Nota

Cuad. herpetol. 36 (2): 245-249 (*2022)*

Amelanism in *Amphisbaena darwinii* Duméril & Bibron, 1839 (Squamata: Amphisbaenidae)

Carolina L. Paiva[1], Mateo Cocimano[2], Ricardo Montero[3], Henrique C. Costa[1]

[1] Departamento de Zoologia, Universidade Federal de Juiz de Fora, 36036-900, Juiz de Fora, Minas Gerais, Brazil.

[2] Almirante Brown 776, Quilmes, Buenos Aires, Argentina

[3] Facultad de Ciencias Naturales, Universidad Nacional de Tucumán, Tucumán, Argentina.

Recibida: 30 Noviembre 2021
Revisada: 12 Febrero 2022
Aceptada: 22 Febrero 2022
Editor Asociado: C. Borteiro

doi: 10.31017/CdH.2022.(2021-069)

ABSTRACT

Color anomalies are rarely reported in Amphisbaenia. We present the first record of amelanism in this group based on a specimen of *Amphisbaena darwinii* from Argentina. The photos were uploaded to a citizen science platform, reinforcing the positive impact of citizen science to filling gaps in our knowledge about biodiversity.

Key Words: Amphisbaenia; Citizen Science; Color Anomaly; Hypopigmentation; iNaturalist

Conspicuous chromatic anomalies occur due to pigmentation production disturbances causing aberrant coloration of the skin (Rook *et al.*, 1998). Such anomalies are not common in wild squamates, but have been frequently reported for snakes, especially cases of hypopigmentation (Borteiro *et al.*, 2021). Traditionally, hypopigmentation anomalies were classified as albinism, leucism, and piebaldism. In albinism, there is a complete absence of pigmentation of the skin and eyes caused by hereditary disposition compromising melanocytes, responsible for melanin production (Griffiths *et al.*, 2016). On the other hand, in leucism and piebaldism, which are also known as 'partial albinism', the eyes are pigmented, but there is an almost complete absence of pigmentation in skin (leucism) or there is a pattern of unpigmented patches along the body (piebaldism) (Prüst, 1984; Bechtel, 1991; Lamoreux *et al.*, 2010; Abreu *et al.*, 2013). Recently, Borteiro *et al.* (2021) reviewed color anomalies in Neotropical snakes and proposed a standardized terminology to be used in reptiles, particularly in cases of hypopigmentation: amelanism, albinism, hypomelanism, leucism, and piebaldism.

Hypopigmentation is rarely reported in worm lizards (Amphisbaenia), although it is suggested that such color anomalies would be of little adaptative harm to fossorial species (Sazima & Di-Bernardo, 1991; Kornilios, 2014; Perez & Alvares, 2020). There are records of hypopigmentation in *Amphisbaena munoai* (Perez & Alvares, 2020), *A. darwinii* (cited as *A. d. trachura*) (Chalkidis & Di-Bernardo, 2004), *Blanus strauchi* (Avcý *et al.*, 2018; Kazilas *et al.*, 2018), and *B. vandellii* (cited as *B. cinereus*) (Malkmus, 1997; Cabana & Vázquez, 2008). With the exception of an albino specimen of *B. strauchi* (Avcý *et al.*, 2018), those reports refer to cases of piebaldism, sometimes cited as partial albinism (Malkmus, 1997; Chalkidis & Di-Bernardo, 2004; Cabana & Vázquez, 2008) or even complete albinism (Fig. 1 in Cabana & Vázquez 2008) (Table 1).

On 24 October 2021, at 6:16 p.m., in La Capilla, Buenos Aires Province, Argentina (34.8925° S, 58.2827° W), the father of MC was shoveling in the backyard, when he unearthed a specimen of *Amphisbaena darwinii* which was buried about 50 cm deep (Fig. 1). The specimen was photographed by MC and released. The photos were uploaded to the citizen science website iNaturalist (https://www.inaturalist.org/observations/99297581), where they caught the attention of the remaining authors.

