Available online at www.sciencedirect.com

Revista Mexicana de Biodiversidad

Revista Mexicana de Biodiversidad 88 (2017) 765–768

Instituto de Biología UNAM
www.ib.unam.mx/revista/

Research note

# First record of *Brachylaima* (Trematoda: Brachylaimidae) in *Salvator merianae* (Squamata: Teiidae)

## *Primer registro de* Brachylaima *(Trematoda: Brachylaimidae) en* Salvator merianae *(Squamata: Teiidae)*

Fabiana Fedatto-Bernardon*, Thainá Dutra-Vieira, Gertrud Müller

*Laboratório de Parasitologia de Animais Silvestres, Departamento de Microbiologia e Parasitologia, Instituto de Biologia, Universidade Federal de Pelotas, Campus Universitário, caixa postal 354, CEP 96010-900, Pelotas, Rio Grande do Sul, Brazil*

Received 5 September 2016; accepted 9 March 2017
Available online 9 August 2017

**Abstract**

Twenty-four gastrointestinal tracts of *Salvator merianae* were examined for helminths research. Immature forms of *Brachylaima* sp. were identified with a prevalence of 4.16%. This is the first occurrence the Brachylaimidae for this host species in Brazil and in South America since the previous records of *Brachylaima* sp. in lizards were known only from Europe and Eurasia.
© 2017 Universidad Nacional Autónoma de México, Instituto de Biología. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

*Keywords:* Argentine black and white tegu; Trematoda; Parasites

**Resumen**

Se revisó el tubo gastrointestinal de 24 tegus argentinos *Salvator merianae* en busca de helmintos. Se encontraron formas inmaduras de *Brachylaima* sp. con una prevalencia del 4.16%. Este es el primer registro de Brachylaimidae en esta especie de hospedero en Brasil y en América del Sur, ya que los registros previos de *Brachylaima* sp. en lagartos se tenían solo de Europa y Eurasia.
© 2017 Universidad Nacional Autónoma de México, Instituto de Biología. Este es un artículo Open Access bajo la licencia CC BY-NC-ND (http://creativecommons.org/licenses/by-nc-nd/4.0/).

*Palabras clave:* Tegu blanquinegro argentino; Trematoda; Parásitos

The geographical distribution of *Salvator merianae* (Duméril and Bibron, 1839) (Squamata: Teiidae), Argentine black and white tegu comprises eastern Bolivia, Argentina, Uruguay and Brazil (Embert, Fitzgerald, & Waldez, 2010; Loebmann & Quintela, 2009). The lizard is omnivorous, feeding on fruits, insects, snails, fish, amphibians, reptiles, rodents, adult birds, nestlings and eggs (Achaval & Olmos, 2003).

Regarding the helminths of *S. merianae*, the diversity is composed of 6 species of Nematoda: *Cruzia travassosi* Kalil and Vogelsangi, 1932 (Kathlaniidae); *Physaloptera retusa* Rudolphi, 1819 (Physalopteridae); *Diaphanocephalus galeatus* (Rudolphi, 1819) (Diaphanocephalidae); *Spinicauda spinicauda* Olfers, 1819 (Heterakidae); *Physaloptera tupinambae* Pereira, Alves, Rocha, Lima, and Luque, 2012 (Physalopteridae); *Physaloptera bainae* Pereira, Alves, Rocha, Lima, and Luque, 2014 (Physalopteridae) and 1 species of Cestoda, *Oochoristica* sp. (Cyclophyllidea) (Ávila & Silva, 2010, 2011; Pereira, Alves, Rocha, Lima, & Luque, 2012, 2014; Vieira, Bernardon, & Müller, 2016). In this context, the present study had the aim to report the occurrence of Brachylaimidae (Trematoda) and their parasitological indexes in *S. merianae*.

Twenty-four *S. merianae* were necropsied (collected in the period of 2007–2015), 20 collected on highways of southern

* Corresponding author.
*E-mail address:* fabifedatto@gmail.com (F. Fedatto-Bernardon).

