**FIRST REPORT AND DESCRIPTION OF MELANISM AND ALBINISM IN GIANT ANTEATER, *MYRMECOPHAGA TRIDACTYLA* (XENARTHRA, PILOSA)**

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Running title: *Melanism and albinism in* Myrmecophaga tridactyla

**Abstract:** *Myrmecophaga tridactyla*, the giant anteater, is a monospecific genus of anteater endemic to South and Central America. This species is marked by a predominantly brown or black coat, with anterolaterally elongated black and white stripes in its body and anterior black bands on its forelimbs. Chromatic variations are so far unknown for this species. Herein, we report and describe the first formal records of melanism and albinism in *M. tridactyla* and discuss the possible causes and environmental relationships of these color anomalies in the species.

**Keywords:** Chromatic disorders; Color variation; Hyperpigmentation; Hypopigmentation; Mammalia

*Myrmecophaga* *tridactyla* (Xenarthra, Pilosa, Vermilingua), the giant anteater, is a monospecific genus of anteater present in a broad range of lowland habitats, from dry scrub and savannah to rainforests, distribucted in southern Central America and northern South America, from Honduras to Bolivia and northern Argentina (Gaudin *et al*. 2018). This species is characterized by a large size, a very elongated and tube-shaped rostrum, the presence of a thicker braincase, small eyes and ears, a forelimb musculature strongly developed and adapted for plantigrade terrestrial locomotion, three well-developed claws on the *manus*, with its unguals on the 4th and 5th digits being strongly reduced or absent, and little sexual dimorphism (Reeve 1940; Eisenberg *et al.* 1999; Reis *et al.* 2006; Gaudin *et al.* 2018).

*Myrmecophaga tridactyla* presents a brown or black dense coat color, with predominate brown in its tail, and elongated and triangular blackstripes bordered by white stripes located anterolaterally in its body (Reis *et al.* 2006). The stripes beginning just below the ears, expand in the anterior portion of the neck and extend diagonally backwards above the shoulders, becoming gradually thinner up to the mid-back. Two black bands are seen anteriorly on the forelimbs, and the hair on these limbs is commonly white or grizzled (Caro *&* Melville 2012). Studies on color variation in *M. tridactyla* are scarce and chromatic disorders, as far as we are aware, are unknown for this species. In fact, melanism and albinism are known for many mammal species such as rodents (*e.g.*, *Oxymycterus dasytrichus*; Stumpp *et al.* 2018, *Proechimys*; Dalapicolla *et al.* 2020), tapirs (*e.g.*, *Tapirus terrestris*; Tokuda & Costa 2021), mustelids (*e.g.*, *Eira barbara*; Aximoff & Rocha 2016), felids (*e.g.*, *Leopardus colocola braccatus*; Aximoff et al. 2021), canids (*e.g.*, *Canis lupus*; Anderson *et al.* 2009) and marsupials (*e.g.*, *Didelphis virginiana*; Cuxim-Koyoc *et al.* 2019). In anteaters, melanism and albinism records are few and restricted to the genus *Tamandua* (Ríos *et al.* 2019, Ríos-Alvear & Cadena-Ortiz 2019). Here we report and describe the first formal records of melanism and albinism for *Myrmecophaga tridactyla* based in photographs reported in two informal media (web portal and communication from the Environmental Military Police) and unknownledge in scientific literature.

Albinism is a hypopigmentary genetic disorder (commonly associated with TYR gene mutations) that affects the production of melanin, causing the reduction or absence of pigmentation in eyes, skin and hair/feathers of vertebrates (Fertl *&* Rosel 2009). In fact, albino animals has as one of the most remarkable characteristic the presence of translucent irises and retinas, with reddish or pink eye coloration due the translucent condition of their ocular structures making visible the blood vascularization in the posterior portion of the eyes (Van Grouw, 2006, Cuxim-Koyoc *et al.* 2019, Dunlop *et al.* 2019). The albino individual of *Myrmecophaga tridactyla* here reported was found in the area of a farm near the district of Arapuá, Municipality of Três Lagoas, Mato Grosso do Sul, Brazil, on August 02, 2021 (Figure 1). The photograph of this individual were initially published in a local news portal (Arapuá News, link: https://arapuanews.com.br/tamandua-alpino-raro-e-encontrado-em-fazenda-da-regiao-de-arapua/). This individual has a mostly white coloration in its coat, with the exception of elongated and yellowish-white hairs that extend in the dorsal, caudal and lateroventral portions of its body and form a dense coat similar to a "mane" (Figure 2). In fact, this "mane" appears to be more voluminous and dense than what is observed in non-albino individuals of *M. tridactyla*. The skin of the albino individual has a very evident pinkish-white color, observable mainly on their head, ears and nostrils, which have regions with very short or absent hair. The head of this individual has hypopigmented and irregular spots, dispersed mainly in the mid-portion of its rostrum and in the region adjacent to its eyes. The eyes, in turn, are also hypopigmented, showing a marked pinkish iris.

