

## Notas / Notes

### Predation of *Rhinella crucifer* (Wied-Neuwied, 1821) (Anura: Bufonidae) by giant water bug *Lethocerus grandis* (Linnaeus, 1758) (Hemiptera: Belostomatidae)

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#### ABSTRACT

Knowing the trophic links between species is essential to understand their functions in the ecosystem. In this work, we report the first predation record of *Rhinella crucifer* by the giant water bug *Lethocerus grandis*. Even though most Brazilian anurans preyed by giant water bugs are smaller than this insect, a larger body size of this predator together with its anesthetic saliva may provide conditions for the subjugation of larger prey.

**Keywords:** aquatic insects, Brazil, natural history, toad.

#### RESUMEN

**Depredación de *Rhinella crucifer* (Wied-Neuwied, 1821) (Anura: Bufonidae) por el insecto de agua gigante *Lethocerus grandis* (Linnaeus, 1758) (Hemiptera: Belostomatidae)**

Conocer los enlaces tróficos entre especies es fundamental para comprender sus funciones en el ecosistema. Aquí, reportamos el primer registro de depredación de *Rhinella crucifer* por el insecto acuático *Lethocerus grandis*. Aunque la mayoría de los anuros brasileños depredados por la chinche acuática gigante son más pequeños que este insecto, un tamaño corporal más grande de este depredador junto con su saliva anestésica, puede proporcionar condiciones para la subyugación de presas mayores.

**Palabras clave:** insectos acuáticos, Brasil, historia natural, sapo.

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Some characteristics of anuran amphibians vary among Neotropical communities, such as abundance, biomass and body-size. Anurans also go through vulnerable periods in their life cycle, which makes them a fundamental group in trophic webs (Wilbur, 1997; Whiles *et al.*, 2006).

In addition to preying on many types of organisms, anurans also serve as prey to a wide variety of potential predators on land or water, including vertebrates and invertebrates (Toledo, 2005). Among invertebrate predators, the hemipteran family Belostomatidae Leach, 1815 (Hemiptera Linnaeus, 1754) includes species of giant water bugs, a group of carnivorous insects that are distributed widely throughout the world (Ribeiro, 2005). These insects vary in size from medium to large (55 to 85 mm) and act as regulators in aquatic communities through predation (Ribeiro, 2005; Ohba, 2019). Predation by belostomatid insects upon adult bufonids is rare, with two known records for Brazil: one of an adult *Rhinella ornata* (Spix, 1824) being preyed upon by a *Lethocerus grandis* Linnaeus, 1758 on the north coast of the state of São Paulo (Haddad & Bastos, 1997), and one of an adult *Rhinella mirandariberoi* (Gallardo, 1965) preyed upon by a *Lethocerus annulipes* (Herrich Schaeffer, 1845) in the municipality of João Pinheiro, state of Minas Gerais (Valencia-Zuleta *et al.*, 2020).

Seeking to expand knowledge of such interactions, herein we report a new predation record of a *Lethocerus grandis* preying upon an adult *Rhinella crucifer* (Wied-Neuwied, 1821). We also provide a list of anuran species preyed by giant water bugs of the family Belostomatidae in Brazil. We compiled the list by performing searches of the Google Scholar database (<https://scholar.google.com/>), using as keywords “*Lethocerus grandis* AND predat AND *Rhinella crucifer*” OR “Belostomatidae AND predat AND anuran AND Brazil”. We then checked the references of the recovered manuscripts, looking for additional records of predation events.

The predation event (Fig. 1) reported here was seen at 18:10 h during field work on 23 July 2019, when one of us (CLA) observed an adult *Rhinella crucifer* with snout-vent length (SVL) of 70 mm, being preyed upon by a *Lethocerus grandis* (99.2 mm). This interaction took place in a small artificial pond used for fish farming in the municipality of São Francisco do Glória, Minas Gerais, southeastern Brazil (20°48'20" S, 42°19'35" W; 515 m; Datum WGS 84). The site is located in a highly anthropized landscape within the Atlantic Forest biome, with a predominantly pasture matrix. At the observation moment, the air and water temperature were 14°C and 17°C, respectively. The toad was alive and struggling at the water surface near the edge of the pond. The giant water bug was positioned on the dorsum of the toad, with the limbs fixed on its ventral region, and the proboscis inserted in its left eye (Fig. 1A). After approximately

