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Authors: Saikia, Uttam, Csorba, Gábor, and Ruedi, Manuel

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First records of *Hypsugo joffrei* (Thomas, 1915) and the revision of *Philetor brachypterus* (Temminck, 1840) specimens (Chiroptera: Vespertilionidae) from the Indian Subcontinent

Uttam Saikia[1], Gábor Csorba[2*] & Manuel Ruedi[3]

[1] *Zoological Survey of India, Risa Colony, Shillong, India. E-mail: uttamzsi@gmail.com*
[2] *Department of Zoology, Hungarian Natural History Museum, Baross u 13, H-1088 Budapest, Hungary.*
[3] *Département de Mammalogie et Ornithologie, Muséum d'histoire naturelle, C.P. 6434, CH-1211 Genève 6, Switzerland. E-mail: Manuel.Ruedi@ville-ge.ch*
* *Corresponding author, E-mail: csorba@nhmus.hu*

Abstract: The Joffre's pipistrelle *Hypsugo joffrei* is a rare and very little known vespertilionid bat previously thought to be confined to Myanmar and Vietnam in Southeast Asia. Based on recently collected material and reassessment of museum specimens, this species is being reported for the first time from India and Nepal which also significantly extends its westward geographic range beyond Myanmar. We also critically compare the type specimen of another poorly known congener from Myanmar, *H. anthonyi* with the present material and propose to recognize the name *H. anthonyi* as the junior subjective synonym of *H. joffrei.* Specimens previously identified as *Philetor brachypterus* from South Asia were found to represent *H. joffrei*, as well. Consequently, the distribution range of *Philetor* is restricted to the Sundaic zoogeographical subregion, the Philippines, New Guinea and Bismarck Is., and the species should be omitted from the bat checklists of India and Nepal.

Keywords: Chiroptera - Vespertilionidae - India.

INTRODUCTION

The Joffre's Pipistrelle *Hypsugo joffrei* (Thomas, 1915) is a poorly known vespertilionid bat that has previously often been classified in the genus *Pipistrellus* (Corbet & Hill, 1992; Bates *et al.*, 2005). It was designated as Data Deficient by the IUCN (Francis & Bates, 2008). Besides the type specimen from Kachin Hills in northern Myanmar, this bat is known by a few specimens from Sagaing division of Chin state in Myanmar (Bates *et al.*, 2005) and from North Vietnam (Kruskop & Shchinov, 2010; Kruskop, 2013). The distinction of *H. joffrei* from another poorly known taxon from Myanmar, *H. anthonyi* (Tate, 1942), rests on slight colour differences. According to the description, *H. anthonyi* is "a dark brown pipistrelline bat structurally close to *joffrei* but colored very dark brown instead of pale brown" (Tate, 1942). However, Bates *et al.* (2005) who examined the specimens kept in the Natural History Museum, London (formerly British Museum of Natural History, BMNH) and referred to *H. joffrei*, noticed that one of them (BMNH.16.3.26.2) was intermediate in colour, suggesting that *H. anthonyi* may prove to be conspecific with *H. joffrei* (Bates *et al.*, 2005). Based on a recently collected specimen from Shillong in northeastern India and examination of museum specimens, we report here a detailed description of this rare species, revise the records of *Philetor* from Sikkim and Nepal, provide mensural information for all known specimens of *H. joffrei* (except the Vietnamese ones) and compare them with *H. anthonyi* in order to resolve their relationship.

MATERIALS AND METHODS

Specimens were examined externally and measured with a dial caliper to the nearest 0.1 mm, while cranidental measurements were taken to the nearest 0.01 mm, as described in Csorba *et al*. (2011). Acronyms of morphological measurements are as follows: Head and body length (HB); tail length (TAIL); ear length (EAR); tragus length (TRAGUS); hindfoot length, excluding claw (HF); forearm length (FA); tibia length (TIBIA); total length of 3rd digit (DIG3); total length of 4th digit (DIG4); total length of 5th digit (DIG5); greatest length of skull (STOL); condylobasal length

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(CBL); condylocanine length (CCL); maxillary toothrow length (CM^3L); width across third molars (M^3M^3W); width across canines (CCW); length of upper molars (M^1M^3L); rostral width (lachrymal; ROW); zygomatic width (ZYW); interorbital width (IOW); mastoid width (MAW); width of braincase (BCW); height of braincase (BCH); anteorbital width (from the foramen infraorbitale to the foramen lachrymale; AOB); upper canine–premolar length (CP^4L); length of mandible (ML); mandibular toothrow length (CM_3L); lower canine–premolar length (CP_4L); coronoid height (CPH); length of lower molars (M_1M_3L).

