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A new case of predation on a lizard by *Tropidurus hispidus* (Squamata, Tropiduridae), including a list of saurophagy events with lizards from this genus as predators in Brazil

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Knowledge on interspecies predation contributes to the faunistic control of biodiversity (Vitt, 2000). When lizards are involved as prey, this predation event is known as saurophagy (Vitt et al., 1996; Faria and Araújo, 2004; Passos et al., 2016). The incidence of predation events, whether by saurophagy or cannibalism, has been increasingly documented (Siqueira and Rocha, 2008; Robbins et al., 2013).

Tropidurus hispidus (Spix, 1825), a medium-sized lizard (up to 35 cm total length), widely distributed throughout South America, is abundant in different microhabitats in Caatinga Biome (Rodrigues, 1987; 1988; Ávila-Pires, 1995; Carvalho, 2013). Lizards of the genus *Tropidurus* Wied, 1820 are considered diurnal, territorial, and sit-and-wait foragers with opportunistic feeding habits (e.g., Van Sluys et al., 2004; Ribeiro et al., 2009; Ribeiro and Freire, 2011a). The individuals of this taxon use arthropods as their primary food source, but also ingest plant parts (leaves, flowers, and fruits) and other vertebrates such as amphibians, amphisbaenians, lizards, and, occasionally, rodents (Faria and Araújo, 2004; Gasparini and Peloso, 2007; Ribeiro and Freire, 2009; Passos et al., 2016). Lizards of *Tropidurus hispidus* have one mite pocket on the lateral neck, one deep and oblique granular axillary mite pocket, and

lack inguinal pockets (Rodrigues, 1987). In the area of the present study, *T. hispidus* is sympatric with the congener *T. semitaeniatus*, which is extremely flattened dorsoventrally when compared to *T. hispidus*.

Gymnodactylus geckoides Spix, 1825 (Phyllodactylidae) is a small gecko (up to 8 cm total length), exhibiting diurnal and nocturnal habits with wide occurrence in Caatinga, from the state of Bahia to state of Rio Grande do Norte (Vanzolini, 1974). It can be found moving over rocks, in leaf litter, as well as on rotten trunks and piles of stones. It feeds on small arthropods, primarily termites, using the sit-and-wait foraging tactic (Vanzolini et al., 1980). These geckos have a coloration that varies from light grey to dark brown, with tubercles along the body in the dorsal region, and the fingers and toes without lamellae (Vanzolini et al., 1980; Vitt, 1995).

This study records, for the first time, *G. geckoides* as prey of *T. hispidus* in the semiarid region of Northeastern Brazil and presents a list of saurophagy events involving *Tropidurus* lizards as predators.

The predation event was observed on 31st March, 2016 during field work to rescue the fauna in an area of the “Projeto de Integração do Rio São Francisco com as Bacias Hidrográficas do Nordeste Setentrional” (PISF), in the municipality of Custódia, state of Pernambuco, Brazil. The region, located in the Sertaneja depression, exhibits a hot, semiarid climate, with average annual temperatures between 26°C and 28°C, averages annual rainfall between 500 and 800 mm, and with predominantly Caatinga vegetation (Velloso et al., 2002; Prado, 2003). At the time of the sighting, the adult *T. hispidus* was on a rocky surface (8.2528°S, 37.7050°W; datum: WGS84; 509 m above sea level) with a specimen of *G. geckoides* in its mouth. The head of the prey was completely inside the lizard’s mouth (Figure 1A). The predator proceeded to swallow the gecko for the next

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Figure 1. Predation of *Gymnodactylus geckooides* by *Tropidurus hispidus* in the municipality of Custódia, state of Pernambuco, Brazil. Prey's head completely ingested (A); trunk of the prey ingested up to the level of the hind legs (B).

Table 1. Records of saurophagy involving seven *Tropidurus* lizard species as predators in Brazil. Asterisks represent cases of part of the body consumed.

