



The first record of *Scotozous dormeri* Dobson, 1875 from Nepal with new locality records of *Pipistrellus coromandra* (Gray, 1838) and *P. tenuis* (Temminck, 1840) (Chiroptera: Vespertilionidae)

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Abstract: Between September 2008 and September 2010, faunal surveys were carried out by the first author in Paschim Kusaha V.D.C. (Village Development Committee) in the buffer zone of Koshi Tappu Wildlife Reserve in south-eastern Nepal. The surveys resulted in the collection of three species of vespertilionid bats, which included the first record from Nepal of Dormer's Pipistrelle *Scotozous dormeri* Dobson, 1875. A brief description is given of the external, cranial, and dental characters of each of the three species collected and the *bacula* of *Pipistrellus coromandra* and *P. tenuis* are illustrated.

Keywords: Distribution, Global 200, Koshi Tappu Wildlife Reserve, *Pipistrellus*, *Scotozous dormeri*, Terai-Duar Savanna and Grasslands.

Nepali Abstract: सन् २००८ सेप्टेम्बर देखि सन् २०१० सेप्टेम्बर सम्म कोशीटप्पु वन्यजन्तु आरक्षको कुशाहा गा.वि.स. मा चमेराको खोजी गरियो। जसमा तीन प्रजातिका चमेराहरू संकलन गरिएका थिए। यी तीन प्रजातिका चमेराहरू मध्ये एउटा नेपालको लागी नया प्रजाति, डोरमरको चमेरा (स्कोटोजस डर्मेरी) पाइयो। अनि बाँकी दुई मध्ये एउटा कोरोमेन्डलको पिपिस्टरेल चमेरा (पिपिस्टरेलस कोरोमान्डरा) र सानो पिपिस्टरेल चमेरा (पिपिस्टरेलस टिनुइस) फेला परेको छ। यी चमेरा प्रजातिका शरिरका विभिन्न भाग सहित खप्पर, दन्त सम्बन्धि जानकारी यँहा प्रस्तुत गरिएको छ। कोरोमेन्डलको पिपिस्टरेल चमेरा र सानो पिपिस्टरेल चमेराहरूको लिङ्गस्थी चित्रण गरिएको छ।

INTRODUCTION

Three species of *Pipistrellus* (*P. coromandra*, *P. javanicus*, and *P. tenuis*) are known to occur in Nepal (Thapa 2010; Pearch 2011) whilst the monospecific genus *Scotozous*, although prevalent in the adjacent Indian state of Bihar (Bates & Harrison 1997), has remained unrecorded hitherto from the country.

Abbreviations: The definitions of measurements are as follows: HB - head and body length; T - tail length; TIB - tibia length; HF - hindfoot length; FA - forearm length; Thumb - first metacarpal length; 3mt - third metacarpal length; 1ph3mt - length of the first phalanx of the third metacarpal; 2ph3mt - length of the second phalanx of the third metacarpal; 4mt - fourth metacarpal length; 1ph4mt - length of the first phalanx of the fourth metacarpal; 2ph4mt - length of the second phalanx of the fourth metacarpal; 5mt - fifth metacarpal length; 1ph5mt - length of the first phalanx of the fifth metacarpal; 2ph5mt - length of the second phalanx of the fifth metacarpal; E - ear length; Tragus - tragus length; GTL - greatest length of skull; CCL - condylo-canine length; BB - breadth of braincase; PC - postorbital constriction; RW - rostral width; C-M3 - maxillary tooththrow length; c-m3 - mandibular tooththrow length; M - mandible length; C1-C1 - anterior palatal width (the distance between the outer borders of the upper canines); M3-M3 - posterior palatal width (the distance between the outer borders of the last upper molars); *Baculum* - *baculum* length. CA - Conservation Area; F.M.N.H. - The Field Museum of Natural History, Chicago, U.S.A.; NP - National Park; WR - Wildlife Reserve.

The biological diversity and distribution of small mammal taxa in the protected areas of Nepal was discussed by Peach (2011), who highlighted the need for further volant and non-volant small mammal surveys, notably in those protected areas of the country that do not return small mammal records currently (Kanchenjunga CA, Khaptad NP, Koshi Tappu WR, and Royal Bardia NP).

These are the first surveys focusing on bats to be carried out in the buffer zone of Koshi Tappu WR, which lies wholly within the critical/endangered Global 200 terrestrial ecoregion number 91, Terai-Duar Savanna and Grasslands (Olson & Dinerstein 2002). Nepal forms part of the Himalaya Hotspot as defined by Conservation International (2007).

