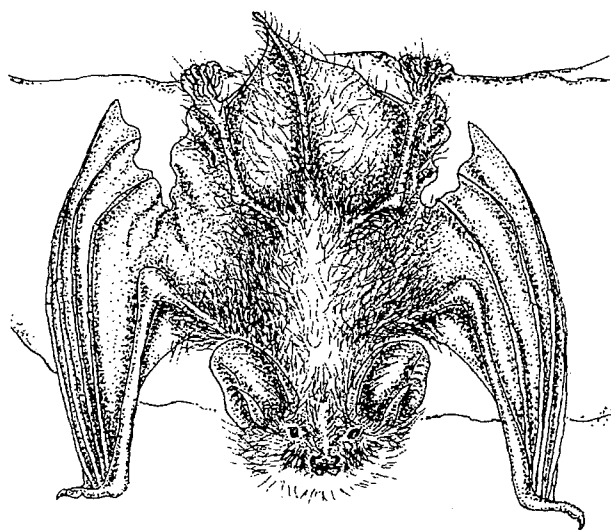


Bats of the Indian Subcontinent

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Definitions of Measurements

External Measurements

HB: head and body length - from the tip of the snout to the base of the tail, dorsally (Fig. i).

T: tail length - from the tip of the tail to its base adjacent to the body (Fig. i).

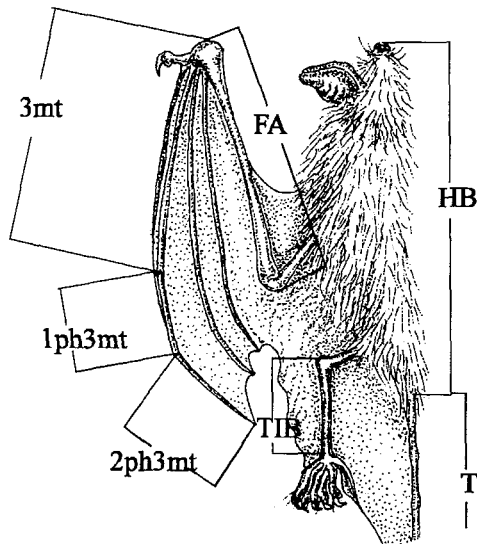


Fig. i. Left wing and body of *Myotis sicarius*.

HF: foot - from the extremity of the heel behind the os calcis to the extremity of the longest digit, not including the hairs or claws.

TIB: length of tibia - from the knee joint to the ankle (Fig. i)

FA: forearm - from the extremity of the elbow to the extremity of the carpus with the wings folded (Fig. i)

WSP: wing span - maximum spread, from tip to tip, with the wings fully extended.

Thumb: length of thumb (first digit), including metacarpal, phalanx and claw.

3mt (MET): third metacarpal - from the extremity of the carpus to the distal extremity of the metacarpal (Fig. i).

4 mt (MET); 5mt (MET): as above but for the fourth and fifth metacarpals respectively (Fig. i).

1ph3mt: first phalanx of the third metacarpal - taken from the proximal to the distal extremity of the phalanx (Fig. i).

2ph3mt: second phalanx of the third metacarpal - taken from the proximal to the distal extremity of the phalanx (Fig. i).

1ph4mt/ 2ph4mt: as above but for the fourth metacarpal.

E: ear: - from the lower border of the external auditory meatus to the tip of the pinna, not including any tuft of hair (Fig. ii).

Cranial and dental measurements

GTL: greatest length of skull: the greatest antero-posterior diameter of the skull, taken from the most projecting point at each extremity, regardless of what structure forms these points (Fig. iv, v).

CBL: condylo-basal length - from an exoccipital condyle to the alveolus of the anterior incisor (Fig. iv).

CCL: condylo-canine length - from the exoccipital condyle to the anterior alveolus of the canine (Fig. iv).

ZB: zygomatic breadth - the greatest width of the skull across the zygomatic arches, regardless of where this point is situated on the arches (Fig. iii).

BB: breadth of braincase - greatest width of the braincase at the posterior roots of the zygomatic arches (Fig. iii).

IC: interorbital constriction - the narrowest width across the interorbital region.

PC: postorbital constriction - the narrowest width across the constriction posterior to the orbits (Fig. iii).

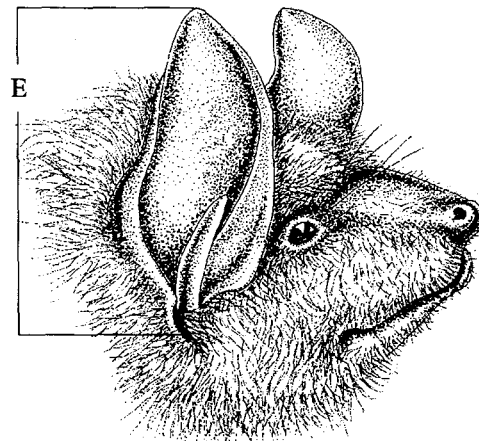


Fig. ii. Right ear and face of *Myotis horsfieldii*.

M: mandible length - from the most posterior part of the condyle to the most anterior part of the mandible, including the lower incisors (Fig. v).

RW: rostral width - taken across the front of the orbits at their most anterior point (Vespertilionids only).

C-Mⁿ: maxillary toothrow - from the front of the upper canine to the back of the crown of the last upper molar (Fig. v).

C-M_n: mandibular tooththrow - from the front of the lower canine to the back of the crown of the last lower molar (Fig. v).

Mⁿ-Mⁿ: posterior palatal width - taken across the outer borders of the last upper molar (Fig. iv).

C¹-C¹: anterior palatal width - taken across the outer borders of the upper canine (Fig. iv).

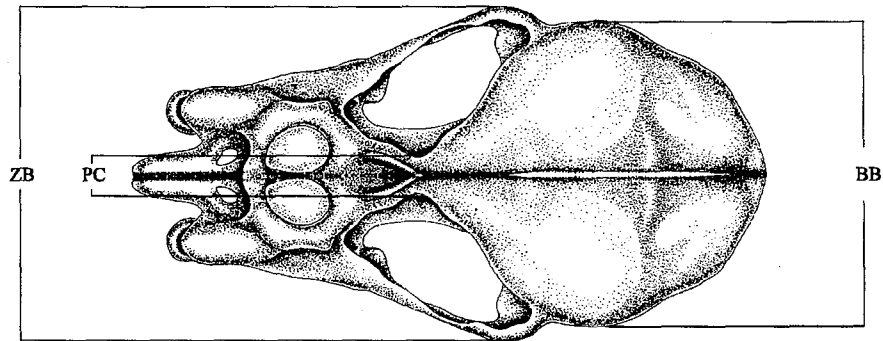


Fig. iii. Dorsal view of the skull of *Rhinolophus beddomei*.

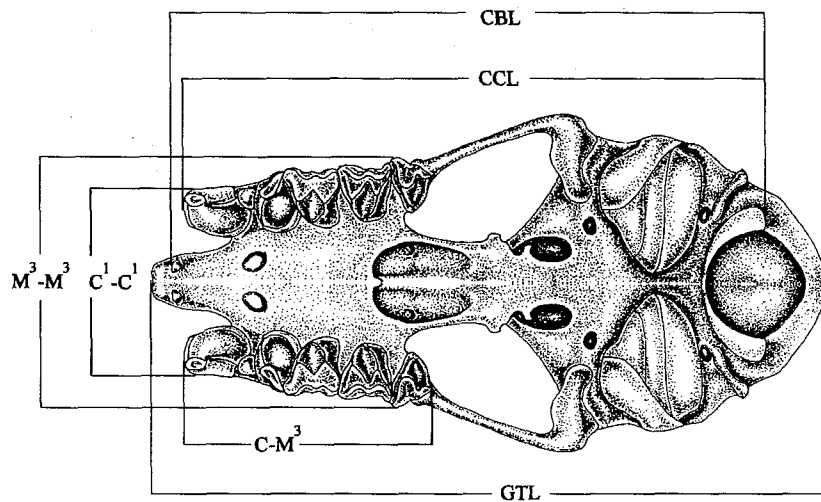


Fig. iv. Ventral view of the skull of *Rhinolophus beddomei*.

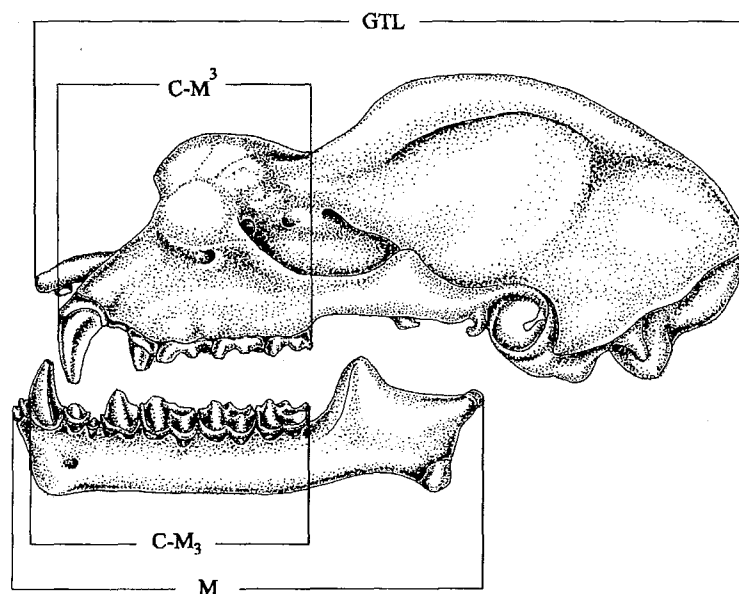


Fig. v. Lateral view of the skull of *Rhinolophus beddomei*.

Sub-Order MICROCHIROPTERA

Family Rhinopomatidae: Mouse-tailed bats

This is a small family of insect-eating bats of primitive structure, found in the arid and semi-arid regions of southern Asia and northern Africa. It is monogeneric (one genus) and is generally thought to include three species (Koopman, 1993; but see also Khajuria, 1988 and Van Cackenbergh & De Vree, 1994). The tail is very long and slender, with the longest part projecting free from the membrane (Plate 2). There is a thickened narial pad present on the end of the muzzle, surmounted by a distinct ridge-like dermal outgrowth (a rudimentary noseleaf). The ears are joined across the forehead by a connecting membrane; each ear has a simple but well

developed tragus. Both the second and third digits of each wing have two distinct bony phalanges. The skull is relatively short and broad and lacks postorbital processes. The lachrymal region is swollen. Separate nasal inflations are present on each side of the rostrum. The premaxillae are separate from each other and from the adjacent part of the skull. The auditory bullae are relatively large. The teeth are of the normal insectivorous type; the upper incisor (i^2) is very small (Fig. 41).

Dental formula: $\frac{i-2-}{1\ 2-} \quad c\frac{1}{1} \quad pm\frac{---4}{-2-4} \quad m\frac{1\ 2\ 3}{1\ 2\ 3} = 28$

Character matrix of the three species of *Rhinopoma* from the Indian Subcontinent

Species	FA mm	Tail mm	CCL mm	C-M ³ mm	Comments
<i>R. microphyllum</i> (page 33)	68.0 59.5-74.6	58.1 50.0-77.0	18.9 17.2-22.7	7.5 7.0-8.0	tail generally shorter than forearm; tympanic bullae and nasal inflations on rostrum of skull relatively small
<i>R. hardwickii</i> (p. 35/ Plate2)	59.2 52.9-64.0	66.8 56.0-78.0	16.5 15.5-17.5	6.4 6.0-6.8	tail generally longer than forearm; dermal ridge on muzzle well developed; nasal inflations moderate, not visible when skull is viewed from below
<i>R. muscatellum</i> (p.37/ Plate 2)	49.4 46.0-53.2	56.0 49.0-64.3	14.9 14.7-15.1	5.6 5.3-5.9	tail generally longer than forearm; dermal ridge on muzzle poorly developed; nasal inflations easily visible when skull is viewed from below

Genus *Rhinopoma* E. Geoffroy, 1818

Rhinopoma E. Geoffroy, 1818: 113; type species *Vespertilio microphyllus*.

Since the family Rhinopomatidae is monogeneric, the generic characters are the same as those of the family.

Rhinopoma microphyllum (Brünnich, 1782)

Greater Mouse-tailed bat

Vespertilio microphyllus Brünnich, 1782: 50, pl. 6, figs. 1-4; Arabia and Egypt (type locality fixed as Giza by Koopman, 1975: 366).

Rhinopoma microphyllum kinneari Wroughton, 1912d: 767; Bhuj, Cutch, India.

External characters: This is the largest of the three species of *Rhinopoma* found in the Indian subcontinent with a forearm length of 68.0 mm (59.5-74.6 mm). The tail is relatively short compared to that of *R. hardwickii*; it does not usually exceed the length of the forearm. The face, ears and connecting membrane on the forehead are naked; the chin is also essentially without hairs. The

dermal ridge on the muzzle is small. The ears are well developed, each with a bluntly sickle-shaped tragus. The feet are slender but average larger than those of *R. hardwickii*. The pelage is short and fine; it is grey brown on the dorsal surface and paler below. It is entirely restricted to the head and body with the membranes naked above and below; the lower back and the posterior lower abdomen are also naked. During the winter there may be considerable fat deposits stored in the region of the thighs, the lower portion of the abdomen and the upper part of the interfemoral membrane. The wings are short with a span of 210-285 mm (Sinha, 1980). The interfemoral membrane is rather small and inserted on each tibia distally at about three-quarters of its length. The baculum is very small; it has a bifid base, a simple tip and a deep groove on the ventral surface (Fig. 37).

Cranial characters: The skull, with an average condylo-canine length of 18.9 mm (17.2-22.7 mm), exceeds in size that of the other two species of *Rhinopoma* known from region. The rostrum is relatively small and the nasals are not conspicuously inflated. The sagittal crest is prominent; commencing in the interorbital region it rises steeply over the frontals and is then sharply

reflected backwards with an almost straight superior border. The lambdoid crests are weak and do not overhang the slightly protuberant supraoccipital. The premaxillae are horn-shaped; their expanded bases are

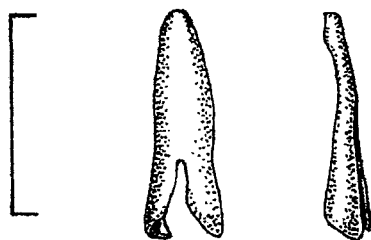


Fig. 37. Dorsal (left) and lateral (right) views of baculum of *Rhinopoma microphyllum*. HZM.15.28205. New Delhi, India. Scale = 1 mm.

not fused to each other in the mid-line nor are they fused to the maxillae. The supraorbital ridges are well developed; there is a well defined hollow, on each side, beneath the nasals, just posterior to the roots of the upper canines. The bony palate is broad and nearly flat; its surface is continuous with the medial expansions of the pterygoid plates, which partly overhang the V-shaped mesopterygoid space. There are no basioccipital pits. The inner margins of the tympanic bullae are flattened; they are relatively smaller than those of *R. muscatellum*. The general morphology of the mandible is similar to that of *R. hardwickii* (Fig. 40) but with the coronoid processes more robust. For a complete review of the cranial and post-cranial osteology of this species see Sinha (1982).

Dentition: Upper toothrow length (c-m³) averages 7.5 mm (7.0-8.0 mm). The upper incisor (i²) is minute, barely emerging from the gum and with the crown scarcely differentiated from shaft. The upper canine has anterior and posterior cutting edges, but lacks a distinct cingulum. There is one upper premolar (pm⁴). It is two-thirds the height of the canine; it possesses a low antero-medial protocone and a well developed antero-external cusp which lies over the postero-lateral part of the canine. m¹ and m² are about equal in size; the pattern of cusps and commissures is typical of the W-shaped insectivorous type; the metacone is the highest cusp and the protocone is well developed. m³ is reduced, with a protocone, paracone, parastyle and two commissures. The second commissure is short and recurved laterally; there is a small vestige of the third. The lower incisors (i₁ and i₂) are tricuspidate and set close together in an even curve. The lower canine has a small antero-medial cusp adjacent to i². The first lower premolar (pm₂) is oval-shaped; it has a small anterior and posterior cusp. The second premolar (pm₄) is taller and broader than pm₂. m₁ and m₂ are about equal in size, their cusps and commissures arranged in a simple W-pattern. m₃ is reduced, with the talonid distinctly smaller than the trigonid.

Variation: Specimens from India are relatively large and are referred to *R. m. kinneari*; according to Hill (1977),

forearm length ranges from 64.5-75.0 mm and condylo-basal length 19.5-21.2 mm. Specimens from Pakistan have been referred to *R. m. microphyllum*; forearm length ranges from 62.9-71.5 mm and condylobasal length 17.6-19.2 mm. Van Cackenbergh & de Vree (1994) suggested that further studies may reveal *kinneari* to be a synonym of *R. m. sumatrae* Thomas 1903 of Indonesia. According to Gaisler (1970a), the males are significantly larger than the females.

Distribution: *Rhinopoma microphyllum* ranges from Mauritania, Senegal, Nigeria and Cameroon to Egypt, Arabia, Iran, Afghanistan, Pakistan, India and Sumatra (Schlitter & Qumsiyeh, 1996).

In the Indian subcontinent (Fig. 38) localities include: **INDIA: Rajasthan:** Ajmer (Garg, 1955); districts of Jaisalmer; Barmer; Jodhpur; Pali; Nagaur; Jhunjhunu; Sawai Madhopur; Sirohi; Jhalawar; Bundi; Dungarpur and Tonk (Advani, 1982b); Aligarh (Agarwal & Gupta, 1982); Udaipur (Lall, 1985); **Gujarat:** Bhuj (Wroughton, 1912bii); Anand (Brosset, 1962a); Baroda; Junagadh (Sinha, 1981a); Broach; Bundi (Advani & Vazirani, 1981); **Maharashtra:** Bombay (Hill, 1977); Nagpur (Sinha, 1980); Osmanabad (Gopalakrishna, 1985); Songir; Bhamburda (BMNH); **Tamil Nadu:** "Madras" [doubtful record, possibly refers to district] (MNHS in Van Cackenbergh & de Vree, 1994); **Andhra Pradesh:** Palkonda (FMNH); **Orissa:** Bhubaneswar (Das *et al.*, 1993); **Madhya Pradesh:** Nimar (Wroughton, 1912biii); Morar (Lindsay, 1926b); Gwalior (Srivastava, 1952); Orcha; Sanchi (Brosset, 1962a); Burhanpur; Asirgarh (Sandhu, 1988b); **Delhi:** New Delhi (HZM); **Uttar Pradesh:** Agra (Brosset, 1962a); Fatehpur Sikri (Sinha, 1980); **Bihar:** Gajhundi (Wroughton, 1915cii).

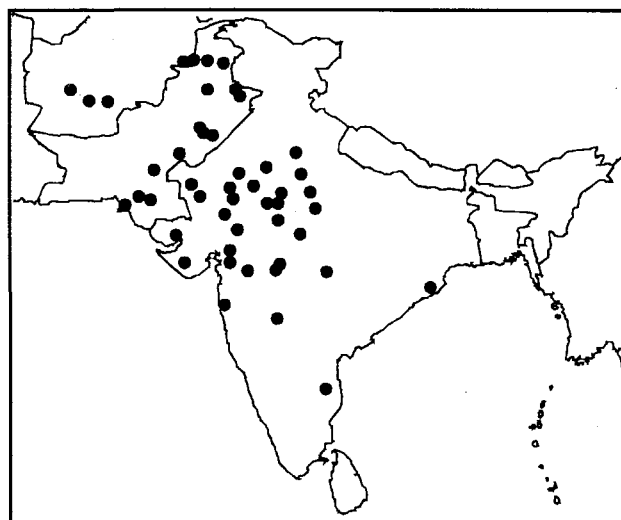


Fig. 38. Distribution of *Rhinopoma microphyllum*.

PAKISTAN: NWFP: Amb (Hill, 1977); Malakand Hills (Roberts, 1977); **Punjab:** Ara (Hinton & Thomas, 1926); Sakesar; Rohtas (Lindsay, 1927ii); Jhelum; Gujrat; Multan; Mailsi (Roberts, 1977); **Baluchistan:** Las Bela (Gaisler, 1970a); Sadikabad; Quatabpur

(Roberts, 1977); **Sind:** Sukkur; Gambat (Wroughton, 1916ci); Hyderabad; Karchat Hills; Karachi (Roberts, 1977).

AFGHANISTAN: Jalalabad; near Kandahar; near Guerechk; Konarha Provinces (Gaisler, 1970a); Chak Wki Sarkani; Chak Naur; Chamchir cave; Dilaram; Hadda; Kala Bnot; Khyber Pass; Kvadjar Largar; Moulmai Cave; Muang Loei; Sarban-Qala (Van Cackenbergh & de Vree, 1994)

Habits: This species is well adapted for life in the arid biomes of the deserts of north-west India (Advani, 1982b) and Pakistan (Roberts, 1977). Its altitudinal range varies from about 108 metres (350 feet) at Junagadh in Gujarat to 1169 metres (3800 feet) at Ara in the Salt Range of the Punjab (BMNH). It roosts in small caves, underground tunnels, old monuments and buildings. It is sometimes found in dark crevices, at other times it may be seen in large numbers in swarms on ceilings. It is surprisingly tolerant of light. At Fatepur Sikri, it was located in brightly lit arches (Brosset, 1962a) and at Baroda in semi-dark rooms (Sinha, 1981a). It is very agile and can easily run across vertical walls. Colonies, which vary in size from a few individuals to two or three thousand are characterised by a strong and unpleasant smell. Both sexes were found together in April in Madhya Pradesh and Uttar Pradesh (Brosset, 1962a) but occupied separate roosts over the entire summer and autumn periods in the south-west Punjab (Roberts, 1977). It migrates on a seasonal basis and leaves its roosts in the Punjab from mid-October to mid-May (Roberts, 1977). Individuals may migrate up to 900 km (Gopalakrishna, 1985); the homing ability is relatively good (Wason & Misra, 1981). It cohabits with *Rhinopoma hardwickii* and other microchiropterans such as *Taphozous perforatus* (Badwaik, 1992), *Megaderma lyra* (Prakash, 1961); *Taphozous melanopogon* and *T. nudiventris* (Brosset, 1962a).

Feeding: It is not a strong flier and the rapid wing beats are usually interspersed with steady glides. It is primarily insectivorous. In Rajasthan, Coleoptera; Lepidoptera and Orthoptera are consumed throughout the year and Hymenoptera are also taken in all except the winter season. During the summer and monsoon months, Isoptera are the preferred diet, whilst Neuroptera and Dictyoptera are consumed in the winter and post monsoon periods (Advani, 1981d). According to Agarwal & Gupta (1982) the tongue is highly adapted for insect feeding and the bat may play an important role in the management of harmful insects in the crop ecosystem (Advani, 1981d). Large fat reserves are built up in the pelvic region in the post monsoon period. In laboratory conditions, it was found that *R. microphyllum* could survive a maximum of 136 days without food in winter but just five days in summer (Dhiman & Rama-Rao, 1987).

Reproduction: In Rajasthan, copulation occurs in late February; females have sperm in their genitalia during

the first week of March and are pregnant from April to June; parturition occurs in the third week of June and weaning is completed by the first week of August (Lall, 1985). The newborn infant is deaf, dumb and naked

Table 15. *Rhinopoma microphyllum*: Specimens from Pakistan and India.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	75.3	60.0 - 84.0	6.2	30
T:	58.1	50.0 - 77.0	5.6	30
HF:	15.0	14.0 - 18.0	1.0	23
FA:	68.0	59.5 - 74.6	3.3	32
E:	19.7	18.0 - 22.0	1.1	31
GTL:	20.9	19.2 - 22.3	0.9	25
CCL:	18.9	17.2 - 22.7	1.1	27
ZB:	12.4	11.4 - 13.4	0.6	21
BB:	8.9	8.2 - 9.4	0.4	27
PC:	2.8	2.1 - 3.1	0.2	28
C-M ³ :	7.5	7.0 - 8.0	0.3	29
C-M ₃ :	8.2	7.6 - 8.6	0.3	29
M:	14.8	13.7 - 15.8	0.7	29

(Gaur & Shahrokh, 1989b). Females abandon their young after two to three weeks and subsequently migrate to their winter roosts in September and October leaving behind colonies of up to 700 juveniles (Gaur & Shahrokh, 1989a). At Qutabpur in the Punjab, the females arrive already pregnant at the summer roost; the time of arrival varies between 18 and 29 May; parturition occurs during the last week of June and the first week of July (Roberts, 1977). In Burhanpur, Madhya Pradesh females arrive at the summer roost from 15 March onwards; the females become pregnant in late March and give birth in early July to a single infant. The gestation period is thought to be about 104 days (Badwaik, 1992).

Conservation status: Worldwide: geographically widespread and not threatened. Indian Subcontinent: relatively abundant with one endemic subspecies (*kinneari*), not threatened. Possible conservation measures include monitoring of human disturbance of known roosts.

Rhinopoma hardwickii Gray, 1831

Lesser Mouse-tailed bat

Rhinopoma hardwickii Gray, 1831: 37; India.

External characters: This is a medium-sized Mouse-tailed bat with an average forearm length of 59.2 mm (52.9-64.0 mm). It is characterised by its exceptionally long tail (Plate 2) which unlike that of *R. microphyllum* usually exceeds forearm length. The dermal ridge of the muzzle is better developed than that of *R. muscatellum*. The pelage is similar in length and texture to that of *R. microphyllum*; it is grey-brown above with paler hair roots; the belly is essentially grey. As in *R.*

microphyllum, the interfemoral and wing membranes, posterior back and lower abdomen are naked; the chin is nearly naked. The feet are smaller and more delicate.

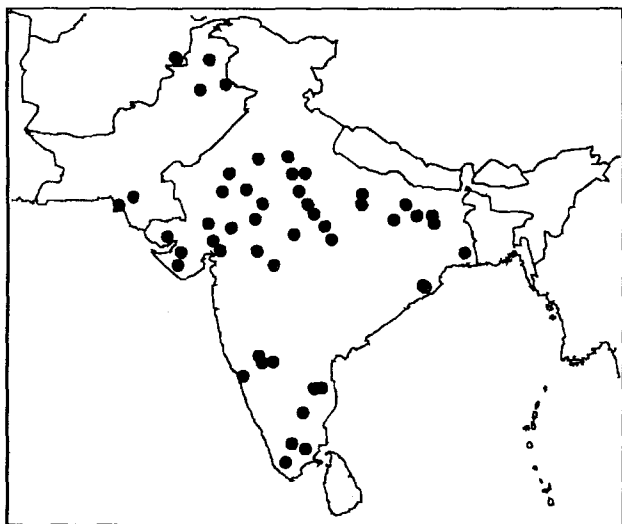


Fig. 39. Distribution of *Rhinopoma hardwickii*.

Cranial characters: The skull is smaller than that of *R. microphyllum* with an average condylo-canine length of 16.5 mm (15.5-17.5 mm). The rostrum is relatively larger and the nasals are more inflated. However, the inflations are not as large as those of *R. muscatellum* and when viewed laterally they do not project in front of the canines. The sagittal crest forms a low elevation above the frontal region; it is not usually as prominent as that of *R. microphyllum*. The lambdoid crests are weak. The anterior border of the mesopterygoid space is U-shaped. The tympanic bullae are less developed than those of *R. muscatellum*. The mandible is illustrated in Fig. 40.

Dentition: Upper toothrow length (c-m³) averages 6.4 mm (6.0-6.8 mm). In general, the dentition (Fig. 41) is lighter than that of *R. microphyllum*. It is essentially similar in morphology although the first lower premolar (pm₂) appears to be relatively smaller.

Variation: All specimens from the Indian subcontinent are referable to *R. h. hardwickii* (Van Cackenbergh & de Vree, 1994).

Distribution: *Rhinopoma hardwickii* ranges from Niger, Morocco and Mauritania to East Africa, Arabia, Iran, Afghanistan, India and Myanmar (Koopman, 1993).

In the Indian subcontinent (Fig. 39) localities include: **INDIA: Rajasthan:** Nasirabad (BMNH); Jaipur (BNHS) and districts of Jodhpur; Nagaur; Jhunjhunu; Ajmer; Dungarpur; Jhalawar and Bundi (Sinha, 1980); **Gujarat:** Bhuj (Wroughton, 1912bii); Junagadh; Rajkot; Vankancer (Ryley, 1913bi); Palanpur; Lunwa; Danta (Ryley, 1914a); Anand; Ahmedabad; Vedtial (Brosset, 1962a); **Karnataka:** Vijayanagar (Wroughton, 1913iii); Pattadkal; Badami (Brosset, 1962a); Gokarna (Bhat & Sreenivasan, 1972); Gadag (Wroughton, 1912c); **Tamil Nadu:** Marungoor (Wroughton, 1921ii); Dharmapuri

Range; Travancore (BNHS); "Madras" [probably district, not city] (BMNH); Madurai (Kock & Felten, 1980); Kanavi Katha Bootham (Usman, 1988); Palni Hills (Lindsay, 1927i); Pannian Malai (HNHM); **Andhra Pradesh:** Palkonda Hills (BNHS); Koduru (BMNH); **Orissa:** Bhubaneswar; Udayagiri (Das & Agrawal, 1973); **Madhya Pradesh:** Narsingarh (Wroughton, 1913ii); Morar (Lindsay, 1926b); Orcha; Gwalior; Sanchi; Asirgarh; Khajurao; Mandu (Brosset, 1962a); Jabalpur District (Khajuria, 1979a); Ghatigaon (Wroughton, 1916a); **Delhi:** New Delhi (Brosset, 1962a); **Uttar Pradesh:** Fatehpur Sikri; Agra (Brosset, 1962a); Pratabgarh (Khajuria, 1953); Allahabad (BMNH); **Bihar:** districts of Gaya; Bhojpur; Giridih; Munger and Rohtas (Sinha, 1986a); **West Bengal:** Calcutta (BMNH).

PAKISTAN: NWFP: Amb (Siddiqi, 1961); **Punjab:** Ara (Hinton & Thomas, 1926); Sakesar; Rohtas; Chitti Dil (Lindsay, 1927iii); **Sind:** Landi (Wroughton, 1916ci); Karachi; Karchat Hills (Roberts, 1977).

AFGHANISTAN: Cha Wki Sarkani; between Darunta and Bisut; Hadda; Jalalabad; Katar; Nurgul; Tschambel/Dewagall; Tut-Tangai (Van Cackenbergh & de Vree, 1994).

Habits: *Rhinopoma hardwickii* is adapted for life in dry and semi-desert conditions. It is usually absent from areas of high rainfall and humidity, although a colony of one hundred individuals was found at Gokarna in

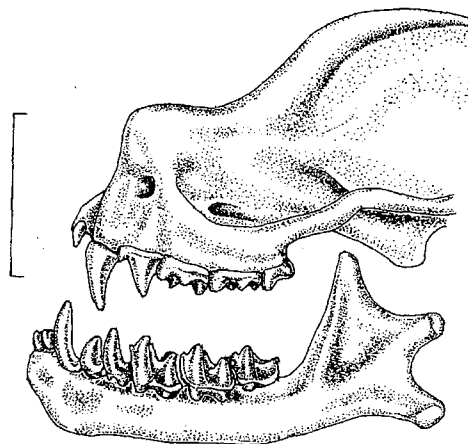


Fig. 40. Anterior skull of *Rhinopoma hardwickii*. HZM. 48.25673. Rajkot, India. Scale = 5 mm.

Karnataka where annual rainfall exceeds 3500 mm (Bhat & Sreenivasan, 1972). In Pakistan, it is found in subtropical dry evergreen and tropical thorn forests (Siddiqi, 1961). Typical diurnal roosts include caves, deserted houses and temples. It has been collected from localities ranging in elevation from 108 metres (350 feet) at Junagadh in Gujarat to 923 metres (3000 feet) on the northern slopes of the Palni Hills in Tamil Nadu (BMNH). In hot weather, it may be found resting in relatively bright retreats amongst boulders; in winter it moves to more sheltered roosts (Khajuria, 1979a). It does not hibernate but may have periods of extended rest. When roosting, it often lives secreted in crevices,

otherwise it hangs from roofs (Plate 2). If disturbed, it creeps like *Taphozous* in a crab-like fashion. Colony size varies from a few individuals to several hundred; an exceptionally large colony numbering some fifteen hundred was located in a cavern in Madurai District (Usman, 1986). According to Brosset (1962a), usually only one to ten individuals live together in the same diurnal roost. However the social group may be larger,

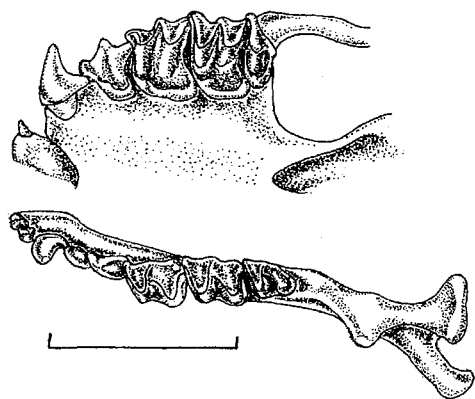


Fig. 41. Occlusal views of maxillary (above) and mandibular (below) dentition of *Rhinopoma hardwickii*. HZM.48.25673, Rajkot, India. Scale = 5 mm.

since several small colonies situated close together may constitute scattered elements of the same population. The colonies are sexually segregated. Individuals within a colony may fight amongst themselves with considerable aggression. All diurnal roosts are impregnated with the characteristic *Rhinopoma* smell; it is known to associate with *Rhinopoma microphyllum* and other small microchiropterans (Advani, 1982c).

Table 16. *Rhinopoma hardwickii*: Specimens from Pakistan and India.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	66.6	55.0 - 73.0	4.1	38
T:	66.8	56.0 - 78.0	5.4	38
HF:	13.4	11.0 - 15.0	1.2	33
FA:	59.2	52.9 - 64.0	2.6	38
E:	19.3	17.0 - 21.0	0.9	39
GTL:	18.7	17.5 - 19.7	0.5	31
CCL:	16.5	15.5 - 17.5	0.6	39
ZB:	10.9	10.1 - 11.7	0.4	33
BB:	8.2	7.8 - 8.5	0.2	42
PC:	2.8	2.5 - 3.2	0.2	44
C-M ³ :	6.4	6.0 - 6.8	0.2	45
C-M ₃ :	7.0	6.5 - 7.5	0.3	42
M:	12.8	11.8 - 13.6	0.4	44

Feeding: It is a high flier with a comparatively slow, weak flight which is accompanied by a peculiar fluttering of the wings (Wroughton, 1913iii). The teeth are also weak and its diet is primarily composed of moths, neuropteran insects and beetles (Prakash, 1959a). In northern India, large fat reserves are built up during

the post-monsoon period, when the insect population is plentiful. These are progressively utilised during the winter and spring months and by May-June have mostly disappeared (Brosset, 1962a).

Reproduction: In Uttar Pradesh, copulation occurs during the latter half of February and the first week of March; ovulation takes place after 11 March; gestation lasts 95-100 days and parturition occurs either in late June or early July; lactation lasts for about two months and females reach sexual maturity when aged between 9 and 9½ months (Banerjee & Karim, 1982). There is usually a single infant (BMNH). A similar breeding pattern was observed in Bihar (Sinha, 1986a) and Madhya Pradesh (Khajuria, 1979a).

Conservation status: Worldwide: a widespread and relatively common species. Indian Subcontinent: widespread and believed to be common, however a brief survey of known roosting sites in Western India found many to have been (at least temporarily) abandoned (Bates *et al.*, 1994a). There are no endemic subspecies.

Rhinopoma muscatellum Thomas, 1903

Small Mouse-tailed bat

Rhinopoma muscatellum Thomas, 1903: 498; Wadi Bani Ruha, Muscat, Oman.

Rhinopoma muscatellum seianum Thomas, 1913a: 90; Seistan, Iran.

External characters: [description based on specimens from Oman]: This is the smallest species of *Rhinopoma* with an average forearm length of 49.4 mm (46.0-53.2 mm). The face (Plate 2) is typical of the genus but with the dermal ridge on the muzzle poorly developed; it consists of a low ridge that may be flat above or may have a slight median depression. The tail is long and usually exceeds the length of the forearm. The feet are small. The pelage in specimens from Oman is paler than that of *R. hardwickii* and *R. microphyllum* but is similarly distributed on the body.

Cranial characters: The skull is small with an average condylo-canine length of 14.9 mm (14.7-15.1 mm). However, the nasals are relatively very large. In contrast to *R. hardwickii* and *R. microphyllum*, these inflations are usually clearly visible when the skull is viewed from below. The tympanic bullae are also relatively large. The mandible is smaller but otherwise similar to that of *R. hardwickii*; the horizontal ramus of each half is particularly short and shallow.

Dentition: Upper toothrow length (c-m³) averages 5.3 mm (5.3-5.9 mm). The dentition is smaller and more delicate but otherwise similar to that of *R. microphyllum* and *R. hardwickii*.

Variation: Specimens from Baluchistan, Pakistan are referred to *R. m. seianum* by Kock & Felten (1980).

Distribution: *Rhinopoma muscatellum* is known from UAE, Oman, Afghanistan, Iran, Pakistan and India.

In the Indian subcontinent (Fig. 42) localities include: **INDIA: Tamil Nadu:** Genji (doubtful record, restricted to Coromandel coast by Van Cackenberghe & de Vree, 1994: but possibly Genji in **Rajasthan**).

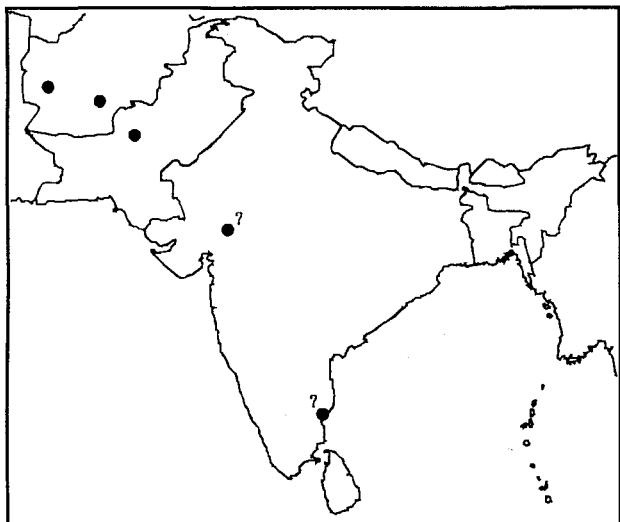


Fig. 42. Distribution of *Rhinopoma muscatellum*.

PAKISTAN: Baluchistan: Sibi (Kock & Felten, 1980); Uzhda Ridge (AMNH: Van Cackenberghe & de Vree, 1994).

AFGHANISTAN: 19.2 km (12 miles) south-west of Kandahar; 48 km (30 miles) west of Dilaram (FMNH).

Habits: Little is known of this bat in Pakistan. In Arabia, it roosts in underground caverns and deserted buildings and was collected at an altitude of 769 metres (2500 feet) in Oman. Although it lives in colonies, it is not usually found in clusters but tends to hang alone (Harrison & Bates, 1991). In Iran, a colony of about 30

individuals was located in a small cave. Elsewhere in Iran, a colony of several hundred *Rhinopoma*, both *R. microphyllum* and *R. muscatellum* was found in the entrance chamber to a long cave complex. It clings to the walls of caves with all four limbs (DeBlase, 1980). In Afghanistan, it was collected at altitudes of 831 metres (2700 feet) near Dilaram and at 1015 metres (3300 feet) in Shamshir Cave near Kandahar (FMNH).

Feeding: In Arabia, it emerges at dusk to hunt, flying along cliff-bordered gorges (Harrison & Bates, 1991). Its diet is not known but probably includes small insects, such as moths.

Reproduction: In Oman, pregnant females were collected in June and July and lactating females in August and September (Harrison & Bates, 1991).

Table 17. *Rhinopoma muscatellum*: Specimens from Pakistan (after Kock & Felten, 1980) and Iran.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	55.2	49.0 - 62.0	3.6	16
T:	56.0	49.0 - 64.3	4.6	17
HF:	12.3	11.0 - 13.0	0.7	17
FA:	49.4	46.0 - 53.2	1.8	21
E:	19.1	15.8 - 20.0	1.2	16
GTL:	16.4	15.9 - 16.8	0.3	8
CCL:	14.9	14.7 - 15.1	0.3	2
ZB:	9.3	8.8 - 9.8	0.3	17
BB:	7.3	6.5 - 7.8	0.4	12
PC:	2.3	2.0 - 2.6	0.2	13
C-M ³ :	5.6	5.3 - 5.9	0.2	13
C-M ₃ :	5.9	5.1 - 6.7	0.5	14
M:	11.0	10.5 - 11.4	0.3	13

Family Emballonuridae: Sheath-tailed bats

With some 47 species, the Sheath-tailed bats are a diverse and geographically widespread group (Koopman, 1993). They occur throughout the tropical regions of the Old World from the islands of the Pacific Ocean through Australia, Indonesia, the Philippines and the Indian Subcontinent to Arabia, Egypt and subsaharan Africa; they are also found in the New World, including Central and South America. To date, the earliest known fossil records are from the Miocene of Africa and the early Eocene of England (Hooker, 1996). The tail is characteristic. It is loosely enclosed in the interfemoral membrane and the tip projects from the upper surface of

the membrane at about the midpoint (Fig. 47). The wings are long and narrow and the second digit of each is without phalanges. When the bat is resting, the first phalanx of the third digit is tucked backwards on to the dorsal surface of the metacarpal. The muzzle is without a noseleaf (Plate 2). A tragus is present in each ear. In the skull, the postorbital processes are well developed; the premaxillae are represented by nasal branches only and are not fused with each other or with the maxillae (Fig. 48). Deep basisphenoid pits are present and the tympanic bullae are usually emarginated on their internal aspects.

one hollow to another. They coexist with *Megaderma spasma* and *Rhinolophus rouxii* (Brosset, 1962c).

Feeding: The flight is strong, fast and straight (Brosset, 1962c). The diet is unknown but is probably similar to that of other large Molossids.

Reproduction: A female with a single young was found in December; other females each had a single foetus (Prater, 1914). The twelve specimens collected in May 1961 and one female in March 1992 were sexually

dormant.

Conservation Status: Worldwide: an endemic species to the Indian subcontinent. To date, it is only known from Barapade Cave, Talewadi. It is extremely vulnerable to roost disturbance and deserves full protection. It is included on List 1 "Threatened species" in the 1996 IUCN Red List of Threatened Animals with the notation CR B1+2c: 'Critically endangered with a small distribution and with a decline in the area, extent or quality of the habitat' (Baillie & Groombridge, 1996).

Family Vespertilionidae: Evening bats

This family of small or medium sized insectivorous bats occurs throughout the Old and New World except in the polar and sub-polar regions and on some oceanic Islands. It is the largest among the bats and according to Corbet & Hill (1992) is comprised of about 44 genera and 350 species. The earliest known fossil record is from the Eocene of Europe, although it is also known from the Oligocene of North America and the Pleistocene of Africa and South America. The muzzle is simple and without any leaf-like appendages and the eyes are small. The tail is well developed and entirely enclosed within the membrane or only protrudes from it for a short distance. The ears are usually, but not always, separate

from each other, their anterior borders often have a distinct basal lobe. The tragus of each ear is well developed and simple in form. The skull is without postorbital processes. The premaxillae are without palatal branches. The palate is widely emarginated anteriorly and abruptly narrowed behind the toothrows. The dentition is usually normal, although in a few genera there is a reduction in the cusps. There is considerable variation in the number of teeth between the genera. This results from a reduction in the number of incisors and premolars. Nineteen genera of Vespertilionid bat are known from the Indian subcontinent.

Character matrix of the nineteen genera of Vespertilionidae from the Indian subcontinent

Genus number of local species	FA mm	CCL mm	C-M ³ mm	Number of upper/ lower incisors	Number of upper/ lower premolars	Comments
<i>Myotis</i> (page 118/ Plate 6 & 7 twelve species	30.0-58.3	11.2-18.9 (Fig. 145)	4.5-8.5	2/3	3/3	ears moderately tall and narrow; tragus tall and slender (Fig. 129); nostrils simple, not tubular and protuberant as in <i>Murina</i>
<i>Plecotus</i> (p. 136/ Plate 7) two species	36.5-45.1	13.8-15.4 (Fig. 151)	5.0-5.8	2/3	2/3	small bat with very large ears joined across the forehead, 37-42 mm (Fig. 150); nostrils open upwards and extend backwards as narrow fissures
<i>Barbastella</i> (p. 139) one species	38.7-42.1	13.4-14.2 (Fig. 155)	4.7-5.1	2/3	2/2	ears broad (Fig. 154); forward facing, joined at bases on forehead; nostrils open upwards and outwards on flat, naked median space, bordered by two elevated ridges
<i>Otonycteris</i> (p. 142/ Plate 7) one species	64.7-65.6	21.7 (Fig. 159)	8.5	1/3	1/2	large pale bat with very large ears, 30-42 mm; dorsal pelage buffy-brown with white roots
<i>Scotomanes</i> (p. 144) one species	56.1-61.2	20.1-20.9 (Fig. 164)	7.8-8.5	1/3	1/2	dorsal pelage orange-brown frosted with white; membranes uniform brown; ears tall (19-23 mm)

<i>Scotophilus</i> (p. 146) two species	44.0-65.8	16.3-21.3 (Fig. 170)	6.1-8.4	1/3	1/2	ears relatively small; tragus sickle shaped (Fig. 167); pelage often chestnut/ tawny brown above; yellow/ buff below
<i>Eptesicus</i> (p. 151/ Plate 7) six species	35.4-55.1	11.7-19.5 (Fig. 174)	4.4-7.8	2/3	1/2	ears with bluntly rounded tips; tragus short and blunt; baculum usually triangular in shape (Fig. 173)
<i>Vespertilio</i> (p. 158) one species	42.0-45.5	15.0 (Fig. 183)	4.9-5.5	2/3	1/2	ears short and broad; tragus short and blunt (Fig. 182); dorsal pelage mottled, dark chocolate and buffy brown; nostrils simple
<i>Ia</i> (p. 160/ Plate 7) one species	70.9-77.3	25.2-26.2 (Fig. 187)	10.5-11.0	2/3	2/2	large bat; grey brown pelage above, with glossy sheen, matt grey on ventral surface; blunt tragus
<i>Tylonycteris</i> (p. 162) two species	26.1-29.0	10.0-11.7 (Fig. 191)	3.4-4.2	2/3	1/2	minute bat with greatly enlarged pads on the foot and thumb (Fig. 196); skull greatly flattened
<i>Pipistrellus</i> (p. 166/ Plate 8) twelve species	25.0-43.6	9.3-15.6 (Fig. 206)	3.5-6.5	2/3 i^2 is often absent in <i>P. dormeri</i>	2/2 pm^2 absent in <i>P. savii</i>	ill defined genus; tragus with broadly rounded tip (Fig. 211); pelage colour variable; nostrils simple; baculum frequently diagnostic (Fig. 205)
<i>Scotoecus</i> (p. 187) one species	34.1-37.3	13.8-14.8 (Fig. 221)	5.5-5.9	1/3	1/2	muzzle broad and flattened; male with very large penis; skull greatly broadened; i^2 nearly half height of canine (Fig. 221)
<i>Nyctalus</i> (p. 188/ Plate 8) three species	42.1-57.8	14.7-18.6 (Fig. 226)	5.5-7.7	2/3	2/2	ears short and rounded with club shaped tragus (Fig. 224); wings with very short fifth finger; heavy body
<i>Philetor</i> (p. 193) one species	31.7-35.7	12.4-13.7 (Fig. 234)	4.5-4.8	2/3	1/2	externally smaller but similar to <i>Nyctalus</i> ; tragus very blunt; short fifth finger; strange genitalia (page 194); skull with peg-like projections over orbit (Fig. 233)
<i>Hesperotenus</i> (p. 195) one species	50.0-60.4	17.2-19.6 (Fig. 238)	7.1-8.2	2/3	1/2	dorsal pelage greyish-yellow to bright golden-brown, sometimes rufous; interfemoral membrane reddish brown darkening to black on outer margin; tragus short and blunt
<i>Miniopterus</i> (p. 198/ Plate 8) two species	39.6-49.6	12.0-14.8 (Fig. 242)	5.1-6.3	2/3	2/3	ears short (Fig. 241); tail and 2 nd phalanx of 3 rd metacarpal very long; fur short and dense
<i>Murina</i> (p. 201/ Plate 8) six species	27.7-40.9	12.1-16.3 (Fig. 247)	4.5-6.1	2/3	2/2	nostrils tubular, laterally directed and protuberant; interfemoral membrane with long hairs on dorsal surface (Fig. 246)
<i>Harpiocephalus</i> (p. 210) one species	44.1-50.1	19.0-19.5	6.5-6.9	2/3	2/2	nostrils and interfemoral membrane as in <i>Murina</i> ; m^3 reduced to a small scale
<i>Kerivoula</i> (p. 212/ Plate 8) three species	31.5-42.0	12.2-15.9 (Fig. 261)	5.5-7.4	2/3	3/3	ears slightly funnel shaped; tragus tall and slender (Fig. 260); nostrils normal not tubular; pelage woolly
NB: the complex and arbitrary nature of some Vespertilionid genera require the use of the above matrix with the text						

Genus *Myotis* Kaup, 1829

Myotis Kaup, 1829: 106; type species *Vespertilio myotis*. The ears are tall and slender and occasionally rather large. The tragus of each ear is also slender; it is spear-shaped and nearly or quite straight (Fig. 129). The tail is entirely enclosed within the interfemoral membrane, except for the extreme tip (Fig. 143). It is about equal in

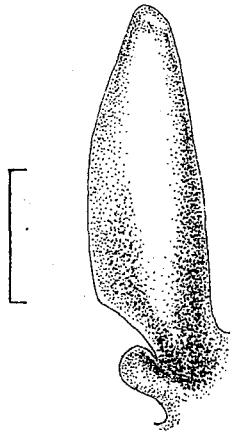


Fig. 129. Right tragus of *Myotis horsfieldii*. HZM.4.28271, Venniar Estate, India. Scale = 2 mm.

length to the hind limbs. The feet are variable in size. The skull is slender and lightly built, without special peculiarities of form. The rostrum is about equal in length to the braincase (Fig. 145). The palate is deeply emarginated in front and constricted behind. The tympanic bullae are well developed and cover more than half the surface area of the cochleae. It is a dentally primitive genus, retaining the maximum number of teeth known in the Order. There are three upper and three lower premolars. Occasionally the second upper (pm^3) and/or second lower premolar (pm_3) may be absent.

Dental formula: $\frac{i-2\ 3}{1\ 2\ 3} \quad \frac{c\ 1}{1} \quad \frac{pm-2\ 3\ 4}{-2\ 3\ 4} \quad \frac{m\ 1\ 2\ 3}{1\ 2\ 3} = 38$

The genus includes 84 species and has an extensive geographical range which includes South, Central and North America, Eurasia, Africa, Madagascar and Australia (Koopman, 1993). Twelve species are recorded from the Indian subcontinent (see page 120).

Myotis blythii (Tomes, 1857)

Lesser Mouse-eared bat

Vespertilio blythii Tomes, 1857: 53; Nasirabad, Rajputana, India (but see Blanford, 1888-91, p. 334 and Topal, 1971, p. 385).

Vespertilio murinoides Dobson, 1837c: 205; Chamba, north-west Himalaya, India, 3000 ft. Pre-occupied by *V. murinoides*.

? *Myotis africanus* Dobson, 1875: 260; 'Gaboony' but more probably from Kashmir (Corbet & Hill, 1992).

External characters: This is a relatively large species of *Myotis* (Plate 6) with an average forearm length of 56.7 mm (55.5-58.3 mm). The ears are tall, ranging from 19-

26 mm in extralimital material from Iran; the tips are bluntly rounded. The anterior border of each pinna is evenly convex, with a sharply projecting lobe at the base. There is a very faint median notch on the posterior border. The antitragus is small and low. The tragus is tall and narrow, about half the height of the pinna. It is widest just above the base and has a straight anterior margin which narrows to the tip, the posterior margin is gently convex in its middle part and sharply emarginated just above the projecting basal lobule. The muzzle is simple with crescentic nostrils that open laterally and a wide shallow internarial groove. The upper and lower lips, glandular swellings of the muzzle and the periorbital regions are only lightly haired; in contrast, the forehead and upper parts of the muzzle, almost to the rhinarium, are thickly haired. The pelage is woolly in texture. The hairs on the back are 7-8 mm long; they are distinctly shorter on the belly. The dorsal surface is buffy brown with dark grey hair roots. The ventral surface is paler but also has dark roots. The feet are not greatly enlarged; they slightly exceed half the length of the tibiae. The wings are rather broad in relation to their length; each wing is attached to the base of the phalanx of the outer metatarsal of its respective foot. The interfemoral and wing membranes are uniformly pale brown and hairless throughout, above and below. The tail is long and entirely enclosed within the interfemoral membrane except for its extreme tip.

Cranial characters: The skull is relatively large, with an average condylo-canine length of 18.5 mm (18.1-18.9 mm). The braincase is not distinctly elevated above the rostrum and the dorsal profile slopes gradually upwards from nasals to the lambda. The rostrum is relatively

Table 61. *Myotis blythii*: Specimens from India.

External, cranial and dental measurements (mm)

	mean	range	s	n
*HB:	74.0	65.0 - 80.0	4.0	42
*T:	58.2	53.0 - 68.0	2.9	42
*HF:	14.4	11.0 - 17.0	1.5	45
TIB:	25.9	23.7 - 27.2	1.3	5
FA:	56.7	55.5 - 58.3	1.2	5
5mt:	53.1	51.5 - 54.4	1.2	5
4mt:	54.9	53.1 - 56.2	1.3	5
3mt:	56.0	54.3 - 57.7	1.6	5
E:	19.0	19.0 - 19.0	-	1
GTL:	21.2	20.8 - 21.5	0.4	3
CCL:	18.5	18.1 - 18.9	-	2
BB:	9.4	9.4 - 9.4	-	2
PC:	5.0	4.8 - 5.2	0.2	4
C-M ³ :	8.4	8.2 - 8.5	0.1	4
C-M ₃ :	9.2	9.2 - 9.2	-	4
M:	15.9	15.7 - 16.0	0.1	4
M ³ -M ₃ :	8.8	8.7 - 9.0	0.1	4
C ¹ -C ₁ :	5.5	5.2 - 5.7	0.2	4

*: based on specimens from Iran listed in DeBlase (1980)

short and broad and there are distinct supraorbital ridges. The zygomata are widely flared and greatly exceed the braincase in breadth. The postorbital region is not greatly restricted in width. The lambdoid crests are weak and merge with the sagittal crest at the lambda, this forms a small elevated triangular area with a flat surface. The supraoccipital is nearly vertical above the foramen magnum, so that the lambda just forms the most posterior part of the skull. The palate is concave and relatively broad; the anterior emargination is wide and extends back to a level equal to the posterior borders of the upper canines. The postdental extension of the palate is long; almost equal to the length of the mesopterygoid space. The hamular processes are blunt and inwardly sloping. The tympanic bullae are small relative to the size of the skull. Each half mandible is long and slender, with its posterior part high, so that the angular process is on a level with the alveolar line. The coronoid process is tall and bluntly triangular with its anterior border almost vertical; the angular process is rather small and narrow and is little deflected outwards and just projects behind the condyle.

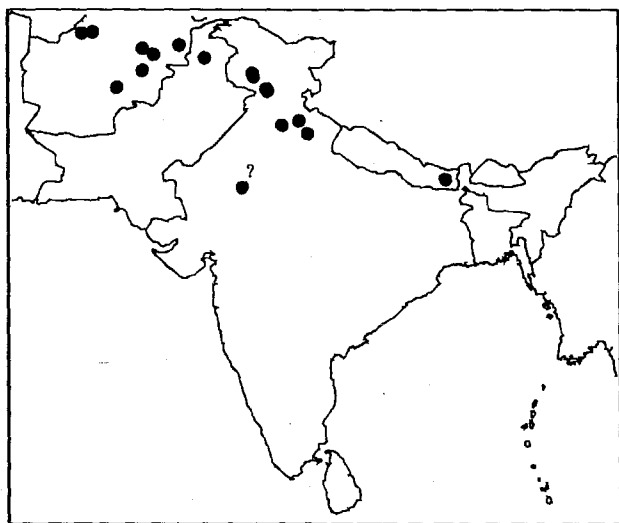


Fig. 130. Distribution of *Myotis blythii*.

Dentition: Upper toothrow length ($c-m^3$) averages 8.4 mm (8.2-8.5 mm). The upper incisors are tall and slender with the second (i^3) subequal in height to the first (i^2). The upper canine is weak relative to the size of skull; its cingulum is without cusps. The second premolar (pm^3) is variably displaced inwards from the toothrow, its crown area is about half that of first (pm^2). Both teeth are small and closely crowded between the canine and the powerful third premolar (pm^4) which attains about three-quarters the height of the canine. m^2 is broader than m^1 and with a greater crown area; the metacones predominate in both teeth and the hypocones are absent; the mesostyles are particularly well developed. m^3 is greatly reduced; it is comprised of a parastyle, mesostyle and three commissures. The first lower incisor (i_1) has three cusps; the second (i_2) is also essentially tricuspidate but has an additional accessory cusp situated postero-medially; the third (i_3) has four cusps and is almost square. The lower canine is low and

broad with the cingulum well developed but without cusps. The small second premolar (pm^3) is situated in the toothrow and is half the crown area of the first (pm^2). The third premolar (pm^4) is large; it is two-thirds the height and three-quarters the crown area of the canine. m^2 slightly exceeds m^1 in size. The talonid of m^3 is reduced; it is about half the crown area of the trigonid.

