

**Primeros registros de leucismo en ocho especies
de mamíferos pequeños (Mammalia: Rodentia)**

First records of leucism in eight species of small mammals (Mammalia: Rodentia)

Jorge Brito¹ and Karla Valdivieso-Bermeo^{1, 2*}

¹ Museo Ecuatoriano de Ciencias Naturales del Instituto Nacional de Biodiversidad, División de Mastozoología. Calle Rumipamba 341 y Av. De Los Shyris. Casilla postal 17-07-8976. Quito, Ecuador. E-mail: jorgeyakuma@yahoo.es (JB).

^{1, 2} Universidad Internacional del Ecuador, Escuela de Biología Aplicada. Km. 3 Av. Simón Bolívar. Casilla postal 17-21-1948. Quito, Ecuador. E-mail: kae_valdivieso@outlook.com (KVB).

* Corresponding author

Leucism is a partial hypopigmentary congenital disorder that indicates low levels of genetic diversity and is considered to be an unusual trait in wild populations. In continental America, few cases of abnormal coloration in vertebrates have been recorded. This feature can increase the selective pressure on individuals who have it, and can result from population isolation which, in turn, could act as an alarming indicator of environmental change. This condition has not been reported previously in genera of small rodent such as *Akodon*, *Nephelomys*, *Thomasomys*, *Trasandinomys* and *Mesomys*. Therefore, the aim of this note is to report 38 cases of leucism found in eight rodent species for the first time: *Akodon mollis* (n = 7), *Nephelomys albigularis* (n = 7), *N. moerex* (n = 18), *Trasandinomys talamancae* (n = 2), *Thomasomys auricularis* (n = 1), *T. taczanowskii* (n = 1), *T. paramorum* (n = 1) and *Mesomys hispidus* (n = 1).

Key words: Ecuador; leucism; Rodentia.

El leucismo es un desorden hipopigmentario congénito, que refleja bajos niveles de diversidad genética y es considerado inusual en poblaciones silvestres. Pocos son los casos que han sido registrados de coloraciones anómalas en vertebrados para el continente americano. Esta característica puede incrementar la presión selectiva en los individuos que la presentan, pudiendo darse por aislamiento poblacional que a su vez podría actuar como un indicador de cambios ambientales. Esta condición nunca había sido reportada en los géneros de roedores pequeños: *Akodon*, *Nephelomys*, *Thomasomys*, *Trasandinomys* y *Mesomys*. Por lo tanto el objetivo de la presente nota es dar a conocer por primera vez 38 casos de leucismo para ocho especies de roedores: *Akodon mollis* (n = 7), *Nephelomys albigularis* (n = 7), *N. moerex* (n = 18), *Trasandinomys talamancae* (n = 2), *Thomasomys auricularis* (n = 1), *T. taczanowskii* (n = 1), *T. paramorum* (n = 1) y *Mesomys hispidus* (n = 1).

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Introduction

Abnormal coloration in mammals and other animals is considered as a hypopigmentary congenital disorder that reflects low genetic diversity levels; these chromatic aberrations are expressed mainly as albinism and leucism (Phillips 1954; Bensch *et al.* 2000). Leucism is expressed as the almost total decoloration of certain parts of the body, but preserving the typical color of eyes, nails and skin (Bensch *et al.* 2000; Miller 2005). The occurrence of leucism is associated with factors such as pollution, environmental alterations (Moller and Mousseau 2001), low-quality diet (Owen and Shimmings 1992; Peles *et al.* 1995), or follicular damage (Phillips 1954; Hafner and Hafner 1987). Individuals with leucism are more frequent in small and isolated populations due to inbreeding, which causes recessive alleles to be expressed (Holyoak 1978; Bensch *et al.* 2000).

Leucism is relatively rare in small mammals (Steen and Sonerud 2012), with only 18 cases of abnormal colorations reported in the American continent for the order Rodentia (Appendix 1). In South America, the genera *Akodon*, *Nephelomys* and *Thomasomys*, all of which include a wide variety

of species, as well as *Transandinomys* and *Mesomys*, with fewer species, are taxa for which albinism and leucism in wild specimens have not been previously reported.

In Ecuador only two cases of color aberrations in small mammals are known, one albino *Vampyrum spectrum* specimen (Brito and Leon 2014) and one *Carollia perpicillata* specimen with leucism (Boada and Tirira 2010); information on these conditions for other mammals is unknown. This note reports the first cases of leucism for several species of Ecuadorian rodents distributed mainly to the southwest and other areas of the country.

