

First record of albinism for the hairy-legged vampire bat,
Diphylla ecaudata Spix, 1823 (Mammalia, Chiroptera, Phyllostomidae),
and a review of cases of albinism in the Neotropics
Primeiro registro de albinismo para o morcego-vampiro-de-perna-peluda
Diphylla ecaudata Spix, 1823 (Mammalia, Chiroptera, Phyllostomidae)
e uma revisão dos casos de albinismo nos Neotrópicos

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Abstract: Albinism is a chromatic anomaly characterized by the absence of melanin in the skin, fur, and eyes. There are at least 67 bat species with albinism records, but this number represents only 4.5% of the bats of the world, indicating a rare anomaly. Reports of bat albinism in the Neotropical region are even rarer, emphasizing the importance of documenting these eventual cases. Here, we document the first case of albinism in *Diphylla ecaudata* Spix, 1823 and present an updated list of records of albinism in bats in the Neotropical region. The juvenile was observed in the cave of the Carajás National Forest, Pará, Brazil, during both daytime and nighttime in November 2024. The bat had complete albinism with all-white hair, including pale skin and reddish eyes. With this record, 28 bat species (including three hematophagous species) have documented occurrences of albinism.

Keywords: Phyllostomidae. Cave. Amazon. Desmodontinae. Hematophagous.

Resumo: Albinismo é uma anomalia cromática caracterizada pela falta da melanina na pele, pelos e olhos. Há pelo menos 67 espécies de morcegos com registro de albinismo, mas esse número representa apenas 4,5% de todas as espécies do mundo, indicando que é uma anomalia rara. Registros de albinismo em morcegos na região Neotropical são ainda mais raros, enfatizando a importância de se registrar os casos eventuais. Aqui, nós documentamos o primeiro caso de albinismo em *Diphylla ecaudata* Spix, 1823, e apresentamos uma lista atualizada dos registros de albinismo em morcegos na região Neotropical. Um indivíduo jovem foi observado em uma caverna da Floresta Nacional de Carajás, Pará, Brasil, em dois períodos do dia (dia e noite), em novembro de 2024. Esse morcego possuía todos os pelos brancos, pele pálida e olhos vermelhos. Com nosso registro, 28 espécies de morcegos (incluindo as três espécies hematófagas) possuem relatos de ocorrência de albinismo.

Palavras-chave: Phyllostomidae. Caverna. Amazônia. Desmodontinae. Hematófago.

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INTRODUCTION

Albinism is a genetic condition expressed by recessive alleles and characterized by a lack of melanin deposition in the skin, fur, and eyes. This condition appears to be rare in wild populations and is associated with a larger vulnerability to predation and pathologies such as visual and immunological defects (Garipis & Hoffmann, 2003). While albinism has been occasionally reported in several Neotropical mammal species, it remains poorly documented, and several records are anecdotal or incidental (Uieda, 2000). In the Neotropical region, albinism has been more often recorded in cetaceans and bats (Abreu et al., 2013). Some studies have suggested that albino bats may have reproductive success (Genelhú et al., 2022), and this may be related to their echolocation abilities and to the fact that most of their roosts are protected against light and predation (Abreu et al., 2013). In the most recent reviews of bat albinism around the world, Lucati and López-Baucells (2016) reported albinism in 61 species belonging to 10 families (Emballonuridae, Hipposideridae, Molossidae, Mormoopidae, Nycteridae, Phyllostomidae, Pteropodidae, Rhinolophidae, Vespertilionidae, and Rhinopomatidae). More recently, studies have increased this number, including six new reports of Neotropical species (Zórtea & Silva, 2017; Bernardi et al., 2019; García et al., 2020; Leal & Ramalho, 2021; Ventorin et al., 2021; Genelhú et al., 2022). Even though this number increased to 67 species with records of albinism, it represents just 4.5% of the world's bat species (1,498 bat species, Simmons & Cirranello, 2025). In the Amazon, there are substantial gaps in the available information on bat albinism, with five reports (Uieda, 2015; Rosa et al., 2017; Nascimento et al., 2018; Bernardi et al., 2019; Genelhú et al., 2022).

