

First record of leucism for *Carollia castanea* Allen, 1890 (Phyllostomidae: Carollinae) in southeastern Costa Rica

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Resumen

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Primer registro de leucismo para Carollia castanea Allen, 1890 (Phyllostomidae: Carollinae) en el sureste de Costa Rica

Carollia castanea se distribuye desde Honduras hasta Venezuela. Casos de leucismo no han sido reportados para esta especie pero sí para otros filostómidos. Capturamos un adulto de *C. castanea* con leucismo en la Zona Protectora Las Tablas. Presentaba depigmentación en la punta de las alas, debajo del antebrazo y en la parte superior del uropatagio, pero las manchas blancas no cubrían una alta porción de la piel. Algunos casos de leucismo en murciélagos han sido explicados por endogamia en poblaciones pequeñas o aisladas, pero esto no está apoyado por evidencia empírica. Nuestro registro es anecdótico, y no podemos ofrecer una explicación ecológica o genética. Proponemos que los casos de leucismo sean evaluados en cada contexto específico y soportado por estudios poblacionales robustos.

Palabras clave: Coloración atípica, Murciélagos, Neotrópico, Talamanca.

Abstract

Carollia castanea is distributed from Honduras to Venezuela. Leucism has not been reported for this species but there are reports for other phyllostomid bats. An adult *C. castanea* with leucism was captured at Las Tablas Protected Zone, Costa Rica. It presented depigmentation on both wing tips, under the and on the upper part of the uropatagium, however the white patches did not cover a high proportion of its skin. Some leucism cases in bats have been explained by inbreeding in small or isolated population, but it is scarcely supported by empirical evidence. Our record is anecdotal therefore we cannot offer an ecological or even a genetic explanation. We propose that leucism cases should be assessed in each specific context where it is recorded, and supported by robust population studies.

Key words: Atypical coloration, Bats, Neotropics, Talamanca.

Introduction

Melanin is the product of a biochemical synthetic pathway; its quantity and distribution is genetically controlled (Griffiths *et al.* 2000). Mutation on the genes involved in the synthesis of melanin can be manifested in chromatic disorders such as albinism or leucism (Griffiths *et al.* 2000, Zalapa *et al.* 2016). Leucism is a skin condition that results from total or partial lack of pigmentation on the skin or fur (van Grouw 2006).

Reports of leucism in terrestrial vertebrates are generally scarce but relatively common for bats (Arriaga-Flores *et al.* 2016). The high frequency of leucism in vertebrates has been explained by inbreeding (Hsu 2003), but the relationship between these genetic changes and their ecological consequences have been scarcely studied (Arriaga-Flores *et al.* 2016).

On bats, leucism is generally expressed with white patches on the skin and fur, and sometimes without white patches along with a paler complexion than normal skin color (Murariu & Chisamera 2006). Cases of leucism in bats have been mainly reported as anecdotic observations of individuals, without a robust population study, therefore this chromatic disorder condition has not been related with genetic processes in the population level or are based on speculations (López-Wilchis & Galvan 2012, Sánchez-Hernández *et al.* 2012, García-Morales *et al.* 2013). Leucism reports in bats are increasing in the literature, with the most records in the family Phyllostomidae (Marín-Vásquez *et al.* 2010, Velandia-Perilla *et al.* 2013, Chacón *et al.* 2015, Zalapa *et al.* 2016).

Carollia Gray, 1838 includes five species in Central America (Reid 2009), four of which are reported for Costa Rica: *Carollia perspicillata* (Linnaeus, 1758), *Carollia sowelli* Baker, Solari & Hoffmann, 2002, *Carollia subrufa* (Hahn, 1905) and *Carollia castanea* Allen, 1890 (Rodríguez-Herrera *et al.* 2014). *C. castanea* is distributed from western Honduras to Venezuela, Bolivia and western Brazil, mainly on the Caribbean slope from lowlands up to 1,100 MASL (Reid 2009). In Costa Rica, it is common in the lowlands, except on tropical dry forest, and is considered rare above 500 MASL (LaVal & Rodríguez-Herrera 2002).

Leucism has been reported in *C. breviceauda*, *C. perspicillata* and *C. sowelli*. Even though *C.*

castanea is a common species, there are currently no reports of leucism for this species. Here we report the first case of leucism for *C. castanea* in Costa Rica and present a review of the reports of leucism in Latin America.

Material and methods

The specimen was collected at Las Alturas de Cotón Farm in the pacific slope of the Talamanca mountains, Costa Rica. This location is an important conservation area since it is part of Las Tablas Protected Zone, buffer area of La Amistad International Park. We conducted an occasional species inventory at the locality. We proctored training sessions to handle mist nets. Our objective was to train a student in handling nets and identifying bats to initiate inventorying of Chiroptera species in Las Tablas Protected Zone.

We conducted our survey at approximately 1,300 MASL, in a tributary stream of the Cotón river (8.93961, -82.82025 WGS84). We used a mist net (6 x 2m) placed over a stream that conveniently crossed a forest trail. We completed our survey at nights, from 19:00 to 22:00h between 26th and 28th -VII-2016. The individuals captured were identified using a taxonomic key for bats of Costa Rica (Timm *et al.* 1999).