Materials and Methods

The study included several field trips to eight sites in 2015. The study area comprises the Cordillera de Chilla, southeastern Ecuador, between 2,434 m (-79.501° W, -3.625° S) and 3,668 m (-79.469° W, -3.063° S). The study sites include natural habitats with human interventions: montane forests (visually dominated by *Polylepis* sp, *Ocotea* sp and several Melastomataceae species); and moorland shrub (visually dominated by *Stipa* sp, *Calamagrostis* sp and several shrub species of Asteraceae). The field work was framed within the project "Guide to the mammals of the El Oro province".

The systematic methodology for capturing small mammals consisted in the use of live traps (Sherman and Tomahawk). One hundred traps (90 Sherman and 10 Tomahawk traps, the latter interspersed every two and three stations) were arranged in transects of 15 and 25 stations, each station with two and six traps, usually with a separation of approximately 10 m between stations. The trapping effort was 1,650 trap-nights. The bait used was a mixture of oats flavored with vanilla and coconut essence. The reference specimens are deposited in the Museo Ecuatoriano de Ciencias Naturales, Instituto Nacional de Biodiversidad (DMMECN). Additionally, a review of the mammal collection of DMMECN was conducted in search of specimens with this anomaly.

Results

A total of 170 rodent specimens belonging to 11 species were captured in Cordillera de Chilla. In all, nine individuals (5.3 %) had leucism (Figure 1). Thirty nine individuals of the genus *Akodon* were captured, six (15.4 %) of which showed leucism. In the case of *Nephelomys* and *Thomasomys* (with 27 and 57 specimens captured, respectively), two (7.1 %) and one (1.8 %) individuals showed this condition. All specimens were captured in areas with native vegetation.

As regards the revision of voucher specimens (DMMECN), 29 showed leucism (Table 1); these belong to two families, five genera and seven species. Cricetids (Figure 2) of the genus *Nephelomys* ($n = 23$) accounted for most cases, while *Akodon* ($n = 1$), *Transandinomys* ($n = 2$), *Thomasomys* ($n = 2$), and *Mesomys* ($n = 1$) exhibited leucism to a lesser extent.

The sum of leucism records in Cordillera de Chilla plus the voucher specimens amounts to 38 individuals of eight species: *Akodon mollis* ($n = 7$), *Nephelomys albigularis* ($n = 7$), *N. moerex* ($n = 18$), *Transandinomys talamancae* ($n = 2$), *Thomasomys auricularis* ($n = 1$), *T. taczanowskii* ($n = 1$), *T. paramorum* ($n = 1$), and *Mesomys hispidus* ($n = 1$).

Discussion

In southwestern Ecuador, Cordillera de Chilla is considered as an important bridge for the passage of wild animals between the Pacific slope, the Andes and the Amazon (Krabbe 2008); however, in the last decades natural habitats have been fragmented, with forests and moors being replaced by pasture and large areas of pine plantations. Today there are only small isolated remnants along the borders of ravines and rocky walls. Even the small ravine forests still existing are being disturbed by livestock that invades these areas to feed on herbs and tree bark. This situation is likely influencing the emergence of species with leucism, in agreement with Holyoak (1978), Bensch et al. (2000) and Lopucki and Mróz (2010), who state that the frequency of occurrence