Museum acronyms are: AMNH: The American Museum of Natural History, New York; BM(NH): The Natural History Museum, London, UK, formerly British Museum (Natural History); FMNH: The Field Museum of Natural History, Chicago; MSB: Museum of Southwestern Biology, University of New Mexico, Albuquerque; ZSI: Zoological Survey of India, Shillong.

TAXONOMY

An adult male specimen of *Hypsugo joffrei* was collected in a mist net in the early evening hours of 18th October, 2012 in the Risa Colony area (25°33.566'N 91°53.931'E, ca 1500 m a.s.l.) on the southern part of the Shillong city (State of Meghalaya, India). The collection locality was close to a small stream in the middle of human habitations and adjacent to a park-like forest made up essentially of *Pinus kesiya*. The animal is preserved in alcohol with the skull removed and incorporated in the collections of the Zoological Survey of India, Shillong, under the registration number V/M/ERS/292.

After capture, the individual was kept for a day in captivity for observation. It had noticeably enlarged testis and hence was probably in reproductive stage. It was very calm and hardly made any attempt to fly or bite when handled gently. This animal had a glossy, dark brown dorsal pelage with a slight reddish tinge and the venter was lighter golden brown; the demarcation line between those two parts was rather sharp (Fig. 1). Individual dorsal hairs were uniformly coloured throughout the whole length whereas the ventral hairs had relatively darker basal portion and lighter tips. Wings and patagium were dark brown and essentially naked, except close to the body. The sides of the muzzle between nostrils and eyes appeared swollen and a few long bristles were visible on the sides of the muzzle. The ears were broad and short with rounded tip and roughly matching a right triangle in side profile. The tragus was short and rounded, with a basal lobe, inner margin concave and the outer margin convex (Fig. 2).

The preserved animal has long and narrow wings, much like those of *Nyctalus* spp., with the fifth digit being noticeably reduced (46 mm in total length) when compared to the third (66 mm). The plagiopatagium is attached to the middle of the metatarsus. The thumb is short, with a small basal pad and bears a short claw. The calcar along the uropatagium has a distinct lobe. The tail tip projects out of uropatagium by about 2.5 mm. The penis does not possess any special structures and is bristly on the dorsal shaft and the testes appear swollen. Because we could not obtain a specific permission while examining the specimen, we refrained from studying the baculum and conducting further genetic studies.

Fig. 1. Picture of the live adult male *H. joffrei* ZSI V/M/ERS/292. Note the dark brown, glossy appearance of the dorsal pelage, and the sharp demarcation between the dorsal and lighter ventral colour.

The skull is rather compact with short and wide rostrum, and short braincase; the supraorbital processes are very prominent and protruding laterally. The braincase is slightly globose and raised posteriorly. The occipital and sagittal crests are hardly developed and do not meet at the lambda. The mandible has a relatively high coronoid process. The two upper incisors are bifid, sub-equal in surface, with the first (I^2) being higher than the second (I^3). The I^3 is placed laterally to the first, and its highest cusp reaches the height of the second cups of I^2. The upper canines are divergent, strong and slender with a prominent secondary cusp nearly reaching half of the primary cusp. A minute first upper premolar (P^2) is present between the canine and second premolar (but not in contact with them) on the right toothrow but is absent on the left one. The second upper premolar (P^3) is well developed and about half the length of the canine. The

Fig. 2. Portrait of *H. joffrei* specimen ZSI V/M/ERS/292. Note the enlarged muzzle and short, roundish tragus.

lower canines are long and slender, and lack secondary cusps. The first lower premolar (P_2) is slightly less in height than the second premolar (P_4); both premolars are compressed in the toothrow. Contrary to all true *Pipistrellus* species, the lower molars in our specimen are myotodont which corresponds to the dental configuration found in *Hypsugo* (Horácek & Hanák, 1985-86).

