



Hidden in the dung: first record of *Maculantrops hirtipes* (Macquart, 1844) (Diptera, Sphaeroceridae) from Brazil

Pedro H. O. Hoffmann¹ , Matheus M. M. Soares² , Joel Kits³ & Leonardo Maltchik¹

¹Universidade Federal do Rio Grande, Instituto de Ciências Biológicas, Programa de Pós-Graduação em Biologia de Ambientes Aquáticos Continentais, Av. Itália, km 8, 96203-900, Rio Grande, RS, Brasil.

²Instituto Nacional de Pesquisas da Amazônia, Programa de Pós-Graduação em Entomologia, Av. André Araújo, 2936, 69067-375, Petrópolis, Manaus, AM, Brasil.

³Agriculture and Agri-Food Canada, Canadian National Collection of Insects, Arachnids, and Nematodes, 960 Carling Ave, Ottawa, Ontario, Canada.

*Corresponding author: hoffmann.paleo@gmail.com

HOFFMANN, P.H.O., SOARES, M.M.M., KITS, J., MALTCHIK, L. **Hidden in the dung: first record of *Maculantrops hirtipes* (Macquart, 1844) (Diptera, Sphaeroceridae) from Brazil.** *Biota Neotropica* 23(3): e20231492. <https://doi.org/10.1590/1676-0611-BN-2023-1492>

Abstract: We recorded for the first time the lesser dung fly *Maculantrops hirtipes* (Macquart, 1844) from Brazil, state of Rio Grande do Sul. Twenty-five specimens were reared from the dung of *Myocastor coypus* (Molina, 1782), this is the first record of the feeding substrate for the genus *Maculantrops* and the second only for the Archiborborinae. In addition, we describe the puparium, provide an updated distribution map and additional photographs of the species.

Keywords: *Sphaeroceridae*; *small dung flies*; *Neotropical region*; *new records*.

Escondido no esterco: primeiro registro de *Maculantrops hirtipes* (Macquart, 1844) (Diptera, Sphaeroceridae) do Brasil

Resumo: Registramos pela primeira vez a mosca-do-esterco *Maculantrops hirtipes* (Macquart, 1844) no Brasil, no estado do Rio Grande do Sul. Vinte e cinco espécimes foram obtidos em amostras fecais de *Myocastor coypus* (Molina, 1782). Este é o primeiro registro do substrato alimentar para o gênero *Maculantrops* e o segundo apenas para subfamília Archiborborinae. Além disso, descrevemos o pupário, fornecemos um mapa de distribuição atualizado e fotografias adicionais da espécie.

Palavras-chave: *Sphaeroceridae*; *mosca-pequena-do-esterco*; *região Neotropical*; *novos registros*.

Introduction

Lesser dung flies (Diptera, Sphaeroceridae) are a small, worldwide distributed Acalyptratae family composed of 59 genera and over 1800 species (Papp & Roháček 2021). Species of sphaerocerid feed as larvae on a wide variety of decaying organic matter including dung, rotting vegetation, and fungi. The family is easily recognized by the short, broad hind basitarsus. The Archiborborinae is an exclusively Neotropical subfamily containing 117 described species in 8 genera (Kits & Marshall 2013, Kits & Marshall 2015). Only one of these species, *Antrops truncipennis* (Enderlein, 1909), has had the immature stages and their biology described (Harrison 1970, Chown 1996 a, b).

The genus *Maculantrops* was erected by Kits & Marshall (2013) on the split of the wide paraphyletic genus *Archiborborus* (Duda, 1921) and comprises two valid species: *M. altiplanus* Kits & Marshall, 2013 (highlands of Bolivia) and *M. hirtipes* (Macquart, 1844) (widespread in Argentina, Chile and Uruguay).

