On the sexual behavior of *Urostrophus vautieri* (Squamata: Leiosauridae): attempted forced copulation

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The genus *Urostrophus* is composed of two species, *Urostrophus vautieri* Duméril & Bibron, 1837 and *Urostrophus gallardoi* Etheridge & Williams, 1991, both from southern South America (Etheridge & Williams, 1991; Santos et al., 2009). *Urostrophus vautieri* is endemic to Brazil, occurring in the Atlantic Forest (Etheridge & Williams, 1991; Pellegrino et al., 1999) and Cerrado (Santos et al., 2009) domains in all southern and southeastern states of the country (Costa et al., 2022). Courtship and reproductive behaviors have not yet been reported for *U. vautieri*, other than a report by Hudson et al. (2019) of a female with seven well-developed eggs in January. Understanding the factors involved in reproductive behaviors can help to clarify the natural history of this species. Herein, we describe the first record of an attempted copulation behavior in *U. vautieri*.

On 02 November 2020, from 5:07 p.m. to 6:04 p.m., J.A.M.P. observed an attempted copulation between two *U. vautieri* on the ground, in a fragment of Atlantic Forest (20.261°S, 43.954°W) near a residential area in the municipality of Itabirito, state of Minas Gerais, Brazil. The fragment is characterized as seasonal semideciduous forest in advanced regeneration, with trees forming a continuous canopy, presence of epiphytes (bromeliads and ferns), a well-developed understory, and few herbaceous and woody vines. A portion of the fragment has suffered anthropo-

genic interference from nearby homes (J.A.M.P. personal observations). The attempted copulation was recorded using a Samsung S9 cell phone.

During the attempted copulation the male grasped the female's abdominal region with his forelegs while biting her on the back (Fig. 1A–F). Male and female remained together during the entire period of observation. The female attempted to avoid copulation, shaking her body constantly and vigorously, alternating with periods of immobility (Fig. 1C–F). The female also made slow (ca. 30–40s), wavy, and crosswise movements of her tail tip. The observation lasted approximately 60 minutes.

When the female attempted to escape, the male bit her neck and held her with his forelimbs. After approximately five minutes, the couple rolled into a venter--to-venter position, but the female continued attempting to escape, remaining in the supine position (Fig. 1C–F). This "flip-over" behavior consists of the female rotating her body when resisting copulation (Olsson, 1995), because she is not in the fertile period, is already fertilized by another male, or does not accept males who lose ritual combats (Jessop et al., 2009; Gogliath et al., 2010; McLean et al., 2016). Females of another leiosaurid species, *Enyalius perditus* Jackson, 1978, may reject mating by aggressively biting the male on his mouth (Barreto-Lima & Sousa, 2006).

We observed that the pelvic girdle and hind limbs of both lizards were far apart and misaligned, preventing hemipenis insertion. We did not observe hemipenis eversion (Fig. 1D–F), suggesting that copulation did not occur. The lizards separated after nearly an hour, were captured by hand and taken to a safe place in the forest fragment, to protect them from nearby domestic animals.

Among Leiosauridae, the behavior of males biting females during copulation has been reported in captivity for *Enyalius catenatus* (Grantsau, 1966) and *Enyalius perditus* (Barreto-Lima & Sousa, 2006), and in the wild for *Enyalius boulengeri* (Barreto-Lima et al., 2020), *Enyalius bilineatus* (Novelli et al., 2015), and *Enyalius leechii* (Vitt et al., 1996), suggesting that this is a widespread behavior in this family, especially in *Enyalius*. In study of Vitt & Lacher (1981), biting the neck during copulation was also observed in the polychrotid lizard *Polychrus acutirostris*.

The attempted copulation and rejection by the female of *Urostrophus vautieri* lasted about 60 min., much longer than reported in the literature for other species, between 25 to 31 seconds (Mitchell, 1973; Olsson, 1995). In *Enyalius*, successful copulations have been reported between 15–45 min., with an average of 24 min. (Barreto-Lima & Sousa, 2006; Novelli et al., 2015; Bar-

reto-Lima et al., 2020). The attempted copulation in this study occurred in late spring, as in *Enyalius* (Barreto-Lima et al., 2020). One pregnant female of *U. vautieri* was reported in January (Hudson et al., 2019), suggesting that the reproductive period of the species begins in spring and extends until summer.

