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An unusual rusty coloration of an Indian Crested Porcupine *Hystrix indica*

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Abstract

The Indian Crested Porcupine (*Hystrix indica*) is a widespread species across India, generally exhibiting a distinctive pattern of alternating black and white bands on quills. Here, we report photographic evidence of an unusual red morph of *H. indica* recorded through camera traps in the Melukote region, Karnataka, southern India. Over a 50-night survey (150 trap-nights across three cameras) from September to November 2025, 564 images documenting 12 vertebrate species were obtained, including two individuals of the red morph and several naturally shed reddish-orange quills. Semi-structured interviews and discussions with forest personnel, researchers, hunters, and residents confirmed that the red morph, locally termed Kemmulla (usual morph porcupine is called 'Karimulla'), is known but rare, with only a few encounters reported over the past two decades. Based on our observations and literature review, we evaluate five potential explanations for this coloration: soil or tannin staining, diet, age, environmental factors, and natural polymorphism. The evidence supports the latter, suggesting that the red morph likely represents a rare, genetically encoded color variant of *H. indica*. Further molecular and ecological studies are needed to determine its genetic basis, distribution, and frequency within Indian porcupine populations.

Keywords: Camera trap, color morph, erythrism, Karnataka, Melukote wildlife sanctuary, natural polymorphism

Introduction

The Indian crested porcupine (*Hystrix indica* Kerr, 1792; Wilson *et al.*, 2016) is among the largest rodents in India, distributed throughout the country except in the extreme north, northeast, and the Himalayan regions (Gurung & Singh, 1998). It is easily recognized by its coat of modified hairs forming spines or quills, each typically ornamented with alternating black or deep brown and white bands (Prater, 1971). The species is considered monotypic, with no recognized subspecies (Prater, 1971).

Occasional reports describe individuals exhibiting atypical coloration, including quills with a distinct rusty-red or orange hue (Prater, 1971; Menon, 2014). This reddish morph has been noted mainly from southern India, particularly the Mysore, Coimbatore, and Kerala hill ranges, and possibly central India (Prater, 1971; Menon, 2014). Most other regional field guides do not mention this color morph (Mallick & Bahuguna, 2010; Choudhury, 2016). It appears to be a rare morph, with few publicly available photographs. One image from Tadoba (Maharashtra) is published in Menon (2014). Anecdotal accounts suggest that reddish individuals may be smaller in size, that the intensity of their color may fade in captivity or with poor health, and that local communities recognize a distinctive odor from their burrows (Prater, 1971). Menon (2014) proposed that coloration could be diet- or habitat-related, though this has not yet been empirically tested in *Hystrix indica*.

Porcupines are primarily herbivorous, consuming roots, tubers, fruits, bark, and occasionally bones, which may provide minerals influencing quill formation (Khan *et al.*, 2022). Since porcupine quills are composed of keratin and pigmented through melanin and related compounds, nutritional factors such as carotenoids and minerals could theoretically affect their pigmentation, as observed in other keratin-based structures like feathers and hair (Roze, 1989; Inayah *et al.*, 2020).

Studies on other porcupine taxa provide insight into color variation as a form of genetic or pigment aberration. For example, in the North American porcupine (*Erethizon dorsatum*), one report documented isabellinism, a genetic condition resulting in pale yellowish to reddish coloration due to partial melanin loss (Jung & Jantunen, 2015). Similarly, in South American *Coendou* species, albinism and pigmentation anomalies have been recorded, including individuals with yellowish or white quills, red eyes, and pink extremities (Ramos *et al.*, 2024). Though porcupines and hedgehogs are not closely related, analogous rusty morphs are known in African pygmy hedgehogs (*Atelerix albiventris*), such as the "Cinnicot" variety, arising from selective pigment expression. These examples suggest that while reddish or rusty morphs are rare in *Hystrix indica*, color variation among porcupines can occur due to a combination of genetic mutations, environmental influences, or dietary factors (Roze, 1989; Inayah *et al.*, 2020). Nonetheless, direct studies on pigmentation mechanisms in porcupines are lacking, and reports of the red morph in India remain largely anecdotal (Prater, 1971; Menon, 2014).

