Predation attempt on the lizard *Kentropyx calcarata* (Spix, 1825) by the snake *Oxybelis aeneus sensu lato* in a fragment of Atlantic Forest, Northeastern, Brazil

Tentativa de predação do lagarto *Kentropyx calcarata* (Spix, 1825) pela serpente *Oxybelis aeneus sensu lato* em um fragmento de Mata Atlântica, Nordeste, Brasil

Rhian Vilar da Silva Vieira[I] | Matheus Cândido Batista[II] | Bruno Halluan Soares de Oliveira[III]

[I]Universidade Federal do Rio Grande do Sul. Programa de Pós-Graduação em Genética e Biologia Molecular. Porto Alegre, Rio Grande do Sul, Brasil

[II]Universidade Estadual da Paraíba. Graduação em Ciências Biológicas. Campina Grande, Paraíba, Brasil

[III]Universidade Federal da Paraíba. Programa de Pós-Graduação em Ciências Biológicas (Zoologia). João Pessoa, Paraíba, Brasil

Abstract: Information about predatory encounters is important for understanding predator-prey interactions and, consequently, for understanding the natural history of the species involved. In this study we report the first event of attempted predation by *Oxybelis aeneus sensu lato* on *Kentropyx calcarata* describing its behavior and comparing it with other reports of snake predation and lizard defensive behavior. We recorded the predation event in an area shaded by cashew trees in the Atlantic Forest of the Reserva Biológica Guaribas, Mamanguape, state of Paraíba, Northeastern Brazil.

Keywords: Food ecology. Diet. Colubridae. Teiidae. Prey.

Resumo: Informações sobre encontros predatórios são importantes para a compreensão das interações predador-presa e, consequentemente, para a compreensão da história natural das espécies envolvidas. Neste estudo, relatamos o primeiro evento de tentativa de predação por *Oxybelis aeneus sensu lato* em *Kentropyx calcarata*, descrevemos seu comportamento e comparamos o evento com outros relatos de predação de serpentes e comportamento defensivo de lagartos. Registramos o evento de predação em uma área sombreada por cajueiros na Mata Atlântica da Reserva Biológica Guaribas, localizada no município de Mamanguape, estado da Paraíba, Nordeste do Brasil.

Palavras-chave: Ecologia alimentar. Dieta. Colubridae. Teiidae. Presa.

Vieira, R. V. S., Batista, M. C., & Oliveira, B. H. S. (2023). Predation attempt on the lizard *Kentropyx calcarata* (Spix, 1825) by the snake *Oxybelis aeneus sensu lato* in a fragment of Atlantic Forest, Northeastern, Brazil. *Boletim do Museu Paraense Emílio Goeldi. Ciências Naturais*, *18*(2), e2023-e872. http://doi.org/10.46357/bcnaturais.v18i2.872

Autor para correspondência: Rhian Vilar da Silva Vieira. Av. Bento Gonçalves, 9500, Campus do Vale - Prédio 43312 M. Porto Alegre, RS, Brasil. CEP 91501-970 (silvarhian412@gmail.com).

Recebido em 06/10/2022
Aprovado em 07/07/2023
Responsabilidade editorial: Pedro Peloso

Oxybelis Wagler, is one of the most widespread genera of snakes in the Americas (Torres-Carvajal et al., 2021). Recently, Jadin et al. (2019, 2020, 2021), based in molecular and morphological analysis, identified *Oxybelis aeneus* as a complex composed of at least eight species. Jadin et al. (2021) suggested the nominal species, *O. aeneus*, is restricted to the Amazon Basin, and proposed the revalidation of *Oxybelis acuminatus* (Wied, 1824) for the brazilian Atlantic Forest. However, following the recommendation by H. Costa et al. (2021), here we adopt the name *Oxybelis aeneus sensu lato* for the population of the Atlantic Rainforest.

Oxybelis aeneus sensu lato is a rear-fanged Neotropical colubrid snake, occurring in the *Caatinga* ecoregion (Vitt & Vangilder, 1983; W. Almeida et al., 2008; Pereira et al., 2015; Magalhães et al., 2015; Nogueira et al., 2019), *Cerrado* ecoregion (Nogueira et al., 2019), and Atlantic Forest (Santana et al., 2008; Pereira Filho & Montingelli, 2011; Marques et al., 2017), even in in urban areas (França et al., 2012; Oliveira et al., 2016; F. Costa et al., 2022). The species is characterized by arboreal and diurnal (sometimes nocturnal) habits (Vitt & Vangilder, 1983; Mesquita et al., 2012) and inhabits different vegetation like riparian areas, natural clearings, dry forest, forest edges and abandoned pastures (Santana et al., 2008; Pereira Filho & Montingelli, 2011; Marques et al., 2017; F. Costa et al., 2022). Adopts the sit-and-wait ambush strategy to capture prey (F. Costa et al., 2022), with lizards constituting the main prey in the diet of this species, which occasionally also includes amphibians, birds and insects (Vitt & Vangilder, 1983; Silva et al., 2015; F. Costa et al., 2022).