Variation: Specimens from the Indian Subcontinent are referred to the nominate subspecies *M. b. blythii* (Strelkov, 1972).

Distribution: *Myotis blythii* ranges from the Mediterranean zone of Europe and north-west Africa to the Crimea, Asia Minor, Israel, Arabia, Afghanistan, Himalayas, China and Mongolia.

In the Indian subcontinent (Fig. 130) localities include: **INDIA: Jammu & Kashmir:** 6 miles from Achabal (BMNH); Shar (Chakraborty, 1983); **Himachal Pradesh:** Chamba (type loc. of *murinoides*); Dalhousie (BMNH); Simla (Thomas, 1915a); **Rajasthan:** Nasirabad (type loc. of *blythii*; but Topal, 1971 suggests the correct locality is Nassenabad, possibly in the Himalayas); **Uttar Pradesh:** Balna (BMNH); Mussoorie (Topal, 1971).

PAKISTAN: NWFP: Karakar Pass (FMNH).

NEPAL: Tumlingtar (FMNH).

AFGHANISTAN: Ghazni; Baschgar Valley; near Kabul; near Maimana; near Qalat; near Beltchiragh (Gaisler, 1970b); Firindjal (FMNH).

Habits: According to Roberts (1977), it is found in areas of low rainfall but not desert and is often associated with scrub forest and low foothills. In Kashmir, it was collected at Bahmajo bat cave, near Achabal at an altitude of 1754 metres (5700 feet) (BMNH). According to Blanford (1888-91), it roosts during the day (and hibernates) in caves and buildings. In Arabia, it is a gregarious, cave dwelling species. In Lebanon, colony size ranged from 10 to over 200 individuals (Harrison & Bates, 1991). In Iran, vast colonies of approximately 5000 and 12000 individuals have been recorded; the bats were hanging in huge clusters, singly or in pairs (DeBlase, 1980). It may also roost in deep inaccessible fissures (Harrison & Bates, 1991) as well as buildings and trees (DeBlase, 1980). Roost sites are frequently shared with *Miniopterus schreibersii*. In Iran and Arabia, it is known to migrate. Individuals collected in Iran in August were in deep torpor (DeBlase, 1980).

Feeding: In Kashmir, it was observed late in the evening, flying one to ten metres above the ground near a stream passing through the town of Shar (Chakraborty, 1983). The flight is slow (Blanford, 1888-91). The stomachs of two specimens revealed semi-digested insects (probably dipteran) (Chakraborty, 1983).

Reproduction: According to Blanford (1888-91),

Character matrix of the twelve species of *Myotis* from the Indian Subcontinent

Species	FA mm	CCL mm	C-M ³ mm	Comments
<i>M. blythii</i> (page 118/ Plate 6)	56.7 55.5-58.3	18.5 18.1-18.9	8.4 8.2-8.5	pelage buffy brown on back, paler on belly with dark hair roots; ears tall (19-26 mm)
<i>M. sicarius</i> (p. 120)	50.7 48.1-54.6	17.4 16.9-17.7	7.3 7.1-7.5	pelage chocolate brown on back, ginger on belly with dark hair roots; ears medium-sized (17-19 mm)
<i>M. formosus</i> (p. 122/ Plate 6)	47.4 44.5-49.1	16.4 16.3-16.6	7.1 6.8-7.2	pelage ginger/ orange on back; wings black and orange; interfemoral membrane orange
<i>M. mystacinus</i> (p. 123)	35.6 34.5-36.8	12.1 11.6-12.4	5.0 4.7-5.3	feet small; ventral pelage with dark hair roots but tips pale grey or creamy white; braincase bulbous; upper canine greatly exceeds third upper premolar (pm ⁴) in height
<i>M. muricola</i> (p. 125)	33.7 31.2-37.0	11.7 11.5-12.3	5.0 4.8-5.3	feet small; ventral pelage with dark hair roots and brown tips; braincase relatively flat; upper canine greatly exceeds third upper premolar (pm ⁴) in height
<i>M. siligorensis</i> (p. 126)	30.8 30.0-31.5	11.2	4.7 4.5-4.8	feet small; ventral pelage with dark brown hair roots and pale brown tips; braincase conspicuously domed anteriorly; canines and molars very weak
<i>M. montivagus</i> (p. 128)	45.3 44.7-46.8	15.3 15.1-15.6	6.6 6.5-6.8	dorsal pelage dark brown; second lower premolar (pm ₃) small, about 50% of crown area of first (pm ₂); second upper premolar (pm ³) small
<i>M. annectans</i> (p. 129)	46.1 45.3-46.5	15.3 14.9-15.5	6.6 6.5-6.7	dorsal pelage dark brown; second lower premolar (pm ₃) minute (or absent), less than 20% of crown area of first (pm ₂); second upper premolar (pm ³) also minute or absent
<i>M. longipes</i> (p. 130)	37.5 36.5-39.0	12.4 12.2-12.8	5.2 5.1-5.3	feet large; pelage greyish brown above, creamy white on belly with dark hair roots; upper canine reduced (Fig. 139)
<i>M. daubentonii</i> (p. 131/ Plate 7)	34.8	*11.1 10.6-11.9	4.9 4.8-5.0	feet large; pelage sooty grey brown above, grey-brown below with dark roots; upper canine exceeds third upper premolar (pm ⁴) in height
<i>M. horsfieldii</i> (p. 133)	38.5 36.5-41.5	13.9 13.4-14.3	5.7 5.5-5.9	feet large; pelage almost black above, grey-brown below with dark roots; wings attached to outer metatarsal of each foot; skull not broad, breadth of braincase = 7.2-7.7 mm
<i>M. hasseltii</i> (p. 134)	39.3 37.2-40.3	14.2 14.0-14.6	5.9 5.8-6.0	feet very large; pelage dark brown above, grey below with dark roots; wings attached to ankles or tibiae; skull broad, breadth of braincase = 8.0-8.3 mm

*: CBL not CCL measurements

females give birth to a single infant. The mother carries her young from the end of May until July. In Iran, it is thought that the two sexes segregate during the breeding season. Adult males select summer roosts in small relatively dry caves and cave-like buildings whereas the females rely on large, damp caves for their nursery colonies (DeBlase, 1980).

Conservation status: Worldwide: this is a widespread species in the Palearctic region. The vast colonies located by DeBlase (1980) in Iran suggest that it is a

common species in at least part of its range but that it is also susceptible to significant population decline should key roosting sites become disturbed. Indian subcontinent: there is no information on its population status. There are no endemic subspecies.

Myotis sicarius Thomas, 1915

Mandelli's Mouse-eared bat

Myotis sicarius Thomas, 1915a: 608; North Sikkim, India.

External characters: This is a smaller species than *M. blythii* with an average forearm length of 50.7 mm (48.1-54.6 mm). The ears are dark and have bluntly rounded tips. The anterior border of each ear is evenly rounded and convex; the posterior border has a long shallow

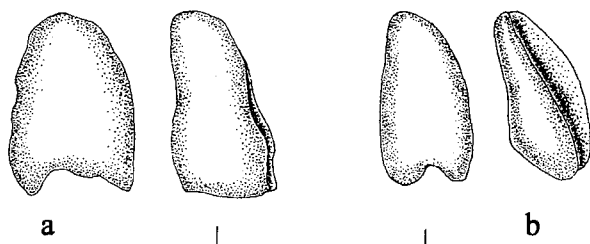


Fig. 131. Dorsal (left of each pair) and lateral (right of each pair) views of the bacula of two species of *Myotis*.
a: *M. sicarius*, HZM.1.16284, Godavari, Nepal.
b: *M. horsfieldii*, HZM.3.28270, Venniar Estate, India.
Scale = 1 mm.

concavity beneath the tip. The tragus is well developed and is about half the height of the pinna. In the wing, the third metacarpal exceeds the fourth and fifth in length. The wings are attached to the base of the first phalanx of the outer metatarsal of each foot. The feet are not greatly enlarged and are about equal to half the length of the tibiae. The wing and interfemoral membranes are semi-translucent, dark brown/ black in colour and without hairs, above and below. The pelage is dense, relatively short and very soft. It is a uniform deep chocolate brown on the dorsal surface. The ventral surface is paler; the hair tips are ginger coloured; the roots are dark. The forehead and muzzle are covered in hairs; the ears and around the eyes and nostrils are essentially naked. The baculum is small, saddle-shaped with a blunt rounded tip (Fig. 131).

Table 62. *Myotis sicarius*: Specimens from Nepal.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	54.0	50.0 - 56.0	3.5	3
T:	45.3	44.0 - 47.0	1.5	3
HF:	10.7	10.0 - 11.0	0.5	4
TIB:	20.7	19.7 - 21.5	0.8	4
FA:	50.7	48.1 - 54.6	2.7	4
5mt:	42.7	40.7 - 44.8	2.1	3
4mt:	44.1	42.0 - 45.3	1.8	3
3mt:	45.5	42.9 - 46.8	2.2	3
E:	18.1	17.2 - 19.0	-	2
GTL:	18.8	18.8 - 18.9	0.1	3
CCL:	17.4	16.9 - 17.7	0.4	3
ZB:	11.8	11.8 - 11.8	-	1
BB:	8.1	8.0 - 8.4	0.2	3
PC:	4.3	4.1 - 4.4	0.2	3
C-M ³ :	7.3	7.1 - 7.5	0.2	3
C-M ₃ :	5.1	4.9 - 5.3	0.2	3
M:	14.4	14.1 - 14.9	0.5	3
M ³ -M ₃ :	7.8	7.7 - 8.0	0.2	3
C ¹ -C ₁ :	5.1	4.9 - 5.3	0.2	3

Cranial characters: The skull is conspicuously smaller than that of *M. blythii* with an average condylo-canine length of 17.4 mm (16.9-17.7 mm). The rostrum is long and robust; its upper surface is evenly rounded and its breadth is accentuated by the development of the lachrymal ridges. The dorsal profile exhibits only a slight post nasal depression and the braincase appears relatively shallow. The zygomata are short and widest posteriorly. The sagittal crest is weakly developed, being most prominent in the fronto-parietal region. The lambdoid crests are also weak. The supraoccipital is nearly vertical and the lambda just forms the most posterior part of the skull. The braincase is small and when viewed from above, it scarcely exceeds the rostrum in surface area. The palate is concave with its anterior emargination extending to about the midpoint of the canines; its postdental extension is broad and about equal in length to the short mesopterygoid space. Each half mandible is more delicate than that of *M. blythii*. The horizontal ramus is shallower and the coronoid process less robust.

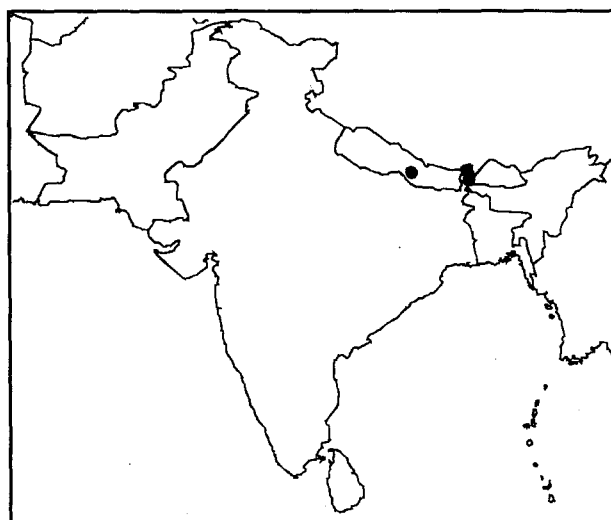


Fig. 132. Distribution of *Myotis sicarius*.

Dentition: Upper toothrow length (c-m³) averages 7.3 mm (7.1-7.5 mm). The dentition is significantly less robust but comparable in morphology to that of *M. blythii*, except that the second upper (pm³) and lower premolars (pm₃) are relatively smaller. In particular, pm₃ has a crown area of between one quarter and one third that of pm₂; in *M. blythii* it is between half and two-thirds the area.

Variation: All specimens are referred to the nominate subspecies *M. s. sicarius*.

Distribution: *Myotis sicarius* is endemic to the Indian Subcontinent (Fig. 132).

INDIA: West Bengal: Pashok (Wroughton, 1916ciii); **Sikkim:** (type loc. of *sicarius*); Rongli (FMNH).

NEPAL: Banss Bahari (Fry, 1925); Godavari (HZM).

Habits: Practically nothing is known of this species

except that it was collected in a mistnet set by a river at Godavari in the Kathmandu Valley, Nepal at an approximate altitude of 1350 metres (4388 feet) (HZM).

Conservation status: This is an endemic species to the Indian subcontinent. According to Agrawal *et al.* (1992), it is one of the rarest bats in West Bengal, only known by three specimens collected in 1915. It is included on List 1 "Threatened species" in the 1996 IUCN Red List of Threatened Animals, with the notation VU A2c, D2: vulnerable with a suspected decline in numbers/ habitat and a restricted population (Baillie & Groombridge, 1996).

Myotis formosus (Hodgson, 1835)

Hodgson's bat

Vespertilio formosa Hodgson, 1835: 700; Nepal.

Kerivoula pallida Blyth, 1863: 34; Chaibassa, Orissa, India.

Vespertilio auratus Dobson, 1871d: 186; Darjeeling, north-east India.

Vespertilio dobsoni Anderson, 1881: 143; Purneah, Bengal, India. Preoccupied by *V. dobsoni* Trouessart, 1878.

= *Vespertilio andersoni* Trouessart, 1897: 129.

External characters: This is a medium-small species of *Myotis* with an average forearm length of 47.4 mm (44.5-49.1 mm). The pelage has a very distinct coloration (Plate 6). The dorsal surface is ginger brown mid-dorsally and orange-brown on the flanks. The ventral surface is deep orange posteriorly and lighter cinnamon brown on the throat. The head is hairy, except for around the eyes, nostrils and lips (Plate 6). The ears are naked; they are orange-coloured with darker margins and are relatively short. Each ear is ovate in shape with the anterior border evenly rounded; there is a shallow concavity on the posterior border. The tragus is long, narrow and obtusely pointed; the anterior border is straight; the posterior border is concave in its upper part. The wings are broad and have a characteristic colour pattern of orange and black. The orange extends in narrow lines alongside each of the metacarpals. Black triangular areas are present between the third, fourth, and fifth metacarpals and inside the fifth. These black triangular areas are sometimes dotted and streaked with orange. The interfemoral membrane is orange. The feet are not enlarged; they average less than half the length of the tibiae. The wings are attached to the base of the phalanx of the outer metatarsal of each foot.

Cranial characters: The skull is smaller than that of *M. sicarius* and has an average condylo-canine length of 16.4 mm (16.3-16.6 mm). However the braincase is relatively larger with the lambda more rounded and just forming the most posterior part of the skull. The sagittal crest is scarcely evident, except in the parietal region; it bifurcates anteriorly to form supraorbital ridges. The

rostrum is robust and with well developed lachrymal projections. The zygomata greatly exceed the braincase in width and are without dorsal projections. The lambdoid crests are essentially absent or very poorly developed. The palate is long, broad and concave; there is a small median process on the postorbital extension. The mesopterygoid space is short. The tympanic bullae are small. In lateral view, there is a gentle gradient between the rostrum and the braincase with the post nasal notch scarcely evident. The coronoid process of each half mandible is well developed; it greatly exceeds the height of the canine; its anterior surface is nearly vertical and its posterior surface slopes gently downwards to the condyle, which is equal to the canine in height.

Dentition: Upper toothrow length (c-m³) averages 7.1 mm (6.8-7.2 mm). The upper canine is tall, slightly recurved and with a well developed cingulum; it is without accessory cusps. Both the first (pm²) and second (pm³) upper premolars are reduced. pm³ is particularly small, occasionally absent, with a crown area of between half and less than one third that of pm²; it is completely displaced inwards so that pm² and third premolar (pm⁴) are in contact. m³ includes a parastyle, mesostyle and three commissures. In the lower dentition, the second premolar (pm₃) is very variable in size, ranging from minute to two-thirds the crown area of the first (pm₂); it is occasionally absent. Both small premolars are situated in the toothrow and are compressed between the canine and third premolar (pm₄).

Variation: Specimens from north-eastern Bihar and Darjeeling district in West Bengal are provisionally

Table 63. *Myotis formosus*: Specimens from India and Tibet.

External, cranial and dental measurements (mm)

	mean	range	s	n
T:	41.3	36.0 - 48.0	6.1	3
HF:	10.6	10.2 - 11.6	0.6	3
TIB:	22.5	21.0 - 23.2	0.9	5
FA:	47.4	44.5 - 49.1	1.9	5
5mt:	43.5	42.3 - 47.2	1.3	5
4mt:	43.1	42.3 - 44.0	0.8	5
3mt:	44.3	43.2 - 45.7	1.1	5
E:	13.6	12.8 - 14.5	0.9	3
GTL:	18.4	18.1 - 18.9	0.4	4
CCL:	16.4	16.3 - 16.6	0.2	4
ZB:	11.8	11.7 - 11.9	-	2
BB:	8.4	8.1 - 8.7	0.3	4
PC:	4.5	4.4 - 4.5	0.1	4
C-M ³ :	7.1	6.8 - 7.2	0.2	4
C-M ₃ :	7.4	7.4 - 7.8	0.2	4
M:	13.9	13.7 - 14.1	0.2	4
M ³ -M ₃ :	7.6	7.4 - 7.8	0.2	4
C ¹ -C ₁ :	5.1	4.9 - 5.3	0.2	4

referred to *M. f. auratus* on account of their larger size (= *M. f. andersoni* in Sinha, 1986). Specimens from elsewhere in the Indian subcontinent are referred to the nominate race *M. f. formosus*.

Distribution: *Myotis formosus* ranges from Afghanistan to China, Taiwan, Korea, Japan, Philippines and Indonesia.

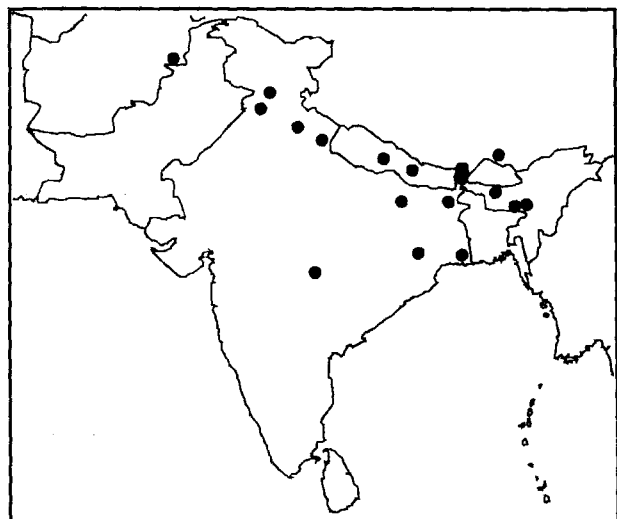


Fig. 133. Distribution of *Myotis formosus*.

In the Indian subcontinent (Fig. 133) localities include: **INDIA: Jammu & Kashmir:** no exact loc. (Das *et al.*, 1995); **Himachal Pradesh:** Dharamsala (Thomas, 1915a); **Punjab:** Hoshiapur (Sinha, 1986a); **Maharashtra:** Nagpur (D'Abreu, 1925); **Uttar Pradesh:** near Mussoorie (Blanford, 1888-91); Dehra Dun (Scully, 1887); Katarmal (Bhat, 1974); **Bihar:** Chaibassa (type loc. of *pallida*); Siripur (Sinha, 1986); Purnea (type loc. of *andersoni*); **West Bengal:** Darjeeling (type loc. of *auratus*); Calcutta (Blanford, 1888-91); **Sikkim:** (Blanford, 1888-91); **Assam:** Goalpara (Sinha, 1986); **Meghalaya:** Cherrapunji (Kurup, 1968); Mawphlang (FMNH).

NEPAL: Kathmandu Valley (type loc. of *formosus*; for explanation see Scully, 1887); Ghorepani (HNHM).

TIBET: Tamdok (Thomas, 1915a).

AFGHANISTAN: Kalat-us-Seraj (Gaisler, 1970b)

Habits: In Nepal, it was collected at an altitude of 1231 metres (4000 feet) in the Kathmandu Valley (Hinton & Fry, 1923) and at 2900 metres (9425 feet) at Ghorepani in the foothills of the Annapurna Range (HNHM). In India, it was found at 2308 metres (7500 feet) at Dharamsala in Himachal Pradesh (BMNH) and at 1692 metres (5500 feet) near Mussoorie in Uttar Pradesh (Blanford, 1888-91). In Taiwan, its roosting sites include the Longan tree (*Nephelium longanum*). Swinhoe (1862) noted that the coloration of the bat closely resembled the orange and black of the Longan tree's decaying leaves. Elsewhere in Taiwan, it was found roosting in a large tree, the flowers of which resembled those of the lilac. "They were hanging head downwards from the stem of a leaf in a bunch, one

against the other, their heads only showing, their bodies being hidden by the leaves. There were about ten of both sexes ..." (Swinhoe, 1870). In China, it was located in a bush and according to Allen (1938), the bright colouration of the wings is associated with its tree-living habits.

Reproduction: In Taiwan, a female with a single infant was observed in July (Swinhoe, 1870).

Conservation status: Worldwide: this is a geographically widespread but little known bat. It is apparently common in South Korea (Wallin, 1969). Indian subcontinent: the taxon *auratus* may prove to be a distinct indigenous subspecies to north-east India. The population status of the nominate form *M. f. formosus* in Nepal remains uncertain. According to Hinton & Fry (1923), it was rare in Nepal both during the surveys of 1920/21 and during the time of Scully (1887). It is also a rare bat in Meghalaya (Das *et al.*, 1995).

Myotis mystacinus (Kuhl, 1819)

Whiskered bat

Vespertilio mystacinus Kuhl, 1819: 202; Germany.

Vespertilio pallidiventrus Hodgson, 1844: 286. *Nomen nudum*

Vespertilio nipalensis Dobson, 1871a: 214; Kathmandu, Nepal.

Myotis meinertzhageni Thomas, 1926: 609; junction of Nubra and Shyok rivers, Ladak, Kashmir.

External characters: This is a small species of *Myotis*, with an average forearm length of 35.6 mm (34.5-36.8 mm). The naked parts of the face and muzzle are nearly black; the eyes are partly concealed by numerous fine hairs and the upper lip has a hairy fringe (hence the common name Whiskered bat). The ears are dark brown/ black and relatively small; the anterior border of each is evenly convex; the posterior border has a shallow concavity beneath the rounded tip. The tragus is tall and narrow, about half the height of the pinna. The feet are small, less than half the length of the tibiae. The pelage is russet brown on the dorsal surface with dark hair roots. The roots are also dark on the ventral surface but the tips are characteristically grey or creamy white in colour; in *M. muricola*, the belly is dark throughout. In the wing, the third metacarpal very slightly exceeds the fourth and fifth in length. The wing membranes are uniformly dark brown and are without hairs above and below; each wing is attached to the distal end of the outer metatarsal of the foot. The interfemoral membrane is also dark; there are some hairs present on the upper surface adjacent to the body and the tibiae.

Cranial characters: The skull with an average condylo-canine length of 12.1 mm (11.6-12.4 mm) is usually larger than that of *M. muricola*. The braincase is bulbous and elevated above the rostrum, but not as abruptly as in *M. siligorensis*. The rostrum is narrow,

shallow and has a very slight depression in the mid-line extending from the nasal orifice to the frontals. The sagittal crest is scarcely evident. The supraoccipital is convex and forms the most posterior part of the skull. In turn, the lambda just forms the most elevated part of the skull. Zygomatic breadth exceeds that of the braincase but each zygoma is short and fragile. The anterior emargination of the palate extends backwards to a level equal to the mid-line of the canines. Each half mandible has a relatively shallow horizontal ramus; its depth is about equal to the height of the protoconid of m_1 ; the height of the coronoid process greatly exceeds that of the canine.

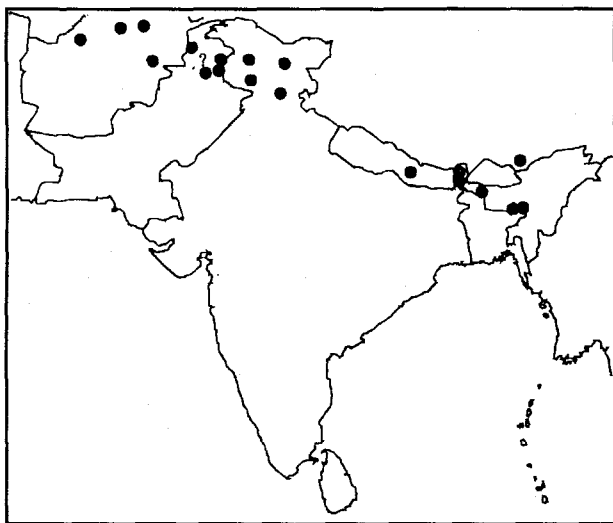


Fig. 134. Distribution of *Myotis mystacinus*.

Dentition: Upper toothrow length ($c-m^3$) averages 5.0 mm (4.7-5.3 mm) and is distinctly more robust than that of *M. siligorensis*. The first upper incisor (i^2) is bicuspidate, with its posterior cusp about half or less the height of the principal cusp. The second incisor (i^3) has a large outer cusp and a small accessory cusp on its inner surface. There is a short gap to the canine which exceeds the third premolar (pm^4) in height; the canine is without accessory cusps but has a well defined cingulum. The anterior upper premolars are small, with the second (pm^3) usually about two-thirds the crown area of the first (pm^2); both lie within the toothrow. m^1 and m^2 are about equal in crown area and both have a well developed protocone; the paracone and metacone are about equal in height. m^3 is about two-thirds the crown area of m^2 ; it includes a metacone and a very short fourth commissure; the metastyle is absent. The first lower incisor (i_1) has three cusps; the second (i_2) also has three cusps but with an additional very small accessory cusp postero-medially. The third incisor (i^3) is considerably broader and has four distinct cusps. The first lower premolar (pm_2) is half the crown area of the third (pm_4) and twice the crown area of the second (pm_3). The talonid of m_1 and m_2 slightly exceeds the trigonid in crown area. In m_3 , the talonid is subequal to the trigonid in size.

Variation: Specimens from the region are provisionally

referred to *M. m. nipalensis*; the status of *meinertzhageni* is unclear, the holotype is considerably paler dorsally than typical *nipalensis* (Hill, 1983), possibly it may represent a distinct race of *M. mystacinus*.

Taxonomic remarks: Although Ellerman & Morrison-Scott (1951) included *muricola* as a subspecies of *M. mystacinus*, the view was subsequently challenged by Corbet (1978). Hill (1983) discussed the status of *mystacinus*, *muricola* and *siligorensis* in detail and subsequently treated them as three distinct species (Corbet & Hill, 1992).

Distribution: *Myotis mystacinus* ranges from Ireland and Scandinavia to northern China, south to Morocco, Iran, Nepal, India and southern China.

In the Indian subcontinent (Fig. 134) localities include:

INDIA: Jammu & Kashmir: junction of Nubra and Shyok rivers (type loc. of *meinertzhageni*); Rambon; Sirguffara (BMNH); Shikargarh (Chakraborty, 1983); **Himachal Pradesh:** Chirot (= *muricola* in Lindsay, 1927ii); **West Bengal:** Hasimara (= *muricola* in Wroughton, 1917a); Darjeeling (Agrawal *et al.*, 1992); **Sikkim:** Choka (Kifune, 1984); **Meghalaya:** Cherrapunji; Mawphlang (FMNH).

PAKISTAN: NWFP: Dir; Shogran (USNM); lower Kaghan Valley (Roberts, 1977) **Punjab:** Murree Hills; Dunga Gali (Roberts, 1977).

NEPAL: Kathmandu (type loc. of *nipalensis*).

TIBET: no fixed locality (Ellerman & Morrison-Scott, 1951 but see Corbet & Hill, 1992).

AFGHANISTAN: Maimana (Meyer-Oehme, 1965); Mazar-i-Sharif, Kabul; Kunduz (FMNH).

Some or all records from Roberts (1977) for **PAKISTAN** may be referable to *M. muricola* and not *M. mystacinus*.

Habits: According to Strelkov (1983), in the former USSR, it favours deserts, semi-deserts and the lower and middle mountain zones. However, in the Indian subcontinent, it is found in warm tropical lowland areas such as Hasimara in West Bengal at an altitude of 188 metres (600 feet) (BMNH) as well as high altitude areas such as Chirot in the Pattan Valley of Himachal Pradesh (3015 metres: 9800 feet) and Ladak in Kashmir (BMNH). Elsewhere in Kashmir, it was collected in November at 1846 metres (6000 feet) at Sirguffara (BMNH) and in August at 2000 metres (6500 feet) at Shikargarh (Chakraborty, 1983). At Rambon, it was collected in November at 951 metres (3091 feet) in an area characterised by scattered bush jungles, with cultivation of wheat and maize on adjacent hill slopes (Chakraborty, 1983). In Nepal, it was considered to be "not common" in the Kathmandu Valley (Scully, 1887).

Feeding: Its diet includes lepidoptera (Chakraborty, 1983).

Conservation status: Worldwide: this is a very

Table 64. *Myotis mystacinus*: Specimens from India.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	40.6	38.0 - 47.0	3.0	8
T:	37.1	32.0 - 40.0	2.6	8
HF:	7.8	7.0 - 8.0	0.4	6
TIB:	16.4	15.0 - 17.3	0.8	7
FA:	35.6	34.5 - 36.8	0.9	8
5mt:	31.0	29.3 - 32.9	1.4	8
4mt:	31.7	30.1 - 33.2	1.1	8
3mt:	32.9	31.2 - 34.5	1.1	8
E:	12.5	12.0 - 14.0	0.8	8
GTL:	13.8	13.5 - 14.1	0.2	8
CCL:	12.1	11.6 - 12.4	0.3	8
BB:	6.6	6.3 - 6.9	0.2	6
PC:	3.5	3.3 - 3.7	0.2	10
C-M ³ :	5.0	4.7 - 5.3	0.2	9
C-M ₃ :	5.5	5.3 - 5.7	0.1	9
M:	10.0	9.7 - 10.3	0.2	9
M ³ -M ₃ :	5.6	5.3 - 5.8	0.2	7
C ¹ -C ₁ :	3.5	3.1 - 3.6	0.2	8

widespread species with no special conservation needs. Indian subcontinent: it was considered to be "not common" in Nepal at the end of the 19th century (Scully, 1887); its current status is not known. The race *nipalensis* is endemic to Nepal. The status of *meinertzhageni* from Ladak deserves further study.

Myotis muricola (Gray, 1846)

Nepalese Whiskered bat

Vespertilio muricola Gray, 1846: 4; Nepal. (*V. muricola* Hodgson, 1841: 212 and 1842: 908 are *nomina nuda*).

Vespertilio caliginosus Tomes, 1859: 73; India.

Vespertilio blanfordi Dobson, 1871a: 214; Himalayas.

External characters: With a forearm length of 33.7 mm (31.2-37.0 mm), this species averages smaller than *M. mystacinus*. It is primarily distinguished from *M. mystacinus* by its darker pelage colour on the ventral surface. Here, the hairs have essentially black bases and ochraceous brown tips. In *M. mystacinus*, the hair bases are also dark but the tips are characteristically grey or creamy white. The hairs on the dorsal surface have dark brown/ black bases and the tips are flecked with russet brown. In general, the hairs on the back appear darker than those of *M. mystacinus*. As in *M. mystacinus*, the ears and feet are relatively small and the wings are attached to the distal end of the outer metatarsal of each foot. The upper lip has a well developed fringe of hairs. The baculum is small, saddle-shaped and with a rounded tip.

Cranial characters: The skull, with an average condylo-canine length of 11.7 mm (11.5-12.3 mm) is usually smaller than that of *M. mystacinus*. In lateral view, the braincase and rostrum appear flattened in comparison to

those of *M. mystacinus* and *M. siligorensis*. As in *M. mystacinus*, the rostrum has a slight depression in the mid-line between the posterior border of the nasal orifice and the frontals. The sagittal crest is very weak; it is just visible posteriorly where it meets the ill-defined lambdoid crests at the lambda. The supraoccipital is slightly convex and just forms the most posterior part of the skull. The mandible is essentially similar to that of *M. mystacinus*.

Dentition: Upper toothrow length (c-m³) averages 5.0 mm (4.8-5.3 mm). The dentition does not differ significantly from that of *M. mystacinus*. Both the first two upper premolars are reduced with the second (pm³) half to two-thirds the crown area of the first (pm²). pm³ is sometimes displaced internally in the toothrow; pm² and the third premolar (pm⁴) are not in contact. The second lower premolar (pm₃) is compressed in the toothrow; it is two-thirds the crown area of the first (pm₂).

Variation: Specimens from Nepal and the eastern Himalayas are referred to the nominate race *M. m. muricola*. Those from the western Himalayas are slightly larger and have tentatively been referred to *M. m. caliginosus* which includes *blanfordi* as a synonym (Hill, 1983).

Taxonomic remarks: As noted in the Taxonomic remarks section of *M. mystacinus*, following Hill (1983), the taxon *muricola* is considered specifically discrete from *M. mystacinus*.

Distribution: *Myotis muricola* ranges from Afghanistan to Taiwan and New Guinea.

Table 65. *Myotis muricola*: Specimens from India, Pakistan and Nepal.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	43.8	41.0 - 47.0	2.1	11
T:	32.9	25.0 - 39.0	4.4	12
HF:	5.1	4.0 - 6.7	0.9	11
TIB:	13.3	11.7 - 16.6	1.4	14
FA:	33.7	31.2 - 37.0	1.7	18
5mt:	30.1	27.8 - 34.5	1.6	17
4mt:	30.7	28.9 - 33.5	1.3	16
3mt:	31.4	29.8 - 33.2	1.4	15
E:	9.9	6.0 - 13.3	2.6	14
GTL:	13.3	12.8 - 13.8	0.3	18
CCL:	11.7	11.5 - 12.3	0.3	18
ZB:	7.8	7.3 - 8.5	0.4	8
BB:	6.2	6.0 - 6.5	0.1	21
PC:	3.3	3.1 - 3.4	0.1	21
C-M ³ :	5.0	4.8 - 5.3	0.1	18
C-M ₃ :	5.4	5.1 - 5.6	0.2	21
M:	9.5	9.2 - 10.1	0.3	18
M ³ -M ₃ :	5.2	4.8 - 5.6	0.2	19
C ¹ -C ₁ :	3.1	3.0 - 3.5	0.2	20

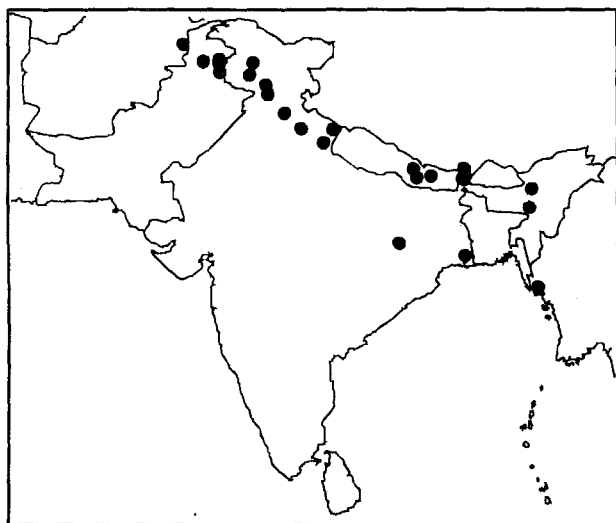


Fig. 135. Distribution of *Myotis muricola*.

In the Indian subcontinent (Fig. 135) localities include:

INDIA: Jammu & Kashmir: Pahlgam; Kokernag (BMNH); Anantnag (Raina & Kaul, 1982); **Himachal Pradesh:** Simla; Dalhousie (Blanford, 1888-91); Samayala (Lindsay, 1927ii); Chamba (Khajuria, 1953); **Uttar Pradesh:** Dehra Dun (Scully, 1887); Mussoorie (Blanford, 1888-91); Phurkia; Deori (= *darjilingensis* in Wroughton, 1914); **Bihar:** Chota Nagpur (Blanford, 1888-91); **West Bengal:** Calcutta (Blanford, 1888-91); Gairibas (Kifune, 1984); Ghum (HNHM); **Sikkim:** Laching (ZSI); Sedonchen; Lachen (Wroughton, 1916b); Jeluk (FMNH); **Assam:** Lokra (Nath, 1952); **Meghalaya:** Konshnong (Kurup, 1968).

PAKISTAN: NWFP: Shogran (HZM); Karakar Pass (FMNH); **Punjab:** Dunga Gali; Murree; Gharial (BMNH).

NEPAL: Kathmandu Valley (type loc. of *muricola*); Kontoum (BMNH); Langtang (HNHM); Those (Kock, 1996).

SRI LANKA: (doubtful record in Blanford, 1888-91).

AFGHANISTAN: Kamdesh (FMNH).

Northern MYANMAR: Akyab (Peters, 1867).

Records from Bhutan Duars (= Hasimara), **West Bengal** (Ellerman & Morrison-Scott, 1951) and Chiroi, **Himachal Pradesh** (Lindsay, 1927ii) previously referred to *muricola* are here included in *M. mystacinus*.

Habits: It was collected at an elevation of 2000 metres (6500 feet) at Sedonchen and 2708 metres (8800 feet) at Lachen in Sikkim (Wroughton, 1916b). In Nepal, it was found at 1230 metres (4000 feet) in the Kathmandu Valley (Hinton & Fry, 1923) and at 3200 metres (10400 feet) at Those in Ramechap District (Kock, 1996). It was collected at 1880 metres (6110 feet) at Langtang in the foothills of the Tibetan Plateau (HNHM) and at 1662 metres (5400 feet) at Chatri in Chamba district, Uttar Pradesh (FMNH). In Assam, it was recorded from the banks of the Bhareli River (Nath, 1952). In Malaysia, it was commonly found in areas of scrub and secondary forest. Its most favoured roosting sites included the

tightly rolled central leaf of the broad-leaved varieties of banana plants, both wild and cultivated. Colony size varied from one to eight. It was also recorded from Bhattu Caves (= *mystacinus* in Medway, 1969).

Feeding: According to Blanford (1888-91), it departs the roost early in the evening, coming out of caves and hollow trees and flying high. It is very rapid in its movements. In the Tennasserim region of Myanmar, it seldom leaves the shelter of trees (Wroughton, 1915b).

Conservation status: Worldwide: this is a geographically widespread species that is common in at least part of its range, for example Malaysia (= *mystacinus* in Medway, 1969). Indian subcontinent: its taxonomic and population status deserves further study. There are potentially two endemic subspecies, the nominate form *muricola* from Nepal and *caliginosus* from the western Himalayas.

Myotis siligorensis (Horsfield, 1855)

Himalayan Whiskered bat; Siliguri bat

Vespertilio siligorensis Horsfield, 1855: 102; Siligori, [Nepal], India.

? *Vespertilio darjilingensis* Horsfield, 1855: 102.

External characters: This is a small species with a forearm length (based on extralimital material) of 30.0-31.5 mm. Pelage colour is a uniform dark brown above. The hairs on the ventral surface have dark brown roots and pale brown tips. The muzzle is pointed with a well developed fringe of fine hairs on the upper lip. The ears are similar to those of *M. muricola* and the feet are not enlarged. The interfemoral and wing membranes are a uniform brown colour and the wings are attached to the base of the phalanx of the outer metatarsal of each foot.

Cranial characters: The skull has a condylo-canine length of about 11.2 mm. The braincase is conspicuously domed, especially anteriorly. In comparison to *M. muricola*, it is distinctly elevated above the flattened rostrum. When viewed from behind, the braincase is tall in relation to its width; it is almost square in outline; in *M. muricola* it is compressed and rectangular in shape. The rostrum has a shallow groove in the mid-line and the zygomata are very delicate. The tympanic bullae are well developed. The coronoid process of each half mandible is robust and exceeds the canine in height. It has a vertical anterior border and a shallow posterior border which slopes gently downwards to the condyle.

Dentition: Upper toothrow length (c-m³) averages 4.7 mm (4.5-4.8 mm). The dentition is very weak. This is especially noticeable in the upper canine which scarcely exceeds the third upper premolar (pm⁴) in height. Both the first two upper premolars are reduced; the second (pm³) is about two-thirds the crown area of the first (pm²); both are situated in the toothrow. pm² is not in

contact with the third premolar (pm^4). The crown area of the molars are greatly reduced throughout. m^3 includes a parastyle, mesostyle and three commissures. In general, the upper molars are about half the crown area of those of *M. muricola*. The lower canine is very poorly developed, equal or less in height and crown area to the third lower premolar (pm_4). The first lower premolar (pm_2) is two-thirds the height of the canine and over half its crown area; the second (pm_3) is about half the height and crown area of pm_2 ; it is also situated in the tooththrow. m_3 is subequal to m_2 in size; the talonid is slightly reduced.

Variation: All specimens from the Indian subcontinent are referred to the nominate subspecies *M. s. siligorensis*.

Taxonomic remarks: As noted in the Taxonomic remarks section of *M. mystacinus*, following Hill (1983), the taxon *siligorensis* is considered specifically discrete from *M. mystacinus*.

Distribution: *Myotis siligorensis* ranges from northern India to southern China, Vietnam, western Malaysia and Indonesia.

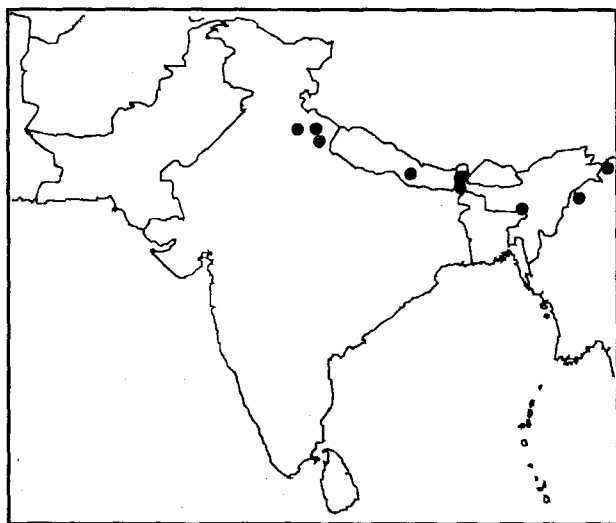


Fig. 136. Distribution of *Myotis siligorensis*.

In the Indian subcontinent (Fig. 136) localities include: **INDIA: Uttar Pradesh:** Dwali; Dogalbita (Bhat, 1974); Mussoorie (FMNH); **West Bengal:** Siliguri (type loc. of *siligorensis*); Ghum (Topal, 1974); **Sikkim:** Bakkim (Kifune, 1984); **Meghalaya:** Konshnong (Hinton & Lindsay, 1926).

NEPAL: Kathmandu Valley (Hinton & Fry, 1923).

Northern MYANMAR: Hai Bum (Carter, 1943); Adung Valley (FMNH).

Specimens from Phurkia and Deori in **Uttar Pradesh, INDIA** referred to *darjelingensis* by Wroughton (1914) are here included in *M. muricola*.

Habits: According to Scully (in Hinton & Fry, 1923), "this is one of the commonest bats in the Nepal valley

(Kathmandu Valley). It may be seen every evening throughout the year, flying rather high in the air". In Uttar Pradesh, it was collected in May and July at elevations ranging from between 2370 and 2770 metres (7703-9003 feet) in the temperate zone of the foothills of the Himalayas and according to Bhat (1974) it was using crevices in roofs as diurnal roosts. In Meghalaya it was collected at 914 metres (3000 feet) at Konshnong (Hinton & Lindsay, 1926). In Malaysia, it was found roosting in small groups in crevices in a cave (Medway, 1969).

Feeding: It emerges at dusk and returns to the roost some 30 minutes before sunrise (Bhat, 1974). In Nepal, it was seen flying high in the air but also frequently entered houses at night to hunt near lamps (Scully, 1887). In Thailand, it departed from its diurnal roost (caves) soon after sunset (1845 hours) and hunted at least until 0200 hours. It usually flew some 2-5 metres above the ground and at least some metres away from the nearest vegetation. It would often spend 10-15 minutes in the same area before moving on to another (Surlykke *et al.*, 1993).

Reproduction: A sexually active male was collected at Ghum in West Bengal on 8 October and a gravid female was collected on 7 May in Vietnam (Topal, 1974). In the Kathmandu Valley, none of the specimens collected from June to November had descended testes or enlarged mammae; an immature female was obtained on 30 June and a very young male on 3 July (Scully, 1887).

Conservation status: Worldwide: this a geographically widespread but apparently rare bat throughout most of its range. Indian subcontinent: according to Das *et al.* (1995), it is rare in Meghalaya. Bhat (1974) however collected 22 specimens from Chamoli and Almora districts in Uttar Pradesh suggesting that it may be more common in the western Himalayas. Previously, Scully (1887) had suggested that it was common in Nepal.

Table 66. *Myotis siligorensis*: Specimens from India and Nepal.

External, cranial and dental measurements (mm)

	mean	range	s	n
*FA:	30.8	30.0 - 31.5	-	2
GTL:	12.8	12.8 - 12.8	-	1
CCL:	11.2	11.2 - 11.2	-	1
BB:	6.2	6.2 - 6.2	-	1
PC:	3.0	2.9 - 3.1	-	2
C-M ³ :	4.7	4.5 - 4.8	-	2
C-M ₃ :	5.0	4.9 - 5.0	-	2
M:	9.1	9.0 - 9.2	-	2
M ³ -M ₃ :	4.9	4.8 - 5.0	-	2
C ¹ -C ₁ :	3.1	3.0 - 3.2	-	2

*: based on extralimital material from Malaysia (Medway, 1969)

Myotis montivagus (Dobson, 1874)

Burmese Whiskered bat

Vespertilio montivagus Dobson, 1874c: 237; Hotha, Yunnan, China.

Myotis peytoni Wroughton & Ryley, 1913: 13; Gersoppa Falls, Kanara, southern India, 1300 ft.

External characters: The local subspecies *M. montivagus peytoni* has an average forearm length of 45.3 mm (44.7-46.8 mm). The dorsal pelage is medium-short in length and soft; it is dark brown, with chocolate brown hair tips and blackish roots. On the ventral surface, the hair bases are dark; the tips paler brown to fawn. The face is densely covered with hairs. The ears

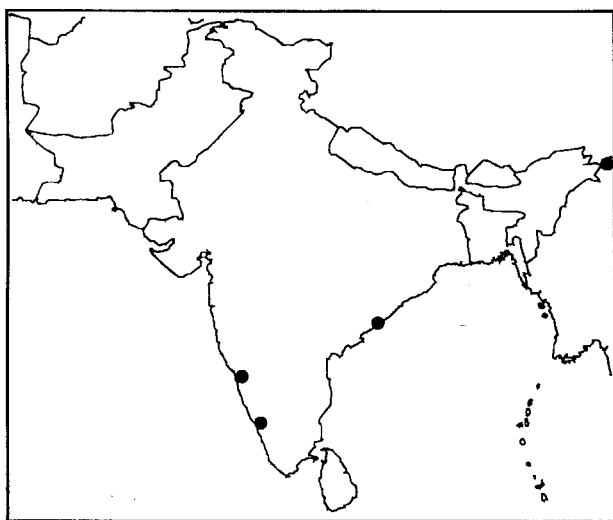


Fig. 137. Distribution of *Myotis montivagus*.

are relatively short and bluntly pointed; the anterior surface is smoothly convex, the posterior surface has a shallow concavity beneath the tip. The tragus is short, less than half the height of the pinna. The membranes are a uniform dark brown and essentially naked. The wings are attached to the base of the outer phalanx of each foot. The feet are not greatly enlarged, less than half the length of the tibiae.

Cranial characters: The skull is robust with an average condylo-canine length of 15.3 mm (15.1-15.6 mm). The rostrum is broad, slightly flattened and about equal in length to the braincase. The sagittal and lambdoid crests are weakly developed. The supraoccipital is vertical and projects posteriorly about equal to the lambda. The zygomata are broadly flared with a slight dorsal thickening of the jugal bone. The braincase is elevated above the rostrum but without a marked post nasal depression. The coronoid process of each half mandible greatly exceeds the canine in height; it has a vertical anterior border and the posterior surfaces slopes gently downwards to the condyle.

Dentition: Upper toothrow length (c-m³) averages 6.6 mm (6.5-6.8 mm). The upper canine is relatively short and broad. The first (pm²) and second (pm³) upper

premolars are reduced; pm³ is less than half the crown area of pm² and is displaced internally, so that it is not visible from without. pm² and pm⁴ are sometimes in contact. The first (i₁) and second (i₂) lower incisors have three cusps; the third (i₃) has four. The lower canine is short, scarcely exceeding the third lower premolar (pm₄) in height. The second lower premolar (pm₃) is half the crown area of the first (pm₂); it is compressed tightly in the toothrow or is occasionally displaced internally.

Variation: Specimens from southern India are relatively large with a forearm length of 44.7-46.8 mm and are referred to *M. m. peytoni*. Those from Myanmar are smaller, with a forearm length ranging from 40.0-40.5 mm, and are assigned to *M. m. montivagus*.

Distribution: *Myotis montivagus* ranges from China to India, Myanmar, western Malaysia and Indonesia.

In the Indian subcontinent (Fig. 137) localities include:

INDIA: Karnataka: Gersoppa Falls (type loc. of *peytoni*); **Kerala:** Anakkampoyle (BMNH); **Andhra Pradesh:** Vishakhapatnam district (Ghosh, 1989).

Northern MYANMAR: Adung Valley (Hill, 1972).

Habits: It was found swarming among rocky crevices at the foot of Gersoppa Falls (= Jog Falls) at an altitude of 400 metres (1300 feet) (Wroughton, 1913i). In Andhra Pradesh, it was collected at an altitude of 884 metres (2873 feet) at Lankapakalu and at 1052 metres (3419 feet) at Anantagiri; both localities in Vishakhapatnam district of the Eastern Ghats (Ghosh, 1989). A specimen from Kerala was recently sent to the Natural History Museum, London.

Table 67. *Myotis montivagus peytoni*: Specimens from India.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	59.7	56.0 - 62.0	2.1	7
T:	45.4	42.0 - 48.0	2.0	7
HF:	9.9	9.0 - 10.0	0.4	8
TIB:	18.5	18.0 - 19.4	0.5	7
FA:	45.3	44.7 - 46.8	0.7	8
5mt:	39.7	38.2 - 40.5	0.7	8
4mt:	41.1	39.4 - 42.5	0.9	8
3mt:	42.4	40.2 - 43.8	1.1	8
E:	15.0	14.2 - 15.5	0.4	8
GTL:	17.2	17.0 - 17.5	0.2	7
CCL:	15.3	15.1 - 15.6	0.2	6
BB:	7.8	7.6 - 8.0	0.2	6
PC:	3.9	3.7 - 4.1	0.1	7
C-M ³ :	6.6	6.5 - 6.8	0.1	7
C-M ₃ :	7.1	6.9 - 7.2	0.1	7
M:	13.1	12.9 - 13.3	0.1	7
M ³ -M ₃ :	7.2	7.1 - 7.3	0.1	7
C ¹ -C ₁ :	4.6	4.4 - 4.8	0.1	7

Table 68. *Myotis annectans*: Specimens from India.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	46.7	45.0 - 48.0	1.5	3
T:	42.3	39.0 - 45.0	3.0	3
HF:	10.0	10.0 - 10.0	-	1
TIB:	19.0	18.6 - 19.3	0.4	3
FA:	46.1	45.3 - 46.5	0.7	3
5mt:	39.9	39.4 - 40.7	0.7	3
4mt:	41.1	41.0 - 41.4	0.2	3
3mt:	42.9	42.2 - 43.4	0.6	3
E:	14.3	14.0 - 15.0	0.6	3
GTL:	17.3	17.0 - 17.7	0.4	3
CCL:	15.3	14.9 - 15.5	0.3	3
ZB:	11.5	11.5 - 11.5	-	1
BB:	8.0	7.7 - 8.2	0.3	3
PC:	4.2	4.1 - 4.3	0.1	3
C-M ³ :	6.6	6.5 - 6.7	0.1	3
C-M ₃ :	7.1	7.1 - 7.2	0.1	3
M:	13.0	12.8 - 13.2	0.2	3
M ³ -M ₃ :	7.3	7.2 - 7.4	0.1	3
C ¹ -C ₁ :	4.8	4.7 - 4.8	0.1	3

Reproduction: Immature specimens were collected at Gersoppa Falls on 6 May 1912 (Wroughton, 1913).

Conservation status: Worldwide: this is a geographically widespread but little studied species. It is included on List 3 "Lower risk: near threatened" in the 1996 IUCN Red List of Threatened Animals (Baillie & Groombridge, 1996). Indian subcontinent: a survey of the Gersoppa Falls would be of interest to help determine the population status of the endemic subspecies *peytoni*.

Myotis annectans (Dobson, 1871)

Hairy-faced bat; Intermediate bat

Pipistrellus annectans Dobson, 1871a: 213; Naga Hills, Assam, north-east India.

Myotis primula Thomas, 1920: 248; Pashok, Darjeeling, north-east India, 3500 ft.

External characters: This bat is of similar size and general appearance to *M. m. peytoni*, and has an average forearm length of 46.1 mm (45.3-46.5 mm). The pelage is very soft, dense and moderately long on the back. It is mid- to dark brown with black hair bases on the dorsal surface. On the ventral surface, the hairs have dark bases and paler tips which are fawn brown intermixed with grey. The face is covered with hairs. The ears are small, with bluntly rounded-off tips and a shallow concavity on the posterior surface. The tragus is relatively broad. The membranes are dark brown/black throughout and essentially naked. The feet are not greatly enlarged and are about equal to half the length of the tibiae.

Cranial characters: The skull is robust with an average

condylo-canine length 15.3 mm (14.9-15.5 mm); it is smaller than that of *M. m. peytoni*. The rostrum is broad and is about equal in width to the braincase. The braincase is smooth with the sagittal and lambdoid crests scarcely evident and the supraoccipital forming the most posterior part of the skull. When viewed from behind the braincase appears flattened with a rectangular outline; in *M. montivagus peytoni* it is less compressed and appears squarer. The palate is very broad with a relatively larger surface area than that of *M. m. peytoni*. The post dental extension is well developed and the mesopterygoid space short and broad.

Dentition: Upper toothrow length (c-m³) averages 6.6 mm (6.5-6.7 mm). The upper canine is short and broad with a well defined cingulum; it slightly exceeds the third upper premolar (pm⁴) in height but has a smaller crown area. The second upper premolar (pm³) is minute; it is about one quarter the crown area of the first (pm²); it is situated completely internal to the toothrow and is occasionally absent. pm² is relatively larger than that of *M. m. peytoni*. The lower canine is short, just taller or equal to the third premolar (pm₄). The second lower premolar (pm₃) is minute; it is about one eighth the crown area of the first (pm₂) and is displaced internally in the toothrow; it is occasionally absent. pm₂ and the third lower premolar (pm₄) are in contact or nearly so.

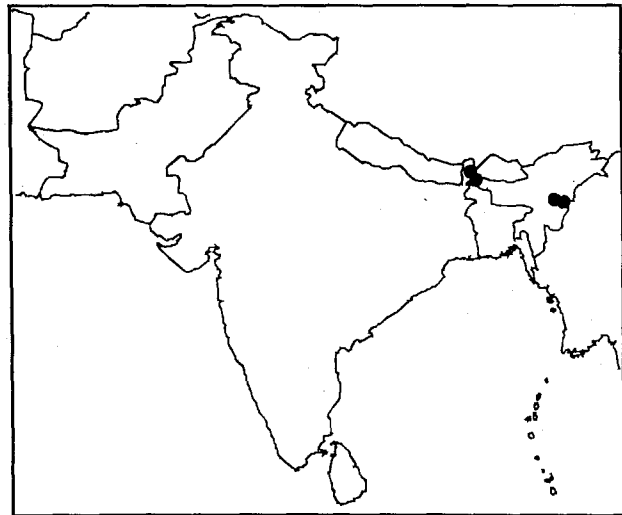


Fig. 138. Distribution of *Myotis annectans*.

Variation: Specimens from Darjeeling district are provisionally referred to *M. a. primula*. Those from Nagaland are referable to *M. a. annectans*.

Taxonomic remarks: The taxon *annectans* was originally included in *Pipistrellus* as the second upper (pm³) and lower (pm₃) premolars on both sides of the jaw are frequently absent (Topal, 1970a).

Distribution: *Myotis annectans* ranges from north-east India to Thailand.

In the Indian subcontinent (Fig. 138) localities include:

INDIA: West Bengal: Pashok (type loc. of *primula*); Teesta Valley (BMNH; Topal, 1970a); **Nagaland:** Samoogooting (type loc. of *annectans*); Takubama (FMNH).

Habits: It was collected at 1077 metres (3500 feet) at Pashok and at 923 metres (3000 feet) in the Teesta Valley (Topal, 1970a).