Hematophagy, or sanguinivory, refers to the consumption of blood from other organisms (Boulton, 2022) and is typically associated with highly specialized anatomical and behavioral adaptations, exemplified by vampire bats. A total of 186 bat species has been recorded in Brazil (Garbino et al., 2024), including the world's only three

species of hematophagous mammals. This unique feeding strategy among mammals is observed in the Common Vampire Bat *Desmodus rotundus* (É. Geoffroy, 1810), the White-winged Vampire Bat *Diaemus youngi* (Jentink, 1893), and in the Hairy-legged Vampire Bat *Diphylla ecaudata* (Spix, 1823), all belonging to the subfamily Desmodontinae, family Phyllostomidae. Desmodontinae bats are endemic to the Americas, occurring from northern Mexico to northern Argentina (Wilson & Mittermeier, 2019). Two of the species, *D. ecaudata* and *D. rotundus*, have a broader distribution compared to *D. youngi*. The Hairy-Legged Vampire Bat occurs from Mexico, to southern Brazil with records also in Chile, Argentina, Uruguay, Paraguay, Bolivia, Colombia, Venezuela, Ecuador, The Guianas, Peru, Trinidad and Tobago, Margarita, Panama, Costa Rica, Nicaragua, Honduras, El Salvador, Guatemala, Belize (Wilson & Mittermeier, 2019). There is also an isolated occasional record from Texas, United States. In Brazil, *D. ecaudata* have been recorded in most biomes of Brazil, except for the Pampas (Rocha et al., 2014; Santos & Lopes, 2015). These bats usually roost in caves or rock crevices, and rarely in holes in trees and abandoned houses (Uieda, 1996; Ocampo-González et al., 2023). They may form colonies of up to 70 individuals, but are more frequently found roosting in small groups of 3-4 individuals (Scheffer et al., 2015).

Several cases of albinism have been reported for vampire bats, including the common vampire bat *D. rotundus* and the white-winged vampire bat *D. youngi* (Uieda, 2001, 2015; Greenhall, 1993; Sánchez-Hernández et al., 2010; Ramirez et al., 2010; Aguilar-López et al., 2021). On the other hand, we have not found any published records of albinism for the hairy-legged vampire bat *D. ecaudata*. Albinism is relatively rarely reported in the literature (Lucati & López-Baucells, 2016; Bernardi et al., 2019; Aguilar-López et al., 2021; Genelhú et al., 2022), and reports are valuable for understanding the frequency and geographic distribution of such anomalies, contributing to broader ecological and conservation knowledge. These cases can provide insights into potential environmental

stressors, animal behavior, and population adaptability (Lucati & López-Baucells, 2016). The objectives of this note are to document the first observation of albinism in *D. ecaudata* and to provide a literature review summarizing previously reported cases of albinism in Neotropical bats, including their geographic locations and context.

METHODS

SAMPLING SITE

During field expeditions to monitor bat populations in caves, we performed active diurnal searches inside the caves in the Carajás National Forest (FLONA Carajás, centroid coordinates 49° 55' 00" W, 06° 08' 49" S), a protected area located in the southeastern Amazonia in Pará state, Brazil. to observed the species in the caves and their roosting behavior, and recorded their echolocation and their social calls. The FLONA Carajás plays a crucial role in conserving Amazonian biodiversity, protecting several threatened species of Brazil's fauna. The area also supports scientific research, ecotourism, and the sustainable use of both plant and mineral resources (Piló et al., 2015).

The area comprises different landscapes, including plateaus of the Carajás Ridges, Amazonian rainforests and savanna-like vegetation called “*Canga*” that grown at the iron-rich soils (Secco & Mesquita, 1983). There are over 1,500 iron caves in the region, and most of these caves follow the escarpment lines of the plateaus (Giulietti et al., 2019). The area is characterized by having two seasons: a dry season from June to September and a rainy season from November to May (Cavalcante et al., 2020). Bat monitoring in the caves of region has been made with active detection methods (active search, hand-a and mist-nets) since 2008 and more recently (starting in 2021) passive acoustic monitoring (ultrasound recorders) has also been used (Trevelin et al., 2025), resulting in at least 23 bat species recorded (Tavares et al., 2012; Appel et al., 2025).

