

Dangerous neighborhood: saurophagy between syntopic *Tropidurus* lizards

Daniel Cunha Passos^{1,4}, Felipe Augusto Correia Monteiro² & Carlos Henrique de Oliveira Nogueira³

¹Universidade do Estado do Rio de Janeiro, Programa de Pós-Graduação em Ecologia e Evolução, Rua São Francisco Xavier, 524, Pavilhão Haroldo Lisboa da Cunha, Sala 224, 20550-013, Rio de Janeiro, RJ, Brazil.

²Instituto Federal de Ciência, Educação e Tecnologia do Estado do Ceará, Jaguaribe, CE, Brazil.

³Universidade Estadual do Norte Fluminense Darcy Ribeiro, Campos dos Goytacazes, RJ, Brazil.

⁴Corresponding author: Daniel Passos, e-mail: biologodanielpassos@gmail.com

PASSOS, D.C., MONTEIRO, F.A.C., NOGUEIRA, C.H.O. **Dangerous neighborhood: saurophagy between syntopic *Tropidurus* lizards.** Biota Neotropica. 16(1): e20150062. <http://dx.doi.org/10.1590/1676-0611-BN-2015-0062>

Abstract: Saurophagy constitutes an important source of mortality among lizards and has been reported for the genus *Tropidurus*. However, the extension of this behavior remains unknown. Herein, we record the predation of *T. jaguaribanus* by its congener *T. hispidus*. This is the first report of saurophagy among different species of syntopic *Tropidurus*. Furthermore, whereas published records of saurophagy tend to be directed against juveniles, this case involved two adult individuals.

Keywords: Predation, mortality, agonistic interactions, Tropiduridae, Caatinga.

PASSOS, D.C., MONTEIRO, F.A.C., NOGUEIRA, C.H.O. **Vizinhança perigosa: saurofagia entre lagartos *Tropidurus* sintópicos.** Biota Neotropica. 16(1): e20150062. <http://dx.doi.org/10.1590/1676-0611-BN-2015-0062>

Resumo: A saurofagia constitui uma importante fonte de mortalidade entre lagartos e tem sido reportada para o gênero *Tropidurus*. Contudo, a extensão deste comportamento permanece desconhecida. Neste estudo registramos a predação de *T. jaguaribanus* por seu congêner *T. hispidus*. Este é o primeiro caso de saurofagia entre diferentes espécies de *Tropidurus* sintópicos. Além disso, embora a saurofagia tenda a ser direcionada contra jovens, este caso envolveu dois indivíduos adultos.

Palavras-chave: Predação, mortalidade, interações agonísticas, Tropiduridae, Caatinga.

Introduction

Predation constitutes one of the major pressures negatively affecting natural populations. In context of lizards, the predation by a sympatric lizard and even by the same species represent two important sources of mortality (Vitt 2000, Siqueira & Rocha 2008). At first glance, the incidence of these kind of predatory events appeared to be infrequent, but cases of saurophagy and cannibalism among lizards are increasingly documented (Pincheira-Donoso 2012, Robbins et al. 2013).

Lizards of the genus *Tropidurus* are known to be ambush foragers with opportunistic feeding habits. Although their diet is primarily composed of arthropods, several species also feed on plant items as well small vertebrates (Faria & Araújo 2004, Van Sluys et al. 2004, Kolodiuk et al. 2010). Among the vertebrate preys of *Tropidurus*, there are consumption records of mammals (Gasparini & Peloso 2007), frogs (Vitt et al. 1996, Kiefer et al. 2006, Ribeiro & Freire 2009, Costa et al., 2010), but mainly of lizards. For instance, saurophagy was reported for *T. hispidus* (Spix, 1825) (Rojas-Runjaic et al. 2006, Costa et al. 2010, Zanchi et al. 2012), *T. itambere* Rodrigues, 1987 (Faria & Araújo 2004), *T. montanus* Rodrigues, 1987 (Kiefer 1998), and *T. torquatus* (Wied, 1820) (Teixeira & Giovanelli 1999, Galdino & Van Sluys

2004, Kokubum & Lemos 2004, Kiefer et al. 2006, Peloso & Pavan 2007). Moreover, cannibalism was recorded in *T. hispidus* (Sales et al. 2011), *T. hygomi* Reinhardt & Lütken, 1861 (Dias & Rocha 2004, Kohlsdorf et al. 2004), *T. montanus* (Kiefer & Sazima 2002), *T. oreadicus* Rodrigues, 1987 (Araujo 1987), and *T. torquatus* (Kiefer et al. 2006).

