

**FIRST RECORD OF THE LESSER MOUSE-TAILED BAT *Rhinopoma hardwickii*  
(RHINOPOMATIDAE: CHIROPTERA) FROM SOUTHERN PUNJAB, PAKISTAN**

A. Javid, M. Mahmood-ul-Hassan<sup>\*</sup>, M. S. Nadeem<sup>\*\*</sup>, N. Rana<sup>\*</sup> and N. Khan<sup>\*\*\*</sup>

Department of Wildlife and Ecology, University of Veterinary and Animal Sciences, Lahore

<sup>\*</sup>Department of Zoology and Fisheries, University of Agriculture, Faisalabad.

<sup>\*\*</sup>Department of Zoology, PMAS – University of Arid Agriculture, Rawalpindi.

<sup>\*\*\*</sup>Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences, Lahore

Corresponding Author e-mail: drmmhassan1@gmail.com

**ABSTRACT**

The lesser mouse-tailed bat *Rhinopoma hardwickii* Gray, 1831 has not been recorded from Pakistan except from northern Punjab (Rohtas) and southern Sindh (Karachi, Landhi and Karchat Hills near Hyderabad). These records date back to 1927. Here after 84 years, we provide an account of the third country and first record of this species from southern Punjab. Rhinopomatid bats (n =5) were captured from this region of which two were euthanized to describe their external body, cranial and bacular measurements. This paper compares various morphometric measurements of these bats to those already mentioned in literatures and documents habitat and new distribution map of this species in Pakistan.

**Key words:** Bacula, Cellar, Forearm length, Noor Mahal, Skull, Bahawalpur.

**INTRODUCTION**

Rhinopomatidae Bonaparte, 1838 is a monotypic family of mouse-tailed bats, comprising of four extant species within the same genus *Rhinopoma* Geoffroy, 1818 (Van cakenberghe and de Vree, 1994) and includes *Rhinopoma microphyllum* (Brunnich, 1782), *R. hardwickii* Gray, 1831, *R. muscatellum* Thomas, 1903, and *R. macinnesi* Hayman, 1937. Former three of these four species are represented in Pakistan (Simmons, 2005). The lesser mouse-tailed bat, *Rhinopoma hardwickii* Gray, 1831 is distributed from Morocco to Burma, south to Mauritania, Senegal, Mali, Burkina Faso, Niger and Kenya and Socotora Isles (Yemen). This species is rare and locally distributed in Pakistan (Roberts, 1997; Mahmood-ul-Hassan and Nameer, 2006). It has been recorded from Rohtas, Salt Range in Punjab (Lindsay, 1927) and from Landhi and Karchat Hills (Hinton and Thomas, 1926) in Sindh (Roberts, 1997; Mahmood-ul-Hassan *et al.*, 2009). Information on the extant of occurrence, area of occupancy, habitat status, distribution and morphology and population trends of this species from Pakistan is scarce and scanty (Sheikh and Molur, 2004). Bates and Harrison, (1997) and Mahmood-ul-Hassan *et al.* (2009) documented information on the distribution and morphology of *R. hardwickii* from Pakistan but both these sources are based on literature reviews and as such little field work has been carried out to know the actual distribution range of this bat in Pakistan in the recent time.

Keeping in mind the original reports (Hinton and Thomas, 1926; Lindsay, 1927), a focused field

survey was conducted to explore their presence or absence in the region. This paper describes habitat, distribution and morphology of *Rhinopoma hardwickii* after 84 years since its first description from Pakistan.

**MATERIALS AND METHODS**

A systematic survey of the northern (Margalla Hills National Park and Chinji National Park), central (Lahore, Kasur, Faisalabad), and southern Punjab (Lal Suhanra National Park) was made to ascertain the presence or absence of rhinopomatid bats in the province from June 2009 to May 2011. Each of the three topographic subdivisions of Punjab was surveyed for three consecutive days in alternate months and thus 30 sites were sampled in 26 field visits. Potential bat roosts such as old and undisturbed buildings, ruins, abandoned wells and farm houses were thoroughly searched. Based on information provided by local residents at Bahawalpur, a building named "Noor Mahal" (N 29°22.695, E 071°40.132) was also surveyed on November 20, 2009. More than thirty bats were roosting in six cellars of this building and on an average five or six were present in each cellar at that time (Plate 1). Only two adult male *R. hardwickii* were captured from a cellar with the help of a hand net. The catch size was intentionally kept low to avoid disturbance and further decreases their population size.

