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Original Article

Morphometrics of the indian false vampire bat (*Megaderma lyra*) from district Jhelum, Pakistan

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(With 2 figures)

Abstract

During the present study thirteen *Megaderma lyra* bats were observed roosting in dark, domed shaped room of Rohtas Fort, district Jhelum. Out of these, six specimens were captured from the roosting site, using hand net. All captured specimens were male. These bats were identified through their unique facial features, an erect and elongated nose-leaf, large oval ears that joined above the forehead and no tail. Mean head and body length of captured specimens was 80 mm, forearm length was 67 mm while average lengths of 3rd, 4th and 5th metacarpals were 51.73 mm, 55.17 mm and 60.42 mm, respectively. Mean skull length was 29.84 mm, breadth of braincase was 12.77 mm. Average Penis length of two specimens was 6.6 mm and total bacular length was 3.08 mm respectively. This is the first record of *Megaderma lyra* from district Jhelum.

Keywords: indo-Malayan region, nose-leaf, Megadermatidae, Rohtas Fort, forearm length.

Morfometria do falso morcego vampiro indiano (Megadermalyra) do distrito de Jhelum, Paquistão

Resumo

Durante o presente estudo, 13 morcegos Megadermalyra foram observados empoleirados em uma sala escura em forma de cúpula no Forte Rohtas, distrito de Jhelum, dos quais 6 espécimes foram capturados no local usando rede manual. Todos os espécimes capturados eram machos. Esses morcegos foram identificados por suas características faciais únicas, uma folha nasal ereta e alongada, grandes orelhas ovais que se juntam acima da testa e sem cauda. O comprimento médio da cabeça e do corpo dos espécimes capturados foi de 80 mm, o comprimento do antebraço foi de 67 mm, enquanto os comprimentos médios do 3º, 4º e 5º metacarpos foram de 51,73 mm, 55,17 mm e 60,42 mm, respectivamente. O comprimento médio do crânio foi de 29,84 mm, e a largura da caixa craniana, de 12,77 mm. O comprimento médio do pênis de duas amostras foi de 6,6 mm, e o comprimento total do báculo foi de 3,08 mm. Este é o primeiro registro de Megadermalyra no distrito de Jhelum.

Palavras-chave: região indo-malaia, folha nasal, Megadermatidae, Forte Rohtas, comprimento do antebraço

1. Introduction

Chiroptera (Bats Blumenbach., 1779) are very famous for their extensive worldwide occurrence, high population densities, high diversity, and common usage of metropolitan habitats (in particular, close to the human surroundings as well as buildings and stables incidence in big cities (Dekker et al., 2013; Ullah et al., 2019; Rahman et al., 2015).

The members of family Megadermatidae are confined to the old world tropics (Bates and Harrison, 1997). This family is represented in Pakistan by a single species *Megaderma lyra*. These bats roost in caves, temples, forts, old ruined buildings, underground tunnels and shallow soapstone mines (Brosset, 1962; Khajuria, 1980). Generally*Megaderma lyra* leave their roosts silently with flapping flight, for a short period after the sunset (Phillips, 1980). Genus *Megaderma* is one of the four genera that have two species but other three genera are mono specific. *Megaderma lyra* is different from its congener *Megadermaspasma* (Linnaeus, 1758) due to short but broad bifid tragus, long nose leaf, deep pre-nasal notch, smaller postorbital process, longer forearm and has ability to listen the weak returning echoes and sounds of the prey (Csorba and Topal, 1994; Leippert et al., 2002; Page and Ryan, 2005). Due to these morphological differences, *M. lyra* was placed in a separate sub-genus *Lyroderma (*Lekagul and McNeely, 1977). This bat has two subspecies, *M. l. lyra*, which has wide distribution from Afghanistan to southern China, Burma, Thailand, west Malaysia and Bangladesh (Simmons, 2005) and the slightly larger *M. l. sinensis,* from China, Thailand, Malaysia and Vietnam (Corbet and Hill, 1992; Hendrichsen et al., 2001).