Despite saurophagic and cannibalistic behaviors had been relatively well documented for *Tropidurus* lizards, the extent of these events remains misunderstood. Furthermore, of all saurophagic records involving *Tropidurus* lizards as predators, none included syntopic congeners as prey. Herein, we expand the knowledge on saurophagy by providing the first record of predation of *T. jaguaribanus* Passos, Lima & Borges-Nojosa, 2011 by *T. hispidus*.

Material and Methods

The observations were made during a field study on the geographical distribution of the species of the *Tropidurus semitaeniatus* group, at the vicinity of the Instituto Federal de Ciência, Educação e Tecnologia do Estado do Ceará – IFCE (5°52'59" S, 38°36'13" W, 137 m a.s.l., Datum: WGS 1984), Jaguaribe municipality, Ceará state, northeastern Brazil. The study area is located in a depression region between residual

massifs along the middle course of the Jaguaribe River, where there are many rocky outcrops. This location is covered by secondary vegetation composed mainly of xerophytic shrubs and an ephemeral herbaceous stratum during the rainy season. The climate is semiarid and the environment is highly susceptible to desertification (Guerra et al. 2010).

Predatory event was video and photographically recorded in detail by two of us (DCP and FACM) about 5 meters from the lizards. After the end of the observations, both prey and predator were collected, fixed in 10% formalin, preserved in 70% ethanol, and deposited in the Coleção Herpetológica da Universidade Federal do Ceará (CHUFC L 5996 - *T. jaguaribanus* and

