

Predation on the Three-striped poison frog, *Ameerega trivittata* (Boulenger 1884; Anura: Dendrobatidae), by *Erythrolamprus reginae* (Linnaeus 1758; Squamata: Collubridae)

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Dendrobatidae (poison frogs) are a diverse group of small Neotropical frogs well known and studied for their aposematic colouration, potent skin alkaloids, and complex reproductive behaviour (Myers and Daly, 1983; Daly et al., 1987; Weygoldt, 1987; Grant et al., 2006; Stynoski et al., 2015). *Ameerega trivittata* (Boulenger, 1884) is one of the largest (SVL approximately 40 mm) and most widely distributed dendrobatid frogs (Silverstone, 1976; Grant et al., 2006). Like in most species of the same genus, the skin of *A. trivittata* contains defensive alkaloids (Daly et al., 1987, 2009). Males vocally advertise and defend territories on the forest floor where oviposition takes place and then transport tadpoles to pools and creeks usually outside their territory (Roithmair, 1994a, 1994b; Pašukonis et al., 2019).

Erythrolamprus reginae (Linnaeus, 1758) is a small to medium size (SVL up to 709 mm) diurnal terrestrial snake widespread in the Amazon basin and the Guiana Shield (Ascenso et al., 2019). On October 17, 2014 at 12:20, we observed an *E. reginae* killing and potentially consuming an adult male *A. trivittata* equipped with a radio-transmitter (NTQ-2 from Lotek Wireless Inc.). The predation happened during a tracking study of *A. trivittata* at the Panguana Biological Field Station inside “Área de Conservación Privada Panguana” on

the lower Río Lullapichis, Amazonian Peru (9.35°S, 74.48°W) (Pašukonis et al., 2019). We tracked a male *A. trivittata* transporting 25 tadpoles to a pool inside a partially dried-up stream bed. The predation occurred soon after the deposition of tadpoles and approximately three meters away from the pool. The limp legs of the frog were visible under a leaf and the snake holding the frog’s head was noticed only after uncovering the leaf (Fig. 1a). After the disturbance, the snake released the frog and retreated approximately 15 cm away (Fig. 1b). The frog appeared dead and was visibly covered in white skin secretions (Fig. 1c). Because the snake did not resume consuming the prey while we observed, we left the area. When we returned approximate one hour later, both the frog and the snake were not visible, but we located the radio-signal coming from a small burrow underground within a few meters from the predation site. We presume that the snake consumed the prey and took refuge in a burrow underground. Alternatively, a differed small animal could have consumed the dead frog while we were away, but we consider that unlikely because of the following observations. Over the next days, we repeatedly localized the signal, which remained underground within an area of a few meters. On October 21 at 17:25 (4 days after the predation), we found the radio-transmitter in the leaf-litter 32 meters away from the predation site. The transmitter was still functional, but it had no remains of the frog probably after having passed through the digestives system of the predator.

Erythrolamprus reginae as well as several other species in the same genus are frog hunting specialists (Vangilder and Vitt, 1983; Michaud and Dixon, 1989; Albarelli and Santos-Costa, 2010). Predations by *E. reginae* have been reported for three presumably non-toxic dendrobatid frog species so far: *Mannophryne herminae* (Michaud and Dixon, 1989), *M. leonardoi* (Manzanilla et al. 2005), and *Allobates* sp. (Martins and Oliveira, 1998). Snakes are the most commonly observed predators of

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Figure 1. Photographs showing the predation of male *Ameerega trivittata* with a radio-transmitter by a colubrid snake *Erythrolamprus reginae*. (a) Immobilized frog held by snake on the head; (b) retreated snake after disturbance; (c) (d) close-ups of the dead frog and the retreated snake. The numbers and arrows indicate: (1) predated *A. trivittata*, (2) head of *E. reginae*, (3) white toxic skin secretions of the dead frog, (4) radio-transmitters attached with a waistband.

dendrobatid frogs (summarized in Costa-Campos et al., 2017; also see Santos and Cannatella, 2011; Lenger et al., 2014), but to the best of our knowledge this is the first reported predation of *A. trivittata* by a snake and the first predation of a toxic dendrobatid by *E. reginae*. *Erythrolamprus epinephalus* has been reported to be resistant to defensive skin alkaloids found in dendrobatid frogs (Myers et al., 1978). Whether other species such as *E. reginae* also have such resistance requires further investigation.

Predation of amphibians tagged with tracking devices has been observed in several other studies (Spieler and Linsenmair, 1998; Jehle and Arntzen, 2000; Ringler et al., 2010), which might be in part due to increased conspicuousness and reduced escape efficiency of tagged animals. Ramos and Caicedo (2019) reported predation of an untagged *A. trivittata* by the fishing spider *Acylometes rufus*. Interestingly, this predation event also occurred during tadpole transport and three other predations have been reported for both tagged and untagged tadpole transporting *Allobates femoralis* (Beck et al., 2017, Pašukonis et al., 2016). We speculate that frogs are more visible to predators when moving to pools and tadpole deposition sites might be particularly

suitable for sit-and-wait predators potentially increasing the predation risk and cost of parental care.

Acknowledgments. We thank Walter Hödl, Juliane Diller and the Mòdena family for supporting our project at the Panguana Biological Station. We also thank Rudolf von May and Carlos Eduardo Costa Campos for providing a critical reviews of the manuscript. This project was funded by the Austrian Science Fund (FWF) projects W1234-G17 and the German Herpetological Society (DGHT, Wilhelm-Peters- Fond 2014).

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