REPTILES & AMPHIBIANS

Predation Attempt of *Tropidurus hispidus* (Spix 1825) by a Domestic Dog in an Urban Environment

Raone Beltrão-Mendes[1], and Míriam Plaza Pinto[2]

[1] Programa de Pós-Graduação em Ecologia e Conservação, Universidade Federal de Sergipe, 49.100-000, São Cristóvão, Brasil. https://orcid.org/0000-0002-3631-5229 (raonebm@yahoo.com.br).
[2] Centro de Biociências, Departamento de Ecologia, Universidade Federal do Rio Grande do Norte, 59.072-970, Natal, Rio Grande do Norte, Brasil. https://orcid.org/0000-0002-4030-5015 (miriam.plaza@ufrn.br).

Domestic animals can impact wildlife in a variety of ways. Such examples include detrimental impact through reduction and loss of natural habitat of native prey (Sangay and Vernes 2008; Marchini and Crawshaw Jr. 2015), limiting large mammal migrations (Osipova et al. 2018), and domestic animals acting as introduced predators (Henderson 1992; Loss et al. 2013; Russell et al. 2018). A common consequence of this are population declines in native fauna. Domestic dogs (*Canis lupus familiaris* Linnaeus 1758) have been considered to be a threat by acting as a predator (Iverson 1978) and as vectors/hosts of parasites or diseases (Cleaveland et al. 2000) that affect wildlife worldwide. Interactions with domestic dogs are a concern for lizards (Koenig et al. 2002) even in urban/periurban conditions (Silva et al. 2018).

Peters' Lava lizard, *Tropidurus hispidus* (Spix 1825), is widely distributed in Brazil (Carvalho 2013), where it is commonly found in natural (Gomes et al. 2015) or urban/periurban environments (Beltrão-Mendes 2017). Lizards of the genus *Tropidurus* are considered sit-and-wait foragers (Schoener 1971), typically with small home ranges, sheltering in trees and rocks in natural habitats, and also walls and rubble in urban areas. These lizards are part of the diet of several species (Maia-Carneiro et al. 2015; Mikalauskas et al. 2017; Smaniotto et al. 2017; Melo et al. 2018; Santana and Texeira 2020; Sousa et al. 2020) and, despite being frequently predated by domestic animals (mainly cats), it is rarely reported (Guedes et al. 2021).

Here we report predation attempts of Peters' Lava Lizard (*Tropidurus hispidus*) by a domestic dog (*Canis lupus familiaris*) in an urban wasteland habitat. The two events took place in an urban setting (10.9286°S, 37.0725°W, WGS84), in the municipality of Aracaju, Sergipe State, northeastern Brazil. The site is a neighborhood of small buildings and residences (Atlantic Forest biome). Events were observed opportunistically and recorded in all instances. There was no handling of animals.

The first predation attempt occurred at 1230 h on 10 July 2021. An adult female of *Canis lupus familiaris* was observed capturing an adult *Tropidurus hispidus*, and quickly giving the lizard to its young (Fig. 1A). The event was noticed

Fig. 1. Predation of *Tropidurus hispidus* by domestic dog on two occasions. (A) Female *Canis lupus familiaris* (larger spotted dog) assisting her young (smaller dog laying down) to handle a *Tropidurus hispidus* accompanied by the adult male (black dog) who continued foraging. (B) The second occasion in which only the adult female captured the prey and gave it to the young (stepping on the lizard). (C) The young playing with the prey on the second occasion; the prey already appeared dead.

Reptiles & Amphibians ISSN 2332-4961
https://doi.org/10.17161/randa.v29i1.16768

as the dogs, accompanied by another adult (a male) were foraging the terrain until they stopped in a rubble pile and began to react as if they sniffed something. A few moments later, the young dog was laying down and playing with its prey, being assisted by the adult female. At this moment, the lizard seemed to be already dead. After that, the dogs moved away from the observer's sight. The second predation attempt occurred at 1425 h on 24 July 2021. The same individuals, the domestic dogs, adult female and the young (no adult male), were observed foraging in the same terrain, sniffing something in a rubble pile close to that of the first event. As soon as the female captured the prey, she gave the *T. hispidus* to the young (Fig. 1B). As in the first event, the young played with the prey – that appeared already dead (Fig. 1C), being assisted by the adult female as if she was teaching the young to handle the prey. A few moments later, again the dogs moved away from the observer's sight. On both occasions, we did not see the dogs effectively feeding on the killed lizards.

To this date, there is only one report about the predation on *Tropidurus torquatus* by domestic dogs (Guedes et al. 2021). Dogs can exert impact on wildlife, as observed by Hughes and Macdonald (2013) and Guedes et al. (2021). These animals, however, appear to be a major threat to larger lizard species (Iverson 1978; Henderson 1992; Koenig et al. 2002; Galetti and Sazima 2006; Tyler et al. 2016), which in part may explain the lack of records on *Tropidurus* spp. predation.