The nutria *Myocastor coypus* (Molina, 1782) is a Neotropical semiaquatic species that has herbivorous habits, distributed from Bolivia to southern Argentina and Chile (Woods et al. 1992, Colares et al. 2010, IUCN 2016). In Brazil, the species has its native distribution restricted to the southern, from the state of Paraná to the state of Rio Grande do Sul (Moojen 1952, Cherem et al. 2004, IUCN 2016, Peixoto-Couto et al. 2022). However, there are records of the species in the states of Rio de Janeiro (Bueno 2013), Mato Grosso do Sul (Peixoto-Couto et al. 2022), and an introduction in São Paulo (De Vivo et al. 2011). Due to its high potential to colonize available habitats (Bueno 2013), it may also occur in other states. They are large rodents, ranging between 40 cm and 60 cm long, weighing between 5 and 9 kg (Waterkeyn et al. 2010). Much of its diet is composed of aquatic plants of different species, the Poaceae family being the most common (Colares et al. 2010). They live associated with bodies of water, preferably where the terrain offers ravines or walls where they dig their refuge burrows

(Silva 2014). In wetlands characterized by large expanses of water, they build their refuges on vegetation with pieces of reeds and grass, which can form large platforms (Silva 2014). The presence of trails, excavations, as well as the cylindrical, elongated and green feces are indications of the presence of this rodent (Silva 2014).

The Brazilian sphaerocerid fauna is poorly studied, with only 82 species in 28 genera registered (Miranda 2023), but this number does not reflect the real diversity of the family in the country. In this paper, we present the first report of *M. hirtipes* in Brazil. Additionally, we describe the puparium and the substrate on which the flies developed. We also provide an updated distribution map and include additional photographs of the species.

Material and Methods

Forty-two dung samples (Figure 1C, D, E) of *M. coypus* were collected at the Taim Ecological Station “32°37’33.93S 52°34’41.02W” state of Rio Grande do Sul, Brazil (Figure 1A, B) in August (rainy season) of 2022 and stored in 50 ml tubes and taken to the laboratory of Universidade do Vale do Rio dos Sinos. The samples were kept in the refrigerator at $\pm 4^{\circ}\text{C}$ for 27 days, when the first author noticed that there were flies walking inside the tubes. The flies were identified as Archiborborinae using the identification key to the genera of Sphaeroceridae of the Neotropical Region and Nearctic Mexico (Marshall & Buck 2010) and later as *Maculantrops hirtipes* using the work of Kits & Marshall (2013). The individuals were euthanized 24 hours after emergence, using cotton soaked with ethyl acetate, then pinned, labeled and deposited at the zoological collection of Unisinos.

The species distribution map was created with QGIS 3.18 using coordinates from the specimen labels and locality data published in Kits & Marshall (2013) and (IUCN 2016).

The Taim Ecological Station (ESEC Taim) is a federal conservation unit located in the extreme south of Brazil. Created in 1986 on the borders of the municipalities of Rio Grande and Santa Vitória do Palmar in the state of Rio Grande do Sul, ESEC Taim protects vast wetlands, lakes, fields, dunes, forests and beaches (ICMBio 2021). It is considered one of the places with the greatest ecological significance in southern Brazil, as it provides shelter, food and a breeding ground for many species (ICMBio 2021). It is a priority area with extremely high importance for the preservation of the Pampa biome (MMA 2007).

The Taim wetlands have international relevance, protect several endemic species and have been recognized since 2017 as a RAMSAR site (ICMBio 2021). The annual average minimum temperature comprises around 23 and 14 °C in summer and winter (Wrege et al. 2012) and the annual pluviometric precipitation varies between 1440 mm and 1452 mm (Simiioni & Wollmann 2016). Relative air humidity is 80% and remains high throughout the year (Tucci et al. 1996).

Results

Maculantrops hirtipes (Macquart, 1844) (Figures 2–3)

Borborus hirtipes Macquart, 1844: 424 Type locality: Chile.

Diagnosis. Easily recognized by the numerous dark spots on the wing and pattern of bands on the legs (Fig. 2A, B) (See Kits & Marshall (2013) for a complete description).

