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Short Note

Muhammad Mahmood-ul-Hassan* and Mohammad Salim

Two new bat species (Chiroptera: Mammalia) for Pakistan: *Miniopterus fuliginosus* and *Myotis formosus*

Abstract: Although over 50 bat species have been recorded in Pakistan, more are expected to inhabit the country. We recorded two new hitherto unrecorded bat species, i.e., *Miniopterus fuliginosus* and *Myotis formosus* in northwestern Pakistan. *M. fuliginosus* was captured from Barcharai Daim in Malakand district, while *M. formosus* was captured from Chinai Ghaz in Dir, Wach Khwar in Swat and Barcharai Diam in Malakand districts, respectively. This paper describes external, cranial, and bacular measurements of captured specimens of these two species.

Keywords: Hodgson's bat; long-fingered bat; morphology; new record; northwestern Pakistan.

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Intensive field efforts across the globe have raised the total number of bat species from 900 to 1200 in the last few years (Simmons 2005). Although exploratory efforts are mostly focused in the tropics and Southeast Asia, Pakistan still remains a poorly surveyed country (Mahmood-ul-Hassan et al. 2009). Most of the literature on bat species of Pakistan was generated during the 19th century, and no worthwhile effort has been made to explore its bat fauna so far. Roberts (1997) has described 50 bat species belonging to 23 genera and eight families from Pakistan. Walker and Molur (2003) expected the presence of some additional bat species from the country. Recent bat surveys in Punjab have revealed significant changes in their distribution ranges (Mahmood-ul-Hassan et al. 2011, 2012, Javid et al.

2012a,b, 2014), but similar information is missing from the northwestern and southwestern parts of the country.

Then, a yearlong bat survey was conducted in three districts of Malakand Division, which is located between the Himalayan and the Hindu Kush foothills and covers a broad altitudinal range. Various climatic zones are identified according to increasing altitude: a) semi-arid-humid-temperate zone (450–600 m), b) warm temperate zone (600–1100 m), c) temperate zone (1100–1500), d) cool temperate zone (1500–1900 m), e) cold temperate zone (1900–3200 m), f) alpine pastures (3200–4700 m), and g) snow and ice zone (4700–6300 m).

Bats were captured using a 16×16-mm mesh sized and 2.5 m high mist net (Ecotone 716/12) erected 1 foot above the ground. The net was operated from 19:00 to 20:30 h (Pakistan standard time) each night. Only one *Miniopterus* and five *Myotis* were captured during three nights spent at Chinai Ghaz (35°00.850' N, 72°03.439' E, 1154 m a.s.l.), Wach Khwar (34°58.104' N, 72°28.270' E, 1159 m), and Barchari Daim (34°33.737' N, 71°44.872' E, 851 m), respectively. External, cranial, and bacular measurements of these specimens were recorded following Bates and Harrison (1997), Mahmood-ul-Hassan et al. (2011), and Javid et al. (2012a,b). These revealed to be hitherto unrecorded bat species in Pakistan.

Miniopterus fuliginosus (Hodgson, 1835): With the recent development of genetic analyses, many cryptic species have been identified within the genus *Miniopterus* Bonaparte, 1837 across the World (e.g., Appleton et al. 2004, Miller-Butterworth et al. 2005, Bilgin et al. 2006, Furman et al. 2010, Šrámek et al. 2013). So, Tian et al. (2004) have shown that Asian populations of previous *Miniopterus schreibersii* belong to a distinct species, *M. fuliginosus* as it was previously suggested by Maeda (1982).

The Eastern Schreiber's long-fingered bat *Miniopterus fuliginosus* captured at Barchari Daim (one female) was recognized in the field on the basis of its small size (body mass: 11.5 g), its bulging forehead, and its exceptionally long second phalanx of the third metacarpal, which was

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Table 1 Wing measurements (mm) of *Miniopterus fuliginosus* (n=1) and *Myotis formosus* (n=5) captured from Malakand Division, Pakistan.