Amphisbaena darwinii is known to occur from

Author for correspondence: ccostah@gmail.com

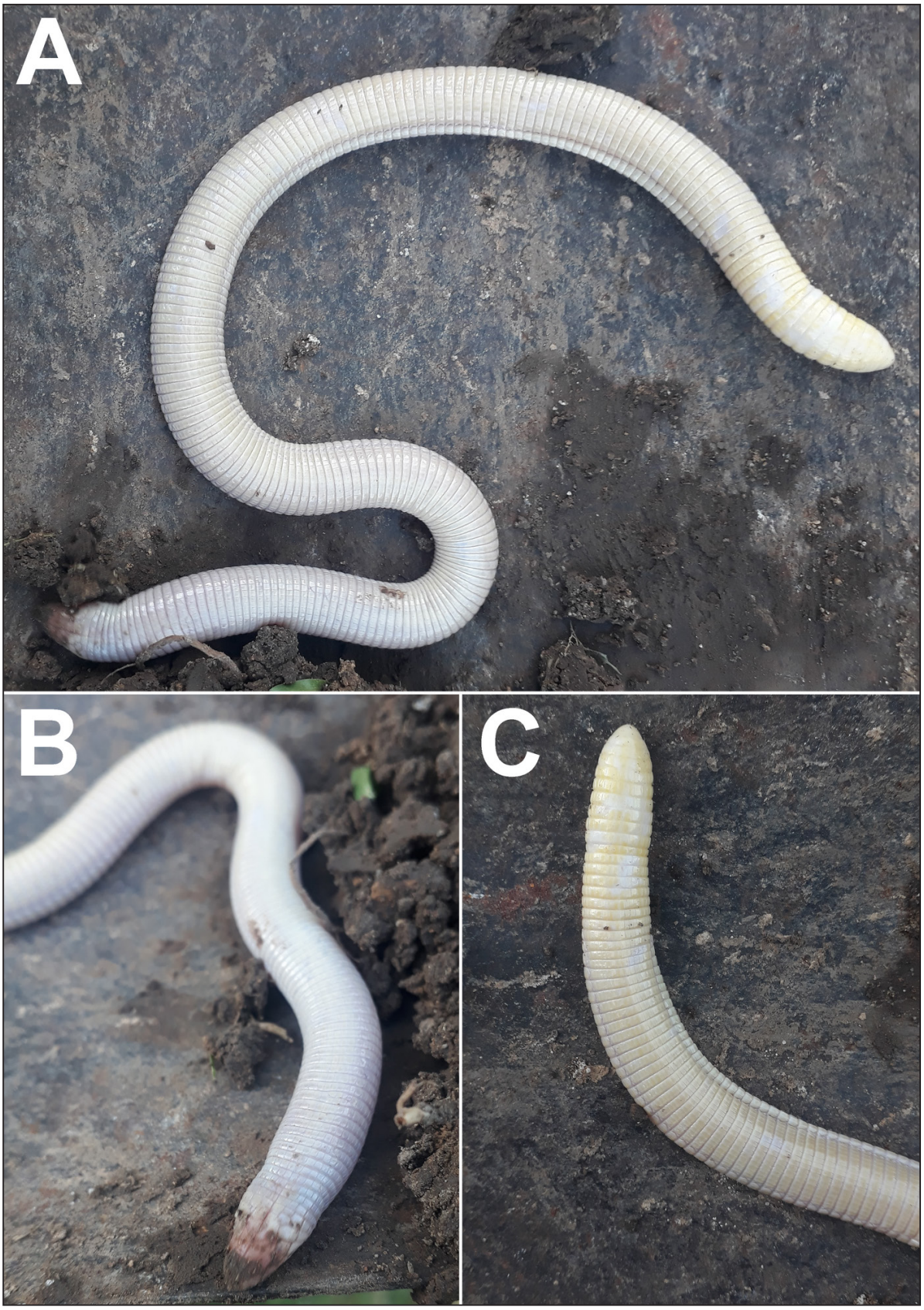

Figure 1. Amelanistic specimen of *Amphisbaena darwinii* unearthed at La Capilla, Buenos Aires Province, Argentina, while a backyard was being shoveled. A) dorsal view of the specimen; B) detail of the head and anterior portion of the body; C) detail of the posterior portion of the body and the tail (note that the tail is not tuberculate and exhibits a pale-yellow color).