MATERIALS AND METHODS

Study area

Koshi Tappu Wildlife Reserve (approximately 26°33'57"–26°43'40"N & 86°55'15"–87°05'02"E) is situated in south-eastern Nepal in the Terai (Fig.

1), the latter being a composition of tropical and subtropical savannas, grasslands, and shrublands supporting mainly an Indomalayan fauna (WWF 2001) that stretches from the north-western Indian states of Uttar Pradesh and Uttarakhand eastwards to the north-western parts of Assam and the south-eastern fringes of Bhutan.

The reserve, established in 1976 with an original ground area of 175km² (reduced by a G.I.S. survey in 2000 to 149.6km² (D.N.P.W.C./P.P.P. 2001)), was designated a Ramsar (wetlands of international importance) site in 1987. Five hundred and fourteen floral taxa are found within the reserve, principal among which are Indian Rosewood *Dalbergia sisso* and the Cutch Tree or Khair *Acacia catechu*. The Red Silk Cotton Tree *Bombax ceiba* dominates the forest, which comprises approximately four percent of the reserve, while about 67 percent of the reserve is covered with grassland (Heinen 1993).

The River Kosi flows from north to south through the eastern part of the reserve, which is characterised elsewhere by watercourses, mudflats, sandbanks, grassland, savanna, lakes, marshes and riverine forest

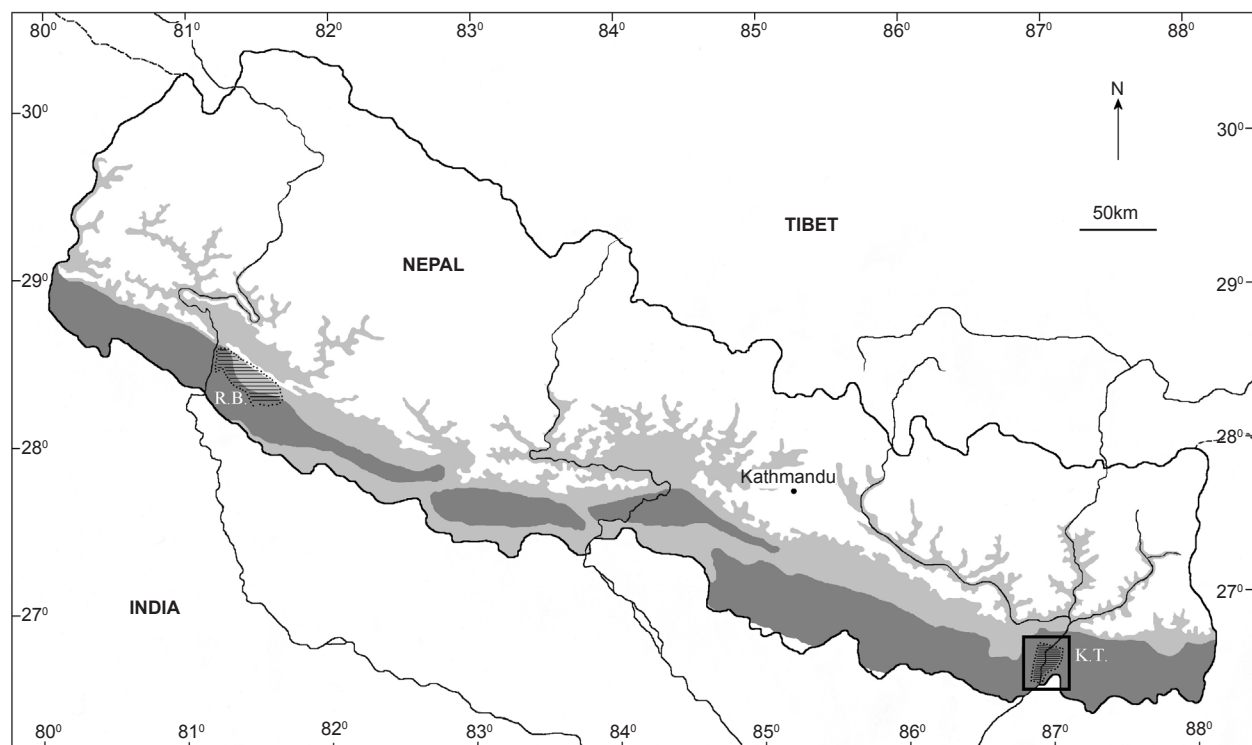


Figure 1. Map of Nepal showing the location of Koshi Tappu WR (K.T.) and Royal Bardia NP (R.B.) and the delineation within the country's borders of the terrestrial ecoregions, Terai-Duar Savanna and Grasslands (area shaded dark grey) and Himalayan subtropical broadleaf forests (area shaded light grey). The area within the black box is depicted in greater detail in Fig. 2.