Measurements	<i>M. fuliginosus</i>	<i>M. formosus</i>
	Mean±SD (Range)	
Second metacarpal (2 mt)	42.72	43.93±2.36 (41.69–47.57)
1st Phalange of 2nd finger	3.21	3.25±0.45 (2.71–3.95)
2nd Phalange of 2nd finger	6.63	16.30±1.77 (14.45–18.32)
1st Phalange of 3rd finger	12.25	18.77±1.61 (17.40–21.49)
2nd Phalange of 3rd finger	32.96	15.47±1.78 (14.28–18.62)
3rd Phalange of 3rd finger	8.04	6.00±0.44 (5.35–6.51)
1st Phalange of 4th finger	9.74	14.26±0.99 (13.49–15.90)
2nd Phalange of 4th finger	17.52	12.19±1.17 (10.56–13.42)
1st Phalanx on 5th finger	10.73	13.88±1.27 (12.31–15.83)
2nd Phalange of 5th finger	8.54	11.63±0.86 (10.23–12.44)

approximately three times the length of the first phalanx (Table 1). Wing membrane was uniformly dark with a soft and silky dark pelage deep blackish brown dorsally and slightly paler with a grayer tinge ventrally. Pelage on the forehead was short and dense and extended up to the nostril pads. The cheeks were naked below the eyes. The tragus (5.66 mm) was almost half the height of the pinna and slightly curved forward, while the antitragus (2.01 mm) was low.

This bat had 36 teeth (dental formula: 2123/3133) (Figure 1). A comparison of the craniodental parameters of this specimen (Table 2) with a population from eastern Afghanistan (Šrámek et al. 2013) confirmed the identification of this specimen.

Historic records of *Miniopterus* from South Asia were considered a subspecies of *Miniopterus schreibersii* (e.g., Bates and Harrison 1997, Simmons 2005); they are now recognized as *Miniopterus schreibersii fuliginosus* (Tian et al. 2004, Srinivasulu and Srinivasulu 2012, Šrámek et al. 2013). West of Pakistan *M. fuliginosus* has been recorded from eastern Afghanistan (Gaisler 1970, Šrámek et al. 2013) and from northern Iran (Etemad 1969). This species has also been recorded from Northern Myanmar to Nepal and India close to the northeastern part of Pakistan (Bates and Harrison 1997). Although Roberts (1997) and other authorities (e.g., Walker and Molur 2003, Mahmood-ul-Hassan and Nameer 2006) expected its occurrence in Pakistan, Brosset (1962) emitted a negative opinion on the basis of its habitat requirements. This record ascertains that there are suitable microclimatic conditions for this species in some parts of Pakistan.

Myotis formosus (Hodgson, 1835): The genus *Myotis* Kaup, 1892 is represented by 15 species in the Indian Subcontinent and hitherto by three species in Pakistan, i.e., *Myotis blythii*, *Myotis nipalensis*, *Myotis muricola* (Bates and Harrison 1997, Srinivasulu and Srinivasulu 2012). The five specimens captured at Chinai Ghaz (1♂, 2♀), Wach Khwar (1♂), and Barchari Diam (1♀) revealed to belong to a fourth one, *Myotis formosus*.

These Hodgson's bats were readily identified by matching their photographs with the reference (Bates and Harrison 1997). These medium-sized *Myotis* bats (body mass: 13.86±1.64 g) were ginger brown dorsally

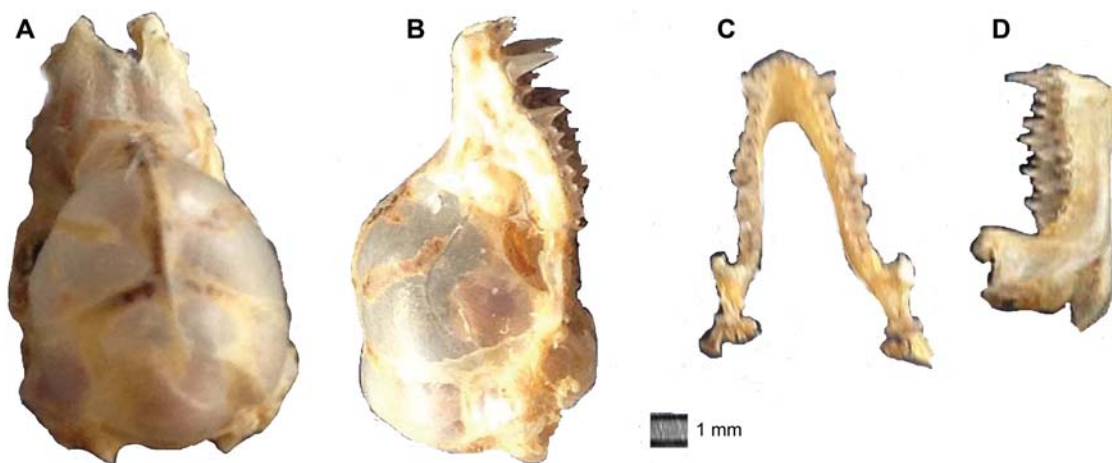


Figure 1 Dorsal and lateral view of the skull (A, B) and lower jaw (C, D) of *Miniopterus fuliginosus* captured from northwestern Pakistan.

