Boletín de la Sociedad Zoológica del Uruguay, 2021
Vol. 30 (1): 61-64
ISSN 2393-6940
https://journal.szu.org.uy
DOI: https://doi.org/10.26462/30.1.6

NOTA

FACING TOXICITY: FIRST REPORT ON THE PREDATION OF *Siphonops paulensis* (CAECILIDAE) BY *Athene cunicularia* (STRIGIDAE)

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Fecha de recepción: 20 de febrero de 2021
Fecha de aceptación: 20 de mayo de 2021

ABSTRACT

We report the first record of *Siphonops paulensis* predation by Burrowing Owl occurred in a Cerrado fragment. In addition to describing the predation event, we discuss the owl's ability to hunt for fossorial species and the presence of poison glands on the amphibian's skin, which can act as a defense against predators.

Key words: Bird of Prey, Caecilians, Foraging, Owl.

RESUMEN

Enfrentando la toxicidad: primer reporte de la depredacíon de *Siphonops paulensis* (Caecilidae) por *Athene cunicularia* (Strigidae). Reportamos el primer registro de depredación de *Siphonops paulensis* por el Mochuelo del Hoyo ocurrido en un área de fragmentos de Cerrado. Además de describir el evento de depredación, discutimos la capacidad del búho para cazar especies fosoriales y la presencia de glándulas venenosas en la piel del anfibio, que pueden actuar como defensa contra los depredadores.

Palabras Clave: Aves de Presa, Búho, Cecilianos, Forrajeando.

The Burrowing Owl (*Athene cunicularia*) is a common bird of prey distributed throughout the American continent, occurring from southern Canada to southern Chile (Sick, 1997). In Brazil, it is quite common to find its in dry and open places with few trees, such as restingas and pastures, being frequently seen in urban areas (Sick, 1997). The species is considered a generalist and opportunistic predator that has fossorial invertebrate such as Coleoptera, Hymenoptera and Orthoptera as their main prey items (Cadena-Ortíz, Freile and Bahamonde-Vinueza, 2013). Some studies have even reported the predation of venomous invertebrates, such as spiders and scorpions (Silva et al., 1995; Motta-Junior, 2006; Carevic, Carmona and Muñoz-Pedreros, 2013; Cadena-Ortíz et al., 2016; Guerrero, Lucero, Agnolin, Lucero and Ortíz, 2017). However, the contribution of invertebrates to biomass is relatively lower if compared to vertebrate preys. Most of the biomass consumed by the Burrowing Owl comes from the predation of small vertebrates, mainly small mammals (Motta-Junior, 2006; Cadena-Ortíz et al., 2016). As the information about the Burrowing Owl's diet is based on pellets and stomach contents (e.g., Motta-Junior, 2006; Cadena-Ortíz et al., 2013; Cadena-Ortíz et al., 2016), some prey items are difficult to identify, such as amphibians,

Fig. 1. A. The moment *Athene cunicularia* was preying upon *Siphonops paulensis*. Illustration by Ingrid R. Miguel. B. *Siphonops paulensis* decapitated and partially eaten by *Athene cunicularia*.

resulting in a gap in the knowledge of predator-prey relations at a specific level. Here, we present the first report of a Burrowing Owl preying on a caecilian, a limbless amphibian that has fossorial habits and is rarely seen on the surface.

On 26 October 2019, at approximately 1:00 a.m. (local time), after a light rain on a trial road in Brazlândia, Brasília, Brazil (15º41'29" S; 48º12'43" W), where agricultural farms are common and surrounded by fragments of Cerrado, we observed a Burrowing Owl preying on a caecilian *Siphonops paulensis.* The Burrowing Owl was holding the caecilian with its claws and decapitating it (Fig. 1A). Upon realizing our presence, the Burrowing Owl ran away and abandoned its prey that was without the head and with a cut along its body (Fig. 1B). We identified the caecilian based on the 106 rings after its necklace (*S. paulensis* can be diagnosed by its 100–118 rings, different from its only sympatric congener *Siphonops annulatus* with 78–98 rings; see Taylor, 1968). The specimen was not collected.