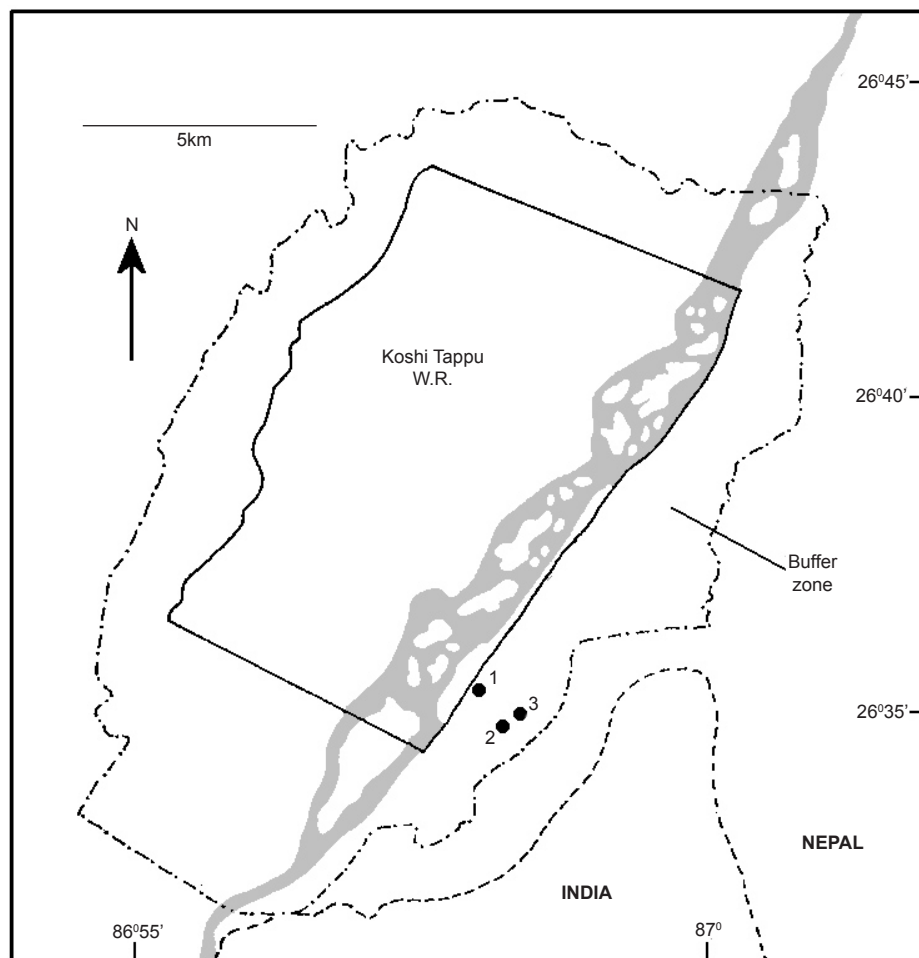


Figure 2. Koshi Tappu W.R. and buffer zone. Black dots indicate the following localities: 1 - Kusaha; 2 - Goithi Tole; 3 - Samsul Tole.

(I.S.R.W. 1995). The reserve is surrounded on all sides by a buffer zone, the limits of which lie between one and five km from the reserve's boundary (Fig. 2).

Specimens of evening bats were collected in dwellings or outbuildings in the neighbourhood of Goshi Tole and Samsul Tole in Paschim Kusaha V.D.C. (Village Development Committee), the same lying one km south-east of the park headquarters at Kusaha. The study site, which occupies an area within the south-eastern section of the buffer zone, is dominated by agricultural land and scattered trees (mainly *Dalbergia sisso*).

The reserve has a seasonal tropical monsoon climate with a wet season lasting from June to mid September (Sah 1997). The mean annual rainfall at Kusaha ranges from 1601–2000 mm. (D.N.P.W.C. / P.P.P. 2001). The average daily maximum temperature range is 23.5–33.4 °C (Sah 1997). The mean monthly temperature range is 15.7–29.2 °C (Singh 2001).

Specimens and measurements

The six voucher specimens, which were collected by hand, were preserved in 70% ethanol before being transferred to the Museum of the Central Department of Zoology (CDZ), Tribhuvan University, Kathmandu, where they are retained as wet specimens with skulls extracted. Preparation of the *bacula* of three specimens (CDZ TU_BAT 021, CDZ TU_BAT 022, and CDZ TU_BAT 024) and the skulls of all six specimens followed Bates et al. (2005). *Bacula* were photographed through the eye-piece of an Olympus CH microscope using a Canon A 2000 digital camera.

