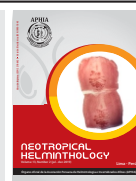




## Neotropical Helminthology



ORIGINAL ARTICLE / ARTÍCULO ORIGINAL

### NEW RECORDS OF CAPILLARIIDAE SPECIES (NEMATODA, ENOPLIDA) PARASITING BATS (MAMMALIA, CHIROPTERA) IN BRAZIL

### NUEVOS REGISTROS DE ESPECIES DE CAPILLARIIDAE (NEMATODA, ENOPLIDA) PARASITANDO MURCIÉLAGOS (MAMMALIA, CHIROPTERA) EN BRASIL

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## ABSTRACT

During a helminthological survey on bats from Minas Gerais state, Brazil, we found 3.13% of bats parasitized with capillarids. *Aonchotheca pulchra* (Freitas, 1934), *Tenoranema rivarolai* (Lent et al., 1946), and some specimens of capillarids non-identified were registered. This is the first report of *A. pulchra* in Minas Gerais state and the second report of *T. rivarolai* in South America.

**Keywords:** *Aonchotheca* – bats – capillarids – mammals – *Tenoranema*

## RESUMO

Durante un muestreo de helmintos de murciélagos realizado en el estado de Minas Gerais, Brasil, se encontró 3,13% de murciélagos parasitados por capillaridos. Se registraron *Aonchotheca pulchra* (Freitas, 1934), *Tenoranema rivarolai* (Lent et al., 1946) y algunos especímenes de capillaridos no identificados. Este es el primer registro de *A. pulchra* en el estado de Minas Gerais y el segundo registro de *T. rivarolai* en América del Sur.

**Palavras-chave:** *Aonchotheca* – capillarides – mamíferos – murciélagos – *Tenoranema*

## INTRODUCTION

Capillarids are cosmopolitan vertebrate nematodes characterized by a filiform body, with a narrow long anterior extremity, esophagus divided into a short and muscular anterior region, and a long and glandular posterior region with one to three longitudinal rows of stichocyte, elongated and bioperculated eggs, males smaller than females and with an eversible spicule sheath (Moravec, 2001).

About 300 species are described and due to the great difficulty of identification, for many years, the capillarids were classified as belonging to a single genus - *Capillaria* Zeder, 1800. However, since the 1950s some authors have already discussed the need for a reclassification of the Capillariidae (Mas-Coma & Esteban, 1985). Currently 22 genera are recognized in the family and the genus identification keys use morphological characters mainly of the male reproductive system, making it difficult to identify samples that contain only females (Moravec, 2001).

In South America, 5 genera and 12 species of capillarids have been found in bats, of which 4 genera and 9 species occur in Brazil (Santos & Gibson, 2015). Few species have a well-elucidated biological cycle, which may involve or not intermediate hosts (Moravec, 2001). No cycle is known of species bats' capillarids in South America. This study aims to report the occurrence of capillarids infecting bats in Minas Gerais state, Brazil.

## MATERIAL AND METHODS

A total of 319 adult bats of 33 species and four families from 79 municipalities of Minas Gerais State, Brazil, were received dead between 2013 January and 2016 March in the Urban Bats Laboratory of the Zoonoses Control Center of the municipality of Belo Horizonte, Minas Gerais State, Brazil. The animals were previously identified according to Vizotto & Taddei (1973) and Gregorin & Taddei (2002) and after frozen at -20°C. For helminthological survey, the bats were thawed at room temperature and necropsied. All

helminth found were conserved in 70% ethanol and clarified with Amann's Lactophenol solution. The parasites were photographed with a digital camera (AxioCam ERc 5s, Carl Zeiss) coupled to the microscope and the morphological measurements performed through the photos by AxioVision 4.8 software (Carl Zeiss Vision). The measurements are presented in micrometers ( $\mu\text{m}$ ), except when other measures are indicated. Drawings were made on CorelDRAW X8 software using the photos as a background for a more accurate drawing. The helminths were deposited in the Helminthological Collection of the Institute of Biosciences (CHIBB), São Paulo State University (UNESP), municipality of Botucatu, São Paulo State, Brazil. This study was approved by the Ethics Committee in Animal Experimentation (CEUA/UFMG) under the protocol number 194/2015.

## RESULTS

Out of 319 bats necropsied, 10 (3.13%) animals were infected with capillarids: one host was monoinfected with *Aonchotheca pulchra* (Freitas, 1934), one host was monoinfected with *Tenoranema rivarolai* (Lent et al., 1946), four hosts were co-infected with *A. pulchra* and *T. rivarolai*, and four hosts were infected with capillarids no identified (only females).