Table 2 Comparison of external body and craniodental measurements (mm) of *Miniopterus fuliginosus* (n=1) and *Myotis formosus* (n=5) captured from Malakand Division (present study) with Šrámek et al. (2013) and Bates and Harrison (1997), respectively.

Species Body parameters	<i>M. fuliginosus</i> (n=1)		<i>M. formosus</i> (n=5)	
	Present study mean±SD (range)	Šrámek et al. 2013 mean±SD (range)	Present study mean±SD (range)	Bates and Harrison 1997 mean±SD (range)
Head and body	57.0	-		
Tail	52.22	-	45.85±2.99 (40.83–47.92)	41.3±6.1 (36.0–48.0)
Forearm	48.54	-	48.74±2.02 (46.66–52.03)	47.4±1.9 (44.5–49.1)
Ear	13.49	-	18.27±1.09 (17.22–19.91)	13.6±0.9 (12.8–14.5)
Hind foot	10.19	-	12.05±0.80 (10.99–12.75)	10.6±0.6 (10.2–11.6)
Tibia	19.94	-	24.18±1.22 (22.96–26.19)	22.5±0.9 (21.0–23.2)
3rd finger	43.11	-	44.26±1.15 (43.37–46.20)	44.3±1.1 (43.2–45.7)
4th finger	41.42	-	43.94±1.81 (42.38–46.83)	43.1±0.8 (42.3–44.0)
5th finger	38.04	-	43.97±1.70 (42.52–46.78)	43.5±1.3 (42.3–47.2)
Greatest length of skull	15.61	15.636±0.254 (15.03–16.13)	17.81±0.12 (17.71–17.94)	18.4±0.4 (18.1–18.9)
Condylar-canine length	14.26	-	15.95±0.17 (15.75–16.05)	16.4±0.2 (16.3–16.6)
Condylar-basal length	15.30	15.296±0.213 (14.86–15.45)	-	-
Zygomatic breadth	8.49	8.919±0.184 (8.57–9.30)	-	-
Braincase breadth	7.86	8.178±0.159 (7.75–8.51)	8.37±0.09 (8.27–8.45)	8.4±0.3 (8.1–8.7)
Postorbital constriction	3.94	3.928±0.083 (3.76–4.15)	4.51±0.09 (4.41–4.57)	4.5±0.1 (4.4–4.5)
Rostral breadth	4.82	4.720±0.118 (4.45–4.91)	5.09±0.12 (4.95–5.17)	5.1±0.2 (4.9–5.3)
Rostral breadth	6.66	6.713±0.135 (6.34–6.96)	7.75±0.30 (7.55–8.10)	7.6±0.2 (7.4–7.8)
Maxillary toothrow length	6.09	6.117±0.107 (5.89–6.34)	7.15±0.05 (7.10–7.20)	7.1±0.2 (6.8–7.2)
Mandible length	11.75	11.304±0.166 (11.00–11.60)	13.85±0.07 (13.77–13.89)	13.9±0.2 (13.7–14.1)
Mandibular toothrow length	6.68	6.507±0.113 (6.31–6.74)	7.80±0.05 (7.75–7.84)	7.4±0.2 (7.4–7.8)

with orange-brown flanks. The throat was lighter cinnamon brown, and the ventral surface was orange in color. The whole body, except some areas around the eyes, nostrils, and lips, was hairy. Ears were relatively short, naked, and orange in appearance with relatively darker margins. The tragus was long (8.77 ± 0.88 mm), narrow, and obtusely pointed; the antitragus (4.02 ± 0.48 mm) was almost half the length of tragus. Their broad wings

(Table 1) had narrow orange colored lines alongside each of the metacarpals, while black triangular areas were present between the metacarpals. These black triangular areas were dotted and streaked with orange. The interfemoral membrane was also orange (Figure 2A). The baculum of two specimens was extracted and measured (in mm); total length: 0.78 ± 0.04 (SD), shaft length: 0.65 ± 0.11 , proximal branch length: 0.01 ± 0.01 , proximal branch width:

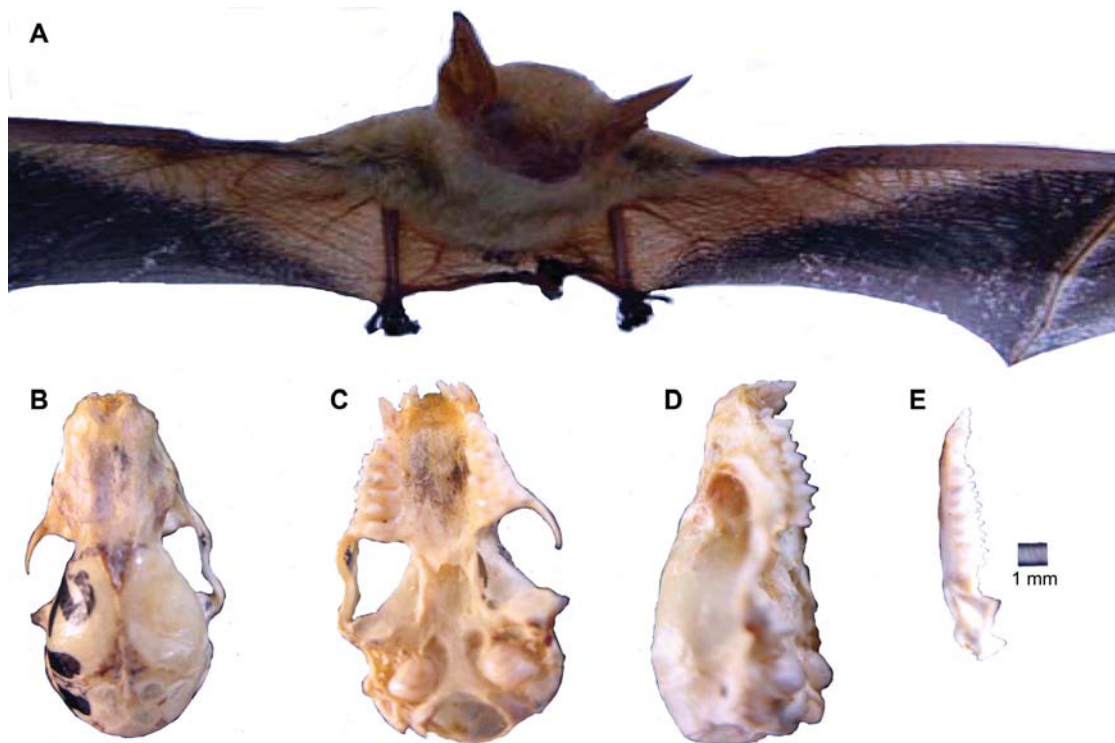


Figure 2 A photographs of *Myotis formosus* showing its characteristic pelage coloration (A) along with the dorsal (B), ventral (C), lateral (D) view of the skull and dorsal view of the lower jaw (E).

0.38 ± 0.04 , width of proximal extreme: 0.51 ± 0.02 , width of distal extreme: 0.43 ± 0.07 . These bats had 34 teeth (dental formula: 2132/3132) (Figure 2B–D).

A comparison with other specimens from the Indian Subcontinent indicated that the Pakistanese specimens had extraordinarily longer ears but slightly longer forearm, hind foot, and tail than those recorded from India and Tibet (Table 2). On the contrary, the greatest length of the skull and condyle-canine length was a bit smaller than those reported by Bates and Harrison (1997).

Widely distributed in northern India (Bates and Harrison 1997, Srinivasulu and Srinivasulu 2012), *Myotis formosus* has also been reported from Kalat-us-Seraj, in the Nangarhar province of Afghanistan (Gaisler 1970). So this presence in Pakistan that should have been foreseen confirms the western extension of a species, which possibly extends from northeastern Pakistan along the Indian border to Kashmir and in the northwestern part of Pakistan including Malakand Division.

With these two newly recorded species, the bat fauna in Pakistan reaches to 55 species. Further bat surveys are requested to record all species that were already reported close to Pakistan borders, such as *Myotis emarginatus* and *Myotis longipes* (Roberts 1997, Walker and Molur 2003, Mahmood-ul-Hassan and Nameer 2006).

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