Nota

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Predation on *Abronia graminea* (Squamata: Anguidae) and *Sceloporus bicanthalis* (Squamata: Phrynosomatidae) by *Lanius ludovicianus* (Laniidae, Aves) in Veracruz, Mexico

Víctor Vásquez-Cruz, Arleth Reynoso-Martínez

[1]PIMVS Herpetario Palancoatl, Avenida 19 número 5525, Colonia Nueva Esperanza, C.P. 94540, Córdoba, Veracruz, México

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ABSTRACT
Here we document the first case of predation on the lizards *Abronia graminea* and *Sceloporus bicanthalis*, presumably by the Loggerhead Shrike, *Lanius ludovicianus*, in west-central Veracruz, Mexico

Key Words: Diet, impalement behavior, Loggerhead Shrike, predator-prey interactions.

Predation can be an important factor in the evolution of species' life history traits (e. g. Steen *et al.*, 2014). However, is rarely observed in the wild and few studies have confirmed the identity of predators and preys either by direct observation of predation events, or by traces of the interaction, such as traces of prey in feces (e.g. Vásquez-Cruz and Reynoso-Martinez, 2020) or stomach dissection of the predator (e.g. Vásquez-Cruz, 2020), and parts of the prey not consumed and left by predators. (e.g. Silva *et al.*, 2018). Identification of the species is necessary for a better understanding of the dynamics in predator-prey relationships.

Sceloporus bicanthalis and *Abronia graminea* are lizard species endemic to Mexico. *Sceloporus bicanthalis* is a medium-sized terrestrial species (adult snout-vent length [SVL] ca. 60 mm) belonging to the family Phrynosomatidae (Canseco-Márquez and Gutiérrez-Mayén, 2010). It occurs in open areas of rocky grassland in forests or xeric scrub in the states of Hidalgo, Mexico, Oaxaca, Puebla, and Veracruz (Ramírez-Bautista *et al.*, 2014), and is considered common within its restricted distribution (Flores-Villela and Santos-Barrera, 2007a). *Abronia graminea* is a larger, mostly arboreal species (adult SVL ca. 110 mm) belonging to the family Anguidae. It is distributed in the highlands of central Veracruz, southwestern Puebla, and northern Oaxaca, and inhabits a wide array of mesic forest types but often dominated by oak (*Quercus* spp.) (Canseco-Márquez and Gutiérrez-Mayén, 2010). The species is endangered by deforestation, climate change, and illegal harvest for pet trade, and is protected by Mexican law under the category Special Protection (IUCN Red List of Threatened Species, Flores-Villela and Santos-Barrera, 2007b; SEMARNAT 2010).

The Loggerhead Shrike (*Lanius ludovicianus*) is a passeriform bird in the family Laniidae with a wide distribution in North America, from southern Canada to northeastern Oaxaca in Mexico (Miller, 1931; Vázquez *et al.*, 2009). It has a carnivorous diet that includes invertebrates, amphibians, reptiles, rodents, and small birds (Jensen, 2013; Cogalniceanu, *et al.*, 2015). Its foraging behavior includes impaling its prey on thorns, branches, and even barbed wire, both to secure the prey for consumption and also for longer-term storage (Craig, 1978). Here we report for the first case of the predation on *Sceloporus bicanthalis* and *Abronia graminea* lizards presumably by the Loggerhead shrike (*Lanius ludovicianus*) in the central west of Veracruz, Mexico.

On 4 December 2019, we found seven lizards impaled on plant thorns, within a 50 m radius of each other, ca. 3 airline km north of Acultzingo

Author for correspondence: victorbiolvc@gmail.com

(18°44'30.7"N, 97°19'43.2"W, WGS 84, elev. 2520 m), Veracruz, Mexico. The area is characterised by pine-oak forest remnants, *Pinus patula* plantations, open areas of cattle pasture, and corn crops. We recorded two males and three females adults of *Sceloporus bicanthalis* and a skull of *Abronia graminea* impaled on thorns of unidentified shrubs at a height of 110–210 cm above the ground (Fig. 1A, B). We also found a male of *Sceloporus bicanthalis* on a terminal leaf spine of a maguey (*Agave* sp.) at a height of 150 cm above the ground (Fig. 1C).

