

SHORT COMMUNICATION

Predation of anurans by spiders: four cases in Mexican tropical forests

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Anurans are components of the trophic networks in ecosystems in which they occur, given their high population densities and being a food source for diverse groups of vertebrates and invertebrates (Wells 2007, Hocking and Babbitt 2014). Spiders are among the most important invertebrate predators on anurans (Menin *et al.* 2005, Toledo 2005). However, observations of predator-prey interactions are scarce, because they are infrequent and are rarely the primary focus of fieldwork that has been designed to document them. Herein, we describe four novel predator-prey interactions involving four spider species and four anuran species in two tropical forests of Mexico.

We observed two predation events during fieldwork in the Zihuapilapa stream, located in the municipality of San Sebastián Tlacotepec in southeastern Puebla (18°24'17" N, 96°50'43" W; 264 m a.s.l.). At 01:03 h on 07 February 2013, an adult *Ptychohyla zophodes* Campbell and Duellman, 2000 (Hylidae; snout-vent length, SVL = 28.81 mm) was being consumed by a female *Ctenus* sp. (Ctenidae; total length, TL = 28 mm) on a leaf 1.1 m above the stream (Figure 1A). Two days later, at 01:42 h on 09 February 2013, we found an adult *Rheohyla miotympanum* (Cope, 1863) (Hylidae; SVL = 24.53 mm) being consumed by a female *Ctenus* sp. (TL = 19 mm) on a leaf at 98 cm above the ground (Figure 1B).

In the private protected area called Área de Protección y Desarrollo de Ceratozamía, located in the municipality of Ixhuatlán del Sureste in southern Veracruz (18°02'34" N, 94°21'32" W;

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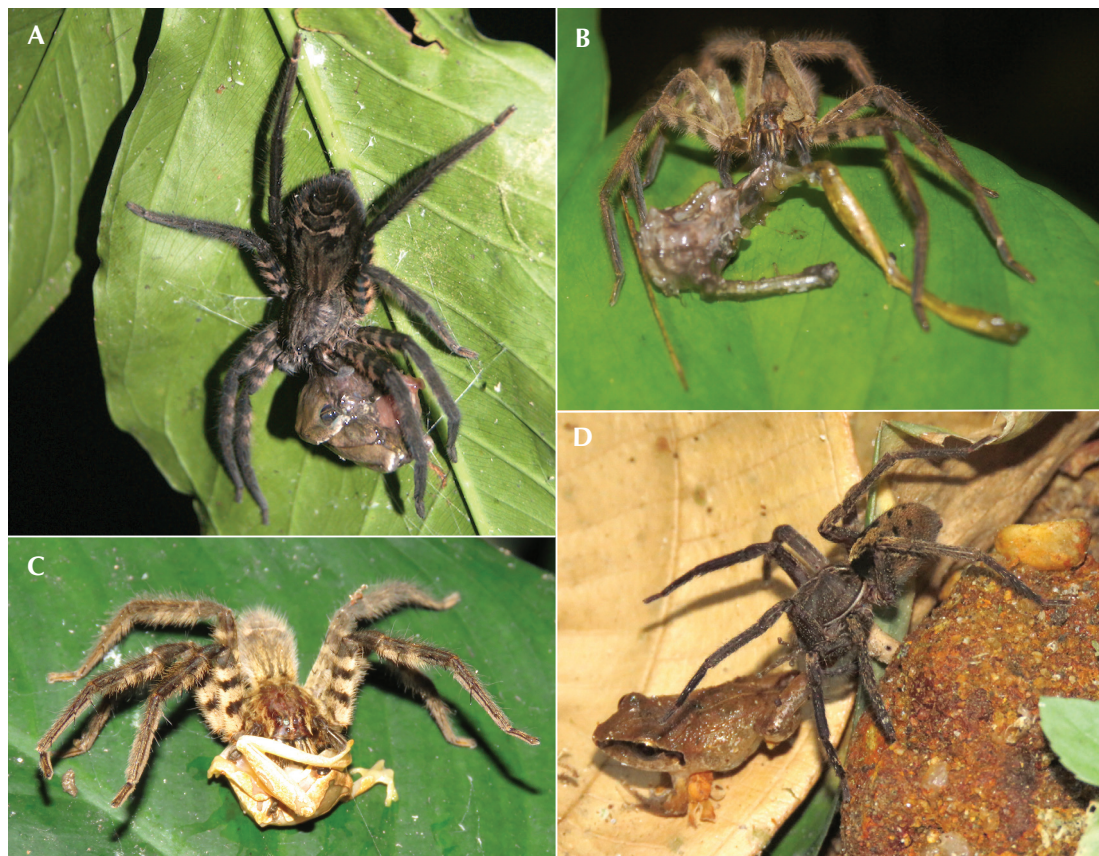