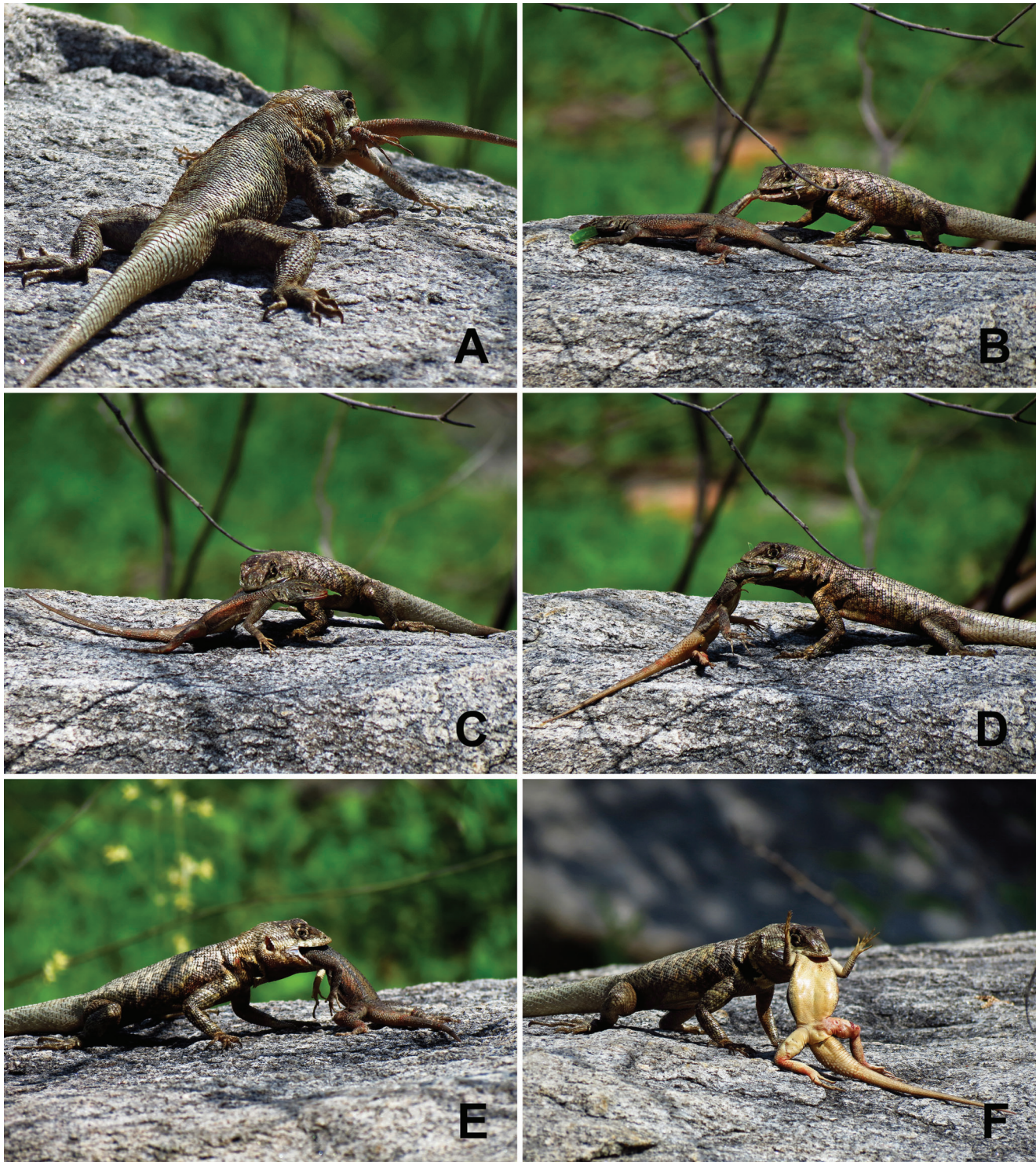


Figure 1. Saurophagic behavior of *Tropidurus hispidus* on *Tropidurus jaguaribanus*. (A) prey capture by the left hindlimb; (B) prey recapture by the right hind limb; (C) prey recapture by the thorax; (D) prey recapture by the head; (E) dorsal attempt to swallow the prey; (F) ventral attempt to swallow the prey.

CHUFC L 5997 - *T. hispidus*). In the lab, the snout–vent length (SVL) of lizards was measured with calipers (to nearest 0.01 mm). An X-ray was made of the *T. jaguaribanus* specimen (VMI-Philips Compacto Plus 500 – 32 kV / 0.03 mAs / mA 100) to evaluate its bone injuries. It was then dissected to diagnose its cause of death by one of us (CHON), at the radiology sector at the Veterinary Hospital of the Universidade Estadual do Norte Fluminense Darcy Ribeiro.

Results

On the morning of 23 April 2015 at 09:14 a.m. an adult male *Tropidurus hispidus* (112.5 mm SVL) chased and caught an adult female of *T. jaguaribanus* (76.4 mm SVL) by its left hind limb (Figure 1A). After a few seconds, the predator vigorously shook the prey still firmly held between its jaws, while the prey writhed and bit its head in unsuccessful attempts to escape. Thereafter, the predator briefly released the prey triggering its escape, but soon pursued and recaptured it again. This process involving release, pursuit and recapture happened several times, differing only in the part of the prey's body (e.g., right hindlimb, thorax, and head, respectively) bitten by the predator (Figure 1B–D). Only 26 minutes after the beginning of the observations we assumed the death of the prey, due to the absence of any reaction to the last release event. On that occasion, the predator kept right off and gently touched the prey. Prey manipulation and observation lasted some minutes, afterwards the predator began to swallow it. There were two attempts to swallow the prey, both head-first. Initially, the predator tried to swallow the prey dorsally (Figure 1E), but failed. Then, it turned the prey with belly up and tried to swallow it again (Figure 1F). However, the predator was not

able to swallow entirely the prey. At 10:16 a.m., after almost an hour, the predator started to lose interest for the prey, and we shot it down with an airgun. Then, both lizards were collected, taken to the lab and deposited at the scientific collection of the Universidade Federal do Ceará.

