

## SHORT COMMUNICATION

**Leucism in *Tityus pusillus* (Scorpiones: Buthidae): Report of a rare event in scorpions**

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**Abstract.** Leucism is a congenital disorder in which the individual is born with partial hypopigmentation. It is quite common in vertebrates, but rare in invertebrates, especially in arachnids like scorpions. This paper presents the first record of this congenital disorder to be observed in the order Scorpiones. During field studies in the Área de Conservação Aldeia-Beberibe, a set of Atlantic forest fragments of 31,634 hectares, we collected a pregnant leucistic female *Tityus pusillus* Pocock, 1893. In this female, the variegated pattern described for the species was a lighter color than normal. The animal produced 10 normal juveniles (not leucistics). In addition, we analyzed 1,164 specimens from 17 populations deposited in the CA-UFPE to verify the frequency of leucism; there were no scorpions with leucism within the analyzed populations. Thus, a break in variegated pattern, as with the leucism described in this study, may increase the mortality rate due to predation.

**Key words:** Brazilian Atlantic Forest, color pattern, depigmentation degree

Color patterns in scorpions have often attracted the attention of researchers, principally for ecological and taxonomical studies (Harington 1984; Lourenço & Cloudsley-Thompson 1996; Lourenço 2002; Vignoli et al. 2005; Olivero et al. 2012). Coloration patterns in these arachnids can vary from pale yellow to black, and the presence of sub-cuticular pigments form different configurations such as longitudinal or confluent bands (Lourenço 2002). Variations from these patterns are well documented for these arachnids, producing different morphology types ('morphs') for the same species (Lamoral 1979; Williams 1980; Harington 1984; Vignoli et al. 2005).

Environmental factors seem to play a role in many scorpions' color variations (Lourenço & Cloudsley-Thompson 1996; Lourenço 2002). For example, with the buthid scorpions *Tityus costatus* (Karsch, 1879) found in the southern portion of the Brazilian Atlantic forest, those that live at sea level (dry environment) are 'light morph,' whereas individuals that occur at 1000 m above sea level (wet environment) are 'darker morph' (Lourenço 2002). Olivero et al. (2012) also found color variation within six Argentinean populations of the bothriurid scorpion *Bothriurus bonariensis* (C.L. Koch, 1842); these authors also reported that scorpions from wet sites are darker than specimens found in drier sites. Another form of variation in scorpion coloration is a complete absence of pigmentation, commonly found in animals that inhabit caves (Mitchell 1968, 1972; Francke 1977, 1978).

In some cases, however, atypical coloration can occur without environmental influences, due to an excess (melanism) or an absence (albinism) of color pigment in part or all of the body (Sanchez-Hernandez et al. 2012). Albinism is a very rare event in scorpions, being reported in the literature only for the Australian scorpion *Urodacus yaschenko* (Birula, 1903) (Locket 1986). This author reported the presence of two albino specimens from the south of Australia, and also compared the eye structure between normal and albino animals, finding abnormalities in the eyes of albino scorpions. Albinism is an extreme form of an absence of color pigmentation in the body, but some animals show a partial hypopigmentary congenital disorder called 'leucism' (Herreid & Davies 1960), which is very common in vertebrates (Sanchez-Hernandez et al. 2012) but not in invertebrates. Here, a case of leucism in the scorpion *Tityus pusillus* Pocock, 1893 is described, together with data on its offspring and the frequency of occurrence in the population.

This is a small ambush predator and the most common scorpion species in the northeast Brazilian Atlantic forest (Lourenço 2002; Lira et al. 2013; Lira & Albuquerque 2014). *Tityus pusillus* is typically found inhabiting the forest floor, with its abundance correlated with climatic conditions and microhabitat structure (Lira et al. 2013, 2015). The species possesses a yellow basal color and brownish variegated coloration (Lourenço & Cloudsley-Thompson 1996; Lourenço 2002).

Leucism in *T. pusillus* was recorded in a pregnant female collected during a nocturnal field study conducted in the Área de Preservação Ambiental Aldeia-Beberibe, a set of Atlantic forest fragments of 31,634 hectares (7° 54' 48" S 35° 2' 36' W) (CPRH 2015). The leucistic individual was maintained in laboratory conditions and gave birth to 10 normal (non-leucistic) young. Confirmation of female gender was carried out according to Lourenço (2002), following death after the young dispersed from her dorsum. The specimen was then deposited in the Arachnological Collection of Universidade Federal de Pernambuco, Brazil.