Thomas described *Nyctalus joffrei* (= *H. joffrei*) based on a specimen from Kachin Hills in Upper Burma (Myanmar) (Thomas, 1915). The reason for its original inclusion in the genus *Nyctalus* was the very small first upper premolar and the reduced fifth digit of the wing, although the author noted its morphological resemblance with *Pipistrellus* bats. The type specimen of *H. joffrei* BM(NH) 88.12.1.37 has a uniform pale brown dorsal and ventral pelage (Thomas, 1915). Externally, cranially and dentally, *H. joffrei* closely resembles another very poorly known species *Pipistrellus anthonyi* (= *H. anthonyi*) except for the very dark brown colour of the latter (Tate, 1942; Bates *et al.*, 2005). This species is known only by a male specimen from Changyinku village in the Chipwi River Valley in Myanmar's Kachin State (which is also close to the type locality *H. joffrei*) and is in possession of the American Museum of Natural History, New York. The type specimens of both *H. joffrei* and *H. anthonyi* were examined by one of the authors (GC), and their skulls were sketched (Fig. 3a, b).

The colouration of the well preserved skin of *H. anthonyi* resembles Tate's original description as "firm, glossy and velvety. Dorsal color near Bone Brown; hairs of underparts tipped with Wood Brown, their bases fuscous" (Tate, 1942). Its plagiopatagium attaches near the middle of the metatarsus and the calcar has an elongated epiblema seemingly supported by a fine central cartilage. The skull, however, is damaged except for the rostral portion (Fig. 3b); the lower molars are myotodont. The obtainable cranial measurements of the type specimen of *H. anthonyi* are comparable to those of *H. joffrei* (Table 1). However, the colour difference between the two species on the basis of which the species distinction was based seems doubtful as one specimen from west of Kindat, Sagaing Division, in north-western Myanmar [BM(NH).16.3.26.2] assigned to *H. joffrei* is intermediate in colour (Bates *et al.*, 2005). The present specimen caught in Shillong (i.e. less than 400 km west of Kindat) also has a darker dorsal and lighter ventral colouration, thus resembling both *H. anthonyi* and the above referred specimen of *H. joffrei* from Myanmar. It also corresponds very well with the external and mensural characteristics of other known *H. joffrei* specimens (Table 1), including the typically reduced fifth digit, reduced (or absent) P^2, long bicuspid upper canine and well developed supraorbital processes. Like the Indian specimen, the Vietnamese specimens of *H.* cf. *joffrei* are also relatively darker in colouration on the dorsum and lighter below (Kruskop & Shchinov, 2010) and this moderate colour variation could be an outcome of individual variations. Thus, we propose to include *H. anthonyi* as a junior synonym of *H. joffrei*.

