

SHORT COMMUNICATION

New records of predators of *Ameivula ocellifera* (Squamata: Teiidae), with an emphasis on predation by birds

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Predation is one of the most important characteristics related to animal evolution (Krebs and Davies 1996, Quinn and Cresswell 2004). It is considered to be one of the determining processes in the natural structure of communities, where prey and predators use chemosensory, visual, and acoustic cues, among others, to detect each other's presence and to assess the associated risks involved (Pianka 1975, Connell 1978, Kinderman *et al.* 2009, Mathot *et al.* 2009).

Ameivula ocellifera (Spix, 1825) is a widely distributed lizard species found in the Diagonal of

Open and Dry Areas in South America, occurring in Brazil, Argentina, and Bolivia. Individuals inhabit areas of sandy soils and high temperatures with shrubby-herbaceous vegetation and forest edges where leaf litter provides foraging sites (Mesquita and Colli 2003, Dias and Rocha 2004, 2007, Menezes *et al.* 2011, Cabrera 2012, Sales *et al.* 2012, Jose *et al.* 2014, Souza *et al.* 2014). This non-territorial species is an active forager and a heliothermal thermoregulator. It is sexually dimorphic in body size and shape; males exceed 100 mm and females are less than 80 mm in CRC (Anderson and Vitt 1990, Pianka and Vitt 2003, Sales *et al.* 2012). Predators of these lizards include a diverse range of animals, including invertebrates (Ribeiro *et al.* 2011, Moura *et al.* 2015), lizards (Sales *et al.* 2010, Gogliath *et al.*

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2010), snakes (Vitt and Vangilder 1983, Bocchiglieri and Mendonça 2009, Mesquita *et al.* 2013, Oliveira *et al.* 2018, Coelho *et al.* 2019), mammals (Olmos 1993) and some birds (Morais and Pinho 2007, Almeida *et al.* 2013, Vieira *et al.* 2018, Lisboa *et al.* 2020) (Table 1).

Table 1. List of species reported as predators of *Ameivula ocellifera* (*recorded in the field).

Predator categories	Species	Source
BIRDS		
Ardeidae	<i>Ardea alba</i> Linnaeus, 1758	Almeida <i>et al.</i> 2013*
Strigidae	<i>Glaucidium brasilianum</i> (Gmelin, 1788)	Vieira <i>et al.</i> 2018*
Bucconidae	<i>Nystalus maculatus</i> (Gmelin, 1788)	Lisboa <i>et al.</i> 2020
	<i>Nystalus chacuru</i> (Vieillot, 1816)	Gurgel and Quintas-Filho 2013
Accipitridae	<i>Rupornis magnirostris</i> (Gmelin, 1788)	Morais and Pinho 2007
	<i>Gampsonyx swainsonii</i> Vigors, 1825	This study*
Falconidae	<i>Falco femoralis</i> Temminck, 1822	This study*
Tyrannidae	<i>Machetornis rixosa</i> (Vieillot, 1819)	This study*
LIZARDS		
Teiidae	<i>Ameivula ocellifera</i> (Spix, 1825)	Sales <i>et al.</i> 2010
	<i>Ameiva ameiva</i> (Linnaeus, 1758)	Gogliath <i>et al.</i> 2010
Tropiduridae	<i>Tropidurus itambere</i> Rodrigues, 1987	Faria and Araujo 2004
	<i>Tropidurus hispidus</i> (Spix, 1825)	Costa <i>et al.</i> 2010, Zanchi <i>et al.</i> 2012*
	<i>Tropidurus torquatus</i> (Wied-Neuwied, 1820)	Kokubum and Lemos 2004*
SNAKES		
Dipsadidae	<i>Phimophis guerini</i> (Duméril, Bibron, and Duméril, 1854)	Bocchiglieri and Mendonça 2009
	<i>Oxyrhopus trigeminus</i> Duméril, Bibron, and Duméril, 1854	Vitt and Vangilder 1983, Mesquita <i>et al.</i> 2013, Coelho <i>et al.</i> 2019, This study*
	<i>Philodryas nattereri</i> (Steindachner, 1870)	Vitt and Vangilder 1983, França <i>et al.</i> 2008, Mesquita <i>et al.</i> 2011
Viperidae	<i>Bothrops erythromelas</i> Amaral, 1923	Oliveira <i>et al.</i> 2018
MAMMALS		
Felidae	<i>Herpailurus yagouaroundi</i> (É. Geoffroy Saint-Hilaire, 1803)	Olmos 1993
INVERTEBRATES		
Scolopendridae	<i>Scolopendra</i> sp.	Moura <i>et al.</i> 2015
Formicidae	<i>Dinoponera quadriceps</i> Kempf, 1971	Ribeiro <i>et al.</i> 2011

The behavioral records presented herein confirm various predators of *A. ocellifera*, in addition to providing detailed descriptions of the sequence and duration of the observed behavioral events.

