vertex just in front of the ears; the forehead is chestnut or rufous-brown, or pale brown, frequently more or less grizzled with white. Sides of the head and muzzle yellowish brown or buff, sometimes with a rufous tinge. A chestnut stripe down the side of the neck from in front of the ear. Lower parts buff or yellowish brown. Dorsal fur blackish or dark brown near the skin, ventral dusky. In specimens wholly or chiefly red above, the terminal portion of the tail, from a quarter to more than half, is sullied white or buff, and the lower surface of the tail is pale throughout; in darker skins the lower surface of the tail is dull red or brown.

Dimensions. Head and body 16 to 18 inches; tail rather less, or, with hair, one or two inches more. In a Malabar specimen, head and body 17 inches, tail 14·5; weight 4½ lbs. Basal length of a skull 2·6 inches, zygomatic breadth 1·8. The Bombay variety, with back and tail entirely red, appears rather smaller than the Malabar and Bengal forms.

Distribution. Throughout the Peninsula of India, south of the Ganges, Soane, and Nerbudda, in all extensive forests, and also to the eastward in Manipur, so this squirrel should be looked for in Cachar, Chittagong, Tipperah, &c. Hodgson once (P. Z. S. 1855, p. 126) incidentally mentioned *S. purpureus* amongst the mammals of the Nepal Terai; but as no such animal is comprised in his lists of Nepal mammals, and no specimen exists in his collections, the name was doubtless inserted in error. *S. indicus* is common in Orissa, Bastar, and parts of Chutia Nagpur, also in the Western Ghâts.

Varieties. This species was divided into three by Jerdon, and into two by Anderson. I think all the three forms distinguished by the first-named well marked races. They are:—

1. The Bombay Squirrel of Pennant, from which *S. indicus* and *S. purpureus* were named, and which was subsequently called *S. elphinstonii*. All the upper parts are red, no black occurring; tail-tip whitish. This appears rather smaller than other varieties, and inhabits the northern part of the Western Ghâts, but has been obtained by Sir O. B. St. John as far south as Mysore.
2. *S. maximus* of Jerdon, not of Schreber. This is chiefly red above, but there is some black on the shoulders and upper part of the tail, the tip of which is usually yellowish. This race, which has no special name, is found in Orissa, Bastar, Chutia Nagpur, South-western Bengal, and Manipur.
3. *S. malabaricus* or *S. maximus* (both founded on Sonnerat's Great Malabar Squirrel). Shoulders, rump, and tail, with more or less of the back, black. This is found in Southern Malabar and parts of Central India. There is a specimen in the British Museum from the source of the Nerbudda.

Habits. The large red squirrel inhabits high trees in forests,



living amongst the branches and rarely coming to the ground. It makes a large nest of twigs and leaves near the top of a lofty tree. A tame animal kept by Mr. Sterndale made nests in several trees, and the same animal was observed to jump 20 feet from one tree to another. This squirrel moves about and feeds at all hours of daylight, except perhaps the middle of the day. The voice is a loud quickly repeated cry. Young animals are easily tamed, but are not very docile or intelligent.

240. *Sciurus bicolor*. *The large Malay Squirrel*.

Sciurus bicolor, *Sparrman, Gotheb. Vet. Svensk. Handl.* i. p. 70 (1778); *Blyth, J. A. S. B.* x, p. 919, xvi, p. 870; *id. Cat.* p. 99; *Cantor, J. A. S. B.* xv, p. 246; *Anderson, An. Zool. Res.* p. 215. *Sciurus giganteus*, *McClelland, P. Z. S.* 1839, p. 150; *Anderson, An. Zool. Res.* p. 220.

Sciurus macruroides, *Hodgson, J. A. S. B.* x, p. 915 (no description); *Jerdon, Mam.* p. 168; *Blyth, Mam. Birds Burma*, p. 35.

Shingsham, Bhot.; *Satheu*, Lepcha; *Leng-theh*, Arrakan; *Sheng*, *Sheng apau*, Burmese; *Chingkrawah*, Malay; *Meng-khan*, Talain; *Kha-hong*, Karen.

Mammæ 6, all inguinal.

Colour. All the upper parts, the outside of all limbs, and tail black or brownish black or brown, lower parts to the vent buff. The dark colour of the face extends around the eyes and ears; a stripe extends backward and downward from the nose behind the gape and below the eye, and there is a dark spot on the chin. Fur of the same colour throughout above; the basal portion of the hairs is dusky below, and becomes conspicuous when the fur is worn.

Dimensions. In the Himalayan form the head and body measure about 16 inches, tail without hair 17 to 22, hair at the end 3 to 4 inches more, hind foot 3.5; basal length of skull 2.75, zygomatic breadth 1.9; weight 4½ lbs. In a very large individual, according to Cantor, the head and body measured 18 inches, tail 21.5.

Distribution. The Eastern Himalayas of Nipal, Sikhim, and Bhutan, also all the hill-regions and large tree-forests of Assam, Manipur, Burma, Siam, the Malay Peninsula, Sumatra, Java, Borneo, and even, it is said, Celebes.

Varieties. In the Malay Peninsula and Islands there are several races of this squirrel, to many of which names have been given, and the coloration of which varies greatly, one Malaccan variety having a whity-brown (*café au lait*) colour above throughout, whilst others are varied in tint, and some grizzled. The hairs of the tail are often white at the base or at the tips. In the Irrawaddy delta, and perhaps in Martaban and Tenasserim, a variety is common with a broad pale band or patch across the back. The worn summer fur is often paler brown, wholly or in patches, the fresh



winter coat nearly black. There is, moreover, much variation in size, Himalayan squirrels being largest, whilst many of the Malay forms are considerably smaller. The distinction, however, upon which most stress has been laid is the presence or absence of ear-tufts. All Himalayan and Arrakan specimens have, on the outside of the ear-conch, a tuft of long hairs, which is wanting in other Burmese skins, especially those from Tenasserim, and in Malaccan specimens. But there are gradations; and squirrels of this species with tufted ears are recorded even from Borneo. It should be remembered that the common European squirrel has tufted ears in winter, but not in summer. The difference in the two races of *S. bicolor* is, probably, due to habitat, the form inhabiting colder countries, such as the Himalayas, having tufted ears. Anderson, Jentink, and others distinguish the larger form with tufted ears as *S. giganteus* (*S. macruroides* of other writers).

Habits. Very similar to those of *S. indicus*. This species inhabits high trees, generally in pairs. It feeds on fruits and nuts of various kinds, and is said by Tickell to eat birds' eggs and insects. The voice, according to the same observer, is a loud harsh cackle.

241. *Sciurus macrurus*. *The grizzled Indian Squirrel*.

*Sciurus macrurus**, Pennant, *Indian Zoology*, pt. 1, pl. i (1769), *teste* Erxleben, *Syst. Regn. An.* p. 420; Blyth, *J. A. S. B.* xvi, p. 869, pl. xxxvi, fig. 2, xviii, p. 601, xx, p. 165; *id.* *Cat.* p. 100; Kelaart, *Prod.* p. 49; Jerdon, *Mam.* p. 168; Anderson, *An. Zool. Res.* p. 224.

Sciurus ceylonicus, Erxleben, *Syst. Reg. An.* p. 416 (1777).

Sciurus tennantii, Layard, Blyth, *J. A. S. B.* xviii, p. 600 (1849), xx, p. 165; *id.* *Cat.* p. 100; Kelaart, *Prod.* p. 50.

Rukiya, *Dandolena*, Cingalese; *Peria-anathan*, Tamul.

Ear sometimes very slightly tufted, sometimes not.

Colour. Upper surface and tail grey or brownish grey, more or less grizzled with white, especially on the sides and tail, except in the variety *S. tennantii*, in which the upper parts and tail are quite black. A pale band across the crown of the head between the ears. Lower parts with the whole forearm and lower parts of tibia all round buff or whitish. Forehead dark, generally black or blackish; sides of head and end of muzzle pale; ears usually dark, but not always. A black streak behind the eye down the side of the neck, often indistinct, but sometimes double. Toes and sometimes the whole feet black. Terminal portion of tail occasionally with long white tips to the hairs. Basal half of dorsal fur dark brown, of ventral dusky.

* *S. macrurus*, Gray and Hardwicke, *Ill. Ind. Zool.* ii, pl. xix, is not this species, but, I think, a variety of *S. bicolor*. *S. albipes*, Blyth, *J. A. S. B.* xxviii, p. 287, though referred to *S. macrurus* by Anderson, is also, I think, *S. bicolor*.



Dimensions. Head and body 13 to 15½ inches, tail rather less, or with the hair rather more. Basal length of skull 2·15, width across zygomatic arches 1·6.

Distribution. Ceylon and the Southern part of the Indian Peninsula, in forests, especially hill-forest. The most northerly localities known are the Shevaroy Hills (whence skins have been sent to me by Mr. Daly), Mysore, and the Nilgiris.

Varieties. The colour varies considerably, and according to Kelaart changes from dark brown to grizzled grey with the seasons, but the only race deserving of notice is that called *S. tennantii* by Layard. This is peculiar to the higher ranges in Ceylon, is decidedly larger in size than typical *S. macrurus*, and has the upper parts, tail, and toes perfectly black, some white tips being occasionally, not always, found on the hair of the tail. Forearm and tibia outside and inside coloured like the abdomen as usual.

I can find nothing especial recorded of the habits.

242. *Sciurus ferrugineus*. The bay Squirrel.

Sciurus ferrugineus, *F. Cuv. Hist. Nat. Mam.* pl. 238 (1829); *Blyth, J. A. S. B.* xxxi, p. 332; *id. Cat.* p. 101; *id. Mam. Birds Burma*, p. 36; *Anderson, An. Zool. Res.* p. 243; *M.-Edwards, Bull. Soc. Philom.* sér. 7, i, p. 16.

Sciurus kerandrenii, *Reynaud, Lesson, Cent. Zool.* p. 11, pl. i (1830); *Blyth, J. A. S. B.* xvi, p. 872, xxiv, p. 474; *Blanford, J. A. S. B.* xxxi, p. 194.

Colour rich ferruginous red almost throughout, varying from bright to deep chestnut and to brownish red, the middle of the back sometimes darker, the paws occasionally blackish, and the end of the tail in one variety white.

Dimensions. Head and body 8 to 10 inches, tail without hair 9 to 12, with hair 11 to 15, hind foot 1·85 to 2·1. The large dimensions are from a Bhámo specimen; the smaller from a Rangoon one preserved in spirit.

Distribution. Throughout Upper Burma, Arrakan, Pegu, and Siam, but not recorded from Martaban or Tenasserim. Common near Rangoon. I have a skin of a rusty-red squirrel from Sikhim which may belong to the present species.

Varieties. In Burma the variation in this squirrel is only from bright chestnut to brownish red, but Anderson and others unite with this form the white *S. finlaysoni* from Siam, the jet-black *S. germani* from the island of Sichang, and other forms, some of them grizzled brown. If *S. finlaysoni* be really identical, the name which was given by Horsfield, in his 'Zoological Researches in Java,' published in 1824, has priority over *S. ferrugineus*. See Anderson, l.c.

243. *Sciurus locria*. *The orange-bellied Himalayan Squirrel.*

Sciurus lokriah, Hodgson, *J. A. S. B.* v, p. 232 (1836); Blyth, *J. A. S. B.* xvi, p. 873, xxiv, p. 475; *ed. Cat.* p. 104; *id. Mam. Birds Burma*, p. 37; Jerdon, *Mam.* p. 169; Anderson, *An. Zool. Res.* p. 250

Sciurus locria, Hodgson, *J. A. S. B.* x, p. 915.

Sciurus subflaviventris, MacClelland, Gray, *List Mam. B. M.* p. 144 (1843), no description; Horsfield, *Cat.* p. 152.

Lokria, Nepal; *Zhamo*, Bhot.; *Kalli* or *Kalli ting-dong*, Lepcha.

Tail shorter than the head and body. Snout elongate, narrow. Teeth small. Length of the five upper molars together about half that of the nasals. Three pairs of mammae, 1 pectoral, 2 inguinal.

