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Defensive repertory of *Pseudoeryx plicatilis* (Linnaeus, 1758) in the Pantanal, Mato Grosso do Sul, Brazil

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ABSTRACT

Defensive behavior is an important mechanism for the survival of organisms, and understanding the different strategies improves our knowledge regarding prey-predator relationships. Herein, based on field observation, we describe a sequence of behaviors displayed by the South American pond snake *Pseudoeryx plicatilis* from the Pantanal floodplains in midwestern Brazil. The individual displayed a repertoire of five different defensive behaviors, without an evident sequence pattern recognized. Two of the displays are new for the species, and one for the tribe. The new defensive repertory described may suggest animals oriented by vision as main predators of *P. plicatilis*.

Key Words: Natural History; Aquatic Snake; Behavior; Dipsadidae; Hydropsini.

Snakes have implemented a diverse repertoire of defensive behaviors depending on the situation, in order to avoid predators and increase their probability of survival (Greene, 1988). Although there are knowledge gaps, new information elucidating the defensive behaviors of snakes have been extensively reported (e.g. Martins, 1996; Araújo and Martins, 2006; Marques *et al*., 2017; Fiorillo *et al*., 2018). Moreover, understanding the defensive strategies is important to encompass the prey-predator relationship along with the evolutionary processes involved in these interactions (Tozetti *et al*., 2009). The effectiveness of these strategies depends on the surrounding environment along with the characteristics and the level of threat of the stimuli (Shine *et al*., 2000; Shepard, 2007; Tozetti *et al*., 2009).

In the Pantanal floodplains several species of water snakes occur, including the rare *Pseudoeryx plicatilis* (Strüssmann and Sazima, 1993; Marques *et al*., 2005). This species is widespread in South America, occurring from southwestern Paraguay, north of Argentina and east of Bolivia, through the Humid Chaco Region, and along the Midwestern and North of Brazil, Peru, Colombia, Venezuela and Guiana Shield in the Amazon basin (Scartozzoni *et al*., 2010). Despite its wide distribution, there are few observations on its natural history (Schargel *et al*., 2007; Kaefer and Montanarin, 2010). Herein, we describe a sequence of behaviors displayed by the South American pond snake *Pseudoeryx plicatilis* from the Pantanal floodplains.

On 02 September 2016, around 21h, at Base de Estudos do Pantanal (19º34'36" S; 57º01'09" W, 92 m elev.), in Corumbá municipality, Mato Grosso do Sul state, western Brazil, we collected an adult male (TL 982mm) of *Pseudoeryx plicatilis* (Fig. 1a) actively foraging in a swamp area at night and stored in a 100 liters bucket with aquatic vegetation and water to minimize stress, the snake did not try to bite or display any defensive behavior. On the next day, around 8:30h, while the specimen was being manipulated with a snake hook in order to take photographs, the individual displayed five distinct defensive behavior displays by hiding its head and the tail (Fig. 1b); dorsally-ventrally flattening of the full body (Fig. 1b-c); making a knot of itself (knot-

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ting) (Fig. 1d-e); turning the ventral region facing upward (invertbody) (Fig. 1f); and performing erratic movements. We did not observe sequence patterns during these displays, perhaps a random choice of defensive strategy and all behaviors were observed several times. The specimen was collected and deposited at Universidade of Mato Grosso do Sul (UFMS), under the voucher ZUFMS-REP 3623.

On the Hydropsini tribe *Pseudoeryx plicatilis* share defensive behaviors with other water snakes, such as: dorsally-ventrally flattening, hiding the head and cloacal discharge (Marques *et al.*, 2005; Santos-Costa *et al.*, 2015) and some strategies are reported only for *Helicops* (e.g. bite, constriction and rotate the body (Martins and Oliveira, 1998)). Dorsal-ventrally flattening is a common behavior in *Helicops* representatives (Marques *et al.*, 2005, 2017; Marques and Sazima, 2004). However, *H. pastazae* and *H. carinicaudus* showing a subtle difference than we reported here, with compression of the first third of the body versus the full body in *P. plicatilis* (García-Cobos and Gómez-Sánchez, 2019; pers.

Figure 1. Defensive behaviors displayed by the observed male of (a) *Pseudoeryx plicatilis* (ZUFMS-REP 3623; TL 982mm) in the Pantanal of Mato Grosso do Sul state, western Brazil: (b) hiding the head and tail, (c) dorsally-ventrally flattening of the full body, (d) making a knot in itself, (e) making a knot in itself, and (f) turning the ventral region facing upward.

obs.). This strategy is common in terrestrial snakes (Greene, 1979; Martins *et al*., 2008), and makes the individual bigger than it is, and may intimidate visual predators, such birds, natural water snake eaters (see Sazima, 2007; Tozetti *et al*., 2009, 2011).