Prey capture and consumption are related to the (i) optimal foraging/diet and (ii) functional response theories (see Holling 1965; Schoener 1971; Stephens et al. 2007). Predator and prey body sizes (and their correlation) are associated with the optimal diet theory, which means that dogs may devote more time with larger prey (e.g., *Iguana*, *Salvator*) than smaller ones such as *Tropidurus* spp., as observed by Koenig et al. (2002). In regard to the functional response, the abundance of *Tropidurus* lizards in urban areas (Andrade 2020) would imply a higher rate of predation by dogs, which might not be the case as there is only one report of predation upon a single individual (Guedes et al. 2021), even though both these species are active in the daytime. This discussion may be confounded by supplemental food provided by villagers in urban environments. Future observations should be reported to see how common this predator-prey interaction is.

An important aspect of these events reported is the similar characteristics related to mother-pup bonding and hunting teaching-learning. This teaching-learning behavior strategy might benefit from any prey available, regardless of its size. According to Werneburg and Geiger (2017), learning to hunt and search is essential for dogs. Therefore, the events may be a hunting teaching-learning situation, rather than any predation attempt or feeding strategy. Slabbert and Rasa (1997) observed a high rate of search learning in young dogs that watched their mother foraging. In the present report, the female continued assisting the young even after it held the lizard, possibly preventing accidental escape. The young, on the other hand, seem to play without noticing that it was learning to forage and sniff out any potential prey. This report reinforces the opportunistic feeding behavior of the generalist *Canis lupus familiaris* and the potential impact on lizard species, whether in urban or natural environments. Continued data sampling and accumulation will help to disentangle the theories associated with the behavior reported here and the impact it has on lizards.

Acknowledgments.

We thank the Brazilian Coordination for Higher Education Personnel Training (CAPES) for the post-doctoral fellowships to RB-M (process 88887.320996/2019-00). We also thank Justin Bernstein for his valuable review, comments, and suggestions.

Literature Cited

Andrade, A.C. 2020. Metropolitan lizards? Urbanization gradient and the density of lagartixas (*Tropidurus hispidus*) in a tropical city. *Ecology and Evolution* 10: 1740–1750. https://doi.org/10.5061/dryad.h7t362d.

Beltrão-Mendes, R. 2017. *Tropidurus hispidus* (Neotropical Ground Lizard). Diet and prey capture. *Herpetological Review* 48(1): 201–202.

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. https://doi.org/10.11646/zootaxa.3640.1.3.

Cleaveland, S., M.G.J. Appel, W.S.K. Chalmers, C. Chillingworth, M. Kaare, and C. Dye. 2000. Serological and demographic evidence for domestic dogs as a source of canine distemper virus infection for Serengeti wildlife. *Veterinary Microbiology* 72: 217–227. https//doi.org/10.1016/s0378-1135(99)00207-2.

Galetti, M. and I. Sazima. 2006. Impacto de cães ferais em um fragmento urbano de Floresta Atlântica no sudeste do Brasil. *Natureza & Conservação* 4(1): 58–63.

Gomes, F.F.A., F.L.S. Caldas, R.A. Santos, B.D. Silva, D.O. Santana, S.M. Rocha, A.S. Ferreira, and R.G. Faria. 2015. Patterns of space, time and trophic resource use by *Tropidurus hispidus* and *T. semitaeniatus* in an area of Caatinga, northeastern Brazil. *The Herpetological Journal* 25(1): 27–39.

Guedes, J.J.M., C.L. Assis, R.N. Feio, and F.M. Quintela. 2021. The impacts of domestic dogs (*Canis familiaris*) on wildlife in two Brazilian hotspots and implications for conservation. *Animal Biodiversity and Conservation* 44: 45–58. https://doi.org/10.32800/abc.2021.44.0045.

Henderson, R.W. 1992. Consequences of predator introductions and habitat destruction on amphibians and reptiles in the post-Columbus West Indies. *Caribbean Journal of Science* 28(1–2): 1–10.

Holling, C.S. 1965. The functional response of predators to prey density and its role in mimicry and population regulation. *The Memoirs of the Entomological Society of Canada* 97(S45): 5–60. https://doi.org/10.4039/entm9745fv.

Hughes, J. and D.W. Macdonald. 2013. A review of the interactions between free-roaming domestic dogs and wildlife. *Biological Conservation* 157: 341–351. https://doi.org/10.1016/j.biocon.2012.07.005.

Iverson, J.B. 1978. The impact of feral cats and dogs on populations of the West Indian rock iguana, *Cyclura carinata*. *Biological Conservation* 14(1): 63–73.

Koenig, J., R. Shine, and G. Shea. 2002. The dangers of life in the city: patterns of activity, injury and mortality in suburban lizards (*Tiliqua scincoides*). *Journal of Herpetology* 36: 62–68. https://doi.org/10.2307/1565803.

Loss, S.R., T. Will, and P.P. Marra. 2013. The impact of free-ranging domestic cats on wildlife of the United States. *Nature Communications* 4: 1–8. https://doi.org/10.1038/ncomms2380.