Twenty eight external, cranial, dental, and bacular measurements of each specimen were taken (where possible) and these are presented in Tables 1, 2, and 3 together with comparative measurements of specimens of *Scotozous dormeri* from India (Table 1) and of *Pipistrellus coromandra* (Table 2) and *P. tenuis* (Table 3) from India, Pakistan, Nepal, and Sri Lanka, the same listed in Bates & Harrison (1997).

Table 1. External, cranial, and dental measurements (in mm.) of *Scotozous dormeri* (CDZ TU_BAT 019) from Kusaha, Koshi Tappu WR, Nepal and from India.

	Kusaha, KTWR		India			
	CDZ TU_BAT 019		(Bates & Harrison 1997)			
		n	mean	Range	n	s
HB	53.0	1	48.9	39.0-55.0	25	3.6
T	30.0	1	35.3	27.0-41.0	25	3.8
TIB	10.0	1	-	-	-	-
HF	8.0	1	6.2	5.0-8.0	25	1.1
FA	33.5	1	34.4	32.7-36.3	25	0.9
Thumb	6.5	1	-	-	-	-
3mt	32.5	1	33.7	31.7-36.5	25	1.3
1ph3mt	12.0	1	-	-	-	-
2ph3mt	9.0	1	-	-	-	-
4mt	32.0	1	33.3	31.6-36.4	25	1.2
1ph4mt	12.0	1	-	-	-	-
2ph4mt	8.0	1	-	-	-	-
5mt	32.0	1	32.6	31.2-35	25	1.1
1ph5mt	9.0	1	-	-	-	-
2ph5mt	6.0	1	-	-	-	-
E	10.0	1	11.9	10.0 - 18.0	25	1.6
Tragus	5.0	1	-	-	-	-
GTL	14.1	1	14.3	13.7-15	29	0.3
CCL	13.2	1	13.3	12.8-13.6	29	0.2
BB	7.0	1	7.1	6.8-7.5	29	0.2
PC	3.5	1	3.9	3.6-4.2	29	0.2
RW	5.6	1	6	5.6-6.4	29	0.2
C-M3	5.3	1	5.4	5.2-5.6	29	0.1
c-m3	5.7	1	5.8	5.5-6.1	29	0.1
M	10.7	1	10.8	10.4-11.2	29	0.3
C1-C1	4.5	1	-	-	-	-
M3-M3	6.5	1	6.7	6.3-7.0	29	0.2
Baculum	-	-	-	-	-	-

n - number of specimens; s - standard deviation.

Systematic review of species

Scotozous dormeri Dobson, 1875

Dormer's Bat, Dormer's Pipistrelle.

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

New material

01.iv.2009, 1 male (adult) (CDZ TU_BAT 019), 1km south-east of Kusaha, Koshi Tappu Wildlife Reserve (buffer zone), Sunsari District, 26°35'N &

86°58'E, elevation 83m.

Diagnosis and description

The single specimen exhibits a greyish brown dorsal pelage with pale hair tips. The ventral surface is paler than the dorsal with individual hairs having buffy white tips. Hairs on both dorsal and ventral areas have dark brown roots; hairs on the dorsum are longer than those on the ventrum. The ears, face, and membranes are a uniform midbrown.

The skull, which is flattened dorsally, has distinct lambdoid crests. In the dentition, there is no secondary cusp on the first upper incisor (i^2), which is large with a distinct posterior cingular cusp. The second upper incisor (i^3) is absent. The upper canine (C^1) has anterior and posterior cingular cusps but no secondary cusp. The first upper premolar (pm^2), which has a crown area two-thirds that of i^2 , is intruded from the toothrow. C^1 and the second upper premolar (pm^4) are in close proximity.

The *baculum* of CDZ TU_BAT 019 was damaged and was not examined.

Distribution in Nepal

1km south-east of Kusaha (this paper).

IUCN status

Least Concern (ver. 3.1, 2001) (Molur & Srinivasulu 2008).

Pipistrellus coromandra (Gray, 1838)

Coromandel Pipistrelle, Indian Pipistrelle, Little Indian Bat.

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

New material

31.iii.2009, 2 males (adult) (CDZ TU_BAT 022, CDZ TU_BAT 024), 1 female (adult) (CDZ TU_BAT 023), 1km south-east of Kusaha, Koshi Tappu Wildlife Reserve (buffer zone), Sunsari District, 26°35'N, 86°58'E, elevation 83m.

