First record of albinism in *Callithrix* sp. in the wild: case report and literature review

Primeiro registro de albinismo em *Callithrix* sp. na natureza: relato de caso e revisão bibliográfica

Primer registro de albinismo en *Callithrix* sp. en estado silvestre: informe de un caso y revisión bibliográfica

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ABSTRACT
Albinism is a rare hereditary condition characterized by the complete absence or severe reduction of melanin production in vertebrates. In Neotropical primates, pigmentation anomalies such as leucism have been documented in species of the genus *Callithrix*, particularly in *Callithrix jacchus* and *Callithrix penicillata*. However, confirmed cases of true albinism in marmosets (*Callithrix* sp.) occurring in natural conditions have not been previously reported. In this study we describe the first confirmed case of albinism in a free-ranging *Callithrix* sp. individual recorded in southeastern Brazil. The specimen was located by a local resident in the municipality of Casa Branca, in the state of São Paulo, and subsequently rescued by the municipal Civil Defense. The animal was later transferred to a veterinary clinic in Santa Cruz das Palmeiras for clinical evaluation by the veterinary team of the Institute of Biology (IBIMM). The individual exhibited phenotypic traits consistent with complete albinism, including total depigmentation of fur and skin, as well as eye abnormalities compatible with the lack of melanin. This record provides the first documented evidence of albinism in *Callithrix* sp. and expands current knowledge on pigmentation anomalies in Neotropical primates. The finding also raises important questions regarding the ecological, genetic, and evolutionary implications of hypopigmentation in wild primate populations.

Keywords: albinism, *Callithrix* sp., albino marmoset, pigmentation anomaly, neotropical primates.

RESUMO
O albinismo é uma condição genética rara caracterizada pela ausência completa ou redução significativa da produção de melanina, resultando em hipopigmentação da pele, pelagem e olhos em vertebrados. Em primatas neotropicais, anomalias de pigmentação, como o leucismo, já foram relatadas em espécies do gênero *Callithrix*, particularmente em *Callithrix jacchus* e *Callithrix penicillata*. No entanto, até o momento, não havia registros confirmados de albinismo verdadeiro em saguis (*Callithrix* sp.) em vida livre. Neste estudo, relatamos o primeiro registro documentado de albinismo em um indivíduo de *Callithrix* sp. no sudeste do Brasil. O animal foi encontrado vivo por um morador local no município de Casa Branca (São Paulo) e posteriormente resgatado pela Defesa Civil, sendo encaminhado para avaliação clínica veterinária. A análise fenotípica revelou características típicas de albinismo, incluindo despigmentação completa da pelagem e da pele, além de alterações oculares compatíveis com a ausência de melanina. Este registro amplia o conhecimento sobre a ocorrência de anomalias de pigmentação em primatas neotropicais e contribui para a compreensão da expressão de mutações raras em populações naturais de *Callithrix*. Além disso, o caso fornece informações relevantes para discussões sobre as possíveis implicações ecológicas e evolutivas do albinismo em primatas de vida livre.

Palavras-chave: albinismo, hipopigmentação, *Callithrix*sp., sagui, primatas neotropicais.

RESUMEN
El albinismo es una afección genética poco frecuente caracterizada por la ausencia total o una reducción significativa de la producción de melanina, lo que provoca hipopigmentación de la piel, el pelaje y los ojos en los vertebrados. En los primates neotropicales, ya se han descrito anomalías de la pigmentación, como el leucismo, en especies del género Callithrix, en particular en Callithrix jacchus y Callithrix penicillata. Sin embargo, hasta la fecha no existían registros confirmados de albinismo verdadero en titíes (Callithrix sp.) en libertad. En este estudio, presentamos el primer registro documentado de albinismo en un individuo de Callithrix sp. en el sureste de Brasil. El animal fue encontrado vivo por un residente local en el municipio de Casa Branca (São Paulo) y posteriormente rescatado por la Defensa Civil, siendo remitido para una evaluación clínica veterinaria. El análisis fenotípico reveló características típicas del albinismo, incluyendo la despigmentación completa del pelaje y la piel, además de alteraciones oculares compatibles con la ausencia de melanina. Este registro amplía el conocimiento sobre la presencia de anomalías de

pigmentación en primates neotropicales y contribuye a la comprensión de la expresión de mutaciones raras en poblaciones naturales de Callithrix. Además, el caso proporciona información relevante para el debate sobre las posibles implicaciones ecológicas y evolutivas del albinismo en primates en libertad.

