

Abnormal pelage color in mantled howler monkey (*Alouatta palliata mexicana*) in Veracruz, México

Coloración no convencional en mono aullador de manto (*Alouatta palliata mexicana*) en Veracruz, México

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Leucism is a total or partial depigmentation of the coat; in contrast, albinism is the total loss of pigments throughout the body; the abnormal conditions of pigment deficiency are usually due to the expression of recessive genes. Expedition *ad libitum* was carried out in the Ejido Álvaro Obregón, on the southwest of Nuevo Cantón, Uxpanapa municipality, Veracruz on December, 2019. We present the first record of abnormal pelage colour (maybe leucismo or albinism) in mantled howler monkey (*Alouatta palliata mexicana*), observed in a wild troop in the Uxpanapa Valley region, Veracruz, México. The coloration of the oral mucosa and the eyelid show no pigmentation and may be the result of the expression of recessive genes in the individual, therefore, conducting more in-depth studies on the expression of recessive genes would broaden the understanding of the phenomenon.

Key words: Albinism; Atelidae; depigmentation; leucism; Primates; Uxpanapa.

El leucismo es una despigmentación total o parcial del pelaje, mientras que el albinismo es la pérdida total de pigmentos en el cuerpo entero; las condiciones anormales de la carencia del pigmento se deben a la expresión de genes recesivos. Se realizó una expedición *ad libitum* en el Ejido Álvaro Obregón, al suroeste de Nuevo Cantón, municipio de Uxpanapa, Veracruz en diciembre de 2019. Presentamos el primer registro de un individuo de mono aullador de manto (*Alouatta palliata mexicana*) con coloración no convencional (probablemente leucismo o albinismo), observado en una tropa silvestre en la región del Valle de Uxpanapa, Veracruz, México. La coloración de la mucosa oral y palpebral no muestran pigmentación y pueden ser resultado de la expresión de genes recesivos en el individuo, por lo que realizar estudios más profundos sobre la expresión de genes recesivos ampliaría la comprensión del fenómeno.

Palabras clave: Albinismo; Atelidae; despigmentación; leucismo; Primates; Uxpanapa.

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Leucism is a genetic abnormality that affect colour expression due to a recessive gene; in this condition, animals have partial or total loss of pigmentation in the skin or coat but maintains the normal coloration in eyes and claws ([García-Morales et al. 2012](#); [Silva-Caballero et al. 2014](#); [Liu et al. 2019](#)). In the other hand, albinism is characterized by the total loss of pigments throughout the body ([García-Morales et al. 2012](#); [Silva-Caballero et al. 2014](#)). The patterns of pigmentation in primates can be the result of a combination of three factors: haemoglobin, structural coloration, and melanin pigmentation ([Bradley and Mundy 2008](#)).

In the past ten years, a variety of forms or types of abnormal pigmentation have been reported in monkeys (Mammalia: Primates). In monkeys such as *Alouatta guariba clamitans* ([Fortes and Bicca-Marques 2008](#); [Aximoff and Vaz 2016](#)), *Ateles geoffroyi* ([Espinal et al. 2016](#)), *Callithrix penicillata* ([do Vale et al. 2018](#)), *Callithrix jacchus*, *Callithrix penicillata* (Primates, Callitrichidae) and their hybrids ([Aximoff et al. 2020](#)), abnormal pigmentation in the coat has presented. Atypical conditions in coat colour are the result of pleiotro-

pic effects, due to the origin of melanocytes and neurocytes in the neural crest and are associated with a loss of genetic diversity in isolated and captive populations due to inbreeding ([Dunn et al. 2014](#)).

For 30 years, the loss and fragmentation of the habitat of *Alouatta palliata* in southern México ([Rylands et al. 2006](#)) has decimated its populations and formed a meta-population (subspecies) with biogeographic limits in the states of Tabasco, Oaxaca, Chiapas, and Veracruz. In the latter, the subspecies *A. p. mexicana*, was classified as Critically Endangered by the IUCN ([Cuarón et al. 2008](#)). Furthermore, [Dunn et al. \(2014\)](#) and [Melo-Carrillo et al. \(2020\)](#) report low genetic diversity in wild populations of *A. p. mexicana* of México. For the state of Veracruz, a genetic variability from low to moderated is reported in populations isolated, fragmented and with populations groups reduced ([Argüello-Sánchez 2012](#); [Argüello-Sánchez and García-Feria 2014](#); [Jasso-del Toro et al. 2016](#)). Loss of genetic diversity and inbreeding in monkey populations can increase the likelihood of abnormal colorations such

as albinism, leucism or piebaldism, which have been little studied due to the lack of a complete genome of the genus *Alouatta*.

