



Field observation of an adult Lesser treefrog *Dendropsophus minutus* (Anura: Hylidae) being consumed by a neotropical *Lethocerus* sp. (Hemiptera: Belostomatidae) nymph

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Amphibians constitute important items in the diet of many predators. Giant water bugs have been reported to feed on several species of amphibians; however, there is still a poor understanding of the complexity of their food webs. Here, we report the consumption of an adult *Dendropsophus minutus* (Anura: Hylidae) by a *Lethocerus* sp. (Hemiptera: Belostomatidae) nymph, in Central Amazon, Brazil. This represents the first observation of trophic interaction between *Lethocerus* sp. and *D. minutus* and the first report of a neotropical *Lethocerus* sp. nymph feeding upon an adult vertebrate.

Giant water bugs of the family Belostomatidae are widely distributed throughout the world's tropical and temperate regions (Hungerford, 1919) and are rapid colonizers of newly formed temporary shallow water environments where they are often found in relatively high densities (Williams, 2006). These aquatic insects are known to prey upon a great variety of taxa and have been suggested to significantly impact the ecological structure of their prey communities (Ohba *et al.*, 2008).

The cosmopolitan subfamily Lethocerinae presents the largest body size among belostomids and possesses raptorial forelegs which it uses to capture terrestrial and aquatic invertebrates, small fish, tadpoles, adult anurans and, less frequently, snakes and turtles (Hirai & Hidaka, 2002; Mori & Ohba, 2004; Ohba *et al.*, 2008; Ohba, 2011). Lethocerinae nymphs are tadpole specialists, however, late stage nymphs are known to occasionally prey upon post-metamorphic amphibians (Ohba *et al.*, 2008).

Adult anurans are key elements of both terrestrial and aquatic food chains, featuring in the diets of vertebrates, invertebrates and even carnivorous plants (Toledo *et al.*, 2007). In the neotropics, trophic interactions between aquatic insects and frogs have been reported for several species, including for members of the genus *Lethocerus*. However, although reports of adult *Lethocerus* spp. preying upon post-metamorphic anurans are not uncommon (e.g. Toledo, 2005; Nenda *et al.*, 2008; Pezzuti *et al.*, 2008; de Andrade *et al.*, 2010; Zaracho, 2012) no trophic interaction between a neotropical *Lethocerus* nymph and adult amphibian has been reported.

The lesser treefrog *Dendropsophus minutus* (Peters, 1872) is a nocturnal arboreal hylid widespread throughout South America, east of the Andes. Its reproduction period takes place in the rainy season from November to May and males usually call from emergent aquatic plants over or next to the water on permanent and temporary ponds (Lima *et al.*, 2005). Adult *D. minutus* have been reported as prey items of the aquatic environment

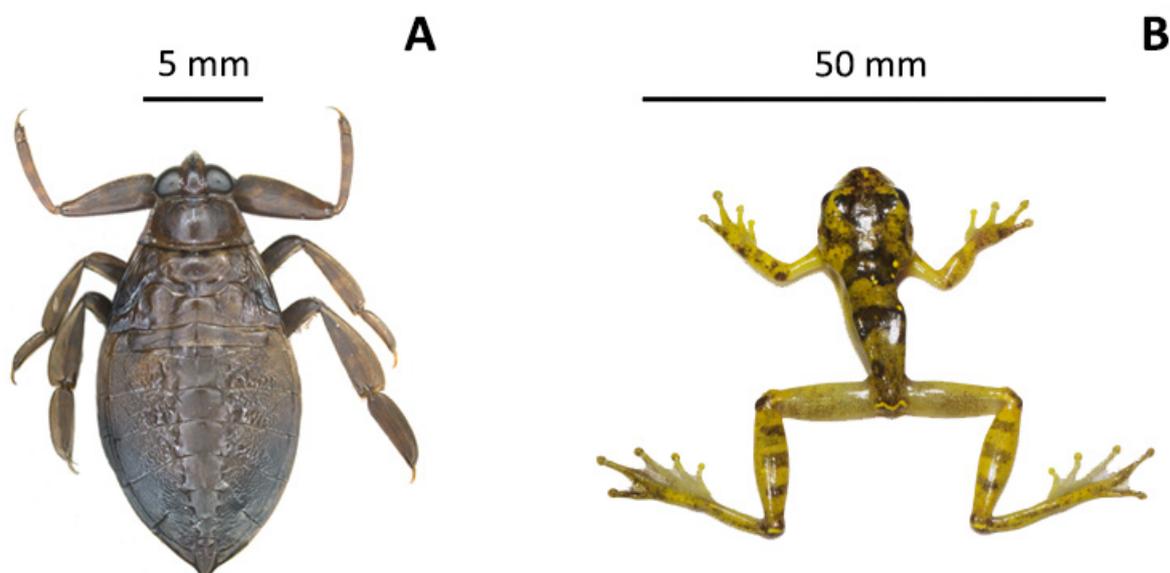


Figure 1. (A) Third instar giant water bug *Lethocerus* sp. nymph and (B) the adult minute tree frog *Dendropsophus minutus* it was feeding upon.

associated spiders of the family Pisauridae (fishing spiders) (Bernarde *et al.*, 1999) and of adult individuals of the family Belostomatidae (water bugs) (Bastos *et al.*, 1994; Toledo, 2003). In this publication, we report a giant water bug *Lethocerus* sp. nymph feeding upon an adult *D. minutus* in Central Amazon, Brazil. This constitutes the first report of consumption of an adult vertebrate by a neotropical *Lethocerus* sp. nymph.