Palabras clave: albinismo, hipopigmentación, Callithrix sp., sagú, primates neotropicales.

1 INTRODUÇÃO

Albinism is defined as the genetic absence of melanin in the skin, fur, and eyes, often resulting from mutations in genes related to pigment production, such as the TYR gene (which encodes the enzyme tyrosinase). In vertebrates, this condition is rare and has been sporadically recorded in various taxonomic orders, including mammals (Ding et al. 2000; Montilla & Link, 2022; Vasconcelos et al. 2017). In Neotropical primates, few cases of albinism have been described, such as in *Aotus griseimembra* (Montilla & Link, 2022), *Ateles chamek* (Lange & Glynn, 2022), *Ateles geoffroyi* (Espinal et al. 2016), *Cebus apella* (Bicca-Marques, 1988), *Sapajus apella* (Henriques et al. 2019), and most recently reported in *Callicebus nigrifrons* (Guimarães-Lopes et al. 2026).

Callithrix spp. refers to the genus of small Neotropical primates (marmosets) endemic to Brazil, particularly the Atlantic Forest, Cerrado, and Caatinga. They measure between 18–27 cm, weigh 300–400 g, and feed on sap, fruits, and insects. Common species include C. *jacchus* (white tufted marmoset) and C. *penicillata* (black tufted marmoset), with many populations threatened by habitat loss and hybridization (Mairrog, 2004).

In the genus *Callithrix*, there are reports of anomalous coloration phenotypes caused by leucism (partial absence of pigment, but with normally pigmented eyes), especially in C. *jacchus* and C. *penicillata*, documented in fragmented forests and urban areas in Brazil (Aximoff et al. 2020; Leandro-Silva, et al. 2023; Vale, et al. 2018). However, to date, there has been no confirmed report of true albinism in individuals of *Callithrix* sp. Confirmation of a case of genuine albinism in these primates will contribute to our understanding of the genetic evolution of pigmentation and the ecological effects of hypopigmentation in Neotropical primates.

2 MATERIALS AND METHODS

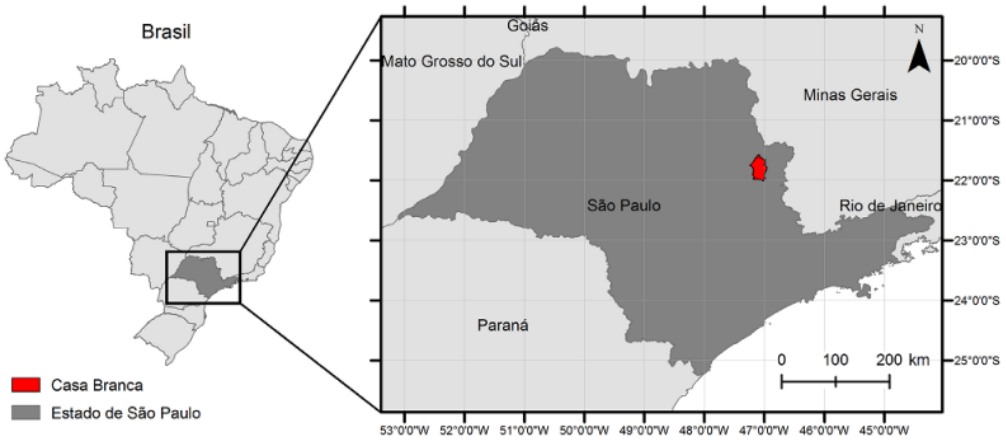
2.1 CLINICAL EXAMINATIONS

The Institute of Marine Biology and the Environment (IBIIM) received the carcass of a juvenile (male) albino *Callithrix* sp. on June 7, 2026, collected from the wild.

The animal was found collapsed in a rural area by a local resident, who contacted the Civil Defense of the municipality of Casa Branca, São Paulo, located at the following geographic coordinates: Latitude: *21° 46′ 26″* S, Longitude: *47° 05′ 09″* W (Figure 1). The still-living specimen

was taken to the wildlife veterinarian, Armando Neto, at the Anvet veterinary clinic, located in the municipality of Santa Cruz das Palmeiras, SP, who provided initial emergency care (Figures 2A and 2B).

Figure 1 – Origin of the juvenile albino *Callithrix* sp. individual. Municipality of Casa Branca, State of São Paulo, Brazil. Source: Prepared by the authors (2026).