Conservation status: Worldwide: very little is known of this bat throughout its restricted range. It is included on List 3 "Lower risk: near threatened" in the 1996 IUCN Red List of Threatened Animals (Baillie & Groombridge, 1996). Indian subcontinent: there is one endemic subspecies (*primula*).

Myotis longipes (Dobson, 1873)

Kashmir Cave bat

? *Myotis theobaldi* Blyth, 1856: 363; caves near Matar Nag, north of Islamabad, Kashmir. Indeterminable (Corbet & Hill, 1992).

Vespertilio macropus Dobson, 1872c: 209; caves of Bhima Divi, Kashmir, 6000 ft. Pre-occupied by *V. macropus* Gould, 1854.

= *V. longipes* Dobson, 1873d: 110.

? *Vespertilio megalopus* Dobson, 1875a: 261; 'Gaboon', but more probably from Kashmir (Corbet & Hill, 1992).

External characters: This is a small species with an average forearm length of 37.5 mm (36.5-39.0 mm). The feet are greatly enlarged, conspicuously bigger than those of *M. muricola* and exceeding half the length of the

tibiae. In turn, the toes are more than half the length of each foot; the claws are long and strong. The ears are naked, relatively tall and narrow, particularly at the tips; the anterior border of each ear is evenly convex and without a basal notch; the posterior border is shallowly concave above and convex below. The tragus is tall, about half the height of the pinna; it is narrow and tapers towards the tip. The head is hairy except for the immediate vicinity of the eyes and around the nostrils. The pelage is dense, soft and of medium length. On the dorsal surface, it is greyish brown with the hair tips paler than the bases. On the ventral surface, the hair tips are creamy white and the bases dark brown/ black. In the wing, the third metacarpal just exceeds the fourth and fifth in length. Each wing is attached to the distal end of the outer metatarsal of its respective foot. The interfemoral and wing membranes are a uniform brown. The wings are nearly naked with some hairs on the interfemoral membrane adjacent to the femora and tibiae.

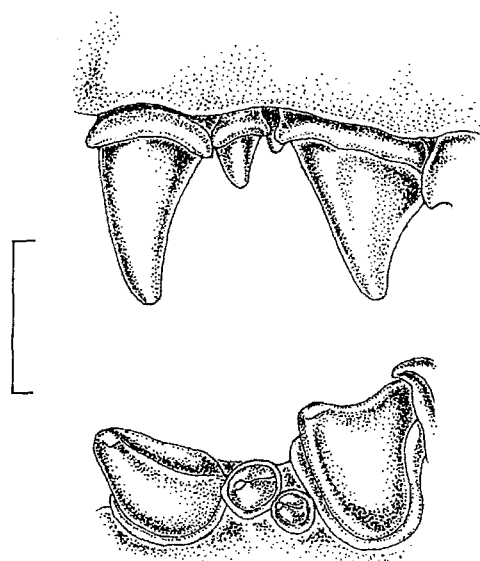


Fig. 139. Lateral (above) and occlusal (below) views of the left maxillary canine and premolars (pm^2 , pm^3 and pm^4) of *Myotis longipes*. HZM.1.5180, Jalalabad, Afghanistan. Scale = 1 mm.

Cranial characters: The skull is small but robust, with an average condylo-canine length of 12.4 mm (12.2-12.8 mm). The braincase is bulbous; it is more rounded than that of *M. muricola* especially posteriorly. It is distinctly elevated above the flattened rostrum. The sagittal and lambdoid crests are scarcely evident. The supraoccipital is very slightly convex and forms the most posterior part of the skull. When viewed from behind, the braincase is distinctly taller in relation to its width than that of *M. muricola* or *M. daubentonii*. The zygomata are widely flared. The palate is concave and the mesopterygoid space short and broad. The coronoid process of each half mandible is characteristically short; its anterior border is vertical but its posterior border is almost horizontal. The condyle is on a line with the tip of the lower canine; the angular process is very weak.

Dentition: Upper toothrow length ($c-m^3$) averages 5.2 mm (5.1-5.3 mm). The upper canine is characteristically

Table 69. *Myotis longipes*: Specimens from India.

External, cranial and dental measurements (mm)

	mean	range	s	n
*HB:	44.6	43.0 - 46.0	1.1	6
*T:	39.3	37.0 - 42.0	1.7	6
HF:	9.4	9.2 - 9.7	0.1	8
TIB:	16.8	14.4 - 17.8	1.0	9
FA:	37.5	36.5 - 39.0	0.8	9
5mt:	33.4	32.0 - 35.2	1.1	9
4mt:	33.9	31.6 - 35.7	1.3	9
3mt:	34.2	32.0 - 36.2	1.3	9
*E:	14.0	10.6 - 15.0	1.6	9
GTL:	14.3	14.0 - 14.6	0.2	5
CCL:	12.4	12.2 - 12.8	0.2	5
ZB:	8.4	8.4 - 8.4	-	1
BB:	6.7	6.5 - 6.9	0.1	5
PC:	3.3	3.2 - 3.4	0.1	5
C-M ³ :	5.2	5.1 - 5.3	0.1	5
C-M ₃ :	5.6	5.5 - 5.9	0.2	5
M:	10.3	10.1 - 10.5	0.2	5
M ³ -M ₃ :	5.4	5.2 - 5.6	0.2	5
C ¹ -C ₁ :	3.5	3.4 - 3.6	0.1	5

*: includes specimens from Afghanistan

very weak; it is about equal to or only slightly exceeds the height and is about half to two-thirds the crown area of the third upper premolar (pm^4) (Fig. 139). The first (pm^2) and second (pm^3) upper premolars are minute. pm^3 is slightly displaced internally from the toothrow

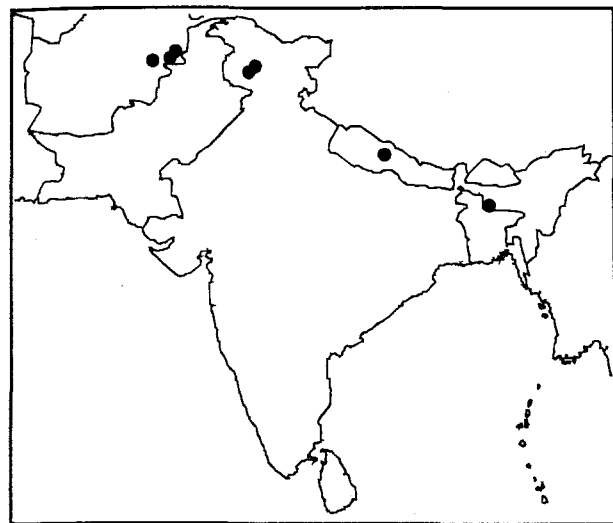


Fig. 140. Distribution of *Myotis longipes*.

and is half to two-thirds the crown area of pm^2 . The lower canine is very small; it is two-thirds the crown area and height of the third lower premolar (pm^4). The first (pm^2) and second (pm^3) lower premolars are greatly reduced in size, considerably more so than those of *M. horsfieldii*. pm^3 is half the crown area of pm^2 ; it is situated in the toothrow. pm^2 and the third premolar (pm^4) are not in contact. The upper and lower molars are relatively large in comparison to the canines and premolars but are otherwise unremarkable.

Variation: All specimens from the Indian subcontinent are provisionally referred to the nominate race *M. l. longipes*.

Distribution: *Myotis longipes* has a range restricted to Afghanistan and India.

In the Indian subcontinent (Fig. 140) localities include: **INDIA: Jammu & Kashmir:** Bhima Devi (type loc. of *longipes*); Matar Nag (type loc. of *theobaldi*); Bumzov Cave (BMNH: Topal, 1974); Bahmajo Bat Cave (BMNH); **Meghalaya:** Siju Cave (Sinha, 1994b).

NEPAL: Syangja (HNHM).

AFGHANISTAN: Pialeh Cave; Jalalabad (Hanak & Gaisler, 1969); Lalanda (FMNH).

Habits: In Kashmir, it was found in a huge colony of some 5000 individuals at Bumzov Cave (Topal, 1974) and at an altitude of 1754 metre (5700 feet) at Bahmajo Bat Cave (BMNH). In Nepal, it was located at 1300 metres (4225 feet) at Kailash Cave (HNHM). At Jalalabad in Afghanistan, a colony of 2000 individuals formed a summer colony in an underground canal beneath the square near the Royal Palace. The canal is about 50 metres long and 1.5 metres wide. At its

entrance, it is about 1.2 metres high, gradually decreasing to 0.8 metres at the far end. The tunnel is very warm with an estimated temperature of about 20°C. The bats hung in several clusters freely from the ceiling; the roost was shared with a small colony of about 200 *Miniopterus schreibersii* (Hanak & Gaisler, 1969).

Feeding: In Afghanistan, *Myotis longipes* departed its roost in Jalalabad earlier in the evening than *Miniopterus schreibersii*. Some individuals appeared to feed over a near-by irrigation channel (Hanak & Gaisler, 1969).

Reproduction: In Kashmir, both pregnant and lactating females were collected on 9 June in Bumzov Cave (Topal, 1974). Similarly, in Afghanistan, it was suggested that the young were born in June (Hanak & Gaisler, 1969).

Conservation status: Worldwide and Indian subcontinent: this species is currently recorded from nine localities within its limited geographical range. It is included on List 5 "Data deficient" in the 1996 IUCN Red List of Threatened Animals (Baillie & Groombridge, 1996). Disturbance of the known roost sites, such as Bumzov Cave in Kashmir and Jalalabad in Afghanistan could have catastrophic consequences for this small *Myotis*.

Myotis daubentonii (Kuhl, 1819)

Daubenton's bat, Water bat

Vespertilio daubentonii Kuhl, 1819: 195; Hanau.

Hessen-Nassau, Germany.

Vespertilio laniger Peters, 1871b: 617; Amoy, Fujian, China

External characters: based on extralimital material (Plate 7) and on the description of *laniger* from China given by Allen (1938). The forearm length averages

Table 70. *Myotis daubentonii laniger*: based on specimens from China (Allen, 1938).

External, cranial and dental measurements (mm)

	mean	range			s	n
HB:	41.3	-	-	-	-	15
T:	38.6	-	-	-	-	15
HF:	7.9	-	-	-	-	15
TIB:	15.0	-	-	-	-	15
FA:	34.8	-	-	-	-	15
E:	12.3	-	-	-	-	15
GTL:	13.3	13.0	-	13.7	0.3	6
CBL:	11.1	10.6	-	11.9	0.5	6
ZB:	8.5	8.0	-	9.0	-	2
C-M ³ :	4.9	4.8	-	5.0	0.1	6
C-M ₃ :	5.1	4.9	-	5.5	0.2	6
M ³ -M ₃ :	5.2	5.0	-	5.9	0.3	6

34.8 mm. The ears are relatively short and well rounded, with a distinct basal emargination on the anterior border. The face is "densely hairy" and is without naked areas around the eyes. The feet are large and usually exceed half the length of the tibiae. The wings are attached to the outer metatarsal of each foot. The interfemoral and wing membranes are a uniform brown. The pelage is dense and short. On the dorsal surface, it is a "dull dark drabby brown" with a "sooty-grey tint". On the ventral surface, it is "everywhere dark at the base, tipped with brownish across the chest, and with paler greyish in the center of the abdomen".

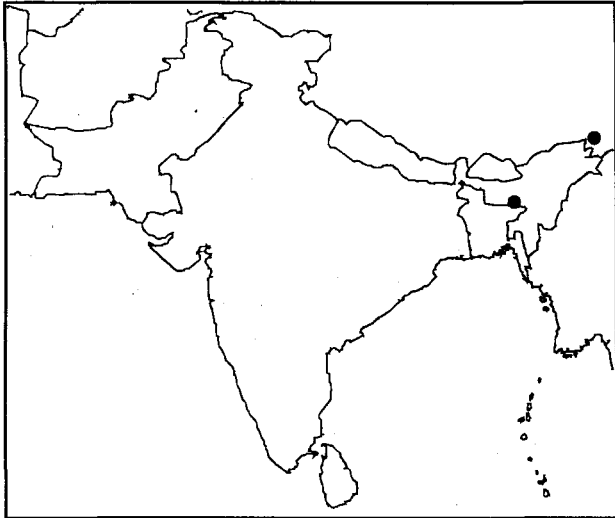


Fig. 141. Distribution of *Myotis daubentonii*.

Cranial characters: According to Allen (1938), condylo-basal length averages 11.1 mm (10.6-11.9 mm). In contrast to *M. longipes*, the braincase is less distinctly elevated above the rostrum and there is no post nasal depression in the lateral profile. The braincase is robust, bulbous and rounded-off posteriorly. The supraoccipital just forms the most backward part of the skull. The lambdoid and sagittal crests are scarcely evident. The zygomata are very thin. The coronoid process of each half mandible is more elevated than that of *M. longipes*, its posterior border slopes very gently downwards towards the condyle. The angular process is weak.

Dentition: According to Allen (1938), the upper toothrow length ($c-m^3$) averages 4.9 mm (4.8-5.0 mm). Unlike *M. longipes*, the upper canine exceeds the third upper premolar (pm^4) in height and is nearly equal to it in crown area. The first (pm^2) and second (pm^3) upper premolars are reduced but to a lesser extent than those of *M. longipes*. pm^3 is situated within the toothrow and is not crowded; it is one third the height and half or less the crown area of pm^2 . In the lower dentition, the canine and three lower premolars are distinctly smaller than those of *M. horsfieldii* and more comparable in size to those of *M. longipes*. The lower canine is equal in height and slightly exceeds the third lower premolar (pm_4) in crown area. The second lower premolar (pm_3) is situated in toothrow; it has half or more the crown area of the first lower premolar (pm_2); both these

premolars are small in comparison to the third (pm_4).

Variation: The two known specimens from India are here referred to *M. d. laniger*.

Distribution: *Myotis daubentonii* ranges from Ireland and Scandinavia, through Europe and Russia to Japan, Korea, China and India.

In the Indian subcontinent (Fig. 141) localities include: **INDIA: Meghalaya:** Mamosmai (= *laniger* in Topal, 1974).

TIBET: south-east Tibet (Corbet & Hill, 1992, map. 59).

Habits: Nothing is known of this species in India except that two specimens were collected in the evening in a cave in Meghalaya (Topal, 1974). Elsewhere in Eurasia it is an abundant species. Although associated with lakes, ponds and streams it also regularly hunts in deciduous woods and mixed forests. Summer roosting sites include hollow trees, buildings, under bridges, rock crevices and even in the nests of tunnelling birds such as Sand Martins (Bogdanowicz, 1994). In China, it is associated with the warmer southern regions (Allen, 1938).

Feeding: Extralimital studies suggest that this species spends over 90% of its foraging time flying less than 2 metres above the ground or water level. It feeds opportunistically on swarms of insects, by slow hawking or gaffing the food from the surface of the water. The tail membrane may also be used as a pouch to entrap small insects (Bogdanowicz, 1994).

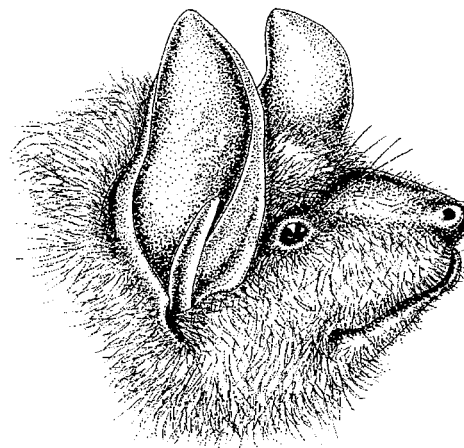


Fig. 142. Face of *Myotis horsfieldii*.

Reproduction: From extralimital studies, it is known that there is usually one, occasionally two embryos and that pregnancy lasts about 53-55 days, but this may vary in duration between regions. The young are born blind but with well formed sensory hairs in the mouth; thin short grey-brown hair is present on the back; birth weight is 1.6-2.4 grams (Bogdanowicz, 1994).

Conservation status: Worldwide: an abundant species

throughout much of its geographical range. Indian subcontinent: an apparently very rare species. There are no endemic subspecies.

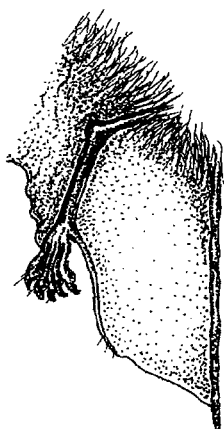


Fig. 143. Left foot and tail of *Myotis horsfieldii*.

Myotis horsfieldii (Temminck, 1840)

Horsfield's bat

Vespertilio horsfieldii Temminck, 1840: 226; Mount Gede, Java.

Myotis dryas Andersen, 1907a: 33; Port Blair, South Andaman Island.

Leuconoe peshwa Thomas, 1915a: 611; Poona, Bombay, India.

External characters: This is a medium-small species of *Myotis* with an average forearm length of 38.5 mm (36.5–41.5 mm) for specimens from peninsular India. The ears are naked, dark and with rounded tips (Fig. 142). The anterior border of each ear is evenly convex; the posterior border is concave above and convex below with a well defined notch in its midpart. The tragus is short, less than half the height of the pinna and relatively broad (Fig. 129). The feet are enlarged and exceed half the length of the tibiae (Fig. 143). The pelage is dark brown almost black on the dorsal surface. On the ventral surface, it is deep brown with greyish tints near the base of the tail. The interfemoral and wing membranes are deep chocolate brown. They are essentially naked, except for some light hairs on the interfemoral membrane adjacent to the body. The wings are attached to the outer metatarsal of each foot; in *M. hasseltii* they are attached to the ankle or tibia. The baculum is small, saddle-shaped and with a rounded tip (Fig. 131).

Cranial characters: The skull (Fig. 145) has an average condylo-canine length of 13.9 mm (13.4–14.3 mm) for specimens from peninsular India. The braincase is less inflated anteriorly than that of *M. hasseltii* and the gradient of the dorsal profile is shallower. The rostrum is robust with a shallow depression in its midline. The sagittal and lambdoid crests are present but not well developed. The braincase is rounded posteriorly with the slightly convex supraoccipital just forming the most posterior part of the skull. The zygomata are well

developed and outwardly flared. The palate is concave. The coronoid process of each half mandible is distinctly more robust than that of *M. longipes*.

Dentition: Upper toothrow length (c-m³) averages 5.7 mm (5.5–5.9 mm) for specimens from peninsular India. The teeth are robust in comparison to *M. daubentonii*. The upper canine is nearly twice the height of the third upper premolar (pm⁴). The first (pm²) and second (pm³) premolars are small (Fig. 146), but considerably less reduced than those of *M. longipes*. pm³ is about half or more the crown area pm², it lies within the toothrow or is sometimes displaced internally. Unlike *M. daubentonii*, the lower canine exceeds the third lower premolar (pm⁴) in height and crown area. The second lower premolar (pm³) is two-thirds the crown area of the first (pm²), it is sometimes crowded between pm² and third premolar (pm⁴). The upper and lower molars are unremarkable.

Variation: Specimens from peninsular India are provisionally referred to *M. h. peshwa* on account of their slightly larger size and browner pelage. The taxon *M. h. dryas* is endemic to the Andaman Islands and averages smaller with a forearm length of 34.8–37.1 mm and a condylo-canine length of 13.3 mm (Hill, 1976b).

Distribution: *Myotis horsfieldii* ranges from south-eastern China, Thailand, India, west Malaysia to Indonesia and Philippines.

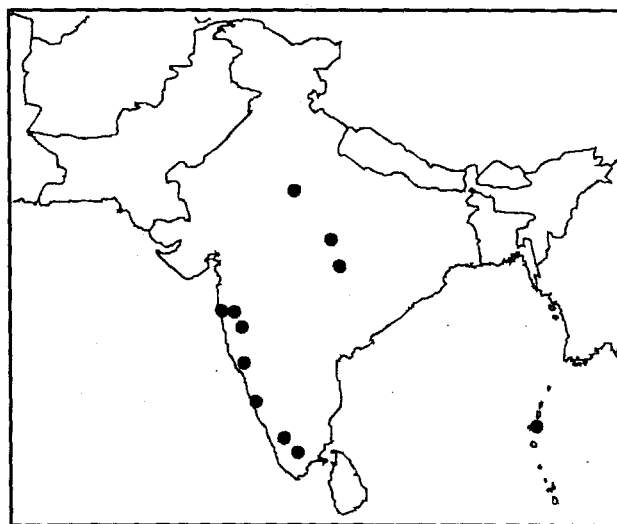


Fig. 144. Distribution of *Myotis horsfieldii*.

In the Indian subcontinent (Fig. 144) localities include: **INDIA: Maharashtra:** Poona (type loc. of *peshwa*); Elephanta Island (Brosset, 1962c); near Satara (Hill, 1976b); **Goa:** Molem (Das, 1986a); **Karnataka:** Kodai (Hill, 1976b); **Kerala:** Baliaparathodu (Das, 1986a); **Tamil Nadu:** Venniar Estate (HZM); **Madhya Pradesh:** Sabalgarh (Hill, 1976b); Mukhi; Kanha National Park; Jabalpur (Khajuria, 1984); **Andaman Islands:** Port Blair (type loc. of *dryas*).

Habits: *Myotis horsfieldii* favours wooded areas with a

local supply of fresh water. In Kerala, it was netted near the edge of a hill stream flowing through a forest (Das, 1986a); in Maharashtra it was collected in an abandoned tunnel in the forests of the Western Ghats (Hill, 1976b) and in Tamil Nadu it was located in a water supply tunnel in the mixed forest/ tea growing area of the Venniar Estate in the High Wavy Mountains (HZM).

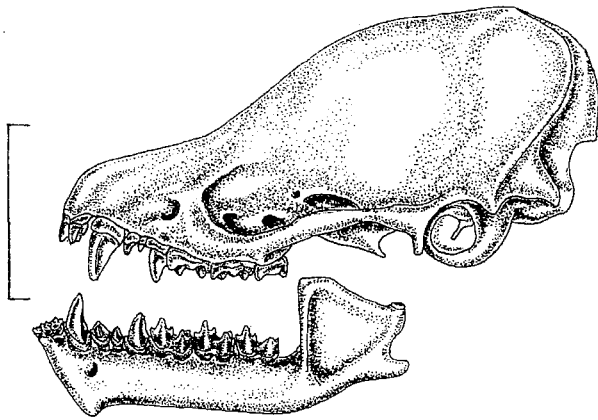


Fig. 145. Skull of *Myotis horsfieldii*. HZM.4.28271, Venniar Estate, India. Scale = 3 mm.

Although found in the leaves of a palmyra palm (Khajuria, 1984), it appears to favour tunnels (especially those containing water), caves, bridges and houses for its diurnal roosting sites. In most cases it spends the day secreted in crevices or small holes, sometimes alone or in small groups of two to three individuals. However in Malaysia, Medway (1969) reported colonies numbering in excess of one hundred individuals. Other bat species known to share the same roosting sites include *Rhinolophus rouxii* (HZM), *Miniopterus schreibersii* and *Hipposideros speoris* (Hill, 1976b).

Reproduction: Two pregnant females were collected in Madhya Pradesh between 26 February and 4 March (Khajuria, 1984).

Conservation status: Worldwide: a geographically widespread species that is common in at least part of its range, for example Malaysia (Medway, 1969). Indian subcontinent: it is relatively abundant on the Venniar Estate in the High Wavy Mountains of Tamil Nadu (pers. observation); elsewhere in India, the population status of the two endemic subspecies *peshwa* and *dryas* deserves further study.

Myotis hasseltii (Temminck, 1840)

Van Hasselt's bat

Vespertilio hasseltii Temminck, 1840: 225; Bantam, Java.

External characters: This species, with an average forearm length of 39.3 mm (37.2-40.3 mm), is comparable in size to *M. horsfieldii*. The feet are long and slender; they greatly exceed half the length of the

tibiae. The ears are rather narrow with the tips narrowly rounded-off. The tragus of each ear is narrow, half or less the height of the pinna. The pelage on the dorsal surface is dark brown with the hair tips slightly paler than the roots. On the ventral surface, they are dark brown/ black at the roots, with the tips a paler grey. The wings are attached to the ankles or tibiae; in *M. horsfieldii* they are attached to the outer metatarsal of each foot; otherwise, they are similar in structure. The interfemoral and wing membranes are a uniform dark brown.

Cranial characters: The skull, with an average condylo-canine length of 14.2 mm (14.0-14.6 mm) is more robust than that of *M. horsfieldii*. The braincase is bulbous, broad and almost spherical in outline. The sagittal crest is visible posteriorly and the lambdoid crests are present. The lambda forms the most elevated part of the skull and the supraoccipital just forms the most posterior part. The zygomata are moderately robust. The rostrum is robust and broad; it is less depressed than that of *M. horsfieldii*; there is a slight post nasal depression on account of the very elevated anterior part of the braincase. The coronoid process of each half mandible is very well developed and greatly exceeds the canine in height; its morphology is essentially similar to that of *M. horsfieldii*.

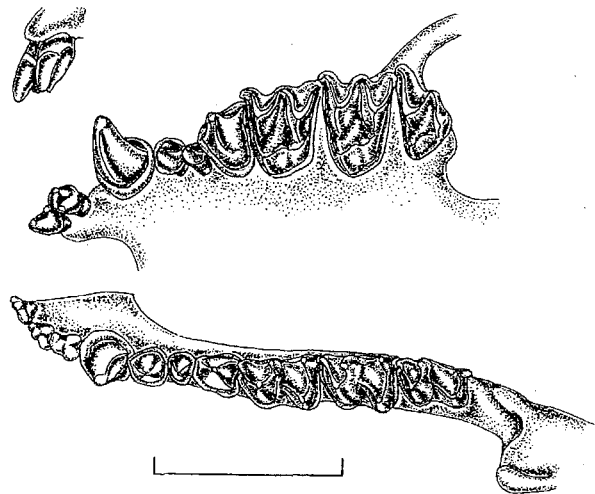


Fig. 146. Occlusal view of maxillary (above) and mandibular (below) dentition; lateral view of upper left incisors (inset) of *Myotis horsfieldii*. HZM.4.28271, India. Scale = 3 mm.

Dentition: Upper toothrow length ($c-m^3$) averages 5.9 mm (5.8-6.0 mm). The upper canine is robust, broad and greatly exceeds the third premolar (pm^4) in height; it is about equal to it in crown area. The second upper premolar (pm^3) is minute or occasionally absent; it is usually about one quarter the crown area of the first (pm^2); pm^2 and pm^4 are in contact or nearly so. The lower canine exceeds the third lower premolar (pm_4) in height and crown area. The second lower premolar (pm_3) is very small; it is one third to one half the crown area of the first (pm_2) and is usually situated in the toothrow but may be displaced internally.

Table 71. *Myotis horsfieldii peshwa*. Specimens from peninsular India.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	53.4	49.0 - 59.0	3.1	7
T:	37.6	34.0 - 42.0	3.0	7
HF:	9.0	7.0 - 11.2	1.6	10
TIB:	17.2	16.8 - 17.8	0.4	5
FA:	38.5	36.5 - 41.5	1.5	12
WSP:	271.5	258.0 - 284.0	8.6	6
5mt:	35.4	33.9 - 37.1	1.2	11
4mt:	36.5	34.5 - 37.7	1.1	11
3mt:	37.8	35.9 - 39.0	0.9	11
E:	14.1	13.0 - 15.2	0.9	5
GTL:	16.0	15.6 - 16.5	0.9	5
CCL:	13.9	13.4 - 14.3	0.3	12
ZB:	9.8	9.3 - 10.2	0.3	10
BB:	7.5	7.2 - 7.7	0.2	12
PC:	3.8	3.5 - 4.1	0.2	12
C-M ³ :	5.7	5.5 - 5.9	0.1	12
C-M ₃ :	6.2	5.9 - 6.4	0.1	12
M:	11.4	11.2 - 11.6	0.1	12
M ³ -M ₃ :	6.1	5.8 - 6.5	0.2	12
C ¹ -C ₁ :	4.3	4.2 - 4.3	0.1	6

Variation: Specimens from India and Sri Lanka are referred to the nominate race *M. h. hasseltii*.

Distribution: *Myotis hasseltii* ranges from Sri Lanka and north-east India to Myanmar, Thailand, Cambodia, western Malaysia and Indonesia.

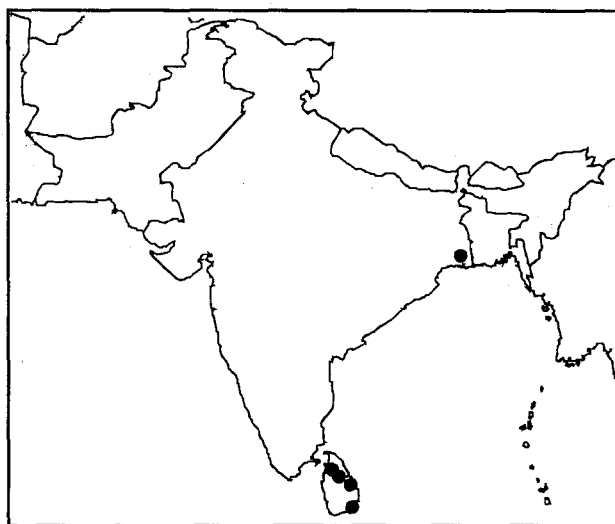


Fig. 147. Distribution of *Myotis hasseltii*.

In the Indian subcontinent (Fig. 147) localities include:
INDIA: West Bengal: Calcutta (HNHM).
SRI LANKA: Northern Province: Kappachchi (Phillips, 1980); **North Central Province:** Anuradhapura (Wroughton, 1915ci); **Eastern Province:** Valaichenai; Kokoputchi (Wroughton, 1915ci); **Southern Province:** Yala (Phillips, 1980).

Habits: In Sri Lanka, it appears to be relatively rare and is restricted to the dry zone areas in the north, east and south of the island. During the day, it secretes itself, either alone or in small groups, in cracks in tree-trunks or bamboos and possibly also in holes in walls of ruined buildings (Phillips, 1980). In Malaysia, about 25 bats of both sexes were found together, roosting in a crack in a large boulder on the foreshore which was isolated at a high tide (Medway, 1969). In Thailand, it has been found roosting inside cut bamboos used as the floor of forest dwellings (Lekagul & McNeely, 1977).

Feeding: It generally flies rather low, often over water. It feeds on small flies, gnats, mosquitoes and other small flying insects (Phillips, 1980). In Malaysia, it frequents mangrove forests and was seen to feed below tree-top level, often flying low over the surface of the water and venturing out as far as the edge of the sea; its diet included moths (Medway, 1969).

Reproduction: In Malaysia, all adult females inspected in early January were either lactating or in advanced pregnancy. Females carry a single foetus (Medway, 1969). In Vietnam, sexually active males with enlarged testes were found roosting with pregnant and lactating females in April; there are apparently no regular nursing colonies (Topal, 1974).

Conservation status: Worldwide: this is a geographically widespread species but probably not common in any one particular area. Indian subcontinent: virtually nothing is known of this species. There are no endemic subspecies.

Table 72. *Myotis hasseltii*: Specimens from Sri Lanka.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	54.7	52.0 - 58.0	3.1	4
T:	38.5	35.0 - 42.0	4.0	4
HF:	10.3	9.0 - 11.0	1.0	4
TIB:	16.6	15.1 - 17.6	1.1	4
FA:	39.3	37.2 - 40.3	1.3	4
5mt:	36.8	35.0 - 38.0	1.3	4
4mt:	38.5	37.2 - 39.8	1.1	4
3mt:	39.2	37.5 - 40.6	1.3	4
E:	16.1	15.5 - 16.5	0.5	4
GTL:	16.2	16.0 - 16.5	0.2	4
CCL:	14.2	14.0 - 14.6	0.3	4
ZB:	10.5	10.5 - 10.5	-	1
BB:	8.2	8.0 - 8.3	0.1	4
PC:	4.1	4.0 - 4.2	0.1	4
C-M ³ :	5.9	5.8 - 6.0	0.1	4
C-M ₃ :	6.4	6.2 - 6.6	0.2	4
M:	11.9	11.7 - 12.0	0.2	4
M ³ -M ₃ :	6.6	6.4 - 6.7	0.1	4
C ¹ -C ₁ :	4.6	4.5 - 4.7	0.1	4

Feeding: It is one of the first bats to appear in the evening. It flies slowly and steadily (Blanford, 1888-91) and disperses to a variety of feeding areas. In Sri Lanka, large numbers can be observed feeding near village 'tanks'. They are attracted to the multitude of flies (and other insects) that live in and above the rotting water weeds and aquatic vegetation (Phillips, 1980).

Table 79. *Scotophilus kuhlii*: Specimens from India, Pakistan and Sri Lanka.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	69.8	60.0 - 78.0	4.1	47
T:	47.5	40.0 - 65.0	4.5	46
HF:	10.0	8.0 - 13.0	1.4	33
FA:	49.0	44.0 - 56.4	2.2	47
5mt:	45.0	42.1 - 53.9	2.2	41
4mt:	48.3	43.7 - 57.2	2.3	43
3mt:	48.8	44.4 - 58.8	2.4	47
E:	13.5	9.0 - 17.0	1.2	46
GTL:	19.6	18.7 - 20.4	0.5	49
CCL:	17.3	16.3 - 18.0	0.4	49
ZB:	13.0	12.4 - 13.7	0.3	43
BB:	8.9	8.5 - 9.4	0.2	49
PC:	4.7	4.4 - 5.1	0.2	49
C-M ³ :	6.5	6.1 - 6.8	0.2	49
C-M ₃ :	7.4	6.9 - 7.8	0.2	48
M:	13.7	12.9 - 14.4	0.3	48
M ³ -M ₃ :	8.4	8.1 - 8.8	0.2	49

Reproduction: In Bangalore, pregnant females were collected from March to July; gestation lasts 105-115 days (Gopalakrishna, 1947). In Bihar, pregnant females were found in April/May; females give birth to one or two young (June/July) (Sinha, 1986a).

Conservation status: Worldwide: this is a widespread species which is apparently common throughout much of its range, including the Indian Subcontinent. However, during recent surveys in Sri Lanka no specimens were collected; possibly they avoid mistnets. There is one endemic subspecies (*wroughtoni*).

Genus *Eptesicus* Rafinesque, 1820

Eptesicus Rafinesque, 1820: 2; type species *Eptesicus melanops*.

These are small or medium sized Vespertilionid bats, without any distinctive external features by which they may be distinguished from *Pipistrellus*. The tragus is short and blunt. The wings are broad. The baculum is more or less triangular in shape; its apex is occasionally extended into a short shaft, basally it is rather wide (Fig. 173). The skull generally has a flat dorsal profile; the braincase is scarcely elevated above the rostrum (Fig. 174). The small upper premolar (pm²) is always absent.

Dental formula: $\frac{i-2\ 3}{1\ 2\ 3} \quad \frac{c\ 1}{1} \quad \frac{pm\ ---\ 4}{-2\ -\ 4} \quad \frac{m\ 1\ 2\ 3}{1\ 2\ 3} = 32$

The genus includes 32 species with a geographical range that includes Africa; Eurasia; Australia; South, Central and North America (Koopman, 1993). Six species are present in the Indian Subcontinent (see page 153).

Eptesicus serotinus (Schreber, 1774)

Serotine

Vespertilio serotinus Schreber, 1774: 167, pl. 53; France.

Vespertilio turcomanus Eversmann, 1840: 21; Between Caspian and Aral Seas, Turkestan.

Scotophilus pachyomus Tomes, 1857: 50; Rajputana, India.

Eptesicus serotinus pashtonus Gaisler, 1970a: 33; Jalalabad, Afghanistan.

External characters: This is a large *Eptesicus* (Plate 7) with an average forearm length of 54.7 mm (54.2-55.1 mm). The tail is long, with its tip protruding from the interfemoral membrane for about 5 mm. The glandular swellings of the muzzle are black and nearly naked; the upper lip is fringed with fine hairs. The ears are dark, moderately tall and with about six transverse ridges. The anterior border of each ear has a strong, almost angular convexity just below half of its height and is nearly straight above to the rounded-off tip; the posterior border is almost straight beneath the tip and then convex below, where it is inserted at the base of the antitragal lobe. The tragus is less than half the height of the pinna; its anterior border is straight, the tip is bluntly pointed and the posterior border gently convex, with a distinct notch just above the basal lobe. The wings are broad in relation to their length; the fifth metacarpal is shorter than the third and fourth. The wing membranes are inserted on the base of the outer toe of each foot. The

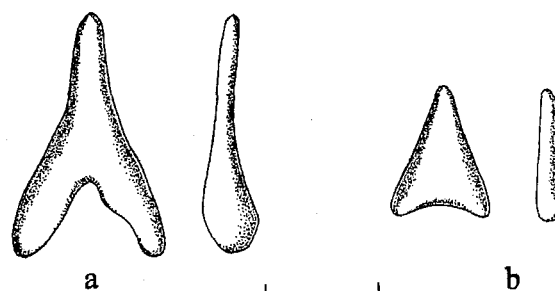


Fig. 173. Dorsal (left of each pair) and lateral (right of each pair) views of the bacula of two species of *Eptesicus*.

a: *E. serotinus*, BM.66.1150, Morocco.

b: *E. bottae*, BM.3.12.8.9, Egypt. Scale = 0.5 mm.

interfemoral and wing membranes are uniformly dark brown/black. The upper surface of the interfemoral membrane is lightly haired adjacent to the body and femora; there are also a few hairs on the ventral surface of each wing alongside the forearm. In general, the pelage is fine, dense and silky with a distinct gloss on the back. The dorsal surface is essentially dark brown, although in some individuals there is a golden tinge on the head and shoulders and/or a light frosting of paler hair tips. The throat and belly are paler, a uniform grey

in some individuals, buffy-grey in others; the hair bases are usually dark above and below. The baculum is very small with a simple tip and bilobate base (Fig. 173).

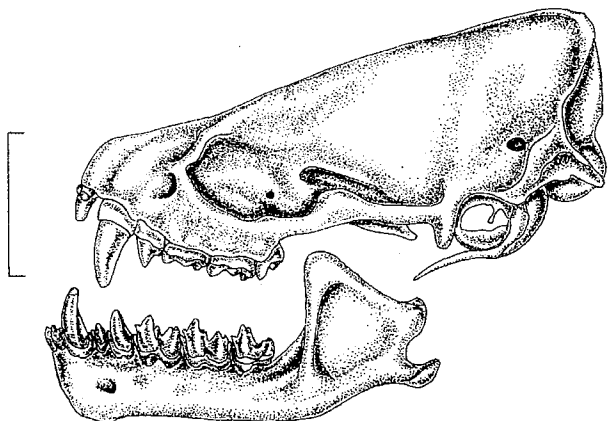


Fig. 174. Skull of *Eptesicus serotinus*. HZM.44.20679, Algeria. Scale = 5 mm.

Cranial characters: The skull (Fig. 174) is robust with an average condylo-canine length of 18.9 mm (18.3-19.5 mm). The rostrum is broad with lateral concavities and prominent lachrymal projections. The zygomatic arches are widely flared; their widest point posteriorly. The braincase is ovoid in outline with prominent flanges in the mastoid regions. The sagittal crest is low but distinct in adult skulls, rising posteriorly to the lambda which forms the most posterior part of the skull in older individuals. The anterior emargination of the palate is not greatly enlarged; it extends back to the level of the middle of the canines. The palate is broad in relation to that of *E. bottae*. It is concave and has a short post

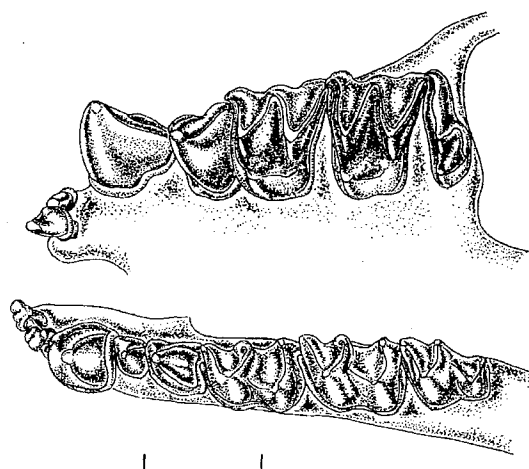


Fig. 175. Occlusal views of maxillary (above) and mandibular (below) dentition of *Eptesicus serotinus*. HZM.44.20679, Algeria. Scale = 2 mm.

dental extension. The floor of the braincase is essentially flat, although there are shallow lateral grooves adjacent to the small tympanic bullae. The coronoid process of each half mandible is tall and bluntly pointed; the angular process is rather small and scarcely projects beyond the condyle.

Dentition: Upper toothrow length (c-m³) averages 7.5 mm (7.1-8.1 mm) in length. First upper incisor (i²) is large and broad, its secondary cusp clearly present in unworn teeth on the outer side of the shaft. The second incisor (i³) is small, barely exceeding the cingulum of i² in height. The single upper premolar (pm⁴) attains about half the height of the canine. m¹ and m² are about equal in crown area with the metacone better developed than the paracone. m³ is reduced; it is greatly compressed antero-posteriorly with crown area significantly less than half that of m²; both the mesostyle and metacone are very poorly developed and the metastyle is absent. There are three lower incisors, all are closely compressed together and the third (i₃) is situated below the anterior, internal cingular cusp of the lower canine. The lower premolars are crowded together, the first (pm₂) is half the height and crown area of the second (pm₄). m₁ and m₂ are about equal in size, with the protoconid the most developed cusp. In m₃, the talonid is significantly smaller than the trigonid.

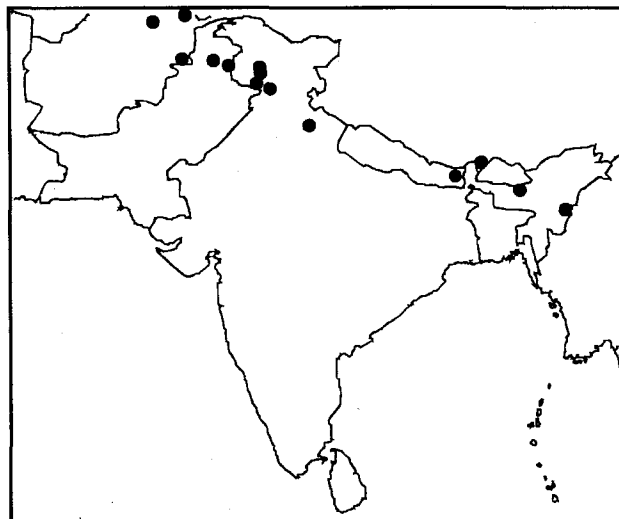


Fig. 176. Distribution of *Eptesicus serotinus*.

Variation: Specimens from Rajasthan and Kashmir are referred to *E. s. pachyomus*. Individuals from northern Afghanistan (Kunduz) are pale and are referred to *E. s. turcomanus*; those from near Jalalabad are grey/brown above and were referred to *E. s. pashtonus* by Gaisler (1970a). They appear closely similar to specimens from Dunga Gali, Pakistan.

Distribution: *Eptesicus serotinus* is a widely distributed species ranging from western Europe through to southern Asiatic Russia, northern India, Thailand and China, north to Korea, Taiwan; also North Africa and perhaps subsaharan Africa.

In the Indian subcontinent (Fig. 176) localities include: **INDIA: Jammu & Kashmir:** Pahlgam (BMNH); Akhnoor; Bhaderwah; Shar (Chakraborty, 1983); **Rajasthan:** no fixed locality (type loc. of *pachyomus*); **Uttar Pradesh:** near Mussoorie (Blanford, 1888-91); **Assam:** Darranga (Kurup, 1968); **Nagaland:** Takubama

Character matrix of the six species of *Eptesicus* from the Indian Subcontinent

Species	FA mm	CCL mm	C-M ³ mm	Comments
<i>Eptesicus serotinus</i> (page 151/ Plate 7)	54.7 54.2-55.1	18.9 18.3-19.5	7.5 7.1-7.8	pelage dark brown on the back; belly and throat paler, grey or buffy-grey; hair roots dark, above and below
<i>Eptesicus bottae</i> (p. 153/ Plate 7)	42.1	15.0	5.8	pelage creamy-buff on the back; belly and throat pale grey with whitish hair tips; hair roots dark, above and below; membranes and naked areas dark brown
<i>Eptesicus pachyotis</i> (p. 155)	38.0-40.3	21.2 (GTL)	-	pelage dark brown above; paler below; lower portion of ears very thick and fleshy
<i>Eptesicus gobiensis</i> (p. 155)	41.3 41.0-41.5	15.1 (CBL)	5.9	pelage light buff on the back; belly and throat straw-white; hair roots almost black, above and below; membranes and naked areas pale yellow
<i>Eptesicus nasutus</i> (p. 156)	36.1 35.4-36.9	12.0 11.7-12.2	4.6 4.4-4.8	pelage buffy brown on the back; belly and throat paler; hair roots comparable in colour to the tips; long tail; membranes mid-brown
<i>Eptesicus tatei</i> (p. 157)	43.4	-	-	pelage "black throughout" (Blanford, 1888-91)

(FMNH).

PAKISTAN: NWFP: Karakoram Pass (FMNH).

NEPAL: Tumlingtar (FMNH).

TIBET: Chumbi (BMNH).

AFGHANISTAN: Jalalabad (type loc. of *pashtonus*); Faisabad; Kunduz (Gaisler, 1970a); Tschaga Serail (Felten, 1971).

Habits: In Pakistan, a specimen was collected from Dunga Gali at an altitude of 2338 metres (7600 feet); it was roosting in a deserted pump house, which it shared with a small colony of female *Myotis mystacinus* (BMNH). A single specimen from Tumlingtar in Nepal was collected at 462 metres (1500 feet) (FMNH). In Arabia and Iran, it has been found in rocky ravines. Its roosts include caves and cracks in rocks (Harrison & Bates, 1991). In India, it is frequently found in hollow trees by day and usually remains solitary or in small numbers, even in winter (Blanford, 1888-91). Specimens from Kashmir were collected at 2246 metres (7300 feet) at Pahlgam. In Afghanistan, it was collected at an altitude of 738 metres (2400 feet) (FMNH).

Feeding: According to Blanford (1888-91), it appears late in the evening; however conversely Chakraborty (1983) states that it emerges rather early to hunt, sometimes while the sun is still shining. Its flight is slow and without zigzags or abrupt turns but rather remains straight and even (Ognev, 1962); Chakraborty (1983) suggests that it frequently dives to lower levels. According to Harrison & Bates (1991), its broad wings are particularly noticeable and Ognev (1962) records that in Russia it flies at a height of 10-15 metres in fine

weather, lower (3-6 metres) during storms. It is also noisy on the wing, uttering a loud metallic squeaking. Its strongly developed teeth suggest it is capable of tackling a variety of insect prey from larger moths to scarabid beetles and dipteran flies (Chakraborty, 1983); these are consumed on the wing, with the indigestible parts being discarded (Ognev, 1962).

Reproduction: It normally has a single infant (Blanford, 1888-91); an extralimital specimen from Israel had a single embryo in the left uterine horn (Harrison & Bates, 1991). Two subadult specimens were collected at Pahlgam in Kashmir in October (BMNH).

Conservation status: Worldwide: it is a geographically widespread species that is not endangered. Indian subcontinent: it has a restricted range with one endemic subspecies *pachyomus* provisionally recognised. Possible conservation measures include the identification and protection of winter hibernacula.

Eptesicus bottae (Peters, 1869)

Botta's Serotine

Vesperus bottae Peters, 1869a: 406; Yemen.

Eptesicus ognevi Bobrinskii, 1918: 12; Bokhara district, Soviet Turkestan.

External characters: This species (Plate 7) is essentially similar in structure to *E. serotinus* but smaller, with a forearm length of 42.1 mm. The pelage on the head, back and flanks is a light creamy-buff with dark hair roots. The throat and belly are pale grey, with whitish

Table 80. *Eptesicus serotinus*: Specimens from India and Pakistan.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	80.0	80.0 - 80.0	-	1
T:	58.0	58.0 - 58.0	-	1
HF:	10.0	10.0 - 10.0	-	1
FA:	54.7	54.2 - 55.1	-	2
5mt:	47.6	46.9 - 48.9	1.2	3
4mt:	50.1	48.8 - 50.9	1.1	3
3mt:	50.6	48.9 - 52.0	1.6	3
E:	14.0	14.0 - 14.0	-	1
GTL:	21.1	20.4 - 21.9	-	2
CCL:	18.9	18.3 - 19.5	-	2
ZB:	14.0	13.3 - 14.6	-	2
BB:	9.5	9.3 - 9.7	-	2
PC:	4.7	4.6 - 4.8	-	2
C-M ³ :	7.5	7.1 - 7.8	-	2
C-M ₃ :	8.6	8.4 - 8.7	-	2
M:	15.5	15.0 - 16.0	-	2
M ³ -M ₃ :	9.0	8.8 - 9.1	-	2

tips to the hairs and dark roots. The ears, naked areas of the muzzle and membranes are dark brown, distinctly darker than the pelage. The feet are relatively large. The baculum is minute; it has a simple tip and a broad base (Fig. 173).

Cranial characters: The skull is much smaller and less heavily ridged than that of *E. serotinus*, with a condylo-canine length of 15.0 mm. The rostrum is broad, flattened and with shallow lateral concavities; it has a well marked median groove between the orbits. The lachrymal projections are less evident than those of *E.*

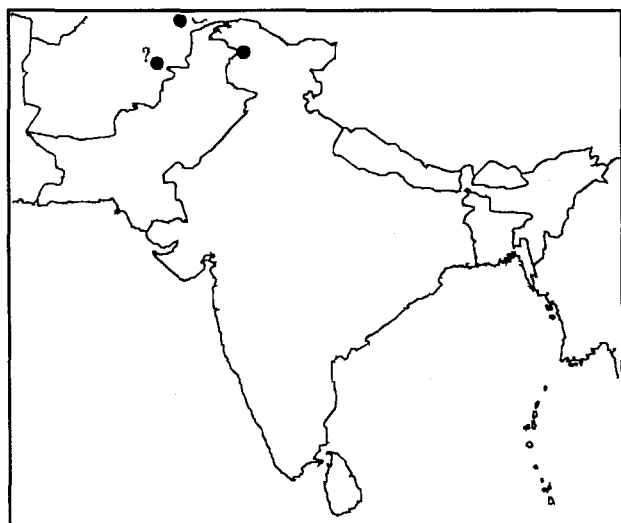


Fig. 177. Distribution of *Eptesicus bottae*.

serotinus. The braincase is ovoid with only faint mastoid projections postero-laterally. The lambda is not prominent and the slightly convex supraoccipital just forms the most posterior part of the skull. The sagittal crest is most developed posteriorly, although absent in

some specimens. The tympanic bullae are relatively large in comparison to those of *E. serotinus* and in consequence the basioccipital is narrower. In the mandible, the posterior border of each coronoid process declines less steeply to the condyle than that of *E. serotinus*.

Dentition: Upper toothrow length (c-m³) is 5.8 mm. The dentition is smaller but essentially similar to that of *E. serotinus*, although m³ is less reduced, with a metacone and three well developed commissures. The talonid of m₃ is relatively less reduced than that of *E. serotinus*; it is however still smaller than the trigonid.

Variation: Specimens from Pakistan and Afghanistan are provisionally referred to *E. b. ognevi*.

Distribution: *Eptesicus bottae* ranges from Egypt, Yemen and Turkey to Pakistan and Mongolia.

In the Indian subcontinent (Fig. 177) localities include:

PAKISTAN: Northern Areas: Shenkagarh (BMNH).

AFGHANISTAN: Faizabad; ?Kabul (Gaisler, 1970b).

Table 81. *Eptesicus bottae*: Specimen from Pakistan.

External, cranial and dental measurements (mm)

	mean	n
HB:	57.0	1
T:	45.0	1
HF:	7.0	1
FA:	42.1	1
5mt:	36.6	1
4mt:	38.5	1
3mt:	39.7	1
E:	15.0	1
GTL:	16.0	1
CCL:	15.0	1
BB:	7.8	1
PC:	4.4	1
C-M ³ :	5.8	1
C-M ₃ :	6.8	1
M:	6.2	1
M ³ -M ₃ :	11.3	1

Habits: In Pakistan, the specimen from Shenkagarh was collected at 3200 metres (10500 feet) in arid mountain steppe (Siddiqi, 1961). In Arabia, it is found in a wide variety of arid or semi-arid habitats ranging from cultivated areas at low altitude in Israel and Iraq to mountainous regions in excess of 1850 metres (6013 feet) in Kurdistan and Oman. Diurnal roosts include buildings where it was located in corrugated iron roofing (Harrison & Bates, 1991).

Feeding: Its flight is low and strong, often accompanied by audible squeaking (Roberts, 1977).

Reproduction: An extralimital specimen from Israel had

two embryos (Harrison & Bates, 1991).

Conservation status: Worldwide: it is fairly widespread but probably never abundant. Indian subcontinent: it is a marginal species that appears to be rare. There are no endemic subspecies.

Eptesicus pachyotis (Dobson, 1871)

Thick-eared bat

Vesperugo (Vesperus) pachyotis Dobson, 1871a: 211;
Khasi Hills, Assam (= Meghalaya), India.

External characters: According to Dobson (1876), forearm length is approximately 40.3 mm (= 1.6 inches) in an adult male. The ears are triangular with rounded tips; the lower portion of each ear (from below the level of the tip of the tragus to the posterior border of the pinna near the angle of the mouth) is very thick and fleshy; and appears as if "it were excavated out of the thick integument of the neck". The tragus is short, broadly rounded-off above and curved inwards as in *Nyctalus*. The head is flat, the muzzle very short and broad and with the glandular areas much developed. The wings are attached to the base of the toes. The pelage is dark brown above, paler below.

Cranial characters: The following brief description is based on the single individual from Thailand illustrated in Lekagul & McNeely (1977). The greatest length of skull is 21.2 mm. The dorsal profile rises smoothly to the prominent lambda. The lambdoid crests and mastoid region appear well developed. The zygomata are robust and the jugal bone has a small dorsal projection. The tympanic bullae are not enlarged, they are subequal in width to that of the basioccipital between them.

Table 82. *Eptesicus pachyotis*: based on specimens from India* and Thailand (Lekagul & McNeely, 1977).

External and cranial measurements (mm)

	range	
HB:	55.0	- 56.0
T:	40.0	- 41.0
HF:	8.0	- 9.0
FA:	38.0	- 40.3*
E:	13.0	- 14.0
GTL:	21.2	- 21.2

Dentition: The first incisor (i^2) is bifid and much larger and longer than the second (i^3) (Dobson, 1876). The canine is well developed; it has a cingulum but no accessory cusps. There is no small upper premolar (pm^2) but pm^4 is robust and about two-thirds the height of the canine. m^3 is less than half the crown area of m^2 . There are three lower incisors. The first lower premolar (pm_2) is small and compressed between the canine and the second lower premolar (pm_4).

Variation: All specimens are referred to the nominate form *E. p. pachyotis*.

Distribution: *Eptesicus pachyotis* is found in Assam, northern Myanmar, Tibet and northern Thailand.

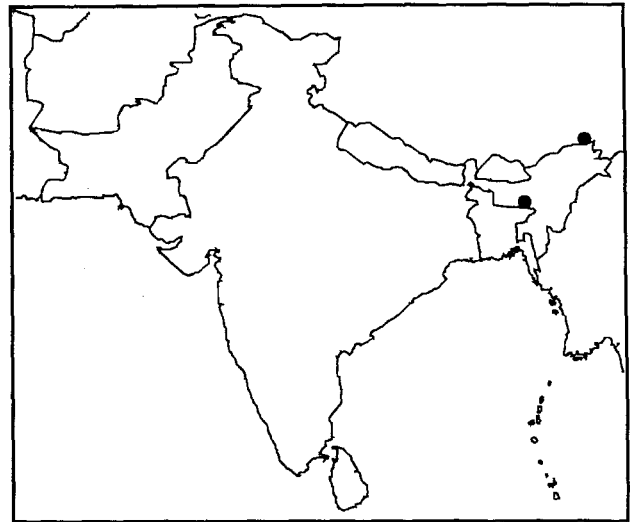


Fig. 178. Distribution of *Eptesicus pachyotis*.

In the Indian subcontinent (Fig. 178) localities include:
INDIA: Meghalaya: Khasi Hills (type loc. of *pachyotis*).

TIBET: southeastern border of Xizang plateau (Zuoqian *et al.*, 1980).

Habits: Nothing is known of the ecology and biology of this species.

Conservation status: Worldwide: only known from a limited number of specimens from a restricted range. It is included on List 3 "Lower risk: near threatened" in the 1996 IUCN Red List of Threatened Animals (Baillie & Groombridge, 1996). Indian Subcontinent: an apparently very rare bat.

Eptesicus gobiensis Bobrinskii, 1926

Bobrinskii's Serotine

Eptesicus nilssonii gobiensis Bobrinskii, 1926: 96;

Burchasteitala, Gobi Altai Mountains, Mongolia.

Eptesicus nilssonii centralasiaticus Bobrinskii, 1926: 96;

Ushchele Khatau, near Russk, Orin-Nor, Tibet.

Eptesicus nilssonii kashgaricus Bobrinskii, 1926: 97;

Khotun-Tagh, mountains Russki, near Kashgar, Chinese Turkestan.