Colour above usually dark rufous-brown, slightly speckled, sometimes speckled dark yellowish brown, sides a little paler. Dorsal fur leaden black at the base, the longer hairs having a single yellow ring and a long black tip. A white or whitish patch behind each ear, often concealed by the coch. Lower parts from chin to vent more or less orange, varying from pale to bright rusty red; the rufous colour is often confined to the middle of the abdomen, and passes gradually into the brown of the sides. Tail not distinctly annulated, blackish or dark brown throughout, sometimes hoary, the hair whitish or pale rufous at the base, then deeper rufous, a dusky ring intervening sometimes, the terminal portion black, sometimes with the extreme tip white.

Dimensions. Head and body 8 inches, tail without hair 5·75, with hair 8·25; basal length of skull 1·2, extreme length 2, zygomatic breadth 1·1. Weight 7 ounces.

Distribution. Nepal, Sikhim, and hills north and south of Assam, Manipur, and Arrakan. This species occurs chiefly, perhaps exclusively, at some elevation above the sea, in Sikhim up to 7000 or 8000 feet.

This squirrel may be distinguished from *S. loeroides* by its longer and more pointed nose and smaller molars, by having one yellow ring instead of two on the longer dorsal hairs, by the whitish patch behind the ear, and by the want of distinct annulation in the tail-hairs, also generally by being more rufous above and below. To the same peculiar group as *S. locria* belong *S. pernyi* and *S. rufigenis*, the three being in fact little more than local races of the same species.

244. *Sciurus rufigenis*. *The red-checked Squirrel.*

Sciurus rufigenis, Blanford, *J. A. S. B.* xlvii, pt. 2, p. 156, pls. vii, viii (1878); Thomas, *P. Z. S.* 1886, p. 71.

Tail without hair considerably shorter than the head and body. Snout elongate, pointed. Much woolly underfur mixed with the hair on the back.

Colour above and on sides of body a fine mixture of yellow and black, the general tint speckled yellowish brown, darker in the middle of the back. Dorsal hairs dark slaty at the base, then



black with one pale yellow ring near the end. A distinct whitish spot behind each ear, often concealed by the cone. Muzzle rufous; cheeks bright ferruginous red, vibrissæ black; chin and fore neck white, sometimes more or less tinged with rufescent; breast and abdomen purer white, the hairs dusky at the base. Tail nearly black above, rich ferruginous below, the hairs on the upper surface black with one white ring near the base and white tips; on the lower surface, chestnut with long black white-tipped terminations. The red beneath the tail extends around the vent and to the back of the thighs.

Dimensions. Head and body 8 inches, tail without hair 6·5, with hair 7·8, hind foot 1·8; extreme length of skull from occiput to end of nasals 2·1, basal length about 1·75, zygomatic breadth 1·2.

Distribution. The sides of Muleyit mountain about 70 miles east of Moulmein, in dense forest at an elevation of 4000 to 6000 feet. Also found in Karennee by Mr. L. Fea. An allied species, *S. pernyi*, occurs in Se-chuen, China.

245. *Sciurus erythræus*. Pallas's Squirrel.

Sciurus erythræus, Pallas, *Glîres*, p. 377 (1778); Blyth, *J. A. S. B.* xi, p. 970, xvi, p. 872, xxiv, p. 473; *id.* *Cat.* p. 102; Anderson, *An. Zool. Res.* p. 236; Thomas, *P. Z. S.* 1886, p. 61.

Sciurus hippurus, McClelland, *P. Z. S.* 1839, p. 151; Horsfield, *Cat.* p. 154, partim, nec Geoffroy.

Sciurus erythrogaster, Blyth, *J. A. S. B.* xi, p. 970 (1842), xvi, p. 871, xxiv, p. 473; *id.* *Cat.* p. 102.

? *Sciurus piceus*, Peters, *P. Z. S.* 1866, p. 429.

Macroxus punctatissimus, Gray, *A. M. N. H.* (3), xx, p. 283 (1867).

Sciurus sladeni and *S. gordonii*, Anderson, *P. Z. S.* 1871, pp. 139, 140; *id.* *An. Zool. Res.* pp. 240, 242, pls. xix, xx.

Kherwa, Manipuri.

Tail bushy, longer than head and body. Two pairs of mammae, ventral and inguinal. Soles of feet smooth, not tubercular, between the pads.

Colour above varying from almost black through speckled blackish olive to pale olive and to rufous or yellowish brown, or occasionally speckled grey. Hairs leaden black at the base, then yellow (whitish or orange) and black alternately, usually two rings of each, the tip black. Lower parts varying from rusty red to deep bay, usually rich chestnut; in some varieties the chin, fore neck, and a stripe down the middle of the abdomen are of the same speckled olive or brown colour as the sides. In some forms too the ears and muzzle, and in one race (*S. sladeni*) the head and feet, are bright ferruginous like the lower parts. The tail is either rufous throughout or annulated by each hair having six or eight alternating rings of black and grey, and the terminal portion, varying from the tip to the greater part of the tail, is either black or ferruginous red.

Dimensions. A Manipur male measured, head and body 7·5 inches, tail without hair 9·5, with hair 12. Judging from other skins, the tail may in this case have been proportionally longer than



usual. Extreme length of skull from occiput to end of nasals 2, basal length 1.75, zygomatic breadth 1.15.

Distribution. Assam, the hills to the south (Khâsi, Gâro, &c.), Cachar, Chittagong, Manipur, and Upper Burma; also (if, as I believe, *S. castaneiventris* is not distinguishable) China. *S. piceus* is said to be from Tenasserim.

Varieties. The following are the principal races that I include under *S. erythræus* :—

1. Typical *S. erythræus* from the Khâsi hills and neighbourhood. This has the upper surface light olive, lower parts chestnut, and the terminal portion of the tail, two thirds or more, coloured like the belly, the extreme tip sometimes whitish; the ears are rufous.
2. *S. erythrogaster* from Manipur. Upper surface dark olive, lower parts chestnut to bay, feet and terminal half or more of the tail black.
3. *S. punctatissimus* (and, as I believe, *S. piceus* of Peters) from Cachar. Upper parts very dark almost black, tail and feet black, lower parts dark bay.
4. *S. gordonii* from Upper Burma, north of Ava. The upper parts brown or olive, more or less rufescent; lower parts pale to deep ferruginous, with a distinct median band along the breast and abdomen coloured and speckled like the sides, the throat and fore neck sometimes speckled olive, sometimes ferruginous. Tail annulated, tip rufous or white, sometimes a black bar between the annulated part and the rufous or white tip. A very similar variety is found in Upper Assam.
5. *S. sladeni* from Thigyain, Upper Burma. Upper parts speckled rufous-olive. Head, feet, termination of the tail, and all the lower parts ferruginous red.

246. *Sciurus quinquestriatus*. *Anderson's Squirrel*.

Sciurus quinquestriatus, *Anderson*, *P. Z. S.* 1871, p. 142, pl. x; *id.* *An. Zool. Res.* p. 266; *Blyth*, *Mam. Birds Burma*, p. 37.

Posterior foot-pads on hind feet linear, soles between pads smooth.

Colour above and on the sides black and yellow or orange mixed to form a speckled brown or olive; dorsal fur leaden black at the base, then annulated with alternate rings of yellow and black, the tip black; the middle of the back often more rufous. Breast and belly white, with three longitudinal dark brown or black stripes, sometimes punctulated, one stripe median, the other two lateral between the white and the olive of the side; the white is sometimes reduced to two narrow stripes. Tail the same colour as the back except at the tip; tail-hairs annulated with yellow or whitish and black, four or five rings of each colour, terminal hairs black with white tips.

Dimensions. Head and body $9\frac{1}{2}$ inches, tail without hair 9, hind foot 1.9; basal length of skull 1.8, zygomatic breadth 1.2.



Distribution. Only obtained as yet on the Kakhyen hills near Bhámo, Upper Burma.

247. *Sciurus phayrei*. *Phayre's Squirrel*.

Sciurus phayrei, Blyth, *J. A. S. B.* xxiv, pp. 472, 476 (1855), xxxi, p. 332; *id.* *Cat.* p. 104; *id.* *Mam. Birds Burma*, p. 36; *Peters*, *P. Z. S.* 1866, p. 429; *Blanford*, *J. A. S. B.* xlvii, pt. 2, p. 160; *Anderson*, *An. Zool. Res.* p. 230.

Sciurus caniceps phayrei, *Thomas*, *P. Z. S.* 1886, p. 69.

Colour. Upper parts speckled greyish brown, the back sometimes with a rufous tinge; dorsal hairs leaden black at the base, then isabelline and black alternately, two rings of each, the tip black. Feet and lower parts light rufous, a black or blackish band on each side of the rufous abdomen from axil to groin. Tail concolorous with the back above and at the sides; below, in the middle, at all events towards the base, pale rufous like the abdomen; tip of the tail black for one or two inches; tail-hairs generally with 4 or 5 rings of each colour, isabelline and black.

Dimensions. Head and body of a female 9·6 inches, tail, without hair 8·8, with hair 11, hind foot from heel 1·8; weight 8 oz. Basal length of skull 1·9, extreme length 2·15, zygomatic breadth 1·25.

Distribution. The province of Martaban in Burma, ranging north to the southern border of the Karennee country.

This form doubtless passes into *S. pygerythrus*, as in some skins the characteristic dark lateral bands are indistinct.

248. *Sciurus pygerythrus*. *The Irrawaddy Squirrel*.

Sciurus pygerythrus, Geoffroy, *Mag. Zool.* 1832, Cl. 1; *Bélangier*, *Voyage, Zool.* p. 145, pl. 7 (1834); Blyth, *J. A. S. B.* xvii, p. 345, xxiv, p. 475, xxxi, p. 333; *id.* *Cat.* p. 103; *id.* *Mam. Birds Burma*, p. 37; *Anderson*, *An. Zool. Res.* p. 227.

Sciurus blanfordi, Blyth, *J. A. S. B.* xxxi, p. 333, xxxii, p. 73; *id.* *Cat.* p. 104; *id.* *Mam. Birds Burma*, p. 36; *Anderson*, *An. Zool. Res.* p. 230.

Colour above speckled olive-brown to grey, below light rufous or buff. Feet sometimes buff like the lower parts, sometimes not. Dorsal hairs leaden black at the base, then white or isabelline and black alternately, usually two rings of each, the tips black. Tail coloured like the back, except the tip, which is black and well defined; tail-hairs annulated, with about four rings of each colour, whitish and black.

Dimensions. Head and body about 9 inches, tail without hair rather less; basal length of skull 1·75, extreme length 2·05, zygomatic breadth 1·25.

Distribution. Throughout the Irrawaddy valley in places from the neighbourhood of Rangoon, where it is common, to above Ava.

Varieties. *S. blanfordi*, the Ava and Upper Burma race, appears to be only a greyer form of the more olivaceous *S. pygerythrus* of Pegu.

249. *Sciurus caniceps*. The golden-backed Squirrel.

Sciurus caniceps, Gray, *A. M. N. H.* x, p. 263 (1842); *Blyth, Mam. Birds Burma*, p. 36; *Anderson, An. Zool. Res.* p. 229; *Blanford, J. A. S. B.* xvii, pt. 2, p. 161; *Thomas, P. Z. S.* 1886, p. 68.

Sciurus chrysonotus, *Blyth, J. A. S. B.* xvi, p. 873, pl. xxxvii, fig. 1, xxiv, p. 474; *id. Cat.* p. 103; *Peters, P. Z. S.* 1866, p. 429.

Sciurus concolor, *Blyth, J. A. S. B.* xxiv, p. 474; *id. Cat.* p. 103.

Two pairs of mammae, one ventral and one inguinal, as in all allied forms. Feet very broad. Soles of all feet bearing granular tubercles between the pads.

Colour above speckled greyish olive to rufous olive, the back in the typical form changing in winter to orange or pale ferruginous red. The dorsal hairs are blackish at the base, and in the grey or olive (summer) phase the terminal portion is alternately yellow and black, 2 rings of each, the tip being black. In the orange (winter) phase all the terminal portion is orange. Head, frequently pale grey. Lower parts speckled grey or olivaceous grey, often with a median dark line. In Southern specimens the flanks and sides of the neck are bright rufous. Tail indistinctly annulated, each hair coloured alternately whitish and black, usually about 4 rings of each; tip of the tail for about 2 to 3 inches black.

Dimensions of a female: head and body 8·7 inches, tail without hair 9·8, with hair 12·1, hind foot 1·2, ear 0·5. In a male the tail, without hair, is shorter than the head and body. Basal length of skull 1·95, extreme length 2·3, zygomatic breadth 1·35.