In the present study, we documented an event of predation on lizard *Kentropyx calcarata* (Spix, 1825) by *Oxybelis aeneus sensu lato*, at 12:30 p.m. on 18 September 2015 in a closed forest in the *Reserva Biológica Guaribas* (situated in: 6° 42' 36" S, 35° 10' 38" W), in Mamanguape, state of Paraíba, Brazil.

A juvenile *K. calcarata* specimen was captured by an adult *Oxybelis aeneus sensu lato* positioned vertically downward toward the ground, on a branch of cashew trees (*Anacardium occidentale* Linnaeus, 1753). We observe the moment when *Oxybelis aeneus sensu lato* bit the right side of the lizard's gular region, lifting it off the ground, the lizard remained immobile after being captured, for about one minute, without a sketching reaction, until the snake dropped it, then it soon ran away.

After that, we captured the snake (collection permits No. 48256-1 MMA/ICMBio/SISBIO), killed it with 2% lidocaine hydrochloride injection (parenteral [fixed anesthesia] intracardiac injection), fixed in injection of 10% formalin solution, and then preserved in 70% ethyl alcohol. Finally we deposited in the *Coleção de Referência do Laboratório de Herpetologia* integrated to *Laboratório de Etnoecologia*, *Universidade Estadual da Paraíba – Campus* I, from Campina Grande, Paraíba.

Kentropyx calcarata is a diurnal, terrestrial and heliothermic lizard (Vitt, 1991; Vitt et al., 1997). At noon, where temperatures are higher, it is possible to observe many individuals of *K. calcarata* foraging on the leaf litter or exposed directly to the sun into the forest, in natural clearings. To avoid overheating, these lizards thermoregulate under the tree shelter and cashew trees usually provide this shelter. The daily activity of *Oxybelis aeneus sensu lato* (Vitt & Vangilder, 1983) coincides with that of several species of lizards, such as *K. calcarata* in the Atlantic Forest (Vitt, 1991; Franzini et al., 2019), and this snake is a stalking predatory which has a morphology and coloring like dry branches of cashew trees (Fleishman, 1985; Greene, 1988).

The vertical position that we observed the snake in the approach, was already recorded during the attack of *Oxybelis aeneus* on other lizards (Abarca & Knapp, 2009; F. Costa et al., 2022). Generally, snakes from *Oxybelis* genus stay relatively close to the ground, at about 0.3 to at most 1.8 meters (Savage, 2002; Grant & Lewis, 2010; F. Costa et al., 2022), being able to attack to about 20 cm of the ground (V. Almeida et al., 2009), exactly the approximate average height in relation to the soil that we recorded in our study. Its approach is characterized by

cryptic movement interspersed with immobile behavior, as it slowly approaches the prey to a quick and precise stroke (Henderson, 1982; Fleishman, 1985; Greene, 1988; Savage, 2002).

Grant & Lewis (2010) reported a predation attempt where *Oxybelis koehleri* (Jadin, Blair, Orlofske, Jowers, Rivas, Vitt, Ray, Smith & Murphy, 2020) was unable to swallow an adult lizard, *Basiliscus plumifrons* (Cope, 1875), interrupting the predation and releasing the prey. In contrast, in our observation, the snake dropped the juvenile individual of *K. calcarata* while manipulating it in the mouth. In addition, the lizard did not show any behavior of resistance, as observed in other lizards, like use of hind legs (Grant & Lewis, 2010), undulating movement of the body (Cupul-Magaña & Escobedo-Galván, 2016), or bites (Abarca & Knapp, 2009). The lizard immobility may have occurred due to asphyxia (V. Almeida et al., 2009; Grant & Lewis, 2010) as a consequence of the pressure of the bite. As recorded by Grant & Lewis (2010), the lizard recovered itself after being immobilized and escaped through the forest.

ACKNOWLEDGMENTS

We thank the *Instituto Chico Mendes de Conservação da Biodiversidade* (ICMBio) for the authorization to collect specimens (license number: 48256-1). In addition, to the entire team that supports research activities at Rebio Guaribas: T. B. S. Nobrega, R. J. C. Tavares, P. E. P. N. Alves, J. N. Oliveira, M. C. Silva, J. I. G. Nunes, E. R. Morais, D. K. S. Montenegro, A. C. S. Silva, M. A. Carvalho, E. A. B. Alamar, C. A. Egito and F. R. Gouveia, M. E. P. Barbosa and T. K. S. Marques. The *Reserva Biológica Guaribas* team, who assisted us when necessary during our field surveys, in particular: G. L. Freitas (Chief), I. M. Silva (Fire Manager/ Deputy Chief), A. H. Leal (Responsible for the Research Sector), A. O. Silvestre (Captain), D. P. Silva, L. V. Gomes, S. M. Gomes and S. S. Birth. Thanks to the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (Capes) and the *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq) for their support and scholarships. And, finally, to thank the Graduate Program in Ecology and Conservation at the *Universidade Estadual da Paraíba* for their assistance in the procedures that made this work possible.