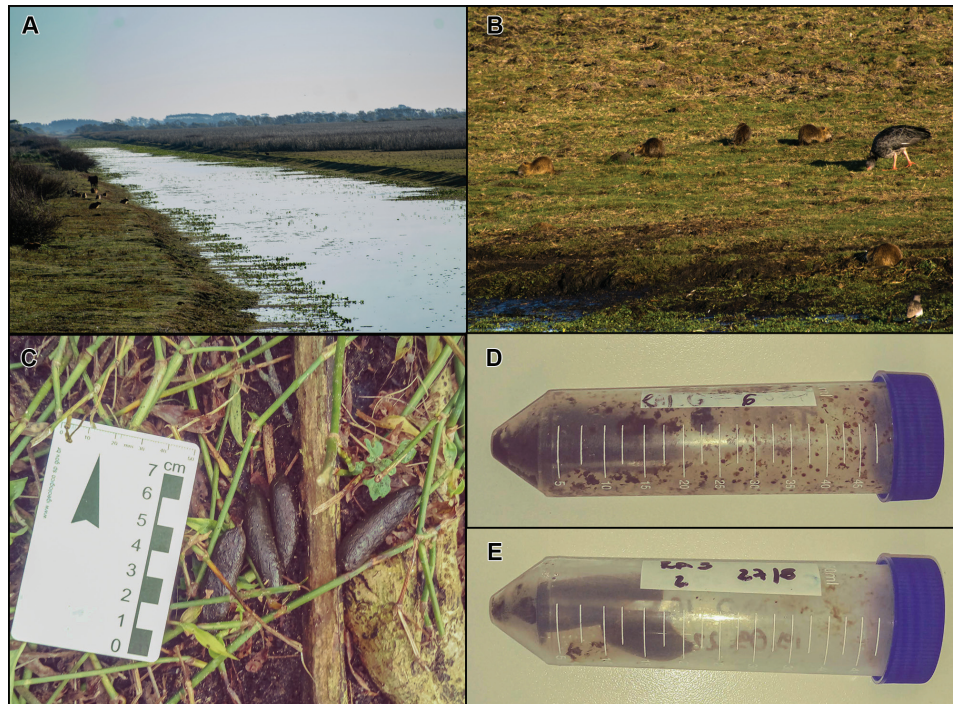


Figure 1. A–C. Living habitat and collection site of dung of *Myocastor coypus* (Molina, 1782). A. Drainage canal parallel to BR-471 highway, In the left one cattle individual and a group of six capybaras; B. Group of five *M. coypus* grazing together with a Southern screamer *Chauna torquata* (Oken, 1816) large bird on the right and a Southern lapwing *Vanellus chilensis* (Molina, 1782) on the lower right corner; C. Dung sample of *M. coypus*. D–E. Tubes with samples with dung stirred and whole respectively.

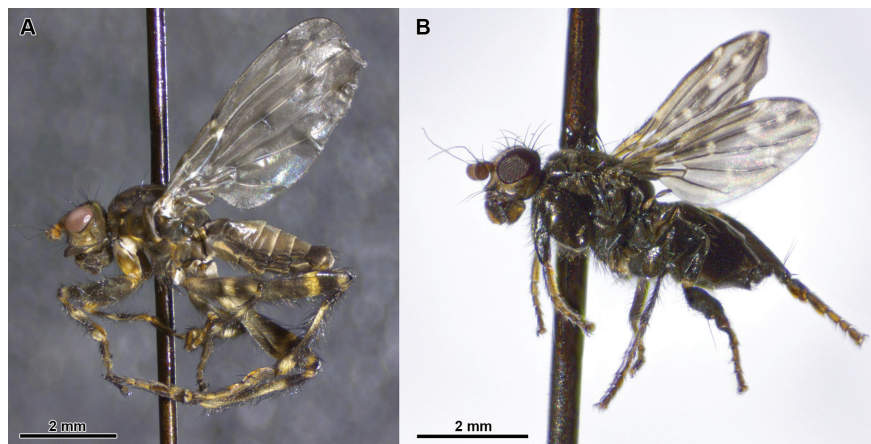


Figure 2. Habitus in lateral view of *Maculanrops hirtipes* (Macquart, 1844). A. Male; B. Female.

