

First record of the Long-snouted Bhutan Squirrel *Dremomys lokriah bhotia* (Wroughton, 1916) (Mammalia: Rodentia) from the state of West Bengal, India

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Abstract

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We present the first confirmed report of the Long-snouted Bhutan Squirrel *Dremomys lokriah bhotia* from the state of West Bengal, India. Previously the subspecies was known from limited localities of East Sikkim (India) and Bhutan. This article, thus, adds to the global knowledge of the subspecies with a note on its habitat and activity pattern, along with new details on its current global distribution.

Key words: Callosciurinae, ecology, habitat, native species, new report, rodent

The Himalayan Orange bellied squirrel *Dremomys lokriah* (Hodgson, 1836) is a polytypic species with eight subspecies (Chatterjee et al., 2021) and is considered Least Concern in the IUCN Red List of Threatened Species (Molur, 2016). It is widely distributed in the Indomalaya region with distribution in India, Nepal, Bhutan, Bangladesh, China, and Myanmar (Molur, 2016). Six of its subspecies are currently known from India, viz., *Dremomys lokriah lokriah* (Hodgson, 1836), *D. l. pagus* Moore, 1956, *D. l. subflaviventris* Thomas, 1922, *D. l. bhotia* Wroughton, 1916, *D. l. garorum* Thomas, 1922, and *D. l. macmillani* Thomas and Wroughton, 1916 (Chatterjee et al., 2021). However, ecological information such as distribution, population number, feeding niche, habitat requirements or any type of behavioral knowledge on these animals barely exists (Agrawal, 2000; Chatterjee et al., 2020). Almost no scientific information is available on the ecology of any subspecies of *D. lokriah*. The majority of the past works on *D. lokriah* were limited to taxonomy and distribution reports (Ellerman, 1961; Agrawal and Chakraborty, 1979; Agrawal, 2000).

The present article reports additional distribution range of *D. l. bhotia* (Wroughton), commonly known as the Long-snouted Bhutan Squirrel, from the state of West Bengal, India. This subspecies has quite restricted distribution in India (E. Sikkim) and Bhutan and was rarely reported in literature (Chatterjee et al., 2021). Additionally, we provide first brief insight into habitat and activity pattern of *D. l. bhotia*.

The Neora Valley National Park is situated in the Oriental Region, with some floral and faunal similarities to the adjacent Palearctic Region. As per Rodger and Panwar (1988) this National Park comes under the central Himalayan biogeographic province. Administrative boundary of the National Park remains in Kalimpong District of West Bengal, India. The park forms an ecological tri-junction with Sikkim and Bhutan (Fig. 1). The Neora Valley National Park has an area of 177 km² with an elevational gradient from 670 meters to 3200 meters (Chatterjee et al., 2019). Vegetation of the region shows characteristics similar to Upper Hill Forest (Champion and Seth, 1968) with unique species composition of the genus *Machilus-Michelia* (Cowen, 1929).

