

ANOMALIES IN AMPHIBIANS (ANURA: BUFONIDAE) FROM NORTHEASTERN BRAZIL

ANOMALÍAS EN ANFIBIOS (ANURA: BUFONIDAE) DEL NORESTE DE BRASIL

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Received: 2023-08-25. Accepted: 2023-10-17. Published: 2023-11-10.

Editor: Adriana Manzano, Argentina.

Resumen.– Se han informado anomalías en poblaciones naturales de anfibios de más de 400 especies de todo el mundo. Estas anomalías son difíciles de registrar, principalmente porque sus hallazgos suelen ser fortuitos, y aún escasos para la mayoría de especies y regiones. Aquí presentamos tres nuevos registros de anomalías morfológicas en bufónidos del noreste de Brasil. Este es el primer estudio que reporta anomalías oculares (anofthalmia y catarata) en *Rhinella diptycha* y el primer reporte de una anomalía en *Rhinella mirandaribeiroi* en Brasil.

Palabras clave.– Anormalidades morfológicas, bufónidos, *Rhinella diptycha*, *Rhinella mirandaribeiroi*, estado de Piauí, Brasil.

Abstract.– Anomalies in natural amphibian populations have been reported for over 400 species from around the world. These anomalies are difficult to register and their observations are still scarce for most species and regions, due mainly to their fortuitous nature. Here, we present three new records of morphological anomalies in bufonids from northeastern Brazil. This is the first study to report ocular anomalies (anophthalmia and cataract) in *Rhinella diptycha* and the first report of an anomaly in *Rhinella mirandaribeiroi* in Brazil.

Keywords.– Morphological abnormalities, bufonids, *Rhinella diptycha*, *Rhinella mirandaribeiroi*, state of Piauí, Brazil.

Amphibians are considered the most endangered class of vertebrates in the world, with 41% of its species threatened with extinction (Luedtke et al., 2023). Because they have highly vascularized skin and a life cycle that, in general, requires a transition between aquatic and terrestrial environments, amphibians are highly vulnerable to diseases, parasites, predators and environmental pollution. These factors can significantly increase the risk of anomalies in amphibians (Johnson et al., 2002; Kiesecker et al., 2004; Taylor et al., 2005; Johnson et al., 2006; Henle et al., 2017a; Haas et al., 2018; Herek et al., 2020; Rebouças et al., 2021). Thus, high rates of anomalies could pose a serious problem for amphibian populations around the world, accelerating the decline of already threatened and vulnerable species (Johnson et al., 2001).

Rhinella diptycha (Cope, 1862) is a large species (~ 171 mm, Stevaux, 2002), widely distributed in Brazil (Frost, 2023). It has a generalist and opportunistic diet, feeding on a wide variety of items, including fruits and congener species, because it also

practices anurophagy and cannibalism (da Silva et al., 2010; Fonseca et al., 2018; Severgnini et al., 2020; Benício, 2021; Costa & Brito, 2022). In northeastern Brazil, it is one of the amphibian species with the highest number of associated parasites (Benício et al., 2022), including blood parasites (Úngari et al., 2022).

Rhinella mirandaribeiroi (Gallardo, 1965) is a medium-sized species (~ 60 mm, Narvaes & Rodrigues, 2009), widely distributed in the Cerrado biome, but also occurring in Cerrado enclaves in the Amazon, ecotonal areas and in the Caatinga *sensu stricto* (de Pina et al., 2015; Benício et al., 2015). Found in open areas, *R. mirandaribeiroi* exhibits an explosive reproduction in permanent or temporary pools (Narvaes & Rodrigues, 2009). It has been reported to be infected with blood parasites (Úngari et al., 2022).

In this study, we present three records of morphological anomalies in *Rhinella diptycha* and *Rhinella mirandaribeiroi* from northeastern Brazil. We followed the classification of morphological abnormalities according to Henle et al. (2017b).

These species are common in the region and were identified based on morphological characters described in specialized literature (i.e., Stevaux, 2002; Narvaes & Rodrigues, 2009). There are no other similar species to *R. diptycha* in the region. *Rhinella granulosa* (Spix, 1824) is similar to *R. mirandaribeiroi*, however, the latter has a white line along the entire back (Fig. 1). After the observations, all individuals were released in their original habitats. For comparison purposes, we have included

photos of specimens without anomalies in all the tables. The first record was observed on November 14, 2020 at 22:38 h, in the municipality of Barras (4°15'12" S, 42°17'46" W), northern region of the state of Piauí, northeastern Brazil. An individual of *Rhinella mirandaribeiroi* was observed presenting an anomaly (amely) in the two posterior limbs (Fig. 1). Given that we did not collect this individual, we cannot support a hypothesis of congenital anomaly. On the other hand, an unsuccessful predation event