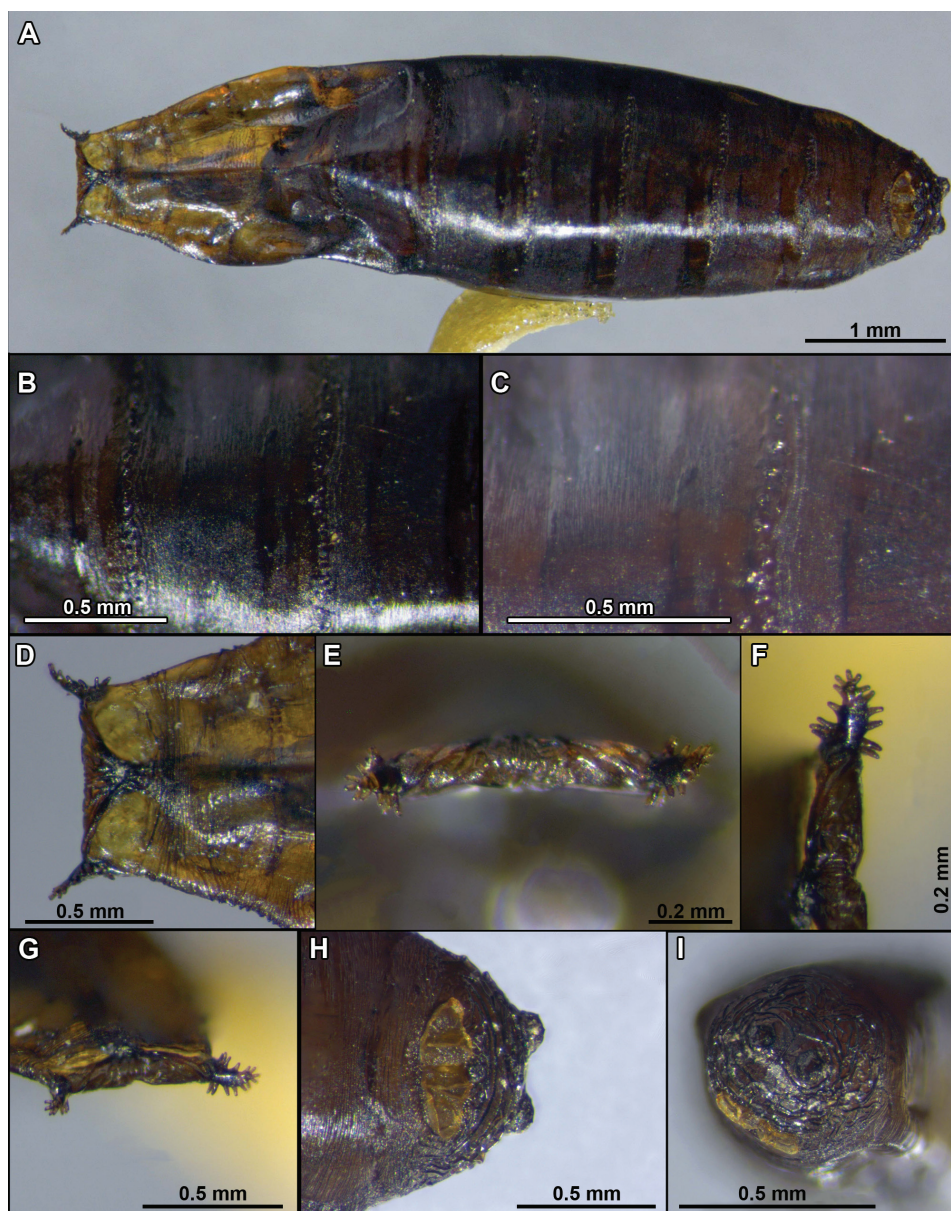


Figure 3. Puparium of *Maculanrops hirtipes* (Macquart, 1844). A. Habitus, ventral view; B-C. Creeping welts, ventral view; D-G. Anterior spiracular processes in ventral, anterior, lateral and anterolateral views respectively; H. Anal segment with reticulate wrinkling. I. Posterior spiracular processes, posterior view.



