

Copulation record of *Tropidurus imbituba* (Squamata: Tropiduridae)

Registro da cópula de Tropidurus imbituba (Squamata: Tropiduridae)

Diego dos Anjos **SOUZA**^{1, 3}; Maricelma Simiano **JUNG**² & Rodrigo Ávila **MENDONÇA**¹

ABSTRACT

Tropidurus imbituba is a lizard with endemic distribution. Data on the species are scarce as it is a new species and has the only known habitat to date. Understanding reproductive aspects is important for their conservation. Thus, the present study presents the first records of the courtship and copulation behavior of *T. imbituba*. Sampling was carried out in spring 2022 and summer 2023, between September 24, 2022 and March 19, 2023. Monitoring was adapted from the Squamata Reptile Monitoring Protocol in Federal Conservation Units of the Caatinga Biome, following the active search method without time limitation (BANLT), in order to register *T. imbituba* individuals without any type of physical restraint. The individuals viewed had their coordinates taken with GPS, photographed with a DSLR camera – 65x zoom with a 21 mm ultra-wide angle lens. Viewing was done with the naked eye and with the aid of 8x40 binoculars. In areas with a concentration of lizards, the fixed point methodology was also used for five to 10 minutes, to observe the animals and other important data, where, at opportune moments, filming and photographs of courtship or copulation behavior were recorded.

Keywords: behavior; lizard; reproduction; restinga.

RESUMO

Tropidurus imbituba é um lagarto com distribuição endêmica. Os dados da espécie são escassos, por ser uma espécie nova e com único hábitat conhecido até o momento. Entender aspectos reprodutivos é importante para a sua conservação. Assim, o presente estudo apresenta os primeiros registros do comportamento de corte e cópula de *T. imbituba*. A amostragem foi realizada na primavera de 2022 e verão 2023, entre 24 de setembro de 2022 e 19 de março de 2023. O monitoramento foi adaptado do Protocolo de Monitoramento de Répteis Squamata em Unidades de Conservação Federais do Bioma Caatinga, seguindo o método busca ativa sem limitação de tempo (BANLT), de forma a registrar os indivíduos *T. imbituba* sem que haja nenhum tipo de contenção física. Os indivíduos visualizados tiveram suas coordenadas tomadas com GPS, fotografados com câmera DSLR – zoom de 65x com lente ultragrande angular de 21 mm. A visualização foi a olho nu e com auxílio de binóculos 8x40. Em áreas de concentração de lagartos, foi feita ainda a metodologia de ponto fixo durante 5 a 10 minutos, para observação dos animais e demais dados importantes, em que foram registradas, em alguns momentos oportunos, filmagens e fotografias do comportamento da corte ou cópula.

Palavras-chave: comportamento; lagarto; reprodução; restinga.

Recebido em: 1.º set. 2023
Aceito em: 20 dez. 2023

¹ Centro de Pesquisa e Triagem de Animais Silvestres, Universidade do Sul de Santa Catarina (Unisul), Caixa Postal 370 – CEP 88704-900, Tubarão, SC, Brasil.

² Unisul, Tubarão, SC, Brasil.

³ Corresponding author: souzadiego.a@gmail.com.

INTRODUCTION

Brazil is considered one of the most diverse countries in the world, with more of 800 described species of reptiles, including 296 lizards (GUEDES *et al.*, 2023). *Tropidurus imbituba* was described by Kunz and Borges-Martins (2013), being a case of microendemism. Species data are scarce because it is a new species with limited habitat. Understanding reproductive aspects is important for their conservation. There is no general reproductive pattern, for example, according to which all or at least most tropical lizards can be classified (SILVA & ARAÚJO, 2008).

The breadth of reproductive strategies within a single species may be related to marked differences in the supply of resources between the different Brazilian biomes (ROCHA, 1994). Tropidurids have an elaborate courtship involving body and head flexions and body shakes (RAND & RAND, 1966). As it is currently present in a single biome and restricted locality, it is necessary to understand copulation strategies and reproductive behaviors of *T. imbituba*. In territorial species, such as tropidurids and polycrotids, the visual signals used in communication are complex, involving morphological and behavioral adaptations (CARPENTER, 1977). The degree of signal elaboration should increase according to the general complexity of the habitat (ORD *et al.*, 2002).

In the present study, we will present courtship and mating records of *T. imbituba* in Morro do Farol, Praia da Vila, Imbituba, Santa Catarina, Brazil.