Diagnosis and description

The dorsal pelage of the collected material is a uniform chestnut brown. The ventral surface is pale brown; hairs have cinnamon brown tips and black roots. The ears and membranes are a uniform mid

Table 2. External, cranial, and dental measurements (in mm) of *Pipistrellus coromandra* (CDZ TU_BAT 022; CDZ TU_BAT 023; CDZ TU_BAT 024) from Kusaha, Koshi Tappu W.R., Nepal and from India, Pakistan, Nepal, and Sri Lanka.

	Kusaha, KTRW			India, Pakistan, Nepal and Sri Lanka			
	CDZ TU_BAT 022, 023, 024			(Bates & Harrison 1997)			
	Mean	range	n	mean	Range	n	s
HB	41.7	41.0–43.0	3	42.3	34.0–49.0	47	3.7
T	31.7	31.0–32.0	3	32.0	22.0–39.0	48	3.5
TIB	11.5	10.5–13.0	3	–	–	–	–
HF	5.3	5.0–6.0	3	5.6	3.4–8.0	38	1.0
FA	30.0	29.0–31.0	3	30.0	25.5–34.3	47	1.7
Thumb	5.3	5.0–6.0	3	–	–	–	–
3mt	29.7	29.0–30.0	3	29.0	25.8–33.1	46	1.4
1ph3mt	11.3	11.0–12.0	3	–	–	–	–
2ph3mt	15.0	15.0	3	–	–	–	–
4mt	29.3	29.0–30.0	3	28.7	25.7–32.7	46	1.6
1ph4mt	10.0	10.0	3	–	–	–	–
2ph4mt	7.7	7.0–9.0	3	–	–	–	–
5mt	28.5	28.0–29.0	3	28.1	25.2–31.1	46	1.6
1ph5mt	7.7	7.0–8.0	3	–	–	–	–
2ph5mt	5.0	4.0–5.5	3	–	–	–	–
E	10.0	10.0	3	10.3	7.1–14.0	48	1.2
Tragus	4.0	4.0	3	–	–	–	–
GTL	12.7	12.5–13.3	3	12.5	11.8–13.1	51	0.3
CCL	11.4	11.2–11.7	3	11.2	10.6–11.9	52	0.3
BB	6.5	6.2–6.7	3	6.2	5.7–6.7	51	0.2
PC	3.4	3.3–3.6	3	3.4	3.0–3.8	51	0.2
RW	4.4	4.3–4.7	3	4.9	4.3–5.3	51	0.2
C–M3	4.5	4.4–4.6	3	4.4	3.9–4.6	53	0.1
c–m3	4.9	4.7–5.0	3	4.7	4.1–5.1	51	0.2
M	9.0	9.0–9.1	3	8.9	8.2–9.5	51	0.3
C1–C1	4.2	4.1–4.3	3	–	–	–	–
M3–M3	5.7	5.4–6.0	3	5.5	5.0–6.0	51	0.2
Baculum	2.9	2.5–3.3	2	–	–	–	–

n - number of specimens; s - standard deviation; see Appendix 1 for individual specimen measurements

brown. Some hairs are present on the interfemoral membrane in the vicinity of the body.

The skull is slightly elevated posteriorly although, in dorsal profile, it is essentially straight.

The first upper incisor (i^2) is bicuspidate. The second upper incisor (i^3) is well developed and, in lateral view, is separated narrowly from the upper canine (C^1). C^1 has a secondary cusp and a marked posterior

cingular cusp.

The first upper premolar (pm^2) is intruded from the toothrow, its crown area equal to that of i^2 . C^1 and the second upper premolar (pm^4) are close to each other but not in contact. The first lower premolar (pm_2) is extruded marginally from the toothrow; its crown area is three-quarters that of the second lower premolar (pm_4).

The *baculum* of *P. coromandra* (CDZ TU_BAT 022) has a mainly straight shaft with a mild depression at approximately two-thirds of its length, which gives the distal end an elevated appearance (Fig. 3). The tip of the *baculum* is notably bifid and the basal lobes are deflected ventrally. The tip of the right hand fork was broken off during preparation of the material.

Distribution in Nepal

Bairia (Hinton & Fry 1923). Bardhaha Khola (Royal Chitwan NP) (Myers et al. 2000); Bharabise (F.M.N.H.); Dudora Nala/Park Rd. (Royal Chitwan NP) (Myers et al. 2000). Hazaria (Hinton & Fry 1923). “Nepal Valley” [Kathmandu Valley] (Scully 1887). Simal Ghol Tal (Royal Chitwan NP) (Myers et al. 2000). Tamar Tal (Royal Chitwan NP) (Myers et al. 2000). Tiger Tops, Dhangari Khola (Royal Chitwan NP) (Myers et al. 2000).

