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FIRST REPORT OF OCULAR HETEROCHROMIA IN *BOANA MARGINATA* (BOULENGER, 1887) (ANURA: HYLIDAE) IN ATLANTIC FOREST, SOUTHERN BRAZIL

PRIMER REPORTE DE HETEROCROMÍA OCULAR EN *BOANA MARGINATA* (BOULENGER, 1887) (ANURA: HYLIDAE) EN LA MATA ATLÁNTICA, SUR DE BRASIL

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Resumen.– Reportamos el primer caso documentado de heterocromía ocular en un individuo de *Boana marginata* (Boulenger, 1887) observado en el bioma de la Mata Atlántica, en el municipio de Treviso, Santa Catarina, Brasil. El espécimen fue encontrado en un área ribereña a lo largo de las márgenes del río Pio, caracterizada por una vegetación densa y sustratos rocosos. El individuo presentó heterocromía unilateral completa, caracterizada por una coloración azul vívida del íris, contrastando marcadamente con el patrón ocular típico de la especie. Discutimos los factores potenciales que subyacen a esta anomalía y sus implicaciones ecológicas para la especie. Este registro contribuye a la comprensión de las anomalías de color en anfibios y resalta la necesidad de realizar más estudios sobre los impactos ecológicos de tales anomalías en poblaciones naturales.

Palabras clave.– Anfibios, anomalías, anomalía de color, rana.

Abstract.– We report the first documented case of ocular heterochromia in an individual of *Boana marginata* (Boulenger, 1887) observed in the Atlantic Forest biome, in the municipality of Treviso, Santa Catarina, Brazil. The specimen was found in a riparian area along the banks of the Pio River, characterized by dense vegetation and rocky substrates. The individual exhibited complete unilateral heterochromia, characterized by a vivid blue coloration of the iris in the right eye, contrasting sharply with the species' typical ocular pattern. We discuss the potential factors underlying this anomaly and its ecological implications for the species. This record contributes to understanding color anomalies in amphibians and highlights the need for further studies on the ecological impacts of such anomalies in natural populations.

Keywords.–Amphibians, anomalies, color anomaly, treefrog.

Anomalies represent deviations from the normal phenotypic spectrum, encompassing morphological and non-morphological traits (Johnson et al., 2010; Henle et al., 2017). In amphibians, anomalies may arise from genetic factors or external stressors, including environmental contamination (Ouellet et al., 1997; Huang et al., 2014), UV-B radiation (Blaustein et al., 1997), parasitic infections (Kiesecker, 2002), and predation (Blaustein & Johnson, 2003; Johnson et al., 2010). The most prevalent anomalies include amelia (limb absence), anophthalmia (unilateral or bilateral eye absence), ectrodactyly (digit absence), polydactyly (supernumerary digits), and polymelia (partial or complete limb duplication; Peltzer et al., 2011; Ramalho et al., 2017; de

Souza et al., 2021; Gobel et al., 2022). These malformations occur more frequently in agricultural landscapes, where pesticide and agrochemical contamination are common (Borges et al., 2019). In contrast, amphibian populations in protected environments exhibit anomaly rates as low as 5 % (Blaustein & Johnson, 2003).

Henle et al. (2017) defined "color anomaly" as non-skeletal abnormalities primarily involving pigmentation disorders, such as albinism, flavism, erythrism, melanism, and blue-colored individuals. Among these, ocular heterochromia is characterized by variations in iris coloration and morphology in one or both eyes (Saniasiaya, 2020). This condition is classified into three types: complete (distinct iris colors between eyes), partial (sectoral color variation within a single iris), or central (a pigmented ring radiating from the pupil into the iris) (Silva et al., 2021).

Ocular heterochromia remains poorly documented in amphibians, with few reported cases globally (e.g., Cortés-Suárez et al., 2021; Alvarez et al., 2022; Hernández-Vázquez et al., 2023). In Brazil, all documented cases involve species of the family Hylidae (n = 4). The first reported case of heterochromia was in *Nyctimantis arapapa* (Pimenta, Napoli, and Haddad, 2009), in the Atlantic Forest of Bahia state, with two juvenile individuals displaying abnormal blue coloration in at least one eye, however, this case lacked sufficient detail to allow for comparisons (Lourenço-de-Moraes et al., 2013). The second was described in *Osteocephalus oophagus* Jungfer & Schiesari, 1995, in the Amazon region, represented by an individual with one eye exhibiting a grayish color (Pedroso-Santos et al., 2022). The third and fourth cases, both in *Boana albomarginata* (Spix, 1824), occurred in the Atlantic Forest biome of Bahia state, with one individual having a completely blue iris in the left eye and another individual showing a blue patch in the lower half of the right iris (Melo et al., 2024). Among these cases, only the last one resembles our report.