Table 1. Published reports of color anomalies in Amphisbaenia.

Taxon	Color anomaly	Source
Amphisbaena darwinii "heterozonata"	Amelanism	This study
Amphisbaena darwinii "trachura"	Piebaldism	(Chalkidis and Di-Bernardo, 2004)
Amphisbaena munoai	Piebaldism	(Perez and Alvares, 2020)
Blanus strauchii	Albinism	(Avcý et al., 2018)
Blanus strauchii	Piebaldism	(Kazilas et al., 2018)
Blanus vandellii	Piebaldism	(Malkmus, 1997; Cabana and Vázquez, 2008)

eastern Bolivia to central Argentina (Montero, 2016). Three subspecies were traditionally recognized: *A. d. darwinii* Duméril & Bibron, 1839, *A. d. heterozonata* Burmeister, 1861 and *A. d. trachura* Cope 1885 – although *darwini* is used by many authors (Gans, 1966; Vanzolini, 2002; Montero, 2016), the original spelling is *darwinii* (Duméril & Bibron, 1839). Some authors have considered these subspecies as valid species (Vanzolini, 2002; Gans, 2005; Perez *et al.*, 2012), but Montero (2016) argued that differences observed are due to clinal variation in morphology, synonymizing *A. heterozonata* and *A. trachura* with *A. darwinii*, without recognition of subspecies. The taxonomy of these taxa was recently reviewed, but still not formally published (Perez, 2016).

Although the photographed specimen was not collected, we can confidently assign its identity to *A. darwinii* due to the following characters that fall within the known variation of the species (Montero, 1996; Vanzolini, 2002): snout rounded, annuli (body+lateral+(autotomy)caudal), 186+2+(8)17; dorsal segments, 13. The number of body annuli (186) falls slightly below the known range of 188–209 in populations from central-eastern Argentina (traditionally assigned to *A. d. heterozonata*; Montero, 1996), but is consistent with the low count observed in the southernmost populations; nevertheless, the counts may be inaccurate as they are based on a photo in dorsal view (Fig. 1A), and the position of the cloaca was estimated based on the posterior end of the lateral sulci. The specimen exhibits a smooth surface at the end of the tail, in congruence with central-eastern Argentina populations (tuberculated in Brazilian populations, traditionally assigned to *A. d. trachura*). We can eliminate the other amphisbaenian species that may occur in the area (*A. kingii* and *A. angustifrons angustifrons*) (Montero, 1996), based on the rounded head shape (keeled in *A. kingii*) and the presence of a well-marked autotomy annulus (absent in *A. a. angustifrons*) (Gans & Diefenbach, 1972).

Typical specimens of *A. darwinii* are brown dorsally (with pigmentation more concentrated in the center of each dorsal segment/scale), darker in the head and tail (Gans, 1966). The photographed specimen reported here clearly lacks normal pigmentation, except for some pale-yellow segments on the posteriormost portion of the body, including the tail (Fig. 1C). Based on the terminology proposed by Borteiro *et al.* (2021), the present case cannot be considered albinism, as there is not a 'total absence of pigments', evidenced by the presence of yellowish stains on the body. The absence of melanin rules out that it may be a case of hypomelanism, leucism or piebaldism (Borteiro *et al.*, 2021). Therefore, we can assume the individual here reported was amelanistic in the sense of Borteiro *et al.* (2021). To the best of our knowledge, this is the first published report of amelanism in Amphisbaenia (Table 1). In the past decades, RM examined hundreds of *A. darwinii* in collections (Montero, 2016) and never recorded naturally unpigmented specimens, suggesting hypopigmentation is a rare condition in this taxon.