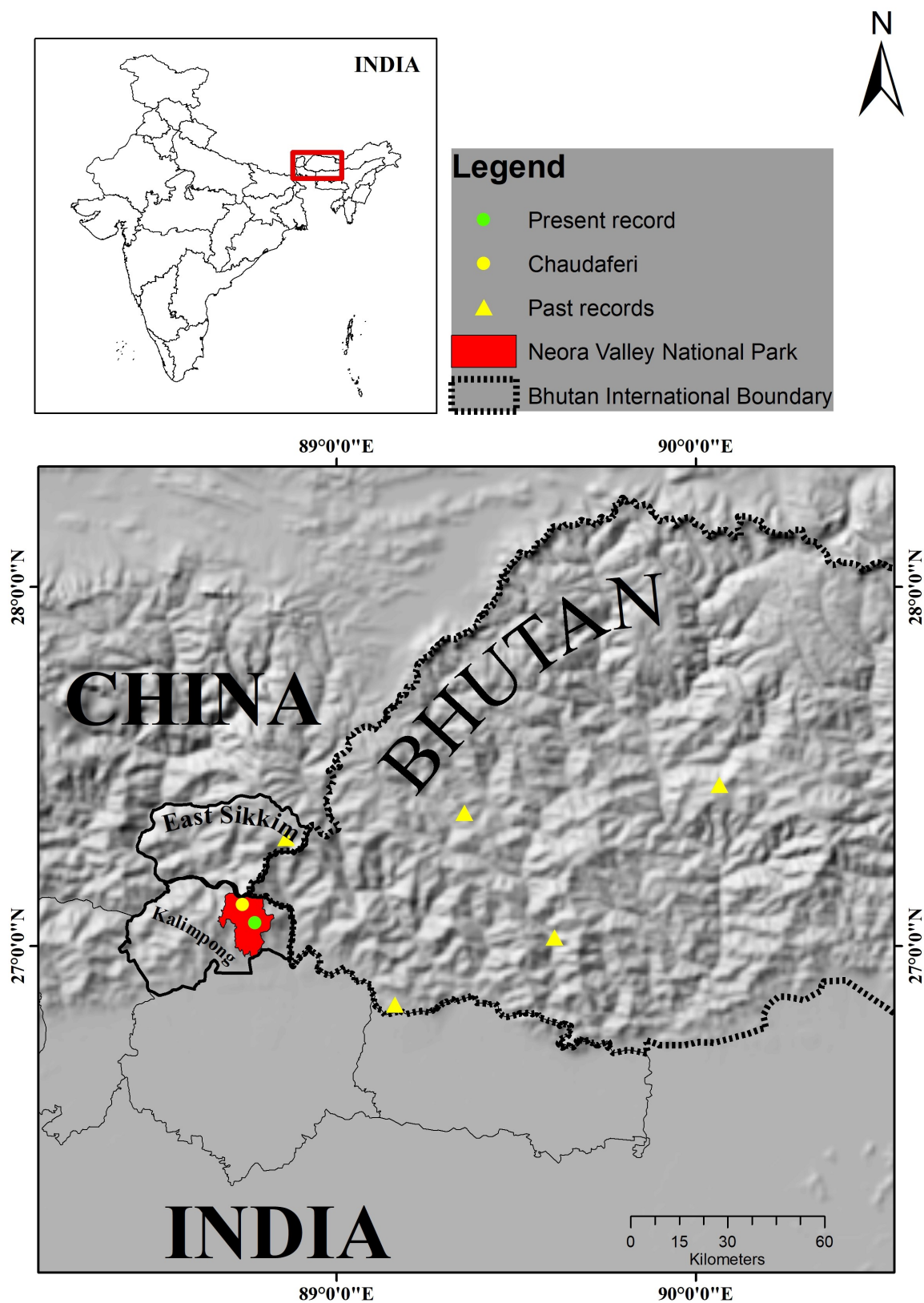


Figure 1: Map of the study area representing past (details in Table 1) and present global distribution records of *Dremomys lokriah bhotia*.

Dominating trees in the present study area includes *Machilus edulis*, *Michelia cathcalii*, *Engelhardtia spicata* and the under-growth of *Symplocos theifolia*, *Eurya acuminata*, *Turpinia nepalensis* and *Mahonia sikkimensis*. The Park has low visibilities (visibility up to 15–35 ± 21 m) due to high vegetation density (> 98% ground cover, 95–98% canopy cover).

During the field survey a 7.7 km forest trail was surveyed using trail transect method for recording the squirrel diversity of the National Park. Surveys were recorded from 06:00–11:00 hours and 15:30–18:30 hours for 12 days in November 2019. Individuals of *D. l. bhotia* were seen after 11:00 hours and henceforth, observations were continued until the individuals were out of sight. The exact time varied up to 16:00 some days continuously.

Forest type, floral composition, ground cover, canopy cover; and other environmental/habitat parameters (elevation, vegetation, temperature and humidity) were recorded for every transect performed during the present study. Environmental parameters were recorded using Kestrel 5500 Pocket Weather Tracker (environment meter). A map of the study area was prepared using ArcGIS 10.8.1. A Nikon P900 camera was used for taking the photographs of the squirrels encountered during the current study.