Figure 4. Known geographic distribution of *Maculantrops hirtipes* (Macquart, 1844) and native distribution of *Myocastor coypus* (Molina, 1782) according IUCN 2016.

Description of puparium (Figure 3). Pupa length: 6.3–7.2 mm. Color yellowish to dark brown, wrinkled transversely (Figure 3A). Abdomen with creeping welts present on anteroventral margin of segments 1–8 (Figure 3A–C). Welts consisting of widely separated, rounded teeth, those on segments 2–8 additionally with 2–3 irregular rows of minute teeth posterior to the larger teeth (Figure 3B, C). Anterior spiracular processes about twice their basal width, each bearing about 12–14 irregularly arranged papillae in a fan shape (Figure 3D–G). Anal segment with reticulate wrinkling (Figure 3H), posterior spiracular processes elevated about half their basal width, spiracular plates without hairs (Figure 3I).

Examined material: BRAZIL, Rio Grande do Sul, ESEC Taim, 32°37'33.93"S 52°34'41.02"W. *M. coypus* dung samples were collected from 26 to 28 August 2022 by P.H.O. Hoffmann & A. Adolfo. The first observation of adult flies in the samples was made on 23 September 2022 by P.H.O. Hoffmann.

Distribution. Argentina, Brazil (State of Rio Grande do Sul, new country record), Chile and Uruguay (Figure 4).

Discussion

Of the 45 fecal samples of *M. coypus* analyzed (Figure 1C), four showed hatching flies, representing a percentage of occurrence of 9%. A total of 25 adult specimens, 23 females, two males and 22 pupae of *M. hirtipes* were recovered from the samples. The samples with larvae of *Maculantrops* are easily recognized by the dung stirred up by the tube (Figure 1D) in contrast to the tubes without larvae where the dung remains whole (Figure 1E).

The *Myocastor coypus* (Figure 1A, B) has its diet based on aquatic plants, feeding mainly on plants from the Poaceae family (Colares et al. 2010). Can feed on 26 different plants, but species such as *Panicum tricholaenoides* Steud. and *Paspalum distichum* L. are among the most

frequent in the diet of this rodent in the study region (Colares et al. 2010). As the nutria, the capybara *Hydrochoerus hydrochaeris* (Linnaeus, 1766) has its diet based on aquatic plants, as well as the nutria of the Poaceae family is more common (Borges & Colares 2007). The capybara is the biggest rodent species of the world (Mones & Ojasti 1986) and occurs in sympatry with nutria in the study area. During the sampling fields we also collected 50 capybara dung samples. But despite going through the same storage methodology and having similarities in their diet, no flies were observed in capybara samples.

The known distribution of *M. hirtipes* shows remarkable overlap with the native distribution of *M. coypus*. Therefore, the distribution of *M. hirtipes* may be wider, reaching Paraguay and Bolivia, and the states of Santa Catarina and Paraná in southern Brazil. This pattern of co-distribution, along with the apparent absence of *M. hirtipes* in dung of *H. hydrochaeris*, may indicate specialization on the dung of this species. Sampling and rearing from mammal dung elsewhere in the range would be needed to more thoroughly address this.