The animal exhibited altered levels of consciousness (excessive drowsiness, stupor, or unconsciousness), pupillary abnormalities (mydriasis, anisocoria, and slow pupillary reflexes), impaired motor coordination (ataxia, weakness, paralysis, and tremors), abnormal behavior (excessive vocalization and apathy), vomiting, and seizures. The clinical condition progressed to death, and the probable "*causa mortis*" was head trauma caused by a depressed skull fracture, which occurs when a strong impact breaks and displaces part of the skull bone inward, toward the brain. This is considered a serious injury that can lead to death, as confirmed by X-ray examination.

Figure 2: In A – A juvenile albino *Callithrix* sp. found collapsed in the wild in the municipality of Casa Branca, in the interior of São Paulo. Source: Images provided by the Casa Branca Civil Defense; and in B – A juvenile albino *Callithrix* sp. described in this study. Prepared by the authors (2026).

The characteristics of albinism were assessed through examination of the skin, coat, and eyes, allowing for the determination of pigmentation, and by comparing them with normal individuals to confirm the absence of pigmentation typical of the taxon, and to distinguish albinism (absence of melanin in the skin, coat, and eyes) from leucism (partial absence of pigment, but pigmented eyes).

Tissue samples (organ tissue fragments) were collected for analysis of rabies and yellow fever and sent to the relevant health surveillance authorities in the city of Santa Cruz das Palmeiras, where the animal died. Skin and hair samples were also collected for future DNA testing. The animal's eyes were packaged and preserved in a 4% paraformaldehyde solution, and tissue fragments were preserved in a 70% alcohol solution for further testing. X-ray and ultrasound imaging were performed to help determine the cause of death and for future evaluations.

The animal's carcass was sent to the taxidermy department of the IBIMM Institute for necropsy, anatomical dissection, and subsequent osteotechnical mounting, which will be displayed at the Natural History Museum of Fazenda Palmares, São Paulo.

The research project was submitted on an urgent basis (No. 007/26) to the IBIMM Institute Ethics Committee and approved on February 12, 2026.

2.2 BIOMETRICS

Biometric measurements of the carcass (*Callitrhix* sp.) were performed using a non-elastic measuring tape, an analog caliper, and a digital scale, in accordance with the protocol by Auricchio (2002). The following measurements were taken: body weight (BW), total length (TL), tail length (TL), right hand length (RHL), right foot length (RFL), chest circumference (CC), head circumference (HC), right ear length (REL), and sex (Figure 3).

Figure 3 – Biometric table of the *Callitrhix* sp. individual, according to the protocol by Auricchio (2002). Source: Prepared by the authors (2026).

Description	Measurement	Unit
Chest circumference (CP)	11,0	cm
Head circumference (CB)	11,0	cm
Body length (CC)	15,0	cm
Tail length (CC)	21,0	cm
Right hand length (RHL)	2,87	cm
Right foot length (RFL)	4,1	cm
Right ear length (REL)	2,2	cm
Weight (W)	0,100	Kg
Sex	juvenile	male

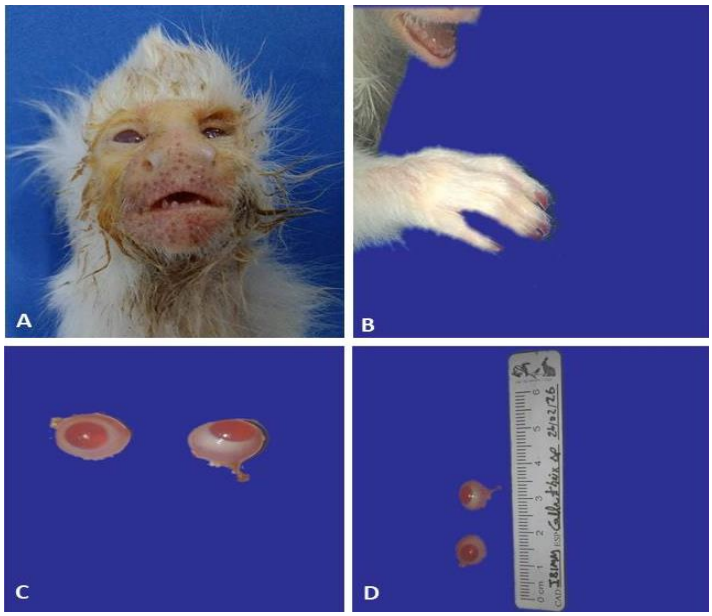
3 RESULTS

The individual of (*Callithrix* sp.) exhibited white coloring in both its fur and skin (Figures 4A, 4B, and Figures 5A, 5B, 5C, and 5D showed visibly light and reddish eyes (indicating a lack of pigmentation in the retina) as well as thoracic limbs, hands, and nails, consistent with a true albinism phenotype. This pattern differs from leucism, in which the eyes remain normally pigmented (Lucati & López-Baucells, 2017; Summers, 2009).

