



Leucism in *Callithrix jacchus* (Primates: Callitrichidae) and *Guerlinguetus aestuans* (Rodentia: Sciuridae) in the northeast of Brazil

Victor Leandro-Silva^{1*} , Jonathas Lins de Souza² , José Sérgio de Alcantata e Silva³ , Nailson de Andrade Neri Júnior⁴ , Rodrigo Farias Silva Regueira⁵ , Yuri Raia Mendes⁶  and Filipe Aléssio⁷ 

1 Programa de pós-graduação em Etnobiologia e conservação da Natureza – Universidade Federal Rural de Pernambuco, Recife, Pernambuco, Brazil.

2 Programa de pós-graduação em Biodiversidade – Universidade Federal Rural de Pernambuco, Recife, Pernambuco, Brazil.

3 Universidade Federal Rural de Pernambuco, Recife, Pernambuco, Brazil

4 Universidade Federal da Paraíba, João Pessoa, Paraíba, Brazil

5 RR Ambiental, Olinda, Pernambuco, Brazil

6 Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil

7 Instituto de Ciências Biológicas, Universidade de Pernambuco – Avenida Agamenon Magalhães, S/N – Santo Amaro, Recife, Pernambuco, Brazil.

* Correspondence: leo.silva.vls@gmail.com

Resumen

La variación fenotípica es común en los vertebrados, especialmente si consideramos las variaciones geográficas, sin embargo, mutaciones como el leucismo, el melanismo y el albinismo no son tan comunes. Aquí, reportamos dos casos de leucismo, en tití común (*Callithrix jacchus*) y ardilla brasileña (*Guerlinguetus aestuans*), registrados en fragmentos de Mata Atlántica en el noreste de Brasil. Estos registros nos permiten comprender mejor este fenómeno, así como las implicaciones ecológicas y fisiológicas para los animales, que tienen una influencia significativa en su supervivencia.

Palabras clave: Mata Atlántica; Brasil; Mammalia; Mutación; Nuevo registro.

Abstract

Phenotypic variation is common in vertebrates, especially if we consider geographic variations, however, mutations such as leucism, melanism, and albinism are not so common. Here, we report two cases of leucism, in common marmoset (*Callithrix jacchus*) and Brazilian squirrel (*Guerlinguetus aestuans*), recorded in Atlantic Forest fragments in northeastern Brazil. These reports allow us to better understand this phenomenon, as well as ecological and physiological implications for animals, which have a significant influence on their survival.

Key words: Atlantic Forest; Brazil; Mammalia; Mutation; New Record.

Pigmentation in vertebrates has a strong genetic and adaptive basis, with genetic changes being linked to variations in fitness-related traits (Hoekstra, 2006) and over 100 genes have been described that can affect pigmentation in mammals (Caro and Mallarino, 2020). The phenotypic variation of animal color can also be influenced by geographic distribution, seasonal climatic variations, age, sex, weight, diet, and sex hormones (Ortolani 1999; Stoner et al. 2003). Two physiological factors can determine the color patterns in mammals: a) the availability and b) the distribution of pigmentation in the skin, hair, and eyes (Hofreiter and Schöneberg 2010, Caro and Mallarino, 2020). The first can change the type, density and/or distribution of pigments along individual hairs; called pigment regulation, while the second factor alters the spatial distribution of pigmentation throughout the body, called pigment patterning (Caro and Mallarino, 2020). Other phenotypic variations (e.g., albinism, leucism, and flavism) are caused by genetic mutations in these animals.

Leucism is rare in vertebrates, specifically in mammals (Steen and Sonerud 2012; Abreu et al. 2013) and much rarer in wild populations (Bried et al. 2005). Leucism is expressed as the almost total or partial discoloration of certain parts of the body, but the color of the eyes and skin is maintained (Bensch et al. 2000; Miller 2005). Generally treated as a simple partial or total absence of melanin caused by a genetic gradient, studies point out that mutations, inbreeding, hybridization, nutritional deficiency, and environmental contamination may be associated with this phenomenon (Bensch et al. 2000; van Grouw 2006). Still, the low number of leucism records has made it difficult to identify patterns and investigate causes and effects (Ribeiro and Gogliath 2012).