Many snakes hide the head as anti-predator mechanism (e.g. Marins and Oliveira, 1998; Carbajal-Márquez *et al*., 2018) and in *Helicops* genus is reported for several species (Melgarejo and Meneghel, 1980; Marques & Sazima; 2004; Marques *et al*., 2017). During our observation we reported the individual hiding the head and tail at the same time, that strategy may suggest predators that attack on the both ends of the body (see Buaso *et al*., 2006). Erratic movements might be another way to protect the head from attack and demonstrate physical vigor. Such behavior is reported for two other Hydropsini, *H. angulatus* and *H. hagmanni* (Martins, 1996; Tozetti *et al*., 2009).

Cloacal discharges have been reported to almost all hydropsins, including *Pseudoeryx plicatilis* (Marques *et al*., 2005, 2017), however we did not record at this field observation. It might be because such behavior appears as a response just when reaching the last stage of the sequence of predation (see Vitt and Caldwell, 2014. p.324), when the predator captures, or handling, the snake, being a chemical response to discourage the aggressor (see Egler *et al*., 1996; Tozetti *et al*., 2009). In addition, two new behaviors for *Pseudoeryx plicatilis* were reported here, invertbody and knotting. Invertbody is a visual strategy and might show a contrast color venter similar to other water snakes (e.g. *Hydrodynastes gigas* and *Helicops infrataeniatus*) that occur in the Pantanal floodplains and are very aggressive (Marques *et al*., 2005). That behavior may be a response for continuous stimulus (Angarita-Sierra, 2015) and occurs in synergy with other displays (Greene, 1988). A knotting is an uncommon behavior in snakes that is usually associated with ecdysis process and ectoparasites prevention (Pickwell, 1971; Lillywhite, 1989). Nonetheless, during our observation the snake does not appear to be in ecdysis process, nor with ectoparasites. Additionally, this behavior may prevent predator attacks due to a larger body part. Pickwell (1971) suggests that a sea snake, *Hydrophis platurus* (Linnaeus, 1766) uses this strategy against sea eagles as a secondary defense strategy.

Pseudoeryx plicatilis is a rare snake with scarce field observations, this species might has a complex defensive repertory as reported here, which indicate that animals oriented by vision (i.e., birds) as its main predators. Nevertheless, this observation does not allow us to make consistent conclusions, and more field, and even captive, observations may clarify if these behaviors have a hierarchical decision making pattern, if the species has a different response for different aggressors, as well as how each defensive technique works in prey-predator interactions.

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Literature cited

Angarita-Sierra, T. 2015. Repertoire of antipredator displays in the semifossorial snake *Ninia atrata* (Hallowell, 1845) (Serpentes: Dipsadidae). *Herpetology Notes* 8: 339–344

Araújo, M.S. & Martins, M. 2006. Defensive behaviour in pit vipers of the genus *Bothrops* (Serpentes, Viperidae). *Herpetological Journal* 16: 297–303.

Cabajal-Márquez, R.A.; Cedeño-Vázquez, R.; García-Balderas, C.M.; Ramírez-Valverde, T. & Quintero-Díaz, G.E. 2018. The defensive behaviour of *Tzabcan rattlesnake*, *Crotalus tzabcan* klauber, 1952 (Squamata: Viperidae). *Herpetology Notes* 11: 429–431.

Egler, S.G.; Oliveira, M.E. & Martins, M. 1996. *Bothrops atrox* (Common Lancehead) Foraging behavior and ophiophagy. *Herpetological Review* 27: 22–23.

Fiorillo, B.F.; Rossi, G.N. & Menegucci, R. 2018. New defensive behaviours of the false coral snake *Phalotris mertensi* (Hoge, 1955) (Serpentes: Dipsadidae). *Herpetology Notes* 11: 869–871.

García-Cobos, D. & Gómez-Sánchez, D.A. 2019. Reproductive mode and defensive behaviour of the South American aquatic snake *Helicops pastazae* (Serpentes: Dipsadidae). *Herpetology Notes* 12: 447–451.

Greene, H.W. 1979. Behavioral convergence in the defensive display of snakes. *Experientia* 35: 747–748.

Greene, H.W. 1988. Antipredator mechanisms in reptiles: 1–152. In: Gans, C. & Huey, R.B. (eds.), Biology of the Reptilia. Alan R. Liss, New York.

