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Defensive behavior in *Rhinella granulosa* (Spix, 1824) (Amphibia: Anura: Bufonidae)

Sarah Mângia[1,*] and Diego José Santana[2]

Abstract. Amphibians are a common prey for vertebrates and invertebrates. Species incapable of rapid scape have developed various defensive strategies in response to predators. We describe a previously unrecorded defensive behavior in a male of *Rhinella granulosa* called stiff-legg. This behavior was already reported on 17 anuran species.

Keywords. Defensive strategy, leaf-litter, stiff-legged.

Introduction

Amphibians are a common prey for a wide variety of vertebrate and invertebrate predators (Duellman and Trueb, 1994; Toledo et al., 2007). Most anurans seem to rely on escape behavior to avoid predation. Accordingly, species incapable of rapid scape have developed various defensive behaviors in response to predators, such as death feigning, stiff-leggs, lung inflation, opening the mouth in a threatening pose, and body raising (Duellman and Trueb, 1994; Toledo et al., 2011).

Rhinella granulosa (Spix, 1824) is a small to medium-sized bufonid frog occurring in Northeastern Brazil, predominantly at the Caatinga Domain, in the States of Minas Gerais, Bahia, Espírito Santo, Alagoas, Ceará, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, and Sergipe (Narvaes and Rodrigues, 2009). This species belongs to the *Rhinella granulosa* group, which is characterized by having a small parotoid gland, wart skin, and well-developed and keratinized cranial crests (Narvaes and Rodrigues, 2009). Here we describe a new type of defensive behavior for *Rhinella granulosa* from the transitional area between the Caatinga and Atlantic Forest domains in Rio Grande do Norte, Northeastern Brazil.

Materials and Methods

We observed a defensive behavior displayed by *Rhinella granulosa* during an anuran survey at the Escola Agrícola de Jundiaí, Macaíba, Rio Grande do Norte, Brazil (5° 53‘ S, 35° 23‘ W) on 26 August 2012 at 20:00 h. The individual was collected and deposited at the Coleção Herpetológica do Laboratório de Anfíbios e Répteis da Universidade Federal do Rio Grande do Norte (AAGARDA 5942). In this paper we follow the systematic classification of Pyron and Wiens (2011).

Results and Discussion

One male of *Rhinella granulosa* flattened its body and stretched out its legs when manipulating for photographs (Figure 1). Additionally, its lungs were slightly inflated. It remained in this stretched position for about one minute. This defensive strategy is described as stiff-legged posture (Sazima 1978). It is suggested that by displaying this behavior frogs could mimic fallen leaves, confusing visually oriented predators.

The stiff-legged posture is recorded in leaf-litter species. However, *R. granulosa* is commonly found at the margin of ponds and streams, and also refuging in ground holes (Ramos and Gasparini, 2004). The individual recorded in this work was collected at the transitional area between the Caatinga and Atlantic Forest domains, with scarce leaf-litter.

Currently, the stiff-legged posture is known in 17 frog species from six families, namely Bufonidae [*Dendrophryniscus leucomystax*, *D. brevipollicatus* (Bertoluci et al., 2007), and *D. berthalutzae* (Toledo et al., 2011)], Craugastoridae [*Euparkerella cochranae* (Toledo et al., 2011)], Cycloramphidae [*Zachaenus parvulus* (Rocha et al., 1998)], Leptodactylidae [*Scythrophrys sawayae* (Garcia, 1999), *Pleurodema bibroni* (cited as “death feigning” by Kolenc et al., 2009), *Paratelmatobius poecilogaster* (Toledo et al., 2011)], Microhylidae [*Stereocyclops parkeri* (Sazima, 1978), *Chiasmocleis ventrimaculata*, *Ctenophryne geayi* (Schlüter and Salas, 1991; Menin and Rodrigues, 2007), *Arcovomer passarellii* (Giaretta and Martins, 2009)], Odontophrynidae [*Proceratophrys appendiculata*

1 Caipora Consultoria e Meio Ambiente LTDA, Muriaé, Minas Gerais, Brazil.

2 Departamento de Sistemática e Ecologia, Centro de Ciências Exatas e da Natureza, Universidade Federal da Paraíba, João Pessoa, PB, Brazil.

* Corresponding author: e–mail: sarahmangia@yahoo.com.br

Figure 1. A male of *Rhinella granulosa* (48.5 mm SVL; AAGARDA 5942) from Macaíba, Rio Grande do Norte, Brazil, displaying stiff-legged defensive behavior.

(Sazima, 1978), *P. moehringi* (Weygoldt, 1986), *P. boiei* (Toledo and Zina, 2004; Costa et al., 2009), *P. melanopogon* (Moura et al., 2010)]

Since the stiff-legged posture occurs in different clades within Neobatrachia (sensu Pyron and Wiens, 2011), we hypothesize that trait could be a plesiomorphic character in this clade. Additionally, the stiff-legged posture is only known in leaf-litter frogs. Thus, this behavior seems to be displayed by forest-dwelling species, and probably other species (e.g., arboreal hylids and centrolenids) have lost or never displayed this behaviour, since they live in different habitats. Nevertheless, another approach is that environment can play a key role in the expression of this behavior. A better way to test this hypothesis would be reconstruct the ancestral character for this behavior (e.g. Schluter et al., 1997; Pagel, 1999; Pagel et al., 2004; Wu et al., 2009), performing an evaluation how this behavior appears in Neobatrachia during its diversification.

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