The cave N1-0174 (50° 18' 3" W, 06° 01' 19" S) has an area of 977.5 m with two entrances and horizontal

projection of 92 m and is located on the N1 north plateau of the FLONA Carajás (Figure 1). *Diphylla ecaudata* is a medium-sized bat like other species of Desmodontinae, but can be differentiated by its shorts and wide ears (wider than long) compared to *D. youngi* and *D. rotundus* with their longer and more pointed ears (clearly longer than wide), also differs from *Diameus* and *Desmodus* in its well developed secondary noseleaf, located behind the primary noseleaf (Kwon & Gardner, 2008; Ocampo-González et al., 2023). Based on bat inventories of the region during 2014 and 2015 made by environmental consultants and acoustic monitoring from 2022 to 2025 made by authors of this study, *D. ecaudata* individuals were observed roosting in this cave, including one albino juvenile individual which was recorded in the rainy season on December 2024.

UPDATED LIST OF ALBINISM RECORDS IN NEOTROPICAL BATS

We searched the literature for the occurrence of albinism in Neotropical bats, restricting the search to the hypopigmentary disorder characterized by a complete lack of melanin in the eyes, skin, and hair (Fertl & Rosel, 2009). Other phenotypic chromatic variations, such as piebaldism, leucism, melanism, and hypomelanism, are not revised in this study. We use as initial basis the albinism recordings made by the last reviews about this theme (Uieda, 2000; Lucati & López-Baucells, 2016) and searched for recent papers in Google Scholar and Web of Knowledge up to May 2025. We also searched on Google for media articles (journal vehicles). Published papers were selected during 1925 to 2025 based on the following search terms: “Bat” OR “chiroptera” AND “albinism” OR “albino” AND “Neotropics” and for the same terms in Portuguese and Spanish. A total of 50 papers and one media article were included in the review. For every report found, we collected the following information: species, country, biome if it was in Brazil and locality of recording (free-flying, roosts).