Previously seven specimens of *M. lyra* have been collected from different localities in Pakistan and preserved in the British Museum (London), six of them from Lehtrar (Murree), Punjab and one from Lasbela, Baluchistan (Siddiqi, 1961). (Roberts (1997) has also reported some specimens from Lahore and Sialkot (Punjab) and Sukkur (Sindh). However, this species has been recorded recently from Malakand district of Khyber-Pakhtunkhwa (KP) (Salim and Mahmood-ul-Hassan, 2014). Although this species has been reported from Afghanistan but has not been reported from Iran (Bates and Harrison, 1997; Mahmood-ul-Hassan et al., 2009; Roberts, 1997; Simmons, 2005).

Megaderma lyra play a vital role in controlling of the pest populations, so therefore present study was designed to ascertain the presence or absence of this species from district Jhelum from where they has not been reported prior to the present study.

2. Materials and Methods

Field surveys were carried out to explore bat fauna of district Jhelum, Punjab province and all the potential bat roost sites such as old and undisturbed buildings, abandoned wells and farm houses were examined (Figure 1). Local people were also interviewed for the collection of information regarding exact location of various bat roosts,The coordinates of all location of bat roost were recorded using a global positioning system device GPS(Garmin etrax H GPS) (Hamidullah et al., 2019; Javid et al., 2012a,b). Mist nets of different size e.g. (Ecotone 716/9, 716/6, 716/18) were used for capturing of bats with "L" shape or "V" shape position. These mist nets were erected in bamboo poles up three to five meter height in such a way that the shelf of the nets was one to two feet above the ground level. All sampling points were visited on monthly basis. All bats specimens were captured during evening hours or early in the morning epically in twilight and some time from 2 hours up to 6 hours after sunset according to the weather condition. All nets were checked constantly at intervals of 15-20 minutes and captured samples of bats were kept in cloth bags separately (Hamidullah et al., 2018; Javid et al., 2011).

Hand net was also used for capturing the bats, epically at roosting site in old building, caves, under bridge and tunnels etc. All the specimens weighed up to an accuracy of 0.1 g (Pesola Spring Balance 300g) and external body measurements were recorded with the help of vernier calipers measuring up to 0.01(mm) accuracy. These finding were also compared with Bates and Harrison (1997), Roberts (1997) and Shahbaz et al. (2015).

The specimens were then euthanized, preserved in absolute alcohol and were transported to the laboratory for recording the cranial and bacular measurements following (Salim et al., 2016a, b; Shahbaz and Javid, 2014).

3. Results and Discussion

Identification of bats using morphological characters, morphometry, skull parameters and external character matrices are still considered a reliable tool to identify

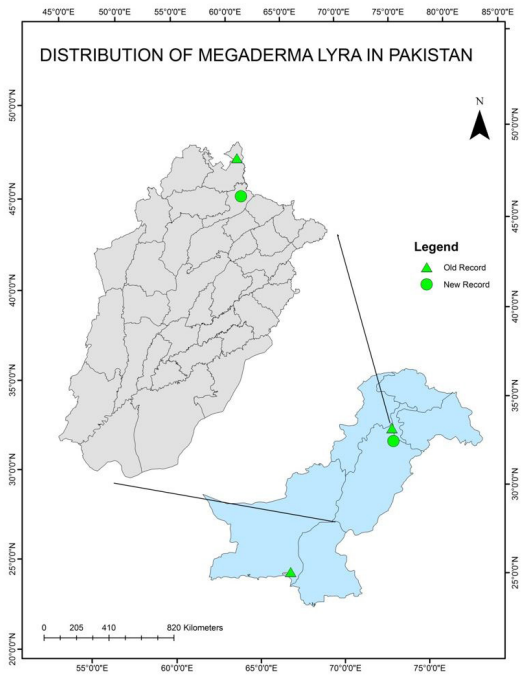

Figure 1. Map of the study area showing survey sight in Pakistan.

different chiropteran species (Daniel, 2009; Srinivasulu et al., 2010; Shahbaz et al., 2014). A total of thirteen *M. lyra* specimens were recorded roosting in a dark domed shaped room of fort Rohtas, which is situated 810 m above sea level in a valley, approximately 9 km away from Tehsil Dina and 16 km north-west of district Jhelum. Out of these thirteen individual six (n = 6) were captured and their external body, cranial and bacular features were compared with Roberts (1997), Bates and Harrison (1997) and Salim and Mahmood-ul-Hassan (2014) (Table 1) (Figure 2).

