Predation on *Pristimantis ridens* (Cope, 1866) by a wandering spider (Ctenidae Keyserling, 1877) in mountain cloud forest of Costa Rica

Daniel Jablonski

Numerous records of predation on amphibians and reptiles by different groups of invertebrates are known and well documented in several review articles (e.g. McCormick and Polis, 1982; Bauer, 1990; Toledo, 2005). Small species of herpetofauna represent suitable food source for invertebrates in different phases of their development (several invertebrate species feed on small reptiles and on amphibian's eggs, tadpoles and postmetamorphic individuals; Menin et al., 2005; Toledo, 2005). According to Menin et al. (2005), predation by invertebrates is an important factor of mortality in amphibians. However, the impact of invertebrate predators on populations of their vertebrate prey is hard to access (McCormick and Polis, 1982). Anurophagy is the most common trophic strategy used by many invertebrate classes and has been very well recorded within different spider families on the Neotropics (see Menin et al., 2005; Toledo, 2005).

The Rio San Juan robber frog, *Pristimantis ridens* (Cope, 1866), is a little, generally diurnal, light colored craugastorid species, distributed in Atlantic humid lowlands of extreme eastern Honduras, Nicaragua, Costa Rica and Panama (Savage, 2002). It also occurs on premontane slopes of evergreen forest in Costa Rica and Panama, lowlands of southwestern Costa Rica and on the evergreen forests of Panama, western Colombia, and northwestern Ecuador, ranging from 15 to 1600 m a.s.l. (Savage, 2002).

On 27 January 2014, I observed a predation over an adult male of *P. ridens* (SVL = c.a. 30 mm) by a wandering spider (Ctenidae Keyserling, 1877) (Fig. 1). The observation took place at 09:15 pm at Monteverde cloud forest (vicinity of Santa Ellena village, Puntarenas province, Cordillera de Tilarán Mts.: 10.31249° N, 84.82336° W, 1350 m a.s.l.). This period corresponds to the peak activity of both species in mountain rocky stream surroundings. The weather was cloudy, with air temperature around 18° C.

The spider was found sitting on a leaf with the captured frog on the margins of a stream and was located c.a. 50 cm above the water. During the predation event, the frog was fully paralyzed and spider was biting the back of its body. Detailed photos *in situ* were taken and voucher specimens were not collected; for this reason, the precise determination of the spider species was not possible, since the taxonomic status of most Neotropics genera of Ctenidae is poorly known (see Hazzi et al. 2013) and the voucher specimen would be necessary to determine the species.

In addition to Ctenidae, other four spider families (Lycosidae Sundevall, 1833; Theraphosidae Thorell, 1869; Sparassidae Bertkau, 1872 and Pisauridae Simon, 1890) are mainly attributed to predate frogs in the Neotropics (Menin et al., 2005). However, the present record represents the first report of predation over *P. ridens* by a ctenid spider in natural conditions.

The observation of anurophagy by this family of spiders is very well documented in many cases and different species of Neotropical amphibians, such as *Adelphobates castaneoticus* (Caldwell and Myers, 1990), *Adenomera marmorata* Steindachner, 1867, *Allobates brunneus* (Cope, 1887), *Craugastor ranoides* (Cope, 1886), *C. stejnegerianus* (Cope, 1893), *Dendropsophus leucophyllatus* (Beireis, 1783), *D. minutus* (Peters, 1872), *Eleutherodactylus cuneatus* (Cope, 1862), *Physalaemus cuvieri* Fitzinger, 1826, *Pristimantis ramagii* (Boulenger, 1888), *Scinax fuscovarius* (Lutz, 1925), *Scinax squalirostris* (Lutz, 1925), *Tlalocohyla loquax* (Gaige and Stuart, 1934) (Ervin et al., 2007; Ugarte and Briggs, 2007; Duryea et al., 2008; Jansen and Schulze, 2008; Barbo et al., 2009; Zumbado-Ulate

Department of Zoology, Comenius University in Bratislava, Mlynská dolina B-1, 842 15, Bratislava, Slovakia Corresponding author: daniel.jablonski@balcanica.cz



Figure 1. The spider of Ctenidae family preying on a Pristimantis ridens in Monteverde region, Costa Rica.

et al., 2009; Bocchiglieri et al., 2010; De Carvalho et al., 2010; Maffei et al., 2010; Fong et al., 2012; Bovo, 2013; Da Fonte and Volkmer, 2013; De Carvalho et al., 2013; Maffei et al., 2014) and other species related in the review papers of Menin et al. (2005) and Toledo (2005).