Citizen science is gaining space in the last years

as an important tool to increase our understanding of biodiversity (Suprayitno *et al.*, 2017; Rowley 2020; Maritz & Maritz, 2020; Yves *et al.*, 2021), and iNaturalist stands out as one of the main platforms for citizen scientists (Hochmair *et al.*, 2020; Maritz & Maritz, 2020; Marshall *et al.*, 2020). Our report reinforces the relevance and positive impact of citizen science in contributing to filling gaps in our knowledge about the natural world, including the secretive worm lizards.

Acknowledgments

We are grateful to an anonymous referee and the subject editor Claudio Borteiro for valuable comments on a first version of this article; and to Ross D. MacCulloch for English review.

Literature cited

Abreu, M.S.L., Machado, R., Barbieri, F., Freitas, N.S. & Oliveira, L.R. 2013. Anomalous colour in Neotropical mammals: a review with new records for *Didelphis* sp. (Didelphidae, Didelphimorphia) and *Arctocephalus australis* (Otariidae, Carnivora). *Brazilian Journal of Biology* 73: 185-194.

Avcý, A., Üzüm, N., Bozkurt, E. & Olgun, K. 2018. The uncommon morphological feature in reptiles: Albinism in the Turkish worm lizard, *Blanus strauchi* (Bedriaga, 1884) (Amphisbaenia, Blanidae). *Russian Journal of Herpetology* 25: 154-156.

Bechtel, H.B. 1991. Inherited color defects: comparison between humans and snakes. *International Journal of Dermatology* 30: 243-246.

Borteiro, C., Abegg, A.D., Oda, F. H., Cardozo, D., Kolenc, F., Etchandy, I., Bisaiz, I., Prigioni, C. & Baldo, D. 2021. Aberrant colourations in wild snakes: case study in Neotropical taxa and a review of terminology. *Salamandra* 57: 124-138.

Cabana, M. & Vázquez, R. 2008. Albinismo parcial y total de *Blanus cinereus* (Vandelli, 1797) en la Península Ibérica. *Boletín de la Asociación Herpetológica Española* 19: 39-40.

Chalkidis, H.M. & Di-Bernardo, M. 2004. *Amphisbaena darwinii trachura* (Worm Lizard). Albinism. *Herpetological Review* 35: 165.

Duméril, A.M.C. & Bibron, G. 1839. *Erpétologie Générale ou Histoire Naturelle Complète des Reptiles*. Paris: Librairie Encyclopédique de Roret. 854 pp.

Gans, C. 1966. Studies on Amphisbaenids (Amphisbaenia, Reptilia) 3. The small species from southern South America commonly identified as *Amphisbaena darwini. Bulletin of the American Museum of Natural History* 134: 185-260.

Gans, C. 2005. Checklist and bibliography of the Amphisbaenia of the World. *Bulletin of the American Museum of Natural History* 289: 1-130.

Gans, C. & Diefenbach, C.O. 1972. Description and geographical variation of the South American *Amphisbaena angustifrons*: the southernmost amphisbaenian in the World (Reptilia, Amphisbaenia). *American Museum Novitates* 2494: 1-20.

Griffiths, A.J.F., Wessler, S.R., Carrol, S.B. & Doebley, J. 2016. Introdução à Genética. Rio de Janeiro: Guanabara-Koogan. 178 pp.

Hochmair, H.H., Scheffrahn, R.H., Basille, M. & Boone, M. 2020. Evaluating the data quality of iNaturalist termite records. *PLoS ONE* 15: e0226534.

Kazilas, C., Kalaentzis, K. & Strachinis, I. 2018. A case of piebaldism in the Anatolian Worm Lizard, *Blanus strauchi* (Bedriaga, 1884), from Kastellorizo Island, Greece (Squamata: Blanidae). *Herpetology Notes* 11: 527-529.