Kaefer, I.L. & Montanarin, A. 2010. *Pseudoeryx plicatilis* (South American Pond Snake). Diet. *Herpetological Review* 41: 372.

Lillywhite, H.B. 1989. Unusual Shedding Behaviors in an Aquatic Snake, *Acrochordus granulatus*. *Copeia* 1989: 768–770.

Marques, O.A.V.; Eterovic, A.; Guedes, T.B. & Sazima, I. 2017. Serpentes da Caatinga. Ponto A. Cotia.

Marques, O.A.V.; Eterovic, A. & Sazima, I. 2001. Serpentes da Mata Atlântica. Guia ilustrado. Holos. Ribeirão Preto.

Marques, O.A.V.; Eterovic, A.; Strüssmann, C. & Sazima, I. 2005. Serpentes do Pantanal. Guia ilustrado. Holos. Ribeirão Preto.

Marques, O.A.V. & Sazima, I. 2004. História natural dos répteis da Estação Ecológica Juréia-Itatins: 257–277. En: Marques

O.A.V. & Duleba, W. (eds.), Estação Ecológica Juréia-Itatins: Ambiente Físico, Flora e Fauna, Holos, Ribeirão Preto.

Martins, M. 1996. Defensive tactics in lizard and snakes: the potential contribution of the neotropical fauna. *Anais de Etologia*, 14: 185–199

Martins, M.; Marques, O.A.V. & Sazima, I. 2008. How to be arboreal and diurnal and still stay alive: Microhabitat use, time of activity, and defense in Neotropical forest snakes. *South American Journal of Herpetology* 3: 58–67.

Melgarejo, A.R. & Meneghel, M.D. 1980. A note on defensive behaviour in *Helicops carinicaudus* (Wied, 1825) (Serpentes: Colubridae). *Contribuciones en Biología del Centro Educativo Don Orione* 3: 3–6.

Pickwell, G.V. 1971. Knotting and coiling behavior in the pelagic sea snake *Pelamis platurus* (L.). *Copeia* 1971: 348–350.

Santos-Costa, M.C.; Maschio, G.F. & Prudente, A.L.C. 2015. Natural history of snakes from Floresta Nacional de Caxiuanã, eastern Amazonia, Brazil. *Herpetology Notes* 8: 69–98.

Sazima, I. 2007. Like an earthworm: Chalk-browed Mockingbird (*Mimus saturninus*) kills and eats a juvenile watersnake. *Revista Brasileira de Ornitologia* 15: 470–471.

Scartozzoni, R.R.; Trevine, V.C. & Germano, V. J. 2010. Reptilia, Squamata, Serpentes, Dipsadidae, *Pseudoeryx plicatilis* (Linnaeus, 1758): new records and geographic distribution map. *Check List* 6: 534–537.

Schargel, W.E.; Fuenmayor, G.R.; Barros, T.R.; Péfaur, J.E. & Navarrete, L.F. 2007. A new aquatic snake (Colubridae: *Pseudoeryx*) from the Lake Maracaibo Basin, Northwestern Venezuela: A relic of the past course of the Orinoco River. *Herpetologica* 63: 236–244.

Shepard, D. B. 2007. Habitat but not body shape affects predator attack frequency on lizard models in the Brazilian Cerrado. *Herpetologica*, 63: 193–202.

Shine, R.; Olsson, M. M.; Lemaster, M. P.; Moore, I. T. & Mason, R. T. 2000. Effects of sex, body size, temperature, and location on the antipredator tactics of free-ranging gartersnakes (*Thamnophis sirtalis*, Colubridae). *Behavioral Ecology*, 11: 239–245.

Strüssmann, C. & Sazima, I. 1993. The snake assemblage of the Pantanal at Poconé, Western Brazil: Faunal Composition and Ecological Summary. *Studies on Neotropical Fauna and Environment* 28: 157–168.

Tozetti, A.M.; Oliveira, R.B. & Pontes, G.M.F. 2009. Defensive repertoire of *Xenodon dorbignyi* (Serpentes, Dipsadidae). *Biota Neotropica* 9: 157–163.

Tozetti, A.M.; Fontana, C.S.; Oliveira, R.B. & Pontes, G.M.F. 2011. Diet of a maguari stork (*Ciconia maguari*, Aves, Ciconiidae) in southern Brazil: The opportunist predation of snake like preys? *Pan-American Journal of Aquatic Sciences* 6: 65–67.

Vitt, L.J., & Caldwell, J.P. 2013. Herpetology: an introductory biology of amphibians and reptiles. Academic press. San Diego.

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