Although we did not observe the predation events, we suggest that these *Sceloporus bicanthalis* and *Abronia graminea* were predated by *Lanius ludovicianus*, since it is a species observed in the study site (Fuentes-Moreno pers. comm., Howell and Webb, 1995) and whose foraging behavior includes the impaling of its prey (Yosef and Pinshowb, 2005). No other bird species in the study area exhibits this type of foraging behavior. Additionally, many species of lizards have been previously documented as preys of *L. ludovicianus* and were predated by impalement. Prey species include *Phrynosoma modestum* (Reid and Fulbright, 1981), *Anniella pulchra* (Fisher, 1901), *Anolis carolinensis*, *Plestiodon inexpectatus*, *Scincella lateralis, Aspidoscelis sexlineata* (Tyler, 1991; Yosef and Grubb, 1993), *Phrynosoma cornutum* (Tyler, 1991; Lemos-Espinal *et al.*, 1998), *Sceloporus edbelli* (Lemos-Espinal *et al.*, 2001), *Uma inornata* (Barrows, 2006), *Ophisaurus ventralis* (Clarke *et al.*, 2011), *Dipsosaurus catalinensis* (Carbajal-Márquez *et al.*, 2012), *Phrynosoma braconnieri* (Arias-Balderas *et al.*, 2012), *Anniella grinnelli*, *Uta stansburiana* (Herr and Papenfuss, 2017), *Phrynosoma hernandesi* (Cairns *et al.*, 2017), *Anolis sagrei* (Simpson *et al.*, 2019), *Phrynosoma mcallii* (e. g. Duncan, 1994; Lara-Resendiz *et al.*, 2019), *Sceloporus aeneus* and *Plestiodon brevirostris* (Gómez-Campos *et al.*, 2019). *Lanius ludovicianus* inhabits open areas where it usually hunts (Howell and Webb, 1995), and many of the lizard species known in its diet are terrestrial and inhabit open areas (e.g. species of Phrynosomatidae and Scincidae families), suggesting that feeding on *Sceloporus bicanthalis* may be recurrent, while predation on *Abronia graminea* could be a fortuitous case since it is an arboreal species (Canseco-Márquez and Gutiérrez-Mayen, 2010). Refuge availability for prey and abundance of both prey and predator species could influence these predator-prey interactions (e.g. Sih, 1987; Kumar, 2006; Das and Samanta, 2019).

Our observations are the first documented records of predation on *Abronia graminea* and add information about *Sceloporus bicanthalis* predators since only have been reported a snake species, *Crotalus intermedius*, as a predator (Schramer et al., 2020). These types of records are important for a better understanding of predator-prey dynamics, especially in reptiles species with secretive habits (e. g. Wiseman *et al.*, 2018), threatened with extinction and restricted distribution, as *Abronia graminea*.

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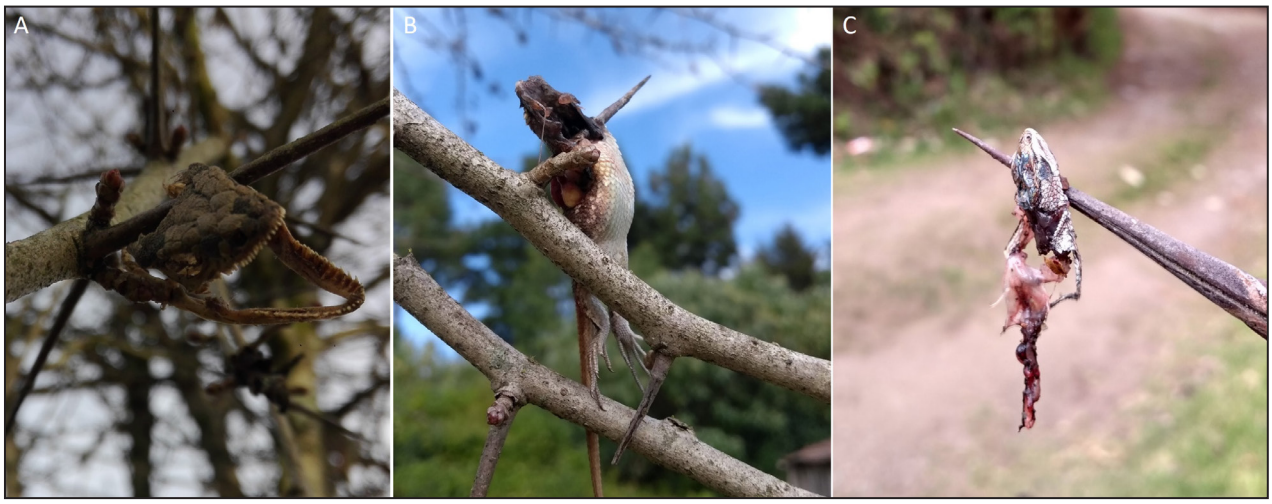

Figure 1. Impaled and predated lizards of *Sceloporus bicanthalis* and *Abronia graminea* in Acultzingo, Veracruz, Mexico. (A) *Abronia graminea* on thorn bush, (B) female *Sceloporus bicanthalis* on thorn bush, and (C) male *S. bicanthalis* on spine of *Agave* sp.

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