

Axanthism in *Pithecopus gonzagai* Andrade et al., 2020 (Anura: Phyllomedusidae)

Cicero Ricardo de Oliveira^{1,4}, Wilmara Mascarenhas², Samuel Cardozo Ribeiro³, Diva Maria Borges Nojosa^{1,4}

¹ Departamento de Biologia, Programa de Pós-graduação em Ecologia e Recursos Naturais, Campus Pici, Universidade Federal do Ceará, Fortaleza, Ceará 60440-900, Brasil

² Departamento de Química Biológica, Programa de Pós-graduação em Diversidade Biológica e Recursos Naturais, Universidade Regional do Cariri, Campus do Pimenta, Rua Cel. Antônio Luiz, 1161, Bairro do Pimenta, Crato, Ceará 63105-000, Brasil.

³ Instituto de Formação de Educadores, Laboratório de Biologia e Ecologia de Animais Silvestres, Universidade Federal do Cariri, Rua Olegário Emídio de Araújo, s/n, Brejo Santo, Ceará 63260-000, Brasil.

⁴ Núcleo Regional de Ofiologia, Bloco 905, Universidade Federal do Ceará, Campus do PICI, Avenida Humberto Monte, s/n, Fortaleza, Ceará 60455-760, Brasil.

Recibida: 09 Agosto 2020

Revisada: 10 Septiembre 2020

Aceptada: 21 Octubre 2020

Editor Asociado: C. Borteiro

doi: 10.31017/CdH.2021.(2020-057)

ABSTRACT

The coloration pattern in wild animals is an important characteristic for survival as well as for intra and interspecific communication, being aberrant colorations rarely observed in vertebrates. Axanthism is the lack of yellow pigmentation, and considered an infrequent anomaly, for which cases have been described in amphibians. We describe herein a case in the frog *Pithecopus gonzagai*, a species characterized by predominantly arboreal habits and widely distributed in northeastern Brazil. This is the first report of an axanthic adult specimen of *P. gonzagai*, found in the municipality of Juazeiro do Norte, Ceará, Brazil.

Key Words: Mutation; Pigment; Color aberrancy; monkey frog; Caatinga.

Coloration plays an important role in many aspects of the natural history of animals, and is often an important feature for inter and intra-specific communication (Silva *et al.*, 2020; Araújo *et al.*, 2020). Intimately linked to animal fitness, color aberrancies rarely occur in nature (Ribeiro and Gogliath, 2012; Silva *et al.*, 2020), possibly due to natural selection, since aberrant individuals may become more visible to predators (Bensch *et al.*, 2000; Rees, 2004). Axanthism is one of these uncommon aberrancies, and refers to the lack of yellow pigmentation in an individual, producing a particular phenotype in populations, which can consist of conspicuous blue, gray or abnormally dark specimens (Chilote and Moreno, 2019).

In amphibians, the most frequently described colour anomalies are albinism and leucism (Lunghi *et al.*, 2017). Although considered less

frequent, cases of animals with axanthism have been described for a large number of amphibians, such as *Bufo bufo* (Kolenda *et al.*, 2017), *Dryophytes japonicus* (Maslova *et al.*, 2018), *Melanophryniscus estebani* (Chilote and Moreno, 2019), *Dendropsophus minutus* (Araújo *et al.*, 2020) and *Smilisca baudinii* (Vásquez-Cruz and Fuentes-Moreno, 2020).

Here we study the specie *Pithecopus gonzagai* is characterized by predominantly arboreal habits, and can be distinguished from other similar species by its smaller size and color pattern, composed mainly of lemon green, which covers the entire back of the animal, white on the abdomen, and orange with black stripes on the inner portions of the hind legs and front (Caramaschi, 2006; Andrade *et al.*, 2020). The recently described species is distributed throughout the northeastern region of Brazil to the north of the São Francisco River, occupying most of

Author for correspondence: riccicer@gmail.com

the Caatinga and Atlantic Forest biome of the states of Alagoas, Pernambuco, Paraíba, Rio Grande do Norte Piauí and Ceará (Caramaschi, 2006; Roberto & Loebmann, 2016; Da Silva *et al.*, 2020; Andrade *et al.*, 2020).