Leucism (Fig. 1A) was characterized by a lighter scale of pigmentation of the variegated pattern of coloration common for the species in relation to the normal color range of individuals (Fig. 1B & C). To verify the frequency of leucism in this species, we examined 1,164 individuals from 17 different populations deposited in the Arachnological Collection (Table 1). Except for the leucistic female, no other record of leucism among individuals from the different populations analyzed was registered.

Scorpions' coloration constitutes the first line of defense of these animals, whose color patterns primarily have cryptic significance (Polis 1990; Lourenço & Cloudsley-Thompson 1996). These authors also suggest that most scorpion species that inhabit forests present two patterns of coloration, darker (darker brownish or black) and variegated (mottled). These colorations are camouflage within the darker environment found in forest interiors (Cloudsley-Thompson 1993a, b). Thus, the sedentary behavior shown by *T. pusillus* specimens (Lira et al. 2013) associated with variegated coloration may work as an effective defense against potential predators. Consequently, lighter morph types, such as the leucistic coloring described in the present study, would be more exposed to predation due to the lack of cryptic protection. In conclusion, our study describes for the first time the occurrence of leucism in scorpions; this event is rare, corresponding to a rate of just 0.06% in the population examined.

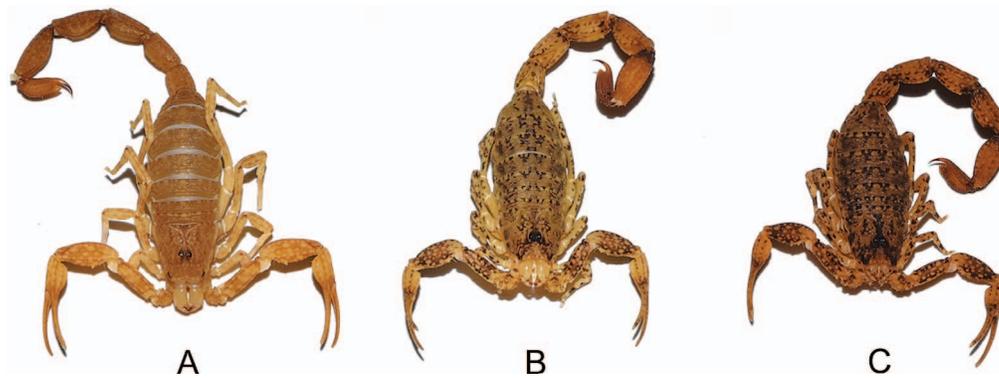


Figure 1.—Variation of color pattern of the scorpion, *Tityus pusillus* Pocock, 1893. A) Leucistic individual. B) Lighter individual. C) Normal individual.

Table 1.—Number of scorpions examined in the seventeen populations.

Location	Coordinates	Scorpions examined
Paudalho	7°54'48"S, 35°02'36"W	60
Água Preta	8°41'31.4"S, 35°29'49"W	2
Jaqueira	8°43'03.9"S, 35°50'21.6"W	104
Ipojuca	8°31'48"S, 35°01'05"W	24
Abreu e Lima	7°46'55"S, 35°09'02"W	101
Recife	8°00'00"S, 34°56'00"W	50
Tamandaré	8°43'43"S, 35°10'39.8"W	60
Moreno	8°06'38.1"S, 35°06'56.4"W	165
Timbaúba	7°36'36.6"S, 35°22'46.6"W	80
Igarassu	8°00'05.8"S, 34°52'23.1"W	85
Buíque	8°35'08.2"S, 37°14'29.3"W	48
Gravatá	8°11'11.8"S, 35°33'51.9"W	37
São Bento do Una	8°31'45.7"S, 36°27'23.8"W	6
Sirinhaém	8°38'59.0"S, 35°10'26.6"W	96
Jaboatão dos Guararapes	8°02'34"S, 35°02'22"W	86
Rio Formoso	8°32'07.6"S, 35°05'53"W	150
Caruaru	8°22'09"S, 36°05'00"W	10