Our observation took place on 20 March 2013 in a temporary pond surrounded by mature secondary regrowth, at the Porto Alegre reserve of the Biological Dynamics of Forest Fragments Project (BDFFP) ($-2^{\circ} 21' 26.64''$, $-59^{\circ} 57' 33.65''$), Central Amazon, Brazil. The BDFFP harbors a rich and diverse amphibian fauna with more than 42 described species (Zimmerman & Rodrigues, 1990); however, its belostomid fauna is poorly known.

At 21:32 pm a third instar *Lethocerus* sp. nymph (TL 31 mm) (fig. 1.A) was observed perching on the pond vegetation and holding an adult *D. minutus* (SVL 24.3 mm) (fig. 1.B) with its raptorial forelimbs. The insect had its proboscis inserted into the *D. minutus*' vocal sac and upon disturbance stopped feeding and released the frog. Since we did not observe the capture event itself we do not exclude the possibility of necrophagy but given the frog's small size we believe this indeed represented a case of opportunistic predation. Both specimens were collected, preserved in 70% alcohol solutions and deposited at the herpetology and entomology collections of the National Institute of Amazonian Research (INPA) in Manaus, Amazonas, Brazil (*D. minutus* catalogue number INPA-H 32305). Unfortunately, at its current developmental stage the nymph lacks the anatomical features necessary for species level identification. However, it could be identified as *Lethocerus* sp. due to its characteristic three segment antennae, the widely dilated anterior and posterior femurs and two large claws on the tarsi of the first pair of legs (de Carlo, 1962).

Post-metamorphic anurans have been found to constitute a significant prey item for third-fifth instar nymphs of *Kirkaldyia* (= *Lethocerus*) *deyrolli* in Japanese rice fields (Ohba *et al.*, 2008). Along with the observation here reported, we witnessed several other adult and nymphal belostomids capturing tadpoles in the referred temporary pond. However, although adult *D. minutus* were commonly observed in the pond, no other trophic interaction between belostomids and adult frogs were observed.

The observation presented suggests that, when available, adult frogs especially of smaller species like *D. minutus*, may constitute important components of the diet of late stage neotropical *Lethocerus* sp. nymphs. Rearing experiments would be valuable to unveil the contribution of main prey items to the specific growth rates of different nymphal stages.

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LITERATURE CITED

- Bastos, R.P., Oliveira, O.C., Pombal Jr, J.P. (1994). *Hyla minuta* (NCN). Predation. *Herpetological Review*, 25: 118.
- Bernarde, P.S., Souza, M.B., Kokubum, M.C.N. (1999). Predation on *Hyla minuta* Peters, 1872 (Anura, Hylidae) by ancylimetes spp. (Aranea, Pisauridae). *Biociências*, 7: 199-203.
- de Andrade, C.A.F., Santana, D.J., de Carvalho-e-Silva, S.P. (2010). Predation on *Scinax xsignatus* (Anura: Hylidae) by the giant water bug *Lethocerus annulipes* (Hemiptera Belostomatidae) in a Brazilian restinga habitat. *Herpetology Notes*, 3: 53-54.
- de Carlo, J.M. (1962). Consideraciones sobre la biología de *Lethocerus mazzai* (Hemiptera: Belostomatidae). *Physis*, 23: 143-151.
- Hirai, T., Hidaka, K. (2002). Anuran-dependent predation by the giant water bug, *Lethocerus deyrollei* (Hemiptera: Belostomatidae), in rice field in Japan. *Ecological Research*, 17: 655-661.
- Hungerford, H. (1919). The biology and zoology of aquatic and semi-aquatic Hemiptera. *Kansas University Bulletin*, 11: 1-341.
- Lima, A.P., Magnusson, W.E., Menin, M., Erdtmann, L.K., Rodrigues, D.J., Keller, C., Hödl, W. (2005). *Guide to the frogs of Reserva Adolpho Ducke, Central Amazonia*. Attema Design Editorial, Manaus.
- Mori, A., Ohba, S. (2004). Field observations of predation on snakes by the giant water bug. [In Japanese]. *Bulletin of the Herpetological Society of Japan*, 2004: 78-81.
- Nenda, S.J., Barrasso, D.A., Cajade, R. (2008). *Physalaemus cuvieri* Predation. *Herpetological Review*, 39: 210.
- Ohba, S. (2011). Field observation of predation on a turtle by a giant water bug. *Entomological Science*, 14: 364-365.
- Odba, S., Miyasaka, H., Nakasuji, F. (2008). The role of amphibian prey in the diet and growth of giant water bug in Japanese rice fields. *Population Ecology*, 50: 9-16.
- Pezzuti, T.L., De Melo, A.L., Leite, F.S. (2008). *Scinax eurydice* Predation. *Herpetological Review*, 39: 341-342.
- Toledo, L.F. (2003). Predation on seven South American anuran species by water bugs (Belostomatidae). *Phyllo-medusa*, 2: 105-108.
- Toledo, L.F. (2005). Predation of juvenile and adult amphibians by invertebrates: Current knowledge and perspectives. *Herpetological Review*, 36: 395-400.
- Toledo, L.F., Silva, R.R., Haddad, C.F.B. (2007). Anurans as prey: an exploratory analysis and size relationships between predators and their prey. *Journal of Zoology*, 271: 170-177.
- Williams, D.D. (2006). *The biology of temporary waters*. Oxford University Press, New York.
- Zaracho, V.H. (2012). Predation on *Elachistocleis bicolor* (Anura: Microhylidae) by *Lethocerus annulipes* (Heteroptera: Belostomatidae). *Herpetology Notes*, 5: 227-228.
- Zimmerman, B.L., Rodrigues, M.T. (1990). Frogs, snakes and lizards of the INPA-WWF reserves near Manaus, Brazil. In: Gentry A.H. (ed.) *Four Neotropical rainforests*, Yale University Press, New Haven: 426-456.