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## First record of leucism in two species of insectivore bats (Chiroptera) from San Luis province, Argentina

Diana B. Acosta (1, 2), Emiliano Pinaridi (1, 2), and Mariano L. Merino (1, 3)

(1) Centro de Bioinvestigaciones (CeBio), Universidad Nacional del Noroeste de la Provincia de Buenos Aires (UNNOBA-CICBA) / Centro de Investigaciones y Transferencia del Noroeste de la Provincia de Buenos Aires CITNOBA (UNNOBA-CONICET), Pergamino, Buenos Aires, Argentina. (2) Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina. (3) Comisión de Investigaciones Científicas de la Provincia de Buenos Aires (CICPBA), La Plata, Buenos Aires, Argentina. [correspondencia: dbacosta@comunidad.unnoba.edu.ar]

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### ABSTRACT

Leucism is defined as the total or partial lack of pigmentation in the body except for the soft parts. This disorder could affect the survival and fitness of the animal. Here, we report the first case of leucism in *Eptesicus furinalis* and *Tadarida brasiliensis* from San Luis Province, Argentina. For each species, leucitic males were recorded, with an atypical coloration both dorsal and ventrally, the coloration of the eyes and the membranes being normal. Communicating these pigmentary disorders in bats is essential as a starting point for future ethological, ecological, and genetic research.

**Keywords:** Argentina, *Eptesicus furinalis*, leucism, San Luis province, *Tadarida brasiliensis*

**RESUMEN - Primer registro de leucismo en dos especies de murciélagos insectívoros (Chiroptera) de la provincia de San Luis, República Argentina.** El leucismo se define como la falta total o parcial de pigmentación en el cuerpo, exceptuando las partes blandas. Este desorden podría afectar la supervivencia y el éxito reproductivo del animal. En este trabajo se reporta el primer caso de leucismo en *Eptesicus furinalis* y *Tadarida brasiliensis* en la provincia de San Luis, Argentina. Para cada especie, se colectó un macho con leucismo, registrándose coloración atípica en el pelaje dorsal y ventral, mientras que los ojos y las membranas tuvieron coloración normal. Comunicar estos desórdenes pigmentarios en murciélagos es fundamental como punto de partida para futuras investigaciones etológicas, ecológicas y genéticas.

**Palabras clave:** Argentina, *Eptesicus furinalis*, leucismo, provincia de San Luis, *Tadarida brasiliensis*

The broad variety of forms and colors found in mammals results from the presence of certain pigments, mostly melanin, in their integuments. Different combinations and intensities lead to a range of hues (Pawelek & Körner 1982).

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Chromatic disorders are pigmentation anomalies that cause abnormal skin coloration and derivatives due to DNA mutations that affect some stages of the pigmentation process (Zalapa et al. 2016). They have been reported in many mammals and are caused by either a deficiency in or an excess of melanin, known as hypopigmentation and hyperpigmentation, respectively (Hofreiter & Schöneberg 2010).

Although there are different classifications for the chromatic disorders in the literature, three main types can be recognized: melanism, in the case of hyperpigmentation, and albinism or leucism, in the case of hypopigmentation (Romano et al. 2015; Lucati & López-Baucells 2016; Salas et al. 2021). Melanism is an inherited hyperpigmentary disorder characterised by the abnormal deposition of melanin in the skin and/or hair follicles or feathers, which gives rise to exaggerated black or brown pigmentation (van Grouw 2013). Albinism is an inherited disorder characterized by a complete lack of melanin. It is caused by an absence of the enzyme tyrosinase that causes individuals to have pale skin, white fur or feathers, and red eyes (van Grouw 2013). Leucism is defined as the total or partial lack of pigmentation in the whole body except the soft parts (Miller 2005). Leucism can be caused by one or several different mutations resulting in a wide variety of different phenotypes, ranging from those that are completely white to some with some streaks of white, but in all cases, there is no loss of eye and nail pigmentation (Miller 2005).

Cases of chromatic disorders in bats have been reported globally (e.g., Buchanan 1985; Uieda 2000; López-Wilchis & León 2012; López-Baucells et al. 2013; Treitler et al. 2013) and can affect both fur and skin, including patagium, ears, and muzzle. Regarding the effect that chromatic disorders may have on survival and biological fitness, some authors consider that hypopigmentation is detrimental, leading to overexposure, and increased risk of predation and intraspecific conflicts (Lucati & López-Baucells 2016). Other authors consider that it has no impact, as bats generally select dark roosts and are active at night when their color has no effect on predation or social behavior (Buys et al. 2002).

