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New records of melanistic *Tamandua tetradactyla* (Pilosa, Myrmecophagidae) from eastern Brazilian Amazonia

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ABSTRACT

Melanism is one of the most common chromatic disorders in mammals. The Southern Tamandua (*Tamandua tetradactyla*) is a widely distributed species in South America with several chromatic patterns, including melanistic forms. Herein, we report two new records of melanistic individuals in Brazil, as well as a new record for the state of Pará. The first record (Pará state) was of a melanistic individual sleeping in the canopies, and the second record (Amapá state) was of a female individual carrying a cub that was also melanistic. Although rare, this may be a fixed polymorphism in some populations of the *T. tetradactyla*, a theory supported by our record, the first one of a melanistic cub in nature. Since melanism in *T. tetradactyla* was only recorded in a few endemism areas in Amazonia, it is possible that unique biogeographic events in the biome may be driving diversification and coat coloration polymorphism in *T. tetradactyla*.

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Introduction

Color anomalies in mammals are common and can occur due to deficits or pigment excesses (Caro 2005; Caro and Mallarino 2020). Mammals can present several chromatic disorders, such as albinism (Fertl and Rosel 2009), melanism (Kingsley et al. 2009), leucism (Lucati and López-Baucells 2016), piebaldism (Lucati and López-Baucells 2016), and xanthochromism (Cotts et al. 2023). One of the most common chromatic disorders in this group is melanism (including partial melanism), a mutation often associated with four genes (Majerus and Mundy 2003; Kingsley et al. 2009) in which the reduced (or absent) expression of pheomelanin, associated with increased expression of eumelanin, generates the dark/brown coloration (Majerus and Mundy 2003).

The Southern Anteater *Tamandua tetradactyla* Linnaeus, 1758, is a widely distributed species in South America, inhabiting several biomes and formations throughout its territory (Wetzel 1975; Fonseca et al. 1996; Hayssen 2011). *Tamandua tetradactyla* presents mostly nocturnal and arboreal activity, feeding upon ants and termites (Wetzel 1982; Rodrigues et al. 2008). It presents four subspecies: *T. tetradactyla tetradactyla* (Linnaeus 1758), *T. tetradactyla straminea*

(Cope 1889), *T. tetradactyla quichua* Thomas 1927 and *T. tetradactyla nigra* (Saint-Hilaire 1803). Regarding the chromatic variation within the species, *T. tetradactyla* is highly polymorphic, with six color patterns described for the species (Cotts et al. 2023). Coat coloration (and cranial osteology) have been employed as diagnostic characters for subspecies delimitation within *T. tetradactyla* (Wetzel 1975). While melanistic phenotypes have been historically linked to *T. tetradactyla nigra*, intraspecific variation in coloration suggests that this trait may be of limited diagnostic utility, given the potential for overlapping color patterns among subspecies (Ríos-Alvear and Cadena-Ortiz 2019; Cotts et al. 2023).

Melanism in this species is characterized by a uniformly dark coat covering most of the body (except the extremities – arms, legs, tail and some portions of the head), a “V” mask in the head formed by a hairless portion in the rostral region, grayish skin and mid to distal segment of tail hairless, with scattered spots and blackened tips (Ríos-Alvear and Cadena-Ortiz 2019; Portillo et al. 2022; Cotts et al. 2023). Conversely, partial melanism was also recorded in the species, with the inner and outer surfaces of limbs and venter mostly gray, with some

yellow hairs (Cotts et al. 2023). Melanistic forms in *T. tetradactyla* are reported from several locations in South America, mostly in the Amazon Rainforest, including Brazil, Colombia, French Guiana, Peru, Trinidad and Tobago, and Venezuela (Menegaux 1902; Wetzel 1975; Gardner 2008; Ríos-Alvear and Cadena-Ortiz 2019; Portillo et al. 2022; Cotts et al. 2023). In Brazil, melanistic forms of *T. tetradactyla* have been recorded in three localities in the state of Amapá (melanism and partial melanism), one locality in the state of Amazonas, and another in the state of Espírito Santo (Atlantic Rainforest, only partial melanism; Cotts et al. 2023).