MATERIAL AND METHODS

The study was conducted at Morro do Farol (22 J 730294.42 m E 6874051.23 m S), corner of Praia da Vila, Imbituba, Santa Catarina, Brazil (SISBIO license n. 84778-1). The Morro do Farol is 1200 x 500 m long, reaches 100 m above sea level and is surrounded by an extensive sandy plain and has high slopes with rocky soils, originating a relief ranging from wavy to steep in the vicinity of the sea (ICMBio, 2018; PMI, 2019), where it is partially inserted in the Área de Proteção Ambiental da Baleia Franca, constituting a public area of the Municipality of Imbituba since December 2018. The biome is Atlantic Forest and the vegetation of the Morro do Farol is restinga (PMI, 2019).

The study was carried out in the spring of 2022 and summer of 2023, between September 24, 2022 and March 19, 2023, weekly in the morning, starting at 9:30 am and in the afternoon at 2:00 pm, performing the exploration from the area on foot. Monitoring was adapted from the Monitoring Protocol for Squamata Reptiles in Federal Conservation Units of the Caatinga Biome (ICMBio, 2012), following the active search method without time limitation (BANLT), in order to register individuals of *T. imbituba* without any kind of physical restraint. All individuals of *T. imbituba* viewed were counted, their coordinates were taken with a Garmin GPS, and whenever possible, photographed with a Canon SX 60 hs DSLR camera – 65x zoom with a 21 mm ultra-wide angle lens. Visualization was with the naked eye and with the aid of JIAXI 8x40 binoculars. In areas with a concentration of lizards, the fixed-point methodology was used for five to 10 minutes to observe the animals and other important data, and the information was recorded. During this period, footage of courtship or copulation behavior was registered at some opportune moments.

RESULTS

All the courtship behaviors described below were seen on the trail in more closed parts of Morro do Farol, towards the ocean, on top of the rock substrate and surrounded by herbaceous or shrubby restinga.

It was witnessed, in the spring of October, in the late morning to early afternoon around 1:47 pm on October 1, 2022, courtship behavior, in which two young individuals were present at the time and only one raised the tail for a few seconds, but it got scared and quickly escaped from the place due to the human presence (figure 1A).

In the summer, three courtship behavior situations were observed: in the first, that occurred in December, on December 23, 2022, around 11:38 am, there were two young individuals, the female being the most morphologically defined and was similar in size to one of the young individual. The female showed off and even got her paws on the male before finishing by raising her tail and offering. The young male performed an inspection lick, in addition to nodding, making a display, demonstrating disinterest. The event ended with a dispute over an insect that passed through the space between the two (figure 1B).

Two other events were observed: an adult male and female, on December 23, 2022 in the afternoon, around 2:43 pm (figure 1C) and an adult male and a female on January 28, 2023 at morning, around 9:55 am (figure 1D). These cases involved adult individuals, already with well-defined morphological characteristics. In courtship behaviors, there was the initial display by the male, and the female had the behavior of raising her tail; the male performed the inspection lick, in addition to nodding, flexing and inflating the neck region, showing himself to the female. Both events were not possible to see to the end due to the presence of people on the trail, which scared the animals.



Figure 1 – Mating behaviors of *T. imbituba*: A) the juvenile individual; B) a young individual and a female in courtship behavior; C) adult individuals in courtship behavior; D) adult individuals in courtship behavior. Source: primary.

At a distance of about 12 meters, the mating act of *T. imbituba* was filmed and observed at 14:36 pm on November 20, 2022 – spring. At that moment, no type of natural or anthropic interference has been registered. The environment was a more open and anthropized area of Morro do Farol. Both individuals were adults, with well-defined morphology, large male and small female.

It is likely that *T. imbituba* somehow engages in some form of communication prior to mating, such as the courtship behaviors previously reported. The beginning of courtship of the registered couple was not seen. In the sampling, it was noticed the male simply jumping from one rock to another to where the female was, in a distance of more or less 30 cm. Then, the male immobilized the female with his mouth, projecting himself over her and biting her back to dominate her (figure 2A). After being successful, the male carried her a few more centimeters in the same position, jumping to another rock with her immobilized. With the female already dominated, the male performed a display

and initiated copulation, projecting his body laterally to the female, still holding the spine with his mouth and using his tail to lift the female's tail and insert his reproductive organ. With the hind paw, the male would contract the female's tail, which was raised, thus holding and forming a support, remaining in the position for about 18 seconds, while copulation was carried out (figure 2B).

After copulating, the male remained shaking and performing displays and released the female, who stayed beside him. The male tilted his head, nodding and projecting his body forward, inflected and inflated the neck region to appear larger and performed a sequence of displays for six seconds. Afterwards, he licked the substrate, performed another seven seconds of display, licked the substrate again and performed another six seconds of display (figure 2C). The female during the display time stood still, moved her tail from right to left a few times. Soon, the male went towards her and, again, positioned himself towards the female in an attitude of dominance over her. Later, he displayed near her tail and, in response, she performed displays as well. During this period, the male licked the female's tail about six times and performed more displays (figure 2D). The female did not move from the spot and finally the male stayed beside her in sit-waiting.