Peer Review under the responsibility of Universidad Nacional Autónoma de México.

http://dx.doi.org/10.1016/j.rmb.2017.06.006
1870-3453/© 2017 Universidad Nacional Autónoma de México, Instituto de Biología. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

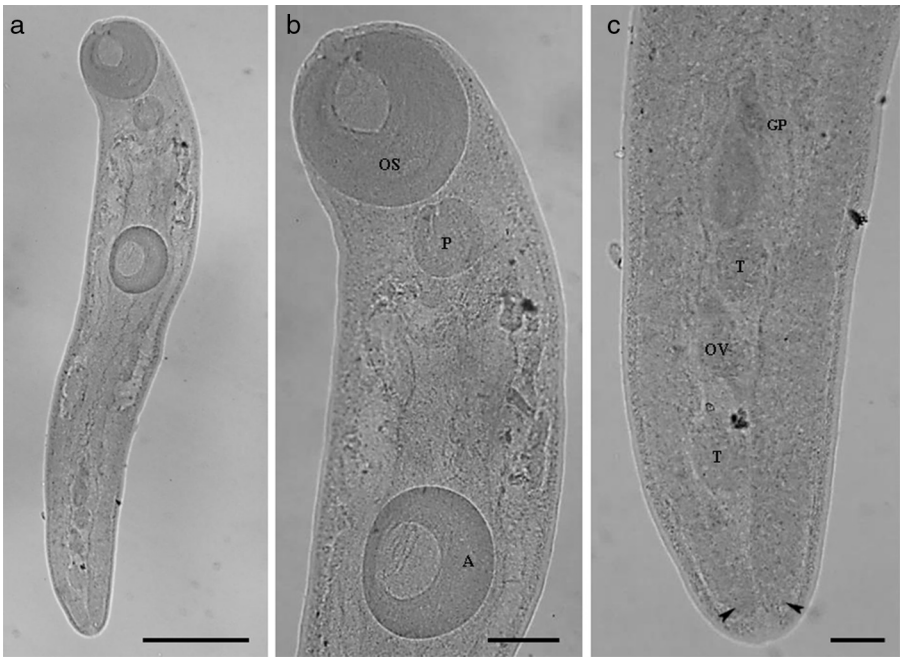


Figure 1. (a–c) *Brachylaima* Dujardin, 1843 (Trematoda: Brachylaimidae) parasite of *Salvator merianae* (Duméril and Bibron, 1839) from southern of Brazil. (a) Body of *Brachylaima* (bar = 0.42 mm); (b) OS = oral sucker; P = pharynx; A = acetabulum (bar = 0.1 mm); (c) GP = genital pore; OV = ovary; T = testes; arrow heads indicate the cecum (bar = 0.06 mm).

Brazil (in Rio Grande do Sul State) under the autorization "Instituto Chico Mendes de Conservação da Biodiversidade – Sistema de Autorização e Informação em Biodiversidade" (ICMBIO-SISBIO 38913-1) from municipalities of Pelotas (31°46′19″ S, 52°20′33″ W) ($n = 13$), Capão do Leão (31°46′3″ S, 52°26′55″ W) ($n = 10$), and Morro Redondo (31°35′18″ S, 52°37′47″ W) ($n = 1$), and 4 were donated by the "Núcleo de Reabilitação da Fauna Silvestre e Centro de Triagem de Animais Silvestres da Universidade Federal de Pelotas" (NURFS-CETAS/UFPel).

The gastrointestinal tracts were sectioned into esophagus, stomach, small intestine and large intestine. These were dissected and washed with a water jet through a sieve (150 μm) and the resulting contents and mucous were examined under an Olympus SZ 51 stereomicroscope. The trematodes were quantified, fixed in AFA, stored in alcohol 70% and dyed with Carmin's Langeron and mounted on slides with Canada's balsam. These were viewed with an Olympus CX21 microscope for morphological and morphometric identification according to Gibson, Jones, and Bray (2002) and Valente, Diaz, Salomón, and Navone (2016).

Vouchers specimens are deposited in "Coleção de Helmintos do Laboratório de Parasitologia de Animais Silvestres do Instituto de Biologia, Universidade Federal de Pelotas (CHLAPASIL/UFPel)" (Nos. 637 and 638).

Measurements are expressed in millimeters (the mean shown in parentheses) and the photographs were taken with an Olympus BX 41 microscope with attached camera system. The parameters calculated were prevalence (P), mean abundance (MA) and mean intensity of infection (MI) according to Bush, Lafferty, Lotz, and Shostak (1997).