Maia-Carneiro, T., P. Goyannes-Araújo, and C.F.D. Rocha. 2015. Predation of *Tropidurus hispidus* (Squamata, Tropiduridae) by *Siphlophis leucocephalus* (Squamata, Dipsadidae). *Neotropical Biology and Conservation* 11: 47–50.

https:/doi.org/10.4013/nbc.2016.111.06.

Marchini, S. and P.G. Crawshaw Jr. 2015. Human–wildlife conflicts in Brazil: a fast-growing issue. *Human Dimensions of Wildlife* 20: 323–328. https://doi.org/10.1080/10871209.2015.1004145.

Melo, L.C.O., M.F. Rodrigues, M.A.B. Oliveira, A. Silva, G. Moura, and A. Soares. 2018. The Lava lizard *Tropidurus hispidus* (Wied, 1820) as prey of a Common marmoset (*Callithrix jacchus*) in the Brazilian Caatinga: a strategy for energy conservation? *Herpetology Notes* 11: 171–173.

Mikalauskas, J.S., D.O. Santana, and S.F. Ferrari. 2017. Lizard predation *Tropidurus hispidus* (Squamata, Tropiduridae) by false coral snake *Oxyrhopus trigeminus* (Squamata, Dipsadidae) in the Caatinga, in northeastern Brazil. *Pesquisa e Ensino em Ciências Exatas e da Natureza* 1: 60–67. https://doi.org/10.29215/pecen.v1i1.174.

Osipova, L., M.M. Okello, S.J. Njumbi, S. Ngene, D. Western, M.W. Hayward, and N. Balkenhol. 2018. Fencing solves human-wildlife conflict locally but shifts problems elsewhere: A case study using functional connectivity modelling of the African elephant. *Journal of Applied Ecology* 55: 2673–2684. https://doi.org/10.1111/1365-2664.13246.

Russell, J.C., C.R. Abrahão, J.C. Silva, and R.A. Dias. 2018. Management of cats and rodents on inhabited islands: An overview and case study of Fernando de Noronha, Brazil. *Perspectives in Ecology and Conservation* 16: 193–200. https://doi.org/10.1016/j.pecon.2018.10.005.

Sangay, T. and K. Vernes. 2008. Human-wildlife conflict in the Kingdom of Bhutan: patterns of livestock predation by large mammalian carnivores. *Biological Conservation* 141: 1272–1282. https://doi.org/10.1016/j.biocon.2008.02.027.

Santana, D.O., and A.A.M. Teixeira. 2020. Predation of the lizard *Tropidurus hispidus* (Squamata, Tropiduridae) by the vine snake *Oxybelis aeneus* (Serpentes: Colubridae) in the Caatinga, northeastern Brazil. *Pesquisa e Ensino em Ciências Exatas e da Natureza* 4: 01–06. https://doi.org/10.29215/pecen.v4i0.1327.

Schoener, T.W. 1971. Theory of feeding strategies. *Annual Review of Ecology and Systematics* 2: 369–404. https://doi.org/10.1146/annurev.es.02.110171.002101.

Silva, K.V.K.A., C.F. Kenup, C. Kreischer, F.A. Fernandez, and A.S. Pires. 2018. Who let the dogs out? Occurrence, population size and daily activity of domestic dogs in an urban Atlantic Forest reserve. *Perspectives in Ecology and Conservation* 16: 228–233. https://doi.org/10.1016/j.pecon.2018.09.001.

Slabbert, J.M. and O.A.E. Rasa. 1997. Observational learning of an acquired maternal behaviour pattern by working dog pups: an alternative training method? *Applied Animal Behaviour Science* 53: 309–316. https://doi.org/10.1016/S0168-1591(96)01163-X.

Smaniotto, N.P., L.F. Moreira, and T.F. Dorado-Rodrigues. 2017. Register of predation upon species of reptiles by *Guira guira* (Aves: Cuculidae). Neotropical Biology and Conservation 12: 71–74. https://doi.org/10.4013/NBC.2017.121.09.

Sousa, J.D., J.H. Andrade-Lima, and M.N. Kokubum. 2020. Predation of *Tropidurus hispidus* (Squamata, Tropiduridae) by *Oxybelis aeneus* (Squamata, Colubridae) in two biomes in the state of Pernambuco, Northeast of Brazil. Herpetology Notes 13: 171–173.

Stephens, D.W., J.S. Brown, and R.C. Ydenberg (eds.). 2007. Foraging: Behavior and Ecology. The University of Chicago Press, Chicago, USA.

Tyler, R.K., K.M. Winchell, and L.J. Revell. 2016. Tails of the city: caudal autotomy in the tropical lizard, *Anolis cristatellus*, in urban and natural areas of Puerto Rico. *Journal of Herpetology* 50: 435–441. https://doi.org/10.1670/15-039.

Werneburg, I., and M. Geiger. 2017. Ontogeny of domestic dogs and the developmental foundations of carnivoran domestication. *Journal of Mammalian Evolution* 24: 323–343. https://doi.org/10.1007/s10914-016-9346-9.