Here we report one such incidence of an unusually reddish porcupine captured through randomly placed camera traps in the Melukote region, Karnataka, India, and discuss potential causes.

Methods

Study Area

This study was carried out at Melukote (12.6626 °N, 76.6486 °E) in Pandavapura Taluk, Mandya District, Karnataka, India (Figure 1). The region forms part of the semi-arid landscape of the southern Deccan Plateau, situated at an elevation of approximately 900 m above sea level. It is characterized by a mosaic of scrub forests, rocky outcrops, and dry deciduous vegetation interspersed with agricultural lands and tanks and falls within the Melukote Wildlife Sanctuary buffer, supporting a rich assemblage of dry-zone fauna. Melukote is also culturally significant, housing the historic Cheluvanarayana Swamy Temple complex and associated sacred groves, which contribute to local biodiversity conservation (Bhagwat & Rutte, 2006). The climate is tropical semi-arid, with mean annual rainfall of around 700–800 mm, largely received during the southwest monsoon (June–September).

Camera trapping

We established three motion-activated infrared camera traps (K&F Concept, model KF35.086; 4K video, 32 MP still images, 0.2 s trigger speed, 100° detection angle, 940 nm low-glow IR LEDs, IP67 waterproof rating) to monitor wildlife presence and activity patterns in and around Melukote, India. Cameras were mounted ca. 30–40 cm above ground and programmed to record 10-second videos with a 2-second interval between triggers. The camera traps were deployed for a total of 50 days and nights, from 21st September 2025 to 11th November 2025.

Semi-structured Interviews

In addition to camera trapping surveys, we conducted semi-structured interviews to assess local knowledge of the unusual reddish morph of *Hystrix indica*. Because porcupines are nocturnal and rarely observed by the general public, individuals most likely to have encountered this morph, like local hunters and personnel from the regional forest department, were identified as key informants. Participants were selected using a snowball sampling approach, whereby initial informants referred others with relevant experience (Biernacki & Waldorf, 1981).