20 minutes of observation, both specimens (insect and anuran) were collected. The toad died during transport, and was fixed in formalin 10%, stored in ethanol 70%, and housed at Coleção Herpetológica do Museu de Zoologia João Moojen, of Universidade Federal de Viçosa, Minas Gerais, Brazil (MZUFV 19511). The anuran was identified as *R. crucifer* by the presence of a fringe on the ventral surface of the tarsus (Baldissera Jr *et al.*, 2004). The giant water bug was identified as *L. grandis* due to its large body size (total length greater than 85 mm), large anterior tarsal claws as long or longer than the sum of the lengths of both anterior tarsal segments measured externally, and anterior femur slightly longer than the posterior femur (Ribeiro, 2005). There has been no previous record of predation on *R. crucifer* by a giant water bug, making this the first. Some “reptiles” are the main predators of the genus *Rhinella*, while records of predation by invertebrates are rare (Oliveira *et al.*, 2017). Our search returned 294 articles, of which 16 were used on this study. Our data show that most of the reported predation events by giant water bugs in Brazil involved



Fig. 1.— Adult male of *Rhinella crucifer* being preyed on by *Lethocerus grandis* in southeastern Brazil (A and B).

Fig. 1.— Macho adulto de *Rhinella crucifer* siendo presa de *Lethocerus grandis* en el sureste de Brasil (A y B).

small-sized anurans (Appendix 1). It seems likely that the larger size of adult *Rhinella* may be difficult for these invertebrates to capture and subjugate (Toledo *et al.*, 2007). In the present case, however, the individual *Lethocerus grandis* was 41.7% larger than its prey. The present observation suggests that the hemipteran large size combined with its anesthetic saliva (Menke, 1979), was sufficient for the hemipteran to subjugate the toad.

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Appendix 1.— Anurans preyed on by species of Belostomatidae family in Brazil.

Apéndice 1.— Anuros depredados por especies de la familia Belostomatidae en Brasil.