Figure 1. Predator-prey interaction between *Ptychohyla zophodes* and *Ctenus* sp. (A), *Rheohyla miotypanum* and *Ctenus* sp. (B), *Dendropsophus ebraccatus* and *Cupiennius salei* (C), and *Craugastor loki* and *Ctenus* sp. (D).

10 m a.s.l.), we encountered two more events of predation of anurans by spiders. On 12 May 2019 at 21:26 h, a *Dendropsophus ebraccatus* (Cope, 1874) (Hylidae; SVL = 21 mm) was being consumed by a female *Cupiennius salei* (Keyserling, 1877) (Trechaleidae; TL = 24 mm), on the leaf of a shrub 1.2 m above the ground (Figure 1C); the frog emitted distress vocalizations during the predation event. On 13 May 2019 at 21:49 h, a *Craugastor loki* (Shannon and Werler, 1955) (Craugastoridae; SVL = 17 mm) was observed being consumed by a male *Ctenus* sp. (TL = 17 mm) in the leaf litter (Figure 1D). The predation events were interrupted in each of


the four cases, and the specimens collected for taxonomic determination. The frogs were identified with the keys of Duellman (2001) and Köhler (2011) and the spiders with Ubick's key (2005). Specimens were not deposited in a scientific collection because of their state of deterioration.

Ctenus sp. is the first known predator of *Ptychohyla zophodes*. In the case of *Rheohyla miotypanum*, *Ctenus* sp. is the third species of spider known to prey on this anuran; the other species are *Cupiennius salei* (García-Vinalay and Pineda 2017) and *Dolomedes holti* Carico, 1973 (Deluna and Montoya 2017). Other

predators of *R. miotympanum* include hemipterans of the family Belostomatidae—a species of the genus *Abedus* (Pineda 2003) and an unidentified genus and species (Hernández-Salinas *et al.* 2012). The predation of *Dendropsophus ebraccatus* by *C. salei* is the third record of predation on this anuran by spiders; earlier records include *Cupiennius coccineus* Pickard-Cambridge, 1901 (Szelistowski 1985) and a ctenid spider of an unidentified genus (Donnelly and Guyer 1994). Other predators of *D. ebraccatus* include snakes (*Leptodeira* sp.) consuming adults, Odonata larvae (family Aeshnidae) and a hemipteran (family Belostomatidae) preying on tadpoles (Ospina and Touchon 2018), and hymenopterans [*Agelais centralis* Haliday, 1836; *Agelais* sp.; *Azteca* sp.; *Polybia rejecta* (Fabricius, 1798)] and dipterans (*Drosophila* sp.) consuming eggs (Toledo 2007, Touchon and Warkentin 2009, Ospina and Touchon 2018). The predation of *Craugastor loki* by *Ctenus* sp. represents the first record of predation by a spider and the second known predator for the species. The only predator previously known is the snake *Leptodeira septentrionalis* (Kennicott, 1859) (Cabrera-Guzmán *et al.* 2009, Platt *et al.* 2016, Nieblas-Camacho 2017).

The observations reported here supplement the various observations of spiders of the genera *Ctenus* and *Cupiennius* consuming anurans in the neotropics (Menin *et al.* 2005, Toledo 2005, 2007, Ervin *et al.* 2007, Barbo *et al.* 2009, Cicchi *et al.* 2010, De-Carvalho *et al.* 2010, Gibbons *et al.* 2010, Vázquez-Cisneros 2011, Amaral *et al.* 2015, Ríos-Rodas *et al.* 2016, De Mira-Mendes *et al.* 2017, Folt and Lapinski 2017, Vázquez-Cruz *et al.* 2017, Abarca *et al.* 2018, Salas *et al.* 2019) and suggest that these spider genera are among the most important predators on postmetamorphic anurans in this region. Further, the observations contribute to the knowledge of the multitrophic interactions of species and their relevance in the functioning of the ecosystem. Spiders may have an impact on anuran

populations, but the effect of the impact is not known (Menin *et al.* 2005); therefore, further studies are needed to evaluate these effects.

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