Predator	Prey / Family	Biome / Habitat	Reference
<i>Tropidurus hispidus</i> (Spix, 1825)	Unidentified lizard	Caatinga	Vitt (1995)
	<i>Tropidurus</i> sp. (tail*) / Tropiduridae	Cerrado / Rocky meadows	Van Sluys <i>et al.</i> (2004)
	<i>Colobosaura modesta</i> (Reinhardt and Lutken, 1862) / Gymnophthalmidae	Atlantic Forest / Restinga	Costa <i>et al.</i> (2010)
	<i>Ameivula ocellifera</i> (Spix, 1825) / Teiidae	Atlantic Forest / Restinga	Costa <i>et al.</i> (2010)
	<i>Tropidurus hispidus</i> (Spix, 1825) / Tropiduridae	Caatinga	Sales <i>et al.</i> (2011)
	<i>Ameivula ocellifera</i> (Spix, 1825) / Teiidae	Atlantic Forest	Zanchi <i>et al.</i> (2012)
	<i>Norops auratus</i> (Daudin, 1802) / Dactyloidae	Amazonia / Forest fragment	Costa-Campos and Souza (2013)
	<i>Tropidurus jaguaribanus</i> Passos, Lima, and Borges-Nojosa, 2011 / Tropiduridae	Caatinga	Passos <i>et al.</i> (2016)
	<i>Gymnodactylus geckooides</i> Spix, 1825 / Phyllodactylidae	Caatinga	Present study
	<i>Tropidurus hygomi</i> Reinhardt and Luetken, 1861	<i>Tropidurus hygomi</i> Reinhardt and Luetken, 1861 / Tropiduridae	Atlantic Forest / Restinga
<i>Tropidurus hygomi</i> Reinhardt and Luetken, 1861 / Tropiduridae		Atlantic Forest / Restinga	Kohlsdorf <i>et al.</i> (2004)
<i>Tropidurus itambere</i> Rodrigues, 1987	<i>Ameivula ocellifera</i> (Spix, 1825) / Teiidae	Cerrado	Faria and Araújo (2004)
	<i>Tropidurus</i> sp. (foot*) / Tropiduridae	Cerrado	Faria and Araújo (2004)
<i>Tropidurus montanus</i> Rodrigues, 1987	<i>Rhachisaurus brachylepis</i> (Dixon, 1974) / Gymnophthalmidae	Cerrado	Kiefer (1998)
	<i>Tropidurus montanus</i> Rodrigues, 1987 / Tropiduridae	Cerrado	Kiefer and Sazima (2002)
<i>Tropidurus oreadicus</i> Rodrigues, 1987	<i>Tropidurus oreadicus</i> Rodrigues, 1987 / Tropiduridae	Caatinga / Canga fields	Araújo (1987)
	<i>Micrablepharus maximiliani</i> (Reinhardt and Luetken, 1862) / Gymnophthalmidae	Cerrado	Faria and Araújo (2004)
	Unidentified lizard (tail*)	Cerrado	Faria and Araújo (2004)
	<i>Tropidurus oreadicus</i> Rodrigues, 1987 / Tropiduridae	Amazonia / Urban area	Albuquerque (2010)
<i>Tropidurus semitaeniatus</i> (Spix, 1825)	<i>Cercosaura schreibersii</i> (Wiegmann, 1834) / Gymnophthalmidae	Amazonia / Forest edge	Albuquerque (2010)
	Unidentified lizard	Caatinga	Vitt (1995)
<i>Tropidurus torquatus</i> (Wied, 1820)	<i>Hemidactylus mabouia</i> (Moreau de Jonnés, 1818) / Gekkonidae	Atlantic Forest / Restinga	Araújo (1991)
	<i>Tropidurus torquatus</i> (Wied, 1820) / Tropiduridae	Marine / Insular	Dutra (1996)
	<i>Brasiliscincus agilis</i> (Raddi, 1823) / Mabuyidae	Atlantic Forest / Restinga	Teixeira and Giovanelli (1999)
	<i>Gymnodactylus darwini</i> (Gray, 1845) / Phyllodactylidae	Atlantic Forest / Restinga	Teixeira and Giovanelli (1999)
	<i>Hemidactylus mabouia</i> (Moreau de Jonnés, 1818) / Gekkonidae	Atlantic Forest / Restinga	Teixeira and Giovanelli (1999)
	<i>Hemidactylus mabouia</i> (Moreau de Jonnés, 1818) / Gekkonidae	Atlantic Forest / Urban area	Galdino and Van Sluys (2004)
	<i>Ameivula ocellifera</i> (Spix, 1825) / Teiidae	Cerrado / Farm area	Kokubum and Lemos (2004)
	<i>Ameivula littoralis</i> (Rocha, Araújo, Vrcibradic, and Costa, 2000) / Teiidae	Atlantic Forest / Restinga	Kiefer <i>et al.</i> (2006)
	<i>Psychosaura macrorhyncha</i> (Hoge, 1946) / Mabuyidae	Atlantic Forest / Restinga	Kiefer <i>et al.</i> (2006)
	<i>Tropidurus torquatus</i> (Wied, 1820) / Tropiduridae	Atlantic Forest / Restinga	Kiefer <i>et al.</i> (2006)
<i>Ameivula nativo</i> (Rocha, Bergallo, and Peccinini-Seale, 1997) / Teiidae	Atlantic Forest / Restinga	Peloso and Pavan (2007)	

