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RECENT RECORD OF LEAST PIPISTRELLE (*Pipistrellus tenuis)* (VESPERTILIONIDAE: CHIROPTERA) FROM ISLAMABAD

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ABSTRACT

The Least Pipistrelle *Pipistrellus tenuis* (Temminck, 1840) was captured from northern Punjab first in 1926 and then in 1961. We captured two specimens of this species from the same area during a three years' survey (2008-2011) to describe and compare their external body, cranial and bacular measurements with those available in literature. Mean body mass of the captured specimens was 4.25 ± 1.061 g, the head and body length was 35.00 ± 2.828 mm, the forearm was 28.00 ± 0.707 mm long. The greatest length of the skull was 10.19 mm and baculum was 3.46 mm long. Mean frequency of maximum energy of four pulses from two calls was 34.1 kHz and the calls were single harmonic. This paper also provides first hand information on the call parameters and status of this species from Pakistan.

Key words: Least pipistrelle, Distribution, Baculum, Cranium, Forearm, kHz, Pakistan.

INTRODUCTION

The Least Pipistrelle or Indian Pygmy Bat (*Pipistrellus tenuis)* is the smallest pipistrelle found in the Indian subcontinent. It is distributed in much of South Asia, southeastern China and Southeast Asia (Simmons, 2005). In South Asia, the species is found in Afghanistan, Bangladesh, Nepal, India, Pakistan and Sri Lanka (Das, 2003; Korad *et al*. 2007; Molur *et al*. 2002; Vanitharani 2006). In Pakistan, it has been recorded from Malakand (Roberts, 1997), Chitral (Sinha, 1980), Multan, Chaklala (Hinton and Thomas, 1926), Chakri (Siddiqui, 1961), Gambat, Sukkur (Siddiqui, 1961), Karachi and Malir (Walton, 1974).. This species is found in arid zones to wet and humid areas. It roosts in hollows of trees, holes, crevices and cracks in walls and ceilings of old buildings, dead leaves of trees. In Southeast Asia, this is largely a forest species that inhabits primary and secondary hill, montane and montane mossy forest (Heaney *et al*., 1998; Bates and Harrison, 1997).

Taber *et al*. (1967) conducted a seven month survey of mammals of Lyallpur region and documented four bat species from this region. These included *Pipistrellus ceylonicus subcanus*, *P. kuhlii kuhlii*, *P. mimus mimus* and *Scotophilus heathii*. *Pipistrellus mimus mimus* has been reclassified as *Pipistrellus tenuis* from the same region. The taxonomy of *Pipistrellus tenuis* is still unclear in Pakistan (Mahmood-ul-Hassan and Nameer, 2006; Mahmood-ul-Hassan *et al*., 2009) and further studies are needed to clarify taxonomic status of populations currently allocated to this species (Francis *et al*., 2008). Ellerman and Morrison-Scott (1951) and Sinha (1999) considered *Pipistrellus mimus* Wroughton, 1899 to represent forms from South Asia. The taxon *glaucillus* Wroughton, 1912, (the origin of this species is Multan Punjab) considered earlier as distinct subspecies, has been synonymised following Sinha (1980) (Srinivasulu *et al.* 2010). Bates and Harrison (1997) synonymised *Pipistrellus mimus glaucillus* Wroughton, 1912 under *P. tenuis* and recognized all the populations from Indian subcontinent as *P. tenuis mimus.*

Population status and distributional ranges of almost all bats of Pakistan has changed over the past fifty years (Mahmood-ul-Hassan *et al.*, 2012; Javid *et al*., 2012). This paper provides an updated record of the status and distribution of P. tenuis from Pakistan. It also documents call parameters of the recently recorded *P. tenuis* and compares their morphometric measurements with those already recorded from Pakistan.

MATERIALS AND METHODS

Study Area: Islamabad and Rawalpindi districts are located between 33°40' and 38°44' N latitude and between 73°08' and 73°15' E longitude. The districts are bounded by Poonch of Azad Kashmir in the east, Attock in the west, Hazara in the north and Jhelum in the south. Latitude ranges from 460 m to 2000 m. Water erosion is active and many streams have formed vey deep channels. The area is drained by the Soan river and its tributaries and dams like Rawal, Simli, Mistriote etc. The soil type is loamy and soils are normally alkaline with pH range of 7.3 to 8.73, *Acacia modesta* is amongst the climax vegetation. Electrical conductivity ranges from 0.86 dsm

at Saidpur to 3.43 dsm at Rawal Lake area (Awan *et al*., 1992). The hills of Islamabad are an extension of the Himalayan range and form the northern boundary of the Potohar Plateau. The area has been included in the sub-tropical scrub forest (Champion *et al*., 1965). The average maximum temperature is 34.3°C while the average minimum temperature is 3.4°C. Snow is occasional. Rain fall occurs in monsoon and winter, average being 1200 mm per year (Shinwari and Khan, 2000).