Kornilios, P. 2014. First report of piebaldism in scolecophidians: a case of *Typhlops vermicularis* (Squamata: Typhlopidae). *Herpetology Notes* 7: 401-403.

Lamoreux, M.L., Delmas, V., Laure, L. & Bennett, D.C. 2010. *The color of mice. A model genetic network.* Bryan: Wiley-Blackwell. 59 pp.

Malkmus, R. 1997. Partieller Albinismus bei der Netzwühle, *Blanus cinereus* (Vandelli, 1797) in Portugal (Reptilia: Amphisbaenidae). *Sauria* 19: 45-46.

Maritz, R.A. & Maritz, B. 2020. Sharing for science: high-resolution trophic interactions revealed rapidly by social media. *PeerJ 8: e9485.*

Marshall, B.M., Freed, P., Vitt, L.J., Bernardo, P., Vogel, G., Lotzkat, S., Franzen, M., Hallermann, J., Sage, R.D., Bush, B., Duarte, M.R., L. Avila, J., Jandzik, D., Klusmeyer, B., Maryan, B., Hosek, J. & Uetz, P. 2020. An inventory of online reptile images. *Zootaxa* 4896: 251-264.

Montero, R. 1996. Lista de localidades de Amphisbaenia de la República Argentina. *Cuadernos de Herpetología* 10: 25-45.

Montero, R. 2016. On the validity of several Argentinian species of Amphisbaena (Squamata, Amphisbaenidae). *Journal of Herpetology* 50: 642-653.

Perez, R. 2016. Revisão taxonômica e sistemática filogenética do complexo de espécies associadas à *Amphisbaena darwinii* (Amphisbaenia: Amphisbaenidae) a partir de dados morfológicos e moleculares. PhD Thesis. Porto Alegre: Universidade Federal do Rio Grande do Sul.

Perez, R. & Alvares, D.J. 2020. First record of piebaldism in the Munoa worm lizard (*Amphisbaena munoai*). *Herpetological Bulletin* 154: 35-36.

Perez, R., Ribeiro, S. & Borges-Martins, M. 2012. Reappraisal of the taxonomic status of *Amphisbaena prunicolor* (Cope 1885) and *Amphisbaena albocingulata* Boettger 1885 (Amphisbaenia: Amphisbaenidae). *Zootaxa* 3550: 1-25.

Prüst, E. 1984. Albinism in snakes. *Litteratura Serpentium* 4: 6-15.

Rook, A., Wilkinson, D.S., Ebling, F.J.B., Champion, R.H. & Burton, J.L. 1998. *Textbook of Dermatology.* Boston: Blackwell Science. 3683 pp.

Rowley, J.J.L. 2020. Citizen Science and Herpetology: joining forces to increase our impact. *Herpetological Review* 51: 412-413.

Sazima, I. & Di-Bernardo, M. 1991. Albinismo em serpentes neotropicais. *Memórias do Instituto Butantan* 53: 167-173.

Suprayitno, N., Narakusumo, R.P., von Rintelen, T., Hendrich, L. & Balke, M. 2017. Taxonomy and Biogeography without frontiers – WhatsApp, Facebook and smartphone digital photography let citizen scientists in more remote localities step out of the dark. *Biodiversity Data Journal* 5: e19938.

Vanzolini, P.E. 2002. An aid to the identification of the South American species of *Amphisbaena* (Squamata,

Amphisbaenidae). *Papéis Avulsos de Zoologia* 42: 351- 362.

Yves, A., Rios, C.H.V., Lima, L.M.C., Araújo, S.M.C., Ferreira, J.G., Mendonça, S.H.S.T. & Costa, H.C. 2021. Predation attempt of *Ameivula cipoensis* (Squamata: Teiidae) by *Tropidurus montanus* (Squamata: Tropiduridae): A citizen science case. *Herpetologia Brasileira* 10: 139-143.