We can find records of these mutations in many species of Neotropical vertebrates, including fish (e.g., Brito and Caramaschi 2005), anurans (e.g., Sanabria et al., 2010), snakes (e.g., Silva et al. 2010), birds (e.g., Veiga and Oliveira 1995; Mancini et al. 2010), and mammals (e.g., Acevedo and Aguayo 2008; Oliveira 2009). In this study, we report two records of mammals with leucism, common marmoset and Brazilian squirrel, respectively.

We recorded a common marmoset and a squirrel with leucism based on two fortuitous occasions in fragments of Atlantic Forest at the Endemism Center of Pernambuco (Atlantic Forest Portion found in northeastern Brazil, above the São Francisco River). The common marmoset was recorded in the RPPN Gargaú (Private Reserve of Natural Patrimony Gargaú - 6°59'18.7"S 34°55'38.7"W) located in the municipality of Santa Rita in the state of Paraíba, northeastern Brazil and photographed on November 11, 2018. The squirrel was recorded in the residential area in the APA Aldeia-Beberibe (Environmental Protection area Aldeia-Beberibe - 7°56'12.6"S 35°01'47.7"W) located in the municipality of Camaragibe in the State of Pernambuco (Figure 1) and it was photographed on March 13, 2016.

Callithrix jacchus (Common marmoset)

The animal with leucism (Figure 2) was alone. The white color was throughout its body. The skin was slightly clear. The eyes looked normal (black color) as in individuals with no leucism of the species. The animal was feeding on fruits at the time of its registration. It was possible to identify that it was an adult male.

Brazilian squirrel

The individual with leucism (Figure 3) was observed in the company of two more individuals of the same species with a normal color pattern of the species. The specimen has total leucism since its body and skin presented light color, however, it had eyes of black color. The group was feeding on native fruits available in the garden. It was possible to observe

that the individual with leucism had very prominent breasts, that is, probably it was in the probable stage of lactation.