External characters: This description is based on Chakraborty (1983) who referred specimens from Gilgit to *nilssonii kashgaricus* but following Corbet & Hill (1992) are here included in *gobiensis*. The forearm length ranges from 41.0-41.5 mm. The pelage colour is characteristically pale; the dorsal surface is pale straw-grey (light buff) with dark hair roots; the ventral surface is straw-white with the hair roots almost black. The

Table 83. *Eptesicus gobiensis*: Based on two specimens listed in Chakraborty (1983).

External, cranial and dental measurements (mm)

	mean	range	s	n
FA:	41.3	41.0 - 41.5	-	2
E:	14.5	14.0 - 15.0	-	2
GTL:	15.9	15.9 - 15.9	-	1
CBL:	15.1	15.1 - 15.1	-	1
BB:	7.7	7.7 - 7.7	-	1
PC:	4.1	4.1 - 4.1	-	1
C-M ³ :	5.9	5.9 - 5.9	-	1
C ¹ -C ¹ :	4.9	4.9 - 4.9	-	1
M ³ -M ³ :	7.0	7.0 - 7.0	-	1

membranes and all the naked areas are pale yellow. The claws are light brown.

Cranial characters: The skull is smaller than that of *E. bottae* with a condylo-basal length of 15.1 mm (Chakraborty, 1983) and with the braincase relatively shorter. The tympanic bullae are not greatly enlarged and basioccipital pits are present.

Dentition: Upper toothrow length is about 5.9 mm (Chakraborty, 1983). Unlike *E. nasutus*, the first upper incisor (*i*²) is bicuspid. In comparison to *E. bottae*, *m*³ is less compressed antero-posteriorly and the talonid of *m*₃ is relatively much larger, subequal to the trigonid; in *E. bottae*, it is about half the size.

Variation: Specimens from Afghanistan and Pakistan are provisionally referred to *E. g. kashgaricus*. Specimens from Tibet and Nepal are possibly referable to *E. g. centralasiaticus* (Corbet & Hill, 1992).

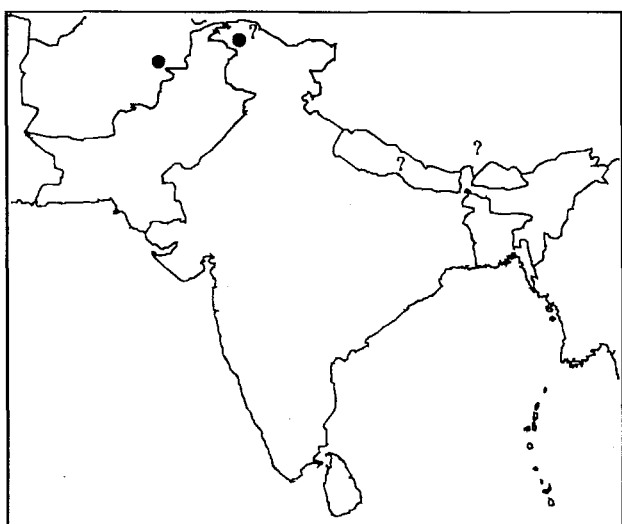


Fig. 179. Distribution of *Eptesicus gobiensis*.

Distribution: *Eptesicus gobiensis* is known from northern Afghanistan, Pakistan, Nepal and Tibet through to Mongolia.

In the Indian subcontinent (Fig. 179) localities include:

PAKISTAN: Northern Areas: possible record from Gilgit (as *borealis* in Blanford, 1888-91; and *kashgaricus* in Chakraborty, 1983).

NEPAL: exact locality not specified (Koopman, 1993).

AFGHANISTAN: Kabul (as *nilssonii kashgaricus* in Felten, 1971).

TIBET: Ushchele Khatu (type loc. of *centralasiaticus*).

Habits: Two possible specimens were collected on 5 and 7 August 1879 from the Gilgit area at an altitude of about 3200 metres (10400 feet) to 3350 metres (10888 feet) (Chakraborty, 1983).

Conservation status: Worldwide: it is geographically widespread in the former Soviet Union (Strelkov, 1986). Indian Subcontinent: the population and systematic status remains uncertain.

Eptesicus nasutus (Dobson, 1877)

Sind Serotine bat

Vesperugo (Vesperus) nasutus Dobson, 1877: 311;

Shikarpur, Sind, Pakistan (according to Blanford, 1888-91 type locality should be 'a little east of Rohri').

External characters: This is a small *Eptesicus* with a relatively long tail which is subequal to the head and body length. Forearm length averages 36.1 mm (35.4-36.9 mm). The muzzle is broad and flat with prominent, nearly naked parahrinal glandular swellings. The ears are small with narrowly rounded tips; the tragus of each is well developed, about half the height of the pinna. The pelage is buffy brown on the dorsal surface and paler on the ventral surface. The hair tips and bases are uniformly coloured. The interfemoral and wing membranes, ears and naked areas of face are mid-brown, distinctly darker than the pelage.

Cranial characters: The skull is smaller than that of *E. bottae* with an average condylo-canine length of 12.0 mm (11.7-12.2 mm). The braincase is relatively small and flattened in lateral view as compared to that of *E. bottae*. The sagittal crest is absent and the lambdoid crests are low but distinct. The slightly convex supraoccipital forms the most posterior part of the skull. The postorbital constriction is narrow and the supraorbital ridges are well developed. The zygomatic arches are delicate and without dorsal projections; they are widely flared anteriorly and posteriorly. The palate is short and broad. The tympanic bullae are relatively large and exceed the breadth of the basioccipital. The coronoid process of each half mandible does not greatly exceed the condyle in height; in consequence the posterior border of the coronoid declines more gently than that of *E. bottae*.

Dentition: Upper toothrow length (c-m³) averages 4.6 mm (4.4-4.8 mm). The first upper incisor (*i*²) is without a secondary cusp. The second incisor (*i*³) is relatively well developed, attaining half the height of *i*². The

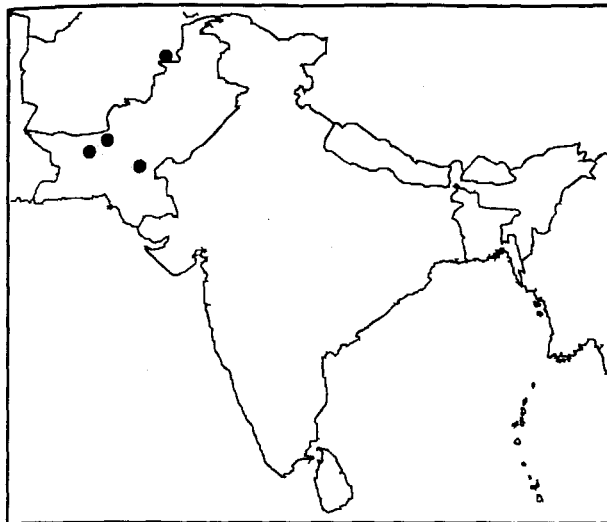


Fig. 180. Distribution of *Eptesicus nasutus*.

upper premolar (pm^4) is relatively small; its crown area slightly exceeds half that of m^1 ; in *E. bottae*, it is in excess of three-quarters. m^3 is about half the crown area of m^2 and with three well developed commissures. The first lower premolar (pm_2) is relatively small; it is crowded between the canine and the second premolar (pm_4). m_1 and m_2 are subequal in size. m_3 has the talonid only slightly reduced.

Variation: All specimens from the region are referred to the nominate subspecies *E. n. nasutus*.

Distribution: *Eptesicus nasutus* ranges from Saudi Arabia and Yemen to Pakistan.

In the Indian subcontinent (Fig. 180) localities include: **PAKISTAN:** Baluchistan: junction of Razhai & Sichk rivers (BMNH); Kharan; near Rajbar (Roberts, 1977);

Table 84. *Eptesicus nasutus*: Specimens from Pakistan, Iran and Afghanistan.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	44.0	40.0 - 46.0	2.3	5
T:	42.2	38.0 - 46.0	2.9	5
HF:	7.3	7.0 - 8.0	0.4	5
FA:	36.1	35.4 - 36.9	0.8	4
5mt:	33.2	31.7 - 34.4	0.8	5
4mt:	34.7	33.7 - 35.7	0.9	5
3mt:	35.3	34.1 - 36.6	1.0	5
E:	13.1	12.5 - 14.0	0.5	5
GTL:	13.1	12.8 - 13.4	0.3	3
CCL:	12.0	11.7 - 12.2	0.3	4
ZB:	8.6	8.4 - 8.8	0.3	2
BB:	6.2	6.2 - 6.3	0.1	3
PC:	3.0	2.9 - 3.1	0.1	4
C-M ³ :	4.6	4.4 - 4.8	0.2	4
C-M ₃ :	5.0	4.8 - 5.1	0.1	5
M:	9.3	8.6 - 9.6	0.4	5
M ³ -M ₃ :	5.8	5.6 - 5.9	0.1	4

Sind: near Rohri (type loc. of *nasutus*, according to Blanford, 1888-91).

AFGHANISTAN: near Jalalabad (Gaisler, 1970a); Laghman (FMNH).

Habits: In Baluchistan, it was collected at 1108 metres (3600 feet) at the junction of Razhai & Sichk rivers (BMNH). In Iran, it was reportedly common in the town of Ahwaz (at an altitude of 68 metres; 220 feet) (BMNH). In Oman, it was found secreted in the walls of ruined buildings, isolated in semi-desert terrain (Harrison & Bates, 1991). In Afghanistan, three female specimens were collected at Lindberg's Cave, 25 miles north of Jalalabad; a further 23 specimens of both sexes were collected at an altitude of 738 metres (2400 feet), 3 miles north of Jalalabad and single female specimen from 862 metres (2800 feet) at Laghman (FMNH).

Reproduction: All males and most females were sexually active in Afghanistan in March/April (Gaisler, 1970a).

Conservation status: Worldwide: probably never abundant throughout its relatively restricted geographical range. It has been included on List 1 "Threatened species" in the 1996 IUCN Red List of Threatened Species with the notation VU A2c 'Vulnerable with a declining population and a continuing decline of the area/ extent/ quality of habitat' (Baillie & Groombridge, 1996). Indian Subcontinent: further research is required to assess its population status.

Eptesicus tatei Ellerman & Morrison-Scott, 1951

Sombre bat

Nycticeius atratus Blyth, 1863: 31; Darjeeling, India.

Preoccupied by *Amblyotus atratus* Kolenati, 1858, in *Eptesicus nilssonii*.

= *Eptesicus tatei* Ellerman & Morrison-Scott, 1951: 158.

External characters: This description is based on Blanford (1888-91). "Ears oval, tips rounded, but appearing pointed when viewed from the side, owing to the conch being longitudinally folded, like *Kerivoula*; the inner margin convex, outer slightly hollowed beneath the tip, with an angular emargination opposite the base of the tragus and terminating in a rounded lobe, the summit of which is marked by a small triangular notch. Tragus with a small rounded lobe at the outer side of its base, expanded above, convex externally and above, inner margin slightly concave. Wings from the base of the toes; last rudimentary caudal vertebra free. Fur long and dense, black throughout".

Cranial characters: Not seen and not described in Blanford (1888-91).

Dentition: "Inner upper incisors (i^2) very long and

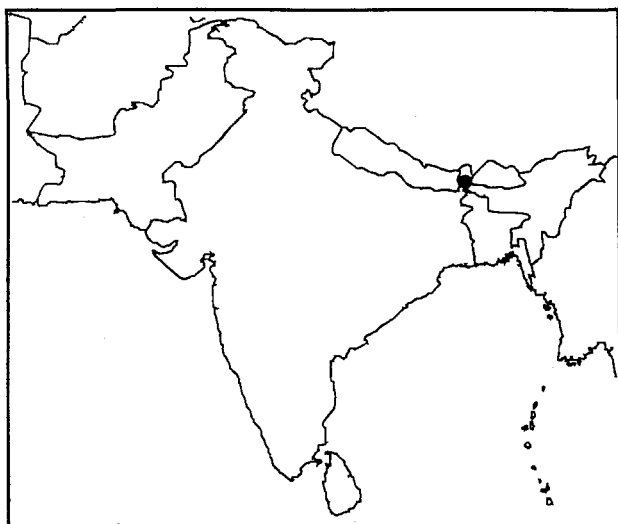


Fig. 181. Distribution of *Eptesicus tatei*.

slightly bifid at the extremity; outer incisors (i^3) minute, scarcely raised above the level of the gum and close to the base of the inner incisors" (Blanford, 1888-91).

Distribution: *Eptesicus tatei* is only known from three specimens (Agrawal *et al.*, 1992); all from the type locality, Darjeeling West Bengal, INDIA (Fig. 181).

Habits: Nothing is known of the ecology or biology of this species.

Conservation status: An apparently endemic species with a most restricted range. Further research is required in Darjeeling district to assess both the taxonomic and conservation status of this bat. It is included on List 5 "data deficient" in the 1996 IUCN Red List of Threatened Animals (Baillie & Groombridge, 1996).

Table 85. *Eptesicus tatei*: Measurements based on Blanford (1888-91).

External measurements (mm)

	mean	n
HB:	48.5	1
T:	45.9	1
FA:	43.4	1
E:	15.3	1

Genus *Vespertilio* Linnaeus, 1758

Vespertilio Linnaeus, 1758: 31; type species *Vespertilio murinus*.

Vespertilio is comparable to *Eptesicus*, but with the ears much shorter and broader. In the skull, the rostrum is flattened above, with a deep concavity on each side between the nares and lachrymal region. The nares are very large; they extend back nearly half way to the interorbital constriction. The width of the palatal

emargination exceeds its length.

Dental formula: $\frac{i-2\ 3}{1\ 2\ 3} \quad \frac{c\ 1}{1} \quad \frac{pm\ ---\ 4}{-2\ -4} \quad \frac{m\ 1\ 2\ 3}{1\ 2\ 3} = 32$

The genus includes 2 species with a geographical range that includes Scandinavia; Europe; Afghanistan to China; Korea; Japan and Taiwan (Koopman, 1993). One species is present in the Indian Subcontinent.

Vespertilio murinus Linnaeus, 1758

Particoloured bat

Vespertilio murinus Linnaeus, 1758: 32; Sweden.

External characters: This is a medium to small species with an average forearm length of 44.2 mm (42.0-45.5 mm) in extralimital specimens. The ears are short; the anterior and posterior borders are smoothly convex and the tips broadly rounded (Fig. 182). The tragus of each

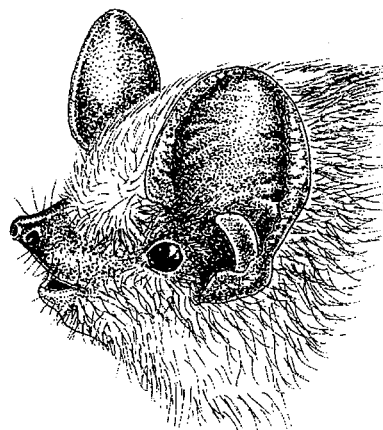


Fig. 182. Face of *Vespertilio murinus*.

ear is small, short, blunt and rounded. The pelage is characteristically coloured. On the dorsal surface, the hair roots are a deep chocolate brown; some of the tips are also dark, others are pale buffy brown. In consequence, the head, shoulders and back appear 'frosted' with pale hairs. On the belly the hair tips are pale but the roots are dark; the hairs on the throat and inner thighs are pale throughout their length. The membranes are mid-brown; the upper interfemoral membrane is lightly haired adjacent to the body. The tibiae are short and the wings are attached to the base of the phalanx of the outer toe of each foot. The tail is long, with the tip slightly extruded from the interfemoral membrane. The lips and face are naked, brown in colour and with the nostrils outward facing. The penis is black, long and slender. There are two pairs of nipples, 4-5 mm apart (Rydell & Baagøe, 1994).

Cranial characters: The skull (Fig. 183) has a condylo-canine length of 15.0 mm (based on one extralimital specimen). In lateral profile, the skull appears flattened (although not as marked as *Tylonycteris*) with the braincase only slightly taller than the rostrum; the dorsal profile is virtually straight from the nares to the lambda. There is no sagittal crest and the lambdoid crests are

low. The rostrum is robust, broad and flattened with concavities on each side between the nares and the lachrymal region. The nasal notch is deep and V-

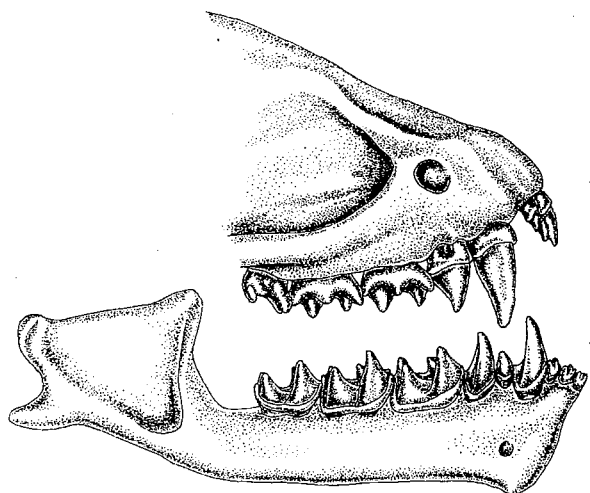


Fig. 183. Anterior skull of *Vespertilio murinus*. BM.46.6.2.21, Sweden. Scale = 3 mm.

shaped. The zygomata slightly exceed the braincase in width; there is a small dorsal process on each jugal bone. The palate is concave and the mesopterygoid space is broad. The tympanic bullae are not greatly enlarged and in consequence the basioccipital is relatively broad. In each half mandible, the coronoid process is short with the posterior border declining gently to the condyle; the angular process is small.

Dentition: Upper toothrow length (c-m³) averages 5.2 mm (4.9-5.5 mm). The first incisor (i²) is bicuspidate with the secondary cusp subequal to the first. The second incisor (i³) is smaller and with one cusp; it is not

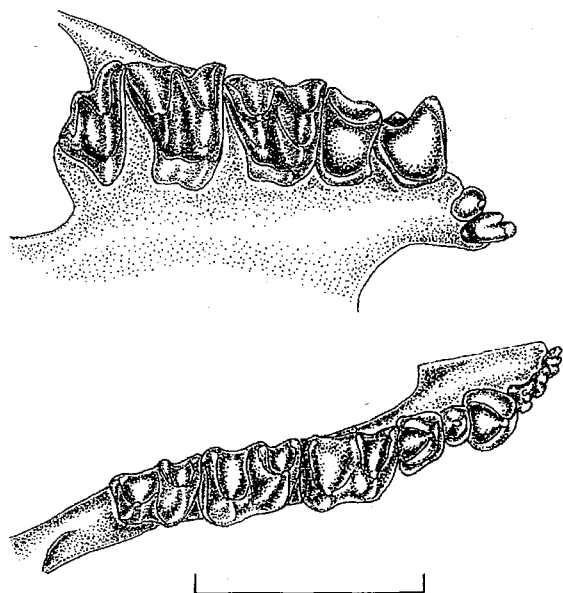


Fig. 184. Occlusal views of maxillary (above) and mandibular (below) dentition of *Vespertilio murinus*. BM.46.6.2.21, Sweden. Scale = 3 mm.

in contact with the upper canine which is unicuspid and with a well defined cingulum. The small upper premolar

(pm²) is absent (Fig. 184). The large upper premolar (pm⁴) is in contact with the canine; it has a well defined antero-medial cusp. m¹ and m² are of the normal insectivorous type and are about equal in crown area. m³ is two-thirds the crown area of m²; it is less reduced than that of *Eptesicus*. In the lower dentition, there are three incisors which are slightly overlapping; the third (i₃) is in contact with the relatively small lower canine. The first lower premolar (pm₂) is situated in the toothrow; it is compressed between the larger second premolar (pm₄) and the posterior cingular cusp of the canine. m₁ and m₂ are about equal in crown area; in m₃ the talonid is more equal to the trigonid in crown area (in *Eptesicus* it is distinctly smaller).

Karyology: 2N= 38, FN= 50; among the autosomes, six pairs are large and metacentric, one pair is small and submetacentric, nine pairs are acrocentric and two pairs are dot-like and acrocentric (Heller & Volleth, 1984; Zima, 1978).

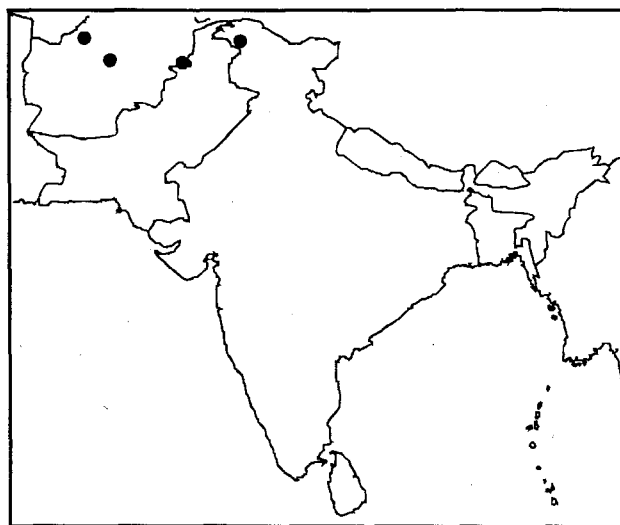


Fig. 185. Distribution of *Vespertilio murinus*.

Variation: Specimens from Pakistan are provisionally referred to *V. m. murinus* (Wallin, 1969).

Distribution: *Vespertilio murinus* ranges from Western Europe to Eastern Siberia, also Pakistan.

In the Indian subcontinent (Fig. 185) localities include: **PAKISTAN: Northern Areas:** Gilgit (Blanford, 1888-91).

AFGHANISTAN: 25 miles east of Maimana (FMNH); south of Jalalabad (mapped by DeBlase, 1980 but locality not listed).

Habits: At Gilgit, it was found at altitudes ranging from 3077-3385 metres (10000 to 11000 feet) (Blanford, 1888-91). Known roosting sites include the attics of houses, hollow trees, behind loose bark, cracks and fissures in walls and and bat boxes erected in tree plantations (DeBlase, 1980; Rydell & Baagøe, 1994). In Europe, there is sexual segregation in the summer when

Table 86. *Vespertilio murinus*: based on extralimital specimens.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	59.6	55.0 - 66.0	5.1	4
T:	43.0	40.0 - 48.0	3.6	4
HF:	9.0	8.0 - 10.0	1.0	3
FA:	44.2	42.0 - 45.5	1.1	8
5mt:	38.4	37.3 - 39.7	1.0	5
4mt:	40.5	39.8 - 41.3	0.6	5
3mt:	41.0	39.4 - 42.3	1.1	5
E:	15.2	14.7 - 16.0	0.7	3
GTL:	15.3	15.0 - 15.6	0.3	5
CCL:	15.0	15.0 - 15.0	-	1
ZB:	9.4	9.1 - 9.7	0.2	5
BB:	8.0	7.6 - 8.7	0.4	7
PC:	4.2	3.8 - 4.4	0.2	8
C-M ³ :	5.2	4.9 - 5.5	0.2	6
C-M ₃ :	5.6	5.3 - 6.1	0.3	5
M:	10.8	10.1 - 11.4	0.5	6
M ³ -M ₃ :	6.5	6.3 - 6.6	0.2	3

the females form small maternity colonies of 10-100 individuals; the males usually roost alone or in small colonies. Throughout their range, these bats have been found in a variety of habitats including forested and urban areas, treeless steppes and agricultural land (Rydell & Baagøe, 1994).

Feeding: According to Ryberg (1947), it leaves its roost late in the evening; it flies between 20 and 40 metres (65-130 feet) above the ground in open country. It feeds on beetles, moths and insects that hatch over water. Diet analyses in Ukraine, Poland and Sweden suggest that dipterans with a body length of less than 10 mm and other flying insects, including aphids, constitute the bulk of the food during all seasons (Rydell & Baagøe, 1994).

Reproduction: In Europe, males have characteristic display flights in autumn which include "songs" that are associated with mating (Rydell & Baagøe, 1994). Females give birth to two young (DeBlase, 1980).

Conservation status: Worldwide: it is a geographically widespread species that is abundant in some places for example eastern Denmark and also in southern Scandinavia (Rydell & Baagøe, 1994). Indian Subcontinent: it has a very limited range, suggesting either it is most uncommon or that it is difficult to observe.

Genus *Ia* Thomas, 1902

Ia Thomas, 1902a: 163; type species *Ia io*.

This is a monospecific genus which according to Miller (1907) is closely allied to *Scotozous*. Ellerman & Morrison-Scott (1951) considered it a subgenus of *Pipistrellus* whilst Menu (1987) referred it to the

synonymy of *Eptesicus*. Hill & Harrison (1987) maintained it as a distinct genus. The single species is characterised by its relatively large size. The crown of the second upper incisor (*i*³) is flat, with a well developed cingulum and a barely indicated central elevation (Fig. 186). The first upper premolar (*pm*²) is minute; it is situated internally to the toothrow. *m*¹ and *m*² have a poorly developed mesostyle which does not extend outwards as far as the parastyle or metastyle.

Dental formula: $\frac{i-2\ 3}{1\ 2\ 3} \quad \frac{c\ 1}{1} \quad \frac{pm-2-4}{-2-4} \quad \frac{m\ 1\ 2\ 3}{1\ 2\ 3} = 34$

The genus includes one species and is known from China, Laos, Vietnam, Thailand, India and Nepal.

Ia io Thomas, 1902

Great Evening bat

Ia io Thomas, 1902a: 164; Chungyang, south Hubei, China.

External characters: This is one of the largest Vespertilionid bats with an average forearm length of 74.1 mm (70.9-77.3 mm). Externally, it resembles a large *Serotine*. The ears are broad, with the tips rounded-off and the breadth subequal to the height (Plate 7). The tragus of each ear is one third the height of the

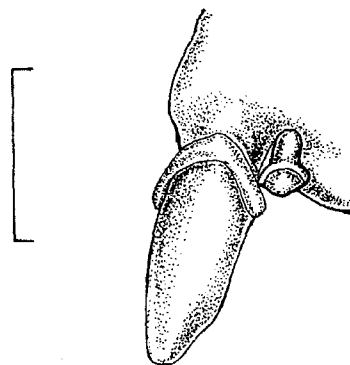


Fig. 186. Right upper incisors (*i*² and *i*³) of *Ia io*. HZM.1. 28130, Nepal. Scale = 2 mm.

pinna. The face is essentially naked with the nostrils simple and outward facing. The wing membranes are black above and below. The interfemoral membrane is also dark above but distinctly paler below. The tail is long, its tip is extruded some 6 mm from membrane. The wings are attached to the outer metatarsal of each foot. The pelage is a uniform grey-brown above, with a slight glossy sheen when viewed in some lights. The ventral surface is a uniform matt grey brown. The baculum is most comparable in form to that of *Eptesicus* with a greatest length of 1.88 mm and a greatest width of 1.15 mm (Topal, 1970b).

Cranial characters: The skull (Fig. 187) is very robust with an average condylo-canine length of 25.7 mm (25.2-26.2 mm). It is comparable in general morphology to that of *Eptesicus serotinus*. The rostrum is broad and flat with well developed lachrymal projections. The zygomata are widely flared, especially posteriorly. The

braincase is ovoid in outline with prominent flanges in the mastoid region. The sagittal crest is low anteriorly but rises to a prominent lambda which forms the most

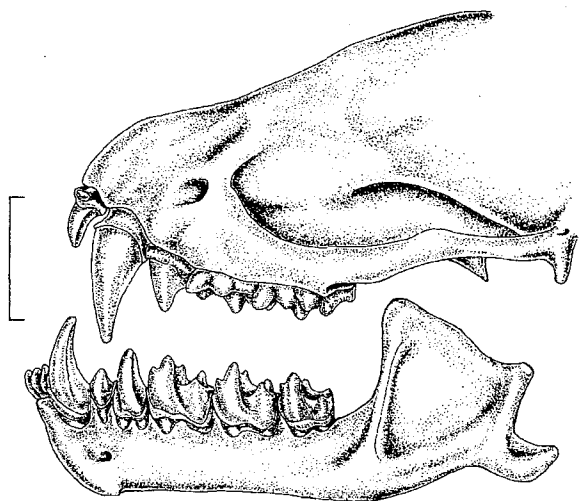


Fig. 187. Anterior skull of *Ia io*. HZM.1.28130, Bimalnager, Nepal. Scale = 5 mm.

posterior part of the skull. The lambdoid crests are strongly developed and overhang the supraoccipital. The dorsal profile is essentially straight, rising gently from the nasal aperture to the lambda. The anterior emargination of the palate extends back to the level of the posterior part of canines. The palate and mesopterygoid space are comparable to that of *E. serotinus* but in contrast there are two well developed basisphenoid pits in the floor of the braincase. The tympanic bullae are not greatly inflated and the basioccipital is broad. Each half mandible is robust with the coronoid process tall and bluntly pointed; the angular process is better developed than that of *E. serotinus* and projects beyond the condyle.

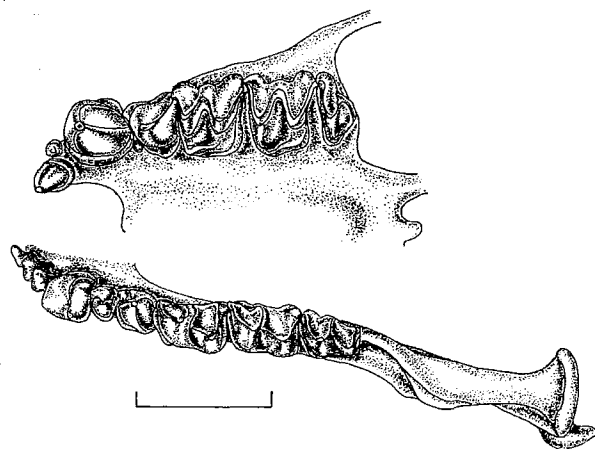


Fig. 188. Occlusal views of maxillary (above) and mandibular (below) dentition of *Ia io*. HZM.1.28130, Bimalnager, Nepal. Scale = 5 mm.

Dentition: Upper tooththrow length (c-m³) averages 10.7 mm (10.5-11.0 mm); the teeth are robust. The first upper incisor (i²) is large and broad, with a trace of a secondary cusp. The second upper incisor (i³) is minute,

subequal in height to the cingulum of i² (Fig. 186). The upper canine is powerful, its cingulum with an indication of a cusp medially. The first upper premolar (pm²) is minute and situated internally to the tooththrow. The second premolar (pm⁴) is large and in contact with the canine. The protocones of m¹ and m² are well developed; the hypocones are virtually absent; the metacone is the predominant cusp in both teeth and the metastyle exceeds the mesostyle in size. m³ is not as reduced as that of *E. serotinus*, it includes three commissures and a small metacone; there is a trace of a fourth commissure. In the lower dentition, there are three overlapping incisors. The lower canine has a well developed cingulum and a cingular cusp posteriorly. The first lower premolar (pm₂) is less than half the crown area of the second (pm₄). pm₄ exceeds the trigonid of m₁ in size; it has a small but well developed antero-internal cusp. m₁ and m₂ have the talonid slightly exceeding the trigonid in size. m₃ has the talonid reduced to about half the crown area of the trigonid.

Variation: All specimens from the Indian subcontinent are provisionally referred to the nominate subspecies *Ia i. io*.

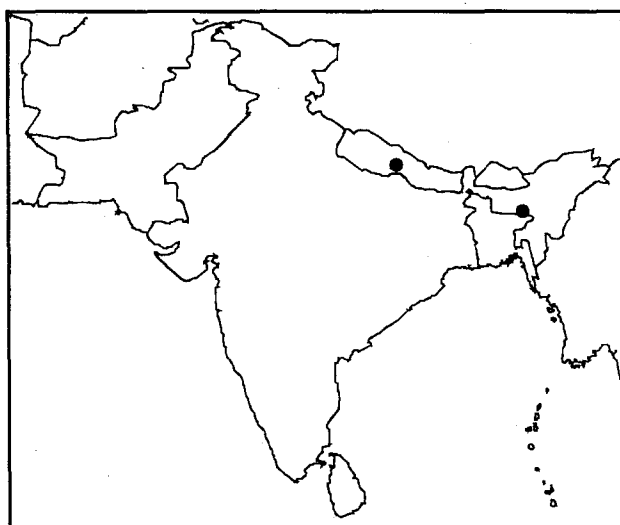


Fig. 189. Distribution of *Ia io*.

Distribution: *Ia io* is known from north-east India, Nepal, southern China, northern Thailand, Laos and northern Vietnam.

In the Indian subcontinent (Fig. 189) localities include:
INDIA: Meghalaya: Cherrapunji (Topal, 1970b).
NEPAL: Bimalnager (HNHM).

Habits: According to Topal (1970b), it was collected in a mist net set in the large entrance chamber of a cave in the village of Mausmai, near Cherrapunji in Meghalaya. The cave was at an altitude of 1600 metres (5200 feet) and was situated in a rather dense karst forest, which was subtropic in character, with *Dracena* and an evergreen *Quercus* as the dominant plant species.

Table 87. *Ia io*: Specimens from Nepal and China.

External, cranial and dental measurements (mm)

	mean	range	s	n
T:	65.0	65.0 - 65.0	-	1
HF:	17.0	17.0 - 17.0	-	1
FA:	74.1	70.9 - 77.3	-	2
5mt:	65.8	62.7 - 68.8	-	2
4mt:	71.7	69.2 - 74.2	-	2
3mt:	73.6	71.3 - 75.8	-	2
E:	23.9	23.7 - 24.0	-	2
GTL:	28.2	27.0 - 29.4	1.2	3
CCL:	25.7	25.2 - 26.2	-	2
ZB:	17.4	16.7 - 18.0	-	2
BB:	11.9	11.7 - 12.2	0.3	3
PC:	5.8	5.5 - 6.1	0.3	3
C-M ³ :	10.7	10.5 - 11.0	0.3	3
C-M ₃ :	11.9	11.6 - 12.1	0.3	3
M:	21.2	20.8 - 21.8	0.5	3
M ³ -M ₃ :	11.2	11.0 - 11.6	0.3	3

Nearby was a large stream. A single specimen was collected at 5.40 pm on 19 November 1967, some 45 minutes after nightfall. It was flying into the cave from the outside and was caught some 60-70 cm above the ground. The cave was possibly its nocturnal resting area; it was not used as a diurnal roost. The previous night some three individuals of this species had been observed in this same cave at 5.30 pm (Topal, 1970b). In China, 55 specimens were collected in a single cave situated at an altitude of 1700 metres (5525 feet) in a pine forest in Szechwan (Sichuan) Province (Pen *et al.*, 1962).

Feeding: Nothing is known of its feeding habits.

Reproduction: In China, 83% of females collected on 25 April were pregnant, each with a single embryo (Pen *et al.*, 1962).

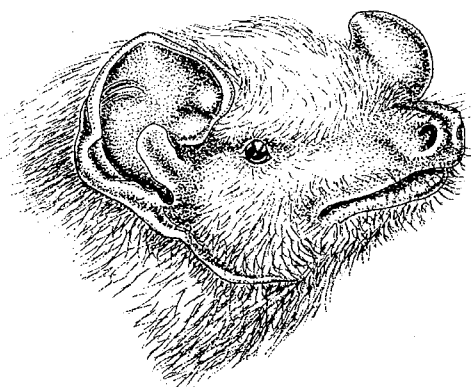


Fig. 190. Face of *Tylonycteris pachypus*.

Conservation status: Worldwide: this is a little known bat but with a fairly widespread geographical distribution. It is included on List 3 "near threatened" in the 1996 IUCN Red List of Threatened Animals (Baillie & Groombridge, 1996). Indian Subcontinent: apparently

rare, being only known from two localities; there are no endemic subspecies.

Genus *Tylonycteris* Peters, 1872

Tylonycteris Peters, 1872a: 703; type species *Vespertilio pachypus*.

This genus is characterised by the remarkable flattening of the skull (Fig. 191). Externally it is like a small *Eptesicus* with the entire head greatly broadened and flattened (Fig. 190). There is a conspicuous fleshy pad on the ball of the thumb and sole of the foot (Fig. 196). The skull is so broad that the depth of the braincase through the tympanic bullae is barely one half the mastoid breadth. The upper surface is flat, sloping gradually forward to the nares. The rostrum is very short

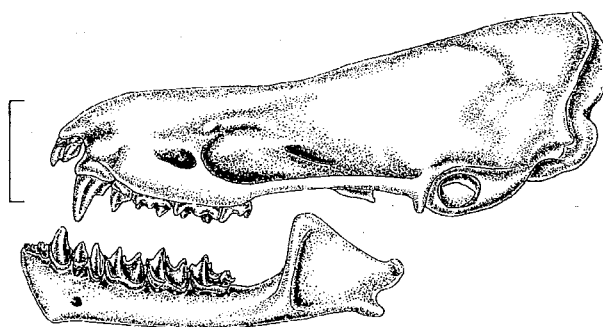


Fig. 191. Skull of *Tylonycteris pachypus*. HZM.1.7446, Malaysia. Scale = 2 mm.

and broad, its length scarcely equal to the lachrymal breadth. There is a distinct blunt projection (supraorbital process) over the anterior upper edge of each orbit (Fig. 197). The first upper incisor is conspicuously bicuspidate, its crown is much longer than broad. The upper canine has a well developed secondary cusp on its posterior edge (Fig. 194).

Dental formula: $\frac{i-2\ 3}{1\ 2\ 3} \quad \frac{c\ 1}{1} \quad \frac{pm-4}{-2-4} \quad \frac{m\ 1\ 2\ 3}{1\ 2\ 3} = 32$

There are two species in the genus with a geographical range that extends from India and southern China to Indonesia and the Philippines. Both species (see matrix on page 165) occur in the Indian subcontinent.

Tylonycteris pachypus (Temminck, 1840)

Bamboo bat; Flat-headed bat; Club-footed bat

Vespertilio pachypus Temminck, 1840: 217, pl. 54; Bantam, West Java.

Scotophilus fulvidus Blyth, 1859: 293; Schwegyin, R. Sittang, south-east Burma (Myanmar).

= *Tylonycteris rubidus* Thomas, 1915c: 227.

Tylonycteris aurex Thomas, 1915c: 228; Astoli, Belgaum, India.

External characters: This is a minute bat with an average forearm length of 27.6 mm (26.1-29.0 mm). The head is characteristically flattened with the nostrils projecting forwards and slightly downwards (Fig. 190).

infants. Weaning young appear in the population by the end of May and immediately become independent. Juveniles attain sexual maturity and breed in their first year. Males are fertile from mid-October to mid-March. Females are in oestrous from mid-November until ovulation occurs in mid-January. Gestation is thought to last 84-91 days (Medway, 1972).

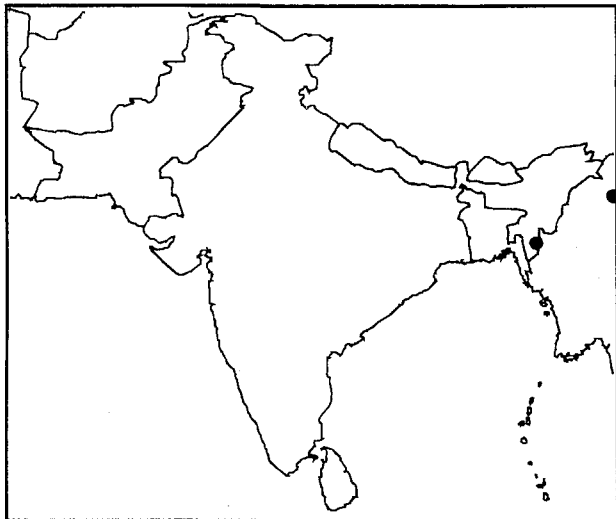


Fig. 198. Distribution of *Tylonycteris robustula*.

Conservation status: Worldwide: it is widespread and locally common in at least a part of its range, for example Malaysia (Medway & Marshall, 1972). Indian Subcontinent: it is apparently rare; there are no endemic subspecies.

Table 89. *Tylonycteris robustula*: specimens from northern Myanmar.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	41.1	40.0 - 44.0	1.6	6
T:	28.3	26.0 - 31.0	1.6	6
HF:	5.3	5.0 - 5.5	0.3	6
FA:	27.5	26.6 - 28.1	0.6	6
5mt:	25.0	24.8 - 25.6	0.3	6
4mt:	25.8	25.4 - 26.0	0.3	6
3mt:	26.1	25.8 - 26.4	0.2	6
E:	9.7	8.5 - 10.5	0.7	6
GTL:	12.3	12.0 - 12.7	0.4	4
CCL:	11.3	11.1 - 11.7	0.3	5
ZB:	9.0	8.9 - 9.1	0.1	2
BB:	7.0	6.9 - 7.0	0.1	5
PC:	3.9	3.8 - 4.1	0.1	6
C-M ³ :	4.0	3.9 - 4.1	0.1	6
C-M ₃ :	5.5	5.4 - 5.8	0.1	6
M:	8.7	8.5 - 9.0	0.2	6
M ³ -M ₃ :	4.3	4.3 - 4.4	0.0	4
RW:	5.5	5.3 - 5.6	0.1	5

Genus *Pipistrellus* Kaup, 1829

Pipistrellus Kaup, 1829: 98; type species *Vespertilio pipistrellus*.

These are small Vespertilionid bats (Plate 8). Externally they are very similar to *Eptesicus*. The nostrils are directed antero-laterally and there is a distinct internarial groove. The parhinal glandular swellings on the muzzle are well marked and nearly naked. The ears tend to be short and broad. The antitragus of each is virtually obsolete; it is distinguishable as a minute lobular projection at the base of the external border of the pinna. The tragus is usually about half the height of the pinna; its anterior border is faintly concave (Fig. 211). Only the extreme tip of the tail projects from the interfemoral membrane. The genus *Pipistrellus* cannot be diagnosed globally by any universally applicable morphological characters, although it can be separated from most other vespertilionine genera by the bacular morphology (Hill & Harrison, 1987). The current definition is that of Miller (1907) who based his diagnosis primarily on dental structure. The first upper incisor (i^2) is simple and usually has a well developed secondary cusp; the second incisor (i^3) is reduced and smaller than i^2 (often absent in *P. dormeri*) but usually extends above the cingulum of that tooth. The upper canine is relatively short, it usually but not always has an incipient secondary cusp on its posterior edge. The small upper premolar (pm^2) is present, except in some specimens of *P. savii* (it is absent in *Eptesicus*) and is usually situated internally to the tooththrow (Fig. 207). pm^3 and pm_3 are absent.

Dental formula: $\frac{i-2\ 3}{1\ 2\ 3} \quad \frac{c\ 1}{1} \quad \frac{pm-2\ 4}{-2\ 4} \quad \frac{m\ 1\ 2\ 3}{1\ 2\ 3} = 34$

The genus *Pipistrellus* is geographically widespread with a range that extends from central southern Africa, throughout Eurasia to Japan, Indonesia, New Guinea, the Solomon Islands and northern Australia. It also occurs in Canada, USA and Mexico. Of the 51 species currently recognised (Koopman, 1993), twelve occur within the Indian Subcontinent (see pages 168 and 169).

Pipistrellus pipistrellus (Schreber, 1774)

Common Pipistrelle

Vespertilio pipistrellus Schreber, 1774: 167, pl. 54; France.

Pipistrellus aladdin Thomas, 1905: 23 (and 1906);

Derbent, 50 miles west of Isfahan, Iran, 6500 feet.

Pipistrellus bactrianus Satunin, 1905: 67, 85; Oasis of Tedzen, Transcaspia, Russian Turkestan.

External characters: This is a small pipistrelle with an average forearm length of 31.0 mm (30.0-31.6 mm). The wings are relatively narrow. The tail is rather short, shorter than the head and body with only its extreme tip projecting from the membrane. The tibiae are short and the feet small. The parhinal glandular swellings on the muzzle are well developed (Plate 8). The ears are short and broad; the anterior border of each is evenly convex; the tip is rounded and there is a concavity on the

posterior border. The tragus (Fig. 211) is almost half the height of the pinna. The pelage is fine, dense and silky; it is a uniform buffy to chestnut brown on the head and

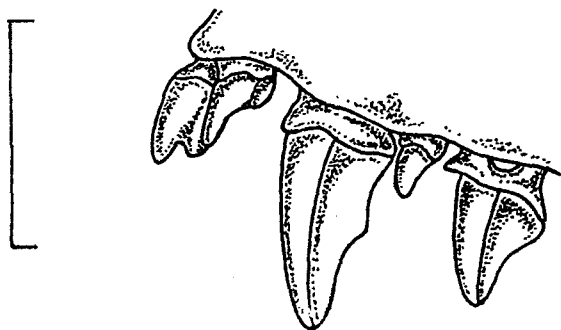


Fig. 199. Left upper anterior dentition of *Pipistrellus pipistrellus*. HZM.117.8650, UK. Scale = 2 mm.

back, with distinctly darker hair bases. The throat and belly are slightly paler but also have dark grey/black hair bases. The interfemoral and wing membranes are a uniform brown and essentially naked, although there are some hairs adjacent to the body and legs on the upper surface of the interfemoral membrane. The baculum is very small, with a narrow extended shaft and a bifid tip; the basal lobes are well developed and deflected ventrally (Fig. 205).

Cranial characters: The skull is small, with an average condylo-canine length of 10.9 mm (10.4-11.3 mm). The rostrum is relatively long and narrow, with a shallow median depression. The dorsal profile rises gradually from the nasal aperture to the lambda, with the braincase elevated above the rostrum; the lambda is curved downwards to the supraoccipital which is convex and forms the most posterior part of the skull. There is a slight depression over the anterior part of the orbit. The braincase is inflated but less elevated, robust and bulbous than that of *P. paterculus*. The sagittal crest is absent. The lambdoid crests are very weak. The zygomata are delicate and moderately flared outwards; they are without dorsal processes on the jugal bones. The palate is concave and parallel-sided. Palatal breadth (m^3 - m^3) is significantly narrower (5.0 mm; 4.8-5.2 mm) than that of *P. paterculus* (5.5 mm; 5.3-5.9 mm). The coronoid process of each half mandible is scarcely elevated above the tip of the lower canine; its anterior surface is nearly vertical; its posterior surface declines gently to the condyle. The angular process is weak.

Dentition: Upper toothrow length (c - m^3) averages 4.2 mm (4.1-4.4 mm). The first upper incisor (i^2) (Fig. 199) is inwardly sloping and bicuspidate, its secondary cusp about two-thirds the height of the principal one. The second incisor (i^3) is equal in crown area to i^2 ; its height almost attains the level of the secondary cusp of i^2 ; it has a larger central and a smaller lateral accessory cusp; it is separated from the upper canine by a short diastema. The upper canine is robust; its posterior cutting edge has a well defined angle/ posterior cusp subequal to half the height of the shaft. The first upper premolar (pm^2) is

small, but not greatly reduced; it is equal in crown area to i^2 and only a little displaced inwards from toothrow. The canine and second premolar (pm^4) are not in contact. m^1 is slightly narrower than m^2 but its antero-posterior diameter is greater; the metacone predominates in each tooth, the protocones are robust and the hypocones distinct. m^3 is about two-thirds the crown area of m^2 ; it includes 3 commissures and a well developed metacone. The lower incisors are tricuspidate and overlapping, the third (i^3) is situated adjacent to the canine. The lower canine is short and broad with a distinct antero-medial secondary cusp above the level of crown of the third incisor (i_3). The first lower premolar (pm_2) attains about half to three-quarters the height and two-thirds the crown area of the second (pm_4). m_1 and m_2 are equal in size, the protoconid is the tallest cusp; the talonid exceeds the trigonid in size. m_3 is smaller; the talonid is about equal to the trigonid in crown area.

Variation: Specimens from India and Pakistan are provisionally referred to the Iranian subspecies *P. p. aladdin* (Corbet & Hill, 1992). Those from north of the main massif of the Hindu-Kush Mountains in Afghanistan are referred to *P. p. bactrianus* (Gaisler, 1970a).

Distribution: *Pipistrellus pipistrellus* ranges from Britain and southern Scandinavia through Europe, China and India to Japan and Taiwan. It is also present in Morocco.

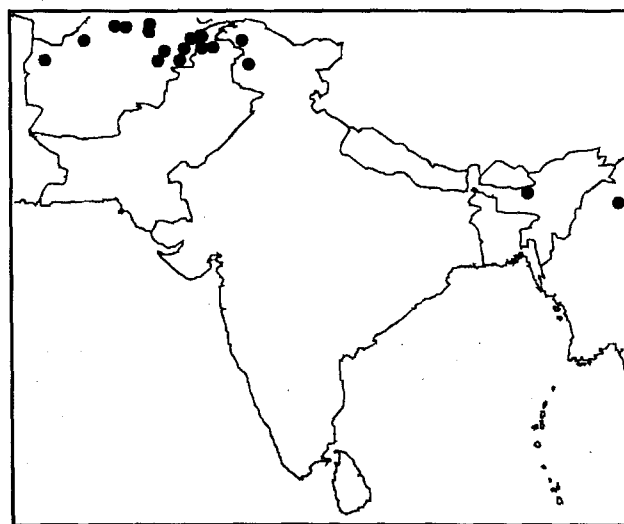


Fig. 200. Distribution of *Pipistrellus pipistrellus*.

In the Indian subcontinent (Fig. 200) localities include: **INDIA: Jammu & Kashmir:** Srinagar; Pandritan (BMNH); **Assam:** Rajapara (BMNH).

PAKISTAN: Northern Areas: Gilgit (Blanford, 1888-91); **NWFP:** Kululai (BMNH: = *P. paterculus* in Walton, 1974); Dir; Chitral (USNM).

Northern MYANMAR: Sumka Uma (BMNH).

AFGHANISTAN records include Kabul; Baschgar Valley; Baghlan; Jalalabad; Kunduz (Gaisler, 1970a); Kamdesh; Balk; Mazar-i-Sharif; Baschgaltal; Maimana;

Character matrix of the twelve species of *Pipistrellus* from the Indian Subcontinent

Species	FA mm	CCL mm	C-M ³ mm	M ³ -M ³ mm	i ³ ½ or more height of i ²	PM ² a: crown area b: position in toothrow	Comments
<i>P. pipistrellus</i> (page 166/ Plate 8)	31.0 30.0-31.6	10.9 10.4-11.3	4.2 4.1-4.4	5.0 4.8-5.2	yes (Fig. 199)	a: = i ² b: usually in toothrow	dorsal pelage chestnut brown; membranes uniform dark brown; upper canine usually bicuspidate; baculum minute (Fig. 205)
<i>P. paterculus</i> (p. 169)	30.9 29.2-34.0	11.2 10.6-11.6	4.4 4.1-4.8	5.5 5.3-5.9	yes	a: = i ² b: variably intruded	dorsal pelage dark brown; membranes uniform dark brown; upper canine usually unicuspid; baculum very large (Fig. 205)
<i>P. javanicus</i> (p. 171)	33.2 30.0-36.0	12.4 11.9-13.1	4.9 4.6-5.2	6.0 5.6-6.7	yes	a: >= i ² b: intruded	dorsal pelage chestnut brown, others darker with light frosting of paler hairs; wing membranes uniform dark brown; upper canine usually bicuspidate
<i>P. coromandra</i> (p. 172)	30.0 25.5-34.3	11.2 10.6-11.9	4.4 3.9-4.6	5.5 5.0-6.0	yes	a: = i ² b: intruded	dorsal pelage mid- to dark brown; membranes dark brown; upper canine usually bicuspidate; baculum small (Fig. 205)
<i>P. tenuis</i> (p. 174)	27.7 25.0-30.2	10.2 9.3-10.7	3.8 3.5-4.1	4.9 4.5-5.2	yes	a: = i ² b: intruded	dorsal pelage mid- to dark brown; membranes uniform dark brown; upper canine usually bicuspidate; small skull and dentition
<i>P. ceylonicus</i> (p. 177/ Plate 8)	37.2 33.0-42.0	13.7 13.1-14.3 (Fig 206)	5.5 5.2-5.9	6.7 6.2-7.2	yes (Fig. 209)	a: = i ² b: intruded	dorsal pelage grey-brown to chestnut brown; large species; membranes dark brown

Herat; Taliqan (FMNH).

Habits: According to Blanford (1888-91), it is often seen near human settlements where during the day it hides in crevices in walls, clefts or rocks, or in any dry protected hole. It is less frequently found in trees. Walton (1974) located a colony of some 100 individuals (referred by him to *P. abramus paterculus* but following examination of specimens in BMNH here considered to be *P. pipistrellus*) of both sexes in a cave near the Kululai Government Rest House in Pakistan. In Afghanistan,

the diurnal roosts are invariably found in buildings, notably in the chinks below flat roofs. Some 200 individuals were observed flying from the town of Baghlan to a nearby orchard. In Jalalabad, a colony of some 100 individuals was observed in cracks among the beams of the former Habibula Palace (Gaisler, 1970a). Collecting localities ranged from an elevation of 461 metres (1500 feet) at Balk to 2462 metres (8000 feet) at Paghman, near Kabul (FMNH).

Feeding: According to Roberts (1977), it generally

Character matrix continued ...

<i>P. kuhlii</i> (page 179)	34.7 33.4-36.0	12.4 12.0-12.9	4.9 4.6-5.0	5.6 5.5-5.9	no (Fig. 209)	a: = $\frac{1}{2} i^2$ b: intruded	dorsal pelage buffy brown; membranes pallid, with white border between foot and 5th metacarpal; baculum distinctive (Fig. 205)
<i>P. savii</i> (p. 180)	34.1 32.1-38.0	12.8 12.4-13.3	4.8 4.6-5.1	6.1 5.9-6.2	yes (Fig. 212)	a: absent/ minute b: intruded	pelage silky and long (7-8 mm in mid-dorsal region), chestnut brown dorsally; braincase low and flat; baculum distinctive (Fig. 205)
<i>P. cadornae</i> (p. 181)	35.1 32.6-36.5	12.7 12.6-12.8	4.7 4.6-4.9	5.9 5.8-6.0	yes	a: < $\frac{1}{2} i^2$ b: intruded	dorsal pelage uniform dark brown; membranes dark brown; deep basisphenoid pits
<i>P. affinis</i> (p. 183)	40.2 38.4-41.4	14.1 13.7-14.5	5.5 5.5-5.7	6.2 6.0-6.5	yes	a: < $\frac{1}{2} i^2$ b: slightly intruded	dorsal pelage dark brown, grizzled with grey; baculum distinctive (Fig. 205)
<i>P. circumdatus</i> (p. 184)	42.4 41.8-43.6	15.1 14.6-15.6	6.3 6.0-6.5	7.6 7.5-7.8	no	a: < $\frac{1}{4} i^2$ b: intruded	dorsal pelage black with some orange tips; baculum minute and distinctive (Fig. 205)
<i>P. dormeri</i> (p. 185)	34.4 32.7-36.3	13.3 12.8-13.6 (Fig 217)	5.4 5.2-5.6	6.7 6.3-7.0	no often absent (Fig. 218)	a: > $\frac{1}{2} i^2$ b: intruded (Fig. 219)	dorsal pelage grey-brown; membranes uniform mid-brown

emerges to hunt very early in the evening, sometimes before the sun has set. It spends a large part of the night resting in its diurnal roost. It has two active periods of hunting during the night, each of only one or two hours duration. Individuals have been observed using their forearm to strike down larger insects as well as cupping insects in their interfemoral membrane. It has a rapid flight with frequent very quick turns and descents (Blanford, 1888-91).

Reproduction: In Srinagar (Jammu & Kashmir), females caught between 26-31 May each had a single embryo in the right horn of the uterus (Topal, 1974). In Pakistan, subadults were collected from Kululai in Swat District on 1 September (BMNH).

Conservation status: Worldwide: this is a geographically widespread species that is not endangered. Indian Subcontinent: it has a restricted range and no endemic subspecies.

Pipistrellus paterculus Thomas, 1915

Mount Popa Pipistrelle

Pipistrellus paterculus Thomas, 1915: 32; Mount Popa, Upper Burma (Myanmar).

External characters: This is a small pipistrelle with an

average forearm length of 30.9 mm (29.2-34.0 mm). It is comparable in size and morphology to *P. pipistrellus* except that the pelage averages darker. On the dorsal surface, the hairs are long and deep chocolate brown in colour throughout their length. On the ventral surface, the hair bases are also dark but the tips are a pale ginger brown. The wings and interfemoral membrane are a uniform dark brown and essentially naked, except for the proximal third of the upper interfemoral membrane. The ears and naked areas of the face are also dark brown. The baculum is characteristically large, with a long narrow shaft and strongly bifid tip, the horns of which are deflected ventrally (Fig. 205).

Cranial characters: The skull has an average condylo-canine length of 11.2 mm (10.6-11.6 mm). The rostrum is broad; it is more robust and elevated, in lateral view, than that of *P. pipistrellus aladdin*. The braincase is also more robust, bulbous and elevated. In dorsal profile, there is a slight concavity where the posterior part of the rostrum meets the anterior part of the braincase. Palatal width (m^3 - m^3) averages 5.5 mm (5.3-5.9 mm); this significantly exceeds that of local *P. pipistrellus* which average 5.0 mm (4.8-5.2 mm).

