

Male-male combat in free-ranging *Epicrates crassus* Cope, 1862 from South America

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The boid *Epicrates crassus* is a stout snake species (usually > 1 m long) that is widely distributed in South America (Nogueira et al., 2019). This species inhabits grasslands and savannah-like areas and preys mainly on small ground-dwelling mammals at night (Pizzatto et al., 2009; Marques et al., 2015). Like other boids, *E. crassus* reproduces seasonally and gives birth to live young (Pizzatto and Marques, 2007; Marques et al., 2015). During the mating season, boids engage in either mating aggregations or male-male combat (Pizzatto et al., 2006). Male-male combat has been recorded only in *Corallus caninus* (Linnaeus, 1758), *E. cenchria*, *E. crassus*, and *E. assisi*, but this behaviour has been predominantly observed in captivity (Osborne, 1984; Schuett and Schuett, 1995; Pizzatto et al., 2006; Senter et al. 2014; Guedes et al., 2019). The combat ritual involves interaction sequences between two male snakes, apparently competing for superiority or dominance (Carpenter, 1977, 1984; Almeida Santos et al., 1999; Pizzatto et al., 2006; Batista et al., 2021). Here, we present the first in-situ record of male-male combat of *E. crassus*.

At 17:46 h on 9 June 2023 (late autumn), two adult male *E. crassus* were found while fighting in a grassland habitat, in Parque Nacional das Emas (18.1000°S, 52.9167°W, 760–880 m a.s.l.), which is a large protected Cerrado area in the state of Goiás, central Brazil. The combat sequence was videotaped and photographed, and the images were used to illustrate the behavioural phases. The complete videotaped sequence is available at <https://photos.app.goo.gl/8ZcgsiNscZ3RA4UKA>. Natural and controlled burns periodically occur in the park. During the recorded event, there was an ongoing

fire approximately 5 m away from the males, on the opposite side of a 3-meter-wide road. Despite the proximity, they remained engaged in the ritualised combat behaviour.

The sequence of events observed in this male-male combat included the following steps: display, ascent, vertical display, alignment-orientation, entwining of the anterior trunk, and topping. This sequence resembles that reported in captive *E. crassus* and *E. assisi* (Pizzatto et al. 2006; Guedes et al., 2019; Fig. 1). However, in situ the degree of entwining was less pronounced, and the topping sequence involved loose interweaving between the combatants. Tight entwining, typical of snakes observed in captivity (e.g., Pizzatto et al. 2006; Guedes et al., 2019), may not have been captured in the short video sequence, as the combat was observed for only eight minutes. The sequence shows that the larger male (Male A) exhibited dominance and guided the positioning of Male B (Fig. 2). However, we were unable to verify whether either male attempted to flee.

Our observation occurred in autumn and coincided with the timing of testis volume increase (an indicator of testicular activity) and vitellogenesis (see Pizzatto and Marques, 2007). Previous records of male-male combat in *Epicrates* (e.g., Schuett and Schuett, 1995; Pizzatto et al., 2006; Guedes et al., 2019) have been associated with the mating season, occurring from autumn to winter (Garcia and Almeida-Santos, 2022). Thus, the male-male combat reported here may be linked to the mating season of *E. crassus*, potentially functioning as a mechanism for selecting one of the males to court a female.

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References

Almeida-Santos S.M., Salomão, M.G., Peneti, E.A., Guimarães, E.S., Sena, P.S. (1999): Predatory combat and tail wrestling in