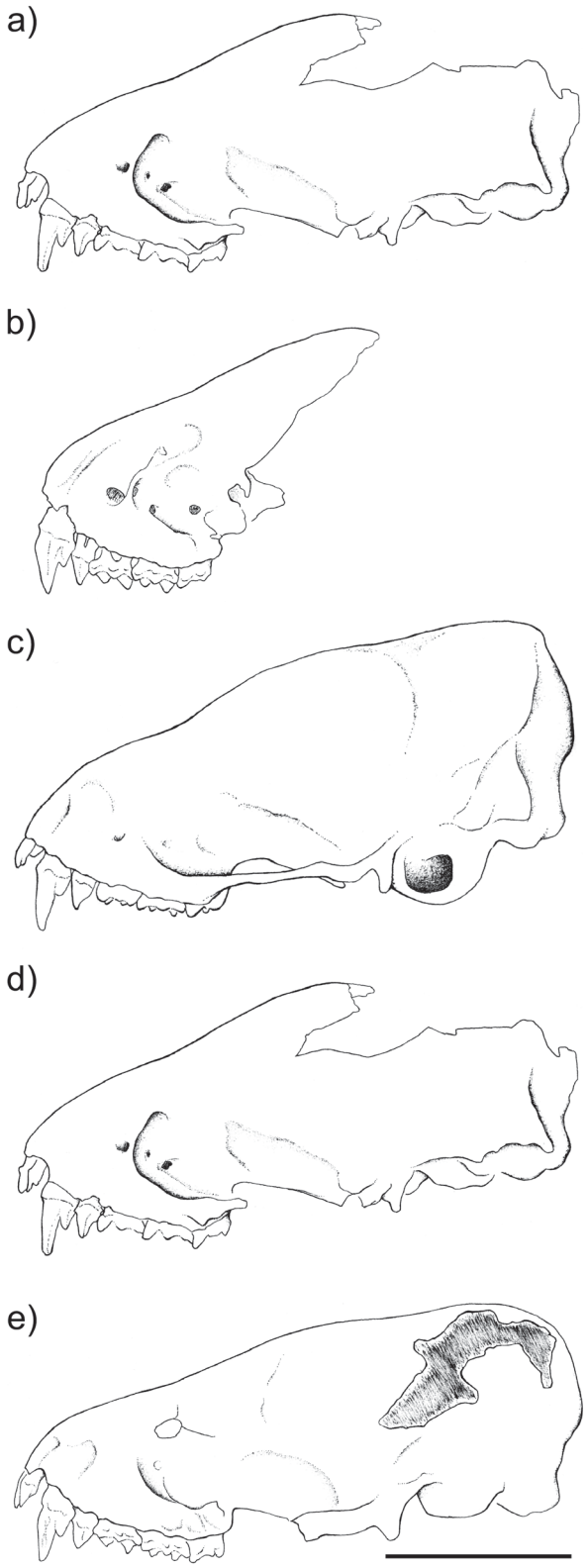

Fig. 3. Lateral views of skulls of (a) *H. joffrei* holotype from Myanmar (BMNH 88.12.1.37), (b) *H. anthonyi* holotype from Myanmar (AMNH 114849), (c) *H. joffrei* from Shillong, Meghalaya (ZSI V/M/ERS/292), (d) *H. joffrei* from Sikkim (MSB 67467), (e) *H. joffrei* from Nepal (FMNH 114249). Scale bar represents 5 mm.

Kruskop and Shchinov (2010) noted that although the external and craniodental characteristics (e.g. myotodont molars) of the Vietnam specimens strongly support their allocation to the genus *Hypsugo*, the baculum shape is different from typical *Hypsugo* and its size is minute. As mentioned above, we could not study the baculum structure of the present Indian specimen or those of the types and thus their allocation to the genus *Hypsugo* is essentially based on the same external and craniodental traits. It is worth to note that the very characteristic bifid upper canine of *H. joffrei* does not occur at any other known species of *Hypsugo*. The exact systematic position of *H. joffrei* itself remains a question of extensive taxonomic reassessment supported by molecular data, which we are lacking at this moment.

The mammal collection of the Museum of Southwestern Biology, University of New Mexico, Albuquerque (MSB), holds two specimens of *Philetor brachypterus* from Sikkim State, India. The female specimens (MSB 67466 and 67467) were collected from the montane forests of Hee-Gyathang (27˚30'N 88˚30'E, 1846 m a.s.l.) in North Sikkim district and were identified by late Karl Koopman of the American Museum of Natural History. Obviously, based on these specimens, *P. brachypterus* was included in the Indian bat fauna (Molur *et al.*, 2002). Although we could not personally study the above specimens from Sikkim or obtain craniodental measurements, the forearm measurements and photographs on the cranium and dentition taken from the MSB 67467 individual strongly suggest that these specimens do not belong to *Philetor* but indeed, represent *H. joffrei* (Fig. 3d). This identification was based on the following morphological traits: shape of rostrum and shallow basioccipital pits are typical *Hypsugo* (vs. extremely shortened rostrum and very deep basioccipital pits in *Philetor*), normally developed upper incisors (vs. blade-like and shortened I^2 and very reduced I^3), and myotodont lower molars (vs. nyctalodont molars).