Dentition: Upper toothrow length (c - m^3) averages 4.4 mm (4.1-4.8 mm) and the dentition is distinctly more robust throughout than *P. pipistrellus aladdin*. The first upper incisor (i^2) is bicuspid; the second (i^3) nearly

Table 90. *Pipistrellus pipistrellus*: Specimens from India and Pakistan.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	44.0	40.0 - 48.0	2.8	7
T:	32.9	29.0 - 35.0	2.0	7
HF:	6.1	6.0 - 7.0	0.4	7
FA:	31.0	30.0 - 31.6	0.6	7
5mt:	28.9	28.4 - 29.8	0.5	7
4mt:	29.6	28.7 - 30.8	0.7	7
3mt:	29.9	29.5 - 31.0	0.6	7
E:	11.1	10.5 - 12.0	0.4	6
GTL:	12.1	11.9 - 12.5	0.2	13
CCL:	10.9	10.4 - 11.3	0.3	14
ZB:	7.6	7.2 - 7.9	0.2	10
BB:	6.1	5.9 - 6.3	0.1	14
PC:	3.3	3.2 - 3.5	0.1	14
C-M ³ :	4.2	4.1 - 4.4	0.1	14
C-M ₃ :	4.5	4.3 - 4.7	0.1	14
M:	8.4	7.9 - 8.7	0.2	13
M ³ -M ³ :	5.0	4.8 - 5.2	0.1	14
RW:	4.6	4.3 - 4.8	0.2	14

attains the height of the secondary cusp of i^2 . There is a short diastema between i^3 and the upper canine. In contrast to *P. pipistrellus*, the posterior cutting edge of upper canine is usually without a well defined angle and secondary cusp. The first upper premolar (pm^2) is small but not minute, it is variably intruded from the toothrow and is about equal in crown area to i^2 . The canine and second upper premolar (pm^4) are closely adjacent but not in contact. In the mandibular dentition, the first premolar (pm_2) is about equal in crown area and three-quarters the height of the second (pm_4).

Variation: All specimens are currently referred to the nominate subspecies *P. p. paterculus*.

Distribution: *Pipistrellus paterculus* ranges from India and Myanmar to Thailand and south-west China.

In the Indian subcontinent (Fig. 201) localities include: **INDIA: Jammu & Kashmir:** Poonch Valley (Nath, 1985); **Bihar:** Buhnar (Sinha, 1983b); **Assam:** Rajapara (BMNH); Palasbari (FMNH); **Nagaland:** Takubama (FMNH); **Manipur:** Aimoli (BMNH).

Northern MYANMAR: Mount Popa (type loc. of *paterculus*); Mandalay; Kyauk Myoung (Wroughton, 1916ai = *mimus* in Wroughton, 1915a); Pyaunggaung (Wroughton, 1916ai = *coromandra* in Ryley, 1914b); Tatkon; Homalin; Hkamti; Tamanthe (Wroughton, 1916ai); Nam Tisang Valley; Sumka Uma; Sumprabum; Ningma (Hill, 1962); Rangoon; Maymyo (BMNH).

Specimens from Kululai, NWFP, Pakistan referred by Walton (1974) to *P. paterculus* are here included in *P. pipistrellus*.

Habits: Little is known of this species in India.

Table 91. *Pipistrellus paterculus*: Specimens from India and Myanmar.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	44.8	42.0 - 48.0	2.0	8
T:	33.7	31.0 - 38.0	2.3	8
HF:	6.5	6.0 - 7.0	0.3	7
FA:	30.9	29.2 - 34.0	1.7	9
5mt:	28.8	27.1 - 31.2	1.6	9
4mt:	29.7	27.4 - 32.4	1.6	9
3mt:	30.0	27.6 - 32.4	1.6	9
E:	10.9	10.0 - 13.0	1.0	8
GTL:	12.1	11.7 - 12.6	0.3	9
CCL:	11.2	10.6 - 11.6	0.4	9
BB:	6.2	6.0 - 6.4	0.1	9
PC:	3.5	3.2 - 3.9	0.2	10
C-M ³ :	4.4	4.1 - 4.8	0.2	10
C-M ₃ :	4.7	4.4 - 5.0	0.2	9
M:	8.8	8.4 - 9.1	0.3	8
M ³ -M ³ :	5.5	5.3 - 5.9	0.2	9
RW:	4.9	4.7 - 5.2	0.2	10

Specimens from Poonch Valley were collected from a fairly deep hole in a tree stump near an old uninhabited building (Nath, 1985). In Myanmar, it has been collected at altitudes ranging from 308 metres (1000 feet) at Ningma to 615 metres (2000 feet) at Sumka Uma (BMNH). Diurnal roosts include the thatched roof of a hut and a banana tree in 'moderate forest' at Sumka Uma (BMNH); it has also been found in dry bamboo in thick forest at Ningma (BMNH) and in 'moderate jungle' at Sumprabum (BMNH).

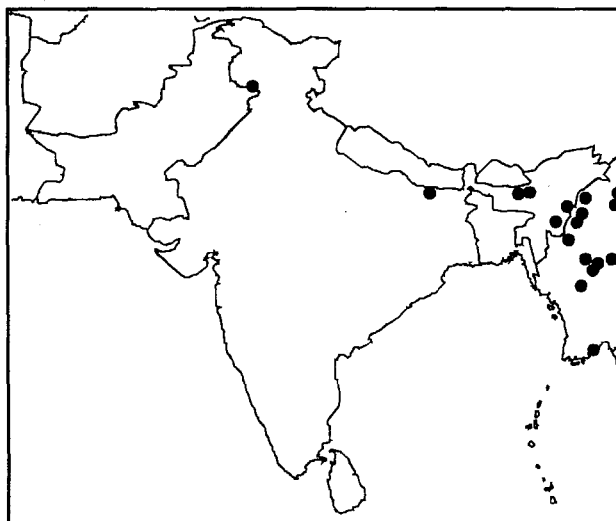


Fig. 201. Distribution of *Pipistrellus paterculus*.

Reproduction: A subadult specimen was collected at Mandalay, Myanmar on 27 June (BMNH).

Conservation status: Worldwide: little is known of this species throughout its range. It is included on List 3 "Lower risk: near threatened" in the 1996 IUCN Red List of Threatened Animals (Baillie & Groombridge, 1996).

Indian Subcontinent: nothing is known of its current status, although in Myanmar, it was apparently "very common" in the Nam Tisang Valley in the 1930s (BMNH). There are no endemic subspecies.

Pipistrellus javanicus (Gray, 1838)

Javan Pipistrelle

Scotophilus javanicus Gray, 1838: 498; Java.

Pipistrellus camortae Miller, 1902: 779; Kamorta Island, Nicobar Islands, Bay of Bengal.

Pipistrellus babu Thomas, 1915: 30; Murree, 8000 feet, Punjab.

Pipistrellus peguensis Sinha, 1969: 83; Pegu, Burma (Myanmar).

External characters: This is a medium-sized pipistrelle with an average forearm length of 33.2 mm (30.0-36.0 mm). Pelage colour varies between individuals; some are a uniform chestnut brown on the dorsal surface, others a darker clove brown with a light frosting of paler brown on the hair tips. The hair tips are buffy brown on the ventral surface with the hair roots black or almost black. The ears and wing and interfemoral membranes are a uniform dark brown and essentially naked. The baculum has a long narrow shaft and strongly bifid tip; the basal lobes are well developed and deflected ventrally (Fig. 205).

Cranial characters: With an average condylo-canine length of 12.4 mm (11.9-13.1 mm), this is a more robust skull than that of *P. coromandra*. The rostrum is broad and dorsally flattened, with a shallow linear depression in the mid-line and two lateral depressions over the

orbits. There is a large V-shaped nasal notch. The supraorbital region is distinctly broadened to produce abruptly incurving lateral margins to the anterior part of the postorbital area. The dorsal profile is almost straight from the nares to the lambda, with a slight depression over the orbits; it is a little flattened at the fronto-parietal suture. The lambda forms the most elevated part of the skull and the convex supraoccipital the most posterior part. The palate is broad, concave and essentially parallel-sided. The basisphenoid pits are moderately developed but not as deep or large as those of *P. cadornae*. The coronoid process of each half mandible is robust but does not exceed the tip of the lower canine in height.

Dentition: Upper toothrow length (c-m³) averages 4.9 mm (4.6-5.2 mm). The first upper incisor (i²) is usually bicuspidate, although occasionally the secondary cusp may be indistinct; it usually attains three-quarters the height of the anterior cusp. The second incisor (i³) is large, about as tall as the secondary cusp of i²; it has a larger central and a smaller lateral accessory cusp and is separated from the upper canine by a narrow diastema. The upper canine has a distinct posterior secondary cusp. The first small upper premolar (pm²) is intruded from the toothrow; it is not greatly reduced with its crown area exceeding that of i². The canine and the second premolar (pm⁴) are closely adjacent but not in contact. The first lower premolar (pm₂) is slightly extruded from the toothrow, it is about half to three-quarters the crown area and two-thirds the height of the second lower premolar (pm₄). m₁ and m₂ are about equal in size, with the talonid larger than the trigonid. m₃ is two-thirds the size of m₂ with the talonid about equal to the trigonid.

Karyology: 2n=36; with three pairs of metacentrics, four pairs of submetacentrics, one pair of subtelocentrics and nine pairs of acrocentrics. The X chromosome is a medium sized metacentric, the Y chromosome a small acrocentric (Dulic, 1980).

Variation: Following Corbet & Hill (1992), the taxa *babu*, *peguensis* and *camortae* have been included in the synonymy of *javanicus*. Specimens from the mainland of the Indian Subcontinent are referred to *P. javanicus babu* and those from the Nicobar Islands to *P. j. camortae*.

Distribution: *Pipistrellus javanicus* ranges from Afghanistan, Pakistan and India to Myanmar, Indonesia, Philippines, Korea, Japan, New Guinea and perhaps Australia.

In the Indian subcontinent (Fig. 202) localities include: **INDIA:** Himachal Pradesh: Simla (BMNH); Maharashtra: Panchgani (Khajuria, 1953); Madhya Pradesh: Sabalgarh (Lindsay, 1926b); Supkhar (LACM); Uttar Pradesh: Ramnagar; Dhakuri; Mussoorie (BMNH); Sukhidhang; Srinagar (Bhat, 1974);

Table 92. *Pipistrellus javanicus*: Specimens from India, Pakistan, Nepal and Bangladesh.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	47.1	40.0 - 55.0	4.5	23
T:	33.9	26.0 - 40.0	3.3	23
HF:	6.0	3.0 - 8.0	1.3	19
FA:	33.2	30.0 - 36.0	1.5	23
5mt:	31.4	29.0 - 33.4	1.2	17
4mt:	32.6	29.9 - 34.7	1.3	17
3mt:	33.0	25.9 - 34.8	1.3	17
E:	11.8	5.0 - 15.0	2.4	22
GTL:	13.6	13.0 - 14.6	0.4	25
CCL:	12.4	11.9 - 13.1	0.3	24
ZB:	8.5	8.2 - 9.0	0.3	8
BB:	6.6	6.3 - 7.1	0.2	26
PC:	3.7	3.3 - 4.3	0.2	28
C-M ³ :	4.9	4.6 - 5.2	0.2	29
C-M ₃ :	5.2	4.8 - 5.5	0.2	28
M:	9.9	9.3 - 10.7	0.3	26
M ³ -M ₃ :	6.0	5.6 - 6.7	0.2	28
RW:	5.4	5.0 - 6.1	0.3	25

West Bengal: Pashok (Wroughton, 1916ciii); Darjeeling; Nimbong (BMNH); Sukna (HNHM); Jalpaiguri (Agrawal *et al.*, 1992); **Sikkim:** Rongli (FMNH); **Assam:** Rajapara (Hinton & Lindsay, 1926);

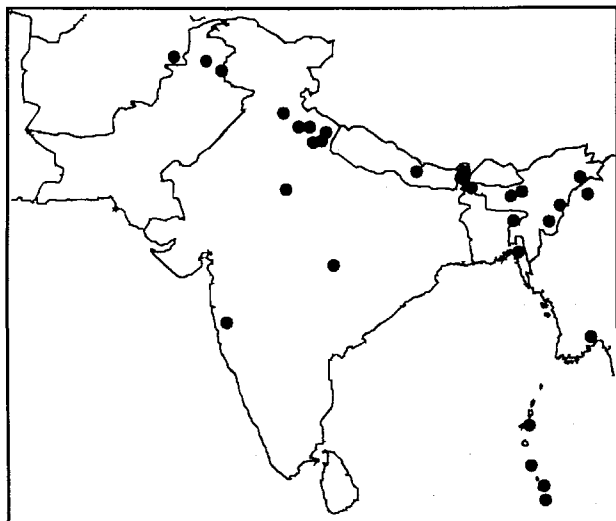


Fig. 202. Distribution of *Pipistrellus javanicus*.

Palasbari (FMNH); Margherita (BMNH); **Nagaland:** Takubama (FMNH); **Manipur:** no exact loc (BMNH); **Andaman Islands:** Port Blair (probable locality according to Das, 1990); **Nicobar Islands:** Camorta Island (type loc of *camortae*); Car Nicobar (Soota & Chaturvedi, 1971); Campbell Bay (Saha, 1980).

PAKISTAN: NWFP: Karakar Pass (FMNH); **Punjab:** Murree (type loc of *babu*); Gharial (Roberts, 1977).

NEPAL: Kakani (Hinton & Fry, 1923); Rasuwa District (Kock, 1996); Najarkot; Bouzini; Sipuri; Kathmandu (BMNH); Godavari (HZM).

BANGLADESH: Luskarpore (BMNH); Purba Gomdandi; Boalkhali Thana (Kock, 1996).

Northern MYANMAR: Pegu (type loc of *peguensis*); Dalu (Carter, 1943).

AFGHANISTAN: Kalat-us-Seraj; Jalalabad (Meyer-Oehme, 1968).

Habits: Little is known of this bat in the Indian Subcontinent. In Uttar Pradesh it was collected at 550 metres (1788 feet) in the tropical zone of Pauri District and at 1380 metres (4485 feet) in Almora District (Bhat, 1974). In Assam, it was collected at 185 metres (600 feet) at Rajapara (Hinton & Lindsay, 1926). Specimens from Gharial in the Murrec Hills of Pakistan were collected at 2380 metres (7800 feet) in pine forest (Roberts, 1977). Those from Nicobar Islands were collected in a clearing on the edge of a high forest along the seashore and in a clearing in the forest (Hill, 1967).

Reproduction: The development of the embryo is discussed in Bhiwgaade *et al.* (1984).

Conservation status: Worldwide: geographically widespread and not endangered. However, the taxon *peguensis* from Myanmar is considered as a discrete

species and included on List 5 "Data deficient" in the 1996 Red List of Threatened Animals (Baillie & Groombridge, 1996). Indian subcontinent: two endemic subspecies are provisionally recognised: *camortae* with a range restricted to the Nicobar Islands and *babu* in the rest of India, Nepal and Pakistan.

Pipistrellus coromandra (Gray, 1838)

Coromandel Pipistrelle; Indian Pipistrelle; Little Indian bat

Scotophilus coromandra Gray, 1838: 498; Pondicherry, Coromandel coast, India.

Vespertilio coromandelicus Blyth, 1851a: 159.

Myotis parvipes Blyth, 1853: 581; Masori (? Mussoorie, Kumaon, India).

?*Vesperugo blythii* Wagner, 1855: 742; Ceylon.

Scotophilus coromandelianus Blyth, 1863: 33.

?*Vesperugo micropus* Peters, 1872b: 259; Masuri, north-west India (and Hutton, 1872: 708; Dehra Dun, near Simla, north-west India).

External characters: This is a small pipistrelle with an average forearm length of 30.0mm (25.5-34.3 mm). Externally, it is often difficult to distinguish this species from *P. tenuis*, occasionally even in localities where both occur together. In general, *P. coromandra* averages larger, but there are significant overlaps in all external measurements. Pelage colour varies between individuals. Generally it is a uniform brown on the dorsal surface, ranging from chestnut to dark clove brown. The ventral surface is conspicuously paler, with beige brown or cinnamon brown tips to the hairs, depending on the individual; the hair roots are dark. The ears and membranes are mid- to dark brown and essentially naked, although there are some hairs on the interfemoral membrane adjacent to the body and the tail, above and below. The baculum has a straight or slightly sinuous shaft, with a distinctly bifid tip and with the basal lobes deflected ventrally (Fig. 205).

Cranial characters: The skull has an average condylo-canine length of 11.2 mm (10.6-11.9 mm). Skull size is midway between the larger *P. javanicus babu* (12.4 mm, 11.9-13.1 mm) and the smaller *P. tenuis mimus* (10.2 mm, 9.3-10.7 mm). The rostrum and palate average broader than those of *P. pipistrellus aladdin*. They are more elongated than those of *P. t. mimus*. The braincase is comparable to that of *P. j. babu* but smaller and more flattened posteriorly; it exceeds that of *P. t. mimus* in size. The dorsal profile is almost straight from the nares to the anterior part of the braincase which is equal or slightly subequal in height to the lambda. The coronoid process of each half mandible is more robust than that of *P. pipistrellus*.

Dentition: Upper tooththrow length (c-m³) averages 4.4 mm (3.9-4.6 mm). The dentition is essentially similar to that of *P. javanicus babu* but less robust. The first upper incisor (i²) is bicuspidate; the secondary cusp is

occasionally small or absent but is usually half the height of the anterior cusp. The second incisor (i^3) is well developed, with a larger principal cusp and a smaller lateral accessory cusp, i^3 usually exceeds the secondary cusp of i^2 in height; it is separated from the upper canine by a narrow diastema. The upper canine has a secondary cusp and a distinct cingular cusp posteriorly. The first upper premolar (pm^2) is intruded from the toothrow; it is equal in crown area to i^2 . The canine and second premolar (pm^4) are not in contact but are closely adjacent. The first lower premolar (pm_2) is slightly extruded from the toothrow; it is half to three-quarters the crown area of the second (pm_4).

Variation: Specimens from throughout the Indian subcontinent are currently referred to the nominate race *P. c. coromandra*. However, Corbet & Hill (1992) suggest those from north-west Pakistan may be prove to be subspecifically distinct being closely similar to specimens from Afghanistan. These individuals are characterised by a greyer pelage and larger cranial measurements. Gaisler (1970a) in his description of specimens from eastern Afghanistan included the name *P. c. afghanus* n. ssp. but did not formally recognise the population as a distinct subspecies. The availability of this name is discussed by Corbet & Hill (1992).

Distribution: *Pipistrellus coromandra* ranges from Afghanistan to southern China, India, Sri Lanka, Nicobar Islands, Thailand and Vietnam.

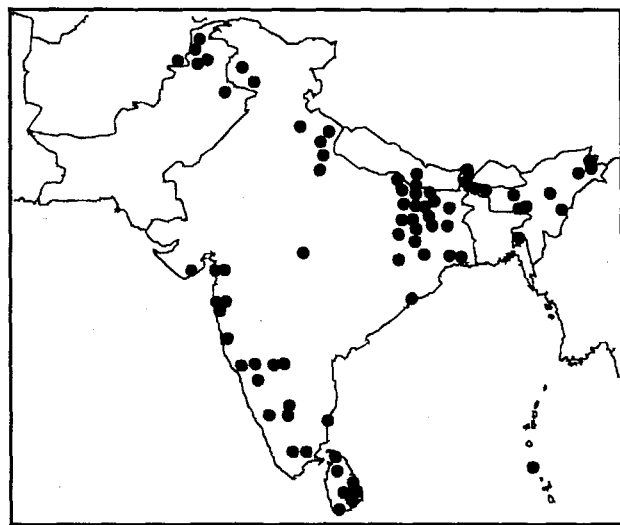


Fig. 203. Distribution of *Pipistrellus coromandra*.

In the Indian subcontinent (Fig. 203) localities include: **INDIA: Jammu & Kashmir:** Srinagar; Shar; Rambon (Chakraborty, 1983); **Gujarat:** Mheskatri; Lunwa; Keshod (BMNH); Surat (Brosset, 1962c); Deogad (Gaisler, 1970a); **Maharashtra:** Bombay; Ratnagiri (Brosset, 1962c); Bandra; Tamankud; Phonda; Pareli (Gaisler, 1970a); **Goa:** Molem (HNHM); **Karnataka:** Vijayanagar (BMNH); Hawsbhavi; Samasgi (Wroughton, 1912c); Bangalore; Sivasamudram (Ryley, 1913a); Dharwar; Hampi; Bellary (Brosset, 1962c);

Srimangala (BMNH); **Tamil Nadu:** Pondicherry (type loc. of *coromandra*); Samaya Malai (HZM); Upper Manalaar (USNM); **Orissa:** districts of Ganjam; Baleswar; Sundargarh (Das *et al.*, 1993); **Madhya Pradesh:** Sohagpur (BMNH); **Uttar Pradesh:** Mussoorie (type loc of *parvipes*); Dhakuri; Lwarkhet (Wroughton, 1914); Mirzapur (HZM); Ramnagar; Philibhit (BMNH); **Bihar:** the districts of Aurangabad; Bhagalpur; Bhojpur; Gaya; Giridih; Gopalganj; Hazaribagh; Katihar; Madhubani; Munger; Muzaffarpur; Palamau; Patna; Purnea; Saharsa; Samastipur; Santal Pargana; Singhbhum; Vaishali; Champaran (Sinha, 1986a); Ranchi (HZM); **West Bengal:** Pedong; Siliguri; Jalpaiguri; Haldibari (Wroughton, 1916b); Gopaldhara; Pashok (Wroughton, 1916ciii); Salbani (Gaisler, 1970a); Hasimara (BMNH); Calcutta; Sujapur; Falta; Mathur (HNHM); **Sikkim:** Rongli (Wroughton, 1916b); Mangpu (FMNH); **Arunachal Pradesh:** Dreyi (BMNH); **Assam:** Golaghat; Sadiya (Kurup, 1968); Palasbari (FMNH); **Meghalaya:** Konshnong (Hinton & Lindsay, 1926); Cherrapunji (FMNH); **Nagaland:** Koia (BMNH); Takubama (FMNH); **Tripura:** Ganganagar (Agrawal & Bhattacharyya, 1977); **Nicobar Islands:** Car Nicobar (Sinha, 1986a).

PAKISTAN: NWFP: Chitral; Dir; Saidu-Sharif (Roberts, 1977); Yakh Tangai (FMNH); **Punjab:** Chakri (BMNH).

BANGLADESH: no exact loc. (Khan, 1982).

NEPAL: Hazaria, Bairia, Bairaglia (Hinton & Fry, 1923); Barabisse (FMNH).

SRI LANKA: Northern Province: Cheddikulam; Kankasanturai (Phillips, 1936i&ii); **North Central Province:** Manampitiya (Phillips, 1932biv); **Central Province:** Kumbalgamuwa (Phillips, 1980); **Uva Province:** Bibile (Phillips, 1933aii); Passara; Namunukula (Phillips, 1980); **Southern Province:** Nakiadeniya (Ryley, 1914b).

AFGHANISTAN: Jalalabad; Dari-i-Nur (Gaisler, 1970a).

Specimens assigned to *P. coromandra* from Pyaunggaung (Ryley, 1914b) in **Northern MYANMAR** are now referred to *P. paterculus*.

Habits: In Sri Lanka, it is mainly found in the dry zone. According to Phillips (1980), it was very plentiful in Northern, Eastern and Uva provinces (and probably also in some southern districts). In Meghalaya, it was collected at altitudes ranging from 185 metre (600 feet) to 923 metres (3000 feet) (Hinton & Lindsay, 1926) and in Uttar Pradesh from 1846 metres (6000 feet) to 2769 metres (9000 feet) (Wroughton, 1914). Its diurnal roosts include trees; the roofs of buildings (Phillips, 1980); crevices between logs; the ceilings and walls of houses (Sinha, 1986a); behind signboards; chimneys of fire places; among the tiles of huts; old buildings; outhouses (Chakraborty, 1983); among the scales of a date palm tree; a hole in a mulberry tree (Gaisler, 1970a) and under the bark of a big *Ficus* (Brosset, 1962c). At Kumbalgamuwa, Sri Lanka, two males and five females

Table 93. *Pipistrellus coromandra*: Specimens from India, Pakistan, Nepal and Sri Lanka.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	42.3	34.0 - 49.0	3.7	47
T:	32.0	22.0 - 39.0	3.5	48
HF:	5.6	3.4 - 8.0	1.0	38
FA:	30.0	25.5 - 34.3	1.7	47
5mt:	28.1	25.2 - 31.1	1.4	46
4mt:	28.7	25.7 - 32.7	1.6	46
3mt:	29.0	25.8 - 33.1	1.6	46
E:	10.3	7.1 - 14.0	1.2	48
GTL:	12.5	11.8 - 13.1	0.3	51
CCL:	11.2	10.6 - 11.9	0.3	52
ZB:	7.9	7.6 - 8.2	0.2	12
BB:	6.2	5.7 - 6.7	0.2	51
PC:	3.4	3.0 - 3.8	0.2	51
C-M ³ :	4.4	3.9 - 4.6	0.1	53
C-M ₃ :	4.7	4.1 - 5.1	0.2	51
M:	8.9	8.2 - 9.5	0.3	51
M ³ -M ₃ :	5.5	5.0 - 6.0	0.2	51
RW:	4.9	4.3 - 5.3	0.2	51

were found roosting together in the hollow trunk of a Papaw tree (Phillips, 1980). Bhattacharyya (1985) examined 15 roosts in Calcutta; the height of the roosts above the ground varied from 6 to 9 metres (20-29 feet) and the size of the entrance hole from 40 to 60 mm; colony size averaged 18, ranging from 8 to 25 individuals. One roost was shared with *P. t. mimus*, although each species lived in a separate isolated group.

Feeding: In Bihar, it emerges a few minutes before to

Table 94. *Pipistrellus tenuis*: Specimens from India, Pakistan, Nepal and Sri Lanka.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	39.1	33.0 - 45.0	3.0	37
T:	28.9	20.0 - 35.0	3.7	37
HF:	5.3	3.0 - 7.0	1.4	32
FA:	27.7	25.0 - 30.2	1.2	39
5mt:	25.9	23.5 - 28.5	1.3	39
4mt:	26.4	23.7 - 29.2	1.2	39
3mt:	26.7	23.9 - 29.7	1.2	39
E:	9.7	5.0 - 11.0	1.5	37
GTL:	11.5	10.7 - 12.1	0.3	47
CCL:	10.2	9.3 - 10.7	0.3	47
ZB:	7.4	7.3 - 7.6	0.1	6
BB:	6.0	5.6 - 6.3	0.2	47
PC:	3.3	2.9 - 3.7	0.2	47
C-M ³ :	3.8	3.5 - 4.1	0.1	48
C-M ₃ :	4.1	3.8 - 4.4	0.1	44
M:	7.9	7.2 - 8.3	0.2	42
M ³ -M ₃ :	4.9	4.5 - 5.2	0.1	46
RW:	4.4	3.9 - 4.8	0.2	47

sixteen minutes after sunset; in the morning it returns some 5-10 minutes before sunrise (Sinha, 1986a). According to Bhattacharyya (1985), it feeds at a higher elevation than *P. t. mimus*. Feeding lasts for about 90 minutes; the bats return to the roost for a rest period of 20-30 minutes before coming out again. The flight is rather slow, fluttering and erratic. It hunts around big trees and often flies amongst the foliage and entanglements of branches (Brosset, 1962c). It feeds on small flies (Brosset, 1962c); small ants and dipteran flies (Sinha, 1986a).

Reproduction: In Bihar, pregnant females usually carry two foetuses, occasionally one, and give birth up to three times a year, in April, July-August and October-November (Sinha, 1986a).

Conservation status: Worldwide: this is a widely distributed and apparently common species in southern Asia. Indian subcontinent: a common species.

Pipistrellus tenuis (Temminck, 1840)

Least Pipistrelle; Indian Pygmy bat

Vespertilio tenuis Temminck, 1840: 229; Sumatra (Tate, 1942).

Pipistrellus mimus Wroughton, 1899: 722; Mheskatri, Dangs, Surat District, Western India.

Pipistrellus mimus glaucillus Wroughton, 1912d: 769; Multan, Punjab, India.

Pipistrellus principulus Thomas, 1915c: 231; Gauhati, Assam, India.

External characters: This is the smallest pipistrelle found within the subcontinent with an average forearm length of 27.7 mm (25.0-30.2 mm). However, it is not possible using external characters alone to discriminate between this species and smaller individuals of *P. coromandra* even when the two occur at the same locality (it is possible using cranial characters). In general, as in *P. coromandra* the dorsal pelage is a uniform brown, varying in tone from mid-brown to a deep clove brown. The ventral surface is paler; the hair tips are buffy brown; the roots are dark brown or black. The ears and membranes are dark throughout and essentially naked. Body weight averages about 2 grams (Gopalakrishna & Karim, 1972). The baculum (Fig. 205) has a long thin shaft and a distinctly bifid tip; the basal lobes are well developed and deflected ventrally (Hill & Harrison, 1987).

Cranial characters: The skull, with an average condylo-canine length of 10.2 mm (9.3-10.7 mm) is significantly smaller than that of *P. coromandra*. The palate (m³-m₃) is noticeably narrower: 4.9 mm (4.5-5.2 mm) as compared to 5.5 mm (5.0-6.0 mm). The postorbital constriction is relatively broad but the braincase is small.

Dentition: Upper toothrow length (c-m³) averages 3.8 mm (3.5-4.1 mm) as compared to 4.4 mm (3.9-4.6 mm)

in *P. coromandra*. The first upper incisor (i^2) is bicuspidate with the secondary cusp usually about half the height of the principal one. The second incisor (i^3) is well developed, it exceeds the secondary cusp of the first incisor in height; it is separated from the upper canine by a narrow diastema. The upper canine has a distinct posterior secondary cusp. The first upper premolar (pm^2) is intruded from the toothrow; it is about equal in crown area to the first upper incisor (i^2). The canine and the second premolar (pm^4) are not in contact but are closely adjacent. The first lower premolar (pm_2) is slightly extruded from the toothrow; it is three-quarters the crown area and about two-thirds the height of the second (pm_4).

Karyology: $2n=38$, $FN=48$ with $12+X$ metacentrics and $24+Y$ acrocentrics (Pathak & Sharma (1969). However, Bhunya & Mohanty (1975) report a different chromosomal formula: $2N=42$, with $24+X$ metacentrics, 2 submetacentrics and $14+Y$ acrocentrics.

Variation: The taxon *glaucoillus* from the Punjab was differentiated from *mimus* from Gujarat on the basis of colour (bistre brown versus mouse-grey). However, pelage colour varies considerably even between individuals from the same colony and therefore all specimens from the Indian subcontinent are here referred to *P. t. mimus* (Sinha, 1980).

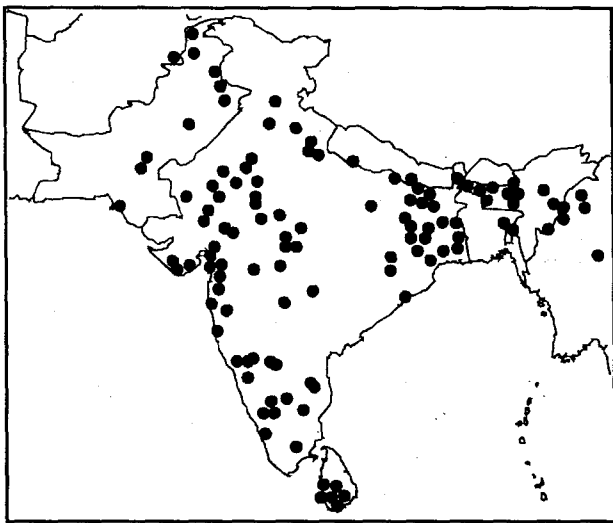


Fig. 204. Distribution of *Pipistrellus tenuis*.

Distribution: *Pipistrellus tenuis* ranges from Afghanistan, Pakistan, India and Sri Lanka to Vietnam and Thailand.

In the Indian subcontinent (Fig. 204) localities include: **INDIA:** **Himachal Pradesh:** Kulu (FMNH); **Haryana:** Chandigarh (Gandhi, 1989); **Rajasthan:** districts of Jodhpur; Banswara; Dungarpur; Jhalawar; Tonk; Bundi; Ajmer; Kota (Advani, 1981b); Nagaur; Barmer; Pali; Sirohi; Sikar; Jhunjhunu (Advani, 1982b); Jaipur (Prakash, 1960); **Gujarat:** Mheskatri (type loc. of *mimus*); Waghai; Deogad (BMNH); Keshod; Sasan; Bagdu (Ryley, 1913bi); Palanpur; Lunwa (Ryley, 1914a);

Vedtia; Anand; Surat (Brosset, 1962c); Junagadh (Sinha, 1981a); **Maharashtra:** Bhodwad (Wroughton, 1912a); Chikalda (Wroughton, 1912b); Chinchpali; Chanda (Wroughton, 1913ii); Bombay; Karnala; Poona (Brosset, 1962c); Ratnagiri (Sinha, 1980); Nanded (Karim, 1975); **Karnataka:** Mysore; Astoli (BMNH); Dharwar; Gadag (Wroughton, 1912c); Potoli; Barchi; Honawar; Kardibetta Forest; Vijayanagar (Wroughton, 1913iii); Bangalore (Ryley, 1913a); Srimangala; Kutta (Ryley, 1913bii); Bellary (Brosset, 1962c); **Kerala:** districts of Thrissur and Ernakulam (BMNH); **Tamil Nadu:** Samaya Malai (HZM); Tirthamalai; Chettiri Range; Kurumbapatti (BMNH); Madurai (pers. obser); **Andhra Pradesh:** Thummalabyu; Koduru (BMNH); **Orissa:** districts of Mayurbhaj; Keonjhar; Sundargarh; Sambalpur; Ganjam; Puri (Das *et al.*, 1993); **Madhya Pradesh:** Khapa; Bori; Sohagpur; Mundra (Wroughton, 1913ii); Guna (Lindsay, 1926b); Hoshangabad (Brosset, 1962c); **Uttar Pradesh:** Sitabani; Ramnagar; Dela; Jerna; Philibhit (Wroughton, 1914); Haldwani; Satyanarayan (Bhat, 1974); Varanasi (Pathak & Sharma, 1969); Neergam; Kaladungi (HZM); **Bihar:** the districts of Begusarai; Bhagalpur; Bhojpur; Darbhanga; Dhanbad; Champaran; Gaya; Hazaribagh; Madhubani; Muzaffarpur; Patna; Rohtas; Saharsa; Santal Pargana; Singhbhum; Sitamarhi; Vaishali (Sinha, 1986a); Ranchi (HZM); **West Bengal:** Bardhaman; Calcutta; Darjeeling; Haora; Hugli; Jalpaiguri; Koch Bihar; Maldah; Medinipur; Murshidabad; Nadia; North 24-Parganas; Puruliya; South 24-Parganas; West Dinajpur (Agrawal *et al.*, 1992); **Assam:** Gauhati (type loc. of *principulus*); Golaghat; Rajapara; Angarakhata (Hinton & Lindsay, 1926); Phulbari (Das *et al.*, 1995); Palasbari (FMNH); **Meghalaya:** Laitkinsao (Hinton & Lindsay, 1926); **Nagaland:** Chekrima (Nath, 1952); **Tripura:** Ambassa; Kanchanpur (Agrawal & Bhattacharyya, 1977). **PAKISTAN:** **NWFP:** Malakand (Roberts, 1977); Chitral (Sinha, 1980); **Punjab:** Multan (type loc. of *glaucoillus*); Bhattu Hissar; Chaklala (Hinton & Thomas, 1926); Chakri (Siddiqi, 1961); Khanewal; Sheikhpura (district) (BMNH); **Sind:** Gambat; Sukkur (Siddiqi, 1961); Karachi; Malir (Walton, 1974). **NEPAL:** Bairia; Hazaria (Hinton & Fry, 1923); Banke District (Mitchell, 1980). **BANGLADESH:** Habiganj (Kock, 1996). **SRI LANKA:** **North-western Province:** Kurunegala (Phillips, 1980); **Central Province:** Kandy (Wroughton, 1915ci); Peradeniya (BMNH); Rattota (USNM); **Western Province:** Anasigalla (BMNH); Colombo; Kalutara (Phillips, 1980); **Uva Province:** Namunukula (Phillips, 1980); **Sabaragamuwa:** Labugama (FMNH); **Southern Province:** Ranna; Hambantota (Ryley, 1914b). **Northern MYANMAR:** Pyaunggaung (Ryley, 1914b); Homalin (Wroughton, 1916ai); Kabaw Valley (Wroughton, 1916cii); Nanyaseik; Dalu; Phawzaw; Maungkan (Carter, 1943). Records from Mandalay and Mount Popa (= *mimus* in Wroughton, 1915a) are referred to *P. paterculus*. **AFGHANISTAN:** Kala-i-Shahi (Gaisler, 1970b).

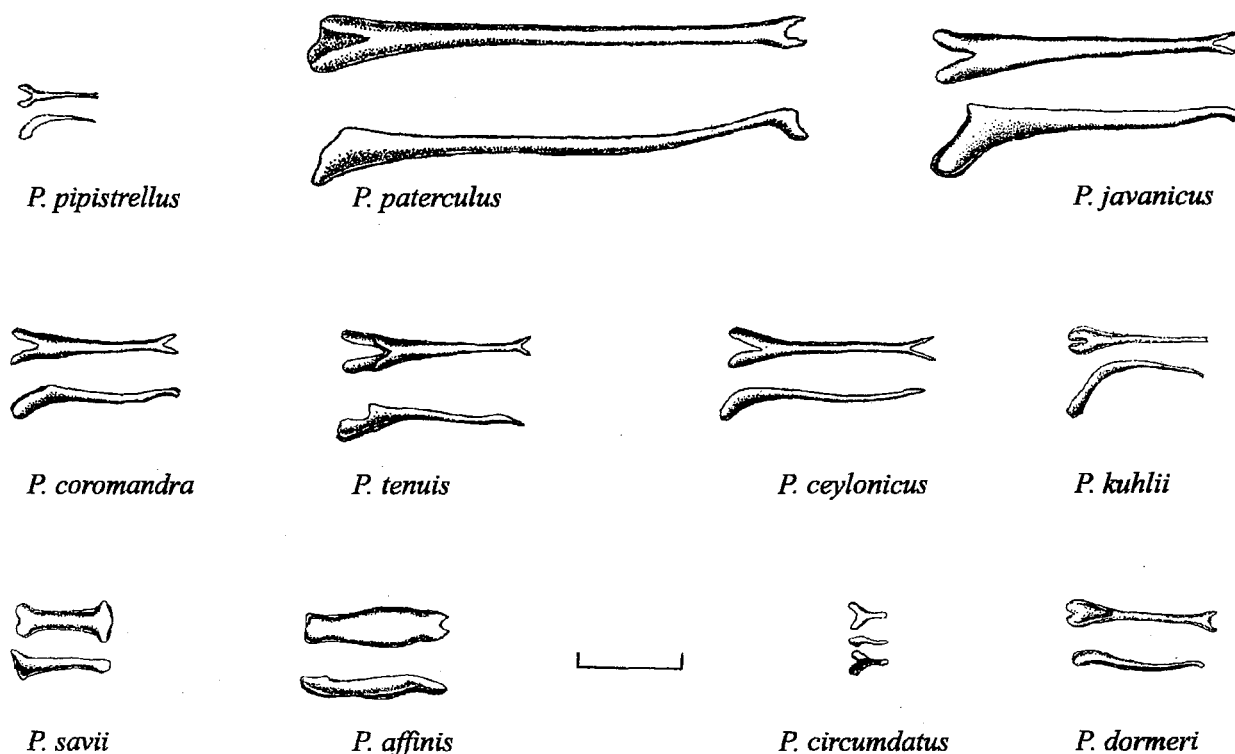


Fig. 205. Bacula of eleven species of *Pipistrellus* (drawings after Hill & Harrison, 1987). Scale = 2 mm.

Habits: In Pakistan, it favours the wooded regions of the Indus valley; is common in the older towns of the Punjab and occurs throughout the Sind from Karachi to the north, although it avoids the extensive desert areas (Roberts, 1977). In India, it is also found in wooded country and is quite common in towns (Brosset, 1962c). In Assam and Meghalaya, it was collected from altitudes ranging from 108 metres (350 feet) to 769 metres (2500 feet) (Hinton & Lindsay, 1926). According to Sharma (1982), it is quite common in the Rajasthan desert. In Sri Lanka, it is mainly found in the intermediate and wet zones, replacing *P. coromandra* in the wetter districts and is especially common in the Colombo and Kalutara districts (Phillips, 1980). In Nepal, it was found at an altitude of 160 metres (520 feet) in Banke district (Mitchell, 1980). Diurnal roosts include: roofs of bungalows; holes and crevices in walls; hollow branches of trees; dead leaves of trees (Phillips, 1980). In Calcutta, on average roosts are located 3 to 6 metres (10-20 feet) above the ground; the diameter of the hole ranges from 30 to 50 mm and typical roost size is 15, with a range of 6 to 20 individuals. Occasionally, it will share a roost with *P. coromandra* but the two species always remain isolated in separate areas within the roost (Bhattacharyya, 1985).

Feeding: In the evening it is one of the first bats to make an appearance, with the time of emergence directly governed by the time of sunset (Prakash, 1962). On first emerging, after circling low around the building or tree in which it has passed the day, it will ascend, with quick wing beats and rather jerky flight, with many twists and turns, to about 9 metres (30 feet). As the evening closes

in, it will generally descend again to near tree-top level and continue hawking for small insects along the verges of open spaces, around buildings, over paddy fields and such places where flying insects are abundant (Phillips, 1980). According to Ryley (1914a), its flight is characterised by a slow flutter and it may also float on the breeze; Roberts (1977) refers to its 'darting erratic flight'. Bhattacharyya (1985) notes that it frequently hunts close to the ground. In Tamil Nadu, it was collected at about one metre (3 feet) in a net set between two trees at Samaya Malai (HZM). Its diet varies according to the seasonal availability of food. In Rajasthan for example, in winter (December-February), it feeds primarily on beetles (66.6%) followed by cockroaches and wingless ants. In summer (March-June), it lives on a variety of insects including grasshoppers and crickets, termites, beetles and moths. In the monsoon season (July-September), the soft winged forms of termites are consumed in the highest proportion (45.5%) whilst moths, Hymenoptera and Orthoptera average between 10-15% of the diet. In the post-monsoon period (October-November), beetles represent some 31.4% of the diet; winged ants and wasps (31.0%), crickets, grasshoppers, flies and mosquitoes are also favoured (Advani, 1981b). In Rajasthan, it was observed that it will not hunt during heavy rains or when the temperature at night falls below 15°C (Sharma, 1982).

Reproduction: In Rajasthan, pregnant females were collected throughout the year, with two peaks of reproductive activity, February-March and another in the post rainy season, July-August. These periods coincide with an abundance of insects in the Indian desert. Males

remain fertile throughout the year, though at a lower rate in the winter months. Females give birth to between one and three individuals, averaging 2.2 births per female. After birth, the subadult stage continues for 30-40 days, after which the bat becomes adult and sexually mature (Advani, 1983). In Maharashtra, peaks in reproduction were observed in May-June and again in September-October, before and after the period of maximum rainfall (Gopalakrishna *et al.*, 1975). In West Bengal, pregnant females were collected in November and December; juveniles were found in May, September and December. According to Topal (1974), this suggests that they breed throughout the year. In Sri Lanka, Phillips (1980) also suggested that they breed intermittently throughout the year. He located females with young from March-June and again in December.

Conservation status: Worldwide: a fairly widespread and apparently common species. Indian subcontinent: a common bat with one endemic subspecies (*mimus*).

Pipistrellus ceylonicus (Kelaart, 1852)

Kelaart's Pipistrelle

Scotophilus ceylonicus Kelaart, 1852: 22; Trincomalee, Ceylon.

Vesperugo indicus Dobson, 1878: 222; Mangalore, Malabar Coast, India.

Pipistrellus chrysothrix Wroughton, 1899: 720; Mheskatri, Surat Dangs, India.

Pipistrellus ceylonicus subcanus Thomas, 1915b: 30; Yalala, Junagadh, Kathiawar, India.

External characters: This is a relatively large *Pipistrellus* with an average forearm length of 37.2 mm (33.0-42.0 mm). The ears, naked areas of the face,

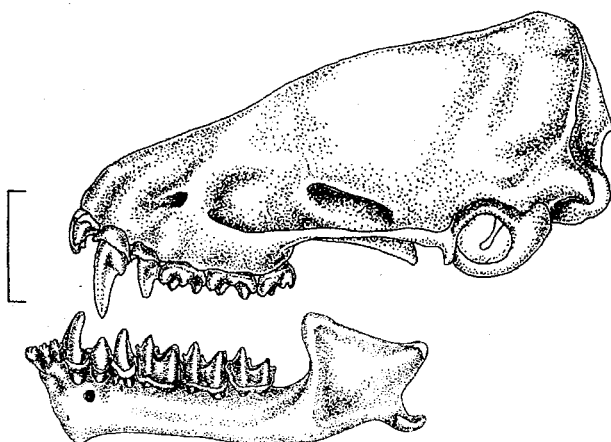


Fig. 206. Skull of *Pipistrellus ceylonicus*. IN55, Khirasara, Gujarat, India. Scale = 2 mm.

wings and interfemoral membrane are a uniform dark brown (Plate 8). There are some hairs on the interfemoral membrane, above and below, adjacent to the body, tail and femora. The dorsal pelage is variable in colour, ranging from grey-brown to chestnut, reddish or golden-brown. The ventral surface has dark hair bases

Table 95. *Pipistrellus ceylonicus*: Specimens from India, Pakistan and Sri Lanka.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	53.5	45.0 - 64.0	3.5	43
T:	38.2	30.0 - 45.0	4.0	43
HF:	8.3	6.0 - 11.0	1.1	30
FA:	37.2	33.0 - 42.0	1.9	40
WSP:	251.1	227.0 - 262.0	10.2	12
5mt:	33.6	30.7 - 36.7	1.4	36
4mt:	35.1	32.6 - 38.5	1.5	41
3mt:	35.8	33.0 - 39.5	1.6	43
E:	12.2	9.5 - 14.0	1.2	43
GTL:	15.0	14.4 - 15.8	0.3	48
CCL:	13.7	13.1 - 14.3	0.3	49
ZB:	9.8	9.2 - 11.0	0.4	33
BB:	7.3	6.8 - 7.8	0.2	49
PC:	4.0	3.7 - 4.3	0.1	49
C-M ³ :	5.5	5.2 - 5.9	0.1	49
C-M ₃ :	5.9	5.7 - 6.5	0.2	49
M:	11.2	10.6 - 12.0	0.3	49
M ³ -M ₃ :	6.7	6.2 - 7.2	0.2	49
RW:	6.2	5.7 - 7.1	0.3	49

and pale grey tips. Adult body weight is between 7-8 grams and with a wing span of about 250 mm (Madhavan, 1971). The baculum is relatively small; it has a slender upwardly curving shaft and a bifid tip; the basal lobes are well developed and deflected ventrally (Fig. 205).

Cranial characters: The skull (Fig. 206) is robust with an average condylo-canine length of 13.7 mm (13.1-14.3 mm). The dorsal profile is slightly convex in the frontal region, with the lambda the highest point. The supraoccipital forms the most posterior part of the skull. The mastoid flanges are well developed. The rostrum is broad with conspicuous incurving margins which produce well defined supraorbital ridges. The zygomata are delicate but widely flared outwards, especially posteriorly. Palatal length exceeds its width and the upper dentition is not convergent. The tympanic bullae are relatively small with basiocciput broad; the basisphenoid pits are shallow. The coronoid process of each half mandible is robust but short, about equal in height to the tip of the lower canine.

Dentition: Upper toothrow length (c-m³) averages 5.5 mm (5.2-5.9 mm). The first upper incisor (i²) is bicuspidate, with the secondary cusp about three-quarters the height of the principal one. The second incisor (i³) is large, two-thirds the height of i². The canine has a secondary cusp posteriorly. The first small premolar (pm²) is intruded in the toothrow; the crown area is equal to i², but not visible from without (Fig. 207). The upper canine and posterior premolar (pm⁴) are almost in contact. The upper molars are typical of *Pipistrellus*. The lower incisors are trifid and slightly overlapping.

The crown area of the second premolar (pm_4) slightly exceeds that of first (pm_2).

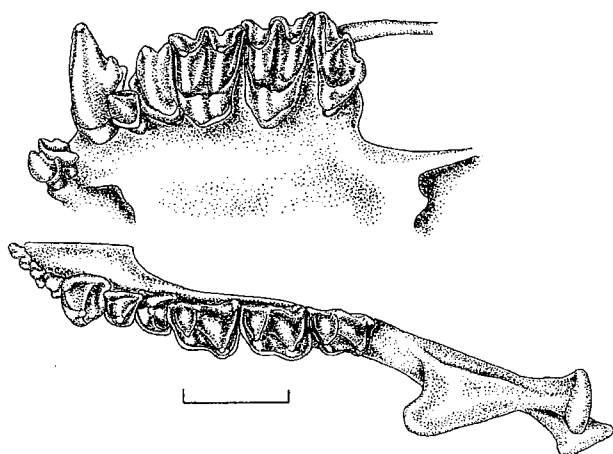


Fig. 207. Occlusal views of maxillary (above) and mandibular (below) dentition of *Pipistrellus ceylonicus*. IN55, Khirasara, Gujarat, India. Scale = 2 mm.

Karyology: $2N=36$, $FN=50$ based on specimens from Nagpur. In the chromosomal set, there are three pairs of metacentrics, four pairs of submetacentrics, one pair of subtelocentrics and 9 pairs of acrocentrics. The biarmed elements are the largest autosomes. The last pairs of autosomes are very small and nearly punctiform. The X chromosome is a medium sized metacentric, the Y chromosome a small acrocentric (Dulic, 1980).

Variation: According to Lal (1984), all specimens from India should be referred to *P. c. indicus* with the taxa *chrysothrix* and *subcanus* included as synonyms; there is considerable individual variation in pelage colour, with reddish, brown and grey individuals found in the same colony, (Brosset, 1962c). Specimens from Sri Lanka are referable to *P. c. ceylonicus*; Phillips (1980) suggests that older individuals assume a more reddish or golden hue.

Distribution: *Pipistrellus ceylonicus* ranges from Pakistan, India and Sri Lanka to Myanmar, China, Vietnam and northern Borneo.

In the Indian subcontinent (Fig. 208) localities include:

INDIA: **Rajasthan:** Mount Abu (Ryley, 1914a); **Gujarat:** Mheskatri (type loc. of *chrysothrix*); Yalala (type loc. of *subcanus*); Bhuj; Charwa (Wroughton, 1912bii); Junagadh; Keshod; Talala; Sasan; Rajkot (Ryley, 1913bi); Ahmedabad; Anand; Baroda (Brosset, 1962c); Broach; Rajpipla (Sinha, 1981a); Khirasara (HSM); Bulsar (BMNH); **Maharashtra:** Helwak (Wroughton, 1916aiii); Chikalda; Ajanta; Nasik; Junnar; Bombay; Poona; Satara (Brosset, 1962c); Panchgani (Tiwari *et al.*, 1971); Belgaum (Khajuria, 1953); Belgaon (Khajuria, 1967); Aurangabad; Nagpur (Sabnis, 1973); Nanded (Madhavan, 1971); Lonavla; Karla (Topal, 1974); Bandra; Thana; Lanje; Andheri (BMNH); **Goa:** Molem (HNHM); **Karnataka:** Mangalore (type

loc. of *indicus*); Gadag (Wroughton, 1912c); Sirsi; Honawar; Vijayanagar (Wroughton, 1913iii); Bangalore; Seringapatam; Sivasamudram (Ryley, 1913a); Mercara; Haleri; Wotekolli; Srimangala (Ryley, 1913bii); Dharwar; Bellary (Brosset, 1962c); Jellopur; Astoli (BMNH); **Kerala:** Wynaad (Blanford, 1888-91); Thrissur district (BMNH); **Tamil Nadu:** Nilgiri Hills (BMNH); **Andhra Pradesh:** Visakhapatnam (USNM); **Orissa:** Sundargarh; Sambalpur; Koraput (Das *et al.*, 1993); **Madhya Pradesh:** Mandu (Brosset, 1962c); **Bihar:** Luia (Wroughton, 1915cii); Chota Nagpur; Dhanbad (Sinha, 1986a); **West Bengal:** Calcutta (Lal & Biswas, 1985a).

PAKISTAN: Landhi (Wroughton, 1916ci); Malir (Walton, 1974); Karachi; Thatta; Lyallpur; Khanewal (Roberts, 1977).

BANGLADESH: no exact loc. (Khan, 1982).

SRI LANKA: **Central Province:** Dambulla; Dikoya; Nuwara Eliya; Kandy; Madulkele (Phillips, 1980); Rattota (USNM); **Eastern Province:** Trincomalee (type loc. of *ceylonicus*); **Western Province:** Kalutara (Phillips, 1980); **Uva:** Passara; Haputale; Ohiya; Horton Plains; Bandarawela; Namunukula (Phillips, 1980).

Northern MYANMAR: Pyaunggaung (Ryley, 1914bii).

Habits: This is an eclectic species which ranges from the tropical thorn forests of Pakistan to the highlands of central Sri Lanka, where it is known from altitudes of up to 2153 metres (7000 feet) (Phillips, 1980). It is very

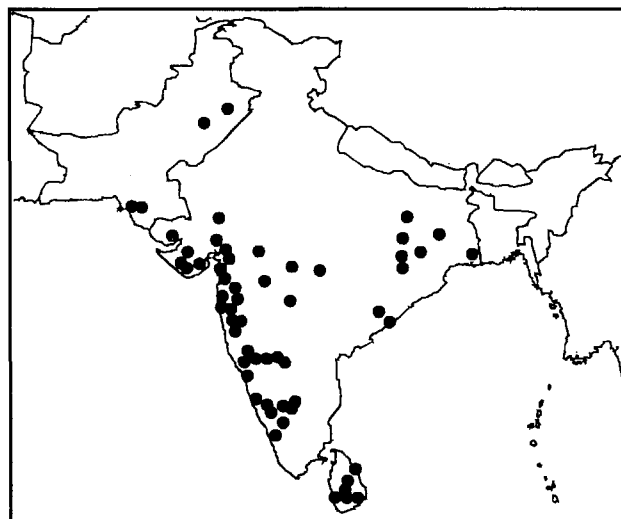


Fig. 208. Distribution of *Pipistrellus ceylonicus*.

common throughout much of its range and is frequently seen in towns and villages. It inhabits old houses and dilapidated buildings where it roosts between wooden rafters and inside cracks in walls and ceilings (Gopalakrishna & Madhavan, 1971). Other diurnal roosts include holes in trees, hollow branches (Phillips, 1980), caves, wells, temples and even a roller blind in an hotel (Brosset, 1962c). Colony size ranges from a single individual to a maximum of about 200 (Gopalakrishna & Madhavan, 1971). It does not hang suspended like the Rhinolophidae but rather clings to surfaces with its feet

and wing claws, while remaining in a head-downwards position (Phillips, 1980). When left on the ground it is unable to fly away, but walks in a cumbersome manner and may have considerable difficulty in becoming airborne. It is inactive during cold or wet seasons, when individuals become partially torpid (Madhavan, 1971).

Feeding: It appears early in the evening, almost as soon as the sun has set. It does not fly particularly fast or high but continually turns, twists and wheels in flight. As the evening progresses, it often ascends higher and flies rather straighter. It feeds on small beetles and other insects (Phillips, 1980).

Reproduction: In Maharashtra, copulation takes place during the first two weeks of June. The inseminated sperm remains alive inside the female genital tract until about the second week of July when ovulation and fertilisation take place, followed immediately by pregnancy (Gopalakrishna *et al.*, 1970). Gestation lasts about 50-55 days and deliveries take place during the first two weeks of September. Normally each female bears two young; in rare cases there is a single infant or triplets. New born infants weigh about 1.25 grams; they have adherent eyelids, are flesh-coloured and completely naked. The skin begins to darken within a few hours and the eyelids open after 72 hours. They are hairy on both the dorsal and ventral sides after 6-8 days (Gopalakrishna & Madhavan, 1971). The young are carried by the mother for 25-30 days and lactation is concluded by the third week of October. Madhavan (1971) suggests that once a suckling infant becomes detached, it is abandoned by its mother. However, Lal & Biswas (1985a) witnessed a mother recovering her infant from the ground by using her expanded wings. Females in an advanced state of pregnancy have been collected during the first week of September in Sri Lanka (Phillips, 1980).

Conservation status: Worldwide: extremely common throughout much of its range. Indian Subcontinent: a common species; endemic subspecies of perhaps rather dubious taxonomic significance include *P. c. ceylonicus* in Sri Lanka and *P. c. indicus* in the rest of the subcontinent.

Pipistrellus kuhlii (Kuhl, 1819)

Kuhl's Pipistrelle

Vespertilio kuhlii Kuhl, 1819: 199; Trieste, Italy.

Pipistrellus lepidus Blyth, 1845: 340; Kandahar, Afghanistan.

Vespertilio (Pipistrellus) leucotis Dobson, 1872: 222:

Rajanpur, Punjab, NW India.

External characters: This is a medium-sized pipistrelle with an average forearm length of 34.7 mm (33.4-36.0 mm). The tail is relatively long subequal in length to the head and body; only its extreme tip projects from the membrane. The ears are tall, narrowed at the tips and

with the anterior border almost straight above the well marked basal lobe. The tragus is tall and narrow (Fig. 211), about half the height of each ear. The pelage is fine and dense; it is a uniform buffy brown on the head and back, with contrasting darker hair bases. The ventral surface is paler, with grey tips to the hairs and dark bases. The ears and membranes are rather pallid and translucent; there is a distinct white border between the foot and the fifth digit of each wing. Parts of the membranes surrounding the bases of metacarpals 2, 3, 4 and 5 are also depigmented. The baculum has a narrow cylindrical shaft and a narrow tip; the basal lobes are strongly deflected ventrally (Fig. 205).