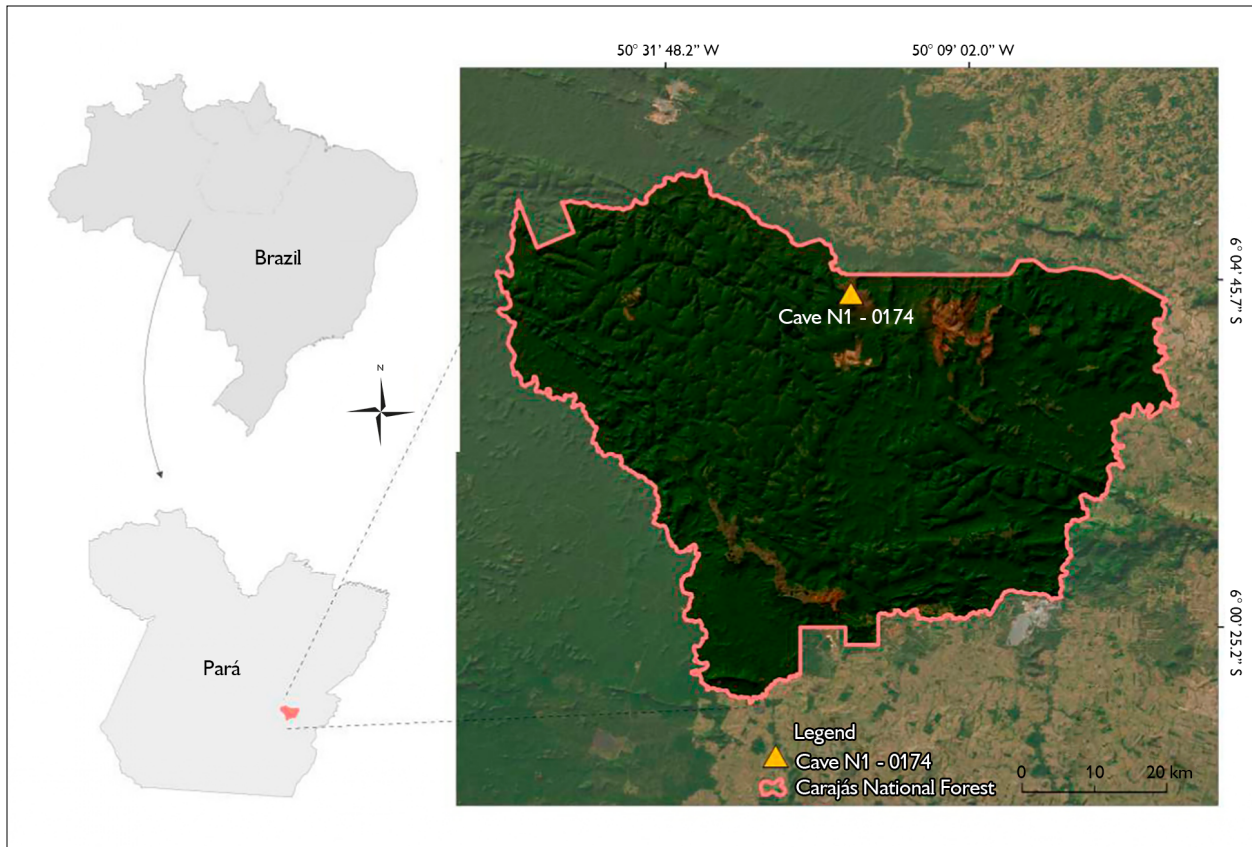


Figure 1. Map of Floresta Nacional de Carajás (Carajás National Forest), northern Brazil (Pará state), showing N1-0174 cave. Map: Marthina Appel (2025).

RESULTS AND DISCUSSION

FIELD RECORD

The albino *Diphylla ecaudata* was a young individual recorded in the rainy season on December 2024 in one cave (N1-0174) in the N1 north plateau of FLONA Carajás in the municipality Parauapebas (Figure 2). With the first record of albinism for *D. ecaudata* reported here, now all the three hematophagous bats have records of this pigmentation disorder. In Brazil specifically, both *Desmodus rotundus* and *Diaemus youngi* have been recorded as albinos (Uieda, 2015). For *D. rotundus*, albinism has been recorded also in Mexico, Argentina and Trinidad and Tobago (Moreira et al., 1992; Greenhall, 1993; Jiménez-Ramírez & De La Torre González, 2006;

Sánchez-Hernández et al., 2010; Ramirez et al., 2010; Guimarães et al., 2013; Aguilar-López et al., 2021).

The group of *D. ecaudata* found shares the N1-174 cave with at least nine other bat species including *Carollia perspicillata* (Linnaeus, 1758), *Lampronnycteris brachyotis* (Dobson, 1879), *Glossophaga soricina* (Pallas, 1766), *Anoura geoffroyi* Gray, 1838, *Anoura caudifer* (É Geoffroy, 1818), *Trachops cirrhosus* (Spix, 1823), *Peropteryx kappleri* Peters, 1867, and *Furipterus horrens* (Cuvier, 1828) (Appel et al., 2025). The bat assemblages were segregated in groups with *D. ecaudata* and *T. cirrhosus* sharing the same chamber of the cave and *C. perspicillata*, *L. brachyotis*, *A. geoffroyi*, *A. caudifer* and *G. soricina* using the same crevice near the small entrance (for visualization of the position of *D. ecaudata* assemblage Appendix 1). *Diphylla ecaudata* groups were

positioned in a large group at the middle of this chamber, *T. cirrhosus* were positioned inside holes approximately one meter apart from the *D. ecaudata* group. Additionally, *D. ecaudata* is estimated to be present in only seven percent of the more than 1,500 caves occurring in the region (L.C. Trevelin, observation personal, 2025).