Color change (darkening) during copulation has been reported for some Leiosauridae, in males of *Enyalius perditus* (Barreto-Lima & Sousa, 2006) and *E. bilineatus* (Novelli et al., 2015), and it may be a defensive camouflage strategy against predators, since individuals become particularly vulnerable while mating during daylight (Barreto-Lima & Sousa, 2006; Barreto-Lima et al., 2020). We did not observe any color change by either individual of *U. vautieri*, as in *E. boulengeri* (Barreto-Lima et al., 2020). Further observations are needed to investigate whether the attempted mating during early evening was related to the absence of color change (Barreto-Lima et al., 2020) or whether such behavior does not occur in *U. vautieri*.

For the first time, the behavior of attempted forced copulation for *U. vautieri* was reported. The male bit and held the female with the forelimbs and the female shook herself and bit the male to disentangle from him. Reproductive behavior is still poorly investigated in Leiosauridae, mostly reported for *Enyalius* (Barreto-Lima et al., 2020). For *Urostrophus vautieri* nothing was known about its mating behavior until now. Additional observations in the field and in captivity would help better understand the reproductive period of *U. vautieri*, the factors that lead to successful or failed courtship and copulation, and how this set of behavioral repertoires may have evolved in Leiosauridae.

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REFERENCES

Barreto-Lima A.F., Sousa B.M. 2006. Court and copulation behaviors of *Enyalius perditus* Jackson, 1978 (Squamata, Leiosauridae) in captivity conditions. *Revista Brasileira de Zoociências* 8:193–197.

Barreto-Lima A.F., Ornellas I.S., Nóbrega Y.C., Silva-Soares. T. 2020. Mating behaviour of *Enyalius boulengeri* Etheridge, 1969 (Squamata, Leiosauridae). *Herpetology Notes* 13:241–244.

Costa H.C., Guedes T.B., Bérnils R.S. 2022 “2021”. Lista de répteis do Bra-

sil: padrões e tendências. *Herpetologia Brasileira* 10:110–279.

Etheridge R., Williams E.E. 1991. A review of the South American lizard genera *Urostrophus* and *Anisolepis* (Squamata: Iguania: Polychridae). *Bulletin of the Museum of Comparative Zoology* 152:317–361.

Gogliath M., Ribeiro L.B., Freire E.M.X. 2010. Forced copulation attempt in the Blue-tailed Lizard, *Micrablepharus maximiliani* (Reinhardt & Luetken, 1862) (Squamata, Gymnophthalmidae) in the Caatinga of northeastern Brazil. *Biota Neotropica* 10:347–350.

Grantsau R. 1966. *Enyalius catenatus*, das brasilianisches "Chamaleon". *Aquarium Terriarium Zeitschrift* 19:217–219.

Hudson A.A., Silva M.A., Honório N.R., Sousa B.M. 2019. *Urostrophus vautieri*. *Herpetological Review* 503:582–583.

Jessop T.S., Chan R., Stuart-Fox D. 2009. Sex steroid correlates of female-specific colouration, behaviour and reproductive state in Lake Eyre dragon lizards, *Ctenophorus maculosus*. *Journal of Comparative Physiology A* 195:619–630.

McLean C.A., Chan R., Dickerson A.L., Moussalli A., Stuart-Fox D. 2016. Social interactions generate mutually reinforcing selection for male aggression in Lake Eyre dragons. *Behavioral Ecology* 27:1149–1157.

Mitchell F.J. 1973. Studies on the ecology of the agamid lizard *Amphibolorus*. *Transactions of the Royal Society of South Australia* 97:47–76.

Novelli I.A., Sousa B.M., Cozendey P., Frieiro-Costa F.A. 2015. *Enyalius bilineatus* (Two-lined Fathead Anole). Courtship Behavior. *Herpetological Review* 46:91–92.

Olsson M. 1995. Forced copulation and costly female resistance behavior in the Lake Eyre dragon, *Ctenophorus maculosus*. *Herpetologica* 51:19–24.

Pellegrino K.C., Bertolotto C.E.V., Rodrigues M.T., Yonenaga-Yassuda Y. 1999. Banding patterns, heteromorphic sex chromosomes and Ag-stained NORs after pachytene stages in the meiosis of the Brazilian lizard *Urostrophus vautieri* (Squamata, Polychrotidae). *Caryologia* 52:21–26.

Santos R.C., Lucas P.S., Sousa B.M., Novelli I.A. 2009. Reptilia, Squamata, Leiosauridae, *Urostrophus vautieri*: Distribution extension and geographic distribution map. *Check List* 5:533–536.

Vitt L.J., Lacher T.E. 1981. Behavior, habitat, diet, and reproduction of the

iguanid lizard *Polychrus acutirostris* in the caatinga of northesastern Brazil. *Herpetologica* 37:53–63.