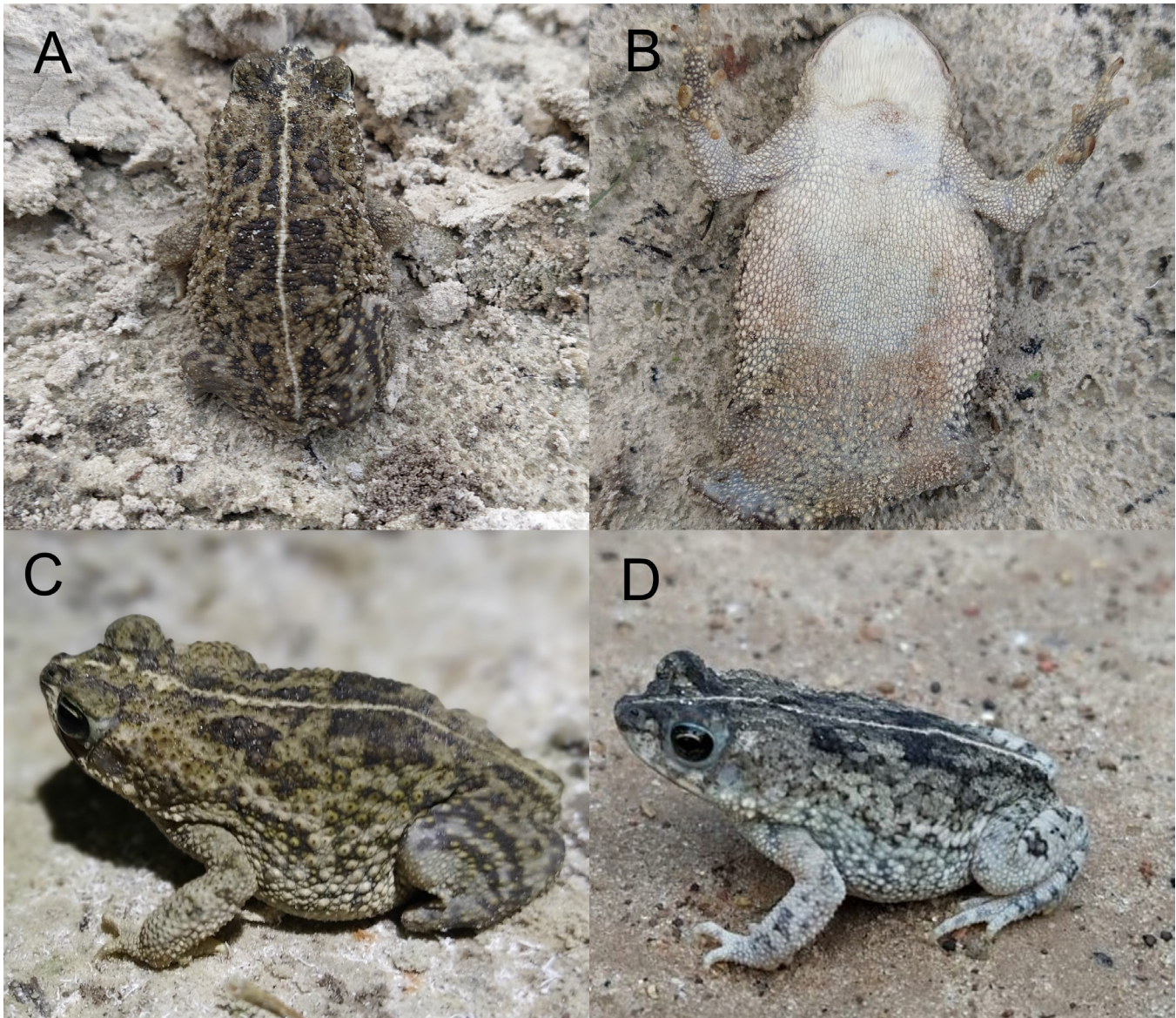


Figura 1. Individuo de *Rhinella mirandaribeiroi* que presenta malformación en las extremidades posteriores (amelia). (A) vista dorsal, (B) vista ventral, (C) vista lateral, (D) Individuo con extremidades posteriores normales.

Figure 1. Individual of *Rhinella mirandaribeiroi* presenting malformation in the hind limbs (amely). (A) dorsal view, (B) ventral view, (C) lateral view, (D) Individual with normal hind limbs.