The radiography showed multiple bone fractures throughout the prey's body (Figure 2) as follows: jaw (complete fracture of the left mandibular bone), right forelimb (luxation of the radioulnar and radiocarpal joints), left hind limb (transversal fracture of the femur), right hind limb (spiral fracture of the fibula). The necropsy also revealed several tegumentary perforations at the bite sites, lacerations and edemas in vicinity of the fractured bones, as well hemorrhagic areas in the femoral region of the left hind limb and in the tibial region of the right hind limb. In addition, the lizard's skull was smashed, estimated about 12% by comparing the photographic records of the beginning and end of the predatory event (head height 7.0 and 6.1 mm, respectively). However, although the hypovolemic shock might be generally the cause of death in severely injured animals (Figuera et al. 2008), we were not able to accurately evaluate the seriousness of the cranial trauma due to the small body size of the prey, and so the *causa mortis* of the specimen could not be precisely determined.

Discussion

The Neotropical lizard *Tropidurus hispidus* has a wide geographical distribution, occurring in Caatinga semiarid and coastal areas in northeastern Brazil as well as in Amazonian savanna enclaves in northern South America (Carvalho 2013). As is known for most *Tropidurus*, this species feeds mainly on arthropods, but leaves, flowers and fruits also may compose its diet (Vitt 1995, Van Sluys 2004, Kolodiuk et al. 2010). Moreover, small vertebrates