Due to their secretive lifestyle, caecilians are one the least studied group among vertebrates (Wilkinson, 2012), with little information about ecological interactions and natural history. Predation reports involving caecilians are rare, leading to uncertainties about their potential predators (Gower and Wilkinson, 2005; Greeney, Gelis and Funk, 2008; Gonzalez, Gomes, Prado, Quinhones and Salles, 2018). Also, their high toxic skin (Wake, 1986; Jared et al., 2018) and fossorial habits (Taylor, 1968; Duellman and Trueb, 1994; Gower and Wilkinson, 2005) reduce their chances of being preyed when compared to other amphibians. Fewer species can prey on caecilians, and only some snakes are pointed out as the main predators (e.g., Duellman and Trueb, 1994; Kupfer, Gower and Himstedt, 2003; Gonzalez et al., 2018). However, other animals have been reported as opportunistic predators of caecilians, such as spiders, ants, caimans, canids, electric fishes and even other birds of prey (e.g., Boistel and Pauwels, 2002; Greeney, Gelis and Funk, 2008; Cisneros-Heredia and Mosquera, 2010; Jestrzemski and Schutz, 2016; Oliveira, Esteves-Silva, Santos-Jr, Kawashita-Ribeiro and Tavares-Dias, 2019a; Oliveira, Vaz-Silva, Souza, Andrade and Morais, 2019b; Escalante and Amador, 2020). Among the birds of prey, just the Barred Hawk's (*Morphnarchus princeps)* (Greeney, Gelis and Funk, 2008), the Common Black Hawk (*Buteogallus anthracinus*) (Escalante and Amador, 2020) and the Burrowing Owl (present study) show how surprising aerial predators have been able to find and toxic prey and fossorial species (Greeney et al., 2008).

The caecilians' skin contains poison glands that can secrete potentially dangerous toxic substances (Wake, 1986). Few studies described the toxicity of this secretions in *S. paulensis*, showing that the substances on this species' skin is associated with an indirect cardiotoxic activity, causing hemolytic activity (Schwartz et al., 1998, 1999, 2003) that can be lethal to their predators. In addition to venom glands in the skin, a recent study with the genus *Siphonops* found this taxon may also have developed a mechanism to inoculate toxins through biting, since species of this genus have an oral venom system (Mailho-Fontana et al., 2020), however, is not clear whether this venom can be used for defense.

Few studies report the presence of amphibians in the Burrowing Owl's diet, and when they are reported they are mostly represented by anurans (e.g., Silva et al., 1995; Sánchez, Malizia and Bó, 2008; Alves, Ceron, Preuss, Zocche and Carvalho, 2019). For some predators, such as American Barn Owl (*Tyto furcata*), the predation of toxic species occurs only when non-toxic prey has low availability (Roulin and Dubey, 2013), a pattern that can be copied by the Burrowing Owl, since it is known to have seasonal variations in its diet (Carevic, Carmona and Muñoz-Pedreros, 2013). In addition, it is worth noting that some species, such as the Great Black Hawk (*Urubitinga urubitinga*),

developed strategies to consume toxic prey by avoiding the prey's skin, ingesting only its internal portions (Carvalho Filho et al., 2006). In this context, it is important to investigate whether there is any specific predation strategy for the consumption of toxic amphibians by the Burrowing Owl.

The event report in this study happened during the rainy season in Central Cerrado, similar to what happened with the Barred Hawk (Greeney et al., 2008). Some caecilian species may have greater activity on the soil surface, depending on the rainy season or soil moisture because the excess of water may flood the underground galleries where they live (Malonza and Measey, 2005). Consequently, rain may cause an increase in the predation of caecilians, due to the greater exposure of these animals in these conditions.

Our observation contributes to the knowledge about predator-prey interactions involving the Burrowing Owl and the caecilians. We suggest new studies to be carried out focusing on the observation of the Burrowing Owl's foraging behavior, in order to better understand its predation strategies (e.g., the predator-prey relationships, how the predators deal with toxic preys, and how frequent these predation events are), especially for amphibians that are easily digested and rarely related in traditional diet studies (e.g., with stomach contents and pellets).

ACKNOWLEDGEMENTS

We thank Bruno A. P. Corrêa and Rodrigo C. Gonzalez to comments on the manuscript.

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Editor de Sección: Raúl Maneyro