IUCN status

Least Concern (ver. 3.1, 2001) (Csorba et al. 2008).

Pipistrellus tenuis (Temminck, 1840)

Least Pipistrelle, Indian Pygmy Bat.

Vespertilio tenuis Temminck, 1840 (1824–1841): 229. Sumatra (Tate, 1942).

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

New material

31.iii.2009, 1 male (adult) (CDZ TU_BAT 021), 1 female (adult) (CDZ TU_BAT 020), 1km south-east of Kusaha, Koshi Tappu Wildlife Reserve (buffer zone), Sunsari District, 26°35'N & 86°58'E, elevation 83m.

Variation

Following the analysis of Sinha (1980), Bates & Harrison (1997) refer all specimens from the Indian subcontinent to the subspecific form *P. t. mimus*. The

Table 3. Selected external, cranial, and dental measurements (in mm.) of *Pipistrellus tenuis* (CDZ TU_BAT 020; CDZ TU_BAT 021) from Kusaha, Koshi Tappu WR, Nepal and from India, Pakistan, Nepal, and Sri Lanka.

Kusaha, K.T.W.R.				India, Pakistan, Nepal, and Sri Lanka			
(CDZ TU_BAT 020; CDZ TU_BAT 021)				(Bates & Harrison 1997)			
	Mean	range	n	mean	range	n	S
HB	37.5	36.0–39.0	2	39.1	33.0–45.0	37	3
T	27.8	25.5–30.0	2	28.9	20.0–35.0	37	3.7
TIB	11.0	11.0	2	-	-	-	-
HF	5.0	-	1	5.3	3.0–7.0	32	1.4
FA	27.0	26.0–28.0	2	27.7	25.0–30.2	39	1.2
Thumb	4.5	4.0–5.0	2	-	-	-	-
3mt	26.5	26.0–27.0	2	26.7	23.9–29.7	39	1.3
1ph3mt	10.5	10.0–11.0	2	-	-	-	-
2ph3mt	15.0	15.0	2	-	-	-	-
4mt	25.5	24.0–27.0	2	26.4	23.7–29.2	39	1.2
1ph4mt	10.5	10.0–11.0	2	-	-	-	-
2ph4mt	6.8	6.0–7.5	2	-	-	-	-
5mt	26.0	25.0–27.0	2	25.9	23.5–28.5	39	1.2
1ph5mt	7.0	7.0	2	-	-	-	-
2ph5mt	5.0	5.0	2	-	-	-	-
E	11.3	10.0–12.5	2	9.7	5.0–11.0	37	1.5
Tragus	3.5	3.0–4.0	2	-	-	-	-
GTL	11.4	11.3–11.4	2	11.5	10.7–12.1	47	0.3
CCL	10.3	10.3	2	10.2	9.3–10.7	47	0.3
BB	6.4	6.3–6.4	2	6	5.6–6.3	47	0.2
PC	3.3	3.2–3.4	2	3.3	2.9–3.7	47	0.2
RW	4.2	4.0–4.3	2	4.4	3.9–4.8	47	0.2
C–M3	3.9	3.8–4.0	2	3.8	3.5–4.1	48	0.1
c–m3	4.3	4.1–4.4	2	4.1	3.8–4.4	44	0.1
M	8.2	8.2	2	7.9	7.2–8.3	42	0.2
C1–C1	3.8	3.7–3.8	2	-	-	-	-
M3–M3	5.2	5.0–5.3	2	4.9	4.5–5.2	46	0.1
Baculum	3.5	-	1	-	-	-	-

n - number of specimens; s - standard deviation; see Appendix 1 for individual specimen measurements

new material listed above is referred similarly as the bacular morphology of CDZ TU_BAT 021 compares favourably with that of *Pipistrellus mimus* as depicted by Hill & Harrison (1987: 290, Fig. 7(g)).

Diagnosis and description

The pelage on the dorsal surface is a uniform midbrown with individual hairs having black roots. Hairs on the ventral surface, which is paler than the

dorsal, have buffy brown tips. The ears and membranes are dark brown.

Cranial morphology is similar to *P. coromandra* (CDZ TU_BAT 022–024) although the average size of the skull is smaller.