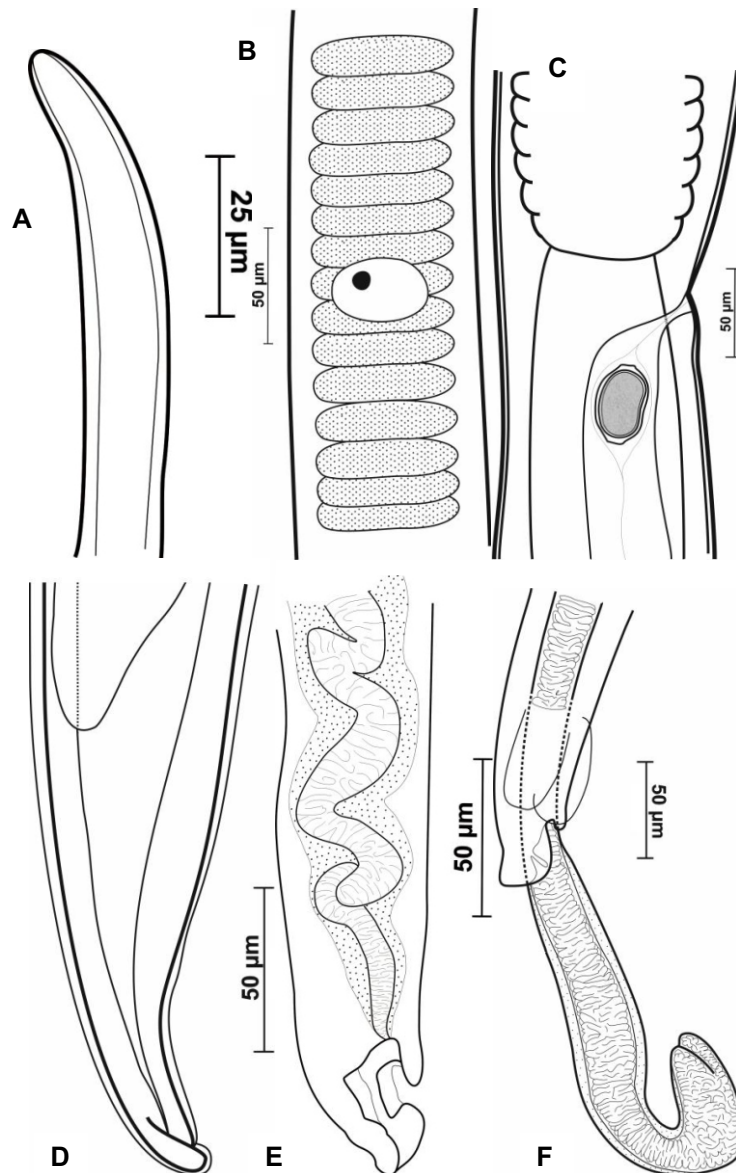
### *Aonchotheca pulchra* (Figure 1; Table 1)

#### Diagnosis

*General:* Long, thin, and smooth body. Very narrow anterior, mouth opening reduced and simple. Long esophagus with a single and organized row of stichocytes. Nervous ring and excretory pore not visualized.

*Female:* Muscular vulva, with or without external appendage. Vulva opening slightly posterior to the junction of the esophagus-intestine. Tail end rounded, anus subterminal. Smooth and bioperculated eggs.

*Male:* Complex posterior extremity, with small membranes of aspect bursate and few and discrete rays. Spicule and caudal papillae not visualized. Surface of spicular sheath wrinkled and without spines. Few specimens presented an exteriorized



**Figure 1.** Schematic representation of *Aonchotheca pulchra*. A - Anterior end; B - stichocytes detail; C - Vulva and egg; D - Posterior end female; E - Posterior end male with inverted spinal sheath; F - Posterior end male with everted spinal sheath.

spicular sheath, which resembles a hook shape.

#### Taxonomic summary

*Synonyms*: *Capillaria pulchra* Freitas, 1934; *Pterothominx pulchra* (Freitas, 1934) Moravec, 1982.

*Host*: *Nyctinomops laticaudatus* (Geoffroy, 1805).

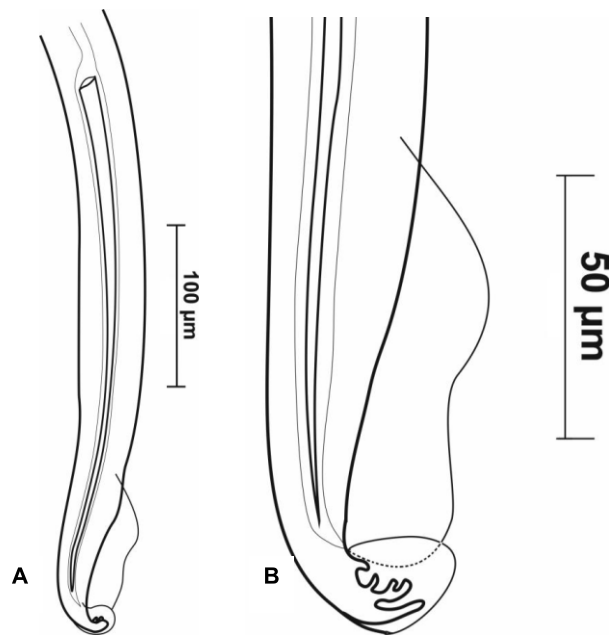
*Host's origin*: Uberaba (19°45'1"S, 47°55'57"W) and Uberlândia (18°54'41"S, 48°15'44"W).