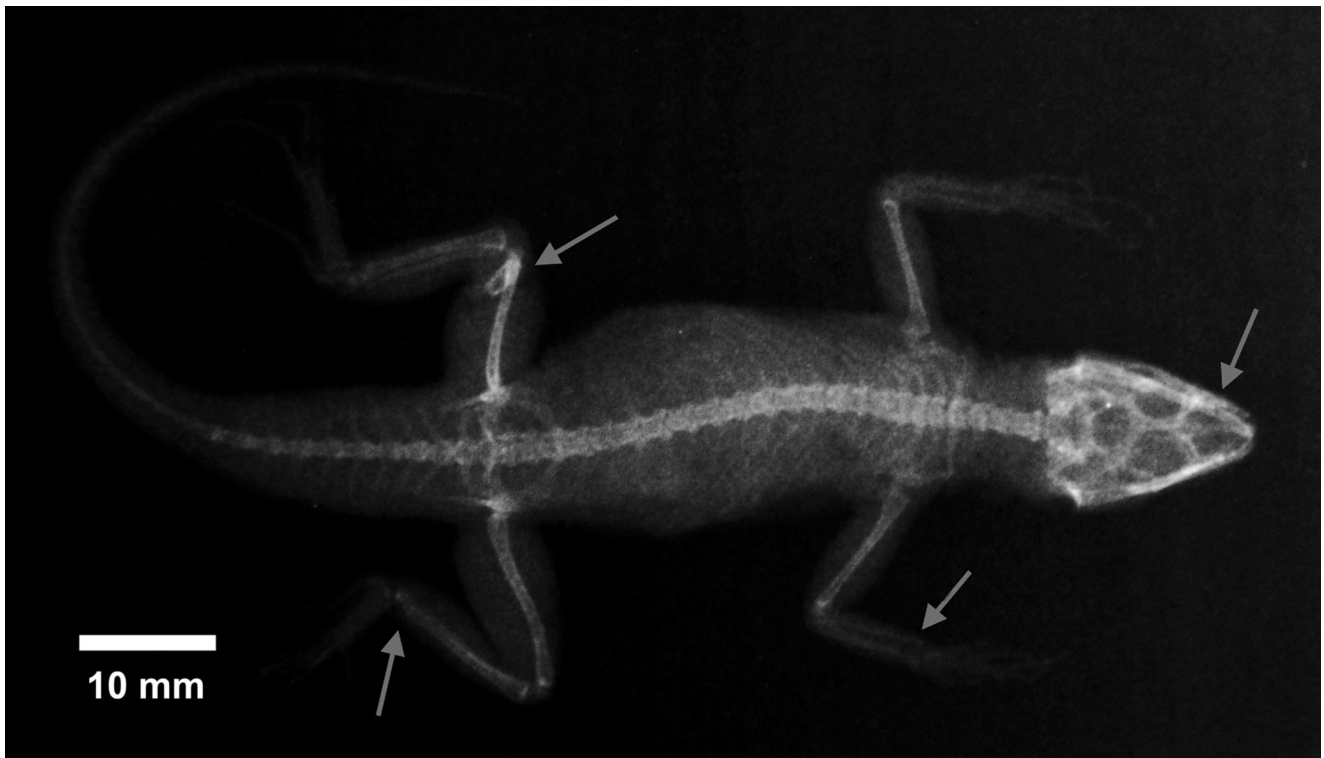


Figure 2. Radiography of an adult female *Tropidurus jaguaribanus*. The arrows indicate the multiple bone fractures.

have been also reported among its prey, such as the frogs *Elachistocleis ovalis* (Schneider, 1799) (Vitt et al. 1996) and *Scinax x-signatus* (Spix, 1824) (Ribeiro & Freire 2009), beyond the lizards *Colobosaura modesta* (Reinhardt and Lütken, 1862) (Costa et al. 2010), *Cnemidophorus ocellifer* (Spix, 1825) (Zanchi et al. 2012) and *Norops auratus* (Daudin, 1802) (Costa-Campos & Souza 2013). Although *T. hispidus* is commonly found in sympatry with other congeners, as *T. erythrocephalus* Rodrigues 1987, *T. hygomi* and *T. montanus* (Rodrigues 1987), to our knowledge there is no record of congeneric saurophagy between syntopic *Tropidurus* species. *Tropidurus hispidus* and *T. jaguaribanus* live in syntopy on rocky outcrops along the Jaguaribe Valley in the state of Ceará (Passos et al. 2011) and although agonistic encounters between the species eventually occur, they usually tolerate the proximity to each other (Passos pers. obs.). Thus, this is the first record of *T. jaguaribanus* as prey of *T. hispidus* and the first report of congeneric saurophagy among different species of syntopic *Tropidurus*.

Tropidurus hispidus is one of the largest species of the *torquatus* group (Rodrigues 1987, Freitas & Silva 2005), whilst *T. jaguaribanus* is the largest one of the *semitaeniatus* group (Passos et al. 2011, Passos et al. 2013). In general, juvenile lizards are more susceptible to predation in both saurophagic and cannibalistic interactions (Siqueira & Rocha 2008). Their smaller relative size compared to adults, their higher relative abundance as well the lack of experience in avoid predators may explain this trend (Vitt 2000). In fact, the majority of records of saurophagy and cannibalism in *T. hispidus* were directed against juveniles (e.g. Sales et al. 2011) or species of smaller body size (e.g. Zanchi et al. 2012). However, the case reported herein involved adult individuals of two of the largest species of the genus *Tropidurus*. This itself would already be noteworthy, even more if added to the complex hunting behavior performed repeatedly by *T. hispidus*.

Acknowledgements

We thank Izamaro Araújo, director of the Instituto Federal de Ciência, Educação e Tecnologia do Estado do Ceará – Campus Jaguaribe, for the opportunity to work on the IFCE's property, and Jean Nixon for fieldwork assistance. We also thank Helena Hokamura, head of radiology sector from Veterinary Hospital of Universidade Estadual do Norte Fluminense Darcy Ribeiro, for logistical support and the radiological analysis. We are grateful to Daniel Cassiano Lima and Laís Feitosa Machado for the critical review of a previous version of this manuscript. We are also grateful to Gunther Köhler and an anonymous referee for the valuable suggestions to this paper. DCP is funded by a Doctor's degree scholarship from the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – CAPES. The collecting permit 42552-4 was granted by the Instituto Chico Mendes de Conservação da Biodiversidade – ICMBio.