In this study, we report complete heterochromia in one individual of *Boana marginata* (Boulenger, 1887). During a trekking activity at 10:00 h on December 21, 2024, at Pousada Santo Antônio (28° 29' 35" S, 49° 31' 49" W, 556 m a.s.l.), municipality of Treviso, Santa Catarina, Brazil, the specimen was observed on a rock along the banks of the Pio River. The individual exhibited a vivid blue coloration across the iris in the right eye (Fig. 1A, B). The typical ocular pattern of *B. marginata* is characterized by a horizontally elliptical black pupil, a golden/copper iris with dark reticulations, and a horizontal brown band crossing the pupil (Fig. 1C).

Iris and pupil anomalies may impair vision, affecting critical behaviors such as predator detection and foraging efficiency in amphibians (Pedroso-Santos et al., 2022). Heterochromia in these organisms can arise from spontaneous or induced mutations altering pigment distribution or abundance in chromatophores, resulting in color variants (Henle et al., 2017). For example, biliverdin, the end product of heme catabolism, is a blue-green hue pigment abundant in many anuran species, and the dominant blue coloration in the affected eye of *B. albomarginata* may result from the accumulation of this pigment in the ocular region (Jones, 1967; Taboada et al., 2017). In addition, physical trauma or larval-stage predator-induced injuries are also potential causes of ocular abnormalities (Bowerman et al.,

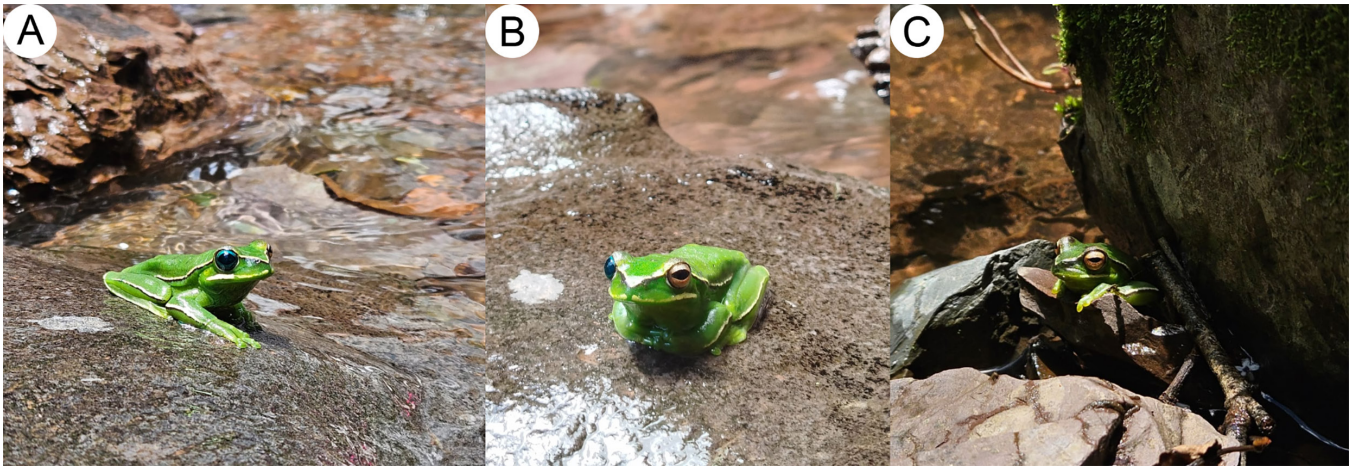

Figura 1. A, B) Individuo de *Boana marginata* con heterocromía en el ojo derecho y C) Patrón usual de coloración ocular en *Boana marginata* encontrado en la misma localidad. Fotos: Daniela G. F. Comin y Samuel C. R. de Oliveira.

Figure 1. 1: A, B) Individual of *Boana marginata* with heterochromia on the right eye and C) Usual pattern of eye coloration in *Boana marginata* found in the same locality. Photos: Daniela G. F. Comin and Samuel C. R. de Oliveira.

2010) and may explain the dilated pupil observed in the *Boana marginata* individual. For arboreal species like *B. marginata*, vision is essential for prey localization, short-range pursuit, and food acquisition (Freed, 1988). Reduced or absent visual acuity could diminish prey capture success and increase predation risk, ultimately compromising reproductive success of individuals.

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