These specimens were placed in cotton bags and were weighed (up to 0.1 g) before being euthanized and preserved in absolute alcohol filled plastic jars. Specimens were then brought to the laboratory for taking

external body measurements which included; head and body length, ear length, tragus length, forearm length, claw length, thumb length, length of each metacarpal including its phalanges, wing span, penis length, tibia length, calcar length, hind foot length, and tail length.

Bat skulls were prepared for recording cranial measurements following Bates *et al.* (2005) and the greatest length of skull (GTL), condylo-basal length (CBL), condylo-canine length (CCL), zygomatic breadth (ZB), breadth of braincase (BB), post-orbital constriction (PC), mandible length (M), maxillary toothrow length (C-M<sup>3</sup>), mandible toothrow length (C-M<sub>3</sub>), posterior palatal width (M<sup>3</sup>-M<sup>3</sup>), anterior palatal width (C<sup>1</sup>-C<sup>1</sup>) were measured following Bates and Harrison (1997). Penis of a single male specimen was cut down and the baculum was prepared following (Bates *et al.*, 2005). Total bacular length (TLB), shaft length (SL), proximal branch length (PBL), distal branch length (DBL), proximal branch width (PBW), distal branch width (DBW) and bacular height (BH) were measured.

## RESULTS AND DISCUSSION

**External Morphology.** The lesser mouse-tailed bat *R. hardwickii* was collected only from a single roost i.e. Noor Mahal located in Bahawalpur City during the present survey (see Plate 2). These bats are often distinguished from their congeners on the basis of their tail which is always longer than their forearm (Roberts, 1997; Mahmood-ul-Hassan *et al.*, 2009). Bats under discussion also had exceptionally long tails (59.00 mm ± 2.828 SD), that were longer than their forearm lengths (54.00 mm ± 0.0 (SD)). Their pelage was brownish grey above with pale hair roots, the interfemoral and wing membranes, posterior back and lower abdomen were naked while the chin was nearly naked (DeBlase *et al.*, 1973; Roberts, 1997; Bates and Harrison, 1997 and Benda *et al.*, 2004).

**Body mass and external body measurements.** The mean body mass was 15.30 g ± 0.424 (SD) while the head and body, ear and tragus lengths were 66.00 mm ± 5.657 (SD); 15.50 mm ± 2.121 (SD) and 6.50 mm ± 0.707 (SD), respectively. Thumb and claw were 5.75 mm ± 0.354 (SD) and 1.75 mm ± 0.354 (SD) long, respectively. The mean forearm length was 54.00 mm ± 0.0 (SD) while 3<sup>rd</sup> metacarpal was 39.00 mm ± 0.0 (SD) long. The 1<sup>st</sup> and 2<sup>nd</sup> phalanges on 3<sup>rd</sup> metacarpal were 9.00 mm ± 0.0 (SD) and 14.25 mm ± 4.596 (SD) long, respectively. The 4<sup>th</sup> metacarpal was 32.75 mm ± 0.354 (SD) long while 1<sup>st</sup> and 2<sup>nd</sup> phalanges on 4<sup>th</sup> metacarpal measured 11.50 mm ± 1.414 (SD) and 10.50 mm ± 0.707 (SD) long, respectively. The 5<sup>th</sup> metacarpal was 37.50 mm ± 0.707 (SD) long while its 1<sup>st</sup> phalanx measured 10.75 mm ± 1.061 (SD). The wing span was 260.50 mm ± 0.707 (SD). Tibia, calcar, hind foot, tail and penis were 27.50 mm ±

1.414 (SD), 5.50 mm ± 0.707 (SD), 14.00 mm ± 0.000 (SD), 59.00 mm ± 2.828 SD and 3.00 mm ± 0.000 (SD) long, respectively (Table 1).

**Cranial measurements.** The braincase and zygomatic bone were 7.61 mm ± 0.018 (SD) and 12.08 mm ± 0.162 (SD) broad, respectively (Table 1). The postorbital constriction, condylo-canine length and condylo-basal lengths were 2.88 mm ± 0.054 (SD), 116.12 mm ± 1.075 (SD) and 17.78 mm ± 0.898(SD) respectively. The greatest skull, maxillary tooth row, mandibular tooth row and mandible length were 19.68 mm ± 0.108 (SD), 5.84 mm ± 0.359 (SD), 6.10 mm ± 0.718 (SD) and 11.28 mm ± 1.652 (SD) respectively. Anterior and posterior palatal widths were 4.98 mm ± 0.934 (SD) and 9.53 mm ± 0.180 (SD), respectively.