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#### LITERATURE CITED

- Cloudsley-Thompson, J.L. 1993a. The adaptational diversity of desert biota. *Environmental Conservation* 20:227–231.
- Cloudsley-Thompson, J.L. 1993b. Successful desert animals – scorpions, beetles and lizards. *Libyan Studies* 24:143–156.
- CPRH. 2015. Agência Estadual do Meio Ambiente. Online at [http://www.cprh.pe.gov.br/unidades\\_conservacao/Apa/APA\\_Aldeia\\_Berberibe/41704%3B41427%3B224202%3B0%3B0.asp](http://www.cprh.pe.gov.br/unidades_conservacao/Apa/APA_Aldeia_Berberibe/41704%3B41427%3B224202%3B0%3B0.asp)
- Francke, O.F. 1977. The genus *Diplocentrus* in the Yucatan peninsula, with description of two new troglobites (Scorpionida, Diplocentridae). *Association of Mexican Cave Studies Bulletin* 6:49–61.
- Francke, O.F. 1978. New troglobite scorpion of genus *Diplocentrus*. Scorpionida, Diplocentridae. *Entomological News* 89:39–45.
- Harington, A. 1984. Character variation in the scorpion *Parabuthus*

- villosus* (Peters) (Scorpiones, Buthidae): A case of intermediate zones. *Journal of Arachnology* 11:393–406.
- Herreid, C.F. II & R.B. Davies. 1960. Frequency and placement of white fur on free-tailed bats. *Journal of Mammalogy* 41:117–119.
- Lamoral, B.H. 1979. The scorpions of Namibia (Arachnida: Scorpionida). *Annals of Natal Museum* 23:497–784.
- Lira, A.F.A. & C.M.R. Albuquerque. 2014. Diversity of scorpions (Chelicerata: Arachnida) in the Atlantic Forest in Pernambuco, northeastern Brazil. *Check List* 10:1331–1335.
- Lira, A.F.A., F.N.A.A. Rego & C.M.R. Albuquerque. 2015. How important are environmental factors for the population structure of co-occurring scorpion species in a tropical forest? *Canadian Journal of Zoology* 93:15–19.
- Lira, A.F.A., A.M. Souza, A.A.C. Silva Filho & C.M.R. Albuquerque. 2013. Spatio-temporal microhabitat use by two co-occurring species of scorpions in Atlantic rainforest in Brazil. *Zoology* 116:182–185.
- Lockett, N.A. 1986. Albinism and eye structure in an Australian scorpion, *Urodacus yaschenkoi* (Scorpiones, Scorpionidae). *Journal of Arachnology* 14:101–115.
- Lourenço, W.R. 2002. Scorpions of Brazil. Les Éditions de l'If, Paris.
- Lourenço, W.R. & J.L. Cloudsley-Thompson. 1996. The evolutionary significance of colour, colour patterns and fluorescence in scorpions. *Revue Suisse de Zoologie* 2:449–458.
- Mitchell, R.W. 1968. *Typhlochactas*, a new genus of eyeless cave scorpion from Mexico (Scorpionida, Chactidae). *Annals of Speleology* 23:753–777.
- Mitchell, R.W. 1972. *Typhlochactas elliotti*, a new eyeless cave scorpion from Mexico (Scorpionida, Chactidae). *Annals of Speleology* 26:135–148.
- Olivero, P.A., C.I. Mattoni & A.V. Peretti. 2012. Morphometry and geographical variation of *Bothriurus bonariensis* (Scorpiones: Bothriuridae). *Journal of Arachnology* 40:113–122.
- Polis, G.A. 1990. *The Biology of Scorpions*. Stanford University Press, Stanford, California.
- Sanchez-Hernandez, C., A. Rojas-Martínez, J.C. Lopéz-Vidal, C. Elizalde-Arellano, M.D.L. Romero-Almaraz, M. Aguillar-López et al. 2012. Leucism in five species of bats from Mexico. *Chiroptera Neotropical* 18:1123–1127.
- Vignoli V., N. Salomone, T. Caruso & F. Bernini. 2005. The *Euscorpius tergestinus* (C.L. Koch, 1837) complex in Italy: Biometrics of sympatric hidden species (Scorpiones: Euscorpiidae). *Zoologischer Anzeiger* 244:97–113.
- Williams, S.C. 1980. Scorpions of Baja California, Mexico, and adjacent islands. *Occasional papers of the California Academy of Sciences* 135:1–127.

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