Capture Technique. The study area was extensively surveyed to find out the diversity of bats. These efforts resulted in the capture of two specimens of *P. tenuis*. Six mist nets which were 12 m (n = 1), 9 m (n =2) and 6 m (n = 3) long high quality, deep black, UV stable and strong (Ecotone 716/6, 716/9 and 716/12) were used to capture bats. The nets were erected along the banks of fish ponds at two stations i.e Rawal Town Fish Hatchery (N 33º40.966, E 073º07.108) and National Agricultural Research Center (N 33º39.892, E 073º07.108) and were employed for one night each i.e. September 29 and 30, 2009, respectively. Two specimen of *P. tenuis* one each at these stations were captured. A total of 15 netting nights were spent at Margalla Hills National Park and adjacent areas in Islamabad and total mist net area during each night was 120 m^2. The netting index for any bat species was calculated using the formula; Netting index of ith species = (ni/Total net area × hrs) 100 where n is the number of bats of ith species caught.

Body mass, external body, cranial and bacular measurements. The captured specimens were placed in cotton bags and weighed up to 0.1 g (Pesola balance 10050, Swiss made). The bats were then euthanized and preserved in absolute alcohol. They were assigned field numbers (MMH 290909.7 and MMH 290909.8) and brought to the laboratory. Before preparing their skulls and bacula, the external body measurements were recorded using a digital vernier caliper (0-150 mm) following Bates *et al*., (2005). These measurements include body mass, head and body length, ear length, tragus length, thumb length, claw length, forearm length, length of 3rd metacarpal, 1st phalanx on 3rd metacarpal, 2nd phalanx on 3rd metacarpal, length of 4th metacarpal, 1st phalanx on 4th metacarpal, 2nd phalanx on 4th metacarpal, length of 5th metacarpal, 1st phalanx on 5th metacarpal, wing span, tibia length, calcar length, hind foot length, tail length and penis length. The cranial measurements include breadth of braincase, zygomatic breadth, postorbital constriction, condylo-canine length, condylo-basal length, greatest length of skull, maxillary toothrow, anterior palatal width, posterior palatal width, mandibular toothrow and mandible length while the bacular measurements included total bacular length, shaft length, proximal branch length, distal branch length, proximal branch width, distal branch width and bacular height. These measurements were used to ascertain the species of the captured bat and compared with those already available in literature (Tate, 1942; Ingle and Heaney, 1992; Bates and Harrison, 1997; Hosken *et al*., 2001; Saikia *et al*., 2011).

Echolocation calls. A Patterson D1000X was used to record bat sounds. The recordings were analyzed with the software Bat-Sound 4 (Pettersson Elektronik AB) using a sample frequency of 44.1 kHz, with 16 bits/sample, and a 512 point FFT with a Hamming window for analysis. The start frequency (SF), end frequency (EF), frequency of maximum energy (FMAXE), call duration (D) and inter-pulse interval (IPI) were measured. Mean and standard deviation for all the pulses analyzed from a single long recording was determined and the values were compared with those available in literature (Mahmood-ul-Hassan *et al*., 2102 this is the reference from paper published in Mammalia).

RESULTS AND DISCUSSION

Distribution and Status. *Pipistrellus tenuis* generally frequents human habitations (Madhavan, 2000) in much of its range in the Southeast Asia (Vanitharani, 2006). Capture of two specimens from Islamabad confirms that a small population (netting index 0.06) of *P. tenuis* still exists in the Federal Capital from where it was previously recorded by Hinton and Thomas (1926) and Siddiqi (1961).

