

First case of piebaldism in black-bearded tomb bat *Taphozous melanopogon* in Goa, India

Primer caso de piebaldismo en el murciélago de tumba de barba negra *Taphozous melanopogon* en Goa, India

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Pigmentation disorders caused by melanin deficiency or excess have been reported in several vertebrate groups, including bats. Piebaldism is a condition that results in white patches in certain areas of skin due to absence of melanocytes there. Here we report the first case of piebaldism in *Taphozous melanopogon* in the world from Goa, India. During a survey to assess species diversity of bats in Goa, historic sites and places of worship were surveyed. These churches with wooden material are roosting sites for bats. Roost locations, microhabitat features, number of bats and their behaviour were noted inside the old Portuguese churches. During one field survey, a single individual of *Taphozous melanopogon* with piebaldism was seen in a church, clinging on to a wooden beam on the ceiling. The body of the individual was normal coloured but with three white patches on the dorsal side and normal coloured eyes. Piebaldism is the most common chromatic aberration reported in bats. In India, cases of chromatic aberrations in bats have been reported in 8 species. With increasing research in bat ecology, reports of pigmentation anomalies are on the rise, and such reports are critical to understanding the cost, benefits, and survival challenges of the affected individuals.

Key words: Albinism; chromatic aberration; leucism; melanin; pigmentation.

Los trastornos de pigmentación son causados por una deficiencia o exceso de melanina y se han reportado en varios grupos de vertebrados, incluidos los murciélagos. El piebaldismo es una afección que produce manchas blancas en ciertas áreas de la piel debido a la ausencia de melanocitos allí. Aquí reportamos el primer caso de piebaldismo en *Taphozous melanopogon* en el mundo en Goa, India. Durante un estudio para evaluar la diversidad de especies de murciélagos en Goa, se inspeccionaron sitios históricos y lugares de culto religioso. Estas iglesias construidas con madera son el lugar de descanso para los murciélagos. En el interior de las antiguas iglesias portuguesas se registró la ubicación de los sitios de percha, las características de los microhábitats, el número de murciélagos y sus comportamientos. Durante un estudio de campo, se vio en una iglesia un solo individuo de *Taphozous melanopogon* con piebaldismo, aferrado a una viga de madera en el techo. El cuerpo del individuo era de color normal con tres manchas blancas en el lado dorsal y ojos de color normal. El piebaldismo es la aberración cromática más común reportada en murciélagos. En la India se han reportado casos de aberraciones cromáticas en murciélagos de 8 especies. Con el aumento de la investigación sobre la ecología de los murciélagos, los reportes sobre anomalías de pigmentación van en aumento, dichos hallazgos son fundamentales para comprender los costos, los beneficios y los desafíos de supervivencia de los individuos afectados.

Palabras clave: Aberración cromática; albinismo; leucismo; melanina; pigmentación.

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Chromatic aberrations such as albinism, melanism, piebaldism, hypomelanism and leucism have been described in most vertebrate groups ([Uieda 2000](#); [Lucati and Lopez-Baucells 2016](#)). These aberrations are caused due to a deficiency or an excess of melanin, both of which result in abnormal skin coloration, fur and feathers ([Abreu et al. 2013](#); [Lucati and Lopez-Baucells 2016](#)). These phenotypic changes are a consequence of genetic mutations that disrupt stages of melanogenesis, the metabolic pathway responsible for the synthesis of melanin ([Slominski et al. 2004](#)).

Generally, hypopigmentation cases are easily detected ([Fertl and Rosel 2002](#)). Piebaldism is a type of hypopigmen-

tation resulting in lack of melanin in part of the skin and/or hair follicles due to the absence of melanocytes in the affected part. Piebald individuals show patchy distribution of white spots on the body but have normal coloured eyes ([Lucati and Lopez-Baucells 2016](#)). This abnormality is often confused with leucism, a condition that results from total or partial lack of pigmentation on the skin or fur of the whole body, but with normal coloured eyes. A total lack of pigmentation on the whole body is termed albinism, a condition generally characterized by a lack of melanin in the skin, coat and eyes ([Montilla and Link 2022](#)).