We observed the albino individual, during the day (12:00 PM) and the night (07:00 PM) of the same day, with approximately 30 minutes of observation each period. In the first observation, we saw a nursing *D. ecaudata* with the albino juvenile together with other individuals of the same species (Figure 2). At night, we saw the albino roosting side by side

with ten other individuals, when it was possible to take pictures of their faces (Figure 3). The specimen was observed hanging on the roof inside the cave, four meters from the entrance, in a twilight zone. At least 25 individuals roosted together with the albino bat, and no segregation was observed between the albino individual and conspecifics with normal pigmentation in the two periods of observations (Figure 2). The juvenile *D. ecaudata* had complete albinism with all-white hairs, including pale skin and reddish eyes (Figure 3), characteristics typical of albinism proposed by Van Grouw (2006, 2016). We noticed no other differences in the behavior of the albino bat compared to other individuals of *D. ecaudata*.



Figure 2. Albino juvenile of *Diphylla ecaudata* suckling the lactating female with other individuals roosting in the N1-0174 cave during the day (12:00 PM) of FLONA Carajás. Photos: Giulliana Appel (2024).



Figure 3. Albino juvenile of *Diphylla ecaudata* roosting with other individuals in N1-0174 cave of FLONA Carajás during the night (19:00 PM). Photos: Giulliana Appel (2024).

UPDATED LIST OF ALBINISM RECORDS IN NEOTROPICAL BATS

We found 50 papers and one media articles mentioning bat albinism in Neotropics (Table 1), reporting 28 species representing five families and 25 genera (Table 1). Families that have more albinism recordings in Neotropics are the Phyllostomidae with 72% of all records, followed by Molossidae with 20%. Mormoopidae had two records and Emballonuridae and Vespertilionidae had only one record each. This finding is associated with the fact that Phyllostomidae species are easier to capture in mist-nets compared to aerial insectivorous bats that

readily detect and avoid mistnets (Kalko & Handley, 2001). The high abundance and wide distribution of Phyllostomidae species, as well as their social behaviour of roosting in large colonies inside caves and artificial roosts also accounts to a higher probability of finding more records of albinism and other chromatic disorders (Lucati & López-Baucells, 2016). Of 10 albinism reports in Molossidae, seven are from *Molossus molossus* (Pallas, 1766) and most of the records were made in buildings (Table 1). Members of this family are known to roost in human-made constructions (Voss et al., 2016). The coexistence with the humans probably increases the

chance of encountering these bats and the pigmentation disorder (Lucati & López-Baucells, 2016).

Brazil is the Neotropical country with the highest number of albinism reports, with 38% of the total records for this biogeographic region, followed by Mexico (16%), Venezuela, Cuba and Argentina (8% each one) and Trinidad and Tobago (6%). Other countries reviewed had fewer than three reports. This difference between the countries could be attributed to Brazil's large geographic extension and the higher diversity of biomes. Brazil also leads as the

country with most species reports ($n = 13$ species) of four of the five families, including studies conducted in almost of all Brazilian biomes, except for the Pantanal wetlands (Table 1). Mexico had five species reports followed by Venezuela and Argentina with four reports each (Table 1). Indeed, Argentina had an exclusive report of albinism in a Vespertilionidae species, the species *Neoeptesicus furinalis* (d'Orbigny and Gervais, 1847), and Brazil had an exclusive report of albinism in Emballonuridae species (*Peropteryx kappleri* Peters, 1867) in the Neotropics (Table 1).