Vitt L.J., Avila-Pires T.C.S., Zani P.A. 1996. Observations on the ecology of the rare Amazonian lizard, *Enyalius leechii* (Polychrotidae). *Herpetological Natural History* 4:77–82.

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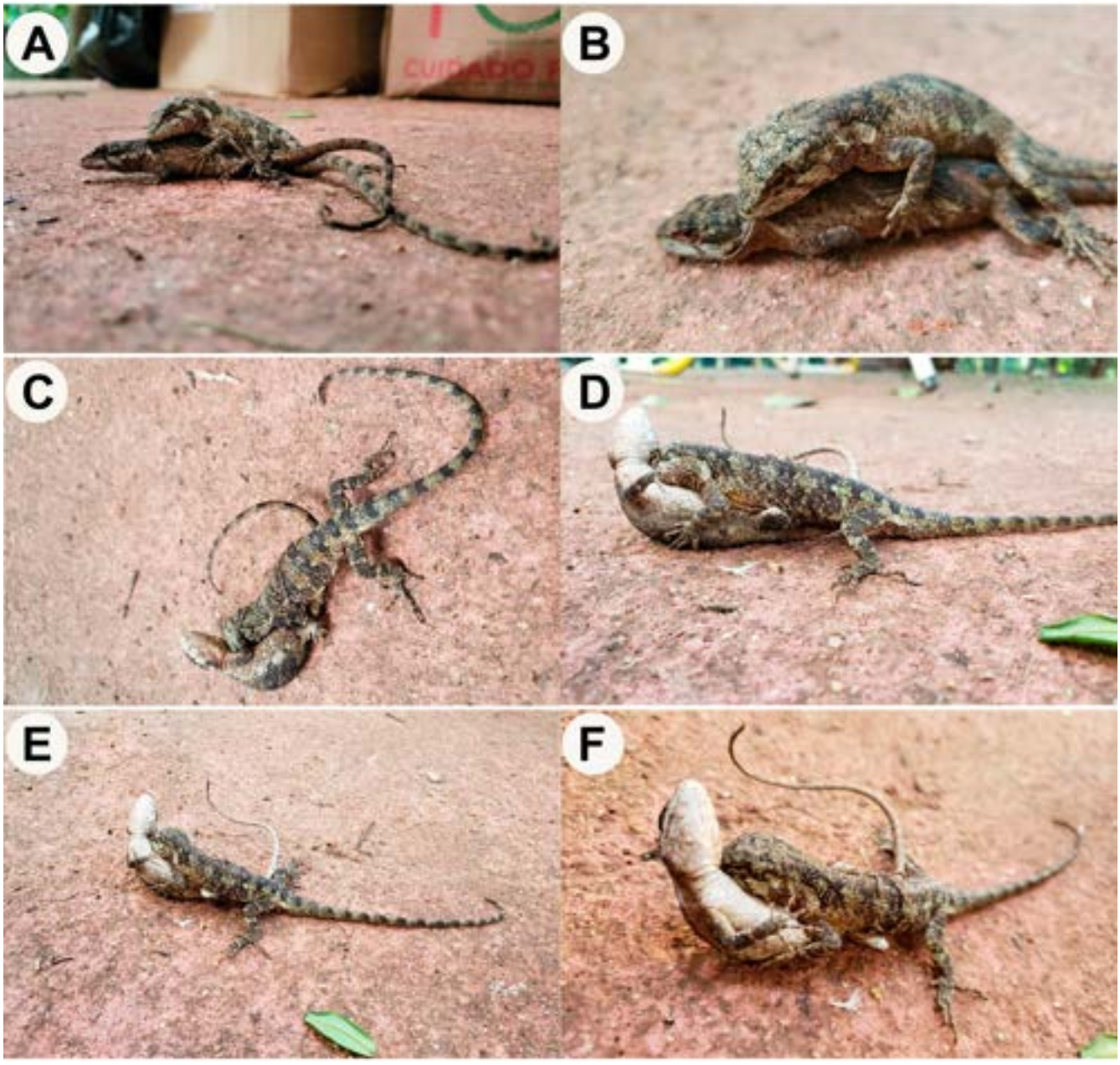


Figure 1. Forced copulation attempt in *Urostrophus vautieri* (Leiosauridae), in the Atlantic Forest of Itabirito, state of Minas Gerais, southeastern Brazil. The female is below the male, who is biting the female. (A-B) Male biting the female in her head. (C-F) Female in supine position trying to escape the male.