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Sociedad Argentina para el Estudio de los Mamíferos

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**First record of albinism in a mustached bat (Chiroptera,
Mormoopidae) from South America**

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Citation: LEAL, E. S. B., & D. F. RAMALHO. 2021. First record of albinism in a mustached bat (Chiroptera, Mormoopidae) from South America. Notas sobre Mamíferos Sudamericanos 3:e21.3.1

ABSTRACT

Chromatic alterations, including albinism, are rare in wild animals. In bats, at least 160 cases of albinism have been recorded in individuals from ten families. For Mormoopidae, a single case of albinism and two cases of piebaldism are known in the world. This paper documents the first case of albinism in Mormoopidae in South America, which represents the first record of pigmentation alteration in Wagner's mustached bat, *Pteronotus personatus* (Wagner, 1843) throughout its range. We provide a discussion on the impacts of interaction in roosts on fitness and survival of albino individuals.

Key words: bat cave, Brazil, Caatinga, chromatic disorder, *Pteronotus*.

RESUMO - Primeiro registro de albinismo em morcego cara-de-fantasma (Chiroptera, Mormoopidae) da América do Sul

Alterações cromáticas, incluindo albinismo, são raras em populações selvagens. Em morcegos, pelo menos 160 casos de albinismo foram registrados em indivíduos de dez famílias. Para Mormoopidae, um único caso de albinismo e dois de piebaldismo são conhecidos no mundo. Este trabalho documenta o primeiro caso de albinismo em Mormoopidae na América do Sul, que representa o primeiro registro de alteração da pigmentação no morcego *Pteronotus personatus* (Wagner, 1843) em toda sua distribuição. Nós fornecemos uma discussão sobre os impactos da interação em poleiros na aptidão e sobrevivência de indivíduos albinos.

Palavras-chave: anomalia cromática, Brasil, Caatinga, caverna de morcegos, *Pteronotus*.

Phenotypic chromatic alterations have been recorded in a wide range of wild vertebrates, affecting the skin, fur, hair, scales and/or eyes (Hiller 1983; McCardle 2012). Regarding albinism, phenotypic effects include a totally white pelage, pale

Recibido el 02 de septiembre de 2020. Aceptado el 22 de enero de 2021. Editor asociado: Mariano Sánchez.



skin, and red eyes, caused by the reflection of the capillaries of the retina (Lucati & López-Baucells 2016). Despite being record in a large diversity of organisms, albinism is a rare condition, particularly in wild populations (Lucati & López-Baucells 2016).

Albinism has been recorded in bats at least 160 times in 66 different species from ten families: Emballonuridae, Hipposideridae, Molossidae, Mormoopidae, Nycteridae, Phyllostomidae, Pteropodidae, Rhinolophidae, Rhinopomatidae, and Vespertilionidae (Lucati & López-Baucells 2016; Singh & Yadav 2016; da Rosa et al. 2017; Zortéa & Silva 2017; Calderón-Álvarez & Marin-Vasquez 2018; do Nascimento et al. 2018; Bernardi et al. 2019; Moreno et al. 2020; Ventorin et al. 2021). Regarding Mormoopidae, which comprises 18 species, all of them with insectivorous diets (Pavan 2019), there is a single known case of albinism for the species *Pteronotus parnellii* (Gray, 1843) in Mexico (Sánchez-Hernández et al. 1989). Furthermore, other pigmentation alterations have been recorded only twice for this family: cases of piebaldism in *Pteronotus quadridens* (Güendlach, 1840) from Puerto Rico (Rodríguez-Durán & Kunz 1992) and *Mormoops megalophylla* (Peters, 1864) from Mexico (Hernández-Aguilar & Santos-Moreno 2018).

In this paper, we present a case of albinism in *Pteronotus personatus* (Wagner, 1843) recorded in Brazil, which represents the first pigmentation disorder in a mormoopid bat from South America, and the second known case of albinism in this family. This record was made on the Furna do Morcego bat cave, located in the municipality of Ibimirim, Pernambuco, northeastern Brazil (latitude -8.570583; longitude -37.382111, elevation 556 m), in the limits between Catimbau National Park and Kapinawá Indigenous land (Fig. 1). This sandstone cave has a horizontal development of 43.8 m, an area of 200.05 m², and a volume of approximately 463 m³ (CECAV 2019). This cave houses a large colony of bats with an average estimated number of 20,000 individuals from five species, including *Carollia perspicillata* (Linnaeus, 1758), *Glossophaga soricina* (Pallas, 1766), *Lonchophylla* sp., *Pteronotus gymnotus* (Wagner, 1843) and *P. personatus*.