Acknowledgments

We thank Andressa Adolfo for the support in the field expeditions and laboratory procedures, Natasha Horn for her support in cataloging the specimens at the Zoological Collection of Unisinos, Jamerson Aguiar (UFMA) for the help with the distribution map and two anonymous reviewers offered useful suggestions to earlier versions of the manuscript. PHOH thanks Coordenação de Aperfeiçoamento de Pessoal de Ensino Superior (CAPES) for the master scholarship (proc.no. 88887.686236/2022-00). MMMS thanks Coordenação de Aperfeiçoamento de Pessoal de Ensino Superior (CAPES) for the PhD scholarship (proc.no. 88882.444402/2019-01). LM hold research productivity grant from the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) (grant no. 307455/2021-1).

Associate Editor

José Mermudes

Author Contributions

Pedro H. O. Hoffmann: Conceptualization; Methodology; Writing – original draft; Writing – review & editing.

Mathus M. M. Soares: Conceptualization; Methodology; Writing – original draft; Writing – review & editing.

Joel Kits: Writing – original draft; Writing – review & editing.

Leonardo Maltchik: Resources; Writing – review & editing.

Conflicts of Interest

The author(s) declare(s) that they have no conflict of interest related to the publication of this manuscript.

Data Availability

Supporting data are available at < <https://www.scielo.br/journal/bn/about/#instructions>>.

References

- BORGES, L.V. & COLARES, I.G. 2007. Feeding habits of capybaras (*Hydrochoerus hydrochaeris*, Linnaeus 1766), in the Ecological Reserve of Taim (ESEC - Taim) - south of Brazil. *Brazilian Archives of Biology and Technology*, v.50, n.3, p.409–416.
- BUENO, C. 2013. Ocorrência de *Myocastor coypus* Molina, 1782 no estado do Rio de Janeiro. *Boletim da Sociedade Brasileira de Mastozoologia*, v.66, p.9–11.
- CHEREM, J.J., SIMÕES-LOPES, P.C., ALTHOFF, S. & GRAIPEL, M.E. 2004. Lista dos Mamíferos do Estado de Santa Catarina, Sul do Brasil. *Mastozoologia Neotropical*, v. 1, n.2, p.151–184.
- CHOWN, S. 1996a. Kelp degradation by *Paractora trichosterna* (Thomson) (Diptera: Helcomyzidae) at sub-Antarctic South Georgia. *Polar Biology*, v.16, p.171–178.
- CHOWN, S. 1996b. Thermal sensitivity of oxygen uptake of Diptera from sub-Antarctic South Georgia and Marion Island. *Polar Biology*, v.17, p.81–86.
- COLARES, I.G., OLIVEIRA, R.N.V., OLIVEIRA, R.M. & COLARES, E. P. 2010. Feeding habits of coypu (*Myocastor coypus* Molina 1978) in the wetlands of the Southern region of Brazil. *Anais da Academia Brasileira de Ciências*, v.82, n. 3, p.671–678.
- DE VIVO, M., CARMIGNOTTO, A.P., GREGORIN, R., HINGSTZAHNER, E., IACK-XIMENES, G.E., MIRETZKI, M., PERCE-QUILLO, A.R., ROLLO JR., M.M., ROSSI, R.V. & TADDEI, V.A. 2011. Checklist of mammals of São Paulo State, Brazil. *Biota Neotropica*, v. 11, n. 1, p.1–21.
- HARRISON, R.A. 1970. Diptera: Acalypterates of South Georgia, Heard and Kerguelen. *Pacific Insect Monographs*, v.23, p.285–289.
- ICMBio. 2021. Plano de Manejo da Estação Ecológica do Taim. Brasília, p.1–61.
- IUCN. 2016. The IUCN Red List of Threatened Species. www.iucnredlist.org. (last access in 13/02/2023)
- KITS, J.H. & MARSHALL, S.A. 2013. Generic classification of the Archborborinae (Diptera: Sphaeroceridae), with a revision of *Antrops Enderlein*, *Coloantrops* gen. nov., *Maculantrops* gen. nov., *Photoantrops* gen. nov., and *Poecilantrops* gen. nov. *Zootaxa*, v.3704, p.1–113.
- KITS, J.H. & MARSHALL, S.A. 2015. A revision of Boreantrops (Diptera: Sphaeroceridae: Archborborinae). *Zootaxa*, v.3915, p.301–355.
- MACQUART, J. 1844. Dipteres exotiques nouveaux ou peu connus. Vol. 2 Pt. 3 me. *Memoires de la Societe royale des Sciences de l'Agriculture et des Arts de Lille*, v. 1842, p.424.
- MARSHALL, S.A. & BUCK, M. 2010. Sphaeroceridae. In *Manual of Central American Diptera* (B.V. Brown et al., eds). NRC Research Press, Ottawa, Ontario, Canada, v.2, p.1165–1187.
- MIRANDA, G.F.G. 2023. Sphaeroceridae in *Catálogo Taxonômico da Fauna do Brasil*. PNUD. <http://fauna.jbrj.gov.br/fauna/faunadobrasil/2614> (last access in 17/01/2023)
- MMA. 2007. Áreas Prioritárias para Conservação, Uso Sustentável e Repartição de Benefícios da Biodiversidade Brasileira: Atualização – Portaria MMA nº9, de 23 de janeiro de 2007. Ministério do Meio Ambiente, Secretaria de biodiversidade e Florestas. Brasília, MMA, p.1–301.
- MONES, A. & OJASTI, J. 1986. *Hydrochoerus hydrochaeris*. *Mammalian Species*, v. 264, p.1–7.
- MOOJEN, J. 1952. Os roedores do Brasil. Ministério da Educação e Saúde, Instituto Nacional do Livro, p.1–214.
- PAPP, L. & ROHÁČEK, J. 2021. Sphaeroceridae. In *Manual of Afrotropical Diptera, Brachycera—Cyclorhapha, excluding Calyptratae* (A.H. Kirk-Spriggs & B.J. Sinclair, eds). *Suricata* 8. South African National Biodiversity Institute, Pretoria, v.3, p.2145–2192.
- PEIXOTO-COUTO, R.M., CORREA-BRANCO, A. & CABREIRA-MIGUEL, M. 2022. First record of *Myocastor coypus* (Molina 1782) (Mammalia, Rodentia) for the state of Mato Grosso do Sul, Brazil, and its distribution in southern South America. *Atualidades Biológicas*, v. 44, n. 116, p.1–6.
- SILVA, F. 2014. Mamíferos Silvestres Rio Grande do Sul. *Via Sapiens*, p.1–308.