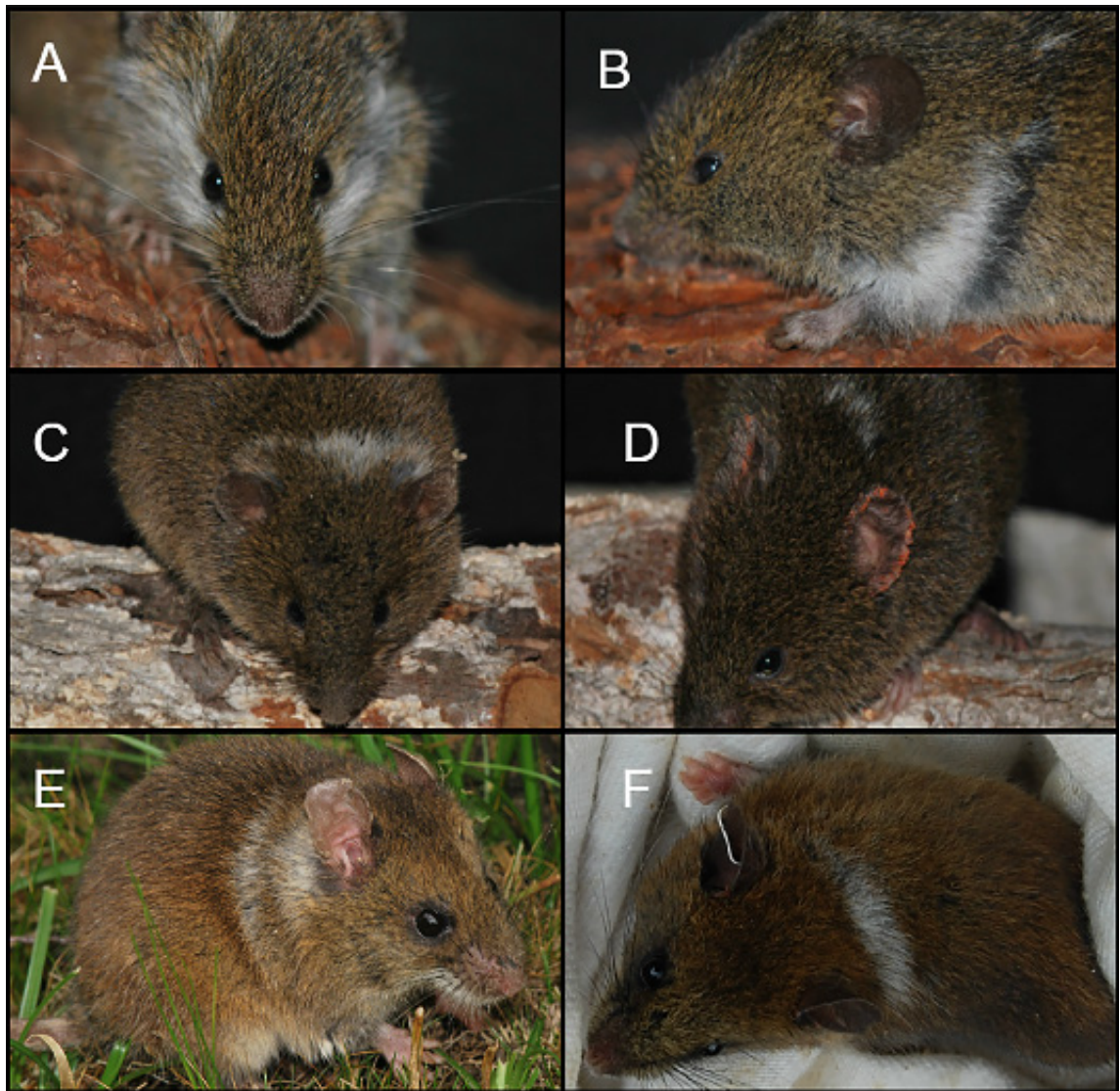


Figure 1. Rodents with leucism recorded in Cordillera de Chilla, southwestern Ecuador: A = *Akodon mollis* (DMMECN 4,847); B = *A. mollis* (DMMECN 4,849); C = *A. mollis* (DMMECN 4,833); D = *A. mollis* (DMMECN 4,845); E = *Thomasomys taczanowskii* (DMMECN 4,822); *Polylepis* forest in northern Ecuador: F = *Thomasomys paramorum* (not collected). Photographs J. Brito.

of Individuals with atypical colorations in a wild population is affected mainly by the isolation of populations.

The fragmentation of natural habitats in Cordillera de Chilla could be preventing gene flow between rodent populations, even in *Akodon mollis*, a terrestrial species that inhabits forests and moorland shrub, and which is usually tolerant to habitat modification. However, *N. albigularis*, a terrestrial rodent, and *T. taczanowskii* a rodent of semi-arboreal habits, both associated only with forests, also showed leucism, although in smaller numbers.

The present is the first report of leucism in eight rodent species of Ecuador. The museological reviews, field reports and studies on population genetics will contribute to understand the existence of spatial and temporal patterns, or demonstrate the indirect causes of these aberrations in natural populations.

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Table 1. Localities of Ecuadorian rodents with leucism reported in this contribution.