Distribution. From the neighbourhood of Moulmein, through to the Tenasserim provinces and Malay Peninsula. Rare in Amherst.

Varieties. Two forms are included under this species, because in the ordinary summer vesture they are indistinguishable; as, however, one has a distinct breeding livery and the other has not, it is doubtful whether the two should not receive different names. These forms are:—

1. Typical *S. caniceps* (*S. chrysonotus*, Blyth), the form found in Northern Tenasserim near Moulmein. This is paler and greyer than the next variety, and both sexes in winter have the back orange. Mr. Thomas has shown, from the examination of a large series of dated specimens, that the yellow colour of the back begins to appear in patches about October, and to disappear and be replaced by grey hair about March.
2. *S. concolor*, found in Southern Tenasserim and the Malay Peninsula. This is darker in colour, both above and below, and has no seasonal change. Malay Peninsula skins have the sides of the neck and flanks rufous.

Habits. Probably precisely the same as those of all the allied forms. Beavan found the nest of this squirrel in July with one young one in it, and observed that the species occurs at times near houses, and occasionally descends to the ground to feed, but never remains there long. The breeding-time apparently is in the spring.

250. *Sciurus griseimanus*. The grey-footed Squirrel.

Sciurus griseimanus, A. Milne-Edwards, *Rev. Mag. Zool.* xix, p. 195 (1867); *Anderson, An. Zool. Res.* p. 233.

Colour speckled greyish brown above; dorsal hairs leaden black at the base then whitish and black alternately, two rings of each. Feet and lower parts pale isabelline or pale fawn. Tail coloured like the back, lower surface near the base the same colour as the abdomen, occasionally a small black tail-tip; tail-hairs generally with 4 or 5 rings of each colour, isabelline and black.

Dimensions of type: head and body 10 inches, tail the same; of Burmese skins apparently somewhat less.

Distribution. Cochin China and Cambodia. A single specimen has been procured by Mr. L. Fea at Kyouk Myoung, Upper Burma.

This squirrel is nearly allied to both *S. locroides* and *S. pygerythrus*, and evidently passes into both.

251. *Sciurus locroides*. The hoary-bellied Himalayan Squirrel.

Sciurus lokroides, *Hodgson, J. A. S. B.* v, p. 232 (1836); *McClelland, P. Z. S.* 1839, p. 152; *Blyth, J. A. S. B.* xvi, p. 873, xxiv, p. 475; *id. Cat.* p. 104; *Jerdon, Mam.* p. 169; *Anderson, An. Zool. Res.* p. 247. *Sciurus locroides*, *Hodgson, J. A. S. B.* x, p. 915.

Sciurus assamensis, *McClelland, apud Gray, List Mam. B. M.* p. 143 (1843), no description; *Blyth, J. A. S. B.* xxiv, p. 475; *id. Cat.* p. 103; *id. Mam. Birds Burma*, p. 37.

Sciurus blythii, *Tytler, A. M. N. H.* ser. 2, xiv, p. 172 (1854).

Sciurus lokrioides and *Macroxus similis*, *Gray, A. M. N. H.* (3) xx, pp. 274, 281.

Snout short. Teeth larger than in *S. locria*. The length of the upper 5 molars together is about two thirds of that of the nasal bones. Usually two pairs of mammae, more rarely three pairs, all ventral or inguinal.

Colour of upper parts, head, body, and tail speckled olive or yellowish brown, sometimes greyish brown, sides very little paler; feet the same as the sides; lower parts isabelline or greyish or pale rufous, more rarely light rufous-brown, sometimes speckled and occasionally with a faint median band. The colour of the abdomen passes gradually into that of the sides. Dorsal hairs leaden black at the base, then alternately yellow or whitish and black, generally two rings of each colour, the tip black; tail-hairs with about four rings of each colour. The terminal hairs of the tail have sometimes longer black tips than the others, but there is never a distinct black tail-tip. Some of the abdominal hairs are occasionally annulated. There is sometimes a rufescent tinge on the sides of the body and neck.

Dimensions. Head and body 8 inches, tail without hair 7·5, with hair 9·5; weight 8 oz. Basal length of skull 1·75, extreme length 2, zygomatic breadth 1·2.

Distribution. The Eastern Himalayas, Nepal, Sikhim, and Bhutan at low elevations, Assam and the Assam hills, Cachar, Tipperah,



Chittagong, Manipur, and Arrakan; also Eastern Bengal (Dacca), Upper Burma (Bhamo), and Prepara Island.

Varieties. The form called *S. assamensis* is scarcely distinguishable from typical *S. locroides*. There is, however, a well-marked variety found in Sikhim and further east, with the anterior surface of the thighs richly fulvous, lower parts generally grey. This is *Macroscus similis* of Gray. Anderson says that a jet-black squirrel found in Sylhet and Cachar is probably referable to the present species.

S. locroides appears to pass into *S. griseimanus* and also, I believe, into the Chinese *S. castaneiventris* through forms of the latter with little or no chestnut on the lower parts.

252. *Sciurus atridorsalis*. The black-backed Squirrel.

Sciurus atrodorsalis, Gray, *A. M. N. H.* x, p. 263 (1842); *Blyth*, *J. A. S. B.* xvi, p. 872, pl. xxxvii, fig. 3, xvii, p. 345, xxiv, p. 477, xxviii, p. 276, xxxi, p. 333; *id.* *Cat.* p. 105; *id.* *Mam. Birds Burma*, p. 36; *Peters*, *P. Z. S.* 1866, p. 428; *Blanford*, *J. A. S. B.* xlvii, pt. 2, p. 159; *Anderson*, *An. Zool. Res.* p. 233; *Thomas*, *P. Z. S.* 1886, p. 70.

Sciurus hyperythrus, *Blyth*, *J. A. S. B.* xxiv, p. 474; *id.* *Cat.* p. 102.

Foot broad; sole smooth, not granulated between the pads. Two pairs of mammae, ventral and inguinal.

Colour very variable. The upper surface speckled greyish or rufous brown, with generally, but not always, an elongate black patch in the middle of the back. In rufous specimens the head is distinctly ferruginous red. Dorsal hairs black at the base, then alternately yellow and black, two rings of each (or occasionally only one ring); the black hairs of the patch in the middle of the back are sometimes black throughout, sometimes have one pale ring and a long black tip. Lower parts, as a rule, chestnut or bay, but there is much variation as to the extent, the throat and breast being often coloured like the sides, speckled greyish, and occasionally the whole under surface is buff. In some skins the breast and a band in the middle of the chestnut belly are speckled greyish, as in the *S. gordonii* form of *S. erythreus*. Tail, as a rule, subannulate, the hairs being alternately ringed with isabelline and black, about 4 rings of each, but at times there are long pale or rufous tips to the hairs, and in some skins the hairs are chiefly or entirely rufous white, in others black with rufous tips. Vibrissae white, white mixed with black, or black.

Dimensions. Head and body 8·5 inches, tail without hair 7·4, with hair 10, hind foot without claws 1·8; extreme length of skull 1·95, basal length 1·7, zygomatic breadth 1·2.

Distribution. Northern Tenasserim, from considerably north of Moulmein to Tavoy. Common in Amherst. Not known certainly to occur further south. Some specimens have been procured in Lower Pegu.

Varieties. The excessive variability of this form in colour will be seen from the description. The pale lower surface in some skins may be due to immaturity, but the presence or absence of a



black patch on the back does not appear to be connected with age, sex, or season, so far as is known. Moulmein specimens appear always to have white vibrissæ; a large collection of skins from Myawadi, 65 miles north of Moulmein, have black vibrissæ, but all the latter have black backs. *S. hyperythrus* of Blyth is a very rufous variety without either black dorsal patch or white whiskers.

Habits. Tickell in his MS. notes states that this squirrel is more common in bushes and hedges near villages, clumps of bamboos and thickets, than in high forest. It has a low cackling cry, and makes a grunting noise when alarmed.

253. *Sciurus palmarum*. *The Palm-Squirrel*,
or common striped Squirrel.

Sciurus palmarum, *L. Syst. Nat.* i, p. 86 (1766); *Elliot, Mad. Jour.* L. S. x, p. 216; *Blyth, J. A. S. B.* xvi, p. 874; *id. Cat.* p. 100;

Jerdon, Mam. p. 170; *Anderson, An. Zool. Res.* p. 257.

Sciurus penicillatus, *Leach, Zool. Misc.* i, p. 6, pl. i (1814); *Horsfield, Cat.* p. 152.

Funambulus indicus, *Lesson, Illust. Zool.* pl. xliii (1832).

Sciurus brodei, *Blyth, J. A. S. B.* xviii, p. 602, xx, p. 166, xxi, p. 350; *Kelaart, Prod.* p. 53.

Sciurus kelaarti, *Layard, Blyth, J. A. S. B.* xx, p. 166; *id. A. M. N. H.* (2) ix, p. 336 (1852); *Kelaart, Prod.* p. 53.

Gilekri, H.; *Beral*, Lakhi, Beng.; *Tidra*, Tu, Kol.; *Khadi*, Mahr.; *Alatu*, Can.; *Urta*, Wadar, *Vodatu*, Tel.; *Chitta Anathan*, Tam.; *Lena*, Cingalese.

Ears covered with short hair. Tail with long hair throughout. Fur short. Naked sole of hind foot not extending quite to heel. Outer posterior pad of hind foot broadly oval, anterior to end of long inner pad. Two pairs of mammae, ventral and inguinal.

Colour of back finely speckled brown, varying from greyish or rufescent to almost black, with three well-marked whitish isabelline or pale rufescent longitudinal stripes from the back of the neck to the rump, the middle stripe extending sometimes on to the base of the tail. All three stripes are about $\frac{1}{2}$ to $\frac{1}{4}$ inch broad and sub-equal. Dark dorsal hairs black, with usually one pale rufous or isabelline subterminal ring. Head paler than back. Sides paler than back and frequently similar in colour to the pale dorsal stripes; the lateral border of the dark dorsal area sharply defined, so that the back may be considered as bearing 4 broad dark longitudinal bands, the two outer narrower than the two inner. Lower parts white, whitish or grey, the hair dusky at the base. Tail blackish or hoary, the hairs either whitish or rufous with two black rings, the more distal generally much the longer; tips of hair always whitish.

Dimensions. Head and body 5.5 to 6 inches, tail with hair rather more, hind foot 1.5; basal length of skull 1.35, extreme length 1.55, zygomatic breadth 0.9.

Distribution. Common throughout India and Ceylon in the more open and cultivated parts, especially near human habitations. Not found on the Malabar coast, nor east of the Bay of Bengal, nor in forest. To the west this squirrel extends into Sind and Baluchistan, though rare in both.

Habits. This is one of the commonest and best known animals of India, and of all wild mammals, in great part from its diurnal habits, it is perhaps the most familiar. It is commonly found in groves and gardens, and in avenues of trees along roads, especially on large banyan and pipal trees, and though often seen on palms, it is by no means particularly partial to them. It is very commonly seen feeding on the ground about trees, very rarely away from them, and it takes refuge in the branches when alarmed. It also very commonly inhabits the rafters and thatch of houses and enters rooms freely. From its abundance about cultivation and houses and from its not being found in forests, this species is probably a follower or "commensal" of the human race, as *Mus rattus*, *M. decumanus*, and *M. musculus* certainly are; and *S. palmarum* may be the semi-domesticated form of *S. tristriatus*, just as Mr. Dobson has suggested that *Crocidura cærulea* is of *C. murina*.

The food, as with other squirrels, consists of seeds, fruits, buds, &c., and according to McMaster of insects also. I have, I think, seen this species eat the flying termites or white-ants. McMaster says *S. palmarum* is said to destroy birds' eggs; but this he doubts, on the very reasonable ground that a nest robber would in the breeding-season cause much excitement among the small birds with which the squirrel lives on perfectly friendly terms. However, as Sterndale justly remarks, *S. vulgaris* is commonly accused of the same propensity in Europe. The cry of the palm-squirrel is a shrill chirp, resembling the note of a bird. The little animal is very easily tamed, having originally little or no fear of man.

The female has, according to Jerdon, two to four young at a birth. It constructs a rough bulky nest, of grass, wool and any fibrous matter it can obtain, in the branches of trees, or sometimes in the eaves or rafters of houses.