- SIMIONI, J.P.D. & WOLLMANN, C.A. 2016. Variabilidade anual dos atributos climáticos e definições das unidades climáticas na Estação Ecológica do Taim-RS. *Geosp – Espaço e Tempo* v.20, n.3, p.676–697.
- TUCCI, C.E.M., LOUZADA, J.A., MOTTA MARQUES, D.M.L., LEÃO, M.I., MEDIONDO, E.M. & SILVA, A.M. 1996. Comportamento hidrológico do banhado do Taim. Instituto de Pesquisas Hidráulicas, Universidade Federal do Rio Grande do Sul. v.2.
- WATERKEYN, A., PINEAU, O., GRILLAS, P. & BRENDONCK, L. 2010. Invertebrate dispersal by aquatic mammals: a case study with nutria *Myocastor coypus* (Rodentia, Mammalia) in Southern France. *Hydrobiologia*, v. 654, n. 1, p.267–271.
- WOODS, C.A., CONTRERAS, L., WILLNER-CHAPMAN, G. & WHIDDEN, H.P. 1992. *Myocastor coypus*. *Mammalian Species*, v. 398, n. 1, p.1–8.
- WREGGE, M.S.S. STEINMETZ, C.R. JÚNIOR & ALMEIDA, I.R. 2012. Atlas Climático da Região Sul do Brasil: Estados do Paraná, Santa Catarina e Rio Grande do Sul (Segunda Edição). Embrapa, Brasília. p.1–336.

Received: 15/03/2023

Accepted: 28/07/2023

Published online: 25/08/2023