*Distribution and hosts*: Brazil - *N. laticaudatus* and

*Nyctinomops macrotis* (Gray, 1840) (São Paulo state) (Cardia et al., 2014); *Tadarida brasiliensis* (Geoffroy, 1824) (Rio de Janeiro state) (Freitas, 1934); Paraguay - *Tadarida brasiliensis* Geoffroy, 1824 (Lent et al., 1946).

*Sites of infection*: stomach and small intestine.

*Specimens deposited*: CHIBB 7921, CHIBB 7931\*, CHIBB 7932\* (\*samples containing *A. pulchra* and *T. rivarolai*).



**Figure 2.** Schematic representation of *Tenoranema rivarolai*. Male. A – Single spicule; B – Caudal alae and rays of bursa.

#### Remarks

Freitas (1934) described the species as *C. pulchra*, being reclassified as *P. pulchra* by Moravec (1982), based on the presence of caudal wings and spines in the spicular sheath, features mentioned in the original description. However, the spines in the spicular sheath were not verified by Lent *et al.* (1946) and Cardia *et al.* (2014). Subsequently, the species was again reclassified as *A. pulchra* by Cardia *et al.* (2014) by the absence of well-sclerotized spicule and spines in the spicular sheath.

#### *Tenoranema rivarolai* (Figure 2; Table 1)

#### Diagnosis

*General:* See *A. pulchra*.

*Female:* See *A. pulchra*.

*Male:* Posterior extremity with two caudal wings, being the anterior larger than the posterior. Tail ventrally curved. The posterior caudal wing with a complex ray system. A single, large and well-sclerotized spicule. Surface of spicular sheath smooth and without spines.

#### Taxonomic summary

*Synonym:* *Capillaria rivarolai* Lent *et al.*, 1946;

*Aonchotheca rivarolai* (Lent *et al.*, 1946) Moravec, 1982.

*Host:* *Nyctinomops laticaudatus* (Geoffroy, 1805).

*Host's origin:* Uberlândia (18°54'41"S, 48°15'44"W).

*Distribution and hosts:* Paraguay – *N. laticaudatus* (Lent *et al.*, 1946).

*Site of infection:* small intestine.

*Specimens deposited:* CHIBB 7923, CHIBB 7931\*, CHIBB 7932\* (\*samples containing *A. pulchra* and *T. rivarolai*).

#### Remarks

Lent *et al.* (1946) described the species as *C. rivarolai*, being reclassified as *A. rivarolai* by Moravec (1982), based on the presence of caudal wings and spicules well-sclerotized. Mas-Coma and Esteban (1985) erected the genus *Tenoranema*, suggesting the reclassification of some *Aonchotheca* species based on the complexity of the rays in the terminal caudal bursa, besides spicular features. These authors also discussed the great similarity of *A. rivarolai* with the specimens type of *Tenoranema*, and Santos and Gibson (2015) considered this case as a synonymy. The present work represents the second occurrence of this species in bats.

Table 1. Morphometrical data of *Aonchotheca pulchra*, *Tenoranema rivarolai*, and capillariids non-identified.