Table 1. Records of albinism in Neotropical bat species. Biome: AM = Amazon, CE = *Cerrado*, CA = *Caatinga*, AF = Atlantic Forest. Legends: * = report made in a journalist media; nd = no data available. (Continue)

Species	References	Country	Biome (Brazil)	Type of record
Emballonuridae				
<i>Peropteryx kappleri</i> Peters, 1867	Bernardi et al. (2019)	Brazil	AM	Cave
Phyllostomidae				
<i>Anoura geoffroyi</i> Gray, 1838	Hargreaves (2013)	Trinidad and Tobago	-	Cave
<i>Artibeus cinereus</i> (Gervais, 1856)	Oliveira and Aguiar (2008)	Brazil	CE	Mist-netting
<i>Artibeus jamaicensis</i> Leach, 1821	Silva-Taboada (1979)	Cuba	-	Cave
	Moreno et al. (2020)	Cuba	-	
<i>Artibeus obscurus</i> (Schinz, 1821)	Ventorin et al. (2021)	Brazil	AF	Foliage
<i>Artibeus phaeotis</i> (Miller, 1902)	García et al. (2020)	Venezuela	-	nd
<i>Artibeus planirostris</i> (Spix, 1823)	Uieda (2000)	Brazil	CA	Tree
	Leal et al. (2021)	Brazil	CA	Mist-netting
<i>Artibeus lituratus</i> (Olfers, 1818)	Pozo and Escobedo-Cabrera (1998)	Mexico	-	Mist-netting
	Zalapa et al. (2016)	Mexico	-	Mist-netting
<i>Carollia brevicauda</i> (Schinz, 1821)	García et al. (2020)	Venezuela	-	Cave
<i>Carollia perspicillata</i> (Linnaeus, 1758)	Falcão et al. (2014)	Brazil	CA	Mist-netting
	Rosa et al. (2017)	Brazil	AM	Tunnel
	Laurindo et al. (2021)	Brazil	AF	Building
	Calderón-Álvarez and Vásquez (2018)	Colombia	-	Building
<i>Desmodus rotundus</i> (É. Geoffroy, 1810)	Verschuren (1955), Greenhall (1993)	Trinidad and Tobago	-	nd
	Moreira et al. (1992)	Brazil	PA	Mist-netting
	Uieda (2000, 2001)	Brazil	CA, AF	Cave, mist-netting

Table 1.

(Conclusion)

Species	References	Country	Biome (Brazil)	Type of record
<i>Desmodus rotundus</i> (É. Geoffroy, 1810)	Sánchez-Hernández et al. (2010)	Mexico	-	Tunnel
	Jiménez-Ramírez and De La Torre González (2006)	Mexico	-	nd
	Ramírez et al. (2010)	Argentina	-	Mist-netting
	Guimarães et al. (2013)	Brazil	nd	Cave entrance
	Aguilar-López et al. (2021)	Mexico	-	Cave
<i>Daemus youngi</i> (Jentink, 1893)	Uieda (2015)*	Brazil	AM	Mist-netting
<i>Diphylla ecaudata</i> Spix, 1823	Present study	Brazil	AM	Cave
<i>Gardnerycteris crenulata</i> (É. Geoffroy, 1803)	Zortéa & Silva (2017)	Brazil	CE	Mist-netting
<i>Glossophaga longirostris</i> Miller, 1898	Setzer (1950)	Venezuela	-	Building
<i>Glossophaga soricina</i> (Pallas, 1766)	Schneider (1925)	nd	-	Nd
	García-Morales et al. (2010)	Mexico	-	Mist-netting
<i>Macrotus waterhousii</i> Gray, 1843	Sánchez-Hernández et al. (1989)	Mexico	-	Cave
<i>Micronycteris minuta</i> (Gervais, 1856)	Gamba-Ríos (2010)	Costa Rica	-	Mist-netting
<i>Lionycteris spurrelli</i> Thomas, 1913	Genelhu et al. (2022)	Brazil	AM	Cave
<i>Rhinophylla pumilio</i> Peters, 1865	Charles-Dominique et al. (2001)	French Guiana	-	Foliage
<i>Sturnira erythromos</i> Tschudi, 1844	Barquez et al. (2003)	Argentina	-	Mist-netting
<i>Vampyrum spectrum</i> (Linnaeus, 1758)	Brito and León (2014)	Ecuador	-	nd
Molossidae				
<i>Eumops glaucinus</i> (Wagner, 1843)	Sodré et al. (2004)	Brazil	AF	Building
<i>Molossus molossus</i> (Pallas, 1766)	Allen (1939)	Cuba	-	nd
	Heatwole et al. (1964)	Puerto Rico	-	Building
	Silva-Taboada (1979)	Cuba	-	nd
	Soriano et al. (1993)	Venezuela	-	nd
	Veiga and Oliveira (1995)	Brazil	nd	Hollow tree
	Nascimento et al. (2018)	Brazil	CE-AM	Building
	Tello et al. (2013)	Peru	-	Building
<i>Molossus rufus</i> É. Geoffroy, 1805	Rengifo et al. (2014)	Peru	-	Building
<i>Tadarida brasiliensis</i> (L. Geoffroy, 1824)	Romano et al. (2015)	Argentina	-	Building
Mormoopidae				
<i>Pteronotus parnellii</i> J. E. Gray, 1843	Sánchez-Hernández et al. (1989)	Mexico	-	Mist-netting
<i>Pteronotus personatus</i> (Wagner, 1843)	Leal and Ramalho (2021)	Brazil	CA	Cave
Vespertilionidae				
<i>Neoptesicus furinalis</i> (d'Orbigny and Gervais, 1847)	Pautasso et al. (2009)	Argentina	-	Building