Blyth and Jerdon classed the small rufous striped squirrels, *S. brodei* and *S. kelaarti*, as varieties of the next species, which they thought replaced *S. palmarum* in Ceylon; but unless these small broad-striped forms from Ceylon, of which there are many specimens in the British Museum, are classed with *S. palmarum*, it is impossible to keep *S. tristriatus* distinct. Some of the Indian varieties with dark back and the tails rufous beneath, referred by various writers to *S. tristriatus*, must also be united to *S. palmarum*, if the two are kept separate.

254. *Sciurus tristriatus*. *The jungle striped Squirrel.*

Sciurus tristriatus, Waterhouse, *Charlesworth's Mag. Nat. Hist.* i, p. 499 (1837); *id.* *P. Z. S.* 1839, p. 118; Blyth, *J. A. S. B.* xvi, pp. 874, 1001, xviii, p. 601; *id.* *Cat.* p. 106; Kelaart, *Prod.* p. 51; Jerdon, *Mam.* p. 171; Anderson, *An. Zool. Res.* 258.

Sciurus (*Tamias*) *dussumieri*, A. Milne-Edwards, *Rev. Mag. Zool.* xix, p. 226 (1867).

Anan, Mal. Other Indian names same as those of the last species.

Structure as in the last except that the skull is broader in pro-



portion and the nose more produced. Colour very similar but darker; the back is black or blackish brown, with three narrow longitudinal white or whitish subequal stripes, not more in general than $\frac{1}{8}$ inch in width, and usually not extending so far back as the root of the tail. Head rufous above, sides greyish brown, belly whitish or grey; tail-hairs deep rufous, with black rings and a white tip.

Dimensions. Head and body 7.5 inches, tail without hair 6.25, with hair 7.5; basal length of skull 1.6, extreme length 1.8, zygomatic breadth 1.

Distribution. Throughout a great part of the peninsula of India and Ceylon, in forest regions. Anderson records this species also from Sikhim. Common in Malabar.

Habits. The voice is said by both Blyth and Jerdon to be quite different in character from that of *S. palmarum* and much less shrill. Although generally a denizen of the woods, this species has been known to enter and inhabit houses in places where the palm-squirrel does not occur, and a case is mentioned by Jerdon as occurring in his own house at Tellichery.

I feel much doubt as to the distinctness of this form from *S. palmarum*, which I suspect, as mentioned under that species, to be a semi-domesticated variety.

255. *Sciurus layardi*. *Layard's striped Squirrel*.

Sciurus layardi, Blyth, J. A. S. B. xviii, p. 602; *id.* Cat. p. 107; Kelaart, Prod. p. 53; Layard, A. M. N. H. (2), ix (1852), p. 335; Jerdon, Mam. p. 172; Anderson, An. Zool. Res. p. 260.

Colour above dark brown, faintly speckled; back blackish with three longitudinal pale bands, that in the middle orange or buff-coloured, well marked, running the whole length of the back, the lateral bands brownish, fainter and shorter. Dorsal hair black, with one small orange ring near the tip. Lower parts deep rusty red, hairs dusky at the base. Tail hoary above, ferruginous below. Basal half of caudal hair rather more rufous with one narrow black ring, terminal half black with whitish tips.

Dimensions. About the same as *S. tristriatus* or rather larger.

Distribution. The mountainous parts of Ceylon, and also, according to Jerdon, of Travancore.

Habits. A forest animal, like *S. tristriatus*, of which this may prove to be a variety.

256. *Sciurus sublineatus*. *The dusky striped Squirrel*.

Sciurus sublineatus, Waterhouse, P. Z. S. 1838, p. 19; Blyth, J. A. S. B. xvi, p. 875; *id.* Cat. p. 107; Jerdon, Mam. p. 173; Anderson, An. Zool. Res. p. 260.

Sciurus delesserti, Gervais, Mag. Zool. 1842, pl. 31.

Sciurus trilineatus, Waterhouse, Blyth, J. A. S. B. xx, p. 165 (1851); Kelaart, Prod. p. 54.



Size small. Naked sole of hind foot not extending quite to heel; outer posterior pad of hind foot oval, short, more distal in position than the long linear inner pad. Fur soft and dense.

Colour. Upper parts dull brown, finely speckled; middle of back deeper brown, with three indistinct narrow pale lines, closer together and shorter than in *S. palmarum* and its allies, and only extending in general from behind the shoulder to the loins. Dorsal hair leaden black at the base, then jet-black, with one or two whitish or orange rings. Lower parts pale brown, more or less rufescent, or dull grey. Tail-hairs with alternating orange or whitish and black rings of subequal length, 3 or 4 of each colour.

Dimensions. Head and body 5 inches, tail with hair rather more, hind foot 1·2; zygomatic breadth of skull 0·7.

Distribution. The mountains of Southern India, Wynaad, Nilgiri, Palni, Travancore &c., and Ceylon. Found as far north as Coorg. Not recorded from the Shevaroyes. According to Kelaart this squirrel is not found in Ceylon below 3000 ft. elevation.

This also is a forest animal, but, despite its stripes, has probably but little affinity with *S. palmarum* and its allies.

257. *Sciurus maclellandi.* The striped Himalayan Squirrel.

Sciurus maclellandi, Horsfield, *P. Z. S.* 1839, p. 152; *Blyth*, *J. A. S. B.* xvi, p. 875; *id.* *Cat.* p. 107; *Jerdon*, *Mam.* p. 173; *Anderson*, *An. Zool. Res.* p. 263; *Thomas*, *P. Z. S.* 1886, pp. 61, 71. *Sciurus pembertoni*, *Blyth*, *J. A. S. B.* xi, p. 887.

Sciurus barbei, *Blyth*, *J. A. S. B.* xvi, p. 875, pl. xxxvi, f. 3 (1847); *id.* *Cat.* p. 107; *id.* *Mam. Birds Burma*, p. 38; *Blanford*, *J. A. S. B.* xl ii, pt. 2, p. 164.

Sciurus maclellandi, var. *swinhoei*, *M.-Edw. Rech. Mam.* p. 308.

Ears covered outside with long hair forming a pencil. Tail with long hair below, but less bushy than in most squirrels. Three pairs of mammae, ventral and inguinal, the anterior pair nearer to the axil than to the groin.

Colour of upper parts dull greyish brown lighter or darker; a well-marked black stripe down the middle of the back with a pale band, ill-marked in Northern specimens, on each side; outside this again is a broad dark band, brown in Himalayan specimens, black in Tenasserim; again outside this is a broad pale buff or whitish band extending from the muzzle down each side of the head, neck, and body, and in some Tenasserim skins this pale band has an outer black border. Dorsal hairs black at the base. Hair on outside of ears black, the hairs on the tips of the ears with long white terminations. Lower parts varying from whitish or pale brown to buff or pale rufous or dull grey. Tail with alternating rufous, whitish, and black rings, usually rufous at the base, then black, then rufous, then a long subterminal black space and a whitish tip.

Dimensions. Head and body 4·5 to 5 inches, tail without hair 3·75 to 5, with hair 5 to 6, hind foot from heel 1·1. Weight about 2·5 oz. A Sikhim skull measures in extreme length 1·35, basal length 1·1, zygomatic breadth 0·8.



Distribution. Found in Sikhim and the Eastern Himalayas, extending eastward into China and as far as Formosa, also in the Assam hills, Cachar and Manipur, throughout the Tenasserim provinces and the Malay peninsula (I possess a specimen collected by Mr. Davison and labelled Malacca), and in Siam and Cochin China. I cannot find this species recorded from Arrakan or Pegu, nor was it obtained by Hodgson at Katmandu in Nepal. All his specimens apparently were from Darjiling.

Varieties. Two very distinct races occur within our area :—

1. Typical *S. macclellandi*, from the Eastern Himalayas, has but one black line on the back, in the middle, and only two distinct pale stripes, one on each side.
2. *S. barbei*, from Tenasserim, is altogether more brightly coloured and has four distinct buff stripes on the back, two on each side, and either 3 or 5 black stripes. Skins from Manipur are intermediate between the two races, and Chinese specimens (*S. macclellandi*, var. *swinhoei*) are duller in colour than Himalayan.

Habits. This squirrel is found in high forest, and, so far as is known, but rarely descends to the ground.

258. *Sciurus berdmorei*. *Berdmore's Squirrel*.

Sciurus berdmorei, *Blyth, J. A. S. B.* xviii, p. 603 (1849), xxviii, p. 418; *id. Cat.* p. 106; *id. Mam. Birds Burma*, p. 37; *Anderson, An. Zool. Res.* p. 261; *Thomas, P. Z. S.* 1886, p. 71; *Anderson, Fauna Mergui Arch.* i, p. 340.

Sciurus mouhoti, *Gray, P. Z. S.* 1861, p. 137; *Blanford, J. A. S. B.* xlvii, pt. 2, p. 162.

Muzzle long and narrow. Ears well clad. Tail with long hair beneath. Soles of the hind feet bare to the heel, and smooth, not tuberculated; the outer posterior pad is linear, but anterior in position to the long inner posterior pad. Three pairs of mammae, ventral and inguinal.

Colour above brown, finely speckled, rufescent on the back, yellower or greyer on the sides. There are two pale yellowish or whitish longitudinal bands on each side; the upper narrower and better defined than the lower. Between the two and above the upper pale band, the fur is darker as a rule and sometimes blackish, and occasionally there is a short black band in the middle of the back. Dorsal fur dusky at the base, then alternately orange and black, usually two rings of each, the tip black. Lower parts white, sometimes tinged with buff. Tail blackish, rendered hoary by the white tips, sometimes indistinctly annulated; hairs light brown or rufous at the base, then black, then rufous again, then for a considerable length black, to near the tips which are whitish.

Dimensions. Head and body 7 inches, tail without hair 5·5, with hair 7·5, hind foot 1·5; extreme length of skull 2.

Distribution. Martaban and Tenasserim, Mergui Archipelago, Cambodia and Cochin China.



Habits. This is said to be chiefly a ground squirrel, and Blyth doubts if it ever ascends trees. Probably, however, its habits are not unlike those of *S. palmarum*. It is said to be found about cultivation.

Subfamily ARCTOMYINÆ.

The marmots, of which this subfamily is composed, are Palearctic and Nearctic, and comprise three genera, *Arctomys*, *Spermophilus*, and *Cynomys*. Only the first of these, distinguished from the others by the want of cheek-pouches, is represented in the Himalayas within our limits. All the members of this subfamily are burrowers, and live in holes in the ground. Some inhabit mountains, others open plains.

Genus ARCTOMYS, Schreber (1792).

Form stout, tail short or moderate, ears very small. Thumb rudimentary.

Dentition : i. $\frac{2}{2}$, pm. $\frac{2-2}{1-1}$, m. $\frac{-3}{3-}$, as in *Sciurus*. Incisors not compressed. Anterior upper premolar larger than in squirrels, but still much smaller than the second; molars broad.

Synopsis of Indian Species.

- Tail less than $\frac{1}{2}$ head and body; colour greyish. *A. himalayanus*, p. 388.
Tail about $\frac{1}{3}$ head and body; colour greyish .. *A. hodgsoni*, p. 389.
Tail fully $\frac{1}{2}$ head and body; colour yellow .. *A. caudatus*, p. 390.

259. *Arctomys himalayanus*. The Tibet Marmot.

Arctomys himalayanus, Hodgson, *J. A. S. B.* x, p. 777, plate (1841), xi, p. 287; ("potius tibetensis hodie") xii, p. 409; Blanford, *J. A. S. B.* xliv, pt. 2, p. 121; id. *Yarkand Miss.*, Mam. p. 36, pls. xii, xii a; Lydekker, *J. A. S. B.* xlix, pt. 2, p. 7; Büchner, *Przewalski Reis.*, Säugeth. p. 25.

Arctomys hobac, Gray, *List Mam. B. M.* 1843, p. 148, partim; Blyth, *Cat.* p. 108, partim; Jerdon, *Mam.* p. 181, partim; Stoliczka, *J. A. S. B.* xxxiv, p. 111; Anderson, *P. Z. S.* 1871, p. 500.

Arctomys tibetanus, Adams, *P. Z. S.* 1858, p. 521.

Bria, Kashmir; *Pfff*, Niti; *Kadia-piu*, *Phya*, Tibetan; *Chibi*, Bhotia of Sikhim.

Tail about $\frac{1}{2}$ the length of the head and body. Six pairs of mammae, extending from the axil to the groin.