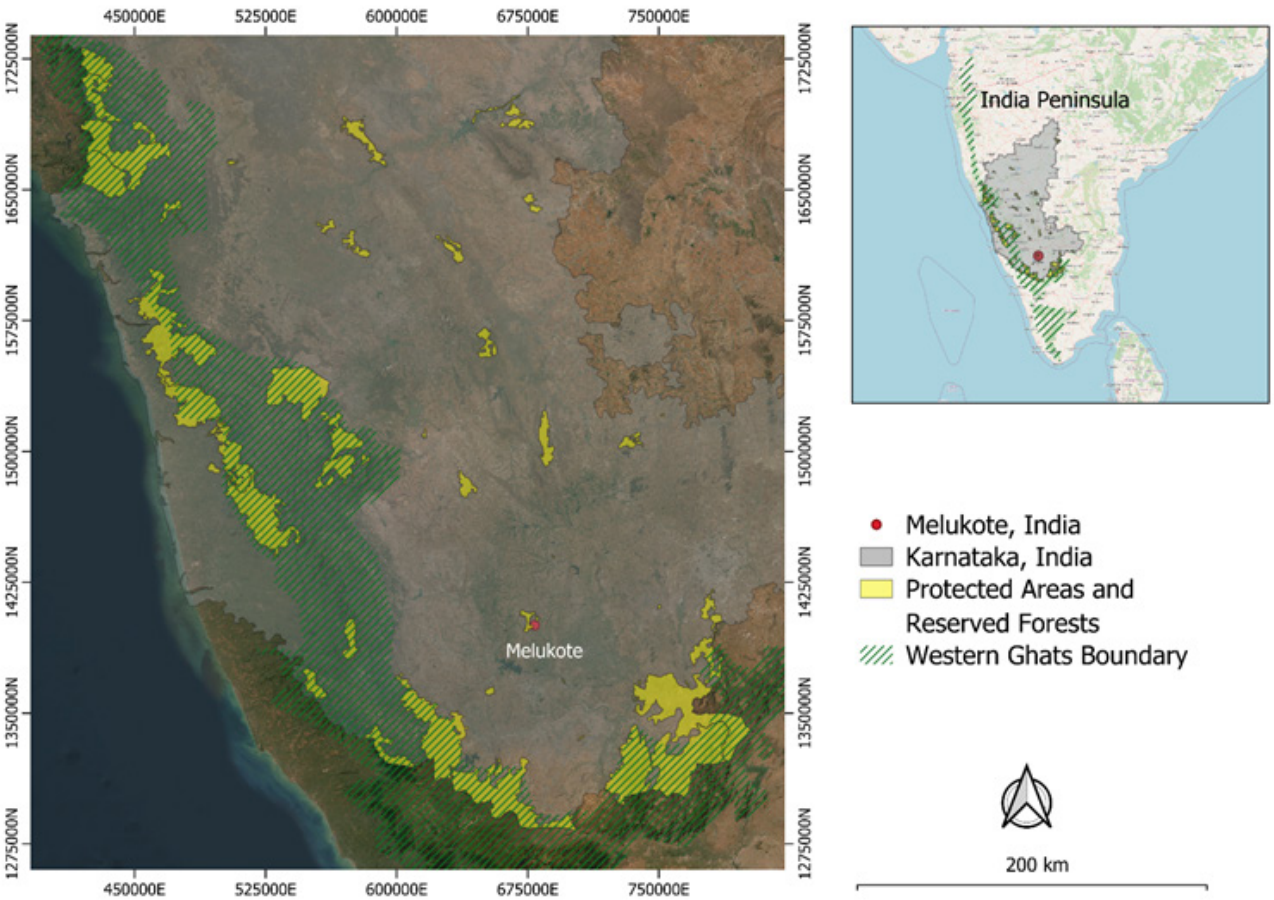

Figure 1. Location of the study area in southern India showing the position of Melukote (12.6626° N, 76.6486° E) in Mandya District, Karnataka, India.

Before each interview, the purpose of the study was explained to participants, and oral informed consent was obtained. A total of nine interviews were conducted, including five local hunters (four aged approximately 60–70 years and one approximately 40 years old, each with two to three decades of experience in the region) and four officials from the local forest department. All interviews were conducted in the local Kannada language.

Semi-structured interviews were chosen to allow flexibility for participants to introduce additional observations while enabling the interviewer to explore predefined themes (Cohen *et al.*, 2007). During the interviews, photographs of the unusually red porcupines were shown to participants, who were asked about local names, frequency of sightings, and any observed morphological or behavioural differences relative to the typical morph. Interviews lasted approximately 10–20 minutes, depending on the depth of responses.

In addition to interview data, we reviewed publicly available photographic records of *H. indica* on iNaturalist (inaturalist.org) and the India Biodiversity Portal (indiabiodiversity.org) to identify further evidence of similar colour morphs. Additionally, we consulted ecologists regarding the presence of red porcupines in their respective study regions.

Results

Over the 50-days period (150 trap-nights across three cameras), a total of 564 images were recorded, documenting 12 vertebrate species, including mammals, birds, and reptiles (Table 1). On 9th October 2025, two individuals of an unusual reddish morph of the Indian Crested porcupine (*Hystrix indica*) were photographed at a burrow at around 11 AM (Figure 2a–c). It had rained that early morning, which could have flooded the burrow, making the porcupines come out during the day hours. Four images of the typical morph were also obtained at a nearby site, ca. 500 m away, but during the night hours (Figure 2d). A road kill of a typical morph was also recovered from the region during the study period.

Table 1. Species recorded from camera traps in the Melukote region, Karnataka, over 50 nights, with corresponding IUCN Red List status.