References

ARAÚJO, A.F.B. 1987. Comportamento alimentar dos lagartos: o caso dos *Tropidurus* do grupo *torquatus* da Serra dos Carajás, Pará (Sauria: Iguanidae). An. Etol. 5:203–234.

CARVALHO, A.L.G. 2013. On the distribution and conservation of the South American lizard genus *Tropidurus* Wied-Neuwied, 1825 (Squamata: Tropiduridae). Zootaxa 3640:042-056, <http://dx.doi.org/10.11646/zootaxa.3640.1.3>.

COSTA-CAMPOS, C.E. & SOUZA, N.S. 2013. *Tropidurus hispidus* (Peters' Lava Lizard). Saurophagy. Herpetol. Rev. 44:215–216.

COSTA, J.C.L., MANZANI, P.R., BRITO, M.P.L. & MACIEL, A.O. 2010. *Tropidurus hispidus* (Calango). Prey. Herpetol. Rev. 41:87.

DIAS, E.J.R. & ROCHA, C.F.D. 2004. *Tropidurus hygomi* (NCN). Juvenile predation. Herpetol. Rev. 35:398–399.

FARIA, R.R. & ARAÚJO, A.F.B. 2004. Syntopy of two *Tropidurus* lizard species (Squamata: Tropiduridae) in a rocky Cerrado habitat in Central Brazil. Braz. J. Biol. 64:775–786, <http://dx.doi.org/10.1590/S1519-69842004000500007>.

FIGHERA, R.A., SILVA, M.C., SOUZA, T.M., BRUM, J.S., KOMMERS, G.D., GRAÇA, D.L., IRIGOYEN, L.F. & BARROS, C.S.M. 2008. Aspectos patológicos de 155 casos fatais de cães atropelados por veículos automotivos. Cienc. Rural 38:1375–1380.

FREITAS, M.A. & SILVA, T.F.S. 2005. Guia ilustrado: a herpetofauna da Mata Atlântica nordestina. Editora USEB, Pelotas.

GALDINO, C.A.B. & VANSLUYS, M. 2004. *Tropidurus torquatus* (Collared Lizard, Calango). Saurophagy. Herpetol. Rev. 35:173.

GASPARINI, J.L. & PELOSO, P.L. 2007. *Tropidurus torquatus* (Brazilian Collared Lizard). Diet. Herpetol. Rev. 38:464.

GUERRA, M.D.F., SOUZA, M.J.N. & LUSTOSA, J.P.G. 2010. Desertificação em áreas semiáridas do Nordeste Brasileiro: O caso do município de Jaguaribe, Ceará. Rev. Geo. 2:67–80.

KIEFER, M.C. 1998. *Anotosaura brachylepis* (NCN). Predation. Herpetol. Rev. 29:41.

KIEFER, M.C. & SAZIMA, I. 2002. *Tropidurus montanus* (NCN). Cannibalism. Herpetol. Rev. 33:136.

KIEFER, M.C., SIQUEIRA, C.C., VAN SLUYS, M. & ROCHA, C.F.D. 2006. *Tropidurus torquatus* (Collared Lizard, Calango). Prey. Herpetol. Rev. 37:475–476.

KOHLSDORF, T., GODOY, C. & NAVAS, C.A. 2004. *Tropidurus hygomi* (NCN). Cannibalism. Herpetol. Rev. 35:398.

KOKUBUM, M.C. & LEMOS, F.G. 2004. *Tropidurus torquatus* (Calango). Saurophagy. Herpetol. Rev. 35:270–271.

KOLODIUK, M.F., RIBEIRO, L.B. & FREIRE, E.M.X. 2010. Diet and foraging behavior of two species of *Tropidurus* (Squamata, Tropiduridae) in the Caatinga of northeastern Brazil. South Am. J. Herpetol. 5:35–44, <http://dx.doi.org/10.2994/057.005.0104>.

PASSOS, D.C., LIMA, D.C. & BORGES-NOJOSA, D.M. 2011. A new species of *Tropidurus* (Squamata, Tropiduridae) of the *semitaeniatus* group from a semiarid area in Northeastern Brazil. Zootaxa 2930:60–68.