Figure 4A and 4B – images of the albino marmoset *Callithrix* sp., confirming white fur and skin, and a pinkish face. Source: Prepared by the authors (2026).

This observation is unique and represents the first confirmed record of albinism in a *Callithrix* sp. individual in the wild, contrasting with previous reports of leucism in the *Callithrix* genus (Aximoff et al. 2020; Leandro-Silva, et al. 2023; Vale, et al. 2018).

Figure 5 – Images of albinism in the *Callithrix* sp. individual, showing in A: facial characteristics; in B: absence of pigmentation on the forelimbs (claws); and in C and D: absence of pigmentation in the retinas. Source: Prepared by the authors (2026).



4 DISCUSSION

Albinism is characterized by the total or near-total absence of melanin due to mutations affecting the melanogenesis pathway, particularly in the TYR gene (Oetting & King, 1999; Montoliu et al. 2014). Leucism, in turn, results from failures in the migration or differentiation of melanocytes during embryonic development, generally maintaining ocular pigmentation (van Grouw, 2006; Lucati & López-Baucells, 2016). Piebaldism, on the other hand, consists of partial and localized depigmentation, frequently associated with mutations in the KIT gene (Fleischman et al. 1991; Spritz, 1994). In primates, such conditions are rare, but have been sporadically reported in Old World primates (Ding et al. 2000; Leroux, M., et al. 2021; Prado-Martinez J. et al. 2013) and Neotropical primates (Aximoff et al. 2020; Bicca-Marques, 1988; Espinal et al. 2016; Guimarães-Lopes et al. 2026; Henriques et al. 2019; Lange & Glynn, 2022; Leandro-Silva, et al. 2023; Montilla & Link, 2022; Vale, et al. 2018).

For the genus *Callithrix*, records of leucism in populations of C. *jacchus* and *C. penicillata* are known and suggest that pigmentation anomalies in these species may be associated with factors such as inbreeding, habitat fragmentation, or hybrids of introduced species (Aximoff et al., 2020; Leandro-Silva et al., 2023; Vale et al., 2018). However, true albinism—the total absence of melanin in the skin, fur, and eyes—had not yet been scientifically documented in this genus.

Underlying genetic factors such as recessive mutations in genes critical for melanin synthesis, along with a potential effect of genetic drift in isolated populations, may contribute to the emergence of albino individuals in natural populations (Oetting & King, 1999; Montoliu et al., 2014). The presence of individuals with abnormal coloration may have implications for survival, such as increased visibility to predators and social interaction within the group, although such effects still need to be quantitatively assessed for *Callithrix* sp. (Aximoff et al. 2020; Caro, 2005; Lange & Glynn, 2022; Ribeiro & Siqueira-Silva, 2020).

Inbreeding in monkeys significantly increases the likelihood of albinism and other recessive genetic conditions. When related monkeys mate, the chance that both carry the same rare recessive albinism gene increases, resulting in albino offspring. Furthermore, habitat loss forces primates to live in small, isolated groups, which leads to inbreeding and increases the occurrence of abnormal fur markings, leucism, or albinism (Espinal et al., 2015).

5 CONCLUSION

This report describes the first confirmed case of albinism in (*Callithrix* sp.), representing a milestone in the study of pigmentation anomalies in Neotropical primates. Such records are valuable for understanding the genetic mechanisms that control pigmentation and the potential ecological

effects of these rare phenotypes in wild populations. Inbreeding does not cause albinism, but it makes it much more likely in isolated or small populations, reducing genetic variability and increasing the risk of disease. Habitat fragmentation may be related to this genetic anomaly, as inbreeding increases homozygosity, causing harmful recessive genes to manifest.

There are already other reports from scientists who have documented cases of albinism in primates, such as the capuchin monkey ("Ubajara Ghost") and the black-faced sawo, often linked to populations with low numbers of individuals.

A good example is the case of the albino gorilla "Snowflake" at the Barcelona Zoo, whose genome was sequenced, confirming that his parents were close relatives and indicating inbreeding.

Therefore, further studies are needed on the region where the individual was found, given that it is an area of habitat fragmentation and a large number of sugarcane farms, with the aim of gaining a deeper understanding, conducting further research, and learning more about other individuals, which may shed light on what leads these animals to develop albinism.

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