REFERENCES

Abarca, J. G., & Knapp, C. R. (2009). Natural history notes: *Oxybelis aeneus* (Narrow-headed Brown Vine Snake). Behaviour. *Herpetological Review*, *40*(1), 101.

Almeida, V. L., Silva, G. L., Campos, T. F., Muniz, S. L. S., & Santos, E. M. (2009). Predação do lagarto *Tropidurus cocoroboensis* pela serpente *Oxybelis aeneus*. *Boletim de Museu de Biologia Mello Leitão*, *25*, 83-86.

Almeida, W. O., Guedes, T. B., Freire, E. M. X., & Vasconcellos, A. (2008). Pentastomid infection in *Philodryas nattereri* Steindachner, 1870 and *Oxybelis aeneus* (Wagler, 1824) (Squamata: Colubridae) in a caatinga of northeastern Brazil. *Brazilian Journal of Biology*, *68*(1), 193-197. https://doi.org/10.1590/S1519-69842008000100028

Costa, H. C., Guedes, T. B., & Bérnils, R. S. (2021). Lista de répteis do Brasil: padrões e tendências. *Herpetologia Brasileira*, *10*(3), 1-171. https://doi.org/10.5281/zenodo.5838950

Costa, F. R. F., Pezeta, Y. F. M., Crozariol, M. A., Oliveira, T. P., Henderson, R. W., & Gonzalez, R. C. (2022). A review of the diet of *Oxybelis aeneus* group (Squamata: Colubridae) including two new prey records from north-eastern Brazil. *Herpetology Notes*, *15*(2022), 785-795.

Cupul-Magaña, F. G., & Escobedo-Galván, A. H. (2016). *Gonatodes albogularis*. Predation by a Brown Vinesnake (*Oxybelis aeneus*). *Mesoamerican Herpetology*, *3*(3), 721-723.

Fleishman, L. J. (1985). Cryptic movement in the Vine Snake *Oxybelis aeneus*. *Copeia*, *1985*(1), 242-245. https://doi.org/10.2307/1444822

França, R. C., Germano, C. E. S., & França, F. G. R. (2012). Composition of a snake assemblage inhabiting an urbanized area in the Atlantic Forest of Paraíba State, Northeast Brazil. *Biota Neotropica*, *12*(3), 183-195. https://doi.org/10.1590/S1676-06032012000300019

Franzini, L. D., Teixeira, A. A. M., Tavares-Bastos, L., Vitt, L. J., & Mesquita, D. O. (2019). Autecology of *Kentropyx calcarata* (Squamata: Teiidae) in a remnant of Atlantic Forest in the easternmost of Americas. *Journal of Herpetology*, *53*(3), 209-217. https://doi.org/10.1670/17-184

Grant, P. B. C., & Lewis, T. R. (2010). Predation attempt by *Oxybelis aeneus* (Wagler) (Mexican Vine-Snake) on *Basiliscus plumifrons* (Cope). *Acta Herpetologica*, *5*(1), 19-22. https://doi.org/10.13128/Acta_Herpetol-8531

Greene, H. W. (1988). Antipredator mechanisms in reptiles. In C. Gans & R.B. Huey (Eds), *Biology of the Reptilia* (pp. 1-152). Alan R. Liss, Inc.

Henderson, R. W. (1982). Trophic relationships and foraging strategies of some new world tree snakes (Leptophis, Oxybelis, Uromacer). *Amphibia-Reptilia*, *3*(1), 71-80. https://doi.org/10.1163/156853882X00185

Jadin, R. C., Blair, C., Jowers, M. J., Carmona, A., & Murphy, J. C. (2019). Hiding in the lianas of the tree of life: molecular phylogenetics and species delimitation reveal considerable cryptic diversity of New World Vine Snakes. *Molecular Phylogenetics and Evolution*, *134*, 61-65. https://doi.org/10.1016/j.ympev.2019.01.022

Jadin, R. C., Blair, C., Orlofske, S. A., Jowers, M. J., Rivas, G. A., Vitt, L. J., . . . Murphy, J. C. (2020). Not withering on the evolutionary vine: systematic revision of the Brown Vine Snake (Reptilia: Squamata: Oxybelis) from its northern distribution. *Organisms Diversity & Evolution*, *20*, 723-746. https://doi.org/10.1007/s13127-020-00461-0

Jadin, R. C., Jowers, M. J., Orlofske, S. A., Duellman, W. E., Blair, C., & Murphy, J. C. (2021). A new vine snake (Reptilia, Colubridae, *Oxybelis*) from Peru and redescription of *O. acuminatus*. *Evolutionary Systematics*, *5*(1), 1-12. https://doi.org/10.3897/evolsyst.5.60626

Magalhães, F. M., Laranjeiras, D. O., Costa, T. B., Juncá, F. A., Mesquita, D. O., Röhr, D. L., . . . Garda, A. A. (2015). Herpetofauna of protected areas in the Caatinga IV: Chapada Diamantina National Park, Bahia, Brazil. *Herpetology Notes*, *8*(2015), 243-261.