Body Mass and External Body Measurements. The mean body mass and external body, cranial and bacular measurements of the two *P. tenuis* specimens are given Table 1. The mean body mass of captured specimens was 4.25 g ± 1.061 (SD), with head and body length of 35.00 mm ± 2.828 (SD). The ear and tragus lengths were 7.50 mm ± 0.707 (SD) and 3.00 mm ± 0.000 (SD), respectively. The thumb and claw lengths were 3.50 mm ± 0.707 (SD) and 1.75 mm ± 0.354 (SD), respectively. The 3rd metacarpal and its 1st and 2nd phalanges were 25.25 mm ± 0.354 (SD), 10.75 mm ± 0.354 (SD) and 8.25 mm ± 1.061 (SD), respectively. The 4th metacarpal and its 1st and 2nd phalanges were 23.75 mm ± 1.061 (SD), 10.75 mm ± 0.354 (SD) and 8.00 mm ± 0.000 (SD) long, respectively. The length of the 5th metacarpal and its 1st phalanx was 23.75 mm ± 1.061 (SD) and 6.75 mm ± 0.354 (SD), respectively. The wing span, tibia, calcar, hind foot, tail and penis lengths were 156.00 mm ± 21.213 (SD), 10.25 mm ± 1.768 (SD), 6.00 mm ± 1.414 (SD), 6.25 mm ± 1.768 (SD), 22.25 mm ± 3.182 (SD) and 4.50 mm ± 0.707 (SD), respectively.

Table 2 compares these measurements with Tate (1942), Ingle and Heaney (1992), Bates and Harrison (1997), Hosken *et al*. (2001) and Saikia *et al*. (2011). The two *P. tenuis* were heavier than those recorded by Ingle and Heaney (1992), and Hosken *et al*. (2001) and smaller

than those recorded by Ingle and Heaney (1992). The means and ranges for head and body length, ear length, forearm length, length of 3rd metacarpal, length of 4th metacarpal, length of 5th metacarpal, calcara length and tail length of the two specimens captured during the present study overlapped with those given by Bates and Harrison (1997) and Saikia *et al*. (2011). The mean hind foot length was within the ranges given by Tate (1942) and Ingle and Heaney (1992).

Cranial measurements. The breadth of the braincase and zygomatic process were 6.30 mm and 7.80 mm, respectively. The post-orbital constriction was 3.96 mm. The condylo-canine and condylo-basal lengths were 9.42 mm and 10.13 mm, respectively. The greatest length of the skull was 10.19 mm. The maxillary toothrow length was 3.78 mm, anterior and posterior palatal widths were 3.56 mm and 5.23 mm, respectively. Mandibular toothrow length and the length of the mandible were 4.27 mm and 7.82 mm, respectively (Table 1). The breadth of the braincase, condylo-canine length and mandible length of *Pipistrellus tenuis* were within the measurements ranges given by Bates and Harrison (1997) while zygomatic breadth, postorbital constriction and mandibular toothrow length were slightly larger than recorded by Saikia *et al*., (2011) from India.

Bacular measurements. The total bacular length was 3.46 mm with shaft length of 2.53 mm. The proximal and distal bacular lengths were 0.63 mm and 0.28 mm, respectively while proximal and distal bacular widths were 0.80 mm and 0.39 mm, respectively. The height of the baculum was 0.65 mm (Table 1, Fig. 2). The baculum was slightly smaller than that recorded by Hosken *et al*., 2001 (Table 2).

Fig. 1. Distribution map of *Pipistrellus tenuis* in Pakistan.

Table 1. Body mass (g), hean abd body, cranial and bacluar measurements (mm) of *Pipistrellus tenuis* captured from Islamabad.

External Body Measurements	n= 2	Cranial Measurements	n= 1
Body mass (g)	4.25±1.061	Breadth of braincase	6.30
Head and body length	35.00±2.828	Zygomatic breadth	7.80
Ear length	7.50±0.707	Postorbital constriction	3.96
Tragus length	3.00±0.000	Condylo-canine length	9.42
Thumb length	3.50±0.707	Condylo-basal length	10.13
Claw length	1.75±0.354	Greatest length of skull	10.19
Forearm length	28.00±0.707	Maxillary toothrow	3.78
Length of 3rd metacarpal	25.25±0.354	Anterior palatal width	3.56
1st Phalanx on 3rd metacarpal	10.75±0.354	Posterior palatal width	5.23
2nd phalanx on 3rd metacarpal	8.25±1.061	Mandibular toothrow	4.27
Length of 4th metacarpal	23.75±1.061	Mandible length	7.82
1st Phalanx on 4th metacarpal	10.75±0.354	**Bacular Parameters**	**n=1**
2nd phalanx on 4th metacarpal	8.00±0.000	Total length of baculum	3.46
Length of 5th metacarpal	23.75±1.061	Length of shaft	2.53
1st phalanx on 5th metacarpal	6.75±0.354	Length of proximal branch	0.63
Wing span	156.00±21.213	Length of distal branch	0.28
Tibia length	10.25±1.768	Width of proximal branch	0.80
Calcar length	6.00±1.414	Width of distal branch	0.39
Hind foot length	6.25±1.768	Height of baculum	0.65
Tail length	22.25±3.182		
Penis length	4.50±0.707		

Table 2. Comparison of body mass (g), heand and body, cranial and bacular measurements (mm) of various specimens of *Pipistellus tenuis*.