The first predation event was recorded by EFM on 29 February 2020, at 09:20 h, in a rural area ($06^{\circ}35'38''$ S, $37^{\circ}37'26''$ W) located in the municipality of Paulista, state of Paraíba, northeastern Brazil. A collared falcon, *Falco femoralis* (Temminck, 1822) (Falconidae), captured a small individual of *A. ocellifera*. During the observation, the time of capture could not be determined. The bird was spotted in flight, already carrying the lizard. It then perched on a fence stake, at which time it was photographed (Figure 1A). In an attempt to approach the falcon to take a more detailed photo, the bird flew away.

The second predation event was recorded by JDS, on 27 June 2020, at 10:28 h in a rural area ($07^{\circ}30'58''$ S, $37^{\circ}17'10''$ W) located in the municipality of Brejinho, state of Pernambuco, northeastern Brazil. An adult *Oxyrhopus trigeminus* (Duméril, Bibron and Duméril, 1854) (Dipsadinae, Colubridae) (sex not determined; total length around 400 mm) was observed in rocky soil, where it was in the process of swallowing head first an *A. ocellifera* (total length around 150 mm) (Figure 1B). After 86 s, the snake left with the lizard in its mouth and stopped in a more sheltered location among leaves and rocks, where it finished ingesting the lizard after 5 min, taking 2 min to ingest the body and 3 min to ingest the tail.

The third predation event was recorded by CJSB on 03 July 2020 at 14:10 h and was observed in a rural area ($07^{\circ}22'40''$ S, $37^{\circ}11'24''$ W), located in the municipality of Itapetim, state of Pernambuco, northeastern Brazil. A *Gampsonyx swainsonii* (Vigors, 1825) hawk (Accipitridae) was observed as it captured a small individual of *A. ocellifera*. At the time, the lizard was still struggling, but it was quickly subdued by the bird with pecks to the neck and head region (Figure 1C). The entire process of subjugation and prey ingestion (documented in photographs) lasted 30 min, starting at 14:11 h and ending at

14:41 h. During the ingestion of prey, the predator discarded some internal organs (probably the stomach), but avidly ate the intestines, as well as the other internal and external structures. After the predation event, the bird cleaned a small piece of meat from its beak on several branches before flying away.

The fourth predation event was recorded by JVAM on 24 January 2021 at 08:28 h in an area of Caatinga converted into pasture at the rural property of Sítio Castelo dos Montes ($06^{\circ}42'03''$ S, $36^{\circ}56'45''$ W), located in the municipality of Ouro Branco, state of Rio Grande do Norte, Northeastern Brazil. A juvenile *A. ocellifera* was captured by a cattle tyrant *Machetornis rixosa* (Vieillot, 1819) (Tyrannidae) while foraging inside a bush. The bird initially took the lizard to a branch off the ground, where it subdued it by holding the lizard's head with its beak and hitting the lizard's body against the branch. The bird then took the lizard to the ground, where it ripped off the tail and parts of the limbs (Figure 1D), repeating the same movement of holding and hitting it. After that, another *M. rixosa* tried to steal the prey and both flew away. It was not possible to observe if they ingested the entire lizard. The process was fast and lasted seconds after the lizard was beaten and became immobile.

Top predators can act as structuring agents and biodiversity indicators in some ecosystems or regions, but not in others. The most common pattern is the effectiveness of the top predator; however, secondary predators appear depending on the species and context (Sergio *et al.* 2008, Estes *et al.* 2011, Pokharel 2020). Thus, our records corroborate Sergio *et al.* (2008) because birds of prey are globally distributed predators and have great potential for structuring biological communities (Sergio *et al.* 2008).

An extensive literature addresses how predators choose their prey (Pokharel 2020). Falconiformes employ various hunting strategies, many of which are associated with catching prey at high speeds. On the other hand, *M. rixosa* has an essentially insectivorous diet, and only one record in the literature describes vertebrate predation. The two predation events we observed



Figure 1. Predation of *Ameiva ocellifera* by (A) *Falco femoralis*, (B) *Oxyrhopus trigeminus*, (C) *Gampsonyx swainsonii*, and (D) *Machetornis rixosa*.

may be opportunistic (Martins *et al.* 2015).

Several records of saurophagy by the snake *O. trigeminus* are based on an analysis of stomach contents (Vitt and Vangilder 1983, Rocha *et al.* 2005, França *et al.* 2008, Alencar *et al.* 2012, Mesquita *et al.* 2013, Coelho *et al.* 2019). Only one study describes observations in nature (Mikalauskas *et al.* 2017). Although the lizard *A. ocellifera* is mentioned in the literature as prey of this snake, this is the first record

describing the predation event.

We compiled a list of 20 predators of *A. ocellifera* based on this study and the literature. Snakes ($N = 9$) were the most common predators of *A. ocellifera* (34.6% of predators reported; Table 1), followed by birds ($N = 8$; 30.8%), lizards ($N = 6$; 23.1%), invertebrates ($N = 2$; 7.7%), and mammals ($N = 1$; 3.8%).

Our observations corroborate literature records that show snakes and birds are predators

of *A. ocellifera*. Our observations further indicate predation by three species of birds previously unknown as predators of *A. ocellifera*. Although studies of stomach contents have recorded the snake *O. trigeminus* as a predator of *A. ocellifera*, we provide the first description of the snake's predatory behavior in nature. *Ameivula ocellifera* is consumed by a variety of animals, which makes this species a significant link in the food chain.

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