On July 23, 2020, we found an adult axanthic specimen of *P. gonzagai* in the rural area of the municipality of Juazeiro do Norte, northeast Brazil (-7.1625383 S, -39.2808628 W). The individual presented grayish coloration on most of the body, but its usual coloration between the lower and forelimbs was preserved (Fig. 1A). The typical color pattern of the species is usually a vibrant green, with orange bars on the lower thighs (Fig. 1B). The referred specimen was observed in activity during the sunset around 5:30 pm, photographed, and returned to the site of collection.

Axanthic individuals of species with typically green coloration (resulting from the combination of yellow and blue pigments), usually present a darker, blue color pattern (Jablonski *et al.*, 2014; Martínez-Silvestre *et al.*, 2016). Consequently, axanthism is often confused with melanism as observed by Vásquez-Cruz and Fuentes-Moreno (2020).

However, the individual of *P. gonzagai* we observed presented mainly grayish color. Similar observations about darker overall coloration in cases of axanthism have also been reported for axanthic snakes, that are usually called black albinos (Borteiro *et al.*, in press).

The causes that induce axanthism are poorly understood, some factors seem to be related to endogamy, environmental stress, nutritional deficiencies, and pollution (Bensch *et al.*, 2000; Chętnicki *et al.*, 2007; Jablonski *et al.*, 2014). Additionally, the frequency of rare phenotypes could also be an indicator of putative low genetic variability in natural populations (Guevara *et al.*, 2011). This could be an explanation of our study case, since the specimen was found in an anthropized area that although rural, is surrounded by urbanization, which can somehow isolate small local populations.

Even though this chromatic aberration was reported for several species of amphibians around the world, this is the first account concerning a free-living individual of *P. gonzagai*. Future investigations are pertinent in an attempt to uncover the adaptive importance this phenotype, and the consequences on individual fitness.



Figure 1. Comparative dorsolateral views of Axanthism (A) and normal (B) adults of *Pithecopus gonzagai* recorded in the municipality of Juazeiro do Norte, northeast Brazil. (Photos: Mascarenhas, W.).

Acknowledgments

We are grateful the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - for

the scholarship (Code 88882.454307/2019-01), and Fundação Cearense de Apoio ao Desenvolvimento Científico e Tecnológico - FUNCAP for a Productivity scholarship (Code BP3-0139-00323.01.00 / 18

and BP4 00172-00223.01.01/20).