In South America, leucism has been reported in fifteen species of bats, while six have been found in Argentina, including the species *Eptesicus furinalis* (d'Orbigny & Gervais, 1847) and *Tadarida brasiliensis* (I. Geoffroy St.-Hilaire, 1824) (Barquez et al. 2003; Idoeta et al. 2011; Tello et al. 2014; Romano et al. 2015; Rivero-Castro et al. 2020). In Argentina, leucistic individuals of *T. brasiliensis* have been reported for Santa Fe and San Juan provinces (Romano et al. 2015; Rivero-Castro et al. 2020), while leucism in *E. furinalis* has only been reported for the province of Corrientes (Idoeta et al. 2011).

The aim of this note is to present the first report of leucism in *Eptesicus furinalis* (Vesperugo) and *Tadarida brasiliensis* (Molossidae) in San Luis province, Argentina.

The study was carried out at “El Centenario” ranch (latitude -34.167222; longitude -65.836388), General Pedernera department, San Luis, Argentina, the site where the species *E. furinalis* was recorded for the first time in this province (Lutz & Merino 2010). This ranch is located within the Pampa ecoregion, where herbaceous vege-



tation predominates with semi-arid grasslands and some chañar islets, and the climate is temperate-humid to sub-humid, with an average annual temperature of 16°C (Brown & Pacheco 2006; Viglizzo et al. 2006).

The colony of bats is located on the porch roof of the main house of the ranch, made up of flagstones on the outside and wood on the inside. For the sampling, a mist net 9 m long and 2.5 m high was placed near the shelter. It was opened for one hour for two days.

Following the guide of Barquez et al. (1999) and Barquez & Díaz (2020) for the identification of the species, the external measurements (in mm) and mass (in g) were taken with a dial caliper and a digital scale, respectively: total length (ToL), tail length (TL), hindfoot length (HFL), ear length (EL), forearm length (FA), and mass (W).

A total of 21 bats were collected, of which two adult males presented leucism (Fig. 1). Based on the external morphometric measurements, they were assigned to the species *E. furinalis* (Tol: 102, TL: 41, HFL: 9, EL: 13, FA: 42, W: 12) and *T. brasiliensis* (Tol: 94, TL: 32, HFL: 8, EL: 17, FA: 43, W: 13). In the case of *E. furinalis* the white spots were found on the dorsal and ventral part of the body, and head, while in *T. brasiliensis* they were found exclusively on the dorsum. Both specimens were deposited in the Mammal Collection of the “Museo Argentino de Ciencias Naturales Bernardino Rivadavia” (*E. furinalis* MACN Ma 30864 and *T. brasiliensis* MACN Ma 30865), Buenos Aires, Argentina.

The normal coloration of the species *E. furinalis* is variable throughout its distribution range, but it is uniform within populations (Barquez et al. 1999). So far, only one leucistic specimen of this species has been reported for Iberá, Corrientes province (Fig. 2) (Idoeta et al. 2011), making our report the second worldwide.

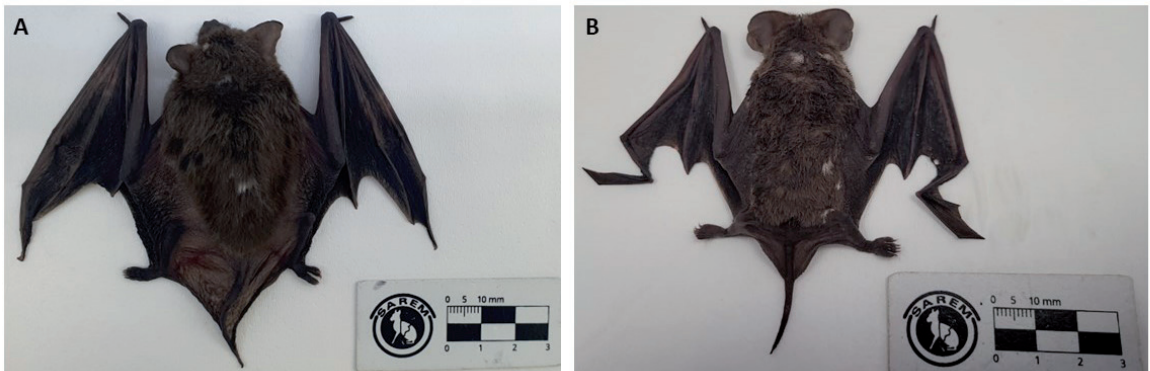
On the other hand, in *T. brasiliensis* chromatic disorders are more frequent, with leucistic and albino specimens reported in other countries such as Mexico and United State, although in low frequency (Herreid & Davis 1960; Caire & Thies 1988; Sánchez-Hernández et al. 2012). Argentina has the same scenario since it is the species with the highest number of reports of specimens with pigmentary disorders (Fig. 2) (Romano et al. 2015; Rivero-Castro et al. 2020).

