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First record of leucism in a wild lowland tapir *Tapirus terrestris* (Linnaeus, 1758) from the Orinoquia region of Colombia

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ABSTRACT
Polymorphic phenotypes, like leucism, occur due to genetic mutations and are rare in wild populations. Leucism, marked by partial or complete pigmentation loss but normal eye color, is often linked to genetic drift and inbreeding in fragmented habitats. We report the first case of leucism in a wild lowland tapir (*Tapirus terrestris*) in Arauca, Colombia. Habitat fragmentation due to agricultural expansion may be causing reproductive isolation and reduced genetic variability. This finding highlights the potential genetic risks facing lowland tapir populations and underscores the need for genetic studies and conservation efforts to mitigate these risks in fragmented landscapes.
Keywords: anomalies, conservation, fragmentation, genetics, polymorphism

RESUMEN – Primer registro de leucismo en un tapir de tierras bajas silvestre *Tapirus terrestris* (Linnaeus, 1758) en la región de la Orinoquia colombiana
Los fenotipos polimórficos, como el leucismo, ocurren como consecuencia de mutaciones genéticas y son raros en poblaciones silvestres. El leucismo, caracterizado por la pérdida parcial o completa de pigmentación, pero con un color de ojos normal, a menudo se asocia con la deriva genética y la endogamia en hábitats fragmentados. Reportamos el primer caso de leucismo en una danta o tapir de tierras bajas (*Tapirus terrestris*) silvestre en Arauca, Colombia. La fragmentación del hábitat debido a la expansión agrícola podría estar provocando aislamiento reproductivo y una disminución de la variabilidad genética. Este hallazgo subraya los posibles riesgos genéticos que enfrentan las poblaciones del tapir de tierras bajas y la importancia de realizar estudios genéticos y esfuerzos de conservación para mitigar estos riesgos en paisajes fragmentados.
Palabras clave: anomalías, conservación, fragmentación, genética, polimorfismo

Polymorphic phenotypes occasionally occur in many taxa and are caused by genetic mutations that affect melanin synthesis, distribution, or aggregation (Dias et al. 2023). Among these phenotypes, pigmentation abnormalities like albinism, melanism, and leucism result from disruptions in melanin production or melanoblast development.

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Albinism and melanism are the most widely recognized pigmentation disorders. Albinism is characterized by the complete absence of melanin in the body, resulting in pale coloration and reddish-pink eyes (Summers 2009). It typically arises from mutations in genes involved in melanin synthesis, such as TYR, which encodes tyrosinase, a critical enzyme in melanin biosynthesis (Lucati & López-Baucells 2017). In contrast, melanism involves the overproduction of melanin, leading to hyperpigmentation. This condition is often linked to mutations in regulatory genes such as ASIP and MC1R, which affect melanin production in skin and hair melanocytes (Kingsley et al. 2009).

Two less recognized hypopigmentation disorders are leucism and piebaldism, both of which involve partial pigment loss (Rubio & Simonetti 2019). Unlike albinism, leucism preserves pigmentation in certain body areas, such as the eyes and skin, and is caused by recessive mutations that disrupt melanoblast migration or survival during development (Pontes & Chivers 2020). Piebaldism, by contrast, presents irregular patches of depigmentation, often associated with distinct genetic pathways (Aximoff et al. 2020; Pontes & Chivers 2020).

Leucism, typically resulting from recessive mutations, is rare in wild populations (Dias et al. 2023). Its occurrence is often associated with populations that are either geographically isolated —such as those on islands (Zeiger et al. 2018)— or have undergone reproductive isolation due to habitat fragmentation (Derlindati et al. 2013; Sagar et al. 2021). In these isolated populations, genetic drift and inbreeding can reduce genetic variability, increasing the homozygosity of recessive alleles responsible for leucism (Pereira et al. 2023). This polymorphism is generally considered disadvantageous, potentially decreasing survival and fitness due to increased visibility to predators and reduced camouflage, particularly in top predators (Ramos-Luna et al. 2022). Leucism is also linked to visual and immunological pathologies (Summers 2009), which can further impact the fitness of affected individuals.