Species	<i>Aonchotheca pulchra</i>		<i>Tenoranema rivarolai</i>		Capillariidae gen. sp.	
	Uberaba e Uberlândia	Uberlândia	Uberlândia	Uberlândia	Belo Horizonte, Patos de Minas e Uberaba	
Host	<i>Nyctinomops laticaudatus</i>		<i>Nyctinomops laticaudatus</i>		<i>Nyctinomops laticaudatus</i> and <i>Nyctinomops macrotis</i>	
Habitat	Stomach and small intestine		Small intestine		Stomach and small intestine	
Sex	♀ (n=1)	♂ (n=6)	♀ (n=1)	♂ (n=12)	♀ (n=3)	
Body (mm)	18.46	12.26 (11.7-12.61)	13.24	9.85 (8.54-11.7)	14.68 (13.61-15.24)	
Width junction esophagus	88.54	74.25 (70.39-77.05)	86.49	53.28 (43.49-77.05)	98.44 (66.14-131.89)	
Width body	212.61	88.21 (84.06-92.35)	125.11	63.31 (53.45-84.06)	138.1 (107.26-159.5)	
Esophagus (mm)	6.55	4.53 (4.33-4.79)	3.28	4.4 (3.15-5.07)	5.92 (5.49-6.67)	
Tail	16.53	-	35.68	-	14.73 (8.83-20.63)	
Length sheath	-	3.85 (n=1)	-	-	-	
Spicule	-	-	-	263.39 (209.20-330.50)	-	
Alae tail	-	-	-	90.63 (86.80-98.94)	-	
Vulva-junction esophagus	82	-	76.15	-	20 (n=1)	
Egg length	48 (44.97-50.07) (n=10)	-	48.77 (45.01-52.63) (n=10)	-	45.56 (43.99-48.79) (n=10)	
Egg width	29.76 (28.4-31.81) (n=10)	-	29.25 (28.22-31.28) (n=10)	-	29.75 (28-31.59) (n=10)	



**Capillariidae gen. sp.**  
(Table 1)

Diagnosis

*General:* See *A. pulchra*.

Taxonomic summary

*Hosts:* *Molossus rufus* (Geoffroy, 1805), *Nyctinomops latacaudatus* (Geoffroy, 1805) and *Nyctinomops macrotis* (Gray, 1840).

*Host's origin:* Belo Horizonte (19°48'57"S, 43°57'15"W), Governador Valadares (18°51'2"S, 41°56'53"W), Patos de Minas (18°34'46"S, 46°31'6"W), and Uberaba (19°45'1"S, 47°55'57"W).

*Site of infection:* stomach and small intestine.

*Specimens deposited:* CHIBB 7893, CHIBB 7926, CHIBB 7927.

Remarks

The specimens were not identified to generic/species level because conspecific males were absent. Besides, in samples co-infected with *A. pulchra* and *T. rivarolai*, the females of both species were indistinguishable morphometrically.

**DISCUSSION**

The species *A. pulchra* is more found in the host's stomach than in the small intestine (Freitas, 1934; Lent *et al.*, 1946; Vicente *et al.*, 1997; Cardia *et al.*, 2014). However, in the present study, specimens of *A. pulchra* were found in the stomach only of the host that presented monoinfection with the species. The species *A. pulchra* and *T. rivarolai*, when associated, were all found only in the small intestine, especially in the jejunum. In the hosts that were co-parasitized by both species, 13 females could not be identified, since the females of *A. pulchra* and *T. rivarolai* are morphometrically indistinguishable.

**BIBLIOGRAPHIC REFERENCES**

- Cardia, DFF, Hoppe, EGL, Tebaldi, JH, Fornazari, F, Menozzi, BD, Langoni, H, Nascimento, AA & Bresciani, KDS. 2014. *Redescription and taxonomical considerations about Aonchotheca (Aonchotheca) pulchra n. comb. (Enoplida: Trichuridae), a nematode of Nyctinomops spp.* Brazilian Journal of Veterinary Parasitology, vol. 23, pp. 399-402.
- Freitas, JFT. 1934. *Sobre as espécies do gênero Capillaria Zeder, 1800, parasitas de morcegos.* Memórias do Instituto Oswaldo Cruz, vol. 28, pp. 239-261.
- Gregorin, R & Taddei, V. 2002. *Chave artificial para a identificação de molossídeos brasileiros (Mammalia, Chiroptera).* Mastozoologia Neotropical, Journal of Neotropical Mammalogy, vol. 9, pp. 13-32.
- Lent, H, Freitas, JFT & Proença, MC. 1946. *Algunos nematodos de murcielagos coleccionados en el Paraguay.* Revista Brasileira de Biologia, vol. 6, pp. 485-497.
- Santos, CP & Gibson, DI. 2015. *Checklist of the helminth parasites of South American bats.* Zootaxa, vol. 3937, pp. 471-499.
- Mas-Coma, S & Esteban, JG. 1985. *Tenoránema alcoveri g. n., sp. n. (Trichuridae: Capillariinae), a nematode parasitizing Eliomys quercinus (Rodentia: Gliridae).* Folia Parasitologica (Praha), vol. 32, pp. 35-42.
- Moravec, F. 1982. *Proposal of a new systematic arrangement of nematodes of the family Capillariidae.* Folia Parasitologica, vol. 29, pp. 119-132.
- Moravec, F. 2001. *Trichinelloid nematodes parasitic in coldblooded vertebrates.* Academia, Prague.
- Vizotto, LD & Taddei, VA. 1973. *Chave para determinação de quirópteros brasileiros.* Boletim de Ciências Faculdade de Filosofia, Ciências e Letras, vol. 1, pp. 1-72.

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