Nota

Cuad. herpetol. 34(1): 103-105 (*2020*)

First record of Ostracod ingestion by adult frogs

Bruna Guarabyra[1], Andressa M. Bezerra[1], Ana Galvão[2], Sergio P. Carvalho-e-Silva[1]

[1] Laboratório de Anfíbios e Répteis, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Ilha do Fundão, 21941-590, Rio de Janeiro, Rio de Janeiro, Brazil.

[2] Laboratório de Ornitologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Ilha do Fundão, 21941-590, Rio de Janeiro, Rio de Janeiro, Brazil.

Recibida: 30 Septiembre 2019
Revisada: 12 Noviembre 2019
Aceptada: 10 Marzo 2020
Editor Asociado: S. Valdecantos

doi: 10.31017/CdH.2020.(2019-034)

ABSTRACT

The marsupial frog *Fritziana goeldii* is an endemic species of Brazil with few aspects of its habits reported in the literature. In this work, we report for the first time the ingestion of *Elpidium* sp., an ostracod that lives in bromeliads which is known to use amphibians as vectors for phoresy, by *F. goeldii*. It is also the first time that this group is reported in the digestive tract of an adult amphibian.

Key Words: Anura; Crustaceans; Bromeligenous; *Elpidium*; *Fritziana goeldii*.

The marsupial frog *Fritziana goeldii* (Boulenger, 1895) belongs to the Hemiphractidae family and is endemic of Brazil; its distribution encompasses the lowlands and slopes of the mountains to elevations of 2200 m above sea level in Rio de Janeiro, São Paulo, Minas Gerais and Espírito Santo state, southeastern Brazil (Frost, 2019). Its individuals have been recurrently found within bromeliads of Parque Nacional da Tijuca (PNT), in Rio de Janeiro state; but until now, little is known about its natural history, being restricted to studies about taxonomy and systematics of the genera and feeding behavior of the tadpole (Duellman & Gray, 1983; Weygoldt, 1989).

The species of *F. goeldii* brood their eggs on their back (Weygoldt *et al.,* 1991; Fig. 1A), which hatch with the tadpoles in a considerable advanced stage (30 to 33, following Gosner, 1960). These tadpoles are known to feed on small portions of undeveloped eggs or retarding and dying larvae (Weygoldt *et al.,* 1991). None information regarding the adults feeding habits is available in the literature.

Amphibians are considered top predators in many ecosystems, including bromeliads, consuming a large variety of invertebrates (Ottonello and Romano, 2010). Among the invertebrates that can be found in bromeliads, there are the microcrustaceans ostracods (Crustacea: Ostracoda; commonly known as seed shrimps). This group is highly diverse and inhabits different aquatic habitats, such as temporary or very restricted water bodies, *e.g.* bromeliads (Pereira, 2017). Ostracods have been recurrently reported attached to frogs skin (*e.g.* Lopez *et al.*, 2005; Sabagh *et al.*, 2011 and Sabagh *et al.*, 2014), which is considered an attempt to dispersal between bromeliads (Lantyer-Silva *et al.*, 2016). Due to its calcareous bivalve carapace surrounding their entire body (Horne *et al.*, 2002; Martens *et al.*, 2008) ostracods have also been found unharmed inside the gut of some tadpoles as *Ololygon perpusila* (=*Scinax perpusillus* in Lopez *et al.*, 2002) and *Aparasphenodon arapapa* (Lantyer-Silva *et al.*, 2016). Until now, no studies reported its ingestion by an adult anuran.

Elpidium Müller, 1880 is a genus of ostracodes of the family Limnocytheridae (Klie, 1938) that lives in freshwater environments, and is distributed from Argentina to Florida (Benzing, 2000; Fig. 1B). It is a medium-sized microcrustacean and due to its low mobility and the isolation provided by the bromeliads, it depends on other animal groups such as amphibians, reptiles and small mammals to disperse (Lopez *et al.,* 1999, 2002). Recent studies demonstrate that besides be attached to the skin of amphibians for transportation, i.e., phoresy (Araújo *et al.*, 2019), they also act as predators of eggs of some anuran species (Ottonello and Romano, 2010). Nonetheless, publications about *Elpidium* are scarce and predominantly related to taxonomic aspects (Pereira, 2017).