Class Trematoda Rudolphi, 1808

Subclass Digenea Carus, 1863

Family Brachylaimidae Joyeux & Foley, 1930

Genus *Brachylaima* Dujardin, 1843: (immature forms) (Fig. 1a–c):

Characterization: based on 8 specimens (5 were measured). Length of body 1.66–2.35 (2.04 ± 0.34); width of body (level of acetabulum) 0.3–0.6 (0.43 ± 0.12); length of oral sucker 0.25–0.36 (0.31 ± 0.02); width of oral sucker 0.25–0.35 (0.31 ± 0.02); length of pharynx 0.1–0.18 (0.13 ± 0.03); width of pharynx 0.12–0.16 (0.14 ± 0.01); length of acetabulum 0.23–0.28 (0.26 ± 0.02); width of acetabulum 0.18–0.27 (0.23 ± 0.04); length of ovary 0.04–0.1 (0.07 ± 0.02); width of ovary 0.04–0.08 (0.05 ± 0.02); length of the anterior testicle 0.05–0.1 (0.08 ± 0.02) and width of anterior testicle 0.04–0.09 (0.06 ± 0.02); length of the posterior testicle 0.05–0.1 (0.08 ± 0.02) and width of the posterior testicle 0.03–0.08 (0.06 ± 0.02). The specimens do not present eggs.

Although the specimens found are immature forms, the following morphological characteristics allowed us to assign them to the genus *Brachylaima*: body elongated; acetabulum located in the anterior half of the body; presence of muscular pharynx; caeca long slightly sinuous, extending to the posterior extremity of the body; uterus intercaecal; vitelline fields extending between the posterior margin of the acetabulum to the anterior margin of the anterior testis; genital pore located in the anterior margin of anterior testis; gonads located in the posterior half of the body near the posterior extremity of the body.

Eight trematodes were found parasitizing the small intestine of only 1 *S. merianae* (P = 4.16%; MA = 0.33; MI = 8) from

Pelotas. The specimens when compared to adults are smaller in size with respect to morphology, exhibit testis, ovary and vitelline glands reduced, and the absence of eggs.

The history of *Brachylaima* Dujardin, 1843 is confusing at first, because some authors, generating various synonyms, used different spelling. *Brachylaima* Dujardin, 1843 (Syns *Brachylaime* Dujardin, 1843; *Brachylaimus* Dujardin, 1845; *Brachylaemus* Blanchard, 1847; *Harmostomum* Braun, 1899; *Heterolope* Looss, 1899; *Entosiphonus* Sinitsin, 1931; *Centrodes* Travassos & Kohn, 1964; *Mazzantia* Travassos & Kohn, 1964; *Rallitrema* Travassos & Kohn, 1964) (Gibson et al., 2002). According to Pojmanska (2002), Brachylaimidae Joyeux and Foley, 1930 is composed of Brachylaiminae Joyeux and Foley, 1930 and Ityogoniminae Yamaguti, 1958. Brachylaiminae includes *Brachylaima*; *Glaphyrostomum* Braun, 1901; *Parabrachylaima* Lotz and Corkum, 1975; *Postharmostomum* Witenberg, 1923 and *Ectosiphomus* Sinitsin, 1931 (Gibson et al., 2002).

In Brazil, 4 species of *Brachylaima*, *Brachylaima advena* Dujardin, 1843; *Brachylaima centrodes* (Braun, 1901); *Brachylaima marsupium* (Braun, 1901) and *Brachylaima mazzantii* (Travassos, 1927) have been registered in mammals (Muridae, Cricetidae; Didelphidae) and birds (Columbidae, Odontophoridae, Tinamidae) (Travassos, Teixeira-de Freitas, & Kohn, 1969). Although there are no reports of *Brachylaima* sp. parasiting *S. merianae*, other digeneans were found parasitizing Teiidae, in *Tupinambis teguixin* Linnaeus, 1758: *Pulchrosomoides elegans* Freitas and Lent, 1937 (Cathaemasiidae); *Paradistomum parvissimum* (Travassos, 1918) (Pronocephalidae); *Dasymetra tupinambis* Nasir and Diaz, 1971 (Plagiorchiidae) and in *Tupinambis rufescens* (Günther, 1871): *Styphlodora condita* Faria, 1911 (Plagiorchiidae) (Ávila & Silva, 2010).

*Brachylaima* species are generally found in the alimentary tract of birds, mammals and rarely in amphibians (Gibson et al., 2002). For lizards, (Squamata) immature forms were registered in the Spain by Roca, López-Balaguer, and Hornero (1989) in *Podarcis bocagei* (Seoane, 1884) (Lacertidae) (P = 0.9%). For the islands (Balearic Archipelago) in *Podarcis pityusensis* (Boscá, 1883) [P = 0.2% ($n$ = 564)] and in *Podarcis lilfordi* (Günther, 1874) [P = 0.8%; MA = 0.01; MI = 1.3 ($n$ = 386)] (Roca, 1996).