During morphometric analysis it was observed that the captured bat specimens were having fine, soft, silky, moderately long and grey hairs on dorsal side, while the ventral surface was paler and hairs of the throat have white tips. The forehead and cheeks were hairy and the muzzle was naked. The captured specimens had naked nose leaf which was vertical and straight, sided with a ridge having two furrows in the middle and a simple rounded horizontal base. Large, oval and medially joined ears with fringe of white hairs on their anterior margins were observed. These observations are in line with the findings of Salim and Mahmood-ul-Hassan (2014) for *M. lyra* specimens recorded from Khyber Pakhtunkhwa province. Wings of the captured specimens were larger as the fifth digit was relatively longer. Similar observations have been documented by Corbet and Hill (1992). The specimens had no second phalanx on the second metacarpal, tail was absent and the inter-femoral membrane was supported by calcars as also reported by Salim and Mahmood-ul-Hassan (2014). Eyes of the captured specimens were bulgy and protrusive in appearance.

The premaxillae were reduced and represented by tiny threadlike bones with reduced nasal bones. The rostrum is also small in relation to the large ovate braincase. Similar observations have been recorded by Bates and Harrison (1997), Roberts (1997) and Salim and Mahmood-ul-Hassan (2014). The mandible was projecting beyond the maxilla as also reported by Hendrichsen et al., (2001).

Table 1. Mean body mass (g) and external body measurements (mm) of *Megaderma lyra* Captured from District Jhelum, Punjab, Pakistan.

Body Parameters	Present study mm (n=6)	Salim and Mahmood-ul-Hassan 2014 mm	Bates and Harrison 2003 mm	Roberts, 1997 mm
Body mass	51 (48-63)	52.4		
Head and Body	80 (78-83)	85.40(82-88)	70-95	76-94
Ear	35.5 (33-37.5)	38.14(31.7-40)	31.5-45	33-40
Forearm length	67 (65-69)	66.4(59-71)	56.0-71.5	65-72
Wing span	427(419-436)	-	396-454	
Hind foot	18 (17-19)	16.7(17-20)	14.00-20.00	
Thumb length	11(10-12)	-		
Length of 3rd metacarpal	51.7 (51-53)			
1st phalanx on 3rd metacarpal	30.5(30-28)			
2nd phalanx on 3rd metacarpal	39 (38-41)			
Length of 4th metacarpal	55.1(54-56.7)			
1st phalanx of 4th metacarpal	20 (19-21.5)			
2nd phalanx of 4th metacarpal	23 (22-24)			
Length of 5th metacarpal	60.4(58.7-62.4)			
1st phalanx on 5th metacarpal	22(21-23.5)			
2nd phalanx on 5th metacarpal	20 (19-21)			
Tibia length	34.5(33-36)			
Nose leaf	12 (11.5-12)			
Cranial Parameters				
`Greatest skull length	29.8 (29.3-30.4)	28.7(29.1-30)	27.1-30.2	
Breadth of brain case	12.7 (12.4-13)	12.2(12.3-12.8)	11.8-12.9	
BacularParameters				
Penis length	6.6(6.6-7)			
Total bacular length	3.08			