Expedition *ad libitum* was carried out in the Ejido Álvaro Obregón, on the southwest of Nuevo Cantón (Poblado 7), Uxpanapa municipality, Veracruz (17°19'16.22" N, 94°32'2.4" W; Figure 1a-c) on December 23, 2019 at 3:00 p.m. The original vegetation in the Uxpanapa region was tropical rainforest (high and middle), but since 1970s, through colonization and relocation programs, deforestation, and changes in land use increase (mainly for rubber and citrus plantations). Nowadays, derived from agricultural, livestock and other anthropogenic activities, the original vegetation is about 30 % (Figure 1c; [Hernández et al. 2013](#)).

We observed approximately for twenty minutes a family of mantled howler monkeys (*Alouatta palliata mexicana* Merriam, 1902, Primates: Atellidae). The family consisted of six individuals, two adult males, two adult females (one with a baby monkey; Figure 2d) and one adult individual (whose sex could not be determined) that shows a condition abnormal pelage color (Figure 2a-d). These monkeys were in a rubber plantation (*Hevea brasiliensis*) between high evergreen forest, secondary vegetation, paddocks, and the urbanized area (Figure 1c). We observed to the family crossing the secondary vegetation area and resting in the treetops of *H. brasiliensis*. We also hear two adult males roaring several times and they finally leave the area heading to the high forest. The photographs of the specimen of *A. p. mexicana* were taken with a digital camera

(Sony Alpha 58® of 20 megapixels).

Leucism is a hereditary disorder in the deposition of pigments (melanine) responsible for the colour of the coat, skin and eyes, due to the expression of recessive genes, that it could increase due to the lack of genetic exchange due to isolation, intraspecific competition, and fitness decrease ([Dunn et al. 2014](#)). In *A. palliata* there are records of coloration patterns with depigmentation that are considered normal; however, the species is known to have normal depigmented coloration patterns that have been used for individual identification ([Rodríguez-Luna 1997](#); [SEMARNAT 2012](#)), but due to the characteristics of the coat of the observed individual, they coincide with an abnormal coat condition rather than with a condition of leucism (lack of pigmentation in the skin) or albinism (pigmentation light of fur and skin, with blue, red or pink eyes; [Shapley 2004](#)).

For many years, mantled howler monkeys have been observed in different places with anomalous colorations ([Bradley and Mundy 2008](#)), but there has been no record of an individual with complete coloration throughout the body, being this the first report of this condition. The expression of recessive genes in this individual may be the result of a lack of genetic exchange due to isolation, where the inbreeding process is possibly increasing the homozygous condition in the population and consequently, the loss of alleles ([Dunn et al. 2014](#)). In fragmented sites in the Chontalpa region, Tabasco, México, two individuals of *A. palliata* presented a lighter coloration that brings advantages in thermoregulation since they retain less heat than their darker congeners ([Sánchez-Soto 2018](#)), this anomalous coloration leans towards piebaldism (light coloration of the coat on any limb of the animal) or aberrations in the coat patterns colours because both individuals only had



Figure 1. a) Location of the study area in southern Veracruz, México. b) Location of "Nuevo Cantón" in west of Uxpanapa. Municipal territorial limits in red. c) Location of sighting site (red point) within the "Ejido Álvaro Obregón", municipality of Uxpanapa, Veracruz, México.



Figure 2. a, b) Individual of mantled howler monkey (*Alouatta palliata mexicana*) with abnormal pigmentation condition. c) Albino or leucistic individual and adult female. d) Albino or leucistic individual and adult female with a baby monkey.

light coloration in some extremities (Hull 1978).

A conservation program for the populations of southern Veracruz should be carried out, for example, restoring the connectivity of the area in collaboration with the owners through a silvopastoral management program would help reduce the pressure of genetic decline in populations. In parallel, more in-depth studies on population genetics should be carried out focused on the presence or absence of these traits.

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