Parameters	I	II	III	IV	V	VI (n = 2)
				(mm)		
Body mass (g)	-	3.0-4.0	-	3.30	-	4.25(3.19-5.31)
Total length	-	68.0-76.0	-	-	-	57.25(57.0-57.5)
Head and Body Length	-	-	39.1(33.0 – 45.0)	-	37-37.5	35.00(33.0-37.0)
Ear length	-	11.0-12.0	9.7(5.0 – 11.0)	-	8.0-8.2	7.50(7.0-8.0)
Tragus length	-	-	-	-	3.4-4.0	3.00(3.0-3.0)
Forearm	30	30.0-32.0	27.7(25.0 – 30.2)	-	27.5-28.5	28.00(27.5-28.5)
3rd metacarpal	-	-	26.7(23.9 – 29.7)	-	-	25.25(25.0-25.5)
4th metacarpal	-	-	26.4(23.7 – 29.2)	-	-	23.75(23.0-24.5)
5th metacarpal	-	-	25.9(23.5 – 28.5)	-	-	23.75(23.0-24.5)
Hind foot	6.1	6.0-7.0	-	-	5.5	6.25(4.48-8.02)
Tibia	-	-	-	-	11.9-12.0	10.25(8.48-12.02)
Calcar	-	-	5.3(3.0 – 7.0)	-	-	6.00(5.0-7.0)
Tail	-	26.0-31.0	28.9(20.0 – 35.0)	-	29.0	22.25(20.0-24.5)
Breadth of braincase	-	-	6.0(5.6 – 6.3)	-	5.8-6.2	6.30
Zygomatic breadth	-	-	7.4(7.3 – 7.6)	-	7.4	7.80
Postorbital constriction	-	-	3.3(2.9 – 3.7)	-	3.2-3.4	3.96
Condylo-canine length	-	10.6-11.0	10.2(9.3 – 10.7)	-	10.3-10.5	9.42
Condylo-basal length	-	11.2-11.7	-	-	10.8-11.0	10.13
Greatest length of skull	-	-	11.5(10.7 – 12.1)	-	11.2-11.4	10.19
Maxillary toothrow	2.5	-	-	-	3.8-3.9	3.78
Anterior palatal width	-	-	-	-	3.4-3.7	3.56
Posterior palatal width	-	-	-	-	4.7-5.0	5.23
Mandibular toothrow	-	-	-	-	4.0-4.3	4.27
Mandible length	-	-	7.9(7.2 – 8.3)	-	8.0-8.1	7.82
Total bacular length		-	-	3.50	-	3.46

* Mean and range for a particular parameter is given when at least two specimens were recorded.
I = Tate, 1942; II = Ingle and Heaney, 1992; III = Bates and Harrison, 1997); IV = Hosken *et al*., 2001; V = Saikia *et al*., 2011; VI = Present study.

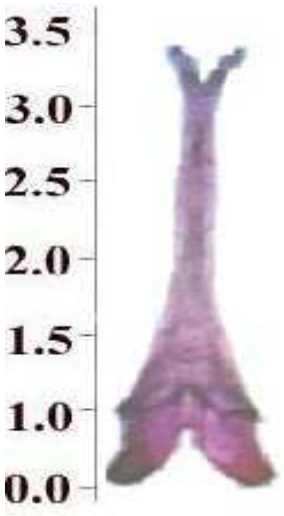

Fig. 2. Baculum of *Pipistrellus tenuis* captured from Islamabad.

Echolocation calls. These bats emit broad band frequency modulated signals (Table 3). Mean duration for these calls was 9.9 ms ± 1.0 (SD). Mean frequency of maximum energy was 34.1 kHz ± 1.5 (SD). Mean start and end call frequencies were 56.0 kHz ± 4.8 (SD) and 33.1 kHz ± 2.6 (SD), respectively where mean inter pulse interval was 121.3 ms ± 73.4 (SD). The calls were single harmonic.

It is hard to differentiate *Pippistrellus tenuis* from its congeners on the basis of external features alone (Bates and Harrison, 1997), the species needs further studies for its exact taxonomic status (Francis *et al*., 2008). *Pipistrellus tenuis* was considered common and widely distributed in Pakistan having stable populations (Molur *et al*. 2002). Countrywide surveys are necessary to refine the taxonomy, distribution and status of this species in Pakistan. Call parameters presented here can help to estimate its population without unnecessary killing of the bats.

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