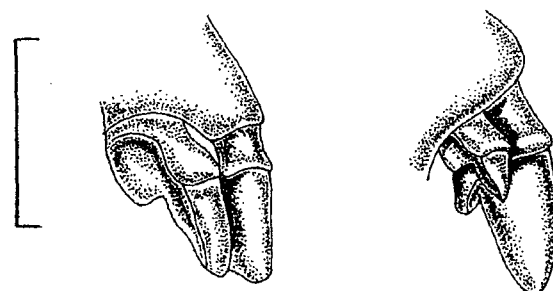


Fig. 209. Right upper incisors (i^2 and i^3) of two species of *Pipistrellus*. Left: *P. ceylonicus*, HZM.1.25667, Khirasara, India. Right: *P. kuhlii*, HZM.69.1985, Iraq. Scale = 2 mm.

Cranial characters: The skull is larger and more robust than that of *P. pipistrellus* with an average condylo-canine length of 12.4 mm (12.0-12.9 mm). The rostrum is long and only moderately broad; with the upper surface slightly flattened medially. The postorbital constriction is not greatly developed. The dorsal profile is almost straight from the lambda to the nares, although it is slightly raised over the frontal region and slightly depressed over the orbits. The lambdoid crests are strongly developed in adults; they almost extend to the lambda which forms a small flat triangular area. The supraoccipital is convex and forms the most posterior part of the skull. The palatal length exceeds its breadth. The basisphenoid pits are shallow. The mandible is robust with well developed coronoid processes.

Dentition: Upper toothrow length ($c-m^3$) averages 4.9 mm (4.6-5.0 mm). The upper incisors are characteristic (Fig. 209); the first (i^2) is tall and conical; its secondary cusp generally absent or reduced; the second (i^3) is minute and barely exceeds the height of the cingulum of i^2 ; it is separated from the upper canine by a short diastema. The upper canine is robust, its posterior cutting edge with only a very faint indication of a secondary cusp. The small first upper premolar (pm^2) is minute, with a crown area about half that of i^2 ; it is displaced inwards from the toothrow, so that the canine and the second premolar (pm^4) are in contact; only the tip of the conical cusp of the pm^2 is visible from without. The first lower premolar (pm_2) is half the height and about half the crown area of the second (pm_4).

Variation: Following Gaisler (1970a), specimens from

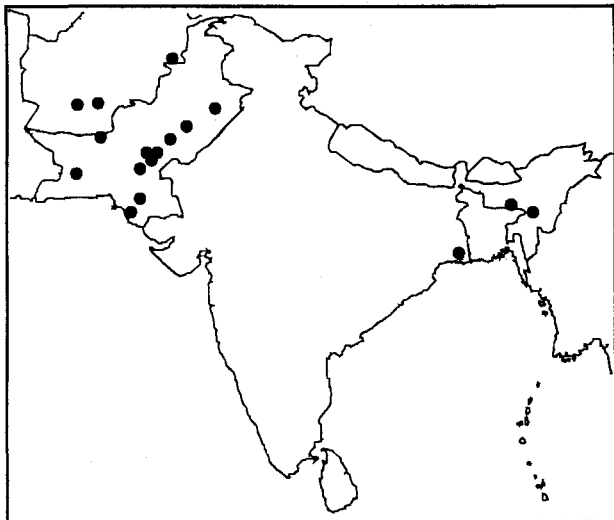


Fig. 210. Distribution of *Pipistrellus kuhlii*.

the Indian subcontinent are referred to *P. kuhlii lepidus*.

Distribution: *Pipistrellus kuhlii* ranges from southern Europe to India; also most of Africa, from Morocco to Egypt and south to South Africa.

In the Indian subcontinent (Fig. 210) localities include: **INDIA: West Bengal:** Calcutta (USNM); **Assam:** Cachar District (Kurup, 1968); **Meghalaya:** Cherrapunji (Kurup, 1968).

PAKISTAN: Punjab: Rajanpur (type loc. of *leucotis*); Muzaffargarh (USNM); Lyallpur; (Roberts, 1977); Multan (BMNH); **Baluchistan:** Panjgur; Darzi Chach (Roberts, 1977); **Sind:** Gambat; Kashmor; Chak; Mirpur; Sukkur (Wroughton, 1916ci); Hyderabad; Mirpur Sakro; Pithoro (Roberts, 1977).

AFGHANISTAN: Kandahar (type loc. of *lepidus*);

Jalalabad (Gaisler, 1970a); Qala Bist (FMNH).

Habits: Little is known of this species in the Indian subcontinent. Specimens from Darzi Chach in Baluchistan were collected from a roost in the thatched roof of a school house (BMNH). According to Roberts (1977), it is more widespread than *P. tenuis mimus* and *P. ceylonicus* in the Indus plain, being better adapted to open desert areas and not so dependent on trees. In Afghanistan, it was collected at altitudes ranging from 615 metre (2000 feet) to 769 metres (2500 feet) in and around Jalalabad (FMNH).

Reproduction: Females have two young (Blanford, 1888-91). A juvenile was collected at Nag in Baluchistan on 19 June (BMNH).

Conservation status: Worldwide: it is a geographically widespread and abundant species. Indian Subcontinent: it has a restricted range and is not common, except in the Indus valley (Roberts, 1977); there are no endemic subspecies.

Pipistrellus savii (Bonaparte, 1837)

Savi's Pipistrelle

Vespertilio savii Bonaparte, 1837: fasc. 20; Pisa, Italy.

?*Pipistrellus austenianus* Dobson, 1871a: 213;

Cherrapunji, Khasi Hills, India.

External characters: This is a medium-sized pipistrelle with an average forearm length of 34.1 mm (32.1-38.0 mm) based on extralimital specimens. The tail is significantly shorter than the head and body. The muzzle is blackish and nearly naked. The ears are relatively large and with broadly rounded tips. Each ear has a broad tragus (Fig. 211). The pelage is noticeably long, about 7-8 mm in the mid-dorsal region, a little shorter on the ventral surface; it has a silky texture and a marked gloss. The bases of the hairs are dark brown for two-thirds their length, above and below; the tips on the back are chestnut brown; on the belly they are grey. There is an indistinct line of demarcation between the two surfaces along the neck. The ears, naked areas of the face and membranes are dark brown, almost black. The interfemoral membrane is essentially naked, except for a few hairs adjacent to the tail and body. The baculum is short and stout; its tip is blunt, expanded and broader than the base, which is feebly bilobate (Fig. 205).

Cranial characters: The skull averages larger than that of *P. kuhlii* with a condylo-canine length of 12.8 mm (12.4-13.3 mm) based on extralimital specimens. In contrast to *P. kuhlii*, the braincase is low and flat; it is elongated rather than globose. The rostrum is long, with a shallow median linear depression and lateral depressions anterior to the orbits; the postorbital constriction is not greatly developed. The dorsal profile is straight or nearly so; the frontal region may form a

Table 96. *Pipistrellus kuhlii*. Specimens from Pakistan.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	44.1	35.0 - 49.0	3.5	11
T:	41.1	33.0 - 45.0	3.0	11
HF:	6.5	6.0 - 8.0	0.7	11
FA:	34.7	33.4 - 36.0	0.8	11
5mt:	32.1	30.7 - 33.6	0.9	11
4mt:	33.1	31.6 - 34.3	1.0	11
3mt:	33.4	31.8 - 34.6	1.0	11
E:	12.1	10.0 - 13.0	0.8	11
GTL:	13.4	12.9 - 13.9	0.3	15
CCL:	12.4	12.0 - 12.9	0.3	15
ZB:	8.5	8.4 - 8.7	0.2	2
BB:	6.6	6.4 - 6.8	0.1	15
PC:	3.4	3.2 - 3.7	0.1	15
C-M ³ :	4.9	4.6 - 5.0	0.1	14
C-M ₃ :	5.2	5.0 - 5.5	0.2	12
M:	9.7	9.3 - 10.4	0.3	15
M ³ -M ₃ :	5.6	5.5 - 5.9	0.1	14
RW:	4.9	4.7 - 5.1	0.1	15

slight convexity. The zygomata are relatively robust but are without processes on the jugal bones. The palate is concave and parallel sided; its length exceeds its width. The basisphenoid pits are scarcely developed. The mandible is unremarkable.

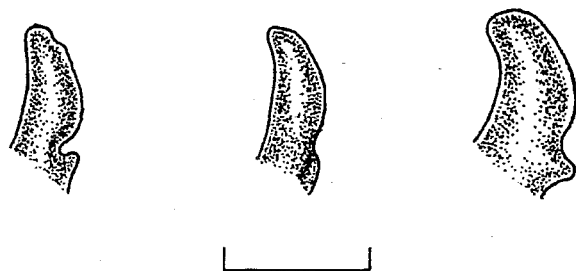


Fig. 211. Left tragus of three species of *Pipistrellus*. Left: *P. pipistrellus*, BM.61.414, Lebanon. Centre: *P. kuhlii*, HZM.100.3009, Israel. Right: *P. savii*, BM.61.393, Lebanon. Scale = 2 mm.

Dentition: Upper toothrow length (c-m³) averages 4.8 mm (4.6-5.1 mm). The first upper incisor (i²) is short, broad and usually bicuspidate, with the posterior cusp about three-quarters the height of the principal one (Fig. 212). The second incisor (i³) is equal to, or exceeds, i² in crown area, it has a strong central cusp and smaller lateral ones; it almost attains the height of the secondary cusp of i². There is a well developed diastema between i³ and the upper canine, which has a broad base and is apparently unicuspid. The first upper premolar (pm²) is frequently absent, when present it is minute, about one eighth the size of i² and is situated in the angle between the canine and the large second premolar (pm⁴); these latter two teeth are usually in contact. The first lower premolar (pm₂) is reduced, about half or less the crown area of the second (pm₄) and about two-thirds its height.

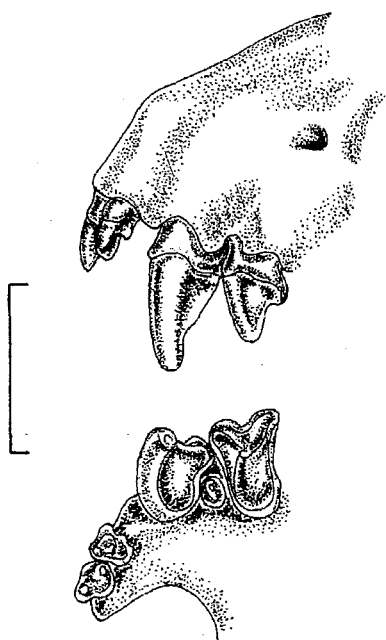


Fig. 212. Lateral (above) and occlusal (below) views of left anterior maxillary dentition (i²-pm⁴) of *Pipistrellus savii*. HZM.2.1007, Italy. Scale = 2 mm.

Variation: Specimens from India and Myanmar are provisionally referred to *P. savii austenianus* (Corbet & Hill, 1992).

Distribution: *Pipistrellus savii* ranges from Iberia to Korea, Japan, Arabia, Iran, Afghanistan, India and Myanmar. It is also present in North Africa.

In the Indian subcontinent (Fig. 213) localities include: **INDIA: Meghalaya:** Cherrapunji (type loc. of *austenianus*).

Northern MYANMAR: Maymyo (Ryley, 1914bii).

AFGHANISTAN: Bamiyan; Maimana; Kamdesh (FMNH).

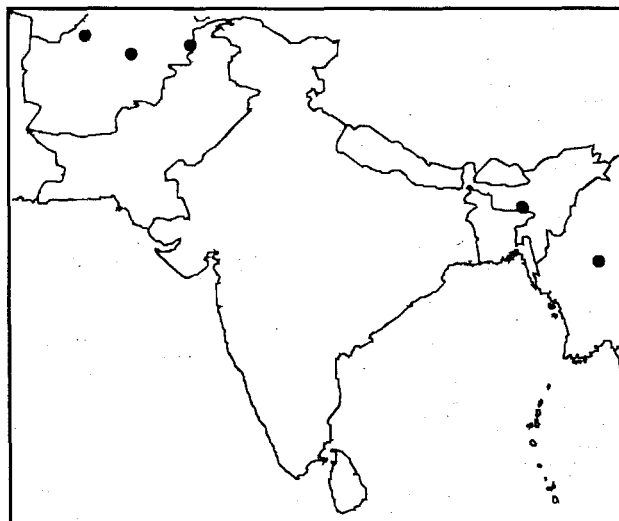


Fig. 213. Distribution of *Pipistrellus savii*.

Habits: Little is known of this species. The specimen from Myanmar was collected at an altitude of 1077 metres (3500 feet) at Maymyo. This is a hill station occupying "an undulating plateau surrounded by hills covered in thin forest" (Ryley, 1914bii). In Afghanistan, it was collected at altitudes ranging from 403 metres (1311 feet) to 2585 metres (8400 feet) (FMNH). Specimens from Iran were collected in a mountain valley near a village; they were mistnetted over a stream and in the entrance to a cave (DeBlase, 1980).

Conservation status: Worldwide: this is a widespread but little studied species. Indian Subcontinent: the endemic subspecies (*austenianus*) has a restricted range.

Pipistrellus cadornae Thomas, 1916

Thomas's Pipistrelle

Pipistrellus cadornae Thomas, 1916a: 416; Pashok, 3500ft, Darjeeling, north-eastern India.

External characters: This is a medium-sized species with an average forearm length of 35.1 mm (32.6-36.5 mm). The pelage is soft, dense and relatively long. It is a uniform dark brown on the dorsal surface, with the hair roots slightly darker than the tips; the ventral surface is a

paler chestnut brown, with the hair roots dark brown/black. The membranes and ears are a uniform dark brown and essentially naked.

Cranial characters: The skull, with an average condylo-canine length of 12.7 mm (12.6-12.8 mm) appears relatively elongated. The rostrum is short in comparison to that of *P. savii*; it is not especially broadened and not greatly angulated inwards posteriorly; the nasal notch is large and rounded. The braincase is narrow and rounded, not flattened as in *P. savii*. The cranial profile is almost completely straight from the nares to the lambda, without a frontal depression between the braincase and the rostrum. The palate is short and the basisphenoid pits are large and deep.

Dentition: Upper toothrow length (c-m³) averages 4.7 mm (4.6-4.9 mm). The first upper incisor (i²) is short and broad and has a distinct secondary cusp; the second incisor (i³) almost attains the height of i²; in some specimens, it is separated from the canine by a short diastema. The upper canine is without a secondary cusp. The first upper premolar (pm²) is minute, about one third of the crown area of i²; it is situated in the recess formed by the upper canine and second upper premolar (pm⁴) which are in contact, or nearly so. The first lower premolar (pm₂) is situated in the toothrow; it is two-thirds the crown area and half the height of the second (pm₄).

Variation: The taxon *cadornae* was listed as a provisional subspecies of *P. savii* by Ellerman & Morrison-Scott (1951) but following Hill (1962) was subsequently treated as a discrete species. All specimens

are referred to the nominate subspecies *P. cadornae cadornae*.

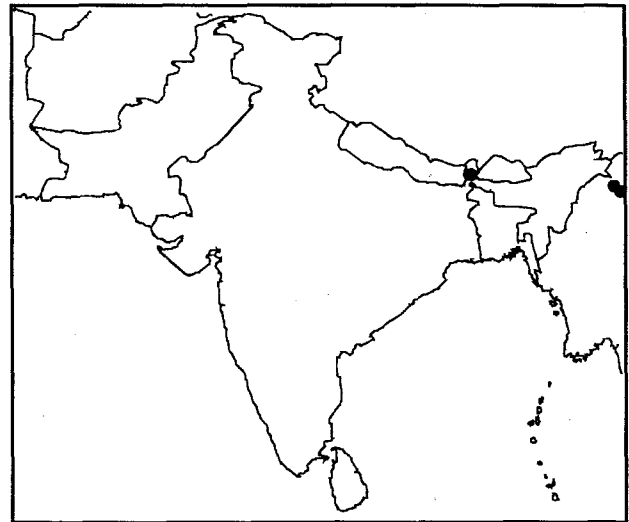


Fig. 214. Distribution of *Pipistrellus cadornae*.

Distribution: *Pipistrellus cadornae* ranges from north-east India to Thailand.

In the Indian subcontinent (Fig. 214) localities include: **INDIA: West Bengal:** Pashok (type loc. of *cadornae*). **Northern MYANMAR:** Htingnan; Tasa Hku (Hill, 1962); Ningma (BMNH).

Habits: Very little is known of this species. The type locality is Pashok which is situated some 27 km (17 miles) east-north-east of Darjeeling on a spur of the outer Himalayas. According to Wroughton (1916ciii), it was a forested region with magnolia, oak, walnut, chestnut, figs, bombax and sal and was one of the driest areas in

Table 97. *Pipistrellus savii*: based on extralimital specimens.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	52.0	47.0 - 60.0	5.4	5
T:	33.0	30.0 - 35.0	2.1	5
HF:	7.1	6.4 - 8.0	0.7	4
FA:	34.1	32.1 - 38.0	2.4	5
WSP:	235.7	226.0 - 251.0	13.4	3
5mt:	30.5	29.1 - 31.3	0.9	5
4mt:	31.5	30.2 - 34.0	1.6	5
3mt:	31.9	30.4 - 33.2	1.2	5
E:	12.1	10.0 - 14.0	1.5	5
GTL:	14.0	13.6 - 14.4	0.4	4
CCL:	12.8	12.4 - 13.3	0.4	5
ZB:	8.7	8.5 - 9.1	0.3	4
BB:	6.7	6.6 - 6.8	0.1	4
PC:	3.6	3.5 - 3.7	0.1	4
C-M ³ :	4.8	4.6 - 5.1	0.2	5
C-M ₃ :	5.1	4.9 - 5.2	0.1	4
M:	9.8	9.6 - 10.3	0.3	4
M ³ -M ³ :	6.1	5.9 - 6.2	0.1	4
RW:	5.4	5.2 - 5.7	0.2	4

Table 98. *Pipistrellus cadornae*: Specimens from India and Myanmar.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	49.3	47.0 - 52.5	2.1	5
T:	39.7	34.0 - 49.0	5.6	5
HF:	6.9	6.5 - 7.0	0.2	5
FA:	35.1	32.6 - 36.5	1.6	5
5mt:	32.3	30.2 - 34.4	1.5	5
4mt:	33.5	31.2 - 35.7	1.6	5
3mt:	34.2	32.5 - 36.0	1.3	5
E:	14.5	14.0 - 15.0	0.5	5
GTL:	13.8	13.6 - 14.0	0.2	3
CCL:	12.7	12.6 - 12.8	0.1	5
BB:	7.1	6.7 - 7.5	0.3	5
PC:	3.7	3.5 - 3.9	0.1	5
C-M ³ :	4.7	4.6 - 4.9	0.1	5
C-M ₃ :	5.0	4.8 - 5.1	0.1	4
M:	9.9	9.5 - 10.3	0.3	5
M ³ -M ³ :	5.9	5.8 - 6.0	0.1	5
RW:	5.1	4.9 - 5.4	0.2	5

Table 99. *Pipistrellus affinis*: Specimens from India and Sri Lanka.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	48.0	43.0 - 51.0	4.4	3
T:	36.3	30.0 - 41.0	4.2	5
HF:	7.3	7.0 - 8.0	0.4	6
FA:	40.2	38.4 - 41.4	1.0	7
WSP:	244.0	244.0 - 244.0	-	1
5mt:	35.5	33.7 - 36.9	1.0	7
4mt:	37.5	35.4 - 39.0	1.1	7
3mt:	37.9	36.2 - 39.1	0.9	7
E:	13.7	12.0 - 15.0	1.5	3
GTL:	15.3	15.0 - 15.7	0.3	4
CCL:	14.1	13.7 - 14.5	0.4	3
ZB:	9.1	9.1 - 9.1	-	1
BB:	7.1	6.9 - 7.2	0.2	3
PC:	3.7	3.5 - 3.9	0.2	4
C-M ³ :	5.5	5.5 - 5.7	0.1	5
C-M ₃ :	5.7	5.6 - 5.8	0.1	4
M:	10.9	10.5 - 11.4	0.4	4
M ³ -M ₃ :	6.2	6.0 - 6.5	0.2	5
RW:	5.6	5.5 - 5.8	0.1	5

Darjeeling District with an average rainfall of 1683 mm (66 inches). In Myanmar, it was collected at 708 metres (2300 feet) at Tasa Hku where it was caught in a banana tree in jungle; it was also found at 923 metres (3000 feet) at Htingnan in dry bamboo in "medium forest" (BMNH).

Conservation status: Worldwide: this species is apparently uncommon throughout its range and is included on List 3 "Lower risk: near threatened" in the 1996 IUCN Red List of Threatened Animals (Baillie & Groombridge, 1996). Indian subcontinent: nothing is known of its population status.

Pipistrellus affinis (Dobson, 1871)

Chocolate Pipistrelle

Vesperugo (Pipistrellus) affinis Dobson, 1871a: 213; Bhamo, north-eastern Myanmar.

External characters: This is a large species of Pipistrelle with an average forearm length of 40.2 mm (38.4-41.4 mm). The pelage is soft, dense and relatively long. It is essentially dark brown above, although the extreme tips of some of the hairs are pale grey, giving a slightly grizzled effect. The ventral surface is also dark, only slightly paler than the back. The membranes, ears and naked parts of the face are a uniform blackish/brown. The baculum is broad, proximally widened and ventrally deeply fluted, with no distal expansion (Fig. 205).

Cranial characters: The skull, with an average condylo-canine length of 14.1 mm (13.7-14.5 mm), exceeds that of *P. cadornae* in size. The rostrum is robust and

elongated, it has distinct supraorbital ridges but is not greatly angulated inwards posteriorly; it has a median and lateral depressions. The braincase appears relatively small in comparison to the rostrum. Apart from a slight depression above the orbits, the dorsal profile is essentially straight from the nares to the lambda. The zygomata are very delicate but with distinct processes on the jugal bones. The basisphenoid pits are virtually absent. The coronoid process of each half mandible is robust; it exceeds the lower canine in height.

Dentition: Upper toothrow length (c-m³) averages 5.5 mm (5.5-5.7 mm). The first upper incisor (i²) is short and broad; the secondary cusp is three-quarters the height of the primary one. The second incisor (i³) is well developed, equal in height to the secondary cusp of i² and with a distinct accessory cusp internally; it is usually situated closely adjacent to the upper canine which is unicuspid and broad basally. The first upper premolar (pm²) is of moderate size, subequal to i² in crown area and slightly displaced internally. The upper canine and the second premolar (pm⁴) are not in contact. The first lower premolar (pm₂) is situated in the toothrow and is about two-thirds the crown area and height of the second (pm₄).

Variation: Specimens from Sri Lanka were referred to *P. mordax* by Phillips (1980) but following Corbet & Hill (1992) are here included in *P. affinis*. However, Corbet & Hill (1992) suggest that *affinis* and *mordax* may prove to be conspecific. In this case, all specimens from the Indian Subcontinent would be included in *mordax* as this is the prior name.

Distribution: *Pipistrellus affinis* extends from Sri Lanka to India, Nepal, Tibet and Myanmar.

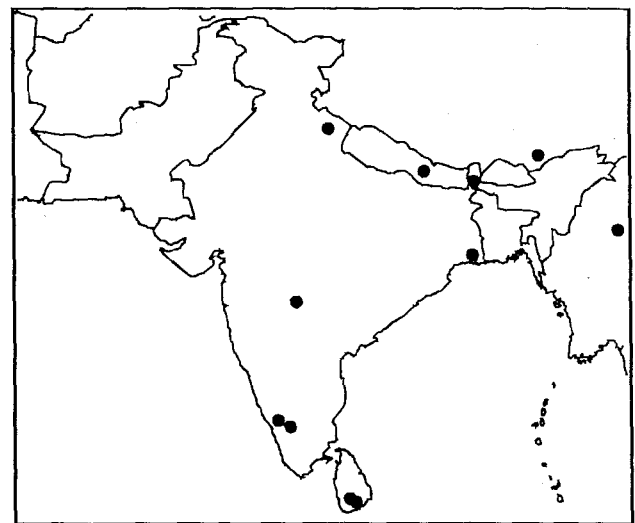


Fig. 215. Distribution of *Pipistrellus affinis*.

In the Indian subcontinent (Fig. 215) localities include: **INDIA:** Uttar Pradesh: Kumaon (BMNH); Maharashtra: Nanded (Pathak & Sharma, 1969); Kerala: Wynaad (BMNH); Tamil Nadu: Kotagiri (BMNH); West Bengal: Gopaldhara (BMNH);

Table 100. *Pipistrellus circumdatus*: Specimens from India and Java.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	95.0	95.0 - 95.0	-	1
T:	40.0	40.0 - 40.0	-	1
HF:	10.0	10.0 - 10.0	-	1
FA:	42.4	41.8 - 43.6	1.0	3
5mt:	36.5	35.8 - 37.2	0.7	3
4mt:	37.9	37.5 - 40.1	0.8	3
3mt:	39.2	38.7 - 40.1	0.8	3
E:	15.0	15.0 - 15.0	-	1
GTL:	16.8	16.8 - 16.8	-	1
CCL:	15.1	14.6 - 15.6	-	2
ZB:	11.7	11.7 - 11.7	-	1
BB:	8.2	8.1 - 8.3	-	2
PC:	4.3	4.3 - 4.4	0.1	3
C-M ³ :	6.3	6.0 - 6.5	0.3	3
C-M ₃ :	6.6	6.4 - 6.8	0.2	3
M:	12.3	11.8 - 12.7	0.5	3
M ³ -M ₃ :	7.6	7.5 - 7.8	0.2	3
RW:	7.1	7.0 - 7.3	0.2	3

Kurseong; Calcutta (Phillips, 1980).

NEPAL: Najarkot (BMNH).

SRI LANKA: Uva Province: Haputale (west) (BMNH); Nuwara Eliya (Phillips, 1980).

Northern MYANMAR: Bhamo (type loc. of *affinis*).

TIBET: no exact loc (Feng Zoujian *et al.*, 1980).

Habits: In Sri Lanka, it appears to spend its days in the roofs of buildings or in cracks and small holes in tree-trunks, emerging at dusk to feed on small flying insects which it captures around human habitations and clearings. It generally flies within 6.2 metres (20 feet) of the ground (Phillips, 1980). It was collected at an altitude of 1846 metres (6000 feet) in the Central Highlands of Sri Lanka (BMNH); at 2000 metres (6500 feet) in Nepal (BMNH) and at 1452 metres (4720 feet) in Darjeeling District, West Bengal (BMNH).

Conservation status: Little is known of this species. It appears that it may be locally common throughout at least part of its range, for example in the Central Highlands of Sri Lanka. There are no endemic subspecies.

Pipistrellus circumdatus (Temminck, 1840)

Black gilded Pipistrelle

Vespertilio circumdatus Temminck, 1840: 214; Tapos, Java.

External characters: This is a large species of *Pipistrellus* with an average forearm length of 42.4 mm (41.8-43.6 mm). The pelage is characteristic. The hairs are soft and long. On the dorsal surface, they are essentially black, however some of the hairs have

distinctive ferruginous tips, giving an almost orange sheen to the head and back. The ventral surface is a uniform brown, paler than the back; the hair roots are slightly darker than the tips. The ears are dark brown/black with pale anterior and posterior margins in some specimens; the tragus of each ear is broad and also has pale margins. The membranes are a uniform dark brown and essentially naked. The baculum is very small, Y-shaped with paired basal lobes and a short shaft (Fig. 205).

Cranial characters: The skull is large with an average condylo-canine length of 15.1 mm (14.6-15.6 mm). The rostrum is very broad and relatively short; it is sharply angulated inwards posterior to the lachrymal projections. Distinct supraorbital and postorbital ridges are present. The braincase is large, with a slight indication of a sagittal and lambdoid crests. In dorsal profile, there is a concavity in the supraorbital region and the lambda is slightly inferior to the most elevated part of the skull. The zygomata are broad, especially posteriorly. Palatal length exceeds the breadth. The basisphenoid pits are well developed.

Dentition: Upper toothrow length (c-m³) averages 6.3 mm (6.0-6.5 mm). The first upper incisor (i²) is robust and bicuspidate; the second incisor (i³) is small, scarcely projecting beyond the cingulum of i². The upper canine is robust and is without a secondary cusp; it is closely adjacent to i³ and is in contact, or nearly so, with the second upper premolar (pm⁴). The first upper premolar (pm²) is minute, one eighth to one quarter the crown area and height of i²; it is displaced internally and is situated in the angle between the canine and pm⁴. The

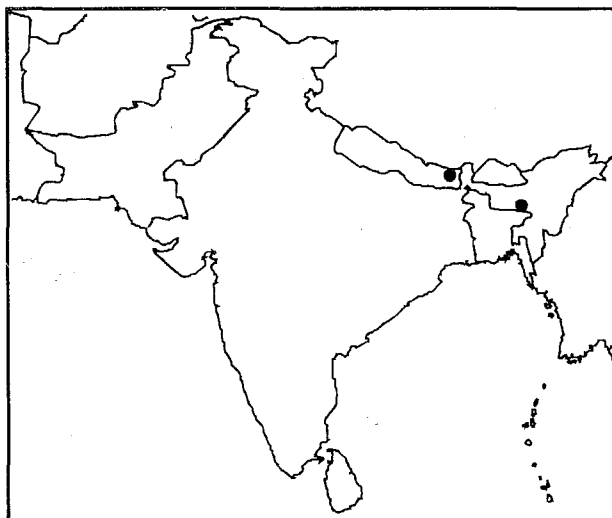


Fig. 216. Distribution of *Pipistrellus circumdatus*.

first lower premolar (pm₂) is situated in the toothrow and is one third the crown area of the second lower premolar (pm₄).

Variation: Specimens from India and Nepal are provisionally referred to *P. c. circumdatus*.

Table 101. *Pipistrellus dormeri*: Specimens from India.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	48.9	39.0 - 55.0	3.6	25
T:	35.3	27.0 - 41.0	3.8	25
HF:	6.2	5.0 - 8.0	1.1	15
FA:	34.4	32.7 - 36.3	0.9	25
WSP:	243.7	238.0 - 257.0	7.9	5
5mt:	32.6	31.2 - 35.0	1.1	25
4mt:	33.3	31.6 - 36.4	1.2	25
3mt:	33.7	31.7 - 36.5	1.3	25
E:	11.9	10.0 - 18.0	1.6	25
GTL:	14.3	13.7 - 15.0	0.3	29
CCL:	13.3	12.8 - 13.6	0.2	29
ZB:	10.0	9.6 - 10.5	0.3	13
BB:	7.1	6.8 - 7.5	0.2	29
PC:	3.9	3.6 - 4.2	0.2	29
C-M ³ :	5.4	5.2 - 5.6	0.1	29
C-M ₃ :	5.8	5.5 - 6.1	0.1	29
M:	10.8	10.4 - 11.2	0.3	29
M ³ -M ₃ :	6.7	6.3 - 7.0	0.2	29
RW:	6.0	5.6 - 6.4	0.2	29

Distribution: *Pipistrellus circumdatus* ranges through Java to Myanmar, India and south-west China.

In the Indian subcontinent (Fig. 216) localities include:

INDIA: Meghalaya: Shillong (Das *et al.*, 1995).

NEPAL: Num (FMNH).

Habits: It was collected at an altitude of 2031 metres (6600 feet) in Suki Patyl Forest, near Num in Nepal on 31 May, 1973 (FMNH).

Conservation status: Little is known of this species. It is apparently uncommon throughout its extensive geographical range; there are no endemic subspecies.

Pipistrellus dormeri (Dobson, 1875)

Dormer's bat

Scotozous dormeri Dobson, 1875: 373; Bellary Hills, India.

Scotozous dormeri caurinus Thomas, 1915b: 33; Junagadh, Kathiawar, 400ft, India.

External characters: This is a medium-sized pipistrelle with an average forearm length of 34.4 mm (32.7-36.3 mm). The tail is considerably shorter than the head and body. The pelage on the dorsal surface is grey-brown, with some of the hair tips almost silver in colour whilst the roots are dark brown/black; overall there is a slight glossy sheen. The ventral surface is contrastingly paler, with all the hair tips white or pale buffy white and the roots very dark. The ears, naked areas of the face and membranes are a uniform mid-brown; in some specimens the veins in the interfemoral membrane are

conspicuously marked in white. The wings and interfemoral membrane are essentially without hairs. The penis is large. The body weight of adult males ranges from 6.0-7.0 grams (Madhavan, 1978). The baculum has a long narrow, slightly sinuous shaft and a broadened, weakly bifid tip; the base is slightly broadened and bifid (Fig. 205).

Cranial characters: The skull (Fig. 217), with an average condylo-canine length of 13.3 mm (12.8-13.6 mm) is robust. The rostrum is broad and has abruptly incurving lateral margins, posterior to the lachrymal processes. There are slight linear depressions in the mid-line of the rostrum and laterally above the orbits. The zygomata are broad anteriorly; consequently they are essentially parallel sided rather than convergent anteriorly. The braincase is not greatly inflated; it is relatively small in comparison to the robust rostrum. The dorsal profile is almost straight from the nares to the lambda with only a very slight depression above the orbits. The lambda forms the most elevated part of the skull. The palate is concave and essentially parallel-sided. The basisphenoid pits are very shallow. The mandible is illustrated in Fig. 217.

Dentition: Upper toothrow length (c-m³) averages 5.4 mm (5.2-5.6 mm). The first upper incisor (i²) is usually without a secondary cusp but has a distinct posterior cingular cusp. The second upper incisor (i³) is absent or when present minute, barely attaining the cingulum of the first upper incisor (Fig. 218). i³ is situated closely adjacent to or sometimes in contact with, the upper canine. The upper canine is without a secondary cusp but has anterior and posterior cingular cusps. The first upper premolar (pm²) intruded from the toothrow, its crown area is two-thirds that of i² (Fig. 219). The canine and the second premolar (pm⁴) are closely adjacent but not in contact. The first lower premolar (pm₂) is slightly extruded from the toothrow; it is about two-thirds to three-quarters the crown area of the second lower premolar (pm₄).

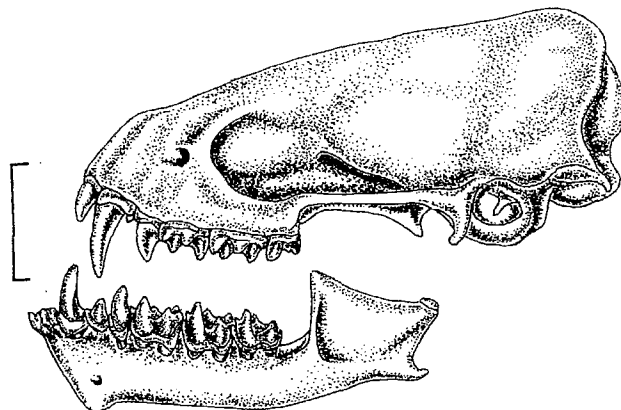


Fig. 217. Skull of *Pipistrellus dormeri*. HZM.4.7316, Khamaria, India. Scale = 3 mm.

Variation: Thomas (1915b) recognised *P. d. caurinus* from Gujarat as distinct from *P. d. dormeri* from

Karnataka on account of the colour of the fur (hoary grey versus brown), larger skull and longer toothrow. However, an analysis of measurements of this bat from throughout India shows that there is no significant regional difference in the length of the forearm, skull or toothrow. The pelage colour is individually variable (Agrawal, 1973). Therefore all specimens are here referred to the nominate race *P. d. dormeri*.

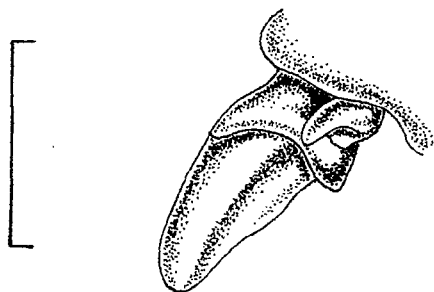


Fig. 218. Left upper incisors (i^2 and i^3) of *Pipistrellus dormeri* HZM.1.6356. India. Scale = 1 mm. (NB: i^3 is absent in many specimens).

Distribution: *Pipistrellus dormeri* is confined to India and Pakistan.

In the Indian subcontinent (Fig. 220) localities include: **INDIA: Punjab:** Nabha (Santosh & Gupta, 1984a); Ferozepore; Moga (Gupta & Metha, 1972); **Haryana:** near Chandigarh; Ambala (Santosh & Gupta, 1984b); **Jammu & Kashmir:** Jhajjar Kotli (Chakraborty, 1983);

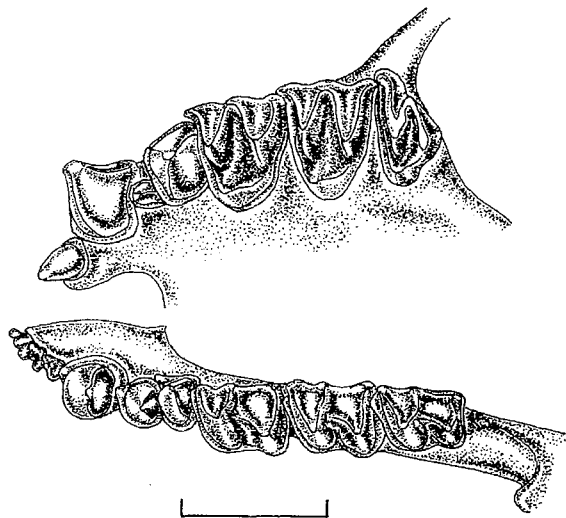


Fig. 219. Occlusal views of maxillary (above) and mandibular (below) dentition of *Pipistrellus dormeri*. HZM.4.7316, Khamaria, India. Scale = 2 mm.

Rajasthan: Dungarpur; Banswara; Jhalawar; Bundi; Tonk; Ajmer; Sawai Madhopur; Jodhpur; Kota (Advani, 1981c); Alwar; Bharatpur (Advani, 1982b); **Gujarat:** Junagadh (type loc. of *caurinus*); Mandvi; Patal; Usked (BMNH); Bhuj (Wroughton, 1912bii); Keshod; Sasan (Ryley, 1913bi); Palanpur; Lunwa (Ryley, 1914a); Vedtia; Anand (Brosset, 1962c); Fata Talab; Rajpipla; Sukal Tirath; Bansda; Bulsar; Silvassa (Sinha, 1981a);

Maharashtra: Chanda (Blanford, 1888-91); Bassina Taluka (BMNH); Ajanta (Wroughton, 1912a); Chikalda (Wroughton, 1912bi); Bombay (Brosset, 1962c); Nanded (Madhavan, 1978); **Goa:** Margao (Agrawal, 1973); **Karnataka:** Bellary Hills (type loc. of *dormeri*); Hawsbhavi (Wroughton, 1912c); Vijayanagar (Wroughton, 1913iii); Dharwar (Brosset, 1962c); **Kerala:** Venginessery (BMNH); **Tamil Nadu:** Salem (HZM); **Andhra Pradesh:** Balapalli (BMNH); **Orissa:** Sundargarh; Sambalpur; Bolangir; Ganjam (Das *et al.*, 1993); **Madhya Pradesh:** Sohagpur; Mundra; Bhopal (BMNH); Hoshangabad (Brosset, 1962c); Jabalpur (Topal, 1974); **Uttar Pradesh:** Khamaria (HZM); **Bihar:** districts of Bhojpur; Gaya; Giridih; Hazaribagh; Muzaffarpur; Patna; Rohtas; Samastipur; Santal Pargana; Singhbhum; Siwan; Vaishali; Champaran (Sinha, 1986a); **West Bengal:** districts of Bardhaman; Birhum; Calcutta; Hugli; Jalpaiguri; Maldah; Medinipur; North 24-Parganas (Agrawal *et al.*, 1992).

PAKISTAN: Punjab: Sialkot (USNM); **Sind:** Shikarpur (Sinha, 1980).

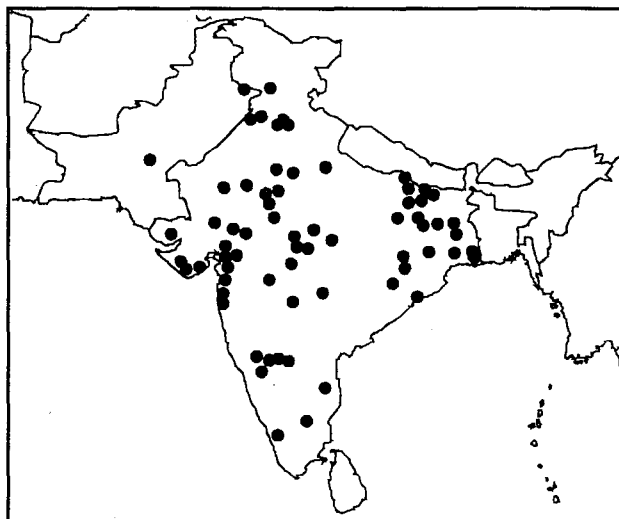


Fig. 220. Distribution of *Pipistrellus dormeri*.

Habits: It is often found in the close vicinity or in the midst of human habitation and occurs even in the most remote villages. It is a gregarious species. Its roosting sites include holes and crevices inside monuments, old temples, tombs, deserted buildings, under roof tiles (Advani, 1981c) and holes in large banyan trees (*Ficus bengalensis*) (Sinha, 1981a). Colony size varies from two to twenty-four (Sinha, 1981a) and includes both sexes (Madhavan, 1978). Occasionally solitary individuals are located (Agrawal, 1973).

Feeding: *Pipistrellus dormeri* flies with rapid wing beats usually interspersed with steady glides. It is however not very fast. It hunts relatively close to its roost and is known to drink from ponds and lakes. Its emergence time varies seasonally, although it is generally about 7.00 pm in Rajasthan and is active until dawn (Advani, 1981c). An analysis of its feeding habits in Rajasthan suggests that there is seasonal variation in the

composition of the diet. In winter (December-February), it mainly feeds on beetles (40% of intake), also moths, grasshoppers, crickets and Neuroptera (at about 10-17%). In the summer season (March-June), winged termites (24.4%) and beetles (21.0%) are the preferred food, with moths, Orthoptera and Hymenoptera also eaten in appreciable proportions. In the monsoon season (July-September), termites constitute 43.5% of the diet;

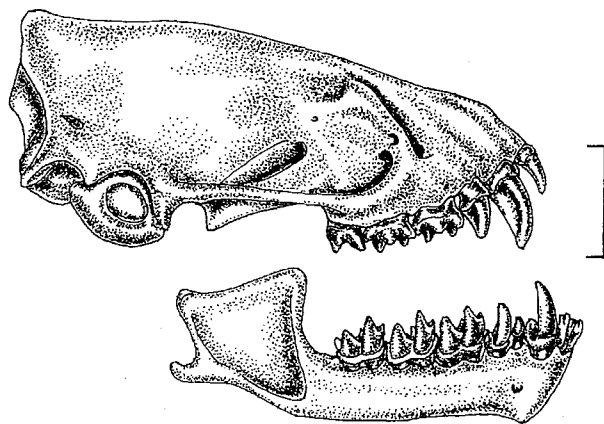


Fig. 221. Skull of *Scotoecus pallidus*. BM.13.4.8.4, Darbhanga, India. Scale = 3 mm.

Coleoptera, Lepidoptera, Orthoptera and Hymenoptera are also present in variable proportions. In the post-monsoon period (October-November), beetles once more dominate the diet (42.1%) (Advani, 1981c). This species plays an active role in managing harmful insect populations of species such as termites, various polyphagous grasshoppers, White Grub and Reed haired caterpillar (Advani, 1981c).

Reproduction: In Maharashtra, it breeds throughout the year. Females experience postpartum oestrus and there is quick succession in pregnancies with females becoming pregnant more than once in a year; females are often pregnant and lactating (Madhavan, 1978). Pregnant females were collected in Rajasthan in July and September (Agrawal, 1973); in Gujarat in September and October and in Bihar in April, July and October (Sinha, 1986a). An immature specimen was collected in Uttar Pradesh in October (HZM).

Conservation status: Worldwide: restricted to the Indian Subcontinent where it is an abundant species in areas such as Rajasthan (Advani, 1983).

Genus *Scotoecus* Thomas, 1901

Scotoecus Thomas, 1901: 263; type species *Scotoecus albofuscus*

This genus is similar externally to *Eptesicus*. The skull is greatly broadened with the zygomatic breadth equal to the condylobasal length. Orbital breadth exceeds the breadth of the palate across the outer edge of the toothrows. The braincase is elevated anteriorly to give a slightly convex frontal profile. The narial and pre-palatal emarginations are exceptionally deep. The

zygomata are very delicate and are often lost in skull preparation. The single upper incisor (i^2) is simple, unicuspid and nearly half as high as the canine, with which it is in contact or nearly so (Fig. 222). The upper premolar (pm^4) is without a cusp on the inner side. The canines, molars and lower premolars are as in *Eptesicus*. m^3 has a crown area more than half that of m^1 or m^2 , its mesostyle, metacone and three commissures are well developed.

Dental formula: $\frac{i-2-}{1\ 2\ 3} \quad c\ 1 \quad pm\ -\ -\ 4 \quad m\ 1\ 2\ 3 = 30$
 $ \phantom{\frac{i-2-}{1\ 2\ 3}} $

The genus includes two African species with a geographical range that includes Senegal to Ethiopia south to Angola and Mozambique; in Asia, one species is known from Pakistan and India (Koopman, 1993).

Scotoecus pallidus Dobson, 1876

Desert Yellow bat

? *Vespertilio noctulinus* I Geoffroy, 1831: 92, pl. 3; Bengal, India.

Scotophilus pallidus Dobson, 1876: 186, app. D, 208; Mian Mir, Lahore, Punjab.

External characters: This is a relatively small Vespertilionid bat, comparable in body size to *Miniopterus schreibersii* but with a shorter forearm, averaging 36.2 mm (34.1-37.3 mm) in length. The muzzle is broad, flattened and essentially naked anteriorly. The nostrils are circular and open obliquely; the lips are fleshy. The ears are of moderate size with rounded tips; the anterior margin of each is without a basal lobe; the tragus is long and relatively narrow with a triangular basal lobe. The pelage is short and fine. On the dorsal surface, it is pale brown, tinged with fawn; it

Table 102. *Scotoecus pallidus*: Specimens from India and Pakistan.

External, cranial and dental measurements (mm)

	mean	range	s	n
HB:	52.8	50.0 - 58.0	2.5	10
T:	36.9	34.0 - 41.0	2.2	10
HF:	8.3	6.0 - 10.0	1.4	10
FA:	36.2	34.1 - 37.3	0.9	10
5mt:	33.7	32.6 - 34.9	0.8	10
4mt:	34.2	32.8 - 35.4	0.9	10
3mt:	34.6	33.5 - 36.0	1.0	10
E:	12.8	12.0 - 15.0	0.9	10
GTL:	15.1	14.5 - 16.1	0.5	8
CCL:	14.1	13.8 - 14.8	0.3	8
ZB:	10.5	10.5 - 10.5	-	1
BB:	7.7	7.5 - 8.2	0.2	9
PC:	4.3	4.2 - 4.5	0.1	8
C-M ³ :	5.6	5.5 - 5.9	0.2	10
C-M ₃ :	6.1	5.9 - 6.4	0.2	9
M:	11.4	10.9 - 12.0	0.3	10
M ³ -M ₃ :	6.9	6.6 - 7.2	0.2	9
RW:	6.5	6.1 - 6.9	0.3	9

Glossary of terms

Abdomen: in mammals, the visceral cavity between the diaphragm and pelvic floor; the belly.

Acrocentric: a chromosome with the centromere very near one end and which appears rod-shaped during segregation in mitosis and meiosis.

Aestivation: a state of torpor during summer.

Allopatric: applied to populations, or species, occupying mutually exclusive ranges.

Alveolus: the socket in a jaw, in which a tooth is implanted.

Angular process: a projection from the lower, posterior part of each half mandible, below the condyle (Fig. 269).

Antebrachial membrane: a membrane in bats, developed in front of the arm, and extending from the shoulder to the forearm, wrist or thumb (Fig. 266).

Anterior: situated in front; in animals, nearer the head.

Antitragus: a lobe developed from the basal part of the outer margin of the ear in some bats (Fig. 265).

Arboreal: of an animal living habitually in trees.

Auditory meatus: passage from the tympanic membrane to the external ear.

Axilla: armpit; the hollow space beneath the forelimb at its junction with the chest.

Baculum: the os penis, or supporting bone of the penis, present in many mammals, absent in others including man.

Basiscranial axis: a line drawn in the lateral view of a skull to indicate the position of the floor of the braincase in the median plane.

Basifacial axis: a line drawn in the lateral view of a skull to indicate the position of the palate, in the median plane.

Basioccipital: the inferior median part of the occipital bone, forming the posterior floor of the braincase (Fig. 269).

Basisphenoid: the median posterior part of the sphenoid bone, forming part of the floor of the braincase (Fig. 269).

Bicuspidate: of teeth having two cusps.

Bifid: of a structure, having two distal processes.

Blastocyst: early developmental stage of a mammalian embryo, containing an inner cell mass destined to become the actual embryo, partially surrounded by a cavity and developing membranes.

Bregma: that point on the vault of the skull where the coronal and sagittal sutures meet.

Buccal pad: an oval epithelial structure, situated in the angles of the mouth of certain bats, between the cheeks and posterior teeth; the cells contain lipid substances.

Calcar: a bony or cartilaginous spur arising from the ankle in bats, helping to support the free margin of the tail membrane.

Canine: a single tooth, situated immediately behind the incisors in each jaw; it is generally tall and pointed in mammals (Fig. 269).

Caniniform: shaped like a canine.

Carnivory: of animals feeding on flesh.

Centromere: a non-staining localised region in each chromosome to which the spindle 'fibre' appears to be attached at metaphase; it remains single for some time after the rest of the chromosome has divided.

Choanae: the posterior nasal apertures, by means of which the nasal cavity communicates with the throat.

Chromosomes: thread-like bodies contained in the nucleus of cells, visible only in dividing cells and along which lie the genes, or essential units of heredity.

Cingulum: a variably developed shelf found on the margin of the crown of mammalian teeth, from which subsidiary cingular cusps may be developed (Figs. 270, 271).

Clavicle: the 'collar bone', part of the shoulder girdle connecting the sternum to the scapula.

Cline: a character gradient; a gradual change of a character through a series of interconnecting populations.

Cochlea: a conical structure, shaped like a snail's shell, situated in the periotic bone and containing the internal organ of hearing (Fig. 269).

Commensal: of animals, such as rats and mice, living in close association with man, and subsisting at his expense, although capable of independent existence.

Commissure: a ridge-like structure of teeth (Fig. 270).

Condyle: an articular process (as of the mandible) (Fig. 269).

Co-ossified: of bones, fused together.

Conspecific: of taxa belonging to the same species.

Cornea: the transparent, circular part of the anterior coat of the eye and the internal aspects of the eyelids.

Coronal suture: the suture between the frontal and parietal bones of the skull, crossing the braincase transversely.

Coronoid process: a variably developed process projecting from the superior border of each half mandible (Fig. 269).

Cretaceous: an epoch of geological time, part of the mesozoic, commencing about 140 million years ago.

Cribriform: having the form of a sieve.

Cusp: of teeth, a prominence or point.

Deme: an interbreeding local population of animals.

Dermal: of, or pertaining to, the skin.

Diastema: a gap between the constituent teeth of a toothrow.

Digit: a finger or toe.

Dimorphism: pertaining to a population or taxon having two genetically determined, discontinuous morphological types.

Diphyly: of a taxonomic group of animals, having two separate ancestral origins.

Diploid chromosomal number (2N): the complete double set of chromosomes present in a cell, with one half derived from each parent.

Distal: situated away from the base or point of attachment or from any named reference point.

Diurnal: pertaining to the daylight hours.

Dorsal: of, or pertaining to, the back.

Echolocation: Navigation during flight by the use of high frequency sound (sonar) pulses, the echo from which is detected by the ears and interpreted by the brain (acoustic orientation).

Ectoconid (Hypoconid): the external cusp situated on the posterior heel or talonid of the placental type of mandibular mammalian molar (Fig. 271).

Enamel: extremely hard outer layer on the crown of a tooth.

Endemic: peculiar to, or prevailing in, some specified country or area.

Entoconid (Endoconid): the internal cusp situated on the posterior heel or talonid of the placental type of mandibular mammalian tooth (Fig. 271).

Eocene: an epoch of geological time, part of the Tertiary period, commencing about 58 million years ago.

Erythrism: of a mammal, exhibiting a pronounced reddish colour phase.

Eustachian canal: an opening in the skull, situated at the apex of the tympanic bulla and permitting the passage of the Eustachian tube from the throat to the middle ear cavity.

Exoccipital condyles: a pair of projections from the occipital bone, on either side of the foramen magnum, by means of which the skull articulates with the cervical spine (Fig. 269).

Fauna: the totality of animals inhabiting a given area.

Femur: the long bone occupying the upper leg or thigh, and extending from the hip to the knee (Fig. 266).

Ferruginous: of the colour of iron-rust.

Filiform: of the papillae of the tongue, thread-like.

Flank: side of an animal's body.

Foetal: pertaining to the foetus or embryo.

Foramen magnum: a large opening in the occipital bone through which the spinal cord passes (Fig. 269).

Form: (taxonomic), an individual or group of specimens with a scientific name; it does not imply a precise taxonomic category.

Frontal: paired bones forming the anterior part of the vault of the skull (Fig. 269).

Fundamental number (FN): number of chromosome arms of the autosomal complement, (excluding the sex pair).

Genitalia: the sexual organs of an animal.

Genus: taxonomic category consisting of one or more closely related species.

Gestation: the period during which a pregnant female carries the developing young before birth.

Glans penis: the expanded, rounded extremity of the male phallus.

Glenoid cavity: an elongated hollow situated on the inferior aspect of the posterior root of each zygoma; it articulates with the condyle of each half mandible, forming the jaw joint (Fig. 269).

Gular sac: a glandular pouch in the skin of the throat of certain bats (Fig. 43).

Hallux: the first, or great toe.

Hamular process: a generally curved hook-like process

projecting downwards and backwards from the internal pterygoid plate of the skull (Fig. 269).

Heterodont: having teeth of different kinds, like the incisors, canines, premolars and molars of mammals.

Holotype: a specimen designated as the name-bearer of a particular taxonomic category.

Homozygosity: a term used in genetics implying the presence of identical genetic factors (alleles) at the homologous (corresponding) loci of the two parental chromosomes. Such an individual will breed true for the character concerned.

Humerus: the long bone of the upper arm, connecting the shoulder to the elbow (Fig. 266).

Hybrid: offspring of two parents of different species; usually infertile.

Hyoid: the skeleton of the second branchial arch; in mammals a chain of slender bones forming an arch in the throat originating in the tympanic region on each side.

Hypocone: a cusp developed on the posterior internal corner of the more evolved four cusp type of upper mammalian molar.

Hypoconid: the external cusp situated on the posterior heel or talonid of the placental type of mandibular mammalian molar (Fig. 271).

Incisor: a front, or cutting tooth; in the upper jaw it is situated in the premaxilla; the lower series are in the front of the mandible (Fig. 269).

Indigenous: originating in a specified place or country; not exotic.

Infraorbital foramen: an opening in the skull, situated on the cheek below the orbit, transmitting the infraorbital vessels and nerve through the maxilla (Fig. 269).

Insectivore: of an animal, having a diet of insects.

Interfemoral membrane (Uropatagium): the tail membrane of bats, extending from the back of the body and inner margins of the legs to enclose part or all of the tail when this is present (Fig. 266).

Intergrade: interbreeding between individuals of two or more subspecies.

Interorbital region: the region of the skull lying between the orbits (Fig. 269).

Jugal: the cheekbone, sometimes called the malar, which occupies the middle part of the zygomatic arch (Fig. 269).

Karyology: the science of the structure and function of nuclei.

Karyotype: the chromosome complement of a species.

Lachrymal: a small bone in the skull, situated at the upper anterior margin of the orbit, pierced by the naso-lachrymal duct.

Lactation: the period of active milk production by the mammary glands.

Lambda: the point where the lambdoid and sagittal crests (or sutures) meet (Fig. 269).

Lambdoid crests: variably developed ridges at the back of the braincase, overhanging the occiput and meeting the sagittal crest in the mid-line (Fig. 269).

Lancet: the erect, subtriangular, posterior part of the noseleaf of bats of the Genus *Rhinolophus* (Fig. 267).

Larynx: the organ of voice, a muscular and cartilaginous

structure at the upper end of the trachea, containing the vocal cords.

Lateral: of, or pertaining to, the side.

Lingual: situated near the tongue.

Lipoid: fatty substance.

Malar: the jugal or cheek bone, part of the zygomatic arch.

Malleus: the most external of the three ossicles in the middle ear, the handle (manubrium) of which is attached to the ear drum (Fig. 269).

Mamma: a mammary gland or breast, providing milk for the nurture of the young, and characteristic of mammals.

Mandible: the lower jaw, composed of two halves, which sometimes fuse together (Fig. 269).

Mastoid: part of the periotic bone, which is visible on the external aspect of the skull as a variably prominent process behind the ear opening.