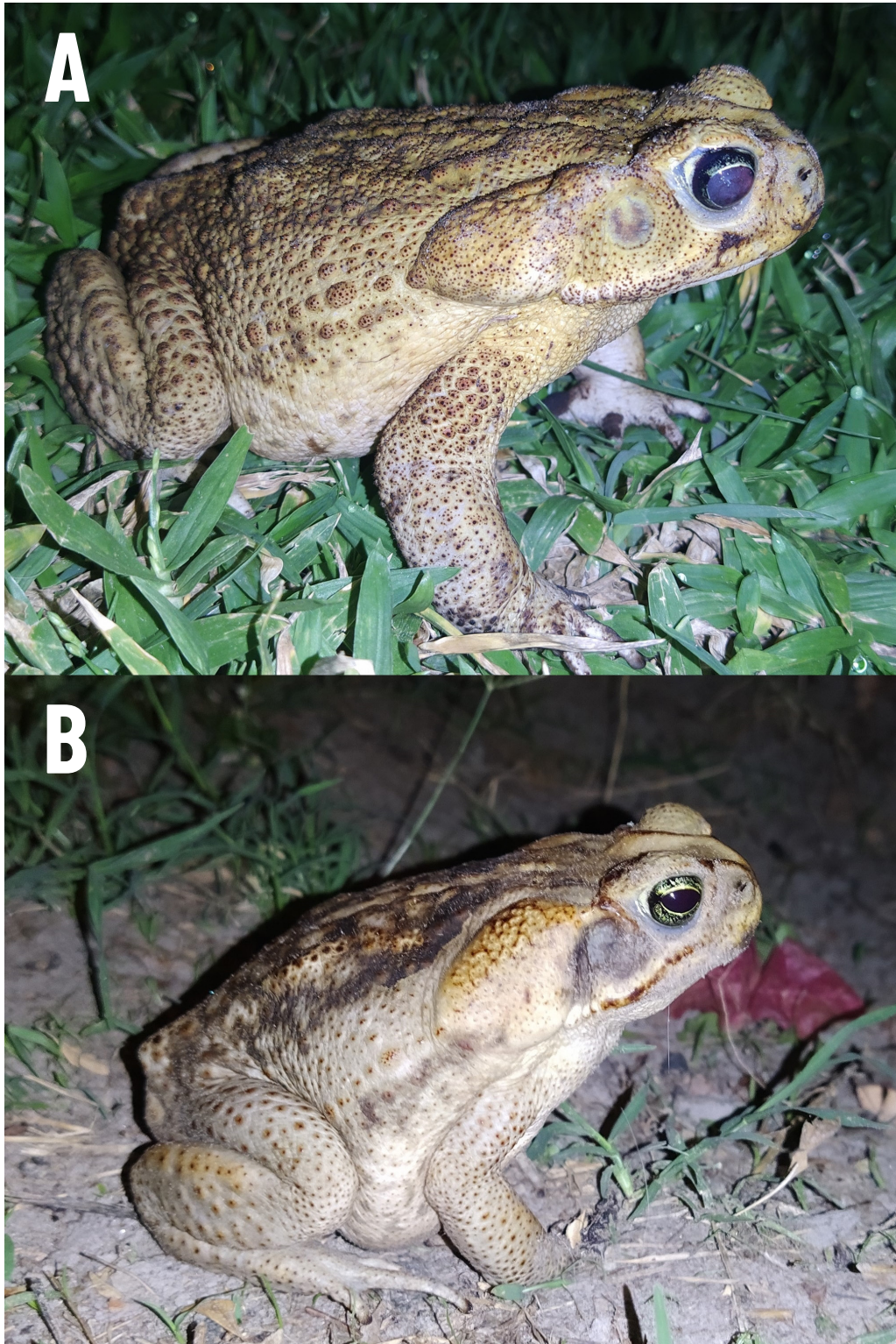


Figura 2. A - Individuo de *Rhinella diptycha* que presenta malformación ocular (catarata). B - Individuo de *Rhinella diptycha* con ojo normal.
Figure 2. A - Individual of *Rhinella diptycha* presenting ocular malformation (cataract). B - Individual of *Rhinella diptycha* with normal eye.

could also be a possible explanation for this abnormality. In fact, recent records (Benício, 2021) have shown that this species can be predated and eventually consumed by other larger bufonid species that are present in the same area, for example *Rhinella diptycha*.

The second record was observed on January 7, 2021 at 21:02 h, also in the municipality of Barras (4°15'13" S, 42°17'46" W), state of Piauí, northeastern Brazil. An individual of *Rhinella diptycha* was observed with ocular anomaly, appearing as cataract (Fig. 2). This individual seemed to be unwell, lethargic and thin for his size. We hypothesize that parasitism is a possible explanation for this ocular anomaly.