**Bacular measurements.** The baculum was 1.1 mm long with a shaft which was 1.0 mm long. The proximal and distal bacular lengths were 0.1 mm and 0.00 mm while proximal and distal breadths of baculum were 0.3 mm and 0.2 mm. The baculum was of 0.4 mm high (Table 1, Plate 3).

**Morphometric comparison.** Two specimen of *Rhinopoma hardwickii* captured during this study (mean body weight 15.30 g) were heavier than those recorded by Benda *et al.* (2004) i.e. 11.97 g from Libya (Table 2). Most of the body measurements were in line with DeBlase *et al.* (1973) except mean ear length that was smaller than those recorded by DeBlase *et al.* (1973), Roberts (1997), Bates and Harrison (1997) and Benda *et al.* (2004). Similarly, the postorbital constriction, condylo-canine length and greatest length of skull of present specimens were same as reported by Bates and Harrison (1997) but the mean breadth of braincase and mandible lengths were smaller while zygomatic breadth was greater than those recorded by Bates and Harrison (1997). Greatest skull length of these two specimens was however greater than those recorded by Benda *et al.* (2004). The mean condylo-basal length was greater than recorded by DeBlase *et al.* (1973) while mean mandible length was smaller than those given by DeBlase *et al.* (1973), Bates and Harrison (1997) and Benda *et al.* (2004). The baculum length of single *R. hardwickii* was smaller than given by Hosken *et al.* (2002) (Table 2).

**Threats to the Species.** Location of a single roost of *R. hardwickii* (n = 30) from southern Punjab during a two year survey indicated a declining population trend. Its congener i.e. *R. mirophyllum* was also recorded from the Salt Range, Multan and Mailsi in Punjab (Roberts, 1997) that was not recorded during the present survey. Fat reserves of both these species are used by local medical practitioners “hakeems” as potion to cure baldness and sexual illnesses (Roberts, 1997) that may be a leading factor of population decline of these species. The security guard at Noor Mahal also indicated that bats were

periodically flushed out from the building to maintain cleanliness in the cellars. Populations of many bat species are declining worldwide, mainly as a consequence of the extensive habitat loss and degradation, hunting for food and medicine (Schipper *et al.*, 2008). Thus conservation efforts and implementation of a global network for monitoring bat populations is urgently required (Jones *et al.*, 2009).



Plate 1. *Rhinopoma hardwickii* roosting at Noor Mahal (29°22.695N, 071°40.132E), Bahawalpur (Courtsey Dr. Muhammad Mahmood-ul-Hassan).

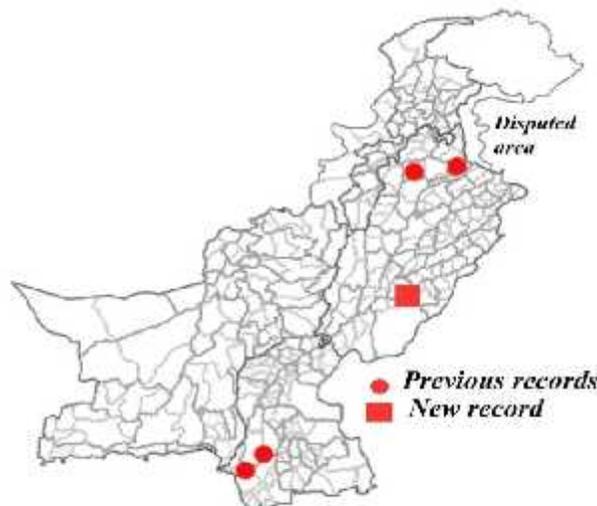


Plate 2. Distribution map of *Rhinopoma hardwickii* in Pakistan.

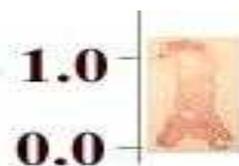


Plate 3. Baculum of *R. hardwickii* captured from Noor Mahal, Bahawalpur

Table 1. Mean body weight (g), external body (mm), cranial (mm) and bacular (mm) measurements of *Rhinopoma hardwickii* captured from Bahawalpur district during a two years' survey carried out from June 2009 to May 2011 in Punjab (n is the number of specimens).

