

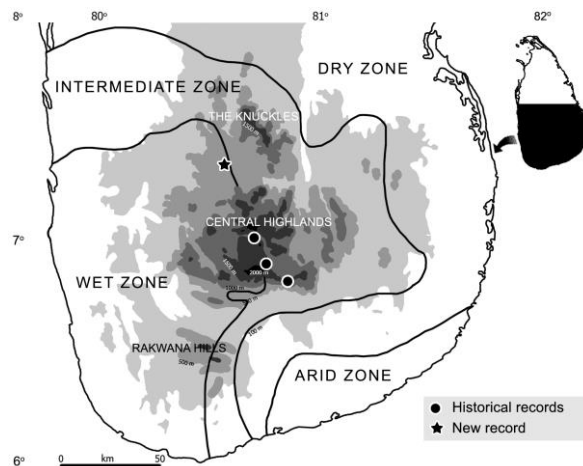


## Chocolate pipistrelle (*Hypsugo affinis*) from Hantana, Sri Lanka, after 87 years

The Chocolate pipistrelle, *Hypsugo affinis*, is a comparatively small vesper bat (Chiroptera: Vespertilionidae) distributed in India, central Nepal, southern China, northeast Myanmar and the central highlands of Sri Lanka; its altitudinal range ascends up to 2,000 m a.s.l. (Srinivasulu & Srinivasulu 2019, Wilson & Mittermeier 2019). In Sri Lanka, it has only been documented at three localities: West Haputale (~1,400 m), Ohiya (~1,700 m) and Nuwara Eliya (~1,900 m), but has not been recorded in the country since 1933 (Phillips 1935, 1980). The National Red List for Sri Lanka listed it as Critically Endangered (IUCN-MOE 2012), although *H. affinis* is listed as of Least Concern in the IUCN Global Red List because of its wide occurrence across southern Asia (Srinivasulu & Srinivasulu 2019; Wilson and Mittermeier, 2019). Herein we document the first observation of *H. affinis* from Sri Lanka after 87 years, including the first photographic evidence and the first roosting site observation.

Our new record comes from the peripheral area of the western slopes of Hantana Mountain Range (7.222806° N, 80.625833° E, alt. 1,160 m a.s.l.) in Mahakanda, Kandy District in Central Province of Sri Lanka (Fig.1). This locality is situated in the wet highland bio-climatic zone (annual mean precipitation: 2,000–3,000 mm and temperature: 25.2–29.5 °C). Visual encounter surveys were conducted in the Hantana area for a period of one year and seven months (8 June 2018 to 28 January 2020). Our surveys covered multiple habitat types—montane grasslands, Pine-dominant forest plantations, and moist montane evergreen broad-leaved forests—involving four trained field biologists, during both day (08:00–14:00 hr) and night (18:00–24:00 hr). Observations focused on potential bat roosting sites, such as tree holes, earthen crevices, and caves. To examine holes, a Work zone endoscopy camera with an 8 mm

illuminated camera head and water proof 105 cm long flexible shaft was used. Microbats encountered during the survey were captured using hand nets (net depth: 45 cm, net diameter: 30 cm, mesh size: 1.5 × 1.5 mm). For all bats captured, standard length measurements following Srinivasulu *et al.* (2010) were taken using digital vernier calipers (Type RD 10) in the field. Morphological characteristics and body coloration were also documented. The captured bats were identified to the species level based on Phillips (1935), Corbet & Hill (1992), Bates & Harrison (1997), and Srinivasulu *et al.* (2010) prior to releasing. Air temperature and relative humidity were measured using a multi-digital hygrometer (TA-138, China), and wind speed was measured using a digital anemometer (MS-6252-A, China). A Garmin Etrex handheld GPS receiver was used to georeference the roosting site.