Maxilla: the principal bone of the upper jaw and side of the face, containing the canine and cheekteeth (Fig. 269).

Medial: of, or pertaining to, the middle.

Membrane: a thin, often transparent, part of the cuticle, as in the wings of bats, or lining of internal structures.

Mesopterygoid space (fossa): the generally U or V-shaped space on the ventral aspect of the skull behind the palate and between the internal pterygoid plates and hamular processes (Fig. 269).

Mesostyle: the central one of three small projections sometimes developed on the outer cingulum of upper molars (Fig. 270).

Metacarpal: one of the long bones of the hand extending from the carpal bones to the proximal phalanges of the fingers (Fig. 266).

Metacentric: of a chromosome having exactly similar arms united by a centromere.

Metacone: the main posterior, external cusp on the crown of the upper molar of mammals having the tuberculosectorial type of cheekteeth, composed of cusps and crests (Fig. 270).

Metaconid: the posterior internal cusp of the main triangle (trigonid) occupying the anterior part of the tuberculosectorial type of lower molar (Fig. 271).

Metaconule: a subsidiary cusp sometimes developed on the commissure which connects the protocone to the metacone in many upper mammalian molars.

Metastyle: the posterior of three small projections that may be developed on the external cingulum of upper molars, of which the anterior one is termed the parastyle, and the central one the mesostyle (Fig. 270).

Metatarsus: the part of the hind limb that is between the tarsus or ankle and the phalanges or bones of each toe.

Miocene: an epoch of geological time, part of the tertiary period commencing about 24 million years ago.

Molar: a posterior cheektooth of mammals, which has no deciduous precursor (Fig. 269).

Molariform: shaped like a molar.

Monophyly: of a taxonomic group of animals, having a single ancestral origin.

Monospecific: of a genus, having only one species.

Monotypic: of a species, that is not comprised of different subspecies.

Morphology: form and structure of an organism.

Mutation: the alteration of a gene, which occurs spontaneously in nature, or may be induced by radiation or certain chemicals.

Nasals: the most anterior bones (paired) on the roof of the skull, forming the roof of the nasal cavity.

Nasal septum: a median bony structure, dividing the two sides of the nasal cavity.

Narial: of the nasal region.

Neonatal: relating to the newly born.

Nocturnal: pertaining to the hours of darkness.

Noseleaf: structures, developed from the skin around the nostrils in some bats, often of a complex nature (Plates 3-6).

Occipital: pertaining to the occiput.

Occiput: the lower back part of the skull; the region of the occipital bone.

Occlusal: of teeth, the crown surface, which impinges on the opposite jaw during closure.

Oligocene: an epoch of geological time, part of the Tertiary period, commencing about 35 million years ago.

Omnivorous: of animals, eating foods of all kinds.

Ontogeny: the development of the individual.

Os penis: the baculum, or supporting bone of the penis.

Palatal foramina: a pair of small openings in the palate (Fig. 269).

Palate: the roof of the mouth, formed of two parts. The anterior part, or hard palate has a bony skeleton formed by the premaxilla and palatine bones, it is covered by a mucous membrane. The posterior division or soft palate, is composed of muscular tissues and mucous membrane (Fig. 269).

Palatine: pertaining to the palate.

Palaeartic: a zoogeographical region, comprising temperate Eurasia, northern Africa and the Arabian peninsula.

Paleocene: an epoch of geological time, part of the Tertiary period commencing about 65 million years ago.

Paracone: the main anterior external cusp of the tritubercular type of upper mammalian molar (Fig. 270).

Paraconid: the principal anterior internal cusp of the trigonid (anterior part) of the tuberculosectorial type of lower molar (Fig. 271).

Pararhinal glands: specialised sebaceous glands developed in the skin of the side of the muzzle of certain bats, often producing an odorous secretion.

Parastyle: the anterior of three small projections sometimes developed on the external cingulum of the upper molar (Fig. 270).

Paratype: specimen, or specimens, of a taxon collected from the same locality and at the same time as the holotype.

Parietal: a paired bone of the vault of the skull, situated between the frontal and the occipital (Fig. 269).

Paroccipital process: a process projecting from the skull behind each tympanic bulla (Fig. 269).

Parturition: the process of birth, delivery of young.

Pectoral: pertaining to the anterior chest region.

Pelage: the hairs of an animal.

Phalanx: a digital bone of a finger or toe, (plural, phalanges) (Fig. 266).

Philtrum: the groove present in some mammals on the median line of the upper lip.

Phylogeny: the evolutionary history of a species or group.

Pinna: the external ear (or conch) (Fig. 265).

Plagiopatagium: the principal wing membrane of a bat, extending between the fore and hind limbs and including the fingers, but not the antebrachial or interfemoral membrane (Fig. 266).

Plantar: pertaining to the sole of the foot

Plantigrade: walking habitually on the whole sole of the foot.

Pleistocene: the Glacial epoch of the Quaternary period, commencing about 1.8 million years ago.

Pliocene: the last epoch of the Tertiary period of geological time, preceding the Pleistocene, commencing about 5 million years ago.

Pollex: the thumb, or first digit of the hand.

Polymorphism: the existence of several forms or types in a species.

Polytypic: of a species that is comprised of two or more subspecies.

Postcalcareal lobe: a small lobule developed in some bats behind the calcar, thus projecting at the proximal margin of the tail membrane.

Posterior: situated behind or towards the hinder part; opposed to anterior.

Postorbital constriction: a narrowing of the skull behind the orbits (Fig. 269).

Postorbital processes: paired bony projections behind the superior orbital margins.

Premaxilla: the anterior bone of the upper jaw, containing the incisors, and contributing variably to the nose and palate (Fig. 269).

Premolar: a mammalian cheektooth, having a milk precursor (Fig. 269).

Protocone: the principal internal cusp of the tritubercular type of upper mammalian molar, once believed to represent the original reptilian cone (Fig. 270).

Protoconid: the principal external cusp of the anterior triangle (trigonid) of the tuberculosectorial lower molar (Fig. 271).

Pterygoid (hamular) processes: a pair of projecting processes of the sphenoid bone, enclosing between them the posterior part of the mesopterygoid space.

Pubic symphysis: the joint formed between the two pubic bones, connecting the two halves of the pelvis in front.

Radio-metacarpal pouch: a pocket developed on the ventral aspect of the wrist of certain bats, extending from the distal radius to the base of the fifth metacarpal (Fig. 52).

Ramus: a branch; of the mandible, having a horizontal part bearing the teeth and an ascending part posteriorly with the

condyle, coronoid and angular processes.

Relict population: one that persists locally after the extinction of the species from at least part of its former range.

Retina: the light sensitive membrane in the eye, on which the image is focused; it is composed of layers of nerve fibres and nerve cells.

Rhinarium: the area of naked, moist skin surrounding the nostrils; the nostril pad (Fig. 265).

Rostrum: the facial part of the skull, in front of the orbits (Fig. 269).

Sagittal crest: a variably developed median crest on the vault of the skull, extending from the postorbital region to the lambda (Fig. 269).

Scapula: the shoulder blade.

Sella: the inferior, saddle-like aspect of the median anterior projection of the noseleaf of a Horseshoe bat (*Rhinolophus*) overhanging the top of the horseshoe (Fig. 267).

Sexual dimorphism: phenotypic difference between the males and females of a particular taxon.

Sibling species: morphologically similar or apparently identical populations that are nevertheless reproductively isolated biological species.

Squamosal: the squamous portion of the temporal bone, forming the lateral part of the braincase and posterior root of the zygomatic arch.

Subspecies: (or race), a geographically localised subdivision of a species, which differs genetically and taxonomically from other subdivisions of the species

Subadult: an individual that has yet to reach full maturity.

Subequal: two approximately similar-sized parts of a structure or structures.

Supraoccipital: the superior part of the occipital bone at the back of the skull (Fig. 269).

Supraorbital foramen: a small opening in the skull above the orbit, transmitting the supraorbital vessels and nerve.

Suture: an immovable joint between two bones.

Sympatric: of species or populations that occur together without interbreeding.

Symphysis menti: the ligamentous or bony junction between the two halves of the lower jaw anteriorly.

Synonym: each of two or more scientific names that have been applied to the same taxon.

Synonymy: a listing of synonyms.

Talonid: the heel of a lower molar (Fig. 271).

Tarsus: the ankle and part of the foot; the segment of skeleton between the lower leg and the metatarsals.

Taxon: any group that is distinguished by a scientific name.

Taxonomy: theory and practice of classification.

Telocentric: of a chromosome, having a terminal centromere.

Temporo-mandibular joint: the jaw joint; the articulation between the mandible and temporal bone.

Temporal ridges: a ridge extending posteriorly across the vault of the skull from the postorbital process on each side (in Megachiroptera).

Testes: the male gonads, or testicles, in which the spermatozoa are formed and the male hormone produced.

Tibia: a long bone of the lower leg; the more robust of the two bones usually extending from the knee to the ankle in mammals (Fig. 266).

Topotype: a specimen subsequently collected from the type locality of a taxon, but not part of the original type series.

Tragus: a cutaneous and cartilaginous projection found at the opening of the external ear in some bats (Fig. 265).

Tricuspidate: of a tooth, having three cusps.

Trigonid: the anterior part of the crown of a lower molar, bearing three main cusps, the protoconid, paraconid and metaconid (Fig. 271).

Trinomial system: the modern system of classification, in which an animal bears three names, indicative of the genus, species and subspecies to which it belongs.

Trochin: the lesser tuberosity of the humerus, for insertion of the subscapularis muscle.

Trochiter: the greater tuberosity of the humerus, a process near its upper end for the insertion of several shoulder muscles.

Tympanic bone: a bony ring, generally incomplete, surrounding the external auditory canal and ear drum.

Tympanic bulla: the usually rounded bony capsule surrounding the middle and internal ear in many mammals. Also known as auditory bulla (Fig. 269).

Tympanic membrane: the ear drum; a thin transparent sheet stretched across the passage leading to the ear, and receiving sound vibrations (Fig. 269).

Unicuspid: of teeth with one cusp.

Uroptagium: the interfemoral, or tail membrane of a bat.

Uterus: the womb; that part of the female genital tract in which the fetus is developed before the birth.

Vascular system: the blood vessels of an animal, comprised of arteries, veins and capillaries.

Ventral: of, or pertaining to, the abdominal surface.

Vertebrae: the individual bones comprising the spinal column, divided into five kinds, the cervical, thoracic, lumbar, sacral and caudal.

Vestigial: a structure which has become a more or less functionless relict.

Vibrissae: elongated, rigid hairs, with a specialised tactile function. These may occur on various parts of the body, but are usually most developed on the face; the 'whiskers'.

Vomer: a facial bone, forming part of the nasal septum, posteriorly.

Zygoma: (plural = zygomata) the arch of the cheekbones, formed typically by the jugal bone in the central part, the maxilla in front and the squamosal behind (Fig. 269).

Zygomatic arch: see zygoma.

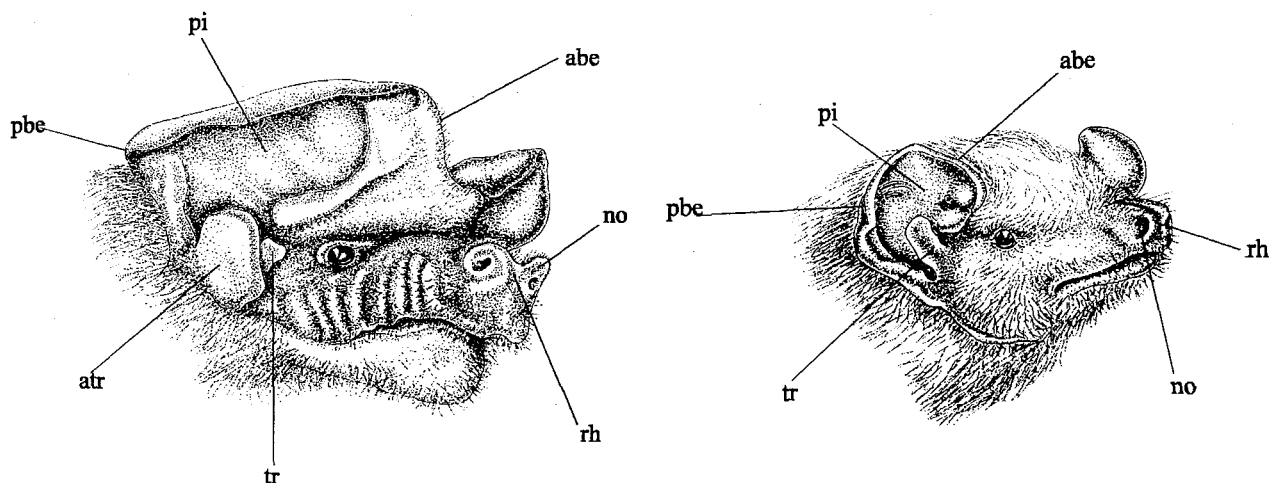


Fig. 265. Faces of *Tadarida plicata* (left) and *Tylonycteris pachypus* (right).

abe: anterior border of ear; atr: antitragus; no: nostril; pbe: posterior border of ear; pi: pinna; rh: rhinarium; tr: tragus.

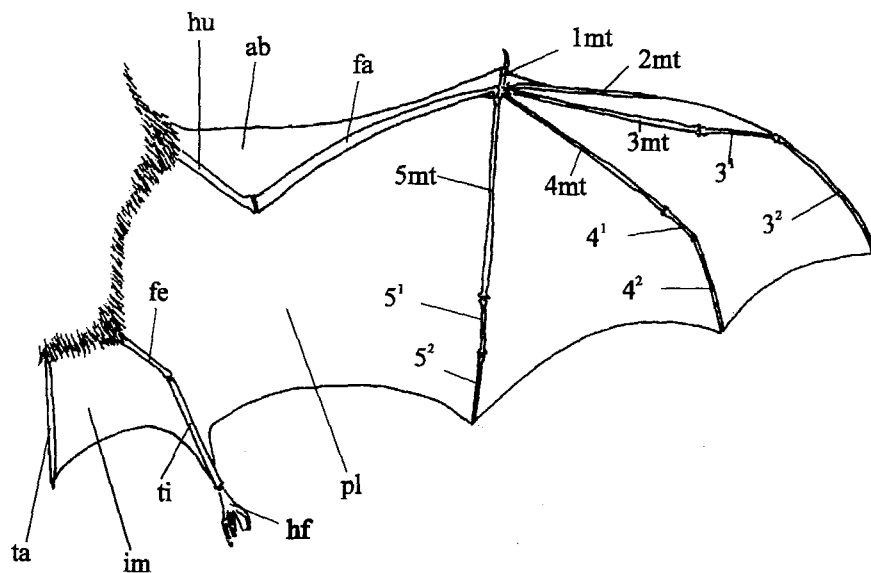


Fig. 266. Right wing of *Rhinolophus*.

ab: antebrachial membrane
fa: forearm
fe: femur
hf: foot
hu: humerus
im: interfemoral membrane
pl: plagiopatagium
ta: tail
ti: tibia
1mt: first metacarpal
2mt: second metacarpal
3mt: third metacarpal
3¹: first phalanx of third metacarpal
3²: second phalanx of third metacarpal
4mt: fourth metacarpal
5mt: fifth metacarpal

Fig. 267. Lateral (left) and anterior (right) views of noseleaf of *Rhinolophus macrotis*

abs: anterior border of sella
bs: base of sella
c: cell of lancet
h: horseshoe
ic: internarial cup
ies: inferior extremity of sella
iss: inferior surface of sella
la: lancet
lp: lappet
meh: median emargination of horseshoe
n: nostril
se: sella
scp: superior connecting process

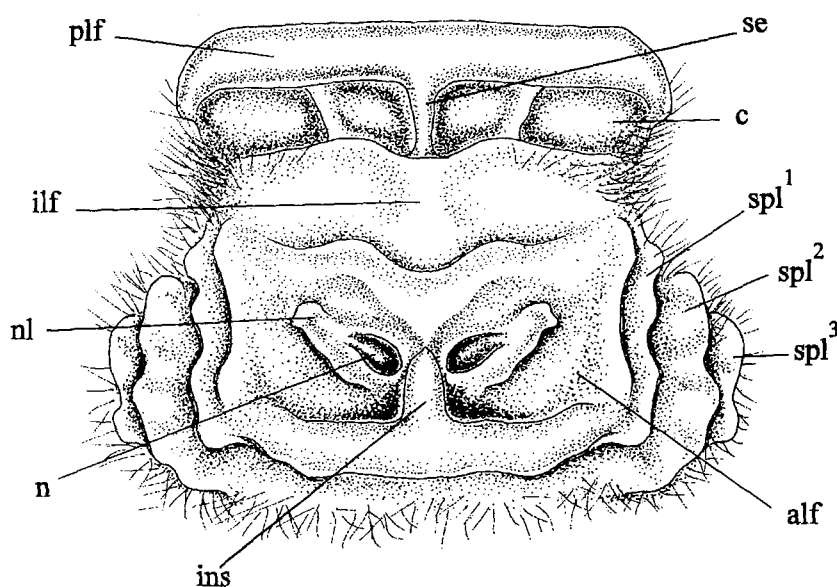
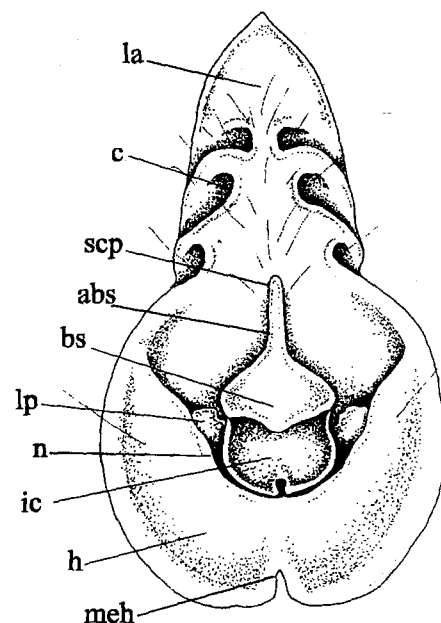
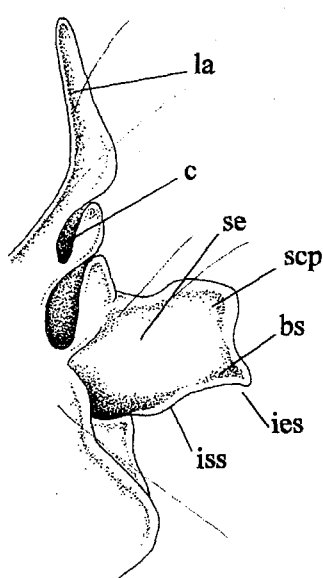


Fig. 268. Anterior view of noseleaf of *Hipposideros speoris*.

alf: anterior leaf
c: cell
ilf: intermediate leaf
ins: internarial septum
nl: narial lappet
n: nostril
plf: posterior leaf
se: septum
spl¹: inner supplementary leaflet
spl²: second supplementary leaflet
spl³: third supplementary leaflet

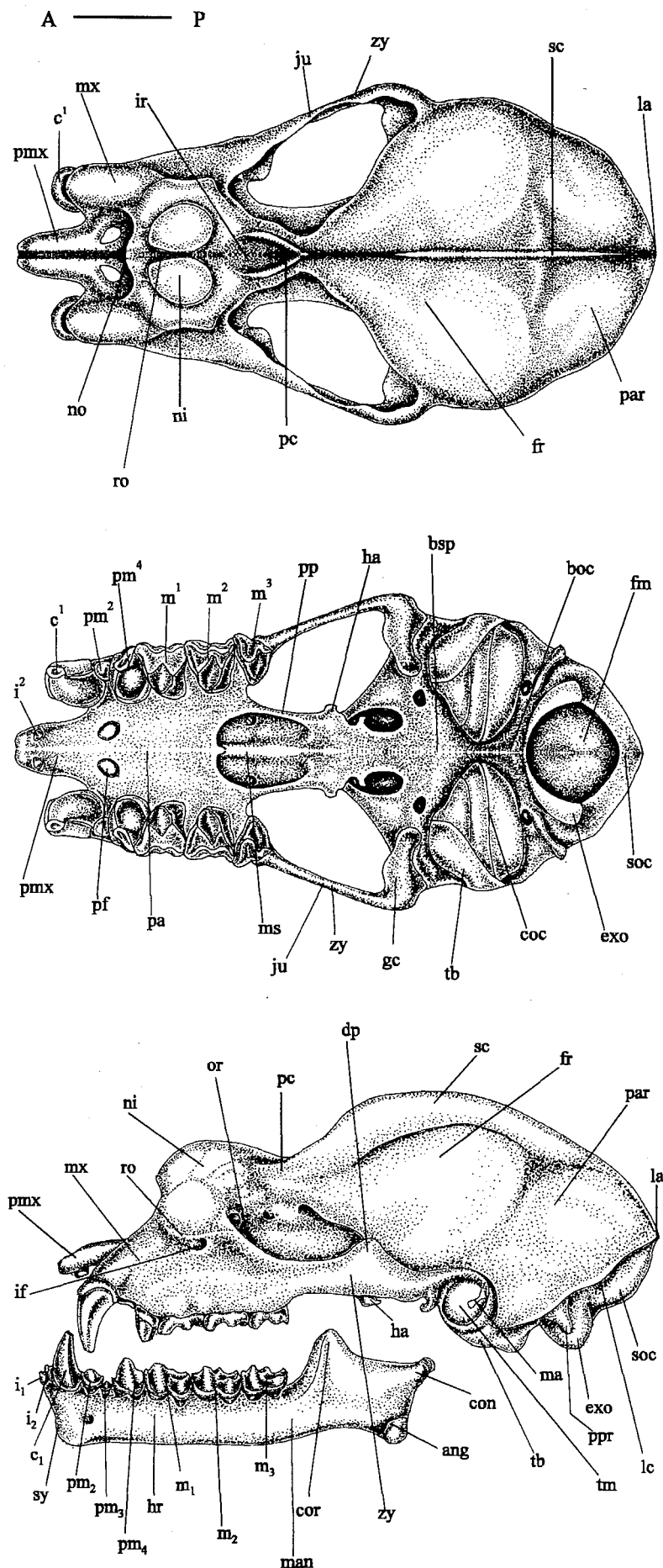


Fig. 269. Dorsal, ventral and lateral views of the skull of *Rhinolophus beddomei*.

- A: anterior
ang: angular process
boc: basioccipital
bsp: basisphenoid
c¹: upper canine
c₁: lower canine
coc: cochlea
con: condyle
cor: coronoid process
dp: dorsal process of zygoma
exo: exoccipital condyle
fm: foramen magnum
fr: frontal
gc: glenoid cavity
ha: hamular process
i²: upper incisor
i₁, i₂: lower incisors
if: infraorbital foramen
ir: interorbital region
ju: jugal
la: lambda
lc: lambdoid crests
m¹⁻³: upper molars
m₁₋₃: lower molars
ma: malleus
man: mandible
ms: mesopterygoid space
mx: maxilla
ni: nasal inflation
no: nasal orifice
or: orbit
P: posterior
pa: palate
par: parietal
pc: postorbital constriction
pf: palatal foramen
pm², pm⁴: upper premolars
pm₂₋₄: lower premolars
pmx: premaxilla
pp: pterygoid plate
ppr: paroccipital process
ro: rostrum
sc: sagittal crest
soc: supraoccipital
sy: symphysis
tb: tympanic bulla
tm: tympanic membrane
zy: zygoma

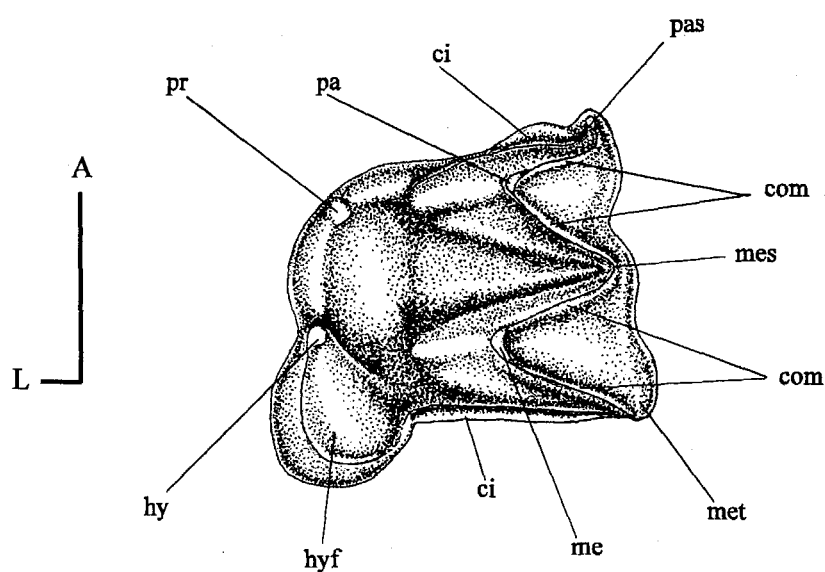


Fig. 270. Left upper molar tooth of *Tadarida teniotis*. A: anterior; ci: cingulum; com: commissures; hy: hypocone; hyf: hypoconal flange; L: lingual; mes: mesostyle; me: metacone; met: metastyle; pa: paracone; pas: parastyle; pr: protocone.

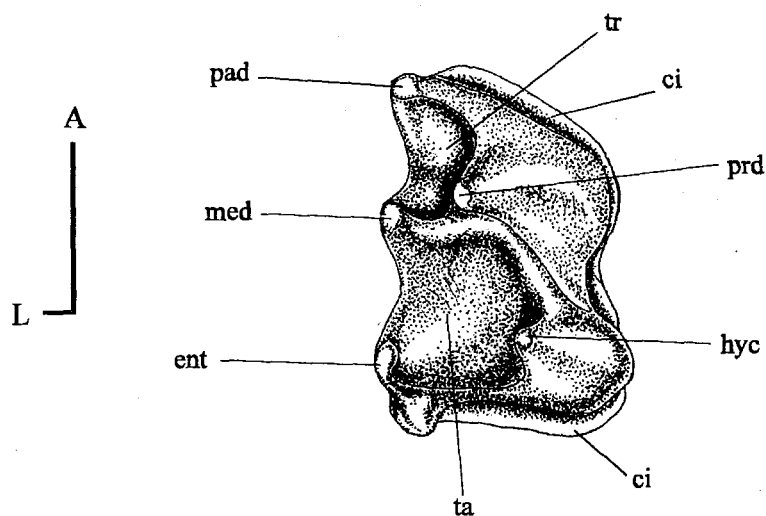


Fig. 271. Right lower molar tooth of *Tadarida teniotis*. A: anterior; ci: cingulum; ent: entoconid; hyc: hypoconid; med: metaconid; pad: paraconid; prd: protoconid; ta: talonid; tr: trigonid; L: lingual.

Geographical Gazetteer

25/12/98 in loc. dlf
V.C.V.C

	north east degrees/minutes
Aatkhet, Pithoragarh Dist, Uttar Pradesh, India ..	not located
Abbotabad, NWFP, Pakistan	34.08 73.12
Abdukil, Afghanistan	appr. 34.41 70.32
Abhoya, Tripura, India	23.18 91.25
Achabal, Jammu & Kashmir, India	33.41 75.14
Addu Atoll, Maldives	c.o. 00.18 73.32
Adung Valley, Myanmar	28.10 97.40
Agalawatta, Western Province, Sri Lanka ..	06.33 80.09
Agar, Madhya Pradesh, India	23.44 76.01
Agar Malwa, Madhya Pradesh, India	not located
Agartala, Tripura, India	23.50 91.23
Aggalkaurba, Western Province, Sri Lanka appr.	06.35 79.59
Agra, Uttar Pradesh, India	27.09 78.00
Ahmedabad, Gujarat, India	23.03 72.40
Ahmednagar, Maharashtra, India	19.08 74.48
Aichisagami, Nagaland, India	c.o. 26.00 94.33
Aimoli, Manipur, India	not located
Ajanta, Maharashtra, India	20.30 75.48
Ajmer, Rajasthan, India	26.29 74.40
Ajodhya Hills, West Bengal, India	appr. 23.20 86.24
Akanti, Upper Chindwin, Myanmar	not located
Akhnoor, Jammu & Kashmir, India	32.54 74.44
Akyab, Myanmar	20.09 92.55
Alakanagoda, North Central Pr., Sri Lanka appr.	07.51 81.07
Alibag, Maharashtra, India	18.38 72.55
Aligarh, Rajasthan, India	25.58 76.09
Allahabad, Uttar Pradesh, India	25.57 81.50
Allapalli, Maharashtra, India	not located
Almora, Uttar Pradesh, India	29.36 79.40
Alwar, Rajasthan, India	27.32 76.35
Amanapoor Hill, Central Pr., Sri Lanka ..appr.	07.15 80.32
Amandara, NWFP, Pakistan	34.33 71.57
Amaravati, Marahashtra, India	20.58 77.50
Amarpur, Tripura, India	23.31 91.39
Amarpura, Bihar, India	25.02 86.55
Amb, North-west Frontier Province, Pakistan ..	34.18 72.51
Ambassa, Tripura, India	23.55 91.50
Ambawela, Sri Lanka	not located
Ambikapur, Madhya Pradesh, India	23.09 83.12
Ampi (Ampibazar), Tripura, India	23.40 91.38
Amraoti, Maharashtra, India	20.58 77.50
Anakkampoyle, Kerala, India	appr. 11.14 75.44
Anand, Gujarat, India	22.34 73.01
Anantnag, Jammu & Kashmir India	33.44 75.11
Anasigalla, Western Province, Sri Lanka ..	06.29 80.03
Andaman Islands, India	c.o. 12.00 92.45
Andheri, Maharashtra, India	19.07 72.50
Angarakhata, Assam, India	appr. 26.37 90.30
Angul, Orissa, India	20.48 85.04
Anmod, Goa, India	not located
Annigera, Nepal	not located
Anuradhapura, North Central Pr., Sri Lanka ..	08.20 80.25
Ara, Salt Range, Punjab, Pakistan	not located
Arambol, Tamil Nadu, India	08.15 77.33
Ari atoll, Maldives	appr. 03.40 73.10
Arnala, Maharashtra, India	appr. 19.52 72.42

	north east degrees/minutes
Arrah, Bihar, India	25.34 84.40
Asgani, Maharashtra, India	17.38 73.26
Asirgarh, Madhya Pradesh, India	21.31 76.22
Astoli, Karnataka, India	15.26 74.30
Atiamochor, West Bengal, India	not located
Aurangabad, Bihar, India	24.46 84.23
Aurangabad, Maharashtra, India	19.52 75.22
Avatgi, Karnataka, India	appr. 15.30 74.50
Azhur, Kerala, India	not located
Bachek, Nepal	appr. 28.01 84.37
Badami, Karnataka, India	15.58 75.45
Bagdu, Gujarat, India	not located
Bageswar, Uttar Pradesh, India	29.50 79.46
Baghlan, Afghanistan	36.11 68.44
Baghmara, (Garo Hills), Meghalaya, India ..	not located
Bagmunda, Orissa, India	appr. 20.40 85.39
Baglung, Nepal	28.16 83.35
Bahawalpur, Pakistan	29.33 71.39
Bahmajo Bat Cave, J. & Kashmir, India ..	appr. 33.40 75.23
Bahwanipur, (Bhojbhawanpur), Nepal	28.05 81.45
Bairaglia, Nepal	appr. 26.45 85.20
Bairia, Nepal	27.00 85.23
Bakkim, Kangchendzonga Area, Sikkim ..	appr. 27.30 88.30
Balaghat, Madhya Pradesh, India	21.48 80.16
Balangoda, Sabaragamuwa Province, Sri Lanka ..	06.39 80.42
Balapalli, Andhra Pradesh, India	appr. 13.50 79.15
Baleshwar (district of), Orissa, India	c.o. 21.31 86.59
Balharshah, Madhya Pradesh, India	not located
Baliaparathodu, Kerala, India	appr. 10.46 76.42
Balk, Afghanistan	36.46 66.50
Balna, Uttar Pradesh, India	29.55 78.54
Balsamand, Rajasthan, India	appr. 26.25 73.07
Balugaon, Orissa, India	appr. 19.49 85.16
Barniyan, Afghanistan	34.50 67.37
Banaras, Uttar Pradesh, India	25.20 83.00
Bandarawela, Uva Province, Sri Lanka	06.50 81.00
Banderdeva, Arunachal Pradesh, India	appr. 27.20 92.30
Bandra, Maharashtra, India	19.04 72.58
Bangalore, Karnataka, India	12.58 77.35
Banke District, Nepal	27.57 81.47
Bankura (district of), West Bengal, India ..	c.o. 23.14 87.05
Bansda, Gujarat, India	20.47 73.25
Banss Bahari, Nepal	appr. 27.48 84.57
Banswara, Rajasthan, India	23.32 74.28
Barabisse, Nepal	appr. 27.35 85.35
Bara Hapjan, Assam, India	not located
Baradia, Gujarat, India	appr. 21.00 70.39
Barbera, Orissa, India	not located
Barberyn Island, Western Province, India ..	appr. 06.26 79.55
Barchi, Karnataka, India	appr. 15.25 74.35
Barddhaman (dist. of), West Bengal, India c.o.	23.15 87.52
Bareilly, Uttar Pradesh, India	28.22 79.24
Barisal, Bangladesh	22.41 90.20
Barkagaon, Bihar, India	appr. 23.50 85.23
Barkalikapur, West Bengal, India	appr. 22.15 88.25
Barkuda Island, Orissa, India	not located

NB: the external boundaries of India in the distribution maps have not been authenticated and may not be correct; localities listed by country in the text may not correspond to the national boundaries in the maps.

ii: geographical co-ordinates with the prefix 'appr.' or 'c.o.' are for indication purposes only and may not be accurate.

Barmer, Rajasthan, India	25.43	71.25	Bongoan, Bihar, India	not located
Baroda, Gujarat, India	22.19	73.14	Bori, (Hoshangabad), Madhya Pradesh, India	not located
Barren Island, Andaman Island, India	12.18	93.49	Borivli, Maharashtra, India	appr. 19.14 72.57
Baschgaltal, Afghanistan	not located		Bouzini, Nepal	appr. 27.42 85.13
Baschgar Valley, Afghanistan	appr. 35.10	70.50	Broach, Gujarat, India	21.40 73.02
Bassein, Maharashtra, India	19.21	72.52	Bubak, Sind, Pakistan	26.25 67.44
Bassina Taluka, Maharashtra, India	appr. 19.14	73.02	Buhnar, Bihar, India	appr. 26.10 85.54
Bastar District, Madhya Pradesh, India	c.o. 19.00	81.00	Bulakolipitiya, Sabaragamuwa, Sri Lanka	07.06 80.20
Battakundi, NWFP, Pakistan	34.56	73.46	Bulapur, Maharashtra, India	appr. 19.58 79.22
Batule Chour, Nepal	appr. 28.14	83.58	Bulathsinghala, Western Province, Sri Lanka	06.39 80.13
Bedsar, Maharashtra, India	appr. 18.50	73.30	Bulath-Sinhalapitya, Sabaragamuwa, Sri Lanka	not located
Begusarai, Bihar, India	25.25	86.08	Bulsar, Gujarat, India	20.36 73.03
Beibeng, Xizang, Tibet	appr. 29.20	95.30	Bumzov Cave, Jammu & Kashmir, India	appr. 33.56 75.24
Belapur, Maharashtra, India	19.36	74.40	Bundi, Rajasthan, India	25.28 75.42
Belgaon, Maharashtra, India	not located		Burdwan, West Bengal, India	23.15 87.52
Belgaum, Karnataka, India	15.54	74.36	Burhanpur, Madhya Pradesh, India	21.18 76.08
Bellary, Karnataka, India	15.11	76.54	Cachar District, Assam, India	c.o. 25.00 93.00
Beltchiragh, Afghanistan	35.50	65.11	Calcutta, West Bengal, India	22.35 88.21
Benhoke, Nilgiris Hills, Tamil Nadu, India	not located		Camorta Island, Nicobar Islands, India	c.o. 08.08 93.42
Bentota, Southern Province, Sri Lanka	06.25	80.00	Campbell Bay, Nicobar Islands, India	appr. 07.00 93.45
Berar, Pali Distr., Rajasthan, India	appr. 25.46	73.26	Canacona, Goa, India	15.01 74.04
Bhaderwah, Jammu & Kashmir, India	32.56	75.47	Cape Comorin, Tamil Nadu, India	08.05 77.35
Bhagalpur, Bihar, India	25.14	86.59	Car Nicobar, Nicobar Islands, India	c.o. 09.12 92.46
Bhaja Caves, Maharashtra, India	18.42	73.30	Centre Camp, Chinnamanur, T. N., India	appr. 09.50 77.26
Bhalukpung, Arunachal Pradesh, India	appr. 26.22	93.52	Chachora, Madhya Pradesh, India	not located
Bhamer, Maharashtra, India	21.04	74.20	Chahade, Maharashtra, India	appr. 19.42 72.50
Bhamo, Myanmar	24.15	97.15	Chaibassa, Bihar, India	22.31 85.50
Bhandra, Maharashtra, India	21.09	79.42	Chailingta, Tripura, India	24.02 92.02
Bharatpur, Rajasthan, India	27.14	77.28	Chainpur, Bihar, India	25.02 83.31
Bharnabari, West Bengal, India	appr. 26.50	89.20	Chak, Sind, Pakistan	appr. 27.44 68.52
Bhattu Hissar, Punjab, Pakistan	not located		Chaklala, Punjab, Pakistan	appr. 33.40 73.08
Bheemanagari, Kerala, India	not located		Chaklasi, Gujarat, India	appr. 22.34 73.01
Bheraghat, Madhya Pradesh, India	23.08	79.52	Chak Naur, Afghanistan	appr. 34.21 70.51
Bhima Devi, Kashmir, India	appr. 33.43	75.17	Chakrapur, Diapurgarmi District, Nepal	26.50 87.01
Bhimbharak, Rajasthan, India	appr. 26.09	73.08	Chakri, Punjab, Pakistan	32.47 73.28
Bhind, Madhya Pradesh, India	26.33	78.47	Chak Wki Sarkani, Afghanistan	not located
Bhodwad, Maharashtra, India	appr. 21.01	75.50	Chalay, Kerala, India	not located
Bhojbhawanpur, Banke, Nepal	appr. 28.05	81.45	Chalesar Ravines, Agra, U.P., India	27.10 78.02
Bhojpur, Madhya Pradesh, India	23.10	77.41	Chalna-Khel, Nepal	c.o. 27.42 85.14
Bhojpur (district), Bihar, India	c.o. 25.34	84.40	Chamba, Himachal Pradesh, India	32.33 76.10
Bhopal, Madhya Pradesh, India	23.17	77.28	Chamchir, Afghanistan	not located
Bhoria, Rajasthan, India	not located		Chamoli, Uttar Pradesh, India	30.22 79.19
Bhubaneswar, Orissa, India	20.13	85.50	Champaran (district), Bihar, India	c.o. 27.06 84.29
Bhuj, Gujarat, India	23.12	69.54	Chanda, Maharashtra, India	19.58 79.21
Bhutan Duars, West Bengal, India	c.o. 26.45	89.25	Chandigarh, Haryana, India	30.43 76.47
Biapo, Myanmar	not located		Chandra, West Bengal, India	22.26 87.21
Bibile, Uva Province, Sri Lanka	07.09	81.14	Chandrapur, Maharashtra, India	appr. 19.55 79.28
Bikaner, Rajasthan, India	28.01	73.22	Chapra, Bihar, India	25.46 84.44
Bilaspur, Uttar Pradesh, India	28.53	79.16	Charilam, Tripura, India	23.38 91.18
Bimalnager, Nepal	27.45	84.29	Charwa, Gujarat, India	appr. 23.12 69.54
Bimlipatam, Andhra Pradesh, India	17.54	83.31	Chauter, Baluchistan, Pakistan	30.22 68.00
Binaganj, Madhya Pradesh, India	appr. 24.03	77.00	Cheddikulam, Northern Province, Sri Lanka	08.40 80.18
Birbhum (districts of), West Bengal, India	c.o. 23.54	87.32	Chekrima, Nagaland, India	appr. 25.35 94.30
Birsivpur, West Bengal, India	appr. 22.20	88.10	Cherrapunji, Meghalaya, India	25.16 91.42
Bist, Afghanistan	not located		Chettiri Range, Tamil Nadu, India	not located
Bisut, Afghanistan	appr. 34.32	70.27	Chib, Baluchistan, Pakistan	63.08 26.09
Boalkhali Thana, Bangladesh	not located		Chichipalli, Chanda, Uttar Pradesh, India	not located
Bochasan, Gujarat, India	22.25	72.51	Chikalda, Maharashtra, India	21.29 77.12
Bodh Gaya, Bihar, India	appr. 24.48	85.00	Chilka Lake, Orissa, India	19.55 85.30
Bogala, Sabaragamuwa Province, Sri Lanka	07.02	80.15	Chiltan, Baluchistan, Pakistan	30.02 66.52
Bogawantalawa, Central Province, Sri Lanka	06.48	80.41	Chinchpali, Maharashtra, India	appr. 19.57 79.22
Boitari, Nepal	appr. 28.01	84.37	Chin Hills, Myanmar	appr. 23.40 94.15
Bolangir (district of), Orissa, India	c.o. 20.41	83.30	Chiriatapu, Andaman Islands, India	appr. 11.40 92.50
Bombay, Maharashtra, India	18.56	72.51	Chiro, Himachal Pradesh, India	appr. 32.40 77.10
Bombdi La, Assam, India	27.18	92.22	Chisapani, Nepal	28.38 81.17
Bonaigarh (district of), Orissa, India	c.o. 21.47	85.02	Chitral, NWFP, Pakistan	35.50 71.47

Chitti Dil, Punjab, Pakistan	not located		
Choka, Sikkim, India	appr.	27.30	88.20
Chumbi, Tibet		27.28	89.00
Chunabhatti, West Bengal, India		26.30	88.50
Chunar, Uttar Pradesh, India		25.08	82.54
Chungtung, Sikkim, India		27.38	88.35
Churpurni, West Bengal, India	not located		
Chota Nagpur, M. Pradesh/Bihar, India	c.o.	23.12	84.14
Cochin, Kerala, India		09.56	76.15
Coimbatore, Tamil Nadu, India		11.02	76.59
Colombo, Western Province, Sri Lanka		06.55	79.52
Colva, Goa, India		15.50	73.57
Coonoor, Tamil Nadu, India		11.21	76.46
Coromandal, Karnataka, India	c.o.	11.43	79.46
Cotengady, Tamil Nadu, India	appr.	10.47	76.43
Cottayam, east of Cochin, India	not located		
Cox's Bazar, Bangladesh		21.25	90.20
Cuddapah, Andhra Pradesh, India		14.30	78.50
Cumbum, Andhra Pradesh, India		15.36	79.07
Cumbum, Tamil Nadu, India		09.44	77.19
Cuttack, Orissa, India		20.26	85.56
Cuttack (district of), Orissa, India	c.o.	20.26	85.56
Dacca, Bangladesh		23.42	90.22
Dadra, Rajasthan, India	not located		
Dadu, Sind, India		26.44	67.47
Daitari, Orissa, India	appr.	20.50	86.25
Dalhousie, Himachal Pradesh, India		32.32	76.01
Dalkeith, Western Province, Sri Lanka	appr.	06.33	80.09
Daltonganj, Bihar, India		24.02	84.07
Dalu, Myanmar	appr.	26.20	96.10
Dambulla, Central Province, Sri Lanka		07.51	80.40
Dammeria, Uva Province, Sri Lanka	appr.	06.57	81.09
Damoh, Madhya Pradesh, India		23.50	79.30
Dandeli, Karnataka, India		15.18	74.45
Dang-Deokhuri District, Nepal	c.o.	28.09	82.17
Dano Kharka, Nepal	not located		
Danta, Gujarat, India		24.13	72.50
Daragiri, Meghalaya, India	appr.	25.30	90.20
Darakhuti, Dang Deokhuri, Nepal	not located		
Darangar, Assam, India	not located		
Darbhangha, Bihar, India	c.o.	26.10	85.54
Dari-i-Nur, Afghanistan	appr.	34.45	70.30
Darjeeling, West Bengal, India		27.02	88.20
Darrang District, Assam, India	c.o.	27.40	92.55
Darrang, Kamrup, Assam, India	appr.	26.50	91.30
Darunta Hills, Afghanistan	appr.	34.32	70.20
Darzi Chach, Baluchistan, Pakistan		29.41	65.37
Daultabad, Maharashtra, India		19.57	75.18
Dawe, Myanmar	appr.	17.55	96.40
Deesa, Gujarat, India		24.14	72.13
Dehiwala, Western Province, Sri Lanka	appr.	06.52	79.52
Dehra Dun, Uttar Pradesh, India		30.19	78.03
Dela, Uttar Pradesh, India	appr.	28.58	79.07
Delhi, Uttar Pradesh, India		28.40	77.14
Dening, Arunachal Pradesh, India		28.00	96.17
Deogad, Gujarat, India	appr.	21.22	73.25
Deori, Uttar Pradesh, India	appr.	29.36	79.40
Deosari Range Forest, U. Pradesh, India	appr.	30.00	79.33
Devikop, Karnataka, India	appr.	15.12	75.05
Dhakuri, Uttar Pradesh, India	appr.	30.00	79.56
Dhain, Madhya Pradesh, India	appr.	22.29	78.14
Dhanbad, Bihar, India		23.47	86.32
Dharamsala, Himachal Pradesh, India		32.14	76.24
Dharchula, Pithoragarh Distr., U.P., India	appr.	29.02	80.42
Dharkuri, Uttar Pradesh, India	appr.	30.00	79.56
Dharmapuri, Tamil Nadu, India		12.11	78.07
Dharwar, Karnataka, India		15.30	75.04
Dhaulagiri, Nepal		28.39	83.28
Dhauli, Orissa, India	appr.	19.51	85.16
Dhenkanal (district of), Orissa, India	c.o.	20.40	85.39
Dhrangadhra, Gujarat, India		22.59	71.32
Dhulia, Maharashtra, India		20.52	74.50
Dibong River, Sadiya, Assam, India	c.o.	28.00	95.38
Dickoya, Central Province, Sri Lanka		06.52	80.36
Digboi, Assam, India		27.22	95.34
Diguvametta, Andhra Pradesh, India	not located		
Dikoya, Central Province, Sri Lanka		06.52	80.36
Dilaram, Afghanistan		32.11	63.27
Dimbulla, Central Province, Sri Lanka		07.51	80.40
Dir, NWFP, Pakistan		35.12	71.52
Dirangmukh, (Cachar), Assam, India	not located		
Dreyi, Arunachal Pradesh, India	appr.	28.00	96.17
Doab, Uttar Pradesh, India	not located		
Dogalbita, Uttar Pradesh, India		30.22	79.19
Doom, Lakhimpur, Assam, India		27.14	94.07
Doom Dooma, Assam, India		27.33	95.33
Dugada, Nainti Tal District, U.P., India	not located		
Dulegounda, Nepal		27.45	84.29
Dummer, Pithoragarh District, U.P., India	not located		
Dunga Gali, Punjab, Pakistan		34.03	73.22
Dungarpur, Rajasthan, India		23.53	73.48
Dura Bandar, Meghalaya, India	appr.	25.32	90.14
Dwali, Uttar Pradesh, India	appr.	29.36	79.40
East Ghara Hills (distr.), Meghalaya, India	c.o.	25.37	90.29
East Khasi Hills (distr.), Meghalaya, India	c.o.	25.20	91.55
Elahera, Central Province, India		07.44	80.47
Elephanta, Maharashtra, India		18.54	72.58
Elephant Pass, Northern Province, Sri Lanka		09.30	80.25
Elkaduwa, Central Province, Sri Lanka	appr.	07.17	80.42
Ellora, Maharashtra, India		20.04	75.15
Ernakulum, Kerala, India		10.00	76.16
Ethipotla Fall, Andhra Pradesh, India	appr.	16.35	79.17
Faizabad, Afghanistan		37.05	70.40
Falta, West Bengal, India		22.18	88.08
Farah, Afghanistan		32.23	62.08
Farrukhabad, Uttar Pradesh, India		27.23	79.35
Fata Talab, Gujarat, India	appr.	21.40	73.02
Fatehpur, Haldwani, Uttar Pradesh, India	appr.	29.13	79.25
Fatehpur Sikri, Uttar Pradesh, India		27.06	77.39
Ferozepore, Punjab, India		30.55	74.38
Firindjal, Afghanistan	appr.	35.00	68.29
Forest of Habitan, Nepal	c.o.	27.42	85.12
Fort Frederick, Eastern Province, Sri Lanka		08.34	81.13
Fort Sandeman, Pakistan		31.21	69.28
Gadag, Karnataka, India		15.26	75.42
Gagaron Ka Kila, Jhalawar Pr, Rajasthan, India	not located		
Gairibas, West Bengal, India	appr.	27.02	88.15
Gajhundi, Hazaribagh Distr., Bihar, India	not located		
Galaha, Central Province, Sri Lanka		07.12	80.40
Galapitakande, Uva Province, Sri Lanka	not located		
Galapitigala, Northern Province, Sri Lanka	appr.	08.02	80.45
Galkulama, North Central Province, Sri Lanka		08.16	80.31
Galle, Southern Province, Sri Lanka		06.01	80.13
Gambat, Sind, Pakistan		27.19	68.32
Gammaduwa, Central Province, Sri Lanka		07.32	80.41
Gampaha, Uva Province, Sri Lanka	not located		
Gan Island, Addu Atoll, Maldives		00.18S	73.32
Gandigram, Madhya Pradesh, India	appr.	23.10	79.59
Ganespur, West Bengal, India	not located		
Ganganagar, Tripura, India		23.45	91.50
Ganganager, Rajasthan, India		29.54	73.56
Ganglakha, Bhutan	appr.	27.20	89.20
Gangodawila, Western Province, Sri Lanka	not located		
Gangtok, Sikkim, India		27.20	88.39

Ganjam (district of), Orissa, India.....	c.o.....	19.28	85.05	Hanumanhalli, Karnataka, India.....		13.09	78.07
Gari, Nepal.....	not located			Hanwella, Western Province, Sri Lanka.....		06.54	80.05
Garjee, Tripura, India.....		23.25	91.27	Haora (districts of), West Bengal, India.....	not located		
Garo Hills, Meghalaya, India.....	c.o.....	25.32	90.15	Haputale, Uva Province, Sri Lanka.....		06.46	80.58
Garudeshwar, Gujarat, India.....	appr.....	21.40	73.02	Harisankar, Orissa, India.....	appr.....	20.42	83.30
Gauhati, Assam, India.....		26.10	91.45	Hasimara, West Bengal, India.....	appr.....	26.52	89.48
Gaya, Bihar, India.....		24.48	85.00	Hathiban, Nepal.....	not located		
Gazipur, Uttar Pradesh, India.....	not located			Hathikhali, (Cachar), Assam, India.....	not located		
Gedu, Bhutan.....	appr.....	27.30	89.30	Hawsbhavi, Karnataka, India.....	appr.....	14.38	75.22
Genji, Rajasthan, India.....		23.42	73.46	Hazaria, Nepal.....	appr.....	26.51	85.20
Gersoppa, Karnataka, India.....		14.12	74.42	Hazaribagh (district), Bihar, India.....	c.o.....	24.00	85.23
Gharial, Punjab, Pakistan.....		33.55	73.27	Helwak, Maharashtra, India.....		17.23	73.47
Gharo, Sind, Pakistan.....		24.44	67.36	Herat, Afghanistan.....		34.20	62.10
Gharo Hills, Meghalaya, India.....	c.o.....	25.29	90.19	Heratara, Addu Atoll, Maldives.....	not located		
Ghatigaon, Madhya Pradesh, India.....		26.03	77.56	High Wavy Mountains, Tamil Nadu, India.....	c.o.....	09.50	77.26
Ghatmatha, Maharashtra, India.....	appr.....	17.43	73.42	Himatnagar, Gujarat, India.....		23.38	73.02
Ghazni, Afghanistan.....		33.33	68.28	Hissar, Punjab, India.....		29.10	75.45
Ghodasgaum, Maharashtra, India.....	appr.....	20.48	75.45	Hisweht, Myanmar.....	appr.....	23.42	94.29
Gholam, Sind, Pakistan.....		24.06	67.48	Hkamti, Myanmar.....	appr.....	26.01	95.45
Ghorepani, Nepal.....	appr.....	28.22	83.35	Homalin, Myanmar.....		24.55	95.01
Ghum, West Bengal, India.....	appr.....	27.02	88.20	Honawar, Karnataka, India.....		14.19	74.27
Gilgit, Northern Areas, Pakistan.....		35.54	74.20	Honkan, Karnataka, India.....	appr.....	14.30	75.10
Girgaon, Pithoragarh District, UP, India.....	not located			Hoogly District, West Bengal, India.....	c.o.....	22.50	88.00
Giridih, Bihar, India.....		24.10	86.20	Horana, Western Province, Sri Lanka.....		06.42	80.04
Glahpur, Punjab, India.....	not located			Horton Plains, Uva Province, Sri Lanka.....	appr.....	06.50	80.47
Goalpara, West Bengal, India.....		26.10	90.38	Hosama, Western Province, Sri Lanka.....	not located		
Godavari, Nepal.....		27.34	85.24	Hoshab, Baluchistan, India.....		26.01	63.55
Godigomuwa, Western Prov., Sri Lanka.....	appr.....	07.16	79.59	Hoshangabad, Madhya Pradesh, India.....		22.44	77.45
Gokarna, Karnataka, India.....		14.34	74.21	Hoshiapur, Punjab, Pakistan.....		31.30	75.59
Gokteik, North Shan State, Myanmar.....	appr.....	22.38	97.24	Hsipaw, Myanmar.....		22.38	97.22
Golaghat, Assam, India.....		26.30	93.59	Htingnan, Myanmar.....		26.36	97.53
Gonapola, Western Province, Sri Lanka.....	appr.....	06.45	80.01	Hubli, Karnataka, India.....		15.20	75.12
Goomti, West Bengal, India.....	not located			Hugel, Arunachal Pradesh, India.....	not located		
Goonati, West Bengal, India.....	not located			Hugli (district of), West Bengal, India.....	c.o.....	22.52	88.21
Gopaldhara, West Bengal, India.....	appr.....	26.59	88.17	Hulekal, Karnataka, India.....		14.42	74.46
Gopalganj, Bihar, India.....		26.28	84.26	Hululay Island, Male Atoll, Maldives.....		04.00	73.28
Gopalpur, Himachal Pradesh, India.....	appr.....	32.04	76.16	Hyderabad, Sind, Pakistan.....		25.24	68.22
Gopalpur, Orissa, India.....		19.20	85.00	Ilam District, Nepal.....		27.01	87.59
Gorkha, Nepal.....		28.01	84.37	Imphal, Manipur, India.....		24.47	93.55
Gosaba, West Bengal, India.....	appr.....	22.10	88.49	Inanpur, Bihar, India.....	not located		
Great Nicobar, India.....	c.o.....	07.00	93.45	Inginiyagala, Eastern Province, Sri Lanka.....		07.16	81.30
Guerechk, Afghanistan.....		31.50	64.35	Interview Island, Andaman Islands, India.....	c.o.....	12.57	92.35
Gujrat, Punjab, Pakistan.....		32.34	74.04	Iril Valley, Nagaland, India.....	not located		
Guliyo, Gopeshwar, Chamoli Dist., U.P., India.....	not located			Islamabad, Jammu & Kashmir, India.....		33.44	75.11
Guna, Madhya Pradesh, India.....		24.40	77.19	Islamabad, Pakistan.....		33.38	73.02
Gunjong, Assam, India.....	appr.....	25.01	92.45	Ismael Khel, Afghanistan.....	appr.....	33.20	69.10
Gupis Valley, Northern Areas, Pakistan.....	appr.....	36.13	73.27	Jabalpur, Madhya Pradesh, India.....		23.10	79.59
Gurdaspur, Punjab, India.....		32.04	75.28	Jacobabad, Sind, Pakistan.....		28.17	68.26
Gurudeshwar, Gujarat, India.....	appr.....	21.40	73.02	Jaintia Hills (distr.), Meghalaya, India.....	c.o.....	25.26	93.14
Gurup, Bihar, India.....	c.o.....	23.15	87.52	Jaintiapur, Bangladesh.....		25.06	92.08
Guwarghat, Madhya Pradesh, India.....	appr.....	23.09	79.58	Jaipur, Rajasthan, India.....		26.53	75.50
Gwaldam, Uttar Pradesh, India.....	appr.....	30.04	79.33	Jaisalmer, Rajasthan, India.....		26.52	70.55
Gwalior, Madhya Pradesh, India.....		26.12	78.09	Jalalabad, Afghanistan.....		34.26	70.25
Gwari, Madhya Pradesh, India.....	appr.....	23.09	79.52	Jalchatra, Bangladesh.....		24.38	90.04
Habiganj, Bangladesh.....		24.22	91.25	Jalpaiguri, West Bengal, India.....		26.30	88.50
Hadda, Afghanistan.....	not located			Jalpaiguri (district of), West Bengal, India.....	c.o.....	26.30	88.50
Haddunmati Atoll, Maldives.....	appr.....	01.45	73.28	Jamankua, Gujarat, India.....	appr.....	21.28	73.22
Hai Bum, Myanmar.....	appr.....	26.02	95.52	Jammu, Jammu & Kashmir, India.....		32.43	74.54
Hakgalla, Central Province, Sri Lanka.....		06.55	80.48	Japa, Nepal.....	not located		
Haldibari, West Bengal, India.....		26.19	88.53	Jarain, (Jaintia Hills), Meghalaya, India.....	not located		
Haldwani, Uttar Pradesh, India.....		29.13	79.29	Jashpur, Madhya Pradesh, India.....	appr.....	21.16	81.42
Halepalya Village, Karnataka, India.....	not located			Jatti, Sind, Pakistan.....		24.22	68.17
Haleri, Karnataka, India.....	appr.....	12.31	75.40	Jellopur, Karnataka, India.....	appr.....	15.00	74.45
Hambantota, Southern Province, Sri Lanka.....		06.07	81.07	Jeluk, Sikkim, India.....	not located		
Hampi, Karnataka, India.....		15.20	76.25	Jeripane, Uttar Pradesh, India.....	appr.....	30.26	78.04
Hangal, Karnataka, India.....		14.49	75.14	Jerna, Uttar Pradesh, India.....	appr.....	28.45	79.07
Hansi, Punjab, India.....		29.06	76.01	Jeypore (= Jaipur), Orissa, India.....	appr.....	18.48	82.41