Species	Province/Locality	Long.	Lat.	Alt.	Voucher (DMMECN)
<i>Akodon mollis</i>	Azuay, El Cajas	-79.0872	-3.1797	4,000	0077
	El Oro, Cerro de Arcos	-79.4694	-3.0630	3,668	4726-27
	El Oro, Payana	-79.6152	-3.5044	3,044	4833
	El Oro, Shiñinguro	-79.5933	-3.4777	3,178	4845,4847, 4849
	Imbabura, Cotacachi	-78.6677	0.3108	1,756	3420
<i>Nephelemys albigularis</i>	El Oro, Chivatuco	-79.5011	-3.625	2,434	4847
	El Oro, Yacuvíñay	-79.7113	-3.5749	2,473	4903
	Morona Santiago, Parque Nacional Sangay	-78.4968	-2.1898	3,300	1521
	Pichincha, Calacalí	-78.5354	0.0030	2,240	3524, 3528
	Pichincha, Nanegalito	-78.7005	0.0628	1,740	2525
<i>Nephelemys moerex</i>	Cotopaxi, San Francisco de las Pampas	-79.0051	0.4179	2,050	1085
	Pichincha, Calacalí	-78.5354	0.0030	2,240	2545
	Pichincha, Lloa	-78.5836	-0.2497	3,387	2551, 2725-26, 2739, 2733, 2737
	Pichincha, Nanegalito	-78.7005	0.0628	1,740	2816, 2824, 2826 2846, 4397
	Pichincha, Nono	-78.6678	-0.1329	2,800	2484, 2538-39, 2541
	Pichincha, Reserva Pahuma	-78.7005	0.0628	1,740	2482
<i>Transandinomys talamaca</i>	Pichincha, Minas,	-78.4343	0.1670	1,820	2583-84
<i>Thomasomys auricularis</i>	Azuay, El Cajas	-79.2355	-2.7872	4,000	0071
<i>Thomasomys taczanowskii</i>	El Oro, Chilla Cocha	-79.6252	-3.5005	3,315	4822
<i>Thomasomys paramorum</i>	Carchi, Bosque de <i>Polylepis</i>	-77.0052	0.2309	3,650	Not collected
<i>Mesomys hispidus</i>	Sucumbíos, Reserva Ecológica Cofán-Bermejo	-77.9822	0.7154	375	3486

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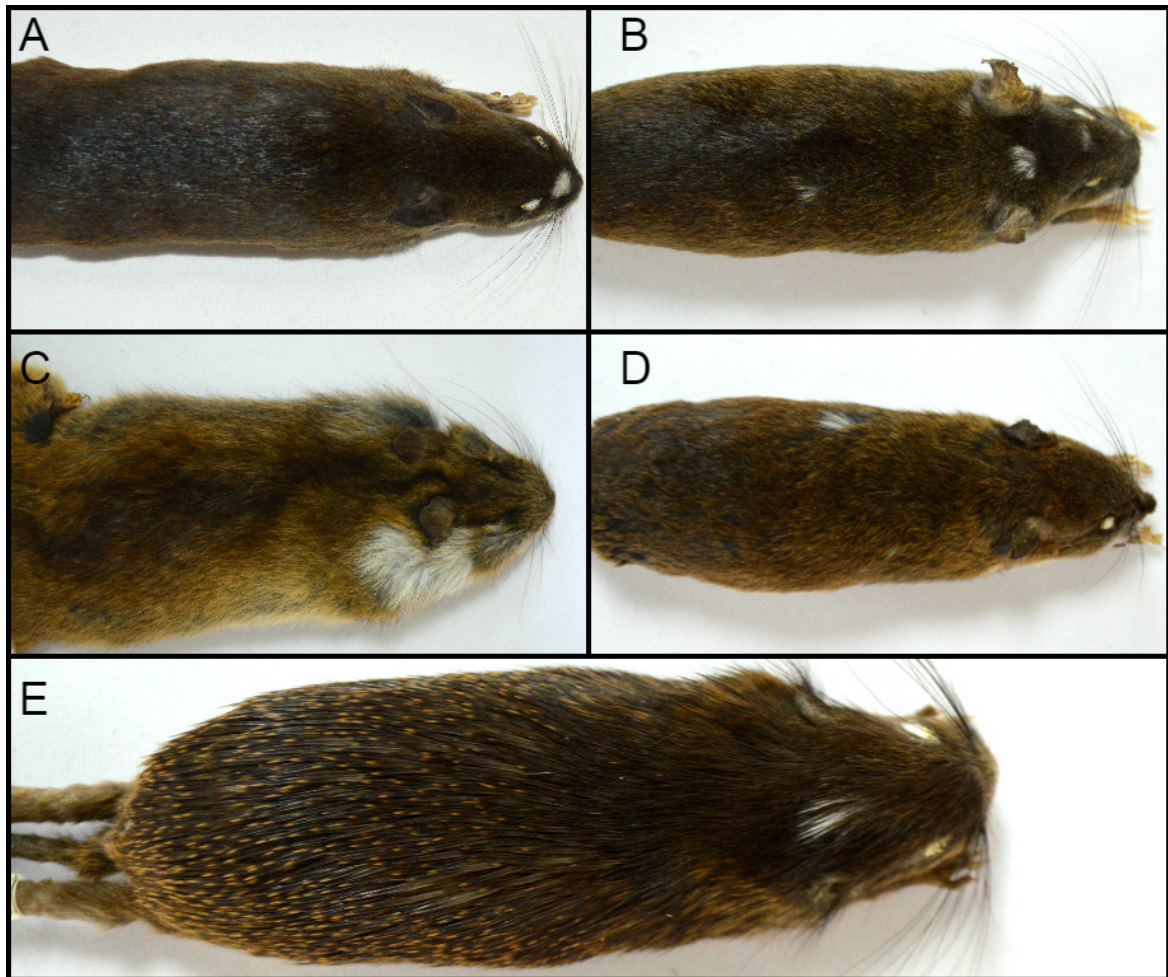