Colour of body and limbs pale tawny, much mixed with black on the upper parts; basal half of fur (basal third on belly) dark brown, terminal half pale fulvous, with black tips on the upper parts; face and terminal third of tail dark brown; cheeks sometimes rufescent.



Dimensions. Head and body 22 to 24 inches, tail without hair 5 to 5.5, with hair 6 to 6.5, hind foot 3.25; basal length of skull 3.85, extreme length 4.1, zygomatic breadth 2.6.

Distribution. Tibet north of the main Himalayan chain, from the neighbourhood of Lhassa to Ladák and the Kuenlun. Common in Rukshu and Ladák at elevations of from about 13,000 or 14,000 feet to 18,000. This species was also obtained in Northern Tibet by Przewalski.

Habits. This marmot inhabits the bleak dry plateau of Tibet in colonies, its burrows being most commonly found on the sides of valleys. It lives on roots and vegetables, coming out to feed in the morning and evening; it doubtless hibernates in the winter. The alarm cry is "a short chirping bark" according to Lydekker. Marmots are easily tamed, and the present species is no exception.

260. *Arctomys hodgsoni*. *The smaller Himalayan Marmot.*

Arctomys hemachalanus, *Hodgson, J. A. S. B.* xii, p. 410 (1843); *Jerdon, Mam.* p. 182; *Blanford, J. A. S. B.* xlv, pt. 2, p. 122; *nec A. himalayanus, Hodgson.*

Arctomys tibetanus, *Gray, Cat. Mam. &c. Nepal & Tibet*, 1846, p. 24; *id.* 2nd ed. p. 12; *nec A. tibetensis, Hodgson.*

Arctomys bobac, *Blyth, J. A. S. B.* xvi, p. 875, partim; *id. Cat.* p. 108, partim, *nec Schreber.*

Arctomys hodgsoni, *W. Blanford, Yarkand Miss., Mam.* p. 35; *id. P. Z. S.* 1880, p. 453.

Jabra, Bhotia.

Tail about a third as long as the body and head. Five or six pairs of mammae.

Colour almost identical with that of *A. himalayanus*, tawny, the dorsal fur dusky at the base and black-tipped, bridge of nose and end of tail dark brown. Sides of head, ears, and limbs rufous, especially in summer.

Dimensions. Head and body 12 to 13 inches, tail 5½, hind foot nearly 3. I believe these measurements, which are Hodgson's, are too small, and that the species grows to 16 or 18 inches from nose to vent. An adult skull measures 3.7 in extreme length, 2.4 in zygomatic breadth.

Distribution. Nepal, Sikhim, and Bhutan; probably Cis-Himalayan, whilst *A. himalayanus* is Trans-Himalayan.

Nothing is known of this species except in confinement. I have never seen the skin of a wild specimen, nor, I believe, has one been recorded, although there are, at present, no less than fifteen specimens in the Indian Museum, Calcutta, and this marmot is apparently far from rare in Sikhim. Hodgson had both this and *A. himalayanus* in confinement. The name *hemachalanus*, being identical with *himalayanus*, cannot be employed.

261. *Arctomys caudatus*. *The red or long-tailed Marmot.*

Arctomys caudatus, *Jacquemont, Voyage dans l'Inde*, iv, p. 66; *Atlas*, ii, pl. 5 (1844); *Blanford, J. A. S. B.* xlv, pt. 2, p. 122; *id. Yarkund Miss.*, *Mam.* p. 37, pls. xiii, xiii a; *Lydekker, J. A. S. B.* xlix, pt. 2, p. 7; *Scully, P. Z. S.* 1881, p. 204; *id. A. M. N. H.* (5) viii, p. 98.

Arctomys bobac, *Adams, P. Z. S.* 1858, p. 521; *Blyth, Cat.* p. 108, partim, *nec Schreber*.

Arctomys hemachalanus, *Anderson, P. Z. S.* 1871, p. 561, *nec Hodgson*.

Drun, Kashmir.

Tail about half the length of the head and body.

Colour yellowish tawny to orange, the back chiefly black, sometimes wholly black, in the middle, the hairs being black throughout; usually the dorsal fur is blackish at the base, then tawny and with long black tips. Face brown, blackish round the eye; tail black at the tip and usually for a considerable portion of the length, tawny towards the base. Lower parts and limbs brownish rufous, deeper in some examples than in others. The general tint is more rufous than in the other Himalayan species and the back is blacker.

Dimensions. Head and body about 2 feet, tail with hair 12 to 13 inches, hind foot 3·4; basal length of skull 4·1, extreme length 4·2, zygomatic breadth 2·6. Specimens from Astor appear smaller.

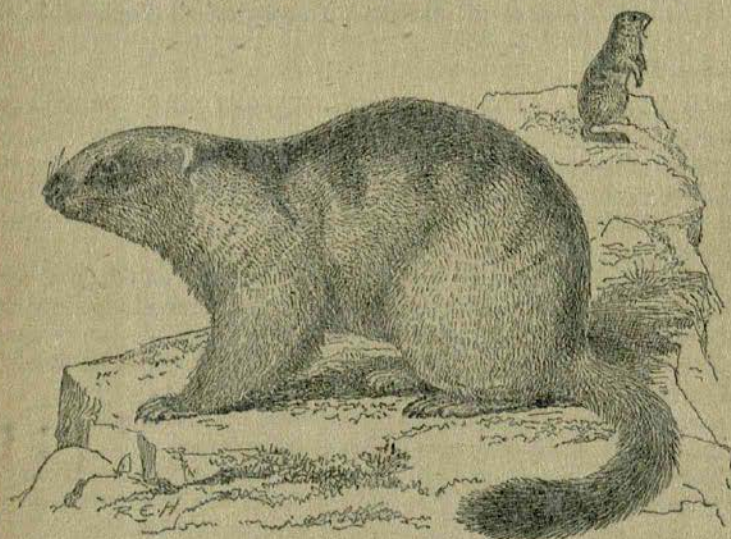


Fig. 124.—*Arctomys caudatus*.

Distribution. The ranges immediately north of Kashmir proper from Wardwan to Deosai and Astor, at elevations between 8000 and 14,000 feet. I can find no account of this marmot's occurrence east of Kashmir, nor is it found in Ladák except on the southern border.



Habits. Similar to those of *A. himalayanus* and other marmots. The call, however, is different; Adams describes it as a loud wailing cry, Lydekker as a long screaming whistle of great shrillness. *A. caudatus* inhabits comparatively fertile localities on the border of the dry region, and is found at a lower elevation than *A. himalayanus*.

Other Central-Asiatic species of marmot are *A. dichrous* from Northern Afghanistan, *A. aureus* from the mountains west of Yarkand, both allied to *A. caudatus* but smaller, and *A. robustus* from Eastern and North-eastern Tibet, allied to *A. himalayanus* but classed as distinct by Milne-Edwards and Büchner. A *Spermophilus*, *S. bactrianus*, has recently been described by Dr. Scully from Afghan Turkestan.

Family DIPODIDÆ.

The present subdivision is composed of the Asiatic and African jerboas, the North-American jumping mice (*Jaculus*), the Cape jumping hare (*Pedetes*), and a few other forms. As a rule they are distinguished by hind limbs of disproportionate length and a long hairy tail, and both in their form and mode of progression resemble kangaroos. They not only move quickly by jumping on their hind legs, but are said to use their tails to aid their movements.

The molars have transverse enamel-folds, the incisors are compressed. The brain-case is short and broad, the infraorbital opening rounded and very large, the zygomatic arch slender and curved downwards, the malar ascending in front of the orbit to the lachrymal in a flattened perpendicular plate, the mastoid (supratympanic) part of the bulla generally greatly developed. The elongated metatarsals are united to form a cannon bone. Hind feet with but three functional digits. Cervical vertebræ more or less ankylosed.

A single species just enters the margin of the Indian area from Central Asia.

Genus **ALACTAGA**, F. Cav. (1836).

Syn. *Sciirtetes*, Wagner.

On the hind foot there are 5 toes, the first and fifth not reaching the ground. Tail long, cylindrical, tufted at the end. Ears long.

Dentition: i. $\frac{2}{2}$, pm. $\frac{1-1}{0-0}$, m. $\frac{3-3}{3-3}$. Incisors not grooved; premolars small, sometimes lost, two anterior molars in both jaws much larger than the third, and bearing external and internal enamel-folds that become loops with wear.

262. *Alactaga indica*. *The Afghan Jerboa*.

Alactaga indica, Gray, *A. M. N. H.* x, p. 262 (1842); *Hutton*, *J. A. S. B.* xv, p. 137; *Blanford*, *Eastern Persia*, ii, p. 77; *Slater*, *P. Z. S.* 1880, p. 538.

Alactaga bactriana, *Blyth*, *Cat.* p. 110.

Khani, in Afghanistan.

The first and fifth toes of the hind foot are subequal, about 0·8 inch short of the middle toe, second and fourth toes 0·15 short. Toe-pads transversely grooved. Ears very long, exceeding the fore leg in length. Fur soft. Tail twice the length of the head and body.

Colour above fawn or light rufescent brown, sometimes mixed with black, becoming paler and more rufous on the sides; lower parts white, and a white band across the outside of each thigh, a black spot sometimes behind and inside the thigh just below the white band. Basal two-thirds or more of hair on the back ashy, light or dark, tips of hairs sometimes black. Tail light brown, the tuft of long hair at the end blackish brown except the tip, which is white.

Dimensions of a male: head and body 3·6 inches, tail without terminal hair 7, with terminal tuft 7·6, ear from crown of head 1·7, hind foot and tarsus 2·2; basal length of skull 1, zygomatic breadth 0·85.

Distribution. Afghanistan, South-eastern Persia, and Northern Baluchistan. Not uncommon on the plains south of Quetta at an elevation of about 6000 feet.

Habits. According to Hutton this jerboa is abundant in the stony plains of Afghanistan, burrowing deeply. When unearthed it bounds away with surprising agility on its hind legs. It is thoroughly nocturnal, sleeping soundly all day. It retires to its burrow in October and remains dormant till the following April. It is easily tamed. Major Money, who sent a living specimen to the Zoological Gardens, London, observed that this jerboa appeared not to require water in its natural state, though it drank in captivity. It fed on green wheat, rice, lucerne or maize, raw potatoes, gram or other grain, and dry biscuit.

The name given to this jerboa by Gray is very objectionable, as the species cannot be said to occur in India. Blyth's name *bactriana* is scarcely better. From the nearly allied *A. acontion*, Pallas, the present species is distinguished by its proportionally longer ears and tail.

Several other species of *Alactaga* and of *Dipus*, the latter having grooved incisors and only three toes on each hind foot, occur in Central Asia.



Family MURIDÆ.

This large and cosmopolitan family comprises the mice and rats, with a large number of allied forms. The following are the principal characters:—

Skull without postorbital processes. Infraorbital opening large, almost always wide above, and terminating below in a narrow groove, the outer wall of which is always a flattened plate, forming the lower root of the maxillary zygomatic process. Malar short and slender. Premolars none; dentition in all Indian genera i. $\frac{2}{2}$, m. $\frac{3-3}{3-3}$.

The number of subfamilies into which this family was divided by Peters and Alston (P. Z. S. 1876, pp. 69, 80), who have been followed by several writers, appears to me too large, and I cannot agree in placing *Nesocia*, which is barely distinguishable generically from *Mus*, in a distinct subfamily from the latter. At the same time, the classification of this extensive family is very difficult. The Indian forms may be thus classed, but the distinctive characters do not always apply to genera not found in India:—

A. Tail much more than $\frac{1}{3}$ total length, generally $\frac{1}{2}$ or more.

a. Crowns of worn molars with oblique subparallel bands of enamel; tail with long coarse hair.....

Platacanthomyinae.

b. Crowns of worn molars with transverse laminae forming oval or lozenge-shaped patterns; tail hairy; hind legs elongate.....

Gerbillinae.

c. Crowns of upper molars with 3 longitudinal rows of tubercles, lower with 2 rows (except in *Hapalomys*); worn molars with transverse enamel-bands curved or straight; tail naked or thinly clad, scaly.....

Murinae.

B. Tail (in all Indian forms) less than $\frac{1}{3}$ total length; all molars either with tubercles in 2 longitudinal rows, or composed of subtrigonal prisms similarly arranged..

Cricetinae.