Author for correspondence: brunaguarabyra29@gmail.com

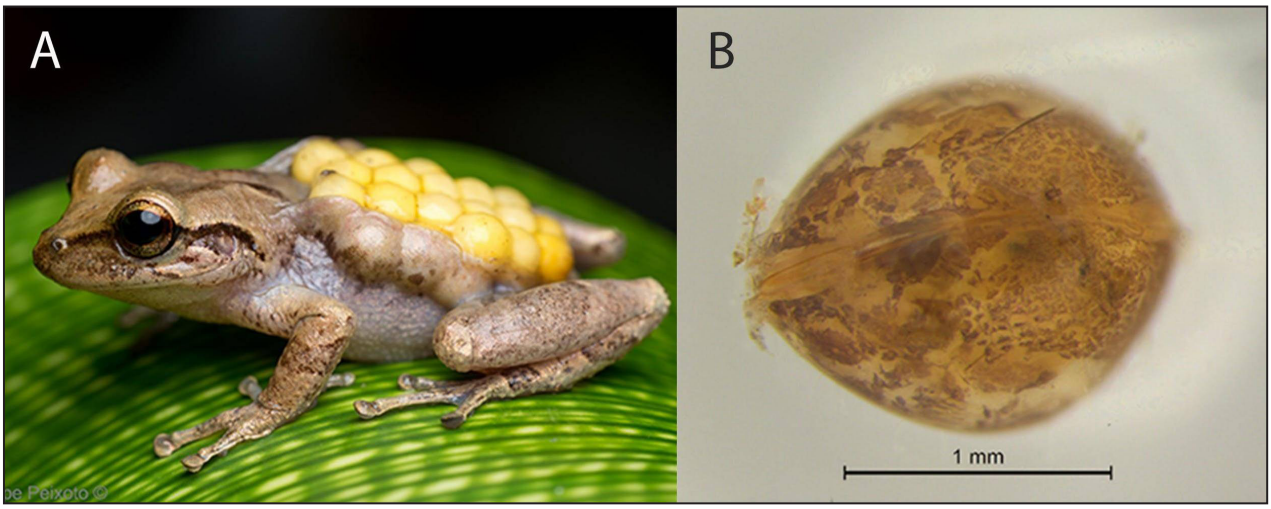

Figure 1. A) Female of *Fritziana goeldii* with eggs on its back from Parque Nacional da Tijuca, Rio de Janeiro, Brazil. Photo: Peixoto, L. F. G. B): Ostracod of the genus *Elpidium* sp. found inside the gastrointestinal tract of *F. goeldii*.

We analyzed the gastrointestinal contents of 38 individuals, both male and female, sampled from Centro de Visitantes (22°57'21.5"S; 43°16'47.3"W) and Açude da Solidão (22°57'43.5"S; 43°17'20.9"W), both locations inside PNT, Rio de Janeiro. The collection of specimens occurred from December 2018 to July 2019, encompassing low temperatures at night and occasional rain typical of autumn and winter seasons in southeastern, although none of the sampled nights were raining. The individuals were found inside bromeliads on the floor and attached to trees near to common visitant spaces, but we could hear its vocalization in other places inside the park.

Among them, eight individuals had ostracods of the genera *Elpidium* inside the gut and just one had inside its stomach, the number varying from one to 12 at the gut and two at the stomach. None of them presented these ostracods attached to the skin. Since the gastrointestinal content was only analyzed after euthanasia and posterior fixation in formalin 10%, it was not possible to confirm if the ostracods were alive in both organs, as previously observed by Lopez *et al.* (2005) for *Ololygon perpusillus* tadpoles. Although this is the first observation of ostracodes in the digestive tract of adult anurans, it was not possible to infer if they were actively ingested by these anurans.

Further studies are necessary to understand why and how *F. goeldii* capture these ostracods inside the bromeliads; is it an item in their diet or its ingestion was not intentional? Was *Elpidium* sp. attached to the skin of these amphibians before predation? Does its ingestion work as a phoresy interaction by ostracods? These questions can help to elucidate interactions between *F. goeldii* and other species, such as *Elpidium* spp.