two minutes. Until we lost sight of the predator, the prey had been swallowed up to its hind limbs (Figure 1B).

Events of saurophagy initiated by the head of the prey have also been reported in other studies (Greene, 1976; Queiroz and Queiroz, 1987; Maia-Carneiro et al., 2016). According to these authors, this tactic is related to the shorter time and energy spent to ingest the prey, in addition to being a strategy to reduce the resistance offered by appendages and body scales. In cases of saurophagy in which the direction of prey ingested by *Tropidurus* lizards is described, three situations of headfirst ingestion were reported, one involving *T. torquatus* preying on two geckos (Galdino and Van Sluys, 2004), and one cannibalism case by *T. hygomi* (Kohlsdorf et al., 2004). On the other hand, four saurophagy events reported tailfirst ingestion, one case of cannibalism by *T. hygomi* (Dias and Rocha, 2004), and three cases of *T. hispidus* preying on three lizards, two teiids and one gymnophthalmid (Costa et al., 2010; Zanchi et al., 2012).

A total of 32 cases of saurophagy are given in Table 1 with preys belonging to seven families and predators corresponding to seven *Tropidurus* lizard species. The most frequent preys belong to the family Tropiduridae (11 cases), followed by Teiidae (six cases), Gymnophthalmidae (four cases), Gekkonidae (three cases), Mabuyidae (two cases), Phyllodactylidae (two cases), and Dactyloidae (one case). Additionally, three unidentified lizards were also reported.

Tropidurus hispidus and *G. geckoides* have wide distribution in the semiarid region (Rodrigues, 2003), and have been recorded in sympatry (Ribeiro and Freire, 2011b). Individuals of these two species exhibit different body sizes, the former being larger (Vitt, 1995). This difference in body sizes among lizard species allows the occurrence of saurophagy (Siqueira and Rocha, 2008; Zanchi et al., 2012). Regarding to the genera *Tropidurus* and *Gymnodactylus* Spix, 1825, a predation event was already recorded in a restinga habitat, involving *G. darwini* (Gray, 1845) as prey of *T. torquatus* (Wied, 1820) (Teixeira and Giovanelli, 1999). Besides saurophagy reports, amphibians such as *Elachistocleis ovalis* (Schneider, 1799) (Vitt et al., 1996) and *Scinax x-signatus* (Spix, 1824) (Ribeiro and Freire, 2009) have been documented to be part of the diet of *T. hispidus*. Two bird predation events were also observed in the Atlantic Forest and in the semiarid region for this lizard species (Guedes et al., 2017).

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