Jhajjar Kotli, Jammu & Kashmir, India.....	appr.	32.55	75.54	Karsiyang, West Bengal, India.....	26.53	88.20
Jhalara-Patan, Rajasthan, India.....	appr.	24.35	76.12	Kasakola, Karnataka, India.....	appr.	12.12 76.37
Jhalawar, Rajasthan, India.....		24.32	76.12	Kasauli, Punjab, India.....		30.54 76.57
Jharsiguda, Orissa, India.....		21.56	84.04	Kashmir Valley, Jammu & Kashmir, India.c.o.....		34.12 74.25
Jhelum, Punjab, Pakistan.....		32.57	73.44	Kashmor, Sind, Pakistan.....		28.25 69.35
Jhunjhunu, Rajasthan, India.....		28.05	75.30	Kasipur, Orissa, India.....	appr.	19.02 82.46
Jiribam (district), Manipur, India.....		not located		Kataithbara, Uttar Pradesh, India.....	appr.	29.50 79.46
Jodhpur, Rajasthan, India.....		26.18	73.08	Katanga, Madhya Pradesh, India.....		not located
Jog Falls, Karnataka, India.....		14.12	74.41	Katangi, Madhya Pradesh, India.....	appr.	23.26 79.52
Jogeshwari, Maharashtra, India.....		19.12	72.58	Katar, Afghanistan.....		not located
Jomson, Nepal.....	appr.	28.49	83.42	Katarmal, Uttar Pradesh, India.....	appr.	29.36 79.40
Joshipur, Orissa, India.....	c.o.....	22.01	86.21	Katchal Island, Nicobar Islands, India.....	c.o.....	07.58 93.20
Jowai, Meghalaya, India.....		25.26	92.14	Kathmandu, Nepal.....		27.42 85.12
Jumla, Nepal.....		29.18	82.11	Kathmandu Valley, Nepal.....	c.o.....	27.42 85.12
Junagadh, Gujarat, India.....		21.31	70.28	Katihar, Bihar, India.....	c.o.....	25.33 87.34
Junction of Nubra & Shyok Rivers, J & K, India.....		34.30	77.30	Kaukaung, Myanmar.....	appr.	25.22 95.19
Junction of Razhai & Sichk rivers, Bal., Pakistan.....		28.34	65.26	Kawya, 160 mi. n. of Kindat, Myanmar.....		not located
Junnar, Maharashtra, India.....		19.15	73.58	Kayouk-Myoung, Myanmar.....		22.36 95.55
Kabaw Valley, Myanmar.....	c.o.....	24.00	94.15	Kaziranga Reserve, Assam, India.....	c.o.....	26.37 93.18
Kabul, Afghanistan.....		34.30	69.10	Keela Kuyil Kudu, Tamil Nadu, India.....	appr.	09.52 78.09
Kadakola, Karnataka, India.....	appr.	12.18	76.37	Keelarakulamaraman, 56 mi. s-w of Madurai, India.....		not located
Kaduganava, Central Province, Sri Lanka.....		07.15	80.32	Keonjah (district of), Orissa, India.....	c.o.....	22.01 86.21
Kaghan Valley, NWFP, Pakistan.....		34.47	73.32	Kerabari, Nepal.....		not located
Kajihitu, Myanmar.....		26.18	97.50	Keshod, Gujarat, India.....	appr.	21.17 71.32
Kakani, Nepal.....	appr.	27.56	85.11	Khagan Valley, NWFP, Pakistan.....	c.o.....	34.47 73.32
Kakdwip, West Bengal, India.....		not located		Khairpur Nathan Shah, Sind, Pakistan.....		27.06 68.44
Kala Bnot, Afghanistan.....		not located		Khajurao, Madhya Pradesh, India.....		24.52 79.55
Kaladungi, Uttar Pradesh, India.....	appr.	29.13	79.29	Khalaktang, Arunachal Pradesh, India.....	appr.	27.30 92.21
Kalahandi (district of), Orissa, India.....	c.o.....	19.57	83.10	Khamaria, Uttar Pradesh, India.....	appr.	27.40 79.32
Kala-e-Safad, Afghanistan.....		not located		Khanchanpur, Tripura, India.....		23.55 92.12
Kala-i-Shahi, Afghanistan.....	appr.	34.30	70.40	Khandagiri, Orissa, India.....		20.20 85.50
Kala Oya, North Western Province, Sri Lanka.....		08.12	80.04	Khandala, Maharashtra, India.....		18.45 73.25
Kala Wewa, North Central Province, Sri Lanka.....		08.00	80.34	Khandwar, Madhya Pradesh, India.....		21.49 76.23
Kalat, Baluchistan, Pakistan.....		29.02	66.34	Khanewal, Punjab, Pakistan.....		30.18 71.56
Kalat-us-Seraj, Afghanistan.....		34.40	70.18	Khapa, (Hoshangabad), Madhya Pradesh, India.....		not located
Kaliani, Assam, India.....		not located		Kharan, Baluchistan, Pakistan.....		28.34 65.26
Kalimpong, West Bengal, India.....		27.02	88.34	Kharjan, Assam, India.....		not located
Kalli, Kerala, India.....		not located		Khasi Hills, Meghalaya, India.....	c.o.....	25.34 91.53
Kalpitiya, North Western Province, Sri Lanka.....		07.27	80.03	Khati, Uttar Pradesh, India.....	appr.	30.04 79.55
Kalutara, Western Province, Sri Lanka.....		06.35	79.59	Khed, Maharashtra, India.....		17.44 73.25
Kalyan, Maharashtra, India.....		19.17	73.11	Kherapera, Meghalaya, India.....	appr.	25.28 90.13
Kamdes, Afghanistan.....		35.25	71.26	Kherkheria, Darrang District, Assam, India.....		not located
Kameng Frontier Division, Assam, India.....	c.o.....	27.15	92.30	Khezabama, Nagaland, India.....	appr.	26.01 94.30
Kamrup, Assam, India.....	c.o.....	26.25	91.30	Khirasara, Gujarat, India.....	appr.	22.18 70.53
Kanavi Katha Bootham, Tamil Nadu, India.....		not located		Khajdar, Baluchistan, Pakistan.....		27.48 66.36
Kanchanpur, Tripura, India.....	appr.	23.50	91.50	Khonshnong, Meghalaya, India.....	appr.	25.30 92.01
Kandahar, Afghanistan.....		31.36	65.47	Khopoli, Maharashtra, India.....	appr.	18.25 73.08
Kandri, Maharashtra, India.....	appr.	21.27	79.24	Khuntimari, West Bengal, India.....		26.31 88.50
Kandy, Central Province, Sri Lanka.....		07.17	80.40	Khyber Pass, Afghanistan.....		34.06 71.05
Kangra, Himachal Pradesh, India.....		32.04	76.16	Kim, Gujarat, India.....	appr.	21.30 73.00
Kanha National Park, M. Pradesh, India.....	appr.	22.35	80.28	Kin, Myanmar.....	appr.	22.45 94.45
Kanheri, Maharashtra, India.....		19.13	72.59	Kindat, Myanmar.....		23.42 94.29
Kankesanturai, Northern Province, Sri Lanka.....		09.48	80.03	Kirthar National Park, Sind, Pakistan.....	appr.	26.30 67.30
Kanniya Kumari, Tamil Nadu, India.....		08.05	77.35	Kirti Mandir, Gujarat, India.....	appr.	22.19 73.14
Kantalai, Eastern Province, Sri Lanka.....		08.22	81.00	Kisi, Myanmar.....	appr.	22.05 95.12
Kantale Tank, Eastern Province, Sri Lanka.....		08.22	81.00	Kitulgala, Sabaragamuwa, Sri Lanka.....		07.00 80.22
Kapkot, Uttar Pradesh, India.....	appr.	29.55	79.54	Koch Bihar, West Bengal, India.....	appr.	26.17 89.40
Kappachchi, Northern Province, Sri Lanka.....	appr.	08.38	80.18	Kochim-kooleh, Manipur, India.....		not located
Karachi, Sind, Pakistan.....		24.51	67.02	Kodai, Karnataka, India.....	appr.	12.54 74.51
Karakar Pass, NWFP, Pakistan.....	appr.	34.26	72.13	Koduru, Andhra Pradesh, India.....	appr.	13.58 79.14
Karapar, Tamil Nadu, India.....	appr.	10.46	76.42	Kohat, Punjab, Pakistan.....		33.34 71.26
Karchat, Sind, Pakistan.....		25.46	67.44	Kohima, Nagaland, India.....	appr.	25.42 94.15
Kardana Coffee Estate, Tamil Nadu, India.....	appr.	09.50	77.27	Koia, Nagaland, India.....	appr.	25.35 94.30
Kardibetta Forest, Karnataka, India.....	appr.	14.08	75.20	Koira, Orissa, India.....	appr.	21.50 85.12
Karen Hills, Myanmar.....	appr.	19.30	97.12	Kokernag, Jammu & Kashmir, India.....		33.41 75.13
Karla, Maharashtra, India.....	appr.	18.48	73.30	Kokoputchi, Eastern Province, Sri Lanka.....		not located
Karnala, Maharashtra, India.....	appr.	18.59	73.28	Kolar, Karnataka, India.....		13.09 78.10

Konarak, Orissa, India.....	19.52	86.12	Lonavla, Maharashtra, India.....	18.45	73.27
Konarha, Afghanistan.....	not located		Long Island, Andaman Islands, India.....	appr.	12.12 92.58
Konarha Provinces, Afghanistan.....	not located		Lopchu, West Bengal, India.....	appr.	27.02 88.19
Kondogorolapenta, Andhra Pradesh, India.....	appr.	13.50 79.00	Loskor, Assam, India.....	appr.	25.10 93.05
Konshnong, Meghalaya, India.....	appr.	25.30 92.01	Lower Dikoya Valley, Central Pr., Sri Lanka.....	06.50	80.36
Kontoum, Nepal.....	not located		Lucknow, Uttar Pradesh, India.....	26.50	80.54
Koraput (district of), Orissa, India.....	c.o.	18.48 82.41	Ludhiana, Punjab, India.....	30.56	75.52
Koslanda, Uva Province, Sri Lanka.....	06.45	81.00	Luia, Bihar, India.....	appr.	22.29 85.15
Kota, Rajasthan, India.....	25.11	75.58	Lunugalla, Uva Province, Sri Lanka.....	07.05	81.13
Kotagarh, Orissa, India.....	appr.	20.30 84.18	Lunwa, Gujarat, India.....	not located	
Kotagiri, Tamil Nadu, India.....	11.21	76.54	Lushai Hills, Mizoram, India.....	c.o.	23.30 93.00
Kotaparah, Orissa, India.....	19.06	82.26	Luskerpore, Bangladesh.....	appr.	24.20 91.30
Kot Diji, Punjab, Pakistan.....	27.21	68.42	Lwarkhet, Uttar Pradesh, India.....	appr.	29.36 79.40
Kotera, near Dharchula, U. P., India.....	appr.	29.02 80.42	Lyallpur, Punjab, Pakistan.....	31.25	73.07
Kotla, Himachal Pradesh, India.....	31.43	77.16	Macherla, Andhra Pradesh, India.....	16.29	79.25
Kozhikode, Kerala, India.....	11.15	75.45	Madan Mahal, Madhya Pradesh, India.....	not located	
Krishnanagar, West Bengal, India.....	23.22	88.32	Madanpur, West Bengal, India.....	c.o.	23.31 88.40
Krishnapur, Karnataka, India.....	appr.	15.20 74.22	Madanpur Rampur, Orissa, India.....	appr.	19.50 83.00
Kuiti, Pithoragarh Distr., U.P., India.....	not located		Madhavoram, Tamil Nadu, India.....	appr.	11.39 78.09
Kulsi, Assam, India.....	appr.	25.50 91.20	Madhopore, Bihar, India.....	26.10	86.23
Kulu, Himachel Pradesh, India.....	31.59	77.06	Madhopur, Rajasthan, India.....	27.26	75.38
Kululai, NWFP, Pakistan.....	35.18	72.35	Madhubani, Bihar, India.....	26.21	86.05
Kumarghat, Tripura, India.....	24.10	92.05	Madhupur, Bangladesh.....	not located	
Kumaon (district), Uttar Pradesh, India.....	c.o.	30.03 79.17	Madola, Sabaragamuwa, Sri Lanka.....	appr.	06.41 79.52
Kumbalgamuwa, Central Prov., Sri Lanka.....	appr.	07.08 80.50	Madras, Tamil Nadu, India.....	13.05	80.18
Kumta, (Golaghat region), Assam, India.....	not located		Madulkele, Central Province, Sri Lanka.....	appr.	07.22 80.42
Kunduz, Afghanistan.....	36.47	68.51	Madurai, Tamil Nadu, India.....	09.55	78.07
Kurnool, Andhra Pradesh, India.....	15.51	78.01	Maerynkueng, Meghalaya, India.....	not located	
Kurseong, West Bengal, India.....	26.54	88.21	Mahaboda, Natugama, Sri Lanka.....	not located	
Kurumbapatti, Tamil Nadu, India.....	not located		Mahableshwar, Maharashtra, India.....	17.56	73.42
Kurunegala, North West Province, Sri Lanka.....	07.28	80.23	Mahanadi, West Bengal, India.....	not located	
Kutta, Karnataka, India.....	appr.	11.55 76.00	Maha Oya, Eastern Province, Sri Lanka.....	07.31	81.22
Kvadjar Largar, Afghanistan.....	not located		Maharagama, Western Prov., Sri Lanka.....	appr.	06.52 79.56
Kyok Myoung, Myanmar.....	22.36	95.55	Mahendra Gupa, Nepal.....	appr.	28.20 83.58
Labugama, Western Province, Sri Lanka.....	appr.	06.55 80.11	Mahendragiri, Orissa, India.....	19.00	84.19
Lachen, Sikkim, India.....	27.46	88.36	Mahtum, Myanmar.....	26.06	97.58
Laching, Sikkim, India.....	27.42	88.48	Mailsi, Punjab, Pakistan.....	29.42	72.12
Lachung, Sikkim, India.....	27.46	88.36	Maimana, Afghanistan.....	35.54	64.43
Laghman, Afghanistan.....	c.o.	34.38 70.18	Makli Hills, Sind, Pakistan.....	24.46	67.57
Lahore, Punjab, Pakistan.....	31.34	74.22	Makut, Nepal.....	28.50	83.25
La-ilad Forest House, Meghalaya, India.....	appr.	25.20 91.55	Malabar Coast, Kerala, India.....	c.o.	10.00 76.15
Laiterai, (Khasi Hills), Meghalaya, India.....	not located		Malad, Maharashtra, India.....	19.13	72.58
Laitkynsao, Assam, India.....	appr.	25.48 91.58	Malakand, North West Frontier Prov., Pakistan.....	34.34	71.57
Lak Bidok, Baluchistan, Pakistan.....	25.12	66.45	Malakondapenta, Andhra Pradesh, India.....	not located	
Lakhimpur (district), Assam, India.....	c.o.	27.20 95.00	Maldah (district of), West Bengal, India.....	not located	
Lalanda, Afghanistan.....	c.o.	34.15 69.04	Male Atoll, Maldives.....	04.00	73.28
Lalru, Haryana, India.....	appr.	30.42 76.48	Malgi, Karnataka, India.....	14.40	75.05
Lamataghat, Madhya Pradesh, India.....	appr.	23.10 79.59	Malir, Sind, Pakistan.....	24.59	67.13
Lamsakhang, (Cachar Distr.), Assam, India.....	not located		Malvan, Maharashtra, India.....	16.05	73.30
Landhi, Sind, Pakistan.....	24.51	67.16	Malwa, Madhya Pradesh, India.....	appr.	23.44 76.01
Langtang, Nepal.....	28.14	85.36	Mamosmai, Meghalaya, India.....	appr.	25.16 91.42
Langting, Assam, India.....	25.28	93.10	Mamsam Falls, Myanmar.....	appr.	22.38 97.26
Lanje, Maharashtra, India.....	not located		Manali, Himachal Pradesh, India.....	32.12	77.06
Las Bela, Baluchistan, Pakistan.....	not located		Manampitiya, North Central Pr, Sri Lanka.....	appr.	07.51 81.07
Lather, Orissa, India.....	not located		Mandalay, Myanmar.....	21.57	96.04
Ledo, Assam, India.....	27.18	95.42	Mandapahar, South Andaman Island, India.....	11.50	92.50
Leh, Jammu & Kashmir, India.....	34.09	77.35	Mandi, Himachal Pradesh, India.....	31.43	76.55
Lehtrar, Punjab, Pakistan.....	33.42	73.26	Mandla, Narbada River, Gujarat, India.....	not located	
Leito, Myanmar.....	appr.	19.20 97.10	Mandra, Gujarat, India.....	appr.	21.16 73.25
Lilam, Johar Valley, Pithoragarh Dist., UP, India.....	not located		Mandu, Madhya Pradesh, India.....	22.22	75.24
Lingasugur, Karnataka, India.....	appr.	15.11 76.54	Mandva, Madhya Pradesh, India.....	appr.	21.30 76.20
Lingtam, Sikkim, India.....	not located		Mandvi, Gujarat, India.....	21.16	73.22
Little Nicobar Island, India.....	c.o.	07.18 93.40	Mangalore, Karnataka, India.....	appr.	12.54 74.51
Loharkhet, Uttar Pradesh, India.....	appr.	29.57 80.00	Mangan, Sikkim, India.....	27.29	88.40
Lohit Valley, Arunachal Pradesh, India.....	c.o.	28.18 97.00	Mangpu, Sikkim, India.....	not located	
Lohogad Fort, Maharashtra, India.....	appr.	19.02 73.40	Manharpur, Bihar, India.....	not located	
Lokra, Assam, India.....	appr.	26.50 92.46	Mankeni, Eastern Province, Sri Lanka.....	08.00	81.28

Mannar, Northern Province, Sri Lanka	08.58	79.54	Mukhi, Madhya Pradesh, India	appr.	21.48	80.16	
Mansar, Maharashtra, India	21.27	79.24	Mulaku atoll, Maldives		02.15	73.28	
Mapalagama, Southern Province, Sri Lanka	06.15	80.16	Mulhalkelle, Central Province, Sri Lanka	appr.	07.06	80.52	
Marala, Punjab, Pakistan	32.40	74.29	Muli, Gujerat, India		22.40	71.34	
Marampur, Assam, India	not located		Multan, Punjab, Pakistan		30.11	71.26	
Marathwada, Maharashtra, India	not located		Mundra, Madhya Pradesh, India	appr.	23.50	78.44	
Margao, Goa, India	15.15	73.59	Munger (district), Bihar, India	c.o.	24.57	86.14	
Margherita, Assam, India	appr.	27.17	95.40	Muroor, Karnataka, India		14.26	74.29
Marradu Island, Addu Atoll, Maldives	not located		Murree, Punjab, Pakistan		33.55	73.26	
Martoli, Uttar Pradesh, India	appr.	30.20	80.14	Murshidabad (dist. of), West Bengal, India	c.o.	24.11	88.19
Marungoor, Kerala/Tamil Nadu, India	not located		Mussoorie, Uttar Pradesh, India		30.26	78.04	
Mastuj Valley, NWFP, Pakistan	appr.	36.15	72.35	Muzaffargarh, Punjab, Pakistan		30.04	71.12
Mastung, Baluchistan, Pakistan	29.48	66.52	Muzaffarpur, Bihar, India		26.07	85.23	
Matale, Central Province, Sri Lanka	07.28	80.37	Muzzaffarabad, Punjab, Pakistan		34.22	73.28	
Matanga River, (North Kamrup), Assam, India	not located		Mylandy, Travancore, Kerala, India	not located			
Matara, Southern Province, Sri Lanka	05.57	80.32	Mysore, Karnataka, India		12.18	76.37	
Matar Nag, Jammu & Kashmir, India	appr.	33.43	75.17	Nabha, Punjab, India		30.22	76.12
Mathur, West Bengal, India	not located		Nadia, West Bengal, India		23.24	88.23	
Matugama, Western Province, Sri Lanka	06.32	80.05	Naga, Jhunjhunu Distr., Rajasthan, India	7.27.75	77.06		
Maungkan, Myanmar	appr.	25.12	95.02	Naga Hills, Nagaland, India	c.o.	26.00	94.30
Mawanela, Western Province, Sri Lanka	07.15	80.26	Nagar Haveli, Rajasthan, India	not located			
Mawphlang, Meghalaya, India	appr.	25.25	92.13	Nagarhole, Karnataka, India	appr.	11.58	76.01
Mawryngkueng, Khasi Hills, Meghalaya, India	not located		Nagarjuna Sagar, Andhra Pradesh India		16.35	79.17	
Maymyo, Myanmar	22.05	96.33	Nagarkanda, West Bengal, India	not located			
Mayurbhanj (district of), Orissa, India	c.o.	21.52	86.48	Nagarcoil, Tamil Nadu, India		08.11	77.30
Mazar-i-Sharif, Afghanistan	36.43	67.05	Nagaur, Rajasthan, India		27.12	73.48	
Medagama, Uva Province, Sri Lanka	07.02	81.17	Nagerjunban, Nepal	appr.	27.46	85.12	
Medamahanuwera, Central Pr., Sri Lanka	appr.	07.16	80.48	Nagoda, Southern Provinces, Sri Lanka	appr.	06.11	80.17
Medinipur (district of), West Bengal, India	c.o.	22.25	87.24	Nagpur, Maharashtra, India		21.10	79.12
Medog Region, Xizang, China,	29.20	95.30	Nagrota, Himachal Pradesh, India		32.03	76.24	
Medu Island, Maldives	not located		Naini Tal, Uttar Pradesh, India		29.22	79.26	
Meerut, Uttar Pradesh, India	29.00	77.42	Nala Pani Cave, Mussoorie, U. P., India	appr.	30.26	78.04	
Mehmabad, Gujarat, India	22.51	72.46	Naibani Salt Lakes, West Bengal, India	appr.	22.35	88.35	
Menoka, Assam, India	not located		Naltar, Northern Areas, Pakistan		36.07	74.14	
Mercara, Karnataka, India	12.29	75.40	Najarkot, Nepal	c.o.	27.42	85.20	
Mettupalayam, Karnataka, India	not located		Nakiadeniya, Southern Prov., Sri Lanka	appr.	06.08	80.20	
Mheskatri, Gujarat, India	appr.	21.10	72.54	Nakki Lake, Mount Abu, Rajasthan, India		24.41	72.50
Mian Mir, Punjab, Pakistan	appr.	31.34	74.22	Namdapha, Arunachal Pradesh, India	c.o.	27.39	96.30
Miao, Arunachal Pradesh, India	appr.	27.39	96.15	Namlang River, Assam, India	not located		
Midnapur, West Bengal, India	22.25	87.24	Nam Tamai Valley, Myanmar		27.42	97.54	
Mikir Hills, Assam, India	c.o.	26.25	93.20	Nam Tisang Valley, Myanmar	not located		
Milam, Uttar Pradesh, India	appr.	30.30	80.12	Namting River, China	not located		
Mingun, Myanmar	22.00	95.58	Namunukula, Uva Province, Sri Lanka		06.55	81.07	
Miranjani, NWFP, Pakistan	34.06	73.25	Nanded, Maharashtra, India		19.11	77.21	
Mirpur, Sind, Pakistan	28.12	68.48	Nangarhar, Afghanistan	appr.	34.30	70.40	
Mirpur Sakro, Sind, Pakistan	24.32	67.38	Nankauri, Nicobar Island, India		07.59	93.22	
Mirzapur, Uttar Pradesh, India	27.41	79.33	Nankowri, Nicobar Island India		07.59	93.22	
Moga, Punjab, India	30.49	75.13	Nanyaseik, Myanmar	appr.	25.32	96.36	
Mogok, Myanmar	22.55	96.29	Narbong, West Bengal, India	appr.	27.04	88.24	
Mohana, Orissa, India	appr.	19.30	84.38	Narcondam Island, Andaman Islands, India		13.29	94.13
Mokokchung, Nagaland, India	appr.	26.20	94.30	Narkota, Uttar Pradesh, India	appr.	30.08	78.48
Molem, Goa, India	15.20	74.15	Narnala, Maharashtra, India		21.16	77.06	
Mondopobae, South Andaman Ids, India	04.50	92.20	Narramale, North Western Prov., Sri Lanka		07.25	80.13	
Monywa, Myanmar	22.05	95.12	Narsingarh, Madhya Pradesh, India		24.00	79.27	
Morar, Madhya Pradesh, India	26.15	78.14	Narsinghpur, Orissa, India		20.28	85.08	
Mornai, (Goalpara), Assam, India	appr.	26.10	90.38	Nasik, Maharashtra, India		20.00	73.52
Moulmai Cave, Afghanistan	not located		Nasirabad, Rajasthan, India		26.16	74.42	
Moulmein, Myanmar	16.30	97.39	Nassenabad, Himalayas	not located			
Mount Abu, Rajasthan, India	24.41	72.50	Nathia Gali, NWFP, Pakistan		34.04	73.24	
Mount Lavinia, Western Province, Sri Lanka	06.50	79.52	Natichigama, Sri Lanka	not located			
Mount Popa, Myanmar	20.56	95.16	Nauabad-Bagrami, Afghanistan	appr.	34.30	69.10	
Mount Sheopuri, Nepal	appr.	27.45	85.45	Naundero, Sind, Pakistan		27.40	68.21
Mousakande, Central Province, Sri Lanka	07.32	80.42	Nawabshah, Sind, Pakistan		26.15	68.26	
Movar, Gwalior, Madhya Pradesh, India	not located		Nawalapitiya, Central Province, Sri Lanka		07.03	80.32	
Mowphlong, Meghalaya, India	25.31	91.31	Nawapur, Gujarat, India	not located			
Muang Loei, Afghanistan	not located		Nazira, Assam, India		26.51	94.42	
Mudavaram, Tamil Nadu, India	appr.	09.00	77.00	Neergam, Uttar Pradesh, India	appr.	30.06	78.16

Negombo, Sabaragamuwa, Sri Lanka.....	07.13	79.51	Parsad, Udaipur District, Rajasthan, India.....	not located	
Nellore, Andhra Pradesh, India.....	14.27	80.01	Parwan Province, Afghanistan.....	c.o.	35.00 68.30
Nemla, Afghanistan appr.....	34.20	70.16	Pashok, West Bengal, India.....		27.04 88.24
New Delhi, Delhi, India.....	28.37	77.13	Passara, Uva Province, Sri Lanka.....		06.58 81.09
Nilandu South, Maldives.....	appr.	02.15 73.18	Patal, Gujarat, India.....	appr.	21.24 73.16
Nilgiri Hills, Tamil Nadu/Kerala, India.....	c.o.	11.28 76.42	Patan, Maharashtra, India.....		17.24 73.57
Niligiri, Orissa, India.....		21.29 86.49	Patna, Bihar, India.....		25.37 85.12
Nimar, Madhya Pradesh, India.....		21.30 76.20	Patni Top, Jammu & Kashmir, India.....	appr.	32.55 75.07
Nimbong, West Bengal, India.....	appr.	27.04 88.25	Pattadkal, Karnataka, India.....	appr.	16.00 75.47
Nimiaghat, Bihar, India.....	appr.	23.56 86.07	Pattibhagan, Nepal.....		27.48 85.15
Ningma, Myanmar.....		26.36 97.45	Paumgaum, North Shan State, Myanmar.....	not located	
Nishangara, Uttar Pradesh, India.....	not located		Pauri, Uttar Pradesh, India.....		30.08 78.48
Nisneer, Karnataka, India.....		14.12 74.33	Pedong, West Bengal, India.....	appr.	27.02 88.20
Nitre Cave, Central Province, Sri Lanka.....	appr.	07.20 80.47	Pegu, Myanmar.....		17.18 96.31
Noitchigama, Sri Lanka.....	not located		Pelmadulla, Sabaragamuwa, Sri Lanka.....		06.38 80.33
Nokania, Gujarat, India.....	not located		Pelong, Sikkim, India.....	appr.	27.20 88.39
Nongpoh, Meghalaya, India.....	appr.	25.34 91.53	Pendritton, Jammu & Kashmir, India.....	appr.	34.08 74.53
Nongprieng, (Khasi Hills), Meghalaya, India.....	not located		Peradeniya, Central Province, Sri Lanka.....		07.15 80.40
North Andaman Island, Andaman Id, India c.o.....	13.24	92.52	Perumal, Tamil Nadu, India.....	appr.	10.18 77.31
North Central Andaman Island, India.....	c.o.	13.10 92.58	Peshawar, Salt Range, Pakistan.....		34.01 71.33
North Male Atoll, Maldives.....	appr.	04.10 73.28	Petlad, Gujarat, India.....		22.29 72.48
North 24-Parganas distr., West Bengal, India.....	not located		Phaloda, Rajasthan, India.....		27.06 72.22
Nowakot District, Nepal.....	c.o.	27.56 85.11	Phawzaw, Myanmar.....	not located	
Num, Nepal.....		27.33 87.17	Philibhit, Uttar Pradesh, India.....		28.37 79.48
Nurgul, Afghanistan.....	not located		Phonda, Maharashtra, India.....	not located	
Nushki, Baluchistan, Pakistan.....		29.33 66.02	Phulbani (district of), Orissa, India.....	c.o.	20.30 84.18
Nusserabad, India.....	not located		Phulbari, Meghalaya, India.....	appr.	25.55 90.03
Nuwakot, Nepal.....		28.09 83.52	Phuntsholing, Bhutan.....	appr.	26.52 89.30
Nuwara Eliya, Central Province, Sri Lanka.....		06.58 80.46	Phurkia, Uttar Pradesh, India.....		30.12 80.03
Ohiya, Uva Province, Sri Lanka.....	appr.	06.50 80.50	Pialeh Cave, Laghman Prov., Afghanistan.....	appr.	34.40 70.30
Orcha, Madhya Pradesh, India.....		25.21 78.38	Pilibhit, Uttar Pradesh, India.....		28.37 79.48
Orong, Car Nicobar, India.....	not located		Pilikutthuwa, Western Province, Sri Lanka.....		07.06 80.00
Osmanabad, Maharashtra, India.....		18.09 76.06	Pili Sipna Valley, Maharashtra, India.....	appr.	21.44 77.12
Ouda, Madhya Pradesh, India.....	appr.	21.48 80.16	Pind Dadan Khan, Punjab, Pakistan.....		32.36 72.57
Pabna District, Bangladesh.....		24.09 89.04	Pishin, Baluchistan, Pakistan.....		30.39 67.00
Padma, Bihar, India.....	appr.	24.12 85.00	Pitabeddera, Southern Province, Sri Lanka.....	appr.	06.11 80.28
Pagan, Myanmar.....		21.07 94.53	Pitakele, Sabaragamuwa, Sri Lanka.....	appr.	06.24 80.34
Pagoda, Sabaragamuwa, Sri Lanka.....	appr.	06.44 80.26	Pithoragarh, Uttar Pradesh, India.....	c.o.	29.35 80.12
Pahlgam, Jammu & Kashmir, India.....		34.01 75.25	Pithoro, Sind, Pakistan.....		25.32 68.21
Paiheirgala, Sabaragamuwa, Sri Lanka.....	not located		Pittalkora, Maharashtra, India.....		20.19 75.10
Paikla, Mizoram, India.....	appr.	23.30 93.00	Poinguinam, Goa, India.....		15.00 74.00
Paiyagala, Western Province, Sri Lanka.....	appr.	06.33 79.59	Point Calimere, Tamil Nadu, India.....		10.17 79.52
Pakhal, Maharashtra, India.....	not located		Pokhara, Nepal.....		28.14 83.58
Pakiyangala, Western Province, Sri Lanka.....		06.38 80.10	Polahari, south Kamrup, Assam, India.....	appr.	26.10 91.20
Palamau, Bihar, India.....		23.53 84.17	Polonnaruwa, North Central Province, Sri Lanka.....		07.56 81.02
Palanpur, Gujarat, India.....		24.12 72.29	Pompour, Jammu & Kashmir, India.....	not located	
Palasbari, Assam, India.....		26.07 91.30	Pondicherry, Tamil Nadu, India.....		11.59 79.50
Palghat, Kerala, India.....		10.46 76.42	Poona, Maharashtra, India.....		18.34 73.58
Pali, Rajasthan, India.....		25.46 73.26	Poonch Valley, Jammu & Kashmir, India.....	appr.	32.43 74.54
Palkonda Hills, Andhra Pradesh, India.....	c.o.	13.50 79.00	Port Blair, Andaman Islands, India.....		11.40 92.44
Pallama, Central Province, Sri Lanka.....		07.32 80.39	Potoli, Karnataka, India.....	appr.	15.09 74.44
Palmajua, West Bengal, India.....	not located		Powai, Assam, India.....	not located	
Palni Hills, Tamil Nadu, India.....	c.o.	10.18 77.31	Powai Lake, Maharashtra, India.....	not located	
Panichikankeni, Eastern Province, Sri Lanka.....		08.04 81.27	Pratabgarh, Uttar Pradesh, India.....		25.34 81.59
Panchgani, Maharashtra, India.....	appr.	17.56 73.49	Prome, Myanmar.....		18.50 95.14
Panchmarhi, Madhya Pradesh, India.....		22.29 78.26	Pulchowki, Nepal.....	appr.	27.42 85.12
Pandrittan, Jammu & Kashmir, India.....	appr.	34.08 74.53	Punch, Jammu & Kashmir, India.....		33.46 74.08
Pangaon, Myanmar.....	not located		Pundaluoya, Central Province, Sri Lanka.....	appr.	07.01 80.43
Pangti, Naga Hills, Nagaland, India.....		26.16 94.20	Pundurhak, Kashmir Valley, J & K, India.....	not located	
Panjgur, Baluchistan, Pakistan.....		26.56 64.06	Purba Gomdandi, Bangladesh.....		22.23 91.55
Panjurmane, central Bhutan, India.....	appr.	27.10 90.30	Puri (district of), Orissa, India.....	c.o.	19.50 85.15
Pannian Malai, Tamil Nadu, India.....	appr.	09.55 78.02	Purnea, Bihar, India.....		25.47 87.28
Papoda, Sabaragamuwa, Sri Lanka.....		06.44 80.26	Puruliya (district of), West Bengal, India.....	c.o.	23.20 86.24
Parasia, Madhya Pradesh, India.....		22.11 78.50	Puttahaut, West Bengal, India.....	not located	
Parchung, Nepal.....	appr.	28.01 85.12	Puttur, Karnataka, India.....		12.45 75.11
Pareli, Maharashtra, India.....	appr.	19.14 73.02	Pyauंगाung, Myanmar.....	appr.	22.38 97.22
Parmadan, West Bengal, India.....		23.13 88.43	Qala Bist, Afghanistan.....		31.28 64.21

Qalat, Afghanistan.....	32.05	66.53	Salurdam, Orissa, India.....	not located
Quetta, Baluchistan, Pakistan.....	28.14	66.56	Samangan, Iran.....	35.30 60.14
Qutabpur, Baluchistan, Pakistan.....	29.54	71.47	Samarakella, Sri Lanka.....	not located
Rachel Seminary, Goa, India.....	appr. 15.50	73.59	Samasgi, Karnataka, India.....	appr. 14.40 75.10
Raipur, Madhya Pradesh, India.....	21.16	81.42	Samastipur, Bihar, India.....	25.52 85.47
Rajagivilena, North Central Province, Sri Lanka.....	08.21	80.30	Samaya Malai, Tamil Nadu, India.....	appr. 09.55 78.07
Rajanpur, Punjab, Pakistan.....	29.06	70.17	Samayala, Himachal Pradesh, India.....	appr. 32.04 76.16
Rajapara, Assam, India.....	appr. 26.30	92.00	Sambalpur (district of), Orissa, India.....	c.o. 21.28 84.04
Rajapur, Maharashtra, India.....	16.38	73.32	Samooogooting, Nagaland, India.....	appr. 25.45 93.45
Rajbar, Baluchistan, Pakistan.....	appr. 29.02	66.34	Samotch-e-Nayak, Afghanistan.....	not located
Rajkot, Gujarat, India.....	22.18	70.56	Sanapahar, Meghalaya, India.....	not located
Rajmahal, Gujarat, India.....	appr. 22.19	73.15	Sanchi, Madhya Pradesh, India.....	23.28 77.42
Rajpipla, Gujarat, India.....	21.49	73.36	Sangajata, Bihar, India.....	appr. 22.31 85.50
Ramanathapuram, Tamil Nadu, India.....	09.23	78.53	Sangameshwar, Maharashtra, India.....	17.10 73.30
Rambon, Jammu & Kashmir, India.....	33.15	75.18	Sangao, Mizoram, India.....	appr. 23.30 93.00
Ramechhap, Nepal.....	27.19	86.05	Sanghoi, Punjab, Pakistan.....	appr. 32.30 72.30
Ramgad, Taluka, Malain, Maharashtra, India.....	not located		Sangser, West Bengal, India.....	appr. 27.04 88.30
Ramnagar, Uttar Pradesh, India.....	29.23	79.07	Sankhuwasabha, (Arun River), Nepal.....	appr. 27.33 87.17
Ranchi, Bihar, India.....	23.22	85.20	Santal Pargana, Bihar, India.....	c.o. 24.17 87.15
Rangapari, (Garo Hills), Meghalaya, India.....	not located		Saran, Bihar, India.....	24.29 86.19
Rangoon, Myanmar.....	16.47	96.10	Sarban-Qala, Afghanistan.....	not located
Ranibagh, Uttar Pradesh, India.....	appr. 29.22	79.26	Sardallu, Kashmir Valley, J. & K., India.....	not located
Ranigunj, West Bengal, India.....	25.56	87.58	Sarobi, Afghanistan.....	appr. 34.40 69.46
Ranna, Southern Province, Sri Lanka.....	06.05	80.52	Sarshahi, Afghanistan.....	appr. 34.20 70.26
Ranthambore, Rajasthan, India.....	26.04	76.32	Sasan, Gujarat, India.....	21.00 70.40
Rara Lake, Nepal.....	29.34	82.05	Sasaram, Bihar, India.....	24.58 84.01
Ratanadi, Himachal Pradesh, India.....	appr. 31.14	77.33	Satara, Maharashtra, India.....	17.43 74.05
Ratangarh, Rajasthan, India.....	28.02	74.39	Satpara Village, Lake Chilka, Orissa India.....	appr. 19.50 85.30
Ratnagiri, Maharashtra, India.....	17.00	73.20	Satyanarayan, Uttar Pradesh, India.....	not located
Rattoo, Gilgit, Northern Areas, Pakistan.....	appr. 35.55	74.20	Savantvadi, Maharashtra, India.....	15.55 73.52
Rattota, Central Province, Sri Lanka.....	07.31	80.41	Savar Farm, Bangladesh.....	23.53 90.17
Rawalpindi, Punjab, Pakistan.....	33.36	73.03	Sawai Madhopur, Rajasthan, India.....	26.00 76.28
Raxaul-Birganj, India/Nepal.....	27.00	84.57	Secunderabad, Andhra Pradesh, India.....	17.27 78.27
Raysen, Maharashtra, India.....	not located		Sedonchen, Sikkim, India.....	appr. 27.15 88.48
Renala Khurd, Punjab, Pakistan.....	30.53	73.34	Seelayampatti, Madurai District, T. N., India.....	not located
Richhai, Madhya Pradesh, India.....	appr. 23.10	79.59	Se'en, N. Shan State, Myanmar.....	not located
Ringin, Sikkim, India.....	not located		Sehore, Madhya Pradesh, India.....	23.12 77.08
Ringmo, Nepal.....	not located		Sei Josa, Arunachal Pradesh, India.....	appr. 27.10 92.50
Ripu, Assam, India.....	26.45	90.09	Seistan, Afghanistan.....	not located
Risa Colony, Meghalaya, India.....	not located		Seringapatam, Karnataka, India.....	12.25 76.41
Rivers Tackchom/Ro Ro, Sikkim, India.....	appr. 27.30	88.30	Shahpur, Sind, Pakistan.....	26.35 67.58
Rohri, Sind, Pakistan.....	27.41	68.54	Shahpura, Madhya Pradesh, India.....	23.10 80.45
Rohtas, Punjab, Pakistan.....	32.58	73.36	Shamgunj, Mymensingh District, Bangladesh.....	24.45 90.23
Rohtas, Bihar, India.....	24.40	83.59	Shangpung, Meghalaya, India.....	appr. 25.30 92.02
Rongli, Sikkim, India.....	27.17	88.45	Shar, Jammu & Kashmir, India.....	appr. 33.44 75.11
Rongmachok, Meghalaya, India.....	not located		Sharan, NWFP, Pakistan.....	34.43 73.28
Rongrengiri, Meghalaya, India.....	25.49	90.22	Shebu, Nepal.....	not located
Royal Chitwan National Park, Nepal.....	appr. 27.37	84.11	Sheikhupura (district), Punjab, Pakistan.....	c.o. 31.43 73.59
Rozelle, Central Province, Sri Lanka.....	appr. 06.58	80.36	Shenkagarh, Northern Areas, Pakistan.....	appr. 35.21 74.52
Rutland Island, Andaman Islands, India.....	c.o. 11.30	92.30	Sheopore, Madhya Pradesh, India.....	25.41 76.42
Ruwanwella, Sabaragamuwa Province, Sri Lanka.....	07.02	80.15	Shevaroy Hills, Tamil Nadu, India.....	c.o. 11.46 78.11
Sabalgarh, Madhya Pradesh, India.....	26.15	77.24	Shigi, Afghanistan.....	appr. 34.40 70.28
Sadikabad, Baluchistan, Pakistan.....	28.18	70.02	Shikargarh, Jammu & Kashmir, India.....	appr. 33.44 75.11
Sadiya, Assam, India.....	27.49	95.38	Shikarpur, Sind, Pakistan.....	27.58 68.42
Sadla, Gujarat, India.....	appr. 23.06	71.47	Shillong, Meghalaya, India.....	25.34 91.53
Sagaing, Myanmar.....	21.54	96.02	Shimoga, Karnataka, India.....	13.56 75.31
Sagar, Karnataka, India.....	16.37	76.45	Shirgaum, Maharashtra, India.....	appr. 17.13 73.35
Sagar, Madhya Pradesh, India.....	23.50	78.44	Shogran, NWFP, Pakistan.....	34.37 73.28
Saharsa, Bihar, India.....	25.54	86.36	Shujawal, Sind, Pakistan.....	24.36 68.05
Saidpur, Punjab, Pakistan.....	33.44	73.07	Sialkot, Punjab, Pakistan.....	32.30 74.32
Saidu-Sharif, NWFP, Pakistan.....	34.44	72.21	Sibbari (West Garo Hills), Meghalaya, India.....	not located
Saila, Maharashtra, India.....	21.25	74.02	Sibi, Baluchistan, Pakistan.....	29.33 67.54
St Thome Island, Tamil Nadu, India.....	13.05	80.18	Sibsagar, Assam, India.....	26.58 94.39
Sakesar, Punjab, Pakistan.....	32.33	71.57	Sigiriya, Central Province, Sri Lanka.....	07.57 80.46
Salbani, West Bengal, India.....	appr. 22.25	87.24	Siju Cave, Meghalaya, India.....	appr. 25.32 90.14
Salem, Tamil Nadu, India.....	11.38	78.08	Sikar, Rajasthan, India.....	27.33 75.12
Salthar, Gorkha, Nepal.....	appr. 28.01	84.37	Sikar Burz, Rajasthan, India.....	appr. 25.23 75.47

Siki, Arunachal Pradesh, India.....	appr.	27.46	93.37
Silent Valley, Kerala, India.....	c.o.	10.46	76.42
Siliguri, West Bengal, India.....		26.42	88.30
Silvassa, Gujarat, India.....		20.12	73.11
Simla, Himachal Pradesh, India.....		31.07	77.09
Sindu District, Nepal.....		28.03	85.33
Singaling Hkamti, Myanmar.....		not located	
Singar, Bihar, India.....	appr.	24.48	85.00
Singhbhum (district), Bihar, India.....	c.o.	22.31	85.50
Singkaling Hkamti, Myanmar.....	appr.	26.00	95.41
Singla, West Bengal, India.....	appr.	27.02	88.19
Singur, West Bengal, India.....		not located	
Sipuri, Nepal.....		not located	
Sirguffara, Jammu & Kashmir, India.....		not located	
Siripur, Bihar, India.....	appr.	25.46	84.44
Sirohi, Rajasthan, India.....		24.53	72.58
Sirsi, Karnataka, India.....		14.40	74.51
Sitabani, Uttar Pradesh, India.....	appr.	29.21	79.08
Sitamarhi, Bihar, India.....		26.36	85.30
Sitang River, Tennasserim, Myanmar.....		not located	
Sitpinzeik, Myanmar.....	appr.	17.22	96.31
Sivasamudram, Karnataka, India.....		12.16	77.08
Sivok, West Bengal, India.....	appr.	26.50	88.32
Siwal, Madhya Pradesh, India.....		not located	
Siwan, Bihar, India.....		26.14	84.21
Sohagpur, Madhya Pradesh, India.....		22.43	78.14
Solan, Himachal Pradesh, India.....		30.54	77.06
Somarkhel, Afghanistan.....	appr.	34.22	70.30
Sonari, Sikkim, India.....		not located	
Sonawane, Madhya Pradesh, India.....	appr.	21.48	80.16
Songir, Maharashtra, India.....		21.02	74.51
Songsak, Meghalaya, India.....		not located	
Soondarijal, Nepal.....	appr.	27.48	85.15
South 24-Pargana, West Bengal, India.....	c.o.	22.22	88.25
South Gharo Hills (dist.), Megh., India.....	c.o.	25.32	90.14
South Male Atoll, Maldives.....	appr.	03.50	73.28
South Sentinel, Andaman Islands, India.....	appr.	11.58	92.12
South Sylhet, Bangladesh.....	c.o.	24.15	91.30
South Xizang Zizhioqu, Tibet.....		29.20	95.30
Srimangala, Karnataka, India.....	appr.	12.01	76.00
Srinagar, Jammu & Kashmir, India.....		34.08	74.50
Srinagar, Uttar Pradesh, India.....		30.12	78.47
Sri Vaikundam, Tamil Nadu, India.....		08.40	77.56
Subsansiri District, Arunachal Prad., India.....	c.o.	27.46	93.37
Suchundrum, Travancore, Kerala, India.....		not located	
Sujapur, West Bengal, India.....		not located	
Sukal Tirath, Gujarat, India.....		not located	
Sukhidhang, Uttar Pradesh, India.....		29.36	79.40
Sukkur, Sind, Pakistan.....		27.42	68.52
Sukna, West Bengal, India.....		not located	
Sullah, Kishtwar, India.....		33.20	75.49
Sultanabad, Surat District, Gujarat, India.....		not located	
Sultanpur, Maharashtra, India.....		21.38	74.04
Sumka Uma, Myanmar.....		25.57	97.49
Sumprabum, Myanmar.....		26.33	97.34
Sundargarh (district of), Orissa, India.....		22.04	84.08
Sundarijal, Nepal.....		not located	
Sunderban, West Bengal, India.....	c.o.	21.50	89.00
Sunwar, Gujarat, India.....		not located	
Supa, Karnataka, India.....		15.18	74.35
Supkhar, Madhya Pradesh, India.....	appr.	21.48	80.16
Surab, Baluchistan, Pakistan.....		28.29	66.15
Surat, Gujarat, India.....		21.10	72.54
Suskerpore, South Sylhet, Bangladesh.....	appr.	24.15	91.30
Syangja, Nepal.....	appr.	28.49	83.42
Sylhet, Bangladesh.....		24.53	91.51
Syndai, Meghalaya, India.....	appr.	25.30	92.00

Taho, Myanmar.....	appr.	19.30	97.12
Talala, Gujarat, India.....		21.00	70.39
Talewadi, Karnataka, India.....	appr.	15.25	74.22
Talgasmankande, Southern Pr., Sri Lanka.....	appr.	06.26	81.20
Talgaswela, Southern Province, Sri Lanka.....	appr.	06.15	80.15
Taliquan, Afghanistan.....		34.46	69.29
Takubama, Nagaland, India.....	appr.	25.37	94.32
Tamankud, Maharashtra, India.....		not located	
Tamanthe, Myanmar.....		25.20	95.18
Tamdok, Tibet.....		28.50	90.59
Tammannewa, North Central Prov., Sri Lanka.....		08.27	80.37
Tanakpur, Uttar Pradesh, India.....		29.04	80.06
Tarasingi, Orissa, India.....	appr.	19.28	85.05
Taron Valley, Myanmar.....		27.38	98.12
Tasa Hku, Myanmar.....		not located	
Tashiding, Sikkim, India.....	appr.	27.46	88.37
Tasu Bum, Myanmar.....	appr.	26.01	96.12
Tatkon, Myanmar.....		23.50	94.30
Teesta Valley, West Bengal, India.....	c.o.	26.30	88.50
Tejam, Pithoragarh District, U.P., India.....		not located	
Tejir, Mishmi Hills, Arunachal Pradesh, India.....		not located	
Teliamura, Tripura, India.....		23.50	91.35
Tellicherry, Kerala, India.....		11.44	75.29
Terur, Travancore, Kerala, India.....		not located	
Thal, Pithoragarh District, Uttar Pradesh, India.....		not located	
Thana, Maharashtra, India.....		19.14	73.02
Thanatpink, Myanmar.....		17.17	96.35
Thandiani, NWFP, Pakistan.....		34.14	73.22
Thankot, Nepal.....	appr.	27.42	85.17
Thanna, Maharashtra, India.....		19.14	73.02
Thatta, Sind, Pakistan.....		24.45	67.56
Thayetmyo, Myanmar.....	appr.	19.20	95.18
Therhali, Karnataka, India.....	appr.	13.10	78.23
Thiruneer Malai, Tamil Nadu, India.....	appr.	13.05	80.00
Those, Nepal.....		27.36	86.05
Thrissur district, Kerala, India.....	appr.	10.32	76.14
Thummalah, Andhra Pradesh, India.....		not located	
Thummalabylu, Andhra Pradesh, India.....	c.o.	14.11	79.09
Tikarpara, Orissa, India.....		20.32	84.56
Tiki, Arunachal Pradesh, India.....	appr.	28.00	96.20
Tillanchang, Nicobar Island, India.....	c.o.	08.29	93.39
Tipai Mukhi, Mizoram, India.....		24.14	93.30
Tirthamalai, Tamil Nadu, India.....		12.06	78.36
Tiruchirapally, Tamil Nadu, India.....		10.50	78.43
Tirunelveli, Tamil Nadu, India.....		08.45	77.43
Titthamaldi, Salem District, Tamil Nadu, India.....		not located	
Toagine, Myanmar.....		not located	
Tonacombe, Sri Lanka.....	appr.	07.08	81.07
Tong Song, West Bengal, India.....	appr.	27.04	88.24
Tonk, Rajasthan, India.....		25.52	75.50
Tori, Sind, Pakistan.....		28.09	69.05
Tor Khama, Afghanistan.....	appr.	34.15	70.55
Toungoo, Shan State, Myanmar.....		18.57	96.26
Toupi, Punjab, Pakistan.....		not located	
Tral, Jammu & Kashmir, India.....	appr.	34.00	74.58
Tranquebar, Tamil Nadu, India.....		11.04	79.50
Travancore, Tamil Nadu, India.....		09.00	77.00
Trichinopoly, Tamil Nadu, India.....		10.50	78.46
Trichur, Kerala, India.....		10.32	76.14
Trincomalee, Eastern Province, Sri Lanka.....		08.34	81.13
Trinkut, Nicobar Island, India.....		08.07	93.37
Tripura State, India.....	c.o.	23.45	91.30
Trivandrum, Kerala, India.....		08.41	76.57
Tschaga Serail, Afghanistan.....		not located	
Tschambel/Dewagall, Afghanistan.....		not located	
Tuglakabad Fort, Delhi, India.....	appr.	28.37	77.13
Tumlingter, Nepal.....	appr.	27.33	87.16

Tura, Meghalaya, India.....	25.32	90.14	Waghai, Gujarat, India.....	20.46	73.29
Tut-Tangai, Afghanistan.....	not located		Walhaputanne, Uva Province, Sri Lanka.....	appr. 06.45	80.54
Udaipur, Rajasthan, India.....	27.40	75.32	Walzhar, Gujarat, India.....	appr. 20.42	73.10
Udaygiri Caves, Orissa, India.....	appr. 20.06	84.32	Wana, Nepal.....	not located	
Udhampur, Jammu & Kashmir, India.....	32.55	75.07	Warakapola, Sabaragamuwa, Sri Lanka.....	07.13	80.14
Udugama, Southern Province, Sri Lanka.....	06.13	80.20	Wariyapola, North Western Province, Sri Lanka.....	07.37	80.15
Umbala (=Ambala?), Punjab, India.....	30.19	75.49	Wavulpane, Sabaragamuwa, Sri Lanka.....	06.25	80.40
Umkiang, Meghalaya, India.....	not located		Wazi Bagh, Paktia Province, Afghanistan.....	not located	
Upper Manalaar, Tamil Nadu, India.....	appr. 09.50	77.24	Weddagala, Sabaragamuwa, Sri Lanka.....	appr. 06.26	80.26
Urugala, Central Province, Sri Lanka.....	appr. 07.17	81.00	Weligatta, Southern Province, Sri Lanka.....	06.12	81.10
Ushchele Khatu, Tibet.....	not located		Wellawaya, Uva Province, Sri Lanka.....	06.44	81.07
Usked, Gujarat, India.....	appr. 21.16	73.20	West Dinajpur (dist. of), W. B., India.....	c.o. 25.38	88.44
Uzhda Ridge, Pakistan.....	not located		Williamnagar, Meghalaya, India.....	not located	
Vaddam Bardez, Goa, India.....	not located		Wimberleyganj, South Andaman Ids, India.....	appr. 11.50	92.45
Vaishali, Bihar, India.....	appr. 25.49	85.25	Wotekolli, Karnataka, India.....	c.o. 12.00	76.00
Valaichenai, Eastern Province, Sri Lanka.....	07.54	81.32	Wrightmyo, Andaman Islands, India.....	appr. 11.43	92.43
Valpoi, Goa, India.....	15.30	74.05	Wynaad, Kerala, India.....	appr. 11.45	76.02
Vankaneer, Gujarat India.....	22.37	70.56	Xizang plateau, Tibet.....	appr. 29.20	95.30
Vannathiparai, Tamil Nadu, India.....	appr. 09.44	77.19	Xizang Zizhioqu, Tibet.....	29.20	95.30
Varanasi, Uttar Pradesh, India.....	25.20	83.00	Yakh Tangai, NWFP, Pakistan.....	appr. 34.34	71.57
Vedtia, Gujarat, India.....	appr. 21.59	72.54	Yakura, Central Province, Sri Lanka.....	07.49	81.02
Veniginissery, Kerala, India.....	appr. 10.32	76.14	Yala, Southern Province, Sri Lanka.....	06.22	81.30
Venniar Estate, Tamil Nadu, India.....	appr. 09.50	77.29	Yalala, Gujarat India.....	appr. 21.31	70.28
Veyangoda, Eastern Province, Sri Lanka.....	appr. 07.08	80.04	Yangi Dawar, Jammu & Kashmir, India.....	35.57	79.24
Vihar Lake, Maharashtra, India.....	appr. 18.56	72.51	Yellapur, Karnataka, India.....	14.59	74.46
Vijayanagar, Karnataka, India.....	15.20	76.28	Yin, Myanmar.....	appr. 22.45	94.46
Vijyadurg, Maharashtra, India.....	16.34	73.22	Zabul Province, Afghanistan.....	not located	
Virajpet, Karnataka, India.....	12.12	75.46	Zakampatti, Tamil Nadu, India.....	not located	
Vishakhapatnam, Andhra Pradesh, India.....	17.42	83.24	Ziarat, Baluchistan, Pakistan.....	30.22	67.44
Vulany, Kerala, India.....	not located		Zunheboto, Nagaland, India.....	not located	

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<i>satyrus</i> , <i>Pteropus</i>	15	<i>spelaea</i> , <i>Eonycteris</i>	29	<i>temminckii</i> , <i>Scotophilus</i>	149
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