The presence of some type of pigmentary disorder could have a negative effect on the fitness of the affected individuals because the animals that present these disorders are more prone to be preyed on and have difficulties finding a partner (Bensch et al. 2000; Torres & Franke 2008; Jogahara et al. 2008). Although leucism is rare, it occurs more frequently in isolated and small populations, probably because inbreeding increases the likelihood of expression of this pigmentation anomaly (Bensch et al. 2000; Chętnicki et al. 2007; Brito & Valdivieso-Bermeo 2016). Bats that live in houses, buildings, caves, and mines tend to present some pigmentary anomaly more frequently, unlike those living in open shelters (Uieda 2000).

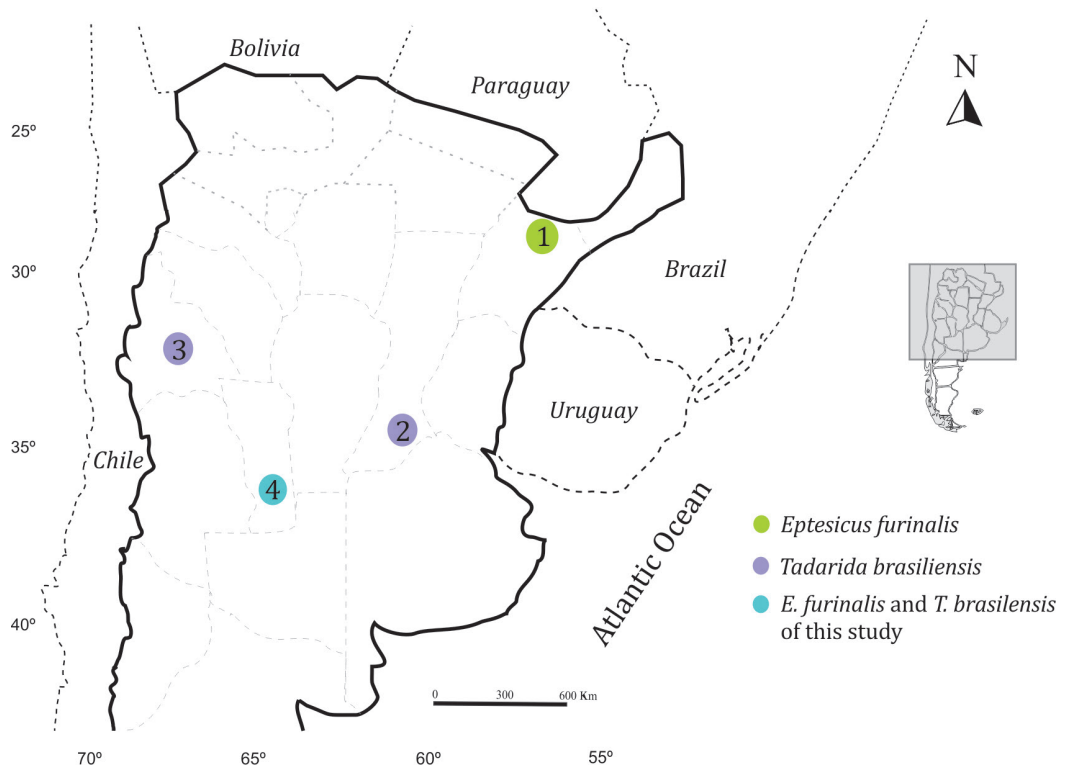
Due to the low frequency of specimens with leucism found in this study, and added to the fact that their refuge is house roofs, we believe that this colorimetric disorder would not have a major negative impact on their respective colonies. Likewise, we consider that a more exhaustive sampling of bat colonies in the region is essential in



order to assess the number of individuals with this disorder more accurately. Finally, we agree with several authors that highlight the importance of reporting cases of differences in pigmentation in bats and, consequently, the existence of collection and sampling protocols in order to understand the causes and consequences of these phenomena due to their importance in terms of ecological, ethological, and genetic research (Garcia-Morales et al. 2010; Lucati & López-Baucells 2016).



**Figure 1.** Dorsal view of adult male bats with leucism from San Luis province, Argentina. A) *Eptesicus furinalis*; B) *Tadarida brasiliensis*.



**Figure 2.** Localities of *E. furinalis* and *T. brasiliensis* with leucism in Argentina. Sites that were previously reported (green and purple circles respectively) include: 1) Iberá (Corrientes province); 2) Rosario (Santa Fe province); and 3) Ullum (San Juan province). Additionally, this study has identified a new record (light blue circle) in 4) General Pedernera (San Luis province).

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