| Family/species                               | Stage    | Prey total length (mm) | Predator                            | Predator total length (mm) | State | Municipality            | Reference                                |
|--|----------|------------------------|-------------------------------------|----------------------------|-------|-------------------------|--|
| <b>Bufonidae</b>                             |          |                        |                                     |                            |       |                         |  |
| <i>Rhinela crucifer</i>                      | Adult    | 69.9                   | <i>Lethocerus grandis</i>           | 99.2                       | MG    | São Francisco do Glória | This work                                |
| <i>Rhinella mirandaribeiroi</i>              | Adult    | -                      | <i>Lethocerus annulipes</i>         | -                          | MG    | João Pinheiro           | Valencia-Zuleta <i>et al.</i> 2020       |
| <i>Rhinela ornata</i> *                      | Juvenile | -                      | <i>Lethocerus grandis</i>           | -                          | SP    | Ubatuba                 | Haddad & Bastos 1997                     |
| <i>Rhinela ornata</i> *                      | Juvenile | 68.2                   | <i>Lethocerus grandis</i>           | 95                         | SP    | Ubatuba                 | Haddad & Bastos 1997                     |
| <b>Hylidae</b>                               |          |                        |                                     |                            |       |                         |  |
| <i>Boana albomarginata</i>                   | Imago    | -                      | <i>Lethocerus</i> sp.               | -                          | PE    | São Lourenço da Mata    | Santos 2009                              |
| <i>Dendropsophus branneri</i>                | Imago    | 19                     | <i>Belostoma</i> sp.                | -                          | RN    | Macaíba                 | Baracho <i>et al.</i> 2014               |
| <i>Dendropsophus jimi</i>                    | Juvenile | 21.8                   | <i>Belostoma elongatum</i>          | -                          | SP    | Itirapina               | Toledo 2003                              |
| <i>Dendropsophus minutus</i>                 | Adult    | 21.8                   | <i>Lethocerus delpontei</i>         | 58.9                       | ES    | São Matheus             | Bastos <i>et al.</i> 1994                |
| <i>Dendropsophus minutus</i>                 | Tadpole  | -                      | <i>Lethocerus</i> sp.               | -                          | PE    | São Lourenço da Mata    | Santos 2009                              |
| <i>Dendropsophus minutus</i>                 | Imago    | -                      | <i>Belostoma</i> sp.                | -                          | PE    | São Lourenço da Mata    | Santos 2009                              |
| <i>Dendropsophus minutus</i>                 | Juvenile | 23.5                   | <i>Belostoma elongatum</i>          | -                          | SP    | Itirapina               | Santos 2009                              |
| <i>Dendropsophus minutus</i>                 | Adult    | 24.3                   | <i>Lethocerus</i> sp.               | 31                         | AM    | Manaus                  | Rocha <i>et al.</i> 2014                 |
| <i>Dendropsophus minutus</i>                 | Tadpole  | -                      | <i>Lethocerus</i> sp.               | -                          | SP    | Águas de Santa Bárbara  | Serrano <i>et al.</i> 2019               |
| <i>Dendropsophus minutus</i>                 | Tadpole  | -                      | <i>Lethocerus</i> sp.               | -                          | SP    | Águas de Santa Bárbara  | Serrano <i>et al.</i> 2019               |
| <i>Dendropsophus minutus</i>                 | Imago    | -                      | <i>Lethocerus</i> sp.               | -                          | SP    | Águas de Santa Bárbara  | Serrano <i>et al.</i> 2019               |
| <i>Pseudis platensis</i>                     | Tadpole  | 83.3                   | <i>Belostoma</i> sp.                | 68                         | MS    | Corumbá                 | Ceron <i>et al.</i> 2017                 |
| <i>Scinax fuscovarius</i>                    | Adult    | -                      | <i>Lethocerus</i> cf. <i>bruchi</i> | -                          | SP    | Borebi                  | Maffei <i>et al.</i> 2014                |
| <i>Scinax</i> sp.                            | Adult    | 33.4-37                | <i>Belostoma elongatum</i>          | -                          | SP    | Itirapina               | Toledo 2003                              |
| <i>Scinax</i> sp.                            | Adult    | 34.6-36.7              | <i>Belostoma elongatum</i>          | -                          | SP    | Itirapina               | Toledo 2003                              |
| <i>Scinax</i> sp.                            | Adult    | 27.1                   | <i>Belostoma elongatum</i>          | -                          | SP    | Itirapina               | Toledo 2003                              |
| <i>Scinax squalirostris</i>                  | -        | 19.5                   | <i>Belostoma elongatum</i>          | -                          | SP    | Itirapina               | Toledo 2003                              |
| <i>Scinax x-signatus</i>                     | Adult    | 35                     | <i>Lethocerus annulipes</i>         | 66                         | RJ    | São João da Barra       | Figueiredo-de-Andrade <i>et al.</i> 2010 |
| <b>Leptodactylidae</b>                       |          |                        |                                     |                            |       |                         |  |
| <i>Leptodactylus labyrinthicus</i>           | Juvenile | -                      | <i>Belostoma elongatum</i>          | -                          | SP    | Itirapina               | Toledo 2003                              |
| <i>Leptodactylus pustulatus</i>              | Tadpole  | 18.9                   | <i>Belostoma</i> sp.                | 30                         | TO    | Caseara                 | Fadel <i>et al.</i> 2019                 |
| <i>Physalaemus</i> cf. <i>fuscomaculatus</i> | Adult    | 40.5                   | <i>Lethocerus</i> sp.               | 62.2                       | MG    | Uberlândia              | Giaretta & Menin 2004                    |
| <i>Physalaemus cuvieri</i>                   | -        | 26.1-29.2              | <i>Belostoma elongatum</i>          | -                          | SP    | Itirapina               | Toledo 2003                              |
| <i>Physalaemus fuscomaculatus</i>            | -        | 41.6                   | <i>Belostoma elongatum</i>          | -                          | SP    | Itirapina               | Toledo 2003                              |
| <i>Physalaemus nattereri</i>                 | Adult    | 40                     | <i>Lethocerus delpontei</i>         | -                          | GO    | Jataí                   | Batista <i>et al.</i> 2013               |
| <i>Physalaemus nattereri</i>                 | Adult    | -                      | <i>Lethocerus annulipes</i>         | -                          | PR    | Diamante do Norte       | Batista <i>et al.</i> 2013               |
| <i>Physalaemus nattereri</i>                 | Adult    | -                      | <i>Lethocerus annulipes</i>         | -                          | MG    | João Pinheiro           | Valencia-Zuleta <i>et al.</i> 2020       |
| <i>Physalaemus nattereri</i>                 | Adult    | -                      | <i>Lethocerus annulipes</i>         | -                          | MG    | João Pinheiro           | Valencia-Zuleta <i>et al.</i> 2020       |
| <i>Physalaemus nattereri</i>                 | Adult    | -                      | <i>Lethocerus annulipes</i>         | -                          | MG    | João Pinheiro           | Valencia-Zuleta <i>et al.</i> 2020       |
| <i>Physalaemus nattereri</i>                 | Adult    | -                      | <i>Lethocerus annulipes</i>         | -                          | MG    | João Pinheiro           | Valencia-Zuleta <i>et al.</i> 2020       |
| <b>Microhylidae</b>                          |          |                        |                                     |                            |       |                         |  |
| <i>Chiasmocleis albopunctata</i>             | Adult    | -                      | Not identified                      | -                          | MG    | Santana do Riacho       | Yves <i>et al.</i> 2018                  |

States abbreviations: PE – Pernambuco; RN – Rio Grande do Norte; ES – Espírito Santo; SP – São Paulo; AM – Amazonas; MS – Mato Grosso do Sul; RJ – Rio de Janeiro; GO – Goiás; PR – Paraná; MG – Minas Gerais and TO – Tocantins. \* Treated as *Bufo crucifer* by Haddad & Bastos (1997).