As with other small mammals, the measurements are chiefly from specimens preserved in alcohol, and in these, especially if strong spirit has been used, the body contracts in length rather more than the tail, whilst membranous parts, such as the ears, shrink rather more in proportion than the body.

Subfamily PLATACANTHOMYINÆ.

Molars rooted, subequal in size, crossed by subparallel folds of enamel directed obliquely inwards and backwards. Anterior palatine foramina small, not extending back beyond the hinder margin of the premaxillaries. Auditory bullæ small. Coronoid process of mandible short. Tail long, hairy.

Genus PLATACANTHOMYS, Blyth (1859).

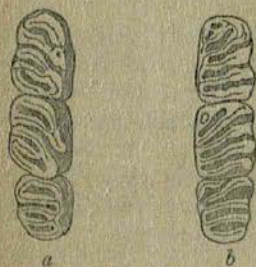


Fig. 125.—Crowns of (a) upper and (b) lower right molars of *P. lasiurus*, $\times 4$.

Form resembling that of a dormouse. Tail clad with long coarse straight hairs, arranged distichously towards the tip. Pollex and hallux short, clawless (the latter may sometimes bear a nail). Skull broad, flattened above behind; a well-marked supraorbital ridge on each side. Infraorbital foramen very large. Bony palate broad, imperfect, perforate. Incisors smooth, narrow.

A single known species peculiar to the hills near the Malabar coast.

263. *Platacanthomys lasiurus*. *The Malabar spiny Mouse*.

Platacanthomys lasiurus, Blyth, *J. A. S. B.* xxviii, p. 288 (1859); *id. Cat.* p. 109; Peters, *P. Z. S.* 1865, p. 398, pl. xx; Jerdon, *Mam. Ind.* p. 210.

Ears large, pointed, posterior margin slightly concave below the tip. Vibrissæ numerous, several of them more than twice the length of the head. Fur of the upper parts mixed with broad flat spines having thickened edges. Tail hairy throughout, the hair coarse but not spiny, and subdistichous, short near the body and gradually increasing in length towards the tip of the tail. Five pads on each palma, and 7 or 8 on the planta, including one long inner metatarsal pad and two or three outer, behind each other, all but the first small. Claws overhung by hair. Mammæ one pair pectoral and one inguinal (Blyth gives 2 pairs abdominal).

Colour above reddish brown, below nearly white, the colours not passing into each other; dorsal fur white at the base and for three quarters of its length or more, tips above brown. Feet white or whitish. Tail coloured like the back above and below, the extremity sometimes whitish.



Dimensions of an adult in spirit: head and body 4·5 inches, tail without hair 3·8, with hair 5, hind foot from heel 0·95, ear 0·8. Basal length of skull 1·05, extreme length 1·25, zygomatic breadth 0·7.

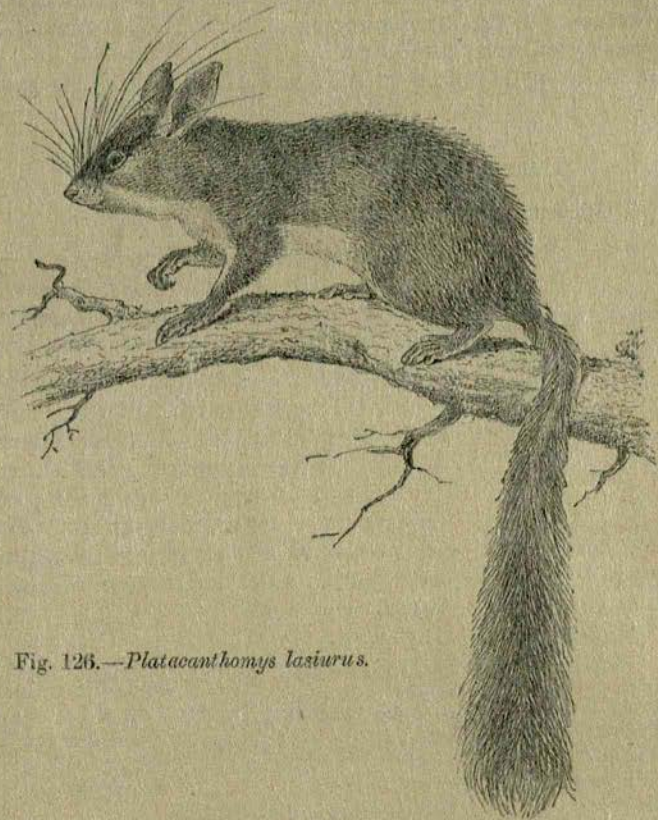


Fig. 126.—*Platacanthomys lasiurus*.

Distribution. Anaimalai and Travancore hills at elevations of more than 2000 feet above the sea. There is a specimen in the British Museum labelled Ootacamund, but I feel doubtful if the locality is correct. The species has not been recorded from Ceylon.

Habits. The Rev. H. Baker, who discovered *Platacanthomys*, informed Mr. Blyth that the species lived exclusively in large trees, in which these rats hollowed out little cavities that they filled with leaves and moss. They were said by the hill-people to destroy much pepper and to do serious damage to angely and jack fruit (*Artocarpus incisa* and *A. integrifolia*), also to be fond of fermented palm-juice or toddy.

Subfamily GERBILLINÆ.

Molars rooted, tubercular at first; when they are worn, the enamel forms transverse oval or lozenge-shaped patterns that after a time coalesce in the middle of the tooth. Auditory bullæ large. Hind limbs elongate; tail hairy.

This subfamily is found in Asia and Africa. A single genus is Indian.

Genus **GERBILLUS**, Desmarest (1804).

Syn. *Meriones*, Illiger (1811).

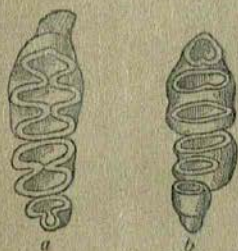


Fig. 127.—(a) Upper and (b) lower right molars of *G. indicus*, $\times 3$.

Tail long, hairy, with a terminal pencil of long hair. Head slightly elongate, ears moderate. Mammaræ 4 pairs: 2 pectoral, 2 inguinal. Large metacarpal pads.

Dentition: i. $\frac{2}{3}$, m. $\frac{3-3}{3-3}$. Upper incisors grooved longitudinally, anterior molar in both jaws composed of three transverse elliptical or lozenge-shaped areas, the second of two, and the third of one; the posterior upper molars with a more or less rudimentary second ridge or heel, soon disappearing with wear. Occipital region of the skull broad.

Synopsis of Indian and Ceylonese Species.

- | | |
|---|-------------------------------|
| A. Size of a rat. Snout to vent exceeding 4 in. | |
| a. Planta entirely naked | <i>G. indicus</i> , p. 396. |
| b. Distal half of planta hairy; ear 0.25 in. | <i>G. hurrianae</i> , p. 398. |
| c. Whole planta hairy; ear 0.45 in. | <i>G. erythrura</i> , p. 399. |
| B. Size of a mouse. Snout to vent less than 3.5 in. | |
| a. Planta with 6 pads, proximal half naked .. | <i>G. nanus</i> , p. 399. |
| b. Planta without distinct pads, hairy throughout | <i>G. gleadowi</i> , p. 400. |

264. *Gerbillus indicus*. The Indian Gerbille or Antelope Rat.

Dipus indicus, Hardwicke, *Linn. Trans.* viii, p. 279, pl. vii (1807).

Gerbillus indicus, F. Cuv. *Tr. Z. S.* ii, p. 143, pl. xxv, figs. 15-19;

Blyth, J. A. S. B. xxxii, p. 327; *id.* *Cat.* p. 110; *Jerdon, Mam.* p. 184; *Blanford, Eastern Persia*, p. 63.

Mus (*Gerbillus*) *indicus*, Elliot, *Mad. Journ. L. S.* x, p. 211.

Gerbillus cuvieri and *G. indicus*, Waterhouse, *P. Z. S.* 1838, p. 56.

Gerbillus cuvieri, Hutton, *J. A. S. B.* xv, p. 139.

Harna mus (antelope rat), H.; *Jhenku indur*, Beng.; *Pándhard undir*, Mahr.; *Yeri yelka*, Wadári; *Tel yelka*, Yenadi; *Billa ilei*, Canarese.

Tail longer than head and body. Ears moderate, rounded, thinly clad. Planta naked, distal portion granular. Two pads at



base of three middle toes, one inside the base of first and another inside the base of fifth toe, four in all. Eyes very large.



Fig. 128.—*Gerbillus indicus*.

Colour light brownish rufous, varying from sandy brown to fawn-colour above; lower parts white, the colours sharply divided at times (probably in summer fur only). Basal two-thirds or more of dorsal hair leaden grey, a few longer hairs on the back, especially towards the rump, with long black tips. Area above and behind the eye, a spot behind the ear, and the whole upper lip white. Tail with a light brown band down each side, above and below darker, the upper surface becoming blackish and clothed with longer hairs towards the end, which is tipped with a pencil of long dark hairs almost black. Feet whitish above. Planta pale or dusky.

Dimensions. Head and body 5 to 7 inches, tail 6 to $8\frac{1}{2}$, hind foot 1.3 to 1.7, ear from head 0.55 to 0.7; weight about 6 ounces. Basal length of a skull 1.65, extreme length 1.85, zygomatic breadth 1.

Distribution. Throughout India and Ceylon in suitable localities, extending west into Baluchistan, but not east of the Bay of Bengal.

Varieties. The Southern Indian form, *G. cuvieri*, is more slender, with longer tail and limbs, the planta dusky, and the first hind toe more proximally situated. Some specimens from Northern India are, however, similar, and there appears to be a complete gradation into the stouter typical *G. indicus*, which is found throughout Northern India, Sind, Baluchistan, &c. In a typical



male Madras specimen (*G. cuvieri*) the head and body measure 6.1 inches, tail 8.15, ear 0.7, hind foot 1.7; and in a Baluchistan male the corresponding dimensions are 5.9, 6.6, 0.7, and 1.4.

Habits. These have been described by Hardwicke, Elliot, and Jerdon. The Indian gerbille is thoroughly nocturnal and very rarely seen outside its hole by daylight. It inhabits uncultivated plains and sandy downs, very often on the borders of cultivation. Here it makes extensive burrows with numerous entrances, and large central chambers from half a foot to a foot in length, containing a bed of dried grass.

These rats feed upon roots and grass, especially *harayāli* (*Cynodon dactylon*), seeds and grain, and sometimes cause great damage to the crops. In 1878-79 they ravaged the grain-fields in the Deccan throughout several thousand square miles (Fairbank, J. A. S. B. xlviii, pt. 2, p. 143), cutting down jawāri (*Holcus sorghum*) and bājri (*H. spicatus*) stalks and feeding on the grain, part of which they stored in their burrows.

The Indian gerbille can make bounds of four or five yards at a time, and, as McMaster relates, often eludes dogs by its activity, sometimes jumping over their backs. The female has 8 to 12 young at a birth, occasionally, it is said, even more.

265. *Gerbillus hurrianæ*. The Indian desert Gerbille.

Gerbillus indicus, Hutton, J. A. S. B. xv, p. 137, nec Hardwicke.

Gerbillus erythourus, Jerdon, Mam. p. 185, App. p. iii, nec Gray.

Gerbillus hurrianæ, Jerdon, ib. p. 186; Blanford, Eastern Persia, ii, p. 68.

Tip of the nose projecting so as partly to cover the nostrils. Tail about equal to head and body. Ears small, rounded, hairy outside. Distal half of planta hairy, proximal half with a considerable naked area. Fur short. Transverse elliptical folds of anterior upper molar united in the middle at an early stage of wear. Bullæ very large. Eyes moderate.

Colour light brownish grey (sandy grey) above; sullied white below, the two colours passing into each other. Some skins are rufescent above. Basal half of dorsal fur dark brown or leaden black, tips of longer hairs, more numerous about rump, black. Tail all round nearly the same colour as the back, except towards the end, where the hairs are longer and black or dark brown. Face-markings indistinct. Feet brownish white above.

Dimensions. Head and body 5.5 to 6.75 inches, tail 5 to 6.5, with hair 5.75 to 7, ear from crown 0.25, hind foot 1. A skull measures: basal length 1.25, extreme length 1.4, zygomatic breadth 0.8.

Distribution. The dry regions of North-western India, Sind, the Punjab, and Western Rajputana, also Baluchistan and South Afghanistan up to about 4000 feet above the sea.