Materials and methods

Our records of melanistic *T. tetradactyla* were made by opportunistic encounters during active surveys, both diurnal and nocturnal. The surveys were all conducted on the Guiana Shield portion of the Amazon Rainforest, in the Brazilian states of Amapá (February 2023) and Pará (August 2019). The map was produced using QGIS software version 3.12.2 (available at: <https://qgis.org/en/site/>.) using previous literature records of melanistic forms in this region (Cotts et al. 2023).

Results

The first record was made on 10 August 2019, at 09h58, in the municipality of Gurupá, Pará state, Brazil (1°10'42" S; 51°32'40" W, 5 m a.s.l.). The melanistic individual of *T. tetradactyla* (unknown sex) was sleeping in the canopy of a tree 3 m high (Figure 1A, B) in a *Várzea* (flooded) forest environment, near an açai extraction area. This is the first record of a melanistic individual for the Pará state.

The second record was made on 23 February 2023, at 22h41 in the municipality of Laranjal do Jari, Amapá state, Brazil (0°32'32" S; 52°34'39" W, 69 m a.s.l.). On the date, we recorded a melanistic female of *T. tetradactyla* carrying a melanistic cub on her back (Figure 1C, D). The female was sighted while walking along a trail in a *Terra Firme* (unflooded) forest. Upon detecting our presence, it immediately climbed a tree up to approximately 5 meters, where she remained motionless for a few minutes, sniffing and scanning the surrounding canopy. She then continued climbing into the canopy, eventually moving out of sight. This observation also represents the first documented record of a melanistic cub in the wild.

All individuals, including the cub, presented a uniform dark coat covering most of the body, with

the exception of the hands, feet, snout, ears and distal portion of the tail. Our records extend the known distribution of this chromatic disorder, expanding it to Southern Amapá state (Laranjal do Jari, 220 km from the nearest record) and to northern Pará state (110 km from Laranjal do Jari, Amapá state – the nearest location of melanistic forms) (Figure 2).

Discussion

The distribution of melanistic forms in *T. tetradactyla* (Cotts et al. 2023) shows that this chromatic disorder has so far been recorded in three areas of endemism in the Amazon Rainforest: Guiana Shield, Napo, and Inambari (sensu Haffer 1969). Biogeographical events in Amazonia may have affected color pattern variation in *T. tetradactyla*, since riverine barriers are significant drivers of diversification in the Amazon Rainforest (Wallace 1852; Ayres and Clutton-Brock 1992; Hoorn et al. 2010; Ribas et al. 2012), likely explaining some of the distribution pattern of chromatic anomalies in the species. Melanism is one of the most common chromatic disorders in the *Tamandua* genus (Ríos-Alvear and Cadena-Ortiz 2019; Cotts et al. 2023), although it seems rarer in other anteaters, with only one record of this pattern in *Myrmecophaga tridactyla* (Cotts and Prestes 2022). Color patterns can influence crypsis, physiology, and visual signaling (Graipel et al. 2019; Caro and Mallarino 2020), which are substantial evolutionary drivers in mammals (Caro and Mallarino 2020). In anteaters, visual signaling may not be an influential driver, since *T. tetradactyla* is nocturnal and mostly smell-oriented (Hayssen 2011), but the darker patterns may provide better camouflage and crypsis against possible predators, especially for cubs and vulnerable younger individuals. Considering that other anteater species (*M. tridactyla*) present records of chromatic anomalies in open formations (Bôlla et al. 2022; Cotts and Prestes 2022; Attias et al. 2023), it is noteworthy that melanism and other chromatic forms seem to be more associated with forested domains in South America (such as Amazon and Atlantic Rainforest), while they appear to be mostly absent in the Dry Diagonal (Cotts et al. 2023).