Two individuals (one adult and one juvenile) of *D. lokriah* with a darker color pattern than the usual agouti morph were recorded for the entire study period at the same site near the Tempola cave (27°3'53.53"N, 88°46'18.37"E; 1963 m a.s.l.), Bhotekharka Camp of the Neora Valley National Park. A total of 96 hours of sampling effort retrieved 5 sighting events at a single day. The encountered individuals of *D. l. bhotia* were recorded in an area with dense canopy cover (> 80%). The survey was conducted in early November. Relative humidity at the recorded site was 92% and there was occasionally drizzling all day. Average temperature was 20.2 °C ± 1.7 during day time and 12 °C ± 2.5 at night.

Historical records state only two species of the subfamily Callosciurinae, *Dremomys lokriah* and *Callosciurus pygerythrus* were ever recorded from the study area (Naulak and Pradhan, 2020). The two individuals which we observed lacked reddish fur on the cheeks and hips and possessed dark dorsal coloration with the face and feet grizzled greyish black (Fig. 2). Faces were devoid of any other color. Internal ear was ashy brown. Ventral side was ochraceous with paler throat. Tail was darker than *D. l. lokharia* but without a black tip. Present individuals were therefore distinct from *Callosciurus pygerythrus* (Corbet and Hill, 1992) and were considered as subspecies of *D. lokriah*.

The present report on the encountered individuals from the Neora Valley National Park is based on

photographic evidence and direct observations. Based on the available identification keys of the subspecies of *D. lokriah* (Agrawal and Chakraborty, 1979; Chatterjee et al., 2021), the recorded individuals were identified as *Dremomys lokriah bhotia* (Wroughton, 1916). Their throat was paler and there was ochraceous orange fur on the side of the belly and flanks. These details separate the subspecies *bhotia* from other subspecies of *D. lokriah* (Moore and Tate, 1965; Agrawal and Chakraborty, 1979; Chatterjee et al., 2021). Our observation, therefore, extends the distribution range of the subspecies further west of the known range. Briefly, *Dremomys lokriah bhotia* is currently known from the West Bengal (Neora Valley National Park, Kalimpong) (present study) and East Sikkim in India, and Bhutan (Table 1).

Individuals of subspecies *bhotia* were recorded in a very wet patch of temperate mixed oak forest with thick and closed canopy cover. The locations were extremely moist and had a high diversity of bryophytes, mushrooms, and ferns on rocks and trees. Ground cover was dominated by bryophytes and the canopy was dominated by species of *Quercus* Linnaeus, *Castanopsis* (D. Don) Spach and *Lantana* Linnaeus. The two individuals were seen on a slanted tree trunk covered with climbers of *Lantana* over the outer edge of a blunt cave. The particular location had a canopy opening of approximately 500 m diameter. It was interesting to note that squirrels were only sighted near the canopy openings and not from areas with completely closed canopy. At the observed location the individuals of *D. l. bhotia* were active on the roof of the cave, and 3 m above the ground on nesting and adjacent trees.

In the observed habitat, *D. l. bhotia* was found to be active during noon (12:00–14:00 hours) until late afternoon (17:00–18:00 hours) with rare sighting in the morning hours (05:00–10:00 hours). Such a diminished activity period might be due to low temperature and minimal sunlight with drizzling and dense cloud cover. On multiple occasions it was noticed that our presence stopped their activity and caused the animals to go much higher in the canopy. This ceased activity period (CAP) was quite long on the first occasion (> 40 min) and was gradually reduced to 10–15 minutes after further 2–3 encounters with us.