Habits. This gerbille abounds in sandy desert or semi-desert, and is particularly common in Sind and the Indian desert between the



Indus and Rajputana, where its holes are found everywhere, especially at the roots of bushes amongst the sand-hills. It is commonly seen out in the day, in the cold season at all events, and is by no means shy. It feeds on various seeds, especially the nuts of *Salvadora persica*, and on roots.

266. *Gerbillus erythrura*. *The Afghan Gerbille*.

Gerbillus erythrura, Gray, *A. M. N. H.* x, p. 266 (1842); Hutton, *J. A. S. B.* xv, p. 139; *Blanford, Eastern Persia*, ii, p. 70.

Nostrils partly covered by a fleshy pad. Tail about equal to the head and body. Ears rounded, moderate, hairy outside. Planta covered with hair except a narrow band along proximal part of inner margin. Fur soft, moderately long. Transverse folds of anterior upper molar united in the middle at an early stage of wear. Bullæ very large.

Colour light sandy brown above, white below, the two passing gradually into each other on the sides. Some specimens are pale rufous above. Basal two thirds of the dorsal hair dark ashy. A few long black-tipped hairs on the lower back. Feet sullied white above. A pale band above the eye, extending to the ear. Tail more or less rufous-brown, not banded, uniformly coloured all round to near the tip, when long blackish hair comes in at first above and afterwards throughout.

Dimensions. An adult male in spirit measures: head and body 4·75 inches, tail without hair 4·75, with hair 5·5, ear from head 0·45, hind foot 1·3. A skull measures: basal length 1·35, zygomatic breadth 0·95.

Distribution. Throughout an extensive area in Afghanistan and Southern Persia, keeping to considerable elevations. I shot specimens at Mehtarzai near Quetta, where the species was obtained by Hutton.

Habits. This species, like *G. hurriana*, makes its holes at the roots of bushes or in sandy banks and mounds, generally in semi-deserted tracts, but often near habitations. The animals may be seen out feeding at all hours of the day in the cold season.

267. *Gerbillus nanus*. *The little Gerbille*.

Gerbillus nanus, W. Blanford, *A. M. N. H.* (4) xvi, p. 312 (1875); *id. Eastern Persia*, ii, p. 72, pl. v, fig. 1.

Nostrils inferior in position, partly covered by the snout. Tail long, more than one and a half times the length of the head and body. Proximal half of planta smooth, naked; distal half granular, with scattered hairs and bearing three pairs of pads. Two metacarpal pads. Vibrissæ very long. Ears oval, thinly furred.

Colour pale fawn above, white below, the two colours blending. Dorsal hairs ashy grey for basal two thirds. Tail light brown



above, becoming rather darker at the tip, but not black, white beneath, no light bands down the sides. Supercilium and sides of face in front of the eyes with most of the vibrissæ white.

Dimensions. Head and body 2·8 inches, tail without hair 4·45, with hair 4·85, hind foot 0·85, ear from orifice 0·45. A skull measures 1·05 in extreme length by 0·55 broad.

Distribution. I first procured this Gerbille west of Gwádar in Baluchistan and have since obtained it at Sukkur and at Laki near Sehwan in Sind. It appears rare. A very similar, probably identical, form is found in Arabia and on the Abyssinian coast-land.

268. *Gerbillus gleadowi*. *The little hairy-footed Gerbille.*

Gerbillus gleadowi, Murray, A. M. N. H. (5) xvii, p. 246 (1886).

Nostrils inferior, partly covered by snout. Tail more than one and a half times the length of the head and body. Planta thinly covered with hair throughout; no distinct pads, an irregular swelling at the base of the toes. Palma swollen, hairy, with one large naked pointed metacarpal pad near the base of the rudimentary pollex. Ears well clad.

Colour rufous-fawn above, white below, the two colours well defined, basal two thirds of dorsal fur slaty. Tail almost uniform pale brownish, paler below, whitish near the tip; the terminal pencil brown above, white below. Supercilium, sides of face in front of the eyes, and all vibrissæ except the uppermost white; a rufous cheek-patch.

Dimensions. Head and body 3·25 inches, tail without hair 5, with hair 5·4, hind foot 1. Extreme length of skull 1·12, basal length 0·9, breadth 0·6.

Distribution. Rohri district, Upper Sind, is the only locality whence this Gerbille has hitherto been obtained.

Gerbillus swinhoei (Scully, A. M. N. H. (5) viii, p. 228, 1881) is rather larger than *G. gleadowi*, but much like that species, except that it has a very much shorter tail, the palma naked, and two metacarpal pads. Planta hairy throughout. Head and body 3·4 inches, tail without hair 3·1, with hair 3·5, hind foot 0·93. Found halfway between Kandahar and the Kojak Pass, and to be looked for around Quetta. Several species of *Gerbillus* inhabit Central and Western Asia and Africa, but none are found in Burma, the Malay Countries, or Southern China.

Subfamily MURINÆ.

Molars rooted, tubercular at first, the tubercles on the upper molars disposed in a triple row longitudinally. When worn the molars exhibit transverse laminæ of enamel. Tail elongate, scaly, and in general nearly naked.



The Indian genera are thus distinguished:—

- | | |
|---|---------------|
| A. Tubercles on anterior lower molars in 3 longitudinal series. | HAPALOMYS. |
| B. Tubercles on lower molars in 2 series. | |
| a. First and fifth digits of all feet with flat nails .. | VANDELEURIA. |
| b. Pollex and hallux only with flat nails, crowns of molars deeply grooved longitudinally | CHIROPODOMYS. |
| c. Pollex (thumb) only with a flat nail, other digits (except hallux in <i>Mus chiropus</i>) with compressed claws; crowns of molars not deeply grooved. | |
| a'. Upper incisors not grooved. | |
| a''. Dorsal fur wholly or chiefly composed of hair. | |
| a. Form slender; transverse laminae of molars considerably curved. | MUS. |
| β. Form stout; laminae nearly or quite straight | NESOCIA. |
| b'. Back entirely covered with stout spines .. | ACOMYS. |
| b'. Upper incisors grooved longitudinally | GOLUNDA. |

Genus **HAPALOMYS**, Blyth (1859).

Hallux terminating in a broad tip bearing a flat nail. Each of the other digits (except the rudimentary pollex) swollen at the end into a lobe, which is deeply grooved longitudinally above, pitted at the anterior end of the groove, and transversely furrowed below to the end like the remainder of the digit. The claws, which are blunt and but little curved, apparently lie in the groove, especially in the fore feet, which have much shorter claws than the hind feet. In both, however, the tips of the digits project beyond the claws. Tail long, terminal portion flattened laterally. Skull with

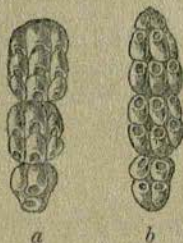


Fig. 129.—Crowns of (a) upper and (b) lower right molars of *H. longicaudatus*, $\times 3$.

the nasals short, anterior border of zygoma-root vertical. Incisors smooth, lower incisors very broad: the two anterior molars in both jaws with tubercles arranged in 3 longitudinal series.

This genus, containing a single known species, differs from all other Muridae in having the tubercles of the anterior lower molars triserially arranged.

269. *Hapalomys longicaudatus*. *Berdmore's Rat*.

Hapalomys longicaudatus, Blyth, *J. A. S. B.* xxviii, p. 296 (1859), xxxii, p. 353; *id. Cat.* p. 112; *id. Mam. Birds Burma*, p. 38.

Fur soft, dense and long. Tail much longer than the head and body, scaly and ringed, with short fine hair that becomes longer on the terminal third of the tail. Ears short, rounded, scantily clad with long hairs. Feet short. Foot-pads large, peculiarly marked



with irregular concentric lines; both metatarsal pads elongate, the hindmost greatly so and much curved. Mammæ 8: 2 pairs pectoral, 2 inguinal. Vibrissæ numerous, fine, longer than the head.

Colour brown above, dull white below. Dorsal fur slaty for the basal two thirds, then glistening brown with black tips and a few long hairs of very fine texture interspersed. Whiskers black, and there is a tuft of fine blackish hair anterior to the ears (Blyth).

Dimensions of a female in spirit: head and body 5 inches, tail 8, ear from crown 0.25, hind foot 1.1; length of skull 1.4, breadth 0.8.

Distribution. Discovered by Major Berdmore at Schwe Gyeng, on the Sittoung River, Burma, in 1859. There is also in the Indian Museum, Calcutta, a specimen from Tavoy.

The terminal fourth of the tail is distinctly compressed laterally in the type specimen. Further specimens are required to show whether this is an individual character.

Genus **VANDELEURIA**, Gray (1842).

First and fifth toes on all feet partially opposable and furnished with a flat nail, not a claw. Claws on the remaining digits small. Hind foot long, plantar pads large; proximal metatarsal pad very elongate, quite as near to the heel as to the base of the middle toe. Tail very long, but without lengthened hair. Skull short, anterior palatine foramina moderate, anterior border of zygoma-root vertical, not emarginate above. Molars broad, transverse bands of enamel deeply folded. Lower molars as in *Mus*. Incisors narrow.

One species only is known.

270. *Vandeleuria oleracea*. *The long-tailed Tree-Mouse.*

Mus oleraceus, Bennett, *P. Z. S.* 1832, p. 121; Elliot, *Mad. Jour. L. S.* x, p. 214; Blyth, *J. A. S. B.* xxxii, p. 344; *id. Cat.* p. 120; Jerdon, *Mam.* p. 202.

Vandeleuria oleracea, Gray, *A. M. N. H.* x, p. 265 (1842); *W. Selater*, *P. Z. S.* 1890, p. 532, pls. xlv, fig. 4, xlv, fig. 10; Thomas, *P. Z. S.* 1886, p. 65.

Mus (Vandeleuria) dumeticola and *Mus povensis*, Hodgson, *A. M. N. H.* xv, pp. 268, 269 (1845).

Mus badius, Blyth, *J. A. S. B.* xxviii, p. 295 (1859); *id. Cat.* p. 120; *id. Mam. Birds Burma*, p. 41.

Mus nilagiricus, Jerdon, *Mam.* p. 203.

Mus (Vandeleuria) oleraceus, Anderson, *An. Zool. Res.* pp. 309, 313; Thomas, *P. Z. S.* 1881, p. 556.

Marad ilei, Can.; *Meina Yelka*, Tel. of Yanadis.

Fur soft. Tail much longer than the head and body. Ears thinly clad with hair, large, rounded. Mammæ 8: 2 pairs pectoral, 2 inguinal.

Colour above light chestnut-red, varying from bright to dull, below white. Basal $\frac{3}{4}$ or more of dorsal hairs dark grey, termin-



ations rufous, a few long black tips intermixed on the rump. Ventral hair white throughout. Tail uniformly dark. Feet white. One specimen from Fatigarh, obtained by the late Mr. A. Anderson, has a rufous cross on the breast.

Dimensions. Head and body 2·2 to 3 inches, tail 3·5 to 4·5, ear about 0·5, hind foot 0·7; length of skull 0·85. *Mus nilagiricus* is slightly larger, head and body 3·5, tail 5.

Distribution. Throughout India (except in the extreme north-west), Ceylon, Assam, and Burma, extending to Yunnan. This species ascends the Himalayas to a moderate elevation and is found, if *M. nilagiricus* is the same, on the top of the Nilgiris.

Habits. The present species inhabits trees and shrubs, and makes a nest, usually of grass or grass and leaves, in the branches. The nest is often found in palms or bamboos, occasionally on the roofs of houses. Three young on one occasion, and four in another were brought to me in a nest. The animal is very active.

Genus **CHIROPODOMYS**, Peters (1868).

Hallux and rudimentary pollex with flat nails instead of claws, the other digits with strong much-curved claws. Plantar pads broad, oval. Skull short and broad. Anterior palatine foramina short. Anterior border of zygoma-root outside the infraorbital foramen vertical throughout, not emarginate above. Incisors narrow, not grooved. Molars tubercular, the transverse bands of enamel on the worn surface much more deeply plicated than in *Mus*, lower molars with a broad outer cingulum. Crowns of all the molars, above and below, when worn, traversed by two deep longitudinal furrows, one furrow, on the lower molars, just inside the cingulum. A single species.

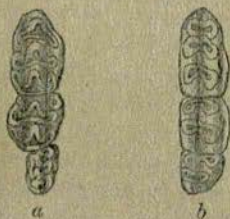


Fig. 130.—(a) Upper and (b) lower right molars of *C. gliroides*, $\times 6$.