Figure 2. Voucher specimens with leucism: A = *Nephelomys albigularis* (DMMECN 3,624), B = *N moerex* (DMMECN 2,824), C = *Thomasomys auricularis* (DMMECN 71), D = *Transandinomys talamacaе* (DMMECN 2,584) and E = *Mesomys hispidus* (DMMECN 3,486). Photographs K. Valdivieso-Bermeo.

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Appendix 1

Records of rodents with chromatic aberrations in the American continent.

Rodentia	Country	Condition	Source
Sciuridae			
<i>Ammospermophilus harrisi</i>	USA	Albinism	Neal 1964
<i>Citellus</i> sp	USA	Albinism	Turkowski y Parker 1967
<i>Tamias striatus</i>	USA	Albinism	Guiles 1997
Geomyidae			
<i>Thomomys</i> sp	USA	Albinism and Leucism	Burnet 1925
Heteromidae			
<i>Liomys pictus</i>	Mexico	Albinism	Martínez-Colonel <i>et al.</i> 2013
<i>Perognathus</i> sp	USA	Albinism	Egoscue and Lewis 1968
Cricetidae			
<i>Akodon mollis</i>	Ecuador	Leucism	This study
<i>Clethrionomys gapperi</i>	Canada	Leucism	Bowman and Curran 2000
<i>Delomys dorsalis</i>	Brazil	Albinism	Cademartori and Pacheco 1999
<i>Microtus montanus</i>	USA	Albinism	Jannett 1981
<i>Microtus pennsylvanicus</i>	USA	Albinism and Leucism	Peles <i>et al.</i> 1995; Parsons and Bondrup-Nielsen 1995
<i>Microtus pinetorum</i>	USA	Albinism	Schantz 1960
<i>Myodes rutilus</i>	USA	Albinism	Whitman and Jackson 2009
<i>Nephelomys albigularis</i>	Ecuador	Leucism	This study
<i>Nephelomys moerex</i>	Ecuador	Leucism	This study
<i>Ondatra zibethicus</i>	USA	Albinism	Benton 1953
<i>Peromyscus fraterculus</i>	Mexico	Leucism	Camargo <i>et al.</i> 2014
<i>Phyllotis andium</i>	Peru	Albinism	Ramirez and Arana 2005
<i>Reithrodontomys megalotis</i>	USA	Albinism	Egoscue 1958
<i>Thomasomys auricularis</i>	Ecuador	Leucism	This study
<i>Thomasomys paramorum</i>	Ecuador	Leucism	This study
<i>Thomasomys taczanowskii</i>	Ecuador	Leucism	This study
<i>Transandinomys talamancae</i>	Ecuador	Leucism	This study
Dasyproctidae			
<i>Dasyprocta azarae</i>	Brasil	Leucism	Oliveira 2009
Echimyidae			
<i>Mesomys hispidus</i>	Ecuador	Leucism	This study
<i>Trinomys albispinus</i>	Brasil	Leucism	Pessôa and Reis 1995