S. No.	Category (Class / Order / Family)	Common name	Scientific name	IUCN status
1	Aves / Galliformes / Phasianidae	Painted Spurfowl	*Galloperdix lunulata*	Least Concern
2	Reptilia / Squamata / Varanidae	Bengal Monitor lizard	*Varanus bengalensis*	Near Threatened
3	Mammalia / Artiodactyla / Suidae	Wild Boar	*Sus scrofa*	Least Concern
4	Aves / Passeriformes / Turdidae	Orange-headed Thrush	*Geokichla citrina*	Least Concern
5	Mammalia / Rodentia / Hystricidae	Indian Crested Porcupine (including red ones)	*Hystrix indica*	Least Concern
6	Mammalia / Pholidota / Manidae	Indian Pangolin	*Manis crassicaudata*	Endangered
7	Aves / Passeriformes / Cisticolidae	Common Tailorbird	*Orthotomus sutorius*	Least Concern
8	Mammalia / Carnivora / Herpestidae	Ruddy Mongoose	*Urva (Herpestes) smithii*	Least Concern
9	Mammalia / Rodentia / Muridae	Gerbil spp. (likely Indian gerbil)	*Tatera indica (probable; record listed as "Gerbil spp.")*	Least Concern
10	Mammalia / Rodentia / Sciuridae	Squirrel (likely Indian palm squirrel)	*Funambulus palmarum (likely)*	Least Concern
11	Mammalia / Lagomorpha / Leporidae	Black-naped Hare	*Lepus nigricollis*	Least Concern
12	Reptilia / Squamata / Pythonidae	Indian Rock Python	*Python molurus*	Near Threatened

The red morph differs from the typical form in that the usual white quill bands are replaced by bright rusty-red or orange bands, while the black bands remain dark. The camera trap data and local interviews yielded both photographic and anecdotal evidence for an unusual reddish morph of *Hystrix indica* in the Melukote region.

Local Knowledge

To assess local awareness of the red morph, semi-structured interviews were conducted with forest personnel, local hunters, and community members. Across all interviews with local hunters (n = 5), informants consistently described the red morph ('*Kemmulla*') as rare, recalling only 2–4 encounters over the past two decades. All respondents indicated no size or weight difference compared to the typical morph ('*Karimulla*'). Our interview data affirmed the local rarity of the red morph 'Kemmulla' relative to the usual 'Karimulla' porcupines and two separate names for the typical and red morph. From the surveys, capture frequency appears extremely low; hunters reported only two confirmed captures of the red morph porcupines over ~15 years, and another hunter reported four sightings in the last 20 years. Local forest department officials reported that they have not observed the red morph in the region, either through direct sightings or during their

Figure 2. The photograph panel shows camera trap images of various species captured during our exercise. a) the red morph Indian Crested Porcupine (*Hystrix indica*) at its burrow, b) a pair of the red morph porcupine showing with erect quills, c) night time image of likely the same red morph porcupine pair at the burrow, d) night time image of a normal morph porcupine at another location. The following animals were photographed at the porcupine burrow site: e) Indian hare (*Lepus nigricollis*), f) Ruddy Mongoose (*Urva smithii*), g) Indian monitor (*Varanus bengalensis*), h) a painted spurfowl (*Galloperdix lunulata*) pair, i) unidentified *Gerbil* spp. j) An Indian pangolin (*Manis crassicaudata*) was photographed at one of the three camera trap sites.

camera-trapping exercises. These accounts, combined with our photographic records, suggest that the red morph is a rare but locally recognized variant of *H. indica* in southern India.

Discussion

This study documents photographic and physical evidence of a rare reddish morph of *Hystrix indica* in southern India, a form that appears to be locally recognized but poorly documented scientifically. Besides the image from Tadoba, Maharashtra (Menon, 2014), we found another camera trap image of a similar red morph porcupine from the Melagiri Hills, Tamil Nadu, captured in August 2011, uploaded on both iNaturalist (observation ID: 78215724) and India Biodiversity Portal (observation ID: 324945). Additionally, a camera-trap image of *H. indica* exhibiting an orangish tinge on its quills was obtained by the Hyderabad Tiger Conservation Society in the Nagarjunasagar-Srisailam Tiger Reserve (Imran Siddiqui, pers. comm.).

Although the species is common and widely distributed, most available camera trap records, often illuminated by infrared or flash, do not accurately reflect true coloration, which may have led to underreporting of this morph. In our study too, the night image of red morph porcupines (Figure 2c) looks indistinguishable from the usual morph (Figure 2d). The actual frequency and distribution of red individuals are therefore likely underestimated.

We propose five possible explanations for the reddish coloration observed in the Melukote individuals and evaluate each below.