Melanism is often caused by an increase or independent expression of eumelanin, responsible for the production of brown or black pigments, which results in the dark coloration typical of this disorder (Majerus *&* Mundy 2003, van Grouw 2017). The melanistic individual of *M. tridactyla* was photographed by the Environmental Military Police of Mato Grosso do Sul during a wildlife rescue on September 17, 2015 (Figure 1). This individual is a juvenile of *M. tridactyla* found hit by a car on the BR 262 highway, in the Municipality of Terenos, Mato Grosso do Sul, Brazil. After the rescue, the individual was taken to the Wild Animal Rehabilitation Center of the Environment Institute of Mato Grosso do Sul (CRAS-IMASUL). This individual has dense and black hair on the dorsal and lateral portions of its body, whereas the ventral portion has very dark brown hairs (Figure 2). The head of this individual has a brown coloration throughout its lateral and inferior portion, which communicates with the ventral brown hairs of the neck and extending to the lateral surface adjacent to the nostrils. The upper portion of the head has a black coloration, continuous with the black hairs on the back and extending to the region close to the upper portion of the nostrils. A light brown stripe extends from the latero-superior portion of the head just above the eyes to the mid-portion of the rostrum, with its coloration being most evident in the mid-posterior portion of the head. The palpebral perimeter of the eyes and the helix of the ears of this individual are also light brown. The claws of the *manus* of this individual are pale black (Figure 2). The *pes*, in turn, could not be observed due to the position in which the animal is in the photographic record. The tail hairs of this individual are slightly lighter black than the rest of the body.

Cases of albinism and melanism in anteaters are rare (*e.g.*, Ríos *et al.* 2019, Ríos-Alvear *&* Cadena-Ortiz, 2019) and poorly studied. Some causes have been correlated with the emergence of albinos in vertebrates populations, such as alterations in diet, environmental contamination (*e.g.*, radiation), habitat fragmentation, inbreeding and, consequently, low genetic diversity (Møller *et al.* 2013, Espinal *et al.* 2016, Cuxim-Koyoc *et al.* 2019). Albino mammals have morphophysiological characteristics that are harmful to their survival, such as high sensitivity to sunlight in their skin and eyes. In fact, the absence of pigmentation in the eyes of albinos contributes to a progressive loss of vision, commonly leaving them nearly blind (Edmunds 1949, Perez-Carpinell *et al.* 1992, Ríos *et al.* 2019). Albinism is a chromatic disorder rarely found in mammals, with abundant taxonomic groups (*e.g.*, Rodentia) presenting less than 2% of individuals with this condition (Dalapicolla et al. 2020). Melanism in anteaters is often attributed to other species, such as *Tamandua tetradactyla* (*e.g.*, Wetzel 1975, Ríos *et al.* 2019). Melanism is more often in mammals than the albinism, may be found in 20% of individuals in some populations (Caro 2005). The occurrence of melanistic individuals in mammal populations has been correlated with some phenomena, such as deforestation, tree density and wildfires in the environments in which they are distributed (Caudill *&* Caudill 2015). The persistence of melanism in some mammal populations indicates a benefit of this condition for the survival of these groups, being favorable mainly for the crypsis and thermoregulation of these animals (Ciurej *et al.* 2019). However, in *M. tridactyla*, albinism and melanism seem to be occasional and uncommon cases in their populations.

The albino individual of *M. tridactyla* is geographically separated from the melanistic individual by a distance of ca. 357 km, being sighted in a transition region between the Cerrado and the Pantanal. This region has been afflicted by strong anthropogenic impacts, including frequent wildfires, deforestation and inadequate landscape management, leading to death of a large number of vertebrates (Oliveira-Júnior *et al.* 2020, Tomas *et al.* 2021). We hypothesized that the albino individual of *M. tridactyla* is an indicator of recurrent impacts in this region, possibly being derived from fragmented populations and inbreeding between animals surviving these catastrophic events. Collevatti et al. (2007) observed a low level of polymorphism and high levels of inbreeding in a population of *M. tridactyla* in Emas National Park, Brazil. These authors comment that the reduction in population size and the isolation of the remaining population due to agricultural expansion and fragmentation of environments may have led to a higher frequency of crosses between relatives in the park areas. This information reinforces the possibility that the albino individual presented here comes from a population subjected to similar events of fragmentation, isolation and frequent inbreeding. The melanistic individual of *M. tridactyla*, in turn, comes from a Cerrado region closer to closed forest areas belonging to the Atlantic Forest. Considering the presence of this individual in an area with frequent anthropogenic impacts, such as wildfires and fragmentation, we consider two hypotheses for the appearance of the melanistic phenotype: 1) The occurrence of melanism is derived from mutations caused by isolation and population size reduction, possibly of individuals of a restricted population of dense forest; 2) Melanism is an adaptive response to frequent wildfires in the Pantanal and Cerrado regions. Some studies comment on the possibility of wildfire areas influence a abundance of melanistic mammals in other countries (*e.g.*, Guthrie 1967, Pausas *&* Parr 2018), with these animals having specializations for survival in the burned and darkened substrate (*e.g.*, black squirrels; Schorger 1949, Creed and Sharp 1958, Guthrie 1967). In this context, darker coat and skin would favor crypsis in wildfire-burned areas. However, the record of only one melanistic individual reported in this study does not favor this hypothesis. In fact, further studies on chromatic disorders in *Myrmecophaga*, as well as in other anteaters, are needed to understand the origin of these anomalies in anteaters. In addition, the continuous recording of chromatic disorders in anteaters will make it possible to test the efficiency of these anomalies as indicators of environmental and climatic disturbances.

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**LEGENDS**

**Figure 1.** Record locations of the melanistic and albino individual of *Myrmecophaga tridactyla* in Brazil (A), with location points highlighted in the state of Mato Grosso do Sul (B).

**Figure 2.** Albino (A, B) and melanistic (C) individual of *Myrmecophaga tridactyla*.