Although leucism is uncommon, it has been reported in several Neotropical mammals, including bats (de Oliveira et al. 2024), primates (Ramos-Lima et al. 2022), peccaries (Aximoff et al. 2020; da Silva et al. 2019), deer of the genera *Mazama Rafinesque*, 1817 and *Blastocerus Wagner*, 1844 (Guastalla et al. 2021; Mejía-Valenzuela & Auz-Cerón 2020; Pereira et al. 2023), rodents (Rubio & Simonetti 2019; Tavares et al. 2020), carnivores (Dias et al. 2023; Pontes et al. 2020; Scrich et al. 2019), anteaters of the genus *Tamandua* Grey, 1825 (Cotts et al. 2023), mountain tapir (*Tapirus pinchaque,* Roulin, 1829) (Nivelo-Villavicencio & Rodas 2021), and lowland tapir (*Tapirus terrestris*) (Tirira & Arbeláez 2020). The latter case of leucism in a lowland tapir involved a captive individual in Ecuador, reported on March 20, 2019. To date, no cases of leucism have been documented in wild populations of lowland tapir. Here, we present the first recorded instance of leucism in a wild lowland tapir.

The lowland tapir is the largest remaining herbivore in South America (Varela et al. 2019), playing a critical ecological role in seed dispersal and forest dynamics (Tobler et al. 2010), but it faces a high risk of extinction due to habitat loss and poaching (Ferreguetti et al. 2017). As keystone species, the lowland tapir relies on tropical forest ecosystems, preferring habitats near water bodies, such as tropical evergreen forests, swamps, and palm-dominated areas (García et al. 2012).

Typically, lowland tapirs exhibit monomorphic traits, characterized by a short, dark brown to reddish-brown coat, with lighter fur around the face and throat (Padilla & Dowler 1994). Juveniles have distinctive white and yellowish stripes and spots that fade as they mature (Varela et al. 2019). Given the species generally monomorphic nature, the occurrence of leucism represents a rare and significant genetic anomaly, particularly in wild populations (Dias et al. 2023).

The study area is located in the municipality of Arauca, Department of Arauca, Colombia (Fig. 1). Arauca is characterized by natural savannas, galleries, riparian and dense forests (Viloria de la Hoz 2009). Dense forests are the predominant ecosystems in the area. These forests have been the object of extensive deforestation due to expansion of rice crops and oil palm plantations (Alviz, personal observations). In addition, they are under the constant presence of illegal armed groups that encourage the deforestation of the forests for their own particular benefits. Dense forests associated with the Arauca River basin are frequented by tapirs, as they offer food resources, shelter, resting, and mating areas when water levels rise as a result of high precipitation levels (Alviz et al. 2023).

The record was obtained from systematic sampling with camera traps. To ensure data independence, we implemented a grid-based sampling design with 1 km^2 grids for each sampling event, placing camera traps 1 km apart within each grid. We deployed 40 camera traps programmed to operate continuously for 24 hours per day over a 40-day period. This resulted in a total of 1,600 camera trap sampling days. Camera traps captured three consecutive photos with a minimum interval of 0.6 seconds between triggers within each photo series. We placed camera traps within each grid cell based on signs of tapir activity such as tracks, feeding sites (e.g., aggregation of palm trees), trails, and feces. The leucitic tapir was recorded on April 28th, 2024 (latitude 6.8551417; longitude -71.0691444) in the locality of Saltos del Lipa, municipality of Arauca (Fig. 1). The coat is predominantly white, with normal pigmentation present only on the sagittal crest and eyes (Fig. 2).

Although this single record does not allow us to determine the exact causes of this pigmentation anomaly, it was observed under environmental conditions similar to those described by Pereira et al. (2023). The anomalies they documented in subpopulations of marsh deer (*Blastocerus dichotomus* (Illiger, 1815)) were attributed to high homozygosity due to low gene flow and isolation. Similarly, the landscape in Arauca is highly fragmented, primarily due to the rapid expansion of rice cultivation. The remaining forest patches are surrounded by a matrix that hinders the dispersal of individuals and may reduce gene flow, making it a critical habitat for lowland tapir conservation.