In some populations of northern South America, melanism and erythrism have been recorded in the same areas for over 100 years (Menegaux 1902; Allen 1904; Cotts et al. 2023). These color variations may reflect a fixed and stable polymorphism (Cotts et al. 2023). In the Brazilian portion of the Guiana Shield (Amapá and Pará states), the only chromatic disorder recorded in the region was melanism and partial melanism (Cotts et al. 2023), supporting the hypothesis of

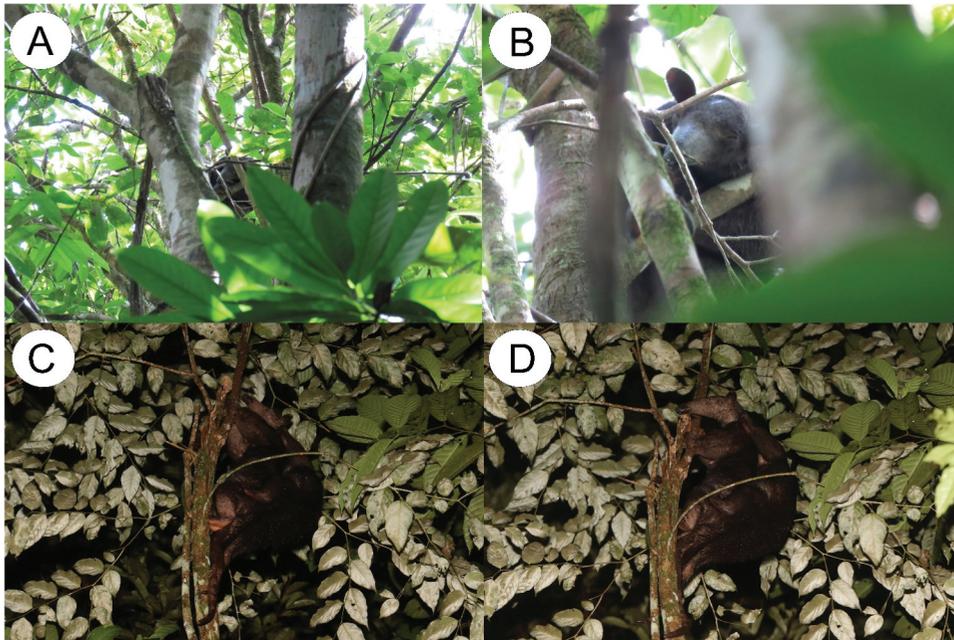


Figure 1. A: Melanistic individual of *Tamandua tetradactyla* sleeping hidden in the canopy. B: Detail of the melanistic *T. tetradactyla* sleeping hidden in the canopy (Photos A–B by Mariana de-Carvalho). C: Female of *T. tetradactyla* carrying a melanistic cub. D: Female of *T. tetradactyla* sniffing and scanning the canopy, while carrying a melanistic cub (Photos C–D by Afonso Santiago de Oliveira Meneses).