The third record was observed on February 1st, 2023 at 19:18 h, in the municipality of Picos (7°04'54" S, 41°26'10" W), south-central region of the state of Piauí, northeastern Brazil. An individual of *Rhinella diptycha* was observed to have an ocular anomaly (anophthalmia) in the left eye (Fig. 3). Note that the specimen's nostril is also injured (Fig. 3C). Most likely, this ocular anomaly is due to an unsuccessful attempt of predation or even an injury caused by humans – in the latter case, this suggests the urgent need for environmental education work on amphibians. Personally, we have frequently observed people's disregard for amphibians in the region. These observations corroborate previous findings, where the death of amphibians caused by human aversion can have serious impacts at a local level, especially in populations that occur in urbanized areas (Deutsch et al., 2021). A week later, we found again this specimen, foraging in the same location and consuming insects that moved on the ground. The eye looked more scarred and the animal was leaner compared to the previous week and to other individuals from the same location.

Anomalies in natural amphibian populations have been reported for over 400 species from around the world (Henle et al., 2017a). Specifically ocular anomalies, several abnormalities have been recorded in bufonid species. For example, anophthalmia in *Rhinella crucifer* (Wied-Neuwied, 1821), *Rhinella icterica* (Spix, 1824) (Haddad et al., 1990), *Incilius occidentalis* (Camerano, 1879) (Castro-Torreblanca and Blancas-Calva, 2021), *Rhinella proboscidea* (Spix, 1824) (Souza et al., 2021) and *Rhinella horribilis* (Wiegmann, 1833) (Bastidas et al., 2022), hyperxanthism, opacity or whitened eye in *Peltophryne taladai* (Schwartz, 1960) (Bosch and Marrero, 2020), microphthalmia in *Bufo bufo* (Linnaeus, 1758), corectopy and dyscoria in *Bufo viridis* (Laurenti, 1768) (Szkudlarek, 2020), and black-eyed and cataract in *Rhinella ornata* (Spix, 1824) (Souza et al., 2021; Guarabyra et al., 2023). On the other hand, although limb anomalies are one of the



Figura 3. Individuo de *Rhinella diptycha* que presenta malformación ocular (anofthalmia). A - vista lateral (ausencia de ojo izquierdo), B - vista lateral (ojo derecho normal), C - vista frontal (tenga en cuenta que las narinas del ejemplar también están lesionadas).

Figure 3. Individual of *Rhinella diptycha* presenting ocular malformation (anophthalmia). A - side view (absence of left eye), B - side view (normal right eye), C - front view (note that the specimen's nostril is also injured).

most common abnormalities in amphibians (Souza et al., 2021), the total absence of a limb (amely) has been rarely reported in bufonids: *Peltophryne florentinoi* (Moreno & Rivalta, 2007) (Bosch et al., 2021) and *Rhinella marina* (Linnaeus, 1758) (Souza et al., 2021). In Brazil, the Bufonidae family has been the third one with the highest number of records of anomalies (preceded by Hylidae and Leptodactylidae) and several species of the genus *Rhinella* have been registered with anomalies (Souza et al., 2021). Despite this, this is the first study to report ocular anomalies (anophthalmia and cataract) for *Rhinella diptycha* in the mainland (for island populations see Toledo & Ribeiro, 2010; Toledo et al., 2014; Rebouças et al., 2021) and this is the first report of an anomaly in *Rhinella mirandaribeiroi* in Brazil.

Several studies have described some type of anomaly in amphibians and its importance in the decline of populations (e.g., Ouellet, 2000; Cohen Jr., 2001; Kiesecker et al., 2004; Henle et al., 2017a; Herek et al., 2020). Although *Rhinella diptycha* and *R. mirandaribeiroi* are nationally assessed as least concern (ICMBio, 2018), locally populations have been recorded with high rates of fungi occurrences (Bd), parasites and anomalies (Benício et al., 2019; Benício et al., 2022; this study). The combination of the high vulnerability of amphibians to diseases and their pathogens, the records of anomalies and the risk of extinction of local populations reinforce the importance of natural history studies to better understand these relationships and their consequences. Thus, we recommend that further studies should assess the extent of these findings and the environmental quality of the study areas where these abnormalities are more frequent, in order to evaluate their impact on local amphibian populations and to propose conservation measures.

Acknowledgements.– We thank the Conselho Nacional de Desenvolvimento Científico Tecnológico – CNPq and Fundação de Amparo à Pesquisa do Estado do Piauí – FAPEPI for financial support (Proc. 301239/2022-3).

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