Marques, R., Rödder, D., Solé, M., & Tinôco, M. S. (2017). Diversity and habitat use of snakes from the coastal Atlantic rainforest in northeastern Bahia, Brazil. *Salamandra*, *53*(1), 34-43.

Mesquita, P. C. M. D., Borges-Nojosa, D. M., Passos, D. C., & Bezerra, C. H. (2012). Activity patterns of the Brown Vine snake *Oxybelis aeneus* (Wagler, 1824) (Serpentes, Colubridae) in the Brazilian semiarid. *Animal Biology*, *62*(2012), 289-299. https://doi.org/10.1163/157075611X618228

Nogueira, C. C., Argôlo, A. J., Arzamendia, V., Azevedo, J. A., Barbo, F. E., Bérnils, R. S., . . . Martins, M. (2019). Atlas of Brazilian snakes: verified point-locality maps to mitigate the Wallacean shortfall in a megadiverse snake fauna. *South American Journal of Herpetology*, *14*(sp1), 1-274. https://doi.org/10.2994/SAJH-D-19-00120.1

Oliveira, C. N., Muniz, S. L. S., & Moura, G. J. B. (2016). Reptiles of an urban Atlantic Rainforest fragment in the state of Pernambuco, northeastern Brazil. *Herpetology Notes*, *9*(2016), 175-183.

Pereira, E. N., Teles, M. J. L., & Santos, E. M. (2015). Herpetofauna em remanescente de Caatinga no Sertão de Pernambuco, Brasil. *Boletim do Museu de Biologia Mello Leitão*, *37*, 29-43.

Pereira Filho, G. A., & Montingelli, G. G. (2011). Check list of snakes from the Brejos de Altitude of Paraíba and Pernambuco, Brazil. *Biota Neotropica*, *11*(3), 145-151. https://doi.org/10.1590/S1676-06032011000300011

Santana, G. G., Vieira, W. L. S., Pereira-Filho, G. A., Delfim, F. R., Lima, Y. C. C., & Vieira, K. S. (2008). Herpetofauna em um fragmento de Floresta Atlântica no estado da Paraíba, Nordeste do Brasil. *Biotemas*, *21*(1), 75-84. https://doi.org/10.5007/2175-7925.2008v21n1p75

Savage, J. M. (2002). *The amphibians and reptiles of Costa Rica: a herpetofauna between two continents, between two seas*. University of Chicago Press.

Silva, C. F., Alcantara, E. P., Oliveira, H. F., Oliveira, M. A. S., & Ávila, R. (2015). *Oxybelis aeneus* (Brown Vinesnake). Diet. *Herpetological Review*, *46*(0018-084x), 648.

Torres-Carvajal, O., Mejía-Guerrero, M., & Terán, C. (2021). Adding missing vines to the tree: multilocus phylogeny of New World vine snakes (Serpentes: Colubridae: Oxybelis), with description of a new species. *Journal of Natural History*, *55*(31-32), 2027-2046. https://doi.org/10.1080/00222933.2021.1986164

Vitt, L. J., & Vangilder, L. D. (1983). Ecology of a snake community in Northeastern Brazil. *Amphibia-Reptilia*, *4*(2), 273-296. https://doi.org/10.1163/156853883X00148

Vitt, L. J. (1991). Ecology and life history of the wide-foraging lizard *Kentropyx calcarata* in Amazonian Brazil (Teiidae). *Canadian Journal of Zoology*, *69*(11), 2791-2799. https://doi.org/10.1139/z91-393

Vitt, L. J., Zani, P. A., Lima, A., & Marinho, C. (1997). Heliotherms in tropical rain forest: the ecology of *Kentropyx calcarata* (Teiidae) and *Mabuya nigropunctata* (Scincidae) in the Curuá-Una of Brazil. *Journal of Tropical Ecology*, *13*(2), 199-220. https://doi.org/10.1017/S0266467400010415

AUTHORS' CONTRIBUTION

R. V. S. Vieira contributed to investigation, visualization, writing and review (original draft); M. C. Batista contributed to investigation, visualization and writing (original draft); and B. H. S. Oliveira to writing (original draft, review and editing).