In Portugal, Galdón, Roca, Barbosa and Carretero (2006) recorded in *P. bocagei* [P = 0.4% ($n$ = 249)] and *Podarcis carbonelli* Pérez Mellado, 1981 (Lacertidae [P = 1.2%; MA = 4.7; MI = 0.05) ($n$ = 257)]. In Turkey, Yildirimhan, Bursey, and Altunel (2011) in *Lacerta trilineata* Bedriaga, 1886 (Lacertidae) [P = 9%; MA = 0.4; MI = 5 ($n$ = 38)] and Incedogan, Yildirimhan, and Bursey (2014) in *Chalcides ocellatus* (Forskal, 1775) (Scincidae) [P = 2.2%; MA = 0.02; MI = 12 ($n$ = 45)]. In Poland, registered in *Anguis fragilis* Linnaeus, 1758 (Anguidae) and *Lacerta agilis* Linnaeus, 1758 (Lacertidae) (Lewin, 1990, 1992 *apud* Incedogan, Yildirimhan, & Bursey, 2014).

In this study, the prevalence, mean abundance and mean intensity values of infection found for *Brachylaima* sp. in *S. merianae* were low (P = 4.16%; MA = 0.33; MI = 8), corroborating with previous studies which indicate that this is a parasite atypical in lizards (Galdón, Roca, Barbosa, & Carretero, 2006; Incedogan et al., 2014; Roca et al., 1989; Yildirimhan, Bursey, & Altunel, 2011).

The life cycle of *Brachylaima* spp. has 2 terrestrial gastropods as intermediate hosts and birds, mammals and less frequently amphibians and reptiles as definitive hosts (Butcher & Grove, 2001). It is probable that the infestation of *Brachylaima* sp. in *S. merinae* occurred through the feeding cycle (Kiefer & Sazima, 2002).

Cases of infection *Brachylaima* spp. in humans were recorded in South Australia (Butcher, 2016; Butcher & Grove, 2001). The patients (2 children and 1 adult) had gastrointestinal symptoms such as abdominal pain and chronic diarrhea. After treatment, adults and eggs of the trematodes were obtained and through experimental infection were identified as *Brachylaima cribbi* Butcher and Groove, 2001 (Butcher, 2016). Both patients lived in rural areas, with plenty of snails, which after analysis of these cases were confirmed as the source of infection in children and adults, the ingestion of raw snails and vegetables contaminated respectively (Butcher, 2016). Although in Brazil there are no cases of infection in humans, the occurrence of *Brachylaima* sp. in *S. merianae* serves as an alert for possible infections, and in other animals that are natural predators such as the carnivorus mammals: *Procyon cacrivorus* (Cuvier, 1789), and *Canis lupus familiaris* Linnaeus, 1758 (Quintela, Lob, & Artioli, 2014; Rangel & Neiva, 2013), once the digenetic has zoonotic potential, and the predators may hold their dispersion.

For the first time in Brazil and the South American continent, immature forms of *Brachylaima* sp. were registered in *S. merianae* presenting the morphological characterization, parasitological indexes and photographies.

We thank the ICMBio for authorization, the NURFS-CETAS/UFPel for donating dead lizards, and Coordenação de Aperfeiçoamento do Pessoal de Nível Superior by financial support through the edict 2010/032.

## References

Achaval, F., & Olmos, A. (2003). *Anfíbios y reptiles del Uruguay* (2ª ed.). Montevideo: Montevideo Graphis.

Ávila, W. R., & Silva, J. R. (2010). Checklist of helminths from lizards and amphisbaenians (Reptilia: Squamata) of South America. *Journal of Venomous Animals and Toxins including Tropical Diseases*, *16*, 543–572.

Ávila, W. R., & Silva, J. R. (2011). Helminths of lizards (Reptilia: Squamata) from Mato Grosso State, Brazil. *Comparative Parasitology*, *78*, 129–139.

Bush, A. O., Lafferty, K. D., Lotz, J. M., & Shostak, A. W. (1997). Parasitology meets ecology on its own terms: Margolis et al. revisited. *Journal of Parasitology*, *83*, 575–583.

Butcher, A. R. (2016). Children, snails and worms: the *Brachylaima cribbi* story. *Microbiology Australia*, *37*, 30–33.

Butcher, A. R., & Grove, D. I. (2001). Description of the life-cycle stages of *Brachylaima cribbi* n. sp (Digenea: Brachylaimidae) derived from eggs recovered from human faeces in Australia. *Systematic Parasitology*, *49*, 211–221.

Embert, D., Fitzgerald, L., & Waldez, F. (2010). *Salvator merianae. The IUCN Red List of Threatened Species. Version 2014.3.*. Retrieved from www.iucnredlist.org

Galdón, M. A., Roca, V., Barbosa, D., & Carretero, M. A. (2006). Intestinal helminth communities of *Podarcis bocagei* and *Podarcis carbonelli* (Sauria: Lacertidae) in NW Portugal. *Helminthologia*, *43*, 37–41.