PASSOS, D.C., LIMA, D.C. & BORGES-NOJOSA, D.M. 2013. Clutch size, incubation time and hatchling morphometry of the largest known *Tropidurus* of the *semitaeniatus* group (Squamata, Tropiduridae), in a semi-arid area from northeastern Brazil. Herpetol. Bul. 123:23–25.

PELOSO, P.L. & PAVAN, S.E. 2007. *Cnemidophorus nativo* (NCN). Predation. Herpetol. Rev. 38:451–452.

PINCHEIRA-DONOSO, D. 2012. Intraspecific predation in the *Liolema* lizard radiation: a primer. Anim. Biol. 62:277–287, <http://dx.doi.org/10.1163/157075611X618219>.

RIBEIRO, L.B. & FREIRE, E.M.X. 2009. *Tropidurus hispidus* (NCN). Frog predation. Herpetol. Rev. 40:228–228.

ROBBINS, T.R., SCHREY, A., MCGINLEY, S. & JACOBS, A. 2013. On the incidences of cannibalism in the lizard genus *Sceloporus*: updates, hypotheses, and the first case of siblicide. Herpetol. Notes 6:523–528.

ROJAS-RUNJAIC, F.J.M., FERRER, A., RIVAS, G.A. & MONTERO, Z.A. 2006. *Tropidurus hispidus*. Saurophagy. Herpetol. Rev. 37:474.

RODRIGUES, M.T. 1987. Sistemática, ecologia e zoogeografia dos *Tropidurus* do grupo *torquatus* ao Sul do rio Amazonas (Sauria, Iguanidae). Arq. Zool. 31:105–230.

SALES, R.F.D., JORGE, J.S., RIBEIRO, L.B. & FREIRE, E.M.X. 2011. A case of cannibalism in the territorial lizard *Tropidurus hispidus* (Squamata: Tropiduridae) in Northeast Brazil. Herpetol. Notes 4:265–267.

SIQUEIRA, C.C. & ROCHA, C.F.D. 2008. Predation by lizards as a mortality source for juvenile lizards in Brazil. South Am. J.

Saurophagy of *T. hispidus* on *T. jaguaribanus*

- Herpetol. 3:82–87, [http://dx.doi.org/10.2994/1808-9798\(2008\)3\[82:PBLAAM\]2.0.CO;2](http://dx.doi.org/10.2994/1808-9798(2008)3[82:PBLAAM]2.0.CO;2).
- TEIXEIRA, R.L. & GIOVANELLI, M. 1999. Ecologia de *Tropidurus torquatus* (Sauria: Tropiduridae) da restinga de Guriri, São Mateus, ES. Rev. Bras. Biol. 59:11–18, <http://dx.doi.org/10.1590/S0034-71081999000100002>.
- VAN SLUYS, M., ROCHA, C.F.D., VRCIBRADIC, D., GALDINO, C.A.B. & FONTES A.F. 2004. Diet, activity and microhabitat use of two syntopic *Tropidurus* species (Lacertilia: Tropiduridae) in Minas Gerais, Brazil. J. Herpetol. 38:606–611.
- VITT, L.J. 1995. The ecology of tropical lizards in the caatinga of northeast Brazil. Oklah. Mus. Nat. Hist. 1:1–29.
- VITT, L.J. 2000. Ecological consequences of body size in neonatal and small-bodied lizards in the Neotropics. Herpetol. Monogr. 14:388–400.
- VITT, L.J., ZANI, P.A. & CALDWELL, J.P. 1996. Behavioural ecology of *Tropidurus hispidus* on isolated rock outcrops in Amazonia. J. T. Ecol. 12:81–101, <http://dx.doi.org/10.1017/S0266467400009329>.
- ZANCHI, D., PASSOS, D.C. & BORGES-NOJOSA, D.M. 2012. *Tropidurus hispidus* (Calango). Saurophagy. Herpetol. Rev. 43:141–142.

Received 29/05/2015

Revised 27/01/2016

Accepted 9/02/2016