Figure 2 – Copulation images of *Tropidurus imbituba*: A) moment of male dominance over female; B) moment of copulation; C) male in display sessions; D) male inspecting the female. Source: primary.

DISCUSSION

The record of courtship behavior and copulation is extremely important for the ecological knowledge of the *T. imbituba* species, as it allows filling a still unknown gap in the subject.

We can conclude that juveniles of *T. imbituba* have courtship behavior and that the reproduction of the species occurs in spring and summer. However, the developed behaviors of more complex courtship and copulation were only recorded for the adult individuals of the species.

We suggest that further studies on the influence of the environment, that is, the presence of people during to the reproductive behavior of the species, to be carried out, to understand the

behavior of the species with anthropization, since the presence of people seemed to affect the animal's courtship behavior in the observations of the study.

ACKNOWLEDGMENTS

We thank the considerations of the Agricultural Engineer and Professor PhD. Patrícia Menegaz de Farias and the Biologist Specialist Hemerson Mafra for evaluations and contributions to the work. We would also like to thank the Prefeitura de Imbituba for the information provided on the area of Morro do Farol, Canto da Praia da Vila, Imbituba – Santa Catarina, Brazil, and an evaluator from the staff of its respective Secretaria do Meio Ambiente. We thank the Instituto Chico Mendes de Conservação da Biodiversidade and Área de Proteção Ambiental da Baleia Franca for the license for our research.

DECLARATIONS

I, Diego dos Anjos Souza, responsible author for the submission of the manuscript entitled “Copulation record of *Tropidurus imbituba* (Squamata: Tropiduridae)” and all the other coauthors here presented, declare that “we do not have conflict of interests” related to the content of the paper.

REFERENCES

- Carpenter, C. The aggressive displays of three species of South American iguanid lizards of the genus *Tropidurus*. *Herpetologica*. 1977; 33: 285-289.
- Guedes, T. B., Entiauspe-Neto, O. M. & Costa, H. C. Lista de répteis do Brasil: atualização de 2022. 2023 [Cited Aug 12 2023]. Available from: <https://doi.org/10.5281/zenodo.7829013>.
- ICMBio – Instituto Chico Mendes de Conservação da Biodiversidade. Diagnóstico faunístico da porção terrestre da APA da Baleia Franca, Imbituba, Santa Catarina, Brasil. 2018. Available from: https://www.gov.br/icmbio/pt-br/assuntos/biodiversidade/unidade-de-conservacao/unidades-de-biomas/marinho/lista-de-ucs/apa-da-baleia-franca/arquivos/16_fauna_terrestre_apa_da_baleia_franca.pdf.
- ICMBio – Instituto Chico Mendes de Conservação da Biodiversidade. Protocolo de monitoramento de répteis Squamata em unidades de conservação federais no bioma caatinga. Goiânia; 2012. [Cited Jul 12 2023]. Available from: https://www.gov.br/icmbio/pt-br/assuntos/monitoramento/gestao-da-informacao/biblioteca/programas-de-monitoramento-de-ambientes-continentais/protocolo_monitoramento_de_squamata_ran-1.pdf.
- Kunz, S. T. & Borges-Martins, M. A new microendemic species of *Tropidurus* (Squamata: Tropiduridae) from southern Brazil and revalidation of *Tropidurus catalanensis* Gudynas & Skuk, 1983. *Zootaxa*. 2013; 3681(4): 413-439 [Cited Jun 12 2023]. Available from: <https://doi.org/10.11646/zootaxa.3681.4.6>.
- Ord, T. J., Blumstein, D. T. & Evans, C. S. Ecology and signal evolution in lizards. *Biological Journal of the Linnean Society*. 2002; 77: 127-148.
- PMI – Prefeitura de Imbituba. Memorial descritivo da Trilha do Farol. Imbituba; 2012. 52 p.
- Rand, S. & Rand, P. Aspects of the ecology of the iguanid lizard *Tropidurus torquatus* at Belém, Pará. *Smithsonian Miscellaneous Collections*. 1966; 15: 1-16.
- Rocha, C. F. D. Introdução a ecologia de lagartos brasileiros. Rio de Janeiro: Setor de Ecologia, Inst. de Biologia, UERJ;1994.
- Silva, V. N. E. & Araújo, A. F. B. Ecologia dos lagartos brasileiros. Rio de Janeiro: Technical Books Editora; 2008. 272 p.