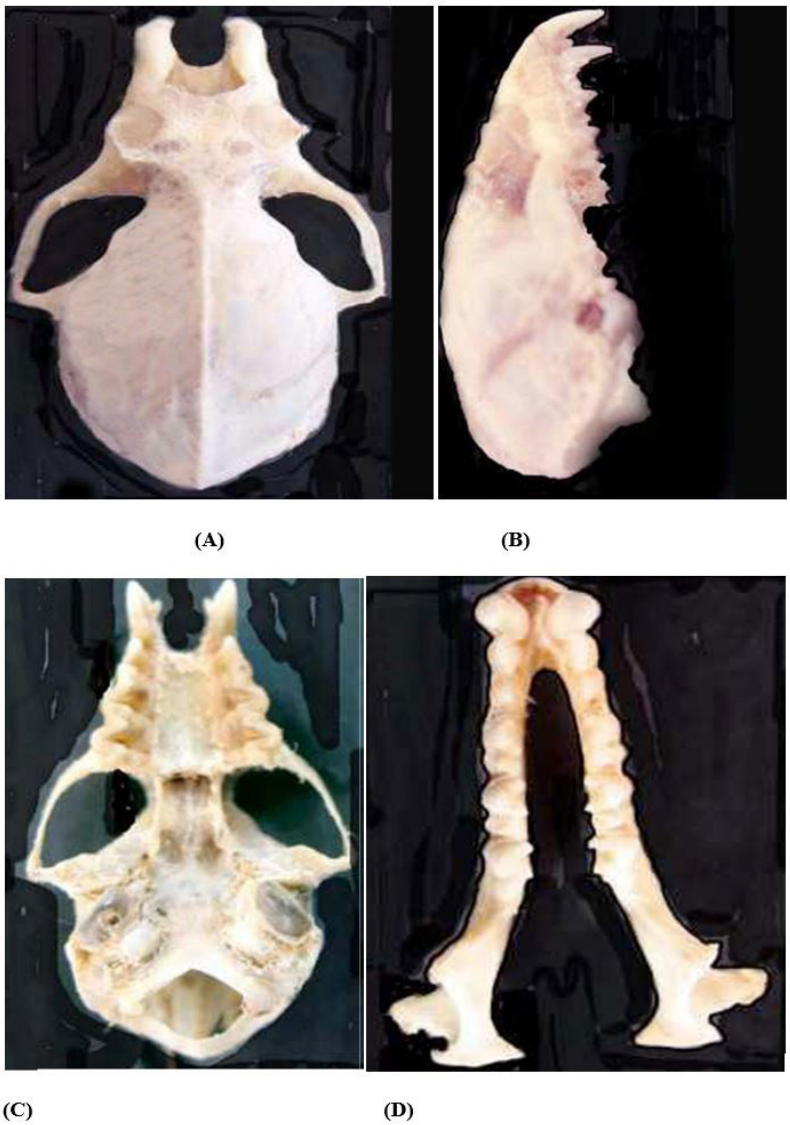

Figure 2. Dorsal (A), Lateral (B) and Ventral (C) view of cranium of *Megaderma lyra* along with Ventral view of the mandibles (D) captured from Rohtas Fort, district Jhelum Pakistan

The frontal palatal notch was wide and profound with its posterior border adjacent to the first upper premolar and the tympanic bullae were small as recorded by Bates and Harrison (1997). There were no upper incisors, the upper canine was large with a well-developed posterior basal cusp and a small antero-internal-cingularcusp but the first upper premolar was minute and was concealed between the canine and the large second premolar. These findings are in line with the observations reported by Salim and Mahmood-ul-Hassan (2014). On the lower jaw, mandibular dentition had two tricuspid incisors (i1 and i2) adjacent to the large and sharply pointed canine as also recorded by Salim and Mahmood-ul-Hassan (2014). The anterior part of the first mandibular premolar (pm2) was situated on the posterior cingulum of the canine. The second premolar (pm4) was slightly surpassing the crown area of pm2 and was more rectangular and less rounded in shape. These findings were also recorded by Bates & Harrison (1997). The average penile length was 6.6 mm.

Megaderma lyra forages and devours insects throughout its accessible range and their echolocation ability enables it to capture and handle prey effectively. (Neuwlier, 2001). Wings morphology and variability in flight style is also a good indicator of a bat diet inclination (Fenton, 2003). *Megaderma lyra* exhibits a blend of ground or vegetation gleaning and perch hunting behavior. It mostly forage less than 6 meters above the ground vegetations, among trees and vegetation in tropical forested niches (Lekagul and McNeely, 1977). The member of family Megadermatidae plays an important role in the control of insect's population

in the forest and agro-ecosystem as a pest and bio-resource manager (Juliet et al., 2015).

This paper documents and describes the morphometric measurements of *Megaderma lyra* from district Jhelum for the first time. The district is deficient in water resources for vegetable crops. *Megaderma lyra* might be playing an important role in pest control, which requires further investigation to access its role as bio control agent as the use of insecticides is detrimental to all species of bats.

Ethical approval

Ethical permission for bat capture was provided by the Research Ethical Committee, Faculty of life and Environmental Sciences University of Peshawar (under registration number NO: 11/EC-F-LIFE-2020). Some captured bats were identified in the field up to the species and immediately released in the field. For further justification some collected specimens were brought to the Bat laboratory at Department of Zoology,University of Peshawar and their skulls and bacula were prepared. After the complete processing of the sample they were preserved in 70% ethanol with specific voucher numbers from bat lab no. 110 to bat lab no. 116 and send to museum of Department of Zoology, University of Peshawar, Pakistan.

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