**Figure 1.** Distribution of *Hypsugo affinis* in Sri Lanka. Historical locations are based on Phillips (1935, 1980); Map © A.A.T. Amarasinghe

One male and two females of *H. affinis* (Figs. 2, 3) were found at 10:38 hrs on 7 January 2020 inside a mainstem cavity of a mature Silver Oak (*Grevillea robusta*) (Proteaceae). The roosting site (Fig. 4) was located in a mid-elevation (850 m) pine plantation with sparse canopy cover (~10%). This tree hole opening

was 15 × 17 cm in size and the cavity depth was 2 m. The host tree height and diameter at breast height were 6 m and 2 m, respectively. During the time of observation, there was relatively low wind speed (2.16–9.5km/h, average 1.68 km/h), moderate ambient temperature (23.3–25.5 °C, average 26.7 °C), and relatively high humidity (65–72%, average 69.5%). *Hipposideros speoris* was also recorded in the vicinity. The measurements and morphological characters are provided in Tables 1 and 2.

This species is known to occur in high altitudes; in India at 1,452 m and in Nepal at 2,000 m (Wilson & Mittermeier 2019). Our observation at 850 m a.s.l. is the lowest altitude for this species in Sri Lanka. Similarly, *H. affinis* was observed at a lower elevation in Myanmar (100 m a.s.l.) in a town flanked by the Irrawaddy River surrounded by deciduous and evergreen forests (Wilson & Mittermeier 2019). Such low-altitude sightings suggest a much greater altitudinal range for this bat in Sri Lanka, extending to suitable habitats outside the central highlands where these exist.

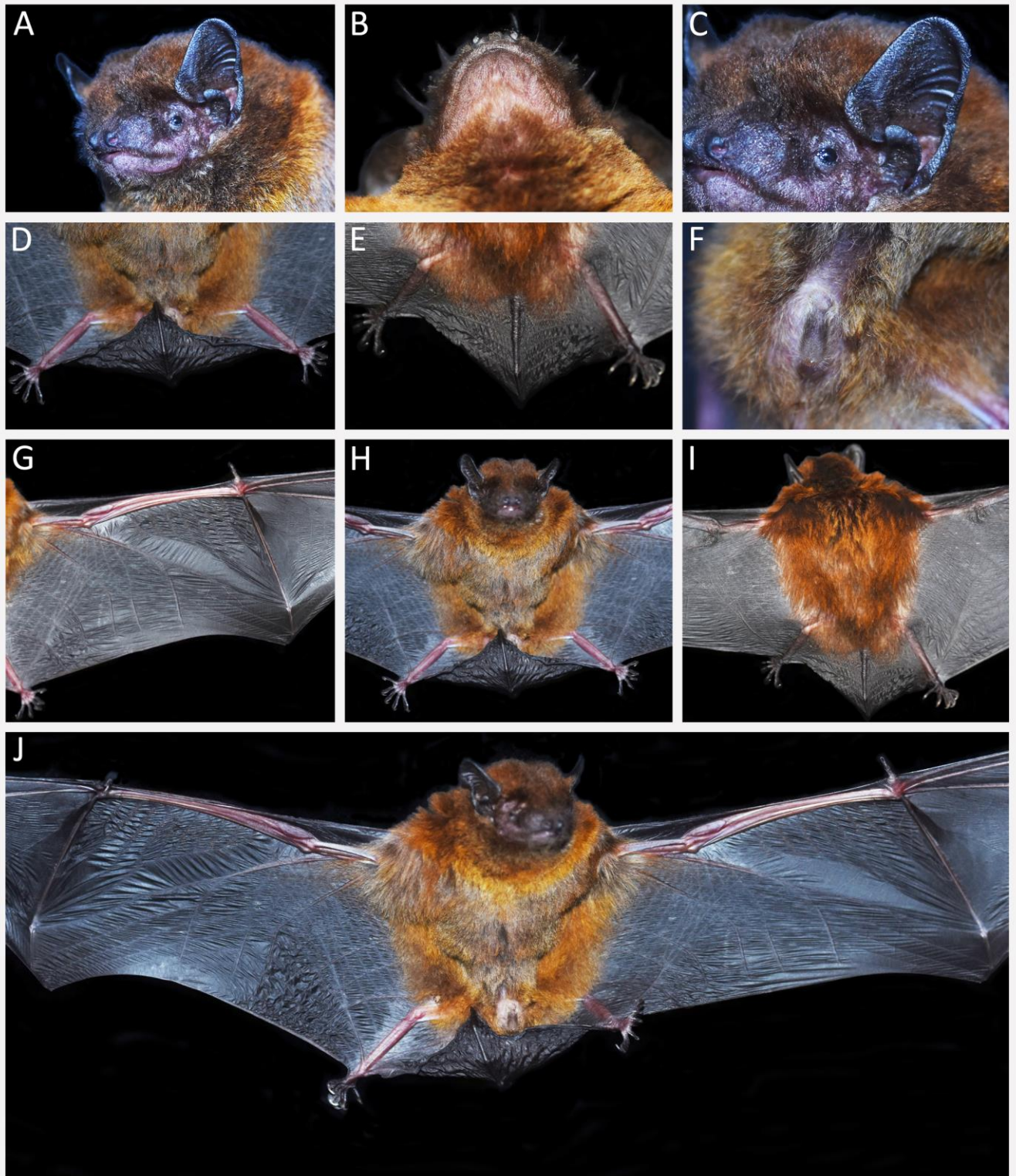
*Hypsugo affinis* is one of the rarest bat species in Sri Lanka. The global documentation of *H. affinis* is also limited as revealed by our search of digital museum records in VertNet and iDigBio (12 specimen records) and Global Biodiversity Information Facility (8 specimen records). This species spends the daytime roosting in the roofs of buildings and in cracks or small holes in tree trunks, emerging at dusk to forage on insects around human habitations and in uncluttered environments (Phillips 1980, Wilson & Mittermeier 2019).