We provide here new confirmation of the presence of *D. l. bhotia* in West Bengal, India and precisions about the habitat, activity pattern and behavior during encounters of this poorly known species. Compared to *D. l. lokriah*, we found *D. l. bhotia* have higher CAP. Our observation at another site of the National Park, Chaudaferi (27°5'9.6" N, 88°39'36" E, 2348 m a.s.l.), in a similar forest habitat with permanent human activity from forest camp and tourists, *D. l. lokriah* showed quite different activity. More than two individuals of *D. l. lokriah* were monitored at this site.

Table 1: Previous and present distributional records of *Dremomys lokriah bhotia*.

Country	Locality	Latitude (N)	Longitude (E)	Altitude (m a.s.l.)	Source
India	Neora Valley National Park, Kalimpong district, West Bengal	27°3'53.5284"	88°46'18.3684"	1963	Present study
	Chungtang, N. Sikkim	27°36'15.984"	88°38'46.356"	1598	GBIF
Bhutan	Chasilakha	27°1'25.14"	89°36'21.384"	1860	Agrawal and Chakraborty (1979)
	Simtokha, Wangdi Phodrang Road, Menchuna Valley	27°26'55.644"	90°3'56.088"	2377	Agrawal and Chakraborty (1979)
	Susuna, Ha Road	27°22'13.332"	89°21'18.684"	2350	Agrawal and Chakraborty (1979)
	Gomchu	26°50'12.768"	89°21'18.684"	2500	Agrawal and Chakraborty (1979)
	Panjurmane	27°9'59.796"	90°43'1.164"	1525	Agrawal and Chakraborty (1979)

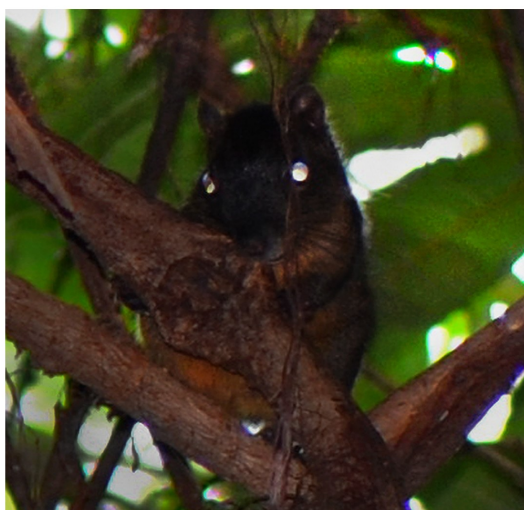
*D. l. bhotia**D. l. bhotia**D. l. lokriah*

Figure 2: Picture of *Dremomys lokriah bhotia* showing pelage differences from *Dremomys lokriah lokriah*. Both subspecies were photographed at the Tempola Cave and Chaudaferi Forest Camps of the Neora Valley National Park, Kalimpong, West Bengal, India.

They were highly active during early morning and peak noon–late afternoon. They showed minimal CAP of less than a minute and were mostly running on open wide forest trails for foraging and storing food, compared to 10–12 minutes of *D. l. bhotia*. These individuals of *D. l. lokriah* stored food in more than one tree although the midden was noticed on a solitary *Abies*. Surprisingly, they were adapted to human activity and even feed on discarded food.

The majority of the rodent species are generally denied any global protection because they are considered pests or due to poor knowledge of these species (Amori et al., 2016). Despite the high rodent diversity in India, ecological data are very poor (Chatterjee et al., 2021). Altered land use and hunting for medicine and bush meats are some of the immediate threats for the South Asian squirrels at present (Dollo et al., 2010; Singh et al., 2014; Chatterjee et al., 2020; Thapamagar et al., 2021).

Our report indicates potentials of *D. l. bhotia* populations to be more widely distributed than accredited. Also, observations in the current study indicates the individuals of *D. l. bhotia* may have been shy and since most of the forests within the known distribution range of the species has low visibility with dense vegetation, it may have been difficult to spot or distinctly detect subspecies of *D. lokriah*. Further studies on the utility of pelage variations, presence of hybrid zones and any indication of speciation for these squirrels are essential.

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Conflict of interest

All the authors declare that there are no conflicting issues related to this short communication.

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