The Catimbau National Park is a protected area with over 62,300 hectares and considered of extreme biological importance due to its relevant numbers of endemic and rare species of fauna and flora (IBAMA 2002). Inside the park, there is an enormous speleological potential, as there are an estimated of over 2,000 natural underground cavities (Carvalho-Neto & Santos 2012), some of which are classified as “bat caves”, hosting some of the largest bat colonies in Brazil (see Azevêdo & Bernard 2015; Otálora-Ardila et al. 2019). The southern part of the Park is bordered by Kapinawá Indigenous land, an area of 12,403 hectares that belongs to one of the thirteen indigenous peoples currently represented in the state (UFPE 2020). The area is located within the Caatinga domain, a seasonally dry forest ecosystem exclusive of Brazil (Leal et al. 2003), and connected with Cerrado and Chaco in an area known as South American dry diagonal. According to Köppen’s classification, the climate in the area is semi-arid tropical (BSh), with an annual precipitation range of 300 to 500 mm, and an annual median temperature of 25 °C (Alvares et al. 2013).

On March 14, 2020, we placed a harp trap on the main entrance of the cave Furna



do Morcego (Fig. 1) before nightfall, in order to intercept bats as they emerge from the roost. At approximately 4:20 a.m., we captured an individual adult male identified as *P. personatus*, according to Díaz et al. (2016), with forearm length of 46.5 mm and complete albinism, including red eyes (Fig. 2). During day searches conducted before the night capture, the specimen was observed solitary on the cave walls approximately four meters from the entrance. After capture, the individual was euthanized and fixed in 10% formalin, preserved in 70% alcohol and deposited in the Mammal Collection of Universidade Federal de Pernambuco (UFPE 3710). The collection of the specimen was authorized by SISBio/ICMBio (#62738-1).

Pteronotus personatus has a visibly furred dorsum, which distinguishes it from *P. gymnonotus*, which has an appearance of naked dorsum due to the union of wing membranes on the dorsal midline of the body (de la Torre & Medellín 2010; Pavan 2019; Pavan & Tavares 2020) (Fig. 2). Wagner's mustached bats may be furred in either a reddish or blackish brown color phase, with no apparent relationship with season, sex, or age (de la Torre & Medellín 2010). Individuals with both conditions were observed in the Furna do Morcego bat cave.

Our record represents the first case of albinism in a mormoopid bat from South America, and the fourth known case of pigmentation disorder in this family worldwide (see Lucati & López-Baucells 2016). In South America, albinism had been observed in species from families Emballonuridae, Molossidae, Phyllostomidae, and Vespertilionidae (Lucati & López-Baucells 2016; da Rosa et al. 2017; Zortéa & Silva 2017; Calderón-Álvarez & Marin-Vasquez 2018; do Nascimento et al. 2018; Bernardi et al. 2019). Most of the cases of albinism and other pigmentation disorders have been observed in closed habitats used for roosting, such as caves and mines (Uieda 2000; Lucati & López-Baucells 2016), with only three records of albinism in open roosts (Ventorin et al. 2021).

The bats of the genus *Pteronotus* Gray, 1838 are known to form large congregations inside caves, generally cohabiting these roosts with other mormoopid species as well as with phyllostomid and natalid bats (Arita 1993; Bateman & Vaughan 1974; Otálora-Ardila et al. 2019). In subterranean environments, the populations of mormoopids can vary from 95 to over 118,000 individuals (Otálora-Ardila et al. 2019), and they usually occur in extensive, deep, humid caves with underground chambers (Pavan 2019). In those chambers, temperature resulting from the body heat of hundreds of thousands of bats combined with vapors from the decomposition of guano and aggregative behavior provide thermoregulatory advantages (Bateman & Vaughan 1974; Trajano & Moreira 1991; Tejedor et al. 2005; Leadle et al. 2012; Torres-Flores et al. 2012). In fact, higher temperature provided by social thermoregulation is important to reduce energetic waste (Willis & Brigham 2007), which could affect survival (Parker et al. 1996; Chaverri & Kunz 2011). For instance, *P. personatus*' average body temperature is 37.5°C, which is generally above the temperature found in caves and in habitats of night foraging (de la Torre & Medellín 2010). This species is sensitive to cold environments, with body temperature dropping rapidly if exposed to low temperature for a long period, reaching critical body temperature at



34°C (de la Torre & Medellín 2010). The thermal monitoring in Furna do Morcego bat cave shows that the mean temperature at the area where bats are concentrated has remained above 30°C, even when low ambient temperature is recorded.