Acknowledgements

We thank F. Hepp and M.R. Gomes to help to identify the ostracods. The study was possible due to the permits (#69339-1; and #65470-1) of "Instituto Chico Mendes de Conservação da Biodiversidade (ICMBIO)".

Literature cited

Araújo, A.P.; Bastos, C.M.; Santos, R.V. I.; Moura, G.J.B.; Melo-Júnior, M. & Tinoco, M.S. 2019. Novel records of phoresy among microcrustaceans and bromeliad treefrogs in the Atlantic Rainforest of Northeast Brazil. *Herpetology Notes* 12: 532-535.

Benzing, D.H. 2000. Bromeliaceae: profile of an adaptive radiation. Cambridge University Press. Cambridge, UK.

Duellman, W. E. & Gray P. 1983. Developmental biology and systematics of the egg-brooding hylid frogs, genera *Flectonotus* and *Fritziana*. *Herpetologica* 39: 333–359.

Frost, D.R. 2019. Amphibian Species of the World: an Online Reference. Version 6.0 Available at: http://research.amnh.org/herpetology/amphibia/index.html. Last accesed: 16 august 2019.

Gosner, K.L. 1960. A simplified table for staging anuran embryos and larvae with notes on identification. *Herpetologic*a 16: 183-190.

Horne, D.J.; Cohen, A. & Mairtens, K. 2002. Taxonomy, Morphology and Biology of Quaternary and living Ostracoda: 5-36. *En*: Holmes, J. A. & Chivas, A. (eds.), The Ostracoda: Applications in Quaternary Research, Geophysical Monograph Series. American Geophysical Union. Washington, D.C. USA.

Lantyer-Silva, A.S.F.; Souza, C.C.; Barreiro, I.M.J. & Solé, M. 2016. Phoretic ostracods. *Herpetological Review* 47: 106.

Lopez, L.C.S.; Filizola, B.; Deiss, I. & Rios, R.I. 2005. Phoretic behavior of bromeliad annelids (*Dero*) and ostracods (*Elpidium*) using frogs and lizards as dispersal vectors. *Hydrobiologia* 549: 15-22.

Lopez, L.C.S.; Gonçalves, D.A.; Mantovani A. & Rios R.I. 2002. Bromeliad ostracods pass through amphibian (*Scinax perpusillus*) and mammalian guts alive. *Hydrobiologia* 485: 209-211.

Martens, K.; Schon, I.; Meisch, C. & Horne, J.D. 2008. Global diversity of ostracods (Ostracoda, Crustacea). *Hydrobiologia* 595: 185-193.

Lopez, L.C.S.; Rodrigues, P.J.F.P. & Rios, R.I. 1999. Frogs and snakes as phoretic dispersal agents of bromeliad ostracods (Limnocytheridae: *Elpidium*) and annelids (Naididae: Dero). *Biotropica* 31: 705-708.

Ottonello, D. & Romano, A. 2010. Ostracoda and Amphibia in temporary ponds: who is the prey? Unexpected trophic relation in a mediterranean freshwater habitat. *Aquatic Ecology* 45: 55-62.

Pereira, J. S. 2017. Taxonomy and morphologic phylogeny of Elpidium Müller, 1880 (Crustacea, Ostracoda). Available at: <www.teses.usp.br>. Last accessed: 24 septiembre 2019.

Sabagh, L.T.; Dias, R.J.P.; Branco, C.W.C. & Rocha, C.F.D. 2011. New records of phoresy and hyperphoresy among treefrogs, ostracods, and ciliates in bromeliad of Atlantic forest. *Biodiversity Conservation* 20: 1837-1841.

Sabagh, L.T. & Rocha, C.F.D. 2014. Bromeliad treefrogs as phoretic hosts of ostracods. *Naturwissenschaften* 101: 493-497.

Weygoldt, P. 1989. Feeding behavior of the larvae of Fritziana goeldi (Anura, Hylidae). *Amphibia-Reptilia* 10: 419-422.

Weygoldt, P. & Carvalho-e-Silva, S.P. 1991. Observations on mating, oviposition, egg sac formation and development in the egg-brooding frog, *Fritziana goeldii*. *Amphibia-Reptilia* 12: 67-80.