External Body Measurements	n= 2	Cranial Measurements	n= 2
Body weight	15.30±0.424	Breadth of braincase	7.61±0.018
Head and body length	66.00±5.657	Zygomatic breadth	12.08±0.162
Ear length	15.50±2.121	Postorbital constriction	2.88±0.054
Tragus length	6.50±0.707	Condylar-canine length	16.12±1.075
Thumb length	5.75±0.354	Condylar-basal length	17.78±0.898
Claw length	1.75±0.354	Greatest length of skull	19.68±0.108
Forearm length	54.00±0.000	Maxillary toothrow	5.84±0.359
Length of 3 <sup>rd</sup> metacarpal	39.00±0.000	Anterior palatal width	4.98±0.934
1 <sup>st</sup> Phalanx on 3 <sup>rd</sup> metacarpal	9.00±0.000	Posterior palatal width	9.53±0.180
2 <sup>nd</sup> phalanx on 3 <sup>rd</sup> metacarpal	14.25±4.596	Mandibular toothrow	6.10±0.718
Length of 4 <sup>th</sup> metacarpal	32.75±0.354	Mandible length	11.28±1.652
1 <sup>st</sup> Phalanx on 4 <sup>th</sup> metacarpal	11.50±1.414	<b>Bacular Parameters</b>	<b>n=1</b>
2 <sup>nd</sup> phalanx on 4 <sup>th</sup> metacarpal	10.50±0.707	Total length of baculum	1.1
Length of 5 <sup>th</sup> metacarpal	37.50±0.707	Length of shaft	1.0
1 <sup>st</sup> phalanx on 5 <sup>th</sup> metacarpal	10.75±1.061	Length of proximal branch	0.1
Wing span	260.50±0.707	Length of distal branch	0.00
Tibia length	27.50±1.414	Width of proximal branch	0.3
Calcaneal length	5.50±0.707	Width of distal branch	0.2
Hind foot length	14.00±0.000	Height of baculum	0.4
Tail length	59.00±2.828		
Penis length	3.00±0.000		

**Table 2. Comparison of mean external body, cranial and bacular measurements (mm) of *Rhinopoma hardwickii* (I = DeBlase *et al.* (1973), II = Roberts (1997), III = Bates and Harrison (1997), IV = Benda *et al.* (2004), Hosken *et al.* (2002), VI = Present study).**

Parameters	I	II	III	IV	V	VI (n= 2)
Body weight	-	-	-	11.97(10.6-13.7)	-	15.30(14.9-15.7)
Total length	119-141	-	-	-	-	125.00(123.0-127.0)
Head and body length	-	62 (55-69)	66.6(55.0 – 73.0)	64.64(62.0-67.0)	-	66.00 (62.0-70.0)
Ear length	18-21	18 (16-20)	19.3(17.0 – 21.0)	22.54(21.2-23.7)	-	15.50 (14.0-17.0)
Tragus length	-	-	-	7.59(6.6-8.5)	-	6.50(5.79-7.21)
Forearm length	52.4-60	60(60–67)	59.2(52.9 – 64.0)	60.52(58.4-62.6)	-	54.00 (54.0)
Hind foot length	12-15	11.5 (9-15 )	13.4(11.0 – 15.0)	-	-	14.00 (14.0)
Tail length	57-70	67(57-77)	66.8(56.0-78.0)	72.69(67.0-79.0)	-	59.00 (57.0-61.0)
Breadth of braincase	-	-	8.2(7.8 – 8.5)	7.62(7.19-7.89)	-	7.61(7.59-7.62)
Zygomatic breadth	9.9-10.9	-	10.9(10.1 – 11.7)	11.01(10.53-11.28)	-	12.08(11.96-12.19)
Postorbital constriction	2.4-2.9	-	2.8(2.5 – 3.2)	-	-	2.88(2.84-2.92)
Condyllo-basal length	15.6-16.9	-	-	-	-	17.78(16.88-18.68)
Condyllo-canine length	-	-	16.5(15.5 – 17.5)	16.48(15.65-16.94)	-	16.12(15.36-16.88)
Greatest length of skull	-	-	18.7(17.5 – 19.7)	18.53(17.60-18.94)	-	19.68(19.60-19.75)
Maxillary tooththrow length	5.7-6.3	-	-	-	-	6.10(5.59-6.60)
Mandible length	11.3-12.4	-	12.8(11.8 – 13.6)	12.71(12.22-13.19)	-	11.28(10.11-12.45)
Bacular length	-	-	-	-	1.33	1.10