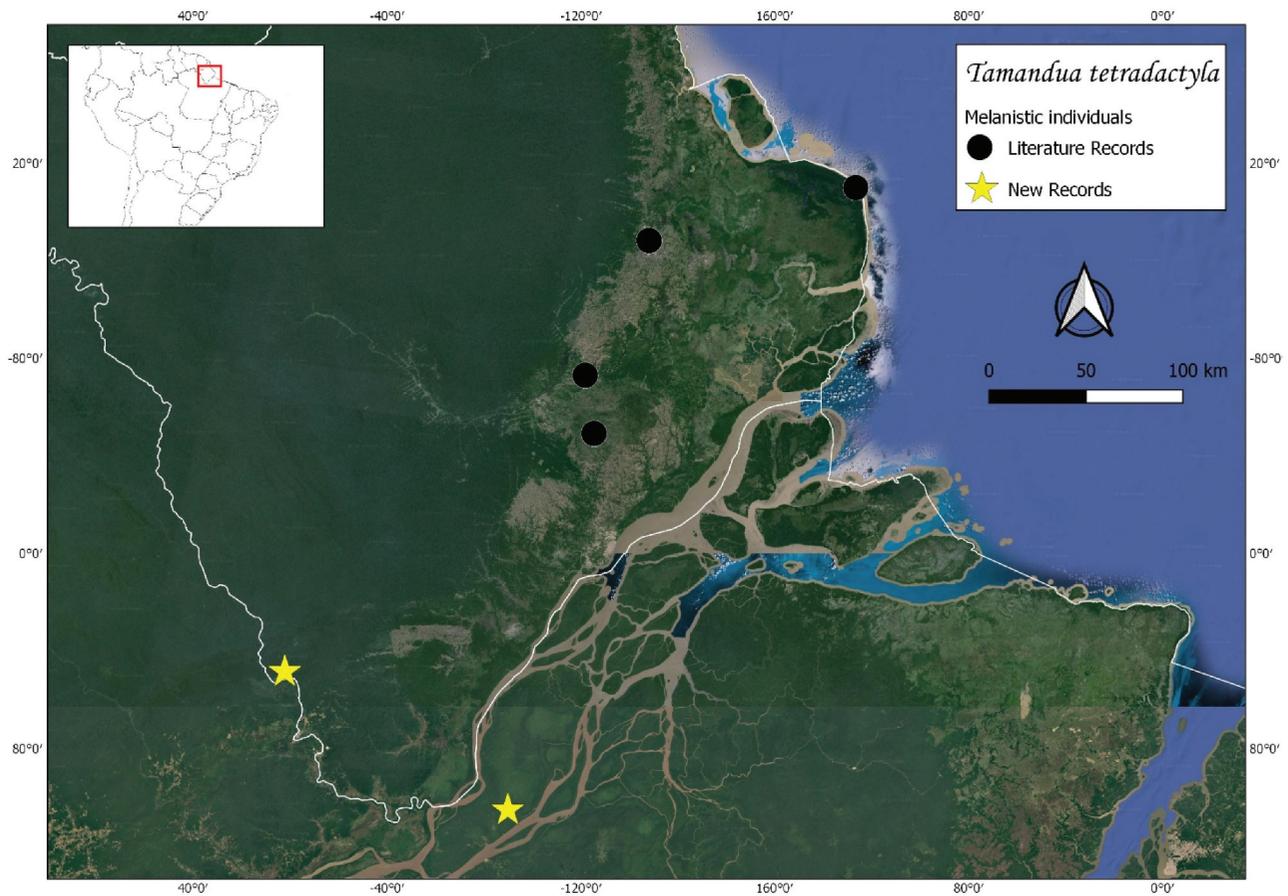


Figure 2. Distribution of melanistic *Tamandua tetradactyla* in eastern Brazilian Amazonia. Yellow stars represent the new records, black dots represent literature records (retrieved from Cotts et al. 2023).

fixed melanistic populations. Also, the first record of a melanistic cub in nature further supports this suggestion, as *T. tetradactyla* can produce offspring with varying color patterns (Ríos-Alvear and Cadena-Ortiz 2019).

Although several areas within the distribution of *T. tetradactyla* exhibit the co-occurrence of different color patterns (Ríos-Alvear and Cadena-Ortiz 2019; Cotts et al. 2023), some patterns appear to occur more frequently than others. While melanism and xanthochromism are the most common chromatic patterns in the species, there are fewer records of xanthochromic forms in the Guiana Shield area when compared to melanistic ones (Cotts et al. 2023). In the eastern Amazon Rainforest, mainly in Ecuador and Peru, there are other chromatic disorders, although darker (melanistic and brown) forms also seem to be much more frequent than yellow ones (Wetzel 1975; Ríos-Alvear and Cadena-Ortiz 2019; Portillo et al. 2022). Populations of *T. tetradactyla* in the Amazon Rainforest present higher diversity in genetic composition (Clozato 2014; Clozato et al. 2015), and the role of riverine barriers in the diversification of the species (and its chromatic patterns) is not fully explained. More studies are necessary to assess the origin and drivers of the highly polymorphic patterns of *T. tetradactyla*.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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