Chromatic disorders are the most frequent type of

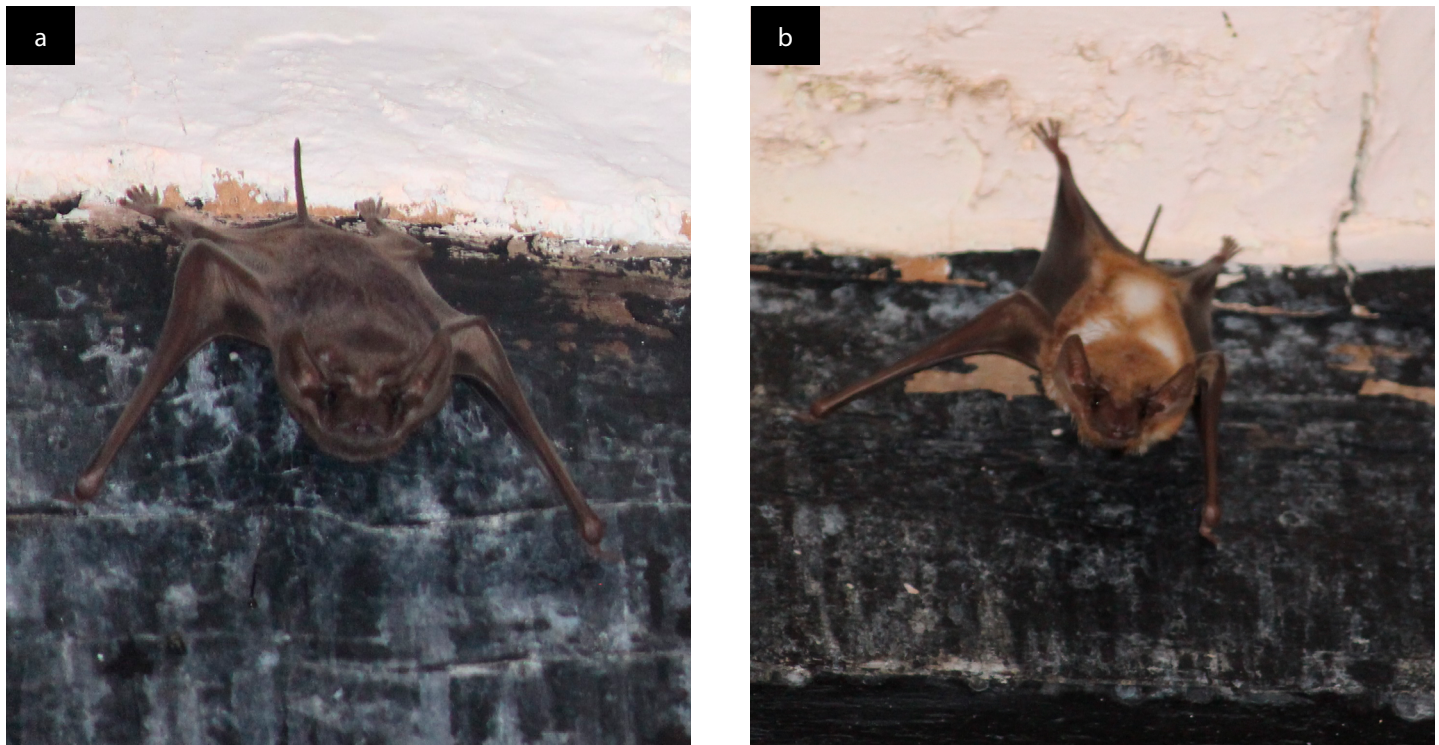


Figure 1. Normal coloured individual (a) and individual with piebaldism (b) of black-bearded tomb bat *Taphozous melanopogon* photographed in Goa, India.

anomalies recorded in bats ([Zalapa et al. 2016](#); [Lucati and López-Baucells 2017](#); [Mahabal et al. 2019](#)). Reviews indicate chromatic aberrations have been reported from 115 species belonging to 11 families ([Lucati and López-Baucells 2016](#)), with new records being reported intermittently. In India, as of now 2 chromatic aberrations, albinism and piebaldism have been reported from 8 species of bats ([Sail and Borkar 2024](#)).