Most reports of the bat albinism in Neotropics were obtained through capture or observations in roosts (Table 1), such as caves (11 events), buildings (nine events), foliage and tree hollows (four events), and tunnels (two events) totaling 54% of the events (Table 1). A smaller percentage of albinism records (28%) was obtained by mist-netting with 16 events (Table 1). Sánchez-Hernández (2012) and Lucati and López-Baucells (2016) argue that the great number of chromatic phenotypic variation in caves and buildings can be related to breeding with individuals of the same assemblage, since some bat assemblages can show fidelity to their roost sites. Also, nocturnal and cave-roosting behaviors can favor the occurrence of albinism, as these environments, in addition to providing protection against visual predators, also offer protection against exposure to sunlight (Uieda, 2000, 2001). The high detectability of albinism in bat roosts may be influenced by the intensive, continuous monitoring of these sites compared to less-surveyed habitats, such as forests.

The Carajás caves have been the subject of long-term monitoring and bat inventories (Fraga et al., 2023; Appel et al., 2025) and our record of albinism in *D. ecaudata* represents the third case of this condition in bats in the region. The previous albinism reports were found in adults and a juvenile as well, including one male adult *P. kappleri* and one juvenile, which were the first records of albinism for the family Emballonuridae in Neotropics (Bernardi et al., 2019), as well as a lactating female of *L. spurrelli* Thomas, 1913 (Genelhú et al., 2022). The record of albinism in a lactating female indicates that successful reproduction occurs despite the condition. These findings reinforce the importance of long-term monitoring for assessing population dynamics, reproductive success, fitness, and phenotypic variation over time. The current report constitutes the first documented case of albinism in the *D. ecaudata*, completing the set of albinism records among all hematophagous bat species. Overall, our observation expands knowledge of chromatic variation

in Neotropical bats and underscores the value of long-term monitoring at roost sites such as caves, where rare phenotypes, such as albinism, can be detected.

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AUTHOR CONTRIBUTIONS

G. Appel contributed to formal analysis, conceptualization, data curation, investigation, methodology, validation, visualization, and writing (original draft, review, and editing); T. C. Benathar contributed to investigation, visualization, and writing (review and editing); J. C. V. Mena contributed to investigation, visualization, and writing (review and editing); M. S. R. Pereira contributed to funding acquisition and writing (review and editing); X. Prous contributed to funding acquisition, resources, and writing (review and editing); V. da C. Tavares contributed to project administration, funding acquisition, resources, and writing (review and editing); and L. C. Trevelin contributed to project administration, funding acquisition, resources, supervision, validation, visualization, and writing (review and editing).

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