1. Pigmentation from external sources such as soil or tannins
Some species derive coloration from environmental staining. For example, bearded vultures (*Gypaetus barbatus*) intentionally bathe in ferruginous waters rich in iron oxides, acquiring a reddish hue (Margalida *et al.*, 2019), while elephants coat themselves in mud for thermoregulation and parasite defense (Mole *et al.*, 2016). Similarly, tannin-rich water from decomposing vegetation can impart reddish tones. However, in this study, several other species, including a mongoose, python, and monitor lizard, used the same burrow system and displayed normal coloration. This strongly suggests that soil or tannin-based pigmentation or any external dye is not the cause.

2. Dietary influences
Dietary composition, particularly amino acid and micronutrient content, can influence coat pigmentation in mammals. Dogs consuming food with reduced phenylalanine, tyrosine, and copper exhibit lighter or less red coats (Watson *et al.*, 2017). However, both normal and red morph porcupines were recorded within the same locality, implying shared foraging resources. Without evidence of dietary segregation, this explanation appears unlikely.

3. Age-related variation
In several mammalian taxa, juvenile coloration differs from adult pelage (*e.g.*, in felids and suids). No ontogenetic color variation has been described in Hystrix. The red individuals recorded here were adult-sized, suggesting that the observed coloration is not age-related.

4. Environmental effects
Environmental gradients can sometimes influence pelage coloration. For instance, rodents tend to show darker or redder hues in warm or humid regions (Cerezer *et al.*, 2024). However, both normal and red morphs were observed in the same locality, indicating that local environmental factors do not explain this variation.

5. Natural polymorphism
Aberrant pigmentation and color polymorphisms such as melanism, leucism, and erythrism occur in many mammals, for example, golden jackal (*Canis aureus*) (Samson *et al.*, 2024) and leopard (*Panthera pardus*) (Pirie *et al.*, 2016). These arise from genetic mutations affecting melanin synthesis (Fuentes *et al.*, 2024). The occurrence of reddish porcupines reported from multiple regions and over several decades suggests that this is not a random, isolated mutation but rather a rare, naturally occurring color morph within *H. indica* populations.

In mammals, pigmentation is primarily governed by the relative production of eumelanin (black or brown pigments) and pheomelanin (red or yellow pigments), regulated by a conserved set of melanogenesis genes (Bennett & Lamoreux, 2003; Hoekstra, 2006). The melanocortin-1 receptor (MC1R) plays a central role in this pathway, with reduced or altered MC1R signaling commonly associated with erythristic or reddish phenotypes across diverse mammalian taxa (Mundy, 2005). Other genes, including ASIP (Agouti Signaling Protein), which antagonizes MC1R, and TYRP1 (Tyrosinase-Related Protein 1), which influences eumelanin synthesis and stability, are also known to produce reddish, diluted, or modified banding patterns in mammalian hair and other keratinous structures when mutated or differentially regulated (Bennett & Lamoreux, 2003; Hubbard *et al.*, 2010). Variation in these genes can result in partial suppression of eumelanin while retaining pheomelanin expression, yielding rusty-red or orange coloration without complete depigmentation.

Taken together, the evidence best supports the hypothesis that the red coloration represents a genetically based polymorphism rather than environmental or dietary staining. Further work combining genetic sampling, morphometric comparison, and systematic camera trapping across regions will be necessary to assess the true distribution, frequency, and heritability of this morph. Investigating potential behavioral or olfactory differences, as historically noted by Prater (1971), may also yield insights into whether color variation in *H. indica* has ecological or reproductive significance.

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CONFLICT OF INTEREST

Ashish Jha is an academic editor at the Journal of Wildlife Science. However, he did not participate in the peer review process of this article except as author. The authors declare that they have no competing interests.

DATA AVAILABILITY

Camera trap images used in this study have been provided in the manuscript.

AUTHOR CONTRIBUTIONS

Conceptualisation, Data curation, Funding acquisition, Investigation: SK and SCL; Formal analysis, Validation, Visualization, Writing – original draft: MM and AJ; Writing – review & editing: SK, MM, and AJ.

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