Three the most typically documented genera of Ctenidae family due to anurophagy in Neotropics are *Ctenus* Walckenaer, 1805, *Cupiennius* Simon, 1891 and *Oligoctenus* Simon, 1887 (Menin et al., 2005; Toledo, 2005). Nevertheless, the taxonomic extent and prey size aspects of that relationship remain still poorly documented. According to Menin et al. (2005) and Toledo (2005), spiders are important predators in Neotropical forest zone and the interaction between spiders and amphibians can occur frequently.

Although, the family Ctenidae is one of the most diverse in Araneae [comprising 475 species in 40 genera (Platnick, 2014)] and it is abundant in tropical forests all over the world (Silva-Dávila, 2004), an interesting fact is rarity of other similar observation of anurophagy by Ctenidae outside Neotropics (Barej et al., 2009). A similar discrepancy in cases of amphibian predation by invertebrates between Neotropics and other biogeographic regions of the world exists also in other groups [e.g. insects, crustaceans or chilopods; see Barej et al. (2009) and literature therein]. Generally, we have not answered yet the question regarding this discrepancy. Probably it is caused by specific and still a hidden eco-evolutionary processes in this region [e.g. suitable correlation between the length of the anuran and length of spiders there or higher densities of spiders on the forest floor, as pointed by Menin et al. (2005)] or simply the lack of knowledge on it (see Riehl et al., 2008; Hamidy et al., 2010; Sung and Fei, 2013; Tanaka, 2013). In cases of other small vertebrates (e.g. bats), it is more known worldwide (Nyffeler and Knörnschild, 2013). Hence, it is still necessary to record new cases of predation over herpetofauna by invertebrates for further comprehensive assessment studies.

Acknowledgments. I would like to thank to Federico Bolaños (University of Costa Rica, San Pedro, Costa Rica) for help with identification, Fábio Maffei (São Paulo State University, São Paulo, Brazil) for the pre-peer review and one anonymous reviewer for his critical suggestions.