Primary habitats of *H. affinis* include tropical and subtropical moist montane forests while gardens, farmlands, and urban forest remnants are marginal habitats (Bates & Harrison 1997, Smith & Xie 2008). Our observations on both the roosting site and habitat associations agree with previous autecological reports. According to Phillips (1980), it flies about 6 m above the ground while feeding. Only scant information exists on population trends, colony size, dietary habits, and breeding (Phillips 1980, Yapa 2017).

**Table 1.** Morphometric variables recorded of *Hypsugo affinis* specimens from the Hantana Mountain Range, Sri Lanka, and comparisons with Phillips (1935, 1980) and Bates & Harrison (1997); measurements in mm; — not measured.

Measurements	This study			Phillips (1935)	Phillips (1980)	Bates & Harrison (1997)
	Male (n=1)	Female (n=1)	Female (n=1)	Male (n=3)	Specimens (n=unknown)	Males and Females (n=unknown)
Head and Body length	46.12	48.35	46.75	52–53	48–53	43.0–51.0
Ear length	13.82	11.23	13.22	13–14	11–14	12.0–15.0
Ear width	7.1	6.98	7.76	—	—	—
Tragus length	5.26	5.4	5.56	6	6	—
Tragus width	1.90	1.70	2.00	—	—	—
Forearm length	38.24	40.64	39.86	40–41	39–41	38.4–41.4
Thumb +1 <sup>st</sup> claw length	5.00	7.32	6.68	—	—	—
2 <sup>nd</sup> metacarpal	34.71	36.55	38.18	—	—	—
3 <sup>rd</sup> metacarpal	37.20	38.67	38.64	—	—	36.2–39.1
4 <sup>th</sup> metacarpal	35.63	37.25	37.52	—	—	35.4–39.0
5 <sup>th</sup> metacarpal	32.54	34.49	35.16	—	—	33.7–36.9
1ph 3mt length	13.31	12.58	14.68	—	—	—
2ph 3mt length	11.41	6.86	11.71	—	—	—
1ph 4mt length	13.32	13.32	14.23	—	—	—
2ph 4mt length	7.39	8.29	10.00	—	—	—
1ph 5mt length	8.56	7.90	8.89	—	—	—
2ph 5mt length	7.38	6.25	7.51	—	—	—
Wingspan length	260	270	260	110	110	244.0
Penis length	5.15	—	—	—	—	—
Penis width	1.70	—	—	—	—	—
Tibia length	16.04	15.37	15.47	—	—	—
Calcar length	10.72	13.37	12.90	—	—	—
Hind foot length	9.21	7.28	8.84	7	7	7.0–8.0
Tail length	38.41	35.53	37.96	35.6–39	30–39	30.0–41.00