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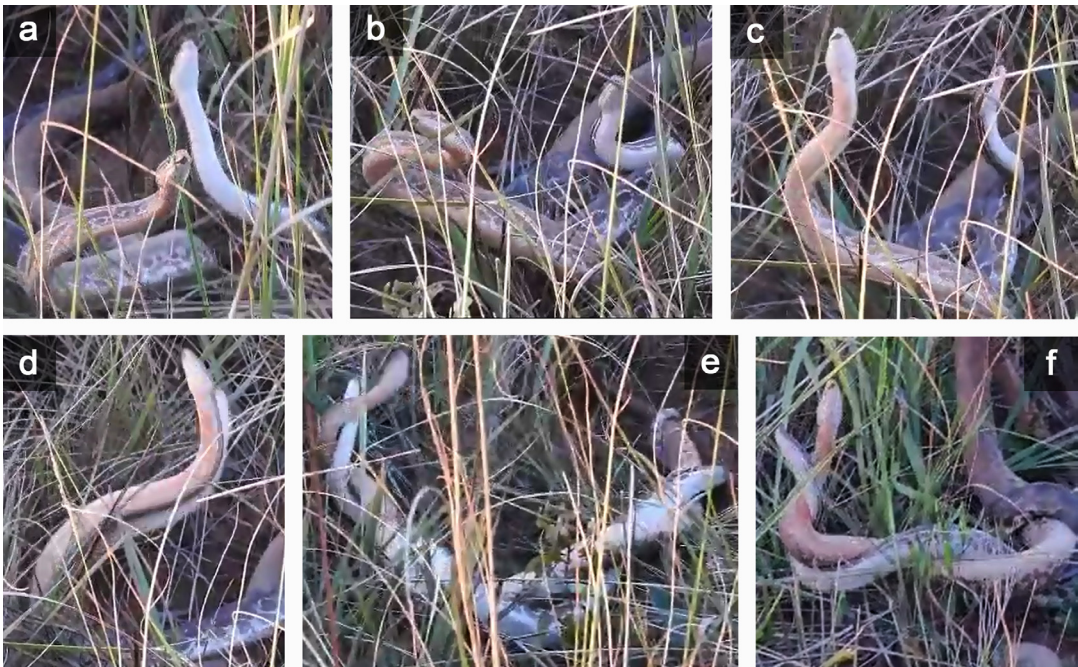


Figure 1. Sequence of male-male combat behaviour in *Epicrates crassus*. (a) Solicitation display. (b) Lyre-shaped position of the anterior trunk region. (c) Ascent, vertical display. (d) Alignment-orientation. (e) Entwining of the anterior trunk. (f) Topping. Photos by Ana Luzia Souza Cunha.



Figure 2. The larger male *Epicrates crassus* (Male A) exhibiting dominance and guiding the positioning of Male B (Fig. 2). Photos by Ana Luzia Souza Cunha.

- hierarchical contexts of the Neotropical rattlesnake *Crotalus durissus terrificus*. *Amphibia-Reptilia* **20**: 88–96.
- Batista, S.F., Muniz-da-Silva, D.F., Almeida-Santos, S.M. (2021): Dominant and submissive behaviour in the rattlesnake *Crotalus durissus* under semi-natural conditions. *Herpetological Bulletin* **157**: 21–24.
- Carpenter, C.C. (1977): Communication and displays of snakes. *American Zoologist* **17**: 217–223.
- Carpenter, C.C. (1984): Dominance in snakes. In: *Vertebrate Ecology and Systematics*, p. 195–202. Seigel, R.A., Hunt, L.E., Knight, J.L., Malaret, L., Zuschlag, N.L. Eds., Lawrence, Kansas, USA, University of Kansas, Museum of Natural History.
- Garcia, V.C., Almeida-Santos, S.M. (2022): Reproductive cycles of neotropical boid snakes evaluated by ultrasound. *Zoo Biology* **41**: 74–83.
- Guedes, T.B., Guedes, A., Almeida-Santos, S.M. (2019): Male-male fighting, dominance, and mating in *Epicrates assisi* (Serpentes: Boidae) in captivity. *Phyllomedusa* **18**: 131–135.
- Marques, O.A.V., Eterovic, A., Nogueira, C.C., Sazima, I. (2015): *Serpentes do Cerrado*. Ribeirão Preto, Brazil, Holos.
- Nogueira, C.C., Argôlo, A.J., Arzamendia, V., Azevedo, J.A., Barbo, F.E., Bérnills, R., et al. (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.
- Osborne, S.T. (1984): *Corallus canina* (Emerald Tree Boa). *Behavior. Herpetological Review* **15**: 50.
- Pizzatto, L., Haddad, R.H., Almeida-Santos, S.M. (2006): Male-male ritualized combat in the Brazilian rainbow boa *Epicrates cenchria crassus*. *Herpetological Bulletin* **95**: 16–20.
- Pizzatto, L., Marques, O.A.V. (2007): Reproductive ecology of boine snakes with emphasis on Brazilian species and a comparison to pythons. *South American Journal of Herpetology* **2**: 107–122.
- Pizzatto, L., Marques, O.A.V., Facure, K. (2009): Food habits of Brazilian boid snakes: overview and new data, with special reference to *Corallus hortulanus*. *Amphibia-Reptilia* **30**: 533–544.
- Schuett, G.W., Schuett, S.P. (1995): *Epicrates cenchria cenchria*. Male combat. *Herpetological Review* **26**: 101.
- Senter, P., Harris, S.M., Kent, D.L. (2014): Phylogeny of courtship and male-male combat behavior in snakes. *PLoS ONE* **9**(9): e107528.