References

- Barbo, F.E., Rodrigues, M.G, Couto, F.M., Sawaya, R.J. (2009): Predationon *Leptodactylus marmoratus* (Anura: Leptodactylidae) by the spider *Ctenus medius* (Araneae: Ctenidae) in the Atlantic Forest, southeast Brazil. Herpetology Notes 2: 99-100.
- Barej, M.F., Wurstner, J.A.M, Böhme, W. (2009): Predation on the treefrog *Leptopelis brevirostris* (Anura: Arthroleptidae) by a wandering spider (Araneae: Ctenidae) in Cameroon. Herpetology Notes 2: 137-139.
- Bauer, A.M. (1990): Gekkonid lizards as prey of invertebrates and predators of vertebrates. Herpetological Review 21: 83-87.
- Bocchiglieri, A., Mendonca, A.F., Motta, P.C. (2010): *Dendropsophus minutus* (Lesser Treefrog). Predation. Herpetological Review 41: 335.
- Bovo, R.P. (2013): Scinax fuscovarius (Snouted Treefrog). Predation. Herpetological Review 44: 300.
- Caldwell, J.P., Myers, C.W. (1990): A new poison frog from Amazonian Brazil, with further revision of the *quinquevittatus* group of *Dendrobates*. American Museum Novitates 2988: 1-23.
- Da Fonte, L.F.M., Volkmer, G. (2013): Scinax squalirostris (Striped Snouted Treefrog). Predation. Herpetological Review 44: 300.
- De Carvalho, C.B, De Freitas, E.B., Dos Santos, R.A., Gueiros, F.B., Santos, R.V.S., Faria, R.G. (2010): *Ischnocnema ramagii* (Paraiba Robber Frog). Predation. Herpetological Review 41: 336-337.
- De Carvalho, J.C., Hernández-Ruz, E.J., De Oliveira, E.A. (2013): *Allobates brunneus* (Chapada Rocket Frog). Predation. Herpetological Review 44: 119.
- Duryea, M.C., Zamudio, K.R., Greene, H.W., Zara, F.J. (2008): *Physalaemus cuvieri* (Barker Frog). Predation. Herpetological Review 39: 209-210.
- Ervin, E.L., Lovich, R.E, Gray-Lovich, K., Scott, N.J., Lopez, J. (2007): *Eleutherodactylus stejnegerianus* (Stejneger's Robber Frog). Predation. Herpetological Review 38: 185.
- Fong, G.A, Hero, J.M., Bignotte-Giró, I., Solano, L.A.R, Gutierrez, Y. (2012): *Eleutherodactylus cuneatus*. Predation. Herpetological Review 43: 319-320.
- Hamidy, A., Matsui, M., Nishikawa, K., Belabut, D., Ahmad, N. (2010): *Rana picturata* (Yellow-spotted Frog). Predation. Herpetological Review 41: 66-67.
- Hazzi, N.A., Valderrama-Ardila, C., Brescovit, A.D., Polotow, D., Simó, M. (2013): New records and geographical distribution of ctenid spiders (Araneae: Ctenidae) in Colombia. Zootaxa 3709: 243-254.
- Jansen, M., Schulze, A. (2008): Dendropsophus leucophyllatus (Bereis' Tre Frog). Predation. Herpetological Review 39: 459.
- Maffei, F., Ubaid, F.K., Jim, J. (2010): Predation of herps by spiders (Araneae) in the Brazilian Cerrado. Herpetology Notes 3: 167-170.
- Maffei, F., Ubaid, F.K., Bolfarini, M. (2014): Predation of *Scinax fuscovarius* (Anura: Hylidae) by two invertebrates in Southeastern Brazil. Herpetology Notes 7: 371-374.
- McCormick, S., Polis, G.A. (1982): Arthropods that prey on vertebrates. Biological Review of Cambridge Philosophical Society 57: 29-58.

- Menin, M., de Rodrigues, D.J., de Azevedo, C.S. (2005): Predation on amphibians by spiders (Arachnida, Araneae) in the Neotropical region. Phyllomedusa 4: 39-47.
- Nyffeler, M., Knörnschild, M. (2013): Bat predation by spiders. Plos One 8: e58120.
- Platnick, N.I. (2014): The world spider catalog, version 14.5. American Museum of Natural History. Available from: http:// research.amnh.org/iz/spiders/catalog (Accessed 4 April 2013).
- Riehl, T., Haas, A., Das, I. (2008): *Hylarana raniceps* (Whitelipped Frog). Predation. Herpetological Review 39: 77-78.
- Savage, J.M. (2002): The Amphibians and Reptiles of Costa Rica: A Herpetofauna between Two Continents, between Two Seas. The University of Chicago Press. Chicago. U.S.A. 934 pp.
- Silva-Dávila, D. (2004): Revision of the spider genus *Caloctenus* Keyserling, 1877(Araneae, Ctenidae). Revista peruana de Biología 11: 5-26.
- Sung, Y-H., Fei, L. (2013): Chiromantis doriae (Doria's Asian Treefrog). Predation. Herpetological Review 44: 120.
- Tanaka, S. (2013): *Rhacophorus viridis viridis* (Okinawa Green Tree Frog). Herpetological Review 44: 129.
- Toledo, L.F. (2005): Predation of juvenile and adult anurans by invertebrates: current knowledge and perspectives. Herpetological Review 36: 395-400.
- Ugarte, C.A., Briggs, V. (2007): *Hyla loquax* (Swamp Tree Frog). Predation. Herpetological Review 38: 186.
- Zumbado-Ulate, H., Soley-Guardia, F. Bolaños, F. (2009): Craugastor ranoides (NCN). Predation. Herpetological Review 40: 201.

Accepted by Diego Santana