The albino individual captured in the Furna do Morcego bat cave was observed roosting alone in areas near the entrance of the cave, which could offer disadvantages for survival in the roost. Interestingly, those bats are extremely susceptible to moderate drops in temperature (Novick 1963), which highlights the importance of large aggregations regulating roost temperature, with a direct effect in reproductive success and offspring growth (Zahn 1999).

Most records of albinism in bats are derived from captures in roosts, with relatively few individuals being captured during flight (Buchanan 1985; Lucati & López-Baucells 2016). However, little is known about how those bats behave inside the roost and how they interact with regular pigmented individuals. In this context, observations on the behavior of albino bats in the wild are important for understanding the social interactions of these animals in the roost, and how pigmentation disorders affect fitness or survival in bats.

ACKNOWLEDGEMENTS

We thank the coordinator of the Long-Term Ecological Program, Catimbau site (PELD Catimbau), Dr. Marcelo Tabarelli, for the logistical support provided during field activities at the Catimbau Natinal Park; We thank guides Genivaldo and Clébio for the collaboration in field data collection and IBAMA, ICMBio and FUNAI for authorizing the research; We thank Federal University of Pernambuco (UFPE), the Northeast Environmental Research Center (CEPAN), National Council for Scientific and Technological Development (CNPq) and the Coordination of Improvement of Higher Level Personnel (CAPES) for providing financial support and scholarships. We also thank the teams from Laboratório de Ciência Aplicada à Conservação da Biodiversidade and Laboratório de Invertebrados Terrestres for assistance during field activities, Diego Rodrigues for assisting in the elaboration of the map, and Dr. Diego A. de Moraes, curator of the UFPE mammal collection, for accepting and cataloging the specimen. We also acknowledge the review work done by the Dr. Guilherme S.T. Garbino and an anonymous reviewer, which have been essential to increase the quality of this study.



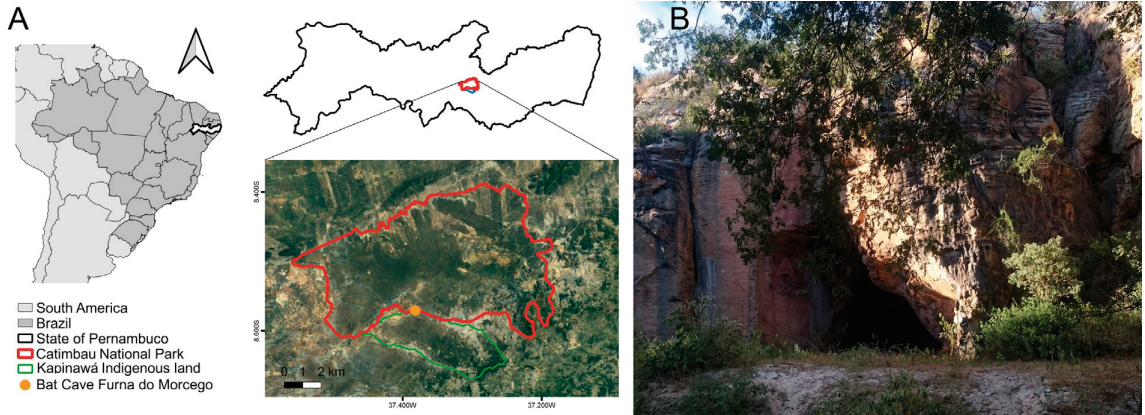


Figure 1. Location (A) and entrance (B) of the Furna do Morcego bat cave (Pernambuco, Brazil) where the albino specimen of *Pteronotus personatus* was captured. Google Earth™. Photo: Edson S.B. Leal.



Figure 2. Ventral (A) and dorsal (B) views of the albino male specimen of *Pteronotus personatus* (voucher UFPE 3710) captured in the Furna do Morcego bat cave, Pernambuco, Brazil. Photos: Edson S.B. Leal.

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