271. *Chiropodomys gliroides*. *The penicillate-tailed Tree-Mouse*.

Mus gliroides, Blyth, *J. A. S. B.* xxiv, p. 721 (1855), xxxii, p. 345; *id. Cat.* p. 120.

Mus peguensis, Blyth, *J. A. S. B.* xxviii, p. 295 (1859), xxxii, p. 345, xxxiv, p. 193; *id. Cat.* p. 116; *id. Mam. Birds Burma*, p. 40.

Chiropodomys penicillatus, Peters, *M.B. Akad. Berl.* 1868, p. 448, pl. i; *Doria, An. Mus. Civ. Genova*, ser. 2^a, iv, p. 631.

Chiropodomys gliroides, Thomas, *P. Z. S.* 1886, p. 78; *W. Schlater, P. Z. S.* 1890, p. 532.

Fur soft, dense and even. Tail much longer than the head and body, thinly clad with hairs, which are short near the root of the tail but become longer towards the tip. Feet short and broad. Ears large, nearly naked, rounded. Vibrissæ copious and long. Mammaræ 4, all abdominal.

Colour brown, not dark nor rufous, above, white or buffy white below. Basal $\frac{3}{4}$ of dorsal hair dark leaden grey, terminal portion light brown (fawn-colour), passing into darker brown at the end. A few longer black tips are scattered on the back. Ventral fur white throughout. A dark mark generally on each hind foot, remainder of the feet white. Tail dark throughout.

Dimensions of a male in spirit: head and body 3 inches, tail 4.5, ear 0.6, hind foot 0.75. A skull measures 0.93 in length.

Distribution. Khási hills, Kakhien hills, near Bhámo, Manipur, Schwe Gyeng, Malacca, Java, and Borneo.

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

Form slender. Muzzle pointed; tail long, scaly. Fur soft or spiny, the spines when present fine and mixed with hair. Pollex rudimentary, with a small flat nail, all other toes (except in

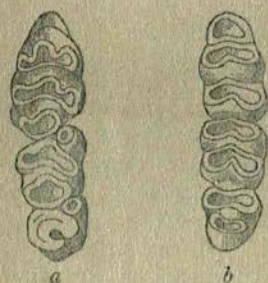


Fig. 131.—(a) Upper and (b) lower right molars of *M. rufescens*,
 × 4.

M. chiropus) with compressed claws. Molars tubercular in the young; the tubercles of the upper molars in a triple longitudinal row, of the lower molars in a double row. The teeth when worn crossed by curved or folded transverse laminae. Incisors smooth, not grooved nor sculptured. Vertebrae: C. 7, D. 13, L. 6, S. 4, C. 26-32.

The genus is cosmopolitan and is largely represented in India. A great number of specific names have been given by various naturalists, and owing to imperfect descriptions, and to the difficulty of comparing the types, many of which were in England, Blyth in 'A Memoir

of the Rats and Mice of India,' published in 1863 (J. A. S. B. xxxii, p. 327), could only collect together the descriptions of about 50 nominal forms and indicate their affinities. Jerdon followed Blyth, and it was not until Thomas in 1881 re-examined Gray's and Hodgson's types with the aid of a large collection of Indian specimens that any important reduction of the overgrown list of names could be effected. Some additional identifications of Blyth's and Anderson's species have since been made by Mr. Thomas, and a few more are now added by the examination of some of Blyth's types, for the loan of which I am indebted to the Trustees of the Indian Museum, Calcutta, and to Mr. W. L. Sclater, who has independently examined the series in the Calcutta Museum and has come to conclusions that agree with my own (P. Z. S. 1890, p. 522). In the present work, by the aid of several observers, an attempt is made to identify all Indian, Ceylonese, and Burmese species hitherto described.

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

- A. Six pads on planta; ears not covered with long hair; third upper molar much smaller than second.
- a. Large, head and body 4 to 9 inches; proximal plantar pad elongate, double length of next pad. (RATS.)
- a'. Lower surface of tail not white or not sharply divided from colour of upper surface.
- a''. Hair on terminal portion of tail not white.
- a³. Outer border of infraorbital foramen deeply emarginate above.
- a⁴. Tail as long as head and body or longer.
- a. Head and body 5 to 8 in., hind foot 1.2 to 1.45; mammae 10
12 *M. rattus*, p. 406.
- β. Head and body 4 in., hind foot 0.9; mammae 8 *M. concolor*, p. 408.
- β⁴. Tail shorter than head and body, hind foot 1.5 to 1.7 *M. decumanus*, p. 408.
- β³. Outer border of infraorbital foramen slightly emarginate above; hind foot 1 inch *M. fulvescens*, p. 409.
- b'. Hair on terminal portion of tail white all round.
- a³. Colour above grey.
- a⁴. A brownish tinge on back; hind foot 2 inches *M. bowersi*, p. 410.
- β⁴. Back pure grey; hind foot 1.4 .. *M. berdmorei*, p. 410.
- β³. Colour of upper parts brown; hind foot 1.3 *M. blanfordi*, p. 411.
- b'. Lower surface of body and tail white, or nearly white, sharply separated from colour of upper parts.
- a''. Hallux with a compressed claw.
- a³. Colour above rich rufous-brown *M. jerdoni*, p. 411.
- β³. Colour above greyish brown *M. niveiventer*, p. 412.
- b''. Hallux opposable, with a flat nail *M. chiropus*, p. 413.
- b. Small, head and body less than 4 in.; proximal plantar pad not double length of next, and generally rounded. (MICE.)
- a'. Tail not shorter than head and body.
- a''. Hind foot without claws not exceeding 0.7 in.; mammae 10.
- a³. Lower parts fulvous or dusky *M. musculus*, p. 413.
- β³. Lower parts white *M. bactrianus*, p. 414.
- b''. Hind foot exceeding 0.7 in.
- a³. Fur dark brown above.
- a⁴. Malar bone concave externally .. *M. sublimis*, p. 415.
- β⁴. Malar convex externally *M. nitidulus*, p. 415.
- β³. Fur chestnut above; mammae 6 *M. arianus*, p. 416.



- δ'. Tail shorter than head and body.
a". Fur spineless or mixed with flexible spines.
a³. Ear laid forward extending to eye . . . *M. cervicolor*, p. 417.
b³. Ear not extending to eye *M. buduga*, p. 416.
b". Dorsal fur mainly or wholly of inflexible spines *M. platythrix*, p. 418.
B. Four or five plantar pads.
a. Back dark brown; hind foot about 1 in. . . *M. mettada*, p. 419.
b. Back sandy or fawn-colour; hind foot 0·7 in. *M. gleadowi*, p. 420.
C. Ears covered with long hair; hind foot 0·32 in. *M. erythrotis*, p. 420.
D. Second and third upper molars equal in size; hind foot 1 inch *M. humei*, p. 421.

272. *Mus rattus*. The common Indian Rat.

- Mus rattus*, Linn. Syst. Nat. i, p. 83 (1766); Blyth, Cat. p. 113; W. Sclater, P. Z. S. 1890, p. 523.
Mus alexandrinus, Geoff. Desc. de l'Egypte, Hist. Nat. ii, p. 733, Atlas, pl. v, fig. 1 (1812); Scully, P. Z. S. 1881, p. 204; Thomas, P. Z. S. 1881, p. 533.
Mus indicus, Geoff., Desm. Mam. p. 299 (1822), nec Bechstein.
Mus rufescens and asiaticus, Gray, Charlesworth's Mag. N. H. i, p. 585 (1837).
Mus rattus and flavescens (nec Waterhouse), Elliot, Mad. Jour. L. S. x, pp. 212, 214.
Mus brunneusculus, rattoides, nitidus, and horeites, Hodgson, A. M. N. H. (1) xv, pp. 267, 268 (1845).
Mus æquicaudalis, Hodgson, A. M. N. H. (2) iii, p. 203 (1849).
Mus nemoralis, Blyth, J. A. S. B. xx, p. 168; id. Cat. p. 114.
Mus kandianus, Kelaart, Blyth, *ibid.* p. 169.
Mus rattus, ceylonus, flavescens, nemoralis, and asiaticus, Kelaart, Prod. pp. 58, 61-63.
Mus robustulus, Blyth, J. A. S. B. xxviii, p. 294 (1859); id. Cat. p. 114; id. Mam. Birds Burma, p. 39.
Mus crassipes, Blyth, J. A. S. B. xxviii, p. 295.
Mus (Leggada) *andamanensis*, Blyth, J. A. S. B. xxix, p. 103 (1860); id. Cat. p. 114.
Mus rattus, andamanensis, nemoralis, rufescens, robustulus, nitidus, horeites, and æquicaudalis, Blyth, J. A. S. B. xxxii, pp. 338-344.
? *Mus infralineatus*, Blyth, Cat. p. 116 (no description).
Mus rattus, infralineatus, brunneus, rufescens, and nitidus, Jerdon, Mam. pp. 194, 197-201.
Mus palmarum, Zelebor, Novarareise, Säugeth. p. 26, pl. 3.
Mus sladeni and yunnanensis, Anderson, An. Zool. Res. pp. 305, 306.
Mus rattus rufescens, Thomas, P. Z. S. 1881, pp. 57, 71.

Chuha, Mûsa, H.; *Gachua-indur*, Beng.; *Kart yelli*, Tam.; *Ghas-miyo*, Cing.

Fur variable, occasionally mixed with fine spines, more often spineless. Tail generally longer than the head and body (more rarely about equal or a little shorter). Ears moderately large, extending to the eye or occasionally beyond it, when laid forward. Mammaræ 10-12: 2 or 3 pairs pectoral, 3 inguinal. Foot-pads 5 on the fore foot, 6 on the hind, the hindmost of the latter (proximal metatarsal pad) considerably elongated.

Skull very slightly convex above, the nasals sometimes greatly



produced. Lower portion of anterior border to zygomatic process of maxillary vertical, or slanting upwards and forwards, above rounded off to a deep emargination. Lower part of infraorbital foramen narrow, with a swelling in front on the maxillary bone. The fronto-parietal area pyriform, the low crest bordering the parietal region convex throughout. Incisors narrow; first upper molar much larger than the second, which is nearly double the size of the third.

Colour above in Indian specimens usually brown, more or less rufous or occasionally yellowish brown; more rarely blackish brown or black; below generally white, frequently sullied, sometimes brown or grey and occasionally with a white, fulvous, or grey median band. Basal three fourths of the dorsal hairs dark grey, the terminal fourth mostly light brown, mixed with longer black tips. When spines are present they are whitish near the base. Tail generally the same colour throughout, but sometimes paler beneath. Feet generally white. Incisors orange.

Dimensions. Head and body 5 to 8 inches, tail 5 to 9 or even more, hind foot without claws 1.2 to 1.5 ear 0.7 to 1. An average skull is 1.5 long by 0.75 broad.

Distribution. Almost world-wide, doubtless from being introduced. Probably indigenous in India and found throughout the country, also in Burma and Ceylon, from the sea-level to an elevation of at least 8000 feet.

Varieties. The typical *Mus rattus* of Europe, the black rat, is doubtless an introduced form. This variety is occasionally found in various parts of India, chiefly large ports, whither it has probably been brought by shipping. Besides this there are three Indian varieties requiring notice:—

1. *M. alexandrinus*.—Size generally large; colour above brown without much rufous tinge, below usually white. The tail is longer than the head and body. This form is found in Western India and extends thence to Northern Africa. Some specimens from Simla have the under surface of the tail quite white.
2. *Mus nitidus*.—This differs from the last in having finer fur often mixed with numerous spines, and in the tail differing but little in length from the head and body, being sometimes rather longer, sometimes a little shorter. Soles of feet often white. The common Eastern Himalayan form.
3. *Mus rufescens*.—A more slender and frequently smaller variety, with a long tail, generally spinous hair, and a rufous or yellowish-brown tint. The variety chiefly found in the Indian Peninsula, Ceylon, and Burma. More arboreal than the others.

Thomas, from whom I take most of these details, has shown that the length of the nasal bones varies in specimens from one locality from 46 to 69 per cent. of the length of the skull.

Mus infralineatus was founded on a small short-tailed specimen with a dark median line on the chest; *Mus andamanensis* on a very spiny variety (I have examined the type); and *Mus gunnanensis* on