Finally, on the basis of two female specimens stored in the Field Museum of Natural History, Chicago, Koopman also reported the presence of *P. brachypterus* from Eastern Nepal which has subsequently been retained in the Nepalese faunal lists (Koopman, 1983; Molur *et al.*, 2002; Jnawali *et al.*, 2011; Thapa, 2014). The FMNH 114249 and 114481 specimens were collected from Bahrabise in Sindhupalchok district of Central Nepal (approx. 27˚78'N 85˚89'E, 575 m a.s.l.) and Num Bridge (approx. 27˚54'N 87˚34'E, 850 m a.s.l.) in Sankhuwasabha district of Eastern Nepal, respectively. These specimens were physically examined by one of the authors (GC) and clearly, the Nepalese specimens do not belong to the genus *Philetor* as reported by Koopman (1983), rather concur well with all the generic characteristics of *Hypsugo*, especially in the unmodified external genitalia and myotodont lower molars. The external, cranial (Fig. 3e) and mensural characteristics (Table 1) of the FMNH specimens conform to the

Table 1. The external and cranial measurements (in mm) of *H. joffrei* specimens from India, Nepal and Myanmar including the holotypes. Measurements marked with * are taken from Tate (1942).

Character	Shillong specimen ZSI V/M/ ERS/292	Nepal specimens FMNH 114249, 114481	Sikkim specimens MSB 67466, 67467	Burmese specimens BM(NH) 16.3.26.2, 16.3.26.83, 16.3.26.84	*H. joffrei* holotype BM(NH) 88.12.1.37	*H. anthonyi* holotype AMNH 114849
HB	61	–	–	–	–	–
TAIL	37	–	–	–	–	41*
EAR	13.2	–	–	–	–	–
TRAGUS	5.1	–	–	–	–	–
HF	8.3	7.2	–	–	–	10*
FA	40.2	37.8, 38.6	38.0-38.5	–	38.8	38*
TIBIA	15.6	15.8	–	–	–	12*
DIG3	66	–	–	–	–	–
DIG4	57.5	–	–	–	–	–
DIG5	46	–	–	–	–	–
STOL	15.1	15.77	–	–	–	–
CBL	14.8	–	–	–	–	–
CCL	13.98	14.33	–	–	–	–
CM3L	5.18	5.15	–	5.13	5.15	–
M^3M^3W	7.23	6.99	–	–	–	–
CCW	5.01	5.14	–	–	–	–
M^1M^3L	3.60	–	–	–	–	–
ROW	7.80	6.84	–	8.18-8.59	7.70	7.92
ZYW	10.09	–	–	10.44	–	–
IOW	4.70	4.83	–	4.72-4.86	4.55	5.02
MAW	9.20	–	–	8.88-9.24	8.92	–
BCW	7.96	8.29	–	7.92-8.30	8.08	–
BCH	5.90	–	–	5.42	–	–
AOB	–	0.36	–	0.75-0.83	0.86	–
CP^4L	2.00	2.10	–	2.01	2.07	2.18
ML	10.90	11.09	–	10.81-11.17	10.84	10.92
CM_3L	5.29	5.49	–	5.60-5.65	5.52	5.60
CP_4L	1.78	1.80	–	–	–	–
CPH	3.8	3.57	–	3.60-3.77	3.68	–
M_1M_3L	3.8	–	–	–	–	–