Habitat patch isolation is believed to be increasing due to ongoing deforestation and the loss of connectivity from a lack of natural biological corridors. In such contexts, the occurrence of pigmentation anomalies is often associated with reproductive isolation caused by habitat fragmentation (Sagar et al. 2021; Zeiger et al. 2018). As populations become smaller and more isolated, genetic drift and inbreeding may occur, leading to reduced genetic variability, which in turn increases homozygosity and the expression of phenotypes linked to recessive alleles (Sagar et al. 2021). It is possible that subpopulations of tapirs in Arauca are at risk of reproductive isolation due to the landscape and social dynamics in the area. This record could serve as a warning of what may eventu-

ally happen to the species, and other large mammals in the area.

Since the lowland tapir is an endangered species with rapidly declining populations (Varela et al. 2019), we recommend the implementation of projects focused on collecting biological samples from this individual for genetic analyses. Furthermore, it is crucial to carry out population genetic studies to assess whether the population is experiencing genetic drift and inbreeding. This will enable the identification of genes associated with leucism and provide potential explanations for the occurrence of this anomaly within the population. Given the increasing fragmentation of habitats in Arauca and the potential for genetic isolation, conservation efforts must prioritize both habitat protection and restoration to ensure the long-term viability of lowland tapir populations. Establishing and maintaining ecological corridors between forest patches is essential for enhancing connectivity and facilitating gene flow between subpopulations. By promoting the movement of individuals across fragmented landscapes, such corridors can mitigate the effects of habitat isolation, reducing the risk of inbreeding and genetic drift, which are particularly concerning in small, isolated populations.

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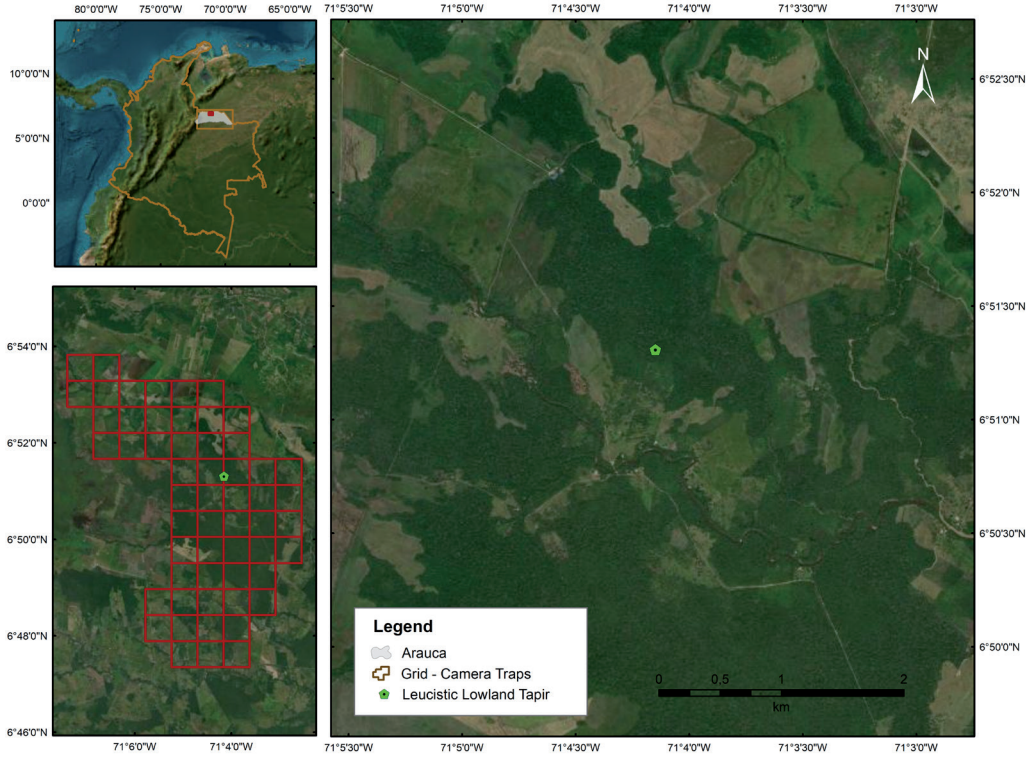

Figure 1. Location of the leucistic lowland tapir in a dense forest fragment in the municipality of Arauca, Colombia. The individual was recorded through a camera trap sampling design in the rural area of Saltos del Lipa.

Figure 2. Leucism in a lowland tapir (*Tapirus terrestris*) in the rural area of the municipality of Arauca, Arauca-Colombia.

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