## REFERENCES

- Bates, P., T. Vu Dinh and S. Bumrungsri (2005). Voucher specimen preparation: bats. Part of the Darwin Initiative Project: Taxonomic initiative for Southeast Asian bat studies (Vietnam, Thailand, Cambodia and Lao PDR). Incomplete ref.
- Bates, P. J. J. and D. L. Harrison (1997). Bats of the Indian Subcontinent. Harrison Zoological Museum. UK. 258 pp.
- Benda, P., V. Hanak, M. Andreas, A. Reiter and M. Uhrin (2004). Two new species of bats (Chiroptera) for the fauna of Libya: *Rhinopoma hardwickii* and *Pipistrellus rueppellii*. Myotis, (41-42): 109-124.
- Bonaparte, C. L. (1838). Iconografia della fauna italiana Fasc. i. xv. Rome.
- Brunnich, M. T. (1782). Dyrenes Historie og dyre-Samlingen udi Universitetets Natur-Theater (The history of animals or the animal collections in the University's Theater of nature). Vol. 1. Kjobenhavn: Nicolaus Moller (In Danish), xxxviii + 76 pp.
- DeBlase A. F., D. A. Schlitter and H. N. Neuhauser (1973). Taxonomic status of *Rhinopoma muscatellum* Thomas (Chiroptera: Rhinopomatidae) from Southwest Asia. Journal of Mammalogy, 54: 831-841.
- Geoffroy Saint-Hilaire, E. (1818). Description de l'Egypte. Historie naturelle. Description des mammiferes qui se trouvent en Egypte, 2: 99-135.
- Gray, J. E. (1831). Description of some new genera and species of bats. The Zoological Miscellany, 1: 37-38.
- Hayman, R. W. (1937). Postscript. - In: St. Leger J.: Mammals collected by the Lake Rudolf Rift Valley Expedition. Annals and Magazine of Natural History (10), 19: 530-531.
- Hinton, M. A. C. and O. Thomas (1926). Report No. 41: Assam and Mishmi Hills. Bombay Natural History Society. Mammal Survey of India, Burma and Ceylon. J. Bombay Natural History Society, 29: 399 – 428.
- Hosken, D. J., K. E. Jones and K. C. A. Dixson (2002). Is the bat os penis sexually selected? Behavioral Ecology Sociobiology, 51:302–307.
- Jones, G., D. S. Jacobs, T. H. Kunz, M. R. Wilig and P. A. Racey (2009). Carpe noctem: the importance of bats as bioindicators. Endangered Species Research, 8: 93-115.
- Lindsay, H. M. (1927). Report No. 43: Nelliampathy plateau and Palni Hill. [591-597]; Report No. 44: Kangra and Chamba. [597- 606]; Report No. 45: The Punjab Salt Range.
- Mahmood-ul-Hassan, M. and P. O. Nameer (2006). Diversity, role and threats to the survival of bats in Pakistan. The J. Anim. Plant Sci., 16: 38-42.
- Mahmood-ul-Hassan, M., G. Jones and C. Dietz (2009). The Bats of Pakistan, the least known creature. VDM. Verlag. Dr. Muller, Germany. 168 pp.
- Roberts, T. J. (1997). Mammals of Pakistan. Revised Ed. Oxford University Press, Oxford.
- Schipper, J., J. S. Chanson, F. Chiozza, N. A. Cox, M. Hoffmann, and V. Katariya (2008). The status of the World's land and marine mammals:

- diversity, threat, and knowledge. *Science*, 322: 225–230.
- Sheikh, K. M. and Molur, S. 2004. (Eds.) Status and Red List of Pakistan's Mammals. based on the Conservation Assessment and Management Planning (CAMP) workshop. IUCN Pakistan. 312pp.
- Simmons, N. B. (2005): Order Chiroptera. In: Wilson D.E. and Reeder D.M. (eds.): *Mammal species of the world- A Taxonomic and Geographic Reference*. 3<sup>rd</sup> ed. Vol. 1: Johns Hopkins University Press Baltimore. p.312-529.
- Thomas, O. (1903). On the species of the genus *Rhinopoma*. *Annals and Magazine of Natural History, Series 7*, 11: 496-499.
- Van cakenberghe, V. and de Vree, F. (1994). A revision of the Rhinopomatidae Dobson 1872, with the description of a new subspecies (Mammalia: Chiroptera). *Senckenbergiana Biologica*, 73: 1-24.