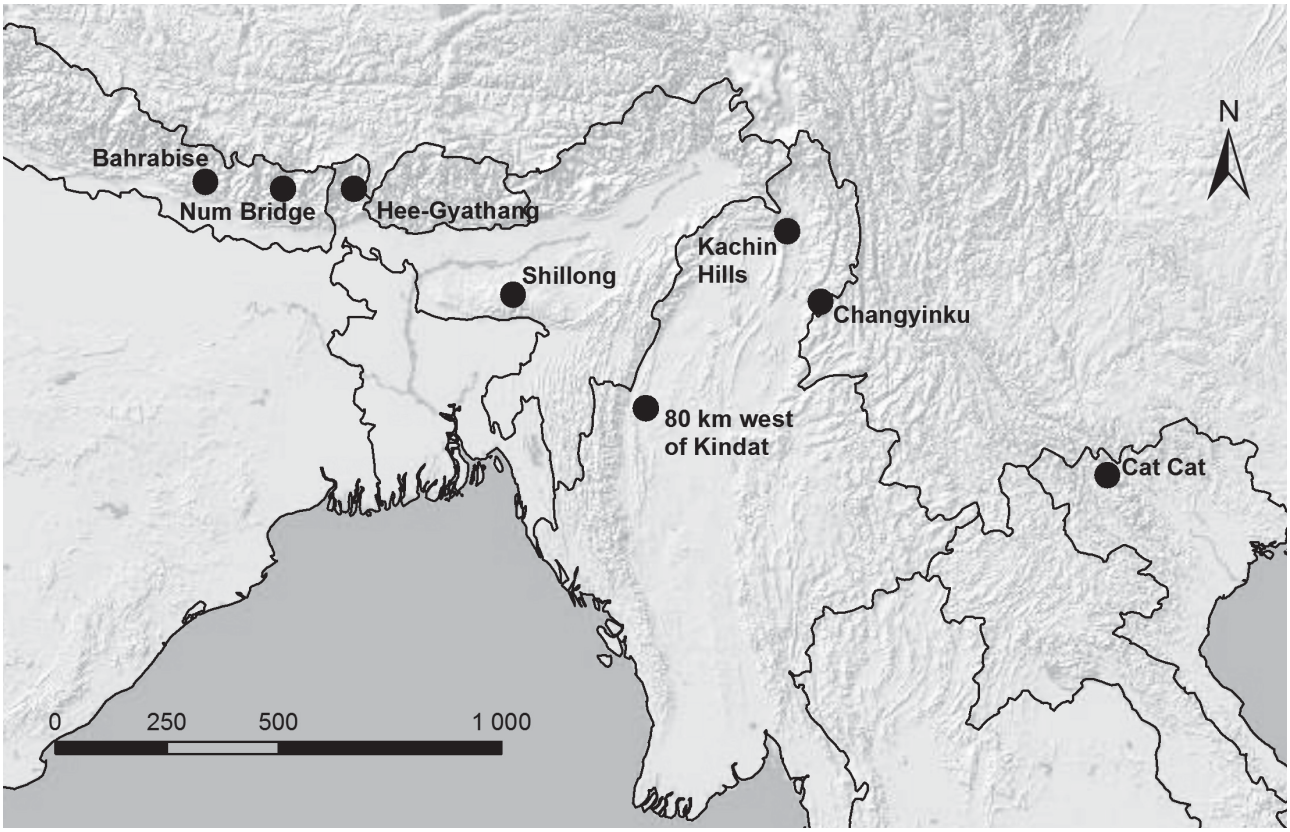

Fig. 4. Map representation of the known occurrences of *H. joffrei.*

described features of *H. joffrei* as well and we therefore revise the Nepalese records of *P. brachypterus* (*sensu* Koopman, 1983) and recognize them as *H. joffrei.*

This study significantly extends the westward distribution range of *H. joffrei* to Central Nepal through northeastern India by over 900 km from the previously known localities in Myanmar, and thus represent the first records of the species in India and Nepal (Fig. 4). The area where the Meghalaya specimen was caught suggests that this apparently rare species might be tolerant to more disturbed habitats than anticipated and could be found in other regions on the foothills of the Himalaya, which are part of the Indo-Burma biodiversity hotspot (Myers *et al.*, 2000). In northern Vietnam, this bat is seemingly not uncommon in some areas of Lao Cai Province (Kruskop & Shchinov, 2010) and may not be as rare in other parts of its distribution range as thought previously. With these revised records, the bat diversity within the political boundary of India and Nepal currently stands at 124 and 51 species respectively (Talmale & Pradhan, 2009; Ruedi *et al.*, 2012; Ruedi *et al.*, 2013; Senacha & Dookia, 2013; Thapa, 2014).

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