The black-bearded tomb bat *Taphozous melanopogon* ([Temminck 1841](#)) is a medium-sized, aerially foraging emballonurid. The bat has a greyish-brown body with a usually paler belly. Male has a patch of black fur like beard at throat region ([Bates and Harrison 1997](#)). This species has a distribution in south and southeast Asia ([Bates and Harrison 1997](#); [Bates et al. 2000](#)). It is a highly gregarious species living in diurnal roosts in caves, ruins, and temples; with its colony size varying from 10 individuals to many hundreds ([Molur et al. 2002](#)). *Taphozous melanopogon* is now commonly reported from urban areas ([Wei et al. 2008](#)). The black-bearded tomb bat is a 'Least Concern' species on the IUCN Red List of Threatened Species ([Phelps et al. 2019](#)). Here we report the first case of piebaldism in the black-bearded tomb bat.

Goa, a maritime Indian state lies between latitudes 14° 53' 54" N and 15° 40' 00" N and longitudes 73° 40' 33" E and 74° 20' 13" E, covering an area of 3,701 km² ([Rangnekar et al. 2010](#)). The state has a warm tropical climate with temperature ranging from 21°C to 31°C ([Rangnekar et al. 2010](#)). As part of the project to assess bat species diversity in Goa, historic sites and places of worship were surveyed. Goa was a Portuguese colony, and several Roman Catholic

churches were built there around 500 years ago ([de Azevedo 1956](#)). These churches have been built using laterite, black granite and have tiled roofs ([Khan and Chatterjee 2021](#)). Their pillars and hallways are intricately carved with wooden material that extend from ground to the ceiling, providing microhabitat for bats. Some of these churches now serve as a roosting sites for *Taphozous melanopogon*.

On April 13, 2024, we observed an individual of *Taphozous melanopogon*, clinging to the wooden frame of the ceiling at the Patriarchal Seminary of Rachol, Salcete (15° 18' 34.89" N, 74° 00' 06.73" E). This individual had 3 discrete white patches; 2 appearing bilaterally on the dorsal lower trunk, and 1 single along the median line posteriorly, just before the uropatagium, while the rest of the body was greyish brown with normal coloured eyes (Figure 1). The individual was a male, as evident from the beard like tuft at the throat region, seen along with other conspecifics roosting across the wooden beam.

Piebaldism is perhaps the most common chromatic aberration occurring or at least reported in bats ([Mora and Sánchez 2022](#)). From a total of 109 reports in the world, 277 individuals of 73 species of bats have been reported for piebaldism ([Lucati and López-Baucells 2016](#); [Borloti et al. 2019](#); [Ferreira et al. 2020](#); [Mora and Sanchez 2022](#); [Hernández-Aguilar et al. 2024](#); [de Oliveira et al. 2024](#)). In India, cases of chromatic aberrations in bats have been reported in 8 species. Of the 14 individuals with chromatic aberrations listed, 11 were cases of albinism and 3 of piebaldism ([Sail and Borkar 2024](#)). Senacha and Purohit (2005) had incorrectly reported 3 individuals of *Rhinopoma hardwickii* as cases of partial albinism in India, however subsequently it has been revised as piebaldism ([Lucati and López-Baucells 2016](#); [Mahabal et](#)

al. 2019). The present case is the first record of piebaldism reported for *Taphozous melanopogon* in the world. It is only the second record for piebaldism among bats in India and second chromatic aberration in bats to be reported from Goa (Sail and Borkar 2024).

In the family Emballonuridae, 4 cases of chromatic aberrations have been reported, piebaldism in *Coleura afra* (Anonymous 2014), leucism in *Taphozous georgianus* (Swanson 1980), albinism in *Taphozous* sp. (Dhanya et al. 2015), including this study. Eighty-seven reports have incorrectly identified piebaldism as leucism or partial albinism due to semantic confusion (Lucati and López-Baucells 2016).

Hypopigmentation is believed to be detrimental; due to assumed poor vision, greater predation risk, lower mating success and lower survival rates in affected individuals (Caro 2005; Oliveira and Aguiar 2008). However, there is no conclusive evidence of such effects influencing the survival of affected bat species (López-Baucells et al. 2013). Efforts at compiling systematic records of pigmentary anomalies in bats are poor, and the ecological implications of these anomalies remain unclear (Romano et al. 1999). However, reports of pigmentation anomalies are important to understand the evolutionary cost and benefits arising from chromatic disorders.

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Associate editor: Beatriz del Socorro Bolívar Cimé

Submitted: December 17, 2024; Reviewed: March 17, 2025.

Accepted: April 1st, 2025; Published online: June 30, 2025.