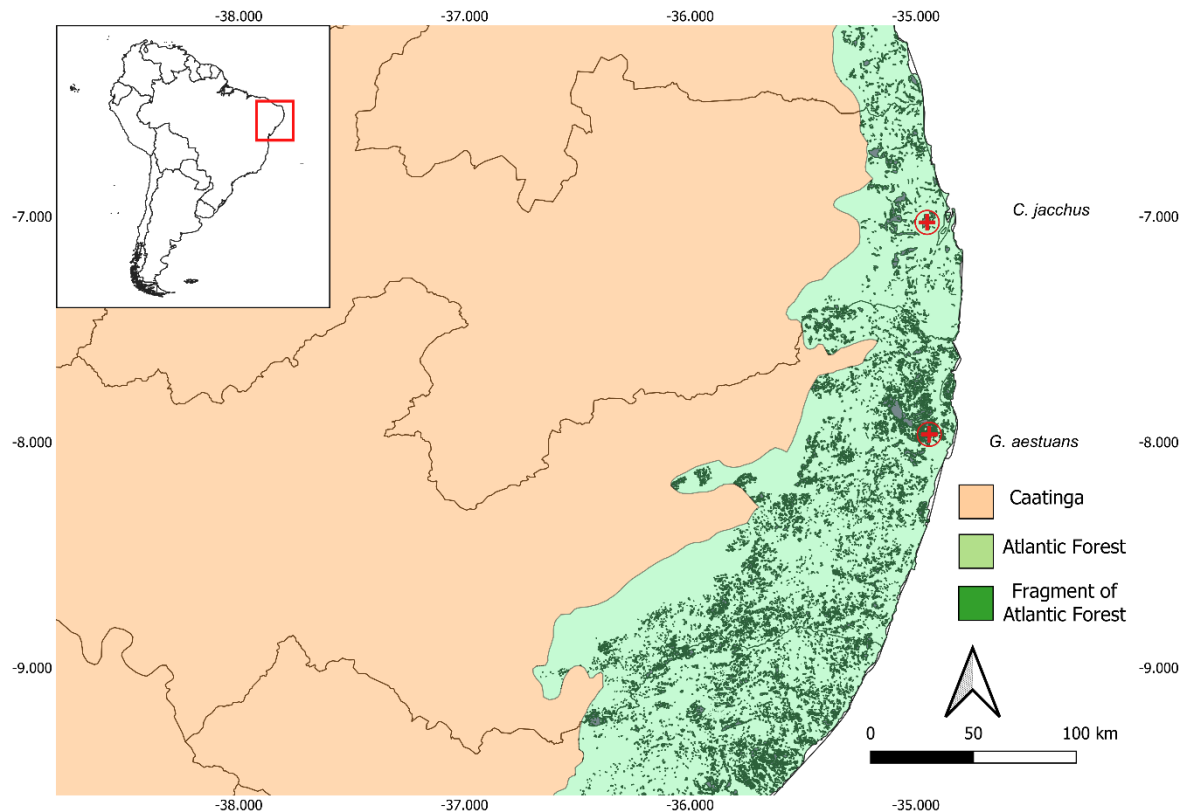


Figure 1: Geographical location of the records, first in the municipality of Santa Rita and the second in the municipality of Camaragibe, where the common Marmoset and the squirrel were photographed, respectively.

The two records of leucism presented in this note are one of the first documented cases of these species in the northeastern regions of Brazil. Other cases are reported in southeastern Brazil, mainly for other species of the genera. In *Callithrix*, there are reports for *C. penicillata* and *C. jacchus* (Aximoff et al, 2020) and for *G. ingrami* (Tavares et al, 2019). This highlights that the phenomenon of leucism is widespread in different regions of this country and around the world in different organisms. Other records of leucism in mammals have been reported around the world, such as Southern fur seals, coatis, skunks, primates, rodents, bats, and irara (Abreu et al. 2013; Silva-Caballero et al. 2014; Aximoff and Vaz 2016; Brito and Valdivieso-Bermeo, 2016; Biassi et al. 2017; Talamoni et al. 2017; Rubio and Simonetti 2019).

Most cases of abnormal coloration of mammals are concentrated in the tropical region (Abreu et al. 2013), but there are several reports of these cases in other regions of the world (for example, Bruyn et al. 2007; Acevedo and Aguayo 2008; Acevedo et al. 2009), leading us to believe that this phenomenon is higher than the frequency reported in the literature (Abreu et al. 2013). This low frequency may be due to several factors, from low sampling, the high mortality rate of leucistic organisms, and even the lack of knowledge of who made the records.

The phenomenon of leucism found in these animals may compromise their social relations. Tové (2008) showed that for primates, colors are of paramount importance and one of the fundamental sensory systems for these organisms. However, Do Vale et al (2018) recorded 3 undue species of *Callithrix penicillata* interacting with other individuals of the same species without compromising their social relations, diverging from what was found in Tovees (2008)' study.

Evolutionarily, mammalian pigmentation of the coat has a camouflage function for these organisms to avoid predators (Parsons and Bonderup-Nielsen 1995). Therefore, color anomalies like albinism, leucism, favism, or others, make them more evident for predators because they are more visible in their habitat. Studies on island sloths and primates have shown that the frequency of this phenomenon may be linked to the absence or low frequency of predators, thereby facilitating their survival, and contributing to the spread and expression of these genes (Duquette et al. 2015). Reports of this phenomenon and others that bring reports of anomalies, whether staining or morphological, should be reported. These reports allow us to better understand this phenomenon, as well as ecological and physiological implications for animals, which have a significant influence on their survival.



Figure 2: Common marmoset (*Callithrix jacchus*) in RPPN Gargaú. Photograph: Yuri Raia Mendes.



Figure 3: Brazilian squirrel (*Guerlinguetus aestuans*) around the APA Aldeia-Beberibe. Photograph: José Sérgio de Alcântara e Silva.

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