In the dentition, the first upper incisor (i^2) is bicuspidate. The robust, second upper incisor (i^3) is slightly higher than the second cusp of i^2 . i^3 is close to, but not in touch with, the upper canine (C^1), which has a distinct posterior secondary cusp. The crown area of the first upper premolar (pm^2), which is intruded from the toothrow, is about half that of i^2 (cf. Bates & Harrison, 1997: 175, who indicate that in specimens of *tenuis* from India, Nepal, Pakistan, and Sri Lanka, the crown areas of the two teeth are “about equal”).

The *baculum* of the single male *P. tenuis* collected from the study area (CDZ TU_BAT 021) has a long, thin shaft and a notably bifid tip (Fig. 3). The tip is declined from the horizontal at the most distal part. The basal lobes are clavate and are deflected ventrally at approximately 45° to the shaft.

Distribution in Nepal

Bahwanipur Village (Banke District) (Mitchell, 1980). Bairia (Hinton & Fry 1923). Dudora Nala/Park Rd. (Royal Chitwan NP) (Myers et al. 2000). Hazaria (Hinton & Fry 1923). Sauraha [Sauraba] (H.N.H.M.; Myers et al. 2000). Simal Ghol Tal (Royal Chitwan NP) (Myers et al. 2000). Tamar Tal (Royal Chitwan NP) (Myers et al. 2000). Tiger Tops, Dhangari Khola (Royal Chitwan NP) (Myers et al. 2000).

IUCN status

Least Concern (ver. 3.1, 2001) (Francis et al. 2008).

DISCUSSION

Whilst *Scotozous dormeri* may be distinguished relatively easily from *Pipistrellus coromandra* and *P. tenuis* on account of its greyish brown dorsal pelage and pale hair tips on both dorsal and ventral surfaces, it is not possible to differentiate *P. coromandra* from *P. tenuis* using external characters alone (Bates & Harrison 1997; Srinivasulu et al. 2010) as the two taxa share a similar outward appearance and there is often to be found an overlap in the ranges of morphological

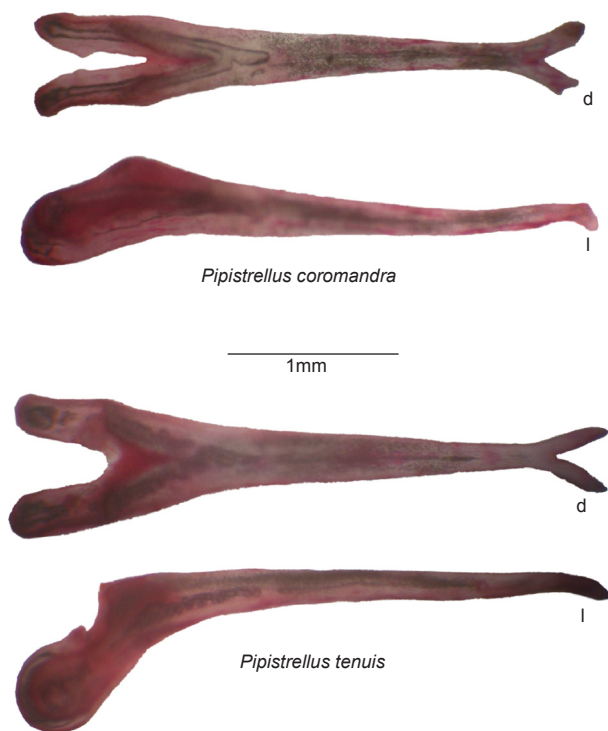


Figure 3. Dorsal (d) and lateral (l) views of the bacula of *Pipistrellus coromandra* (CDZ TU_BAT 022) and *Pipistrellus tenuis* (CDZ TU_BAT 021).

measurements. It is considered generally to be the case, however, that *coromandra* is a larger bat and this may be evinced by a comparison of cranial measurements of the two taxa (Bates & Harrison 1997; Srinivasulu et al. 2010). It can be seen from Tables 2 and 3 that in each of the mean cranial values given (GTL, CCL, BB, PC, and RW), specimens of *P. coromandra* examined within the study area are greater in size than specimens of *P. tenuis* although there remains overlap in the BB, PC, and RW measurement ranges, notably in the breadth of braincase (BB), where the range given for *tenuis* falls wholly within that of *coromandra*. The complexities of the specific discrimination of pipistrelles both in Nepal and elsewhere have been highlighted by Myers et al. (2000) and Hill & Harrison (1987), respectively. It is suggested that one method of minimising or eliminating these difficulties would be to use the process of polymerase chain reaction (PCR) to analyse DNA extracted not only from the two taxa mentioned but from other *Pipistrellus* species that are difficult to discriminate using conventional taxonomic methods.