Results

We accomplished a survey effort of 9 hours per net during which we found 8 bat species, all belonging to the family Phyllostomidae. Our records include *Artibeus lituratus* Olfers, 1818, *Dermanura tolteca* Saussure, 1860, *Sturnira hondurensis* Goodwin, 1940, *Sturnira parvidens* Goldman, 1917, *Desmodus rotundus* (É. Geoffroy, 1810), *C. sowelli*, *C. perspicillata*, and *C. castanea*. One of the three captured individuals of *C. castanea* exhibited the leucism condition.

The individual exhibiting leucism was found on the first night of our survey (26-VII-2016). We confirmed the individual as *C. castanea* by using the following morphometric characteristics: three colored stripes on its skin, 36.4 mm forearm and 15 mm tibia (Timm *et al.* 1999). The specimen is an adult male and it was housed in the Museo de Zoología of the Universidad de Costa Rica (catalogue number 4770 and collect permission No. SINAC-SE-CUS-PI-12-131-2016). The specimen



Figura 1. Individuo colectado de *Carollia castanea* con leucismo el 26-VII.2016 en la Zona Protectora Las Tablas, Costa Rica (número de catálogo 4770). A. Vista dorsal del ala izquierda con parches blancos; B. Vista ventral del cuerpo; C. Vista ventral del uropatagio; D. Vista dorsal con falta de pelaje sobre la parte baja del cuerpo.

Figure 1. Individual of *Carollia castanea* with leucism collected on 26-VII-2016 in Las Tablas Protected Zone, Costa Rica (catalogue number 4770). A. dorsal view of the left wing with white patches; B. ventral view of the body; C. ventral view of the uropatagium; D. dorsal view of the body with lack of fur on the lower area.

was preserved in fluid (fixed in formalin and stored in 70% alcohol). Leucism in the collected individual was exhibited in white-colored skin patches on both wing tips, axillar area and ventral area of the uropatagium (Fig. 1). We found no other skin color alterations on this individual, nonetheless it presented lack of fur on the inferior dorsal area of the body (Fig. 1D).

Currently, 27 species of Phyllostomidae have been reported with leucism in nine countries of Latin America (Soriano *et al.* 1993, Roncancio & Ramírez 2008, Medina & López 2010, Marín-Vásquez *et al.* 2010, Boada & Tirira 2010, Acosta *et al.* 2011, Mantilla-Meluk & Jiménez-Ortega 2011, Díaz & Linares 2012, Marín-Vásquez *et al.* 2013, Velandia-Perilla *et al.* 2013, Tello *et al.* 2014, Chacón *et al.* 2015, Zalapa *et al.* 2016) and the cases potentially will continue to be registered, increasing reports in frequency and distribution, as well as in number of species. Records of leucism in Phyllostomidae have been increasing for the last years.

Discussion

Leucism condition is reported for *Carollia brevicauda* (Schinz, 1821) in Colombia and Venezuela (Soriano *et al.* 1993, Marín-Vásquez *et al.* 2010, Velandia-Perilla *et al.* 2013), *C. perspicillata* in Ecuador (Boada & Tirira 2010), and *C. sowelli* in Mexico (Hernández-Mijangos 2009). To date, there are no records of leucism in Costa Rica for any Phyllostomidae, nor any records of leucism in *C. castanea*.

The most leucism records are represented in the family Phyllostomidae. However, geographic and taxonomic gaps still exist. We encourage researchers to fill these gaps with the publication of records from fieldwork studies and revision of museum specimens, such as the work by Velandia-Perilla *et al.* (2013). This way, we could understand the frequency, taxonomic representation, and geographic patterns of this atypical coloration. Also, it is necessary to understand the effects of this condition on behavior, reproduc-

tion, and survival.

Leucism in bats is considered a rare condition in terms of frequency relative to survey efforts (e.g. Marín-Vásquez *et al.* 2010) or taxonomic representation (Gardner 2008). The explanation for low frequency and scarce taxonomic representation is the potential negative effects in reproduction and survival, such as reported for viperid snakes (Krečsák 2008) and otariids (Acevedo & Aguayo 2008). However, recent records and discussion about atypical coloration in bats support that leucism condition does not have potential negative effects since its frequency is relative to survey effort (Velandia-Perilla *et al.* 2013), it is present in adults and pregnant females (García-Morales *et al.* 2012; Velandia-Perilla *et al.* 2013), as well as has a wide taxonomic representation (Zalapa *et al.* 2016). However, the high frequency of leucism reported by Velandia-Perilla *et al.* (2013) was explained by the absence of predators in the island where the study was carried out.

It is considered that on small or isolated populations, leucism could be more frequent due to inbreeding (Hsu 2003, García-Morales *et al.* 2013). In some studies, leucism reports have been explained by inbreeding (e.g. López-Wilchis & Galvan 2012, Sánchez-Hernández *et al.* 2012, García-Morales *et al.* 2013) but these studies are generally not based on robust population studies. However, our observation is anecdotal and therefore we cannot conclude about genetic processes involved or ecological consequences, in order to avoid these kind of speculations.

The individual we found was an adult and the white patches did not cover a high proportion of its skin. This suggests that the condition has not greatly affected its capacity to obtain food or avoid predation in contrast to other individuals with normal skin color. For this reason, we propose that any leucism effects in bats should be studied, with attention to different circumstances such as individual condition, taxonomic lineage, inter and intraspecific interaction, habitat, or spatial patterns. Thus, effects of leucism should not be generalized and this condition should be evaluated in each specific context where it is encountered.

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