Literature cited

- Andrade, F.S.; Haga, I.A.; Ferreira, J.S.; Recco-Pimentel, S.M.; Toledo, L.F. & Bruschi, D.P. 2020. A new cryptic species of *Pithecopus* (Anura, Phyllomedusidae) in north-eastern Brazil. *European Journal of Taxonomy* 723: 108-134.
- Araújo, K.C.; Cavalcante, L.A.; Oliveira, D.B. & Andrade, E.B. 2020. Axanthism in the treefrog *Dendropsophus minutus* Peters, 1872 (Anura: Hylidae) from a relictual forest mountain in Northeastern Brazil. *Herpetology Notes* 13: 257-259.
- Bensch, S.; Hansson, B.; Hasselquist, D. & Nielsen, B. 2000. Partial albinism in a semi-isolated population of Great Reed Warblers. *Hereditas* 133: 167-170.
- Borteiro, C.; Abegg, A.D.; Oda, F.H.; Cardozo, D.; Kolenc, F.; Etchandy, I.; Bizaiz, I.; Prigioni, C. & Baldo, D. Aberrant colouration in wild snakes: case study in Neotropical taxa and a review of terminology. *Salamandra* (in press).
- Caramaschi, U. 2006. Redefinição do grupo de *Phyllomedusa hypochondrialis*, com redescoberta de *P. megacephala* (Miranda-Ribeiro, 1926), revalidação de *P. azurea* Cope, 1862 e descrição de uma nova espécie (Amphibia, Anura, Hylidae). *Arquivos do Museu Nacional* 64: 159-179.
- Chętnicki, W.; Fedyk, S. & Bajkowska, U. 2007. Cases of coat colour anomalies in the common shrew, *Sorex araneus* L. *Folia biologica* 55: 73-76.
- Chilote, P.D. & Moreno, L.E. 2019. Primer registro de axantismo para el género *Melanophryniscus* (Anura: Bufonidae). *Boletín de la Asociación Herpetológica Española* 30: 60-61.
- Da Silva, F.P.; Fernandes-Ferreira, H.; Montes, M.A. & da Silva, L.G. 2020. Distribution modeling applied to deficient data species assessment: A case study with *Pithecopus nordestinus* (Anura, Phyllomedusidae). *Neotropical Biology and Conservation* 15: 165-175.
- Duellman, W.E.; Marion, A.B. & Hedges, S.B. 2016. Phylogenetics, classification, and biogeography of the tree frogs (Amphibia: Anura: Arboranae). *Zootaxa* 4104: 1-109.
- Frost, D.R. 2020. Amphibian Species of the World: an Online Reference. Version 6.1 Electronic Database accessible at <https://amphibiansoftheworld.amnh.org/index.php>. American Museum of Natural History, New York, USA.
- Accessed: June 21, 2020.
- Guevara, L.; Ramírez-Chaves, H.E. & Cervantes, F.A. 2011. Leucismo en la musaraña de orejas cortas *Cryptotis mexicana* (Mammalia: Soricomorpha), endémica de México. *Revista Mexicana de Biodiversidad* 82: 731-733.
- Jablonski, D.; Alena, A.; Vlček, P. & Jandzik, D. 2014. Axanthism in amphibians: A review and the first record in the widespread toad of the *Bufo viridis* complex (Anura: Bufonidae). *Belgian Journal of Zoology* 144: 93-101.
- Kolenda, K.; Najbar, B.; Najbar, A.; Kaczmarek, P.; Kaczmarek, M. & Skawiński, T. 2017. Rare colour aberrations and anomalies of amphibians and reptiles recorded in Poland. *Herpetology Notes* 10: 103-109.
- Lunghi, E.; Ficetola, G.F.; Barzaghi, B.; Vitillo, C.; Mulargia, M. & Manenti, R. 2017. Melanism in European plethodontid salamanders (Amphibia, Plethodontidae, Hydromantes). *Spixiana* 40: 157-160.
- Martínez-Silvestre, A.; Soler, J. & Montori, A. 2016. Axantismo en *Pelophylax perezi*: nuevas citas en Cataluña. *Boletín de la Asociación Herpetológica Española* 27: 53-55.
- Maslova, I.; Jang, Y.; Zhestkov, A. & Borzée, A. 2018. Colour variants in the Japanese Treefrog (*Dryophytes japonicus*) from Russia and South Korea. *Herpetology Notes* 11: 1007-1008.
- Rees, P.A. 2004. Are white lions ambassadors or conservation white elephants? *International Zoo News* 51: 484-489.
- Ribeiro, L.B. & Gogliath, M. 2012. Um caso de leucismo em pardal, *Passer domesticus* (Linnaeus, 1758) em uma ilha do Rio São Francisco, Nordeste do Brasil. *Biotemas* 25: 187-190.
- Roberto, I.J. & Loebmann, D. 2016. Composition, distribution patterns, and conservation priority areas for the herpetofauna of the state of Ceará, northeastern Brazil. *Salamandra* 52: 134-152.
- Silva, P.J.B.; Farikoski, I.O.; Souza, M.B.; Carmo, E.C.O.; Souza, F.A. & Ribeiro, V.M.F. 2020. Leucismo em jacaretinga: relato de caso. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia* 72: 480-484.
- Vásquez-Cruz, V. & Fuentes-Moreno, A. 2020. Antes verde, ahora azul: primer caso de axantismo en *Smilisca baudinii* (Duméril y Bibron, 1841) (Amphibia: Anura). *Cuadernos de Herpetología* 34: 313-320.