The addition of *Scotozous dormeri* to Nepal's faunal list increases the number of bats known from

the country to 51 and the number of non-volant, terrestrial, small mammal taxa to 119 (see Pearch 2011 for details of small mammal species recorded hitherto) while the collection of *Pipistrellus coromandra* and *P. tenuis* from the buffer zone of Koshi Tappu WR extends the easternmost limit of the two species' ranges in Nepal by 108km and 157km, respectively. Of the ten localities from which *P. coromandra* is now known in Nepal, nine are either in the critical/endangered subtropical broadleaf forests of southern and central Nepal or in the critical/endangered Terai-Duar savanna and grasslands. All nine of the localities at which *P. tenuis* has been collected are also to be found in one or other of these two critical/endangered ecoregions. The degeneration of habitat in the Terai is occasioned primarily by logging, erosion, overgrazing, and the clearance of rare grasslands for agricultural purposes (WWF 2001) and it was estimated over a decade ago that almost 75 percent of the Terai-Duar savanna and grasslands had already been degraded (WWF 2001). As the small mammal fauna of this region has not been sampled extensively (Pearch 2011), there remains an incomplete understanding of the extent to which populations of small mammals have been depauperated. The record of *S. dormeri* brings the number of bat species occurring only in this ecoregion in Nepal to three.

Following the collection of the material discussed herein in the buffer zone of Koshi Tappu WR, it is recommended that a detailed survey of the Reserve, itself, be undertaken. The recommendation of Pearch (2011) that similar surveys be carried out in the other three protected areas in Nepal that return no records of small mammals is reiterated. The primary focus of attention in this respect should be Royal Bardia NP in south-western Nepal (Fig. 1), firstly, as it comprises both the critical/endangered ecoregions mentioned above and, secondly, because it retains some of the best preserved tracts of natural tall grassland habitat in Nepal (Thapa et al. 2010; WWF 2001). As pressure on the habitats in southern Nepal increases, it is essential that the component fauna of protected areas in Nepal and the efficacy of those areas in the conservation of small mammals is understood properly.

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Appendix I. Measurements of individual bat specimens mentioned in this paper.

	<i>Scotozous dormeri</i>	<i>Pipistrellus coromandra</i>			<i>Pipistrellus tenuis</i>	
	CDZ TU_BAT 019	CDZ TU_BAT 022	CDZ TU_BAT 023	CDZ TU_BAT 024	CDZ TU_BAT 020	CDZ TU_BAT 021
HB	53.0	41.0	41.0	43.0	36.0	39.0
T	30.0	31.0	32.0	32.0	25.5	30.0
TIB	10.0	13.0	11.0	10.5	11.0	11.0
HF	8.0	5.0	6.0	5.0	5.0	5.0
FA	33.5	29.0	31.0	30.0	26.0	28.0
Thumb	6.5	5.0	6.0	5.0	4.0	5.0
3mt	32.5	29.0	30.0	29.0	26.0	27.0
1ph3mt	12.0	11.0	12.0	11.0	10.0	11.0
2ph3mt	9.0	15.0	15.0	15.0	15.0	15.0
4mt	32.0	29.0	30.0	29.0	24.0	27.0
1ph4mt	12.0	10.0	10.0	10.0	10.0	11.0
2ph4mt	8.0	7.0	9.0	7.0	6.0	7.5
5mt	32.0	28.0	29.0	28.5	25.0	27.0
1ph5mt	9.0	8.0	7.0	8.0	7.0	7.0
2ph5mt	6.0	4.0	5.5	5.5	5.0	5.0
E	10.0	10.0	10.0	10.0	10.0	12.5
Tragus	5.0	4.0	4.0	4.0	3.0	4.0
GTL	14.1	13.3	12.5	12.5	11.3	11.4
CCL	13.2	11.2	11.4	11.7	10.3	10.3
BB	7.0	6.6	6.7	6.2	6.3	6.4
PC	3.5	3.6	3.4	3.3	3.2	3.4
RW	5.6	4.4	4.7	4.3	3.8	4.0
C-M3	5.3	4.4	4.6	4.5	4.1	4.4
c-m3	5.7	5.0	4.7	5.0	8.2	8.2
M	10.7	9.0	9.0	9.1	3.7	3.8
C1-C1	4.5	4.1	4.3	4.3	5.0	5.3
M3-M3	6.5	5.4	5.7	6.0	4.0	4.3
<i>Baculum</i>	-	3.3	-	2.5	-	3.5



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