Gibson, D. I., Jones, A., & Bray, R. A. (2002). *Keys to the Trematoda*. London: Ed. CABI.

Incedogan, S., Yildirimhan, H. S., & Bursey, C. R. (2014). Helminth parasites of the ocellated skink *Chalcides ocellatus* (Forskal, 1775) (Scincidae) from Turkey. *Comparative Parasitology*, *81*, 260–269.

Kiefer, M. C., & Sazima, I. (2002). Diet of juvenile tegu lizard *Tupinambis merianae* (Teiidae) in southeastern Brazil. *Amphibia-Reptilia*, *23*, 105–108.

Lewin, J. (1990). Parasitic worms in a slowworm (*Anguis fragilis* L.) population from the Bieszczady Mountains (Poland). *Acta Parasitologica Polonica*, *35*, 207–215.

Lewin, J. (1992). Parasites of the sand lizard (*Lacerta agilis* L.) in Poland. *Acta Parasitologica*, *37*, 19–24.

Loebmann, D., & Quintela, F. M. (2009). *Guia Ilustrado – Os Répteis da Região Costeira do Extremo Sul do Brasil*. Rio Grande do Sul: USEB, Pelotas.

Pereira, F. B., Alves, V. P., Rocha, B. M., Lima, S. S., & Luque, J. L. (2012). A new *Physaloptera* (Nematoda: Physalopteridae) parasite of *Tupinambis merianae* (Squamata: Teiidae) from Southeastern Brazil. *Journal of Parasitology*, *98*, 1227–1235.

Pereira, F. B., Alves, V. P., Rocha, B. M., Lima, S. S., & Luque, J. L. (2014). *Physaloptera bainae* n. sp. (Nematoda: Physalopteridae) parasitic in *Salvator merianae* (Squamata: Teiidae), with a key to *Physaloptera* species parasitizing reptiles from Brazil. *Journal of Parasitology*, *100*, 221–227.

Pojmanska, T. (2002). Family Brachylaimidae Joyeux & Foley 1930. In D. I. Gibson, A. Jones, & R. A. Bray (Eds.), *Keys to the Trematoda* (pp. 37–43). London: Ed. CABI.

Quintela, F. M., Lob, G., & Artioli, L. G. S. (2014). Diet of *Procyon cancrivorus* (Carnivora, Procyonidae) in restinga and estuarine environments of southern Brazil. *Iheringia Série Zoologia*, *104*, 143–149.

Rangel, C. H., & Neiva, C. H. M. B. (2013). Predação de vertebrados por cães *Canis lupus* F Familiaris (Mammalia: Carnivora) no Jardim Botânico do Rio de Janeiro. *Biodiversidade Brasileira*, *2*, 261–269.

Roca, V. (1996). The effect of some factors on the helminth parasite infracommunities of *Podarcis lizards* in the Balearic Islands (Western Mediterranean). *Bolleti de la Societat d'Historia Natural de les Balears*, *39*, 65–76.

Roca, V., López-Balaguer, E., & Hornero, M. J. (1989). Helmintofauna de *Podarcis hispanica* (Steindachner, 1870) y *Podarcis bocagei* (Seoane, 1884) (Reptilia: Lacertidae) em el Cuadrante Noroccidental de la Península Ibérica. *Revista Ibérica de Parasitología*, *49*, 127–135.

Travassos, L., Teixeira de Feitas, J. F., & Kohn, A. (1969). Trematódeos do Brasil. *Memórias do Instituto Oswaldo Cruz*, *67*, 1–886.

Valente, R., Diaz, J. I., Salomón, O. D., & Navone, G. T. (2016). The role of *Phyllocaulis variegatus* (Mollusca: Veronicellidae) on the transmission of digenean parasites. *Revista Mexicana de Biodiversidad*, *87*, 255–257.

Vieira, T. D., Bernardon, F. F., & Müller, G. (2016). *Diaphanocephalus galeatus* (Nematoda: Diaphanocephalidae), parasite of *Salvator merianae* (Squamata: Teiidae) in southern Brazil. *Revista Mexicana de Biodiversidad*, *87*, 512–515.

Yildirimhan, H. S., Bursey, C. R., & Altunel, F. N. (2011). Helminth parasites of the Balkan green lizard, *Lacerta trilineata* Bedriaga 1886, from Bursa, Turkey. *Turkish Journal of Zoology*, *35*, 519–535.