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**Figure 2.** Unique characters of *Hypsugo affinis* specimen (male) recorded from Hantana Mountain Range, Sri Lanka: (A) facial structure, (B) throat area [see the fur colour], (C) external ear lobe and tragus [note the small notch], (D) ventral and (E) dorsal aspects of the interfemoral (tail) membrane, (F) short light brown, colour hairs around the penis and the scrotum, (G) ventral aspect of the wing membrane (patagium), (H) ventral and (I) dorsal aspects of the body including the proximal parts of the patagium, (J) ventral aspect of expanded wings.

Photo © Sameera Akmeemana



**Table 2.** Detailed morphological features of *Hypsugo affinis* recorded from the Hantana Mountain Range, Sri Lanka.

Morphological characters	Male		Female
	Simple	Simple	
Nose shape			
Head	muzzle broad, eyes rounded and small; face, ears, tragus and other naked parts blackish brown		
Chin area	semi naked with brown colour and few short hairs present		semi naked with blackish brown colour and few short hairs present
Ears	ears broad and moderately long, triangular; dark brown hairs on base of the ears; few brown short hairs in the middle of the ears		
Tip of the ear		naked	
Tragus	moderately stout, slightly curved and bluntly pointed with a small notch at the base of the outer margin		
Dorsal area	dark brown and chestnut hairs on head and body		dark brown hairs on head and body
Ventral area	dark brownish to bright brown hairs on shoulder area; chest with dark brown to light brown hairs tipped with whitish-grey hairs		blackish brown to light brown hairs
Breast (nipple)	—		not well-developed and covered with blackish brown to light brown hairs
Ante-brachial membrane		present	
Radio-metacarpal pouch		absent	
Wing membrane	wings moderate in length, dark brownish to bright brown with short hairs close to the body; brown with few short hairs close to the forearms		
Forearms		naked	
1 <sup>st</sup> metacarpal thumb		naked	
2 <sup>nd</sup> -5 <sup>th</sup> metacarpals, 1 <sup>st</sup> -5 <sup>th</sup> phalanx		naked	
1 <sup>st</sup> -5 <sup>th</sup> metacarpals		naked	
Dorsal and Ventral surface of tibia		naked	
Inter-femoral membrane (dorsal)		naked	
Inter-femoral membrane (ventral)		brown with few short hairs present	
Wing attached to		base of the toes	
Penis (foreskin)	foreskin area light brown with few short hairs present		—
Vagina	—		naked
Testicles	blackish brown to brilliant brown hairs		—
Anus	bright brown with few short hairs		brown with few short hairs
Hind feet	well-developed and brown with few short hairs		
Calcar	well-developed and brown with few short hairs		
Tail	enclosed within the interfemoral membrane; tail moderately long, with the last caudal vertebra free and projecting from the membrane		



**Figure 4.** Habitat of *Hypsugo affinis* in Hantana Mountain Range, Sri Lanka. Photo © S. Akmeemana

Some literature suggests that this species may hibernate for short periods of time during cold and frosty weather (Phillips 1980, Wilson & Mittermeier 2019). Molur *et al.* (2002) considered the population size as small and declining in South Asia due to the continued deterioration of the quality and extent of suitable habitats. Throughout its distribution, this species is threatened with habitat loss from logging, firewood harvesting, agriculture, and human interference with roosting sites (Wilson & Mittermeier 2019).

The taxonomy, ecology, distribution and conservation status of most of the Sri Lankan bats is poorly known. Exploring remote localities in Sri Lanka for bats can help fill in knowledge gaps, consolidate their distributional ranges, and improve our understanding of their habitat associations (Nanayakkara *et al.* 2012, Edirisinghe *et al.* 2013, 2020a–b, Wellappulli-Arachchi *et al.* 2014). Field surveys can contribute to developing maps of Sri Lankan bats, which is imperative for implementing conservation efforts.

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