



***Urotrema macrotestis* and *Urotrema scabridum* (Digenea: Urotrematidae) parasitizing bats (Mammalia: Chiroptera) in Brazil**

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Abstract: *Urotrema scabridum* Braun 1900 and *Urotrema macrotestis* Mané-Garzón and Telias 1965 are reported from the small intestine of *Eumops glaucinus* (Wagner, 1843). The species were differentiated by the body width, the size and position of acetabulum, the size of testis, the caecal termination, and the distribution of vitellarium. The present study expands the distribution and the hosts of both species in Minas Gerais State and reports *U. macrotestis* parasitizing bats for the first time.

Key words: *Eumops glaucinus*, infection, Taxonomy, Trematoda.

INTRODUCTION

Bats are hosts for a great diversity of helminths, however, the parasitism in these animals is still little investigated. *Eumops glaucinus* (Wagner, 1843) (Molossidae) is a bat widely distributed in the Americas (Best et al. 1997), but only three helminth species are described in this host: *Vampirolepis decipiens* (Diesing, 1850) (Cestoda), *Anenterotrema eduardocaballeroi* (Freitas 1960) Caballero 1960 (Trematoda), and *Pterygodermatites (Paucipectines) andyraicola* Cardia et al. 2015 (Nematoda) (Cardia et al. 2015, Santos and Gibson 2015).

Urotrema spp. are parasites of bats, rodents, lizards, and fishes (Sutton and Lunaschi 1990, Goldberg et al. 1998, Bray et al. 1999, Santos and Gibson 2015). Their life cycle and details of their ecology are not known. However, considering the diet of the definitive hosts, it is believed that insects may act as second intermediate hosts (Font and Lotz 2008). In South America, only *Urotrema scabridum* Braun 1900 is reported in insectivorous bats (Santos and Gibson 2015).

The aim of the present study is to describe a new occurrence and a new host for *U. scabridum* and *Urotrema macrotestis* Mané-Garzón and Telias 1965 in Brazil.

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MATERIAL AND METHODS

One *E. glaucinus* from the municipality of Governador Valadares (18°51'14.6"S, 41°56'42.3"W), Minas Gerais state, Brazil, was received for diagnosis of rabies virus and was stored in a freezer at -20°C in the Urban Bats laboratory of the Zoonosis Control Center of the municipality of Belo Horizonte, Minas Gerais state, Brazil. The carcass of this bat was thawed at room temperature and surveyed for parasites. Helminths found were fixed under the slight pressure of the coverslip and then stored in 70% ethanol. For identification, they were stained with chloride carmine, cleared with creosote, and analyzed in a computerized system for image analysis (Qwin Lite 3.1, Leica Microsystems). All the measurements were presented in micrometers (µm) and expressed as means, followed by the range, unless otherwise stated. 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, Estadual University Júlio de Mesquita Filho (UNESP), municipality of Botucatu, São Paulo state, Brazil, under the numbers 7935 and 7936.

RESULTS AND DISCUSSION

A co-infection of 50 specimens of *U. macrotestis* and *U. scabridum* was found in the small intestine of an *E. glaucinus*. It was not possible to count exactly each species because some specimens were damaged and could not be differentiated.

The species were differentiated by the body width (wide in *U. macrotestis* and slim in *U. scabridum*), the position of the acetabulum (next to the ovary in *U. macrotestis* and distant from the ovary in *U. scabridum*), the size of the acetabulum (larger than oral sucker in *U. macrotestis* and similar size to oral sucker in *U. scabridum*), the size of testis (similar to size of the ovary in *U. scabridum*

and larger in *U. macrotestis*), the caecal termination (exceeding the posterior testis in *U. macrotestis* and not exceeding the posterior testis in *U. scabridum*) and the distribution of vitellarium (extracaecal and caecal with some follicles intercaecal in *U. macrotestis* and extracaecal and caecal with several follicles intercaecal in *U. scabridum*).

***Urotrema macrotestis* Mané-Garzón and Telias 1965**

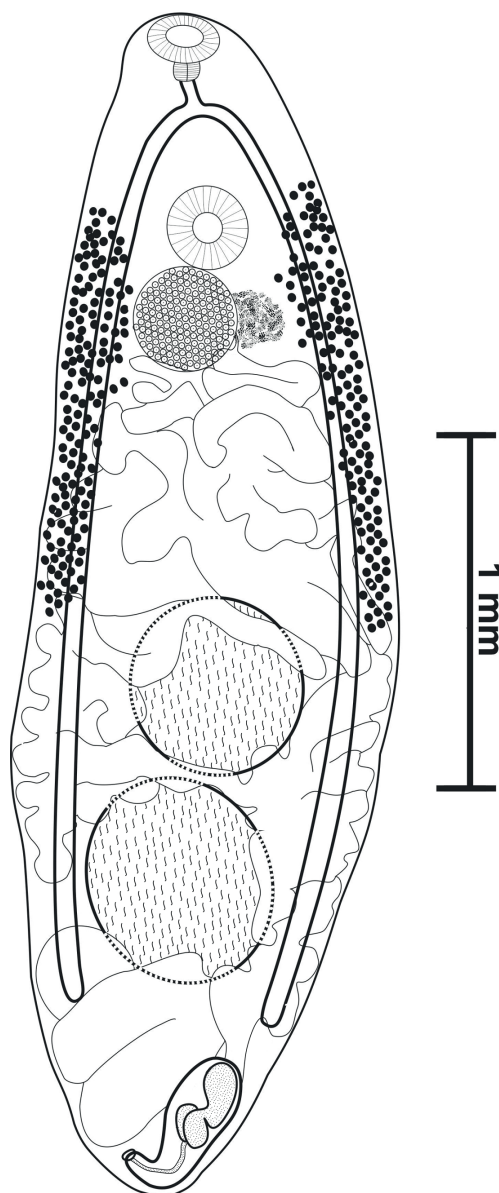


Figure 1 - *Urotrema macrotestis* Mané-Garzón and Telias 1965 found in *Eumops glaucinus* (Wagner, 1843).

TABLE I
Morphometrical data of *Urotrema macrotestis*.

Reference	Present work	Mañé-Garzón & Telias, 1965
Host	<i>Eumops glaucinus</i>	<i>Holochilus brasiliensis</i>
Specimens analyzed	4	22*
Origin	Brazil	Uruguay
Variables	Mean (range)	Range
Body		
Length	2.91 (2.51-3.34) (mm)	3.03-3.58 (mm)
Width	976.7 (896.2-1,077.2)	1.04-1.29 (mm)
Oral sucker		
Length	145 (134.3-161.1)	140
Width	181.3 (146-201.6)	100
Pharynx		
Length	86.07 (75.49-94.68)	90-110
Width	79.38 (70-86.2)	80
Esophagus		
Length	75.55 (62.03-93.43)	100-150
Acetabulum		
Length	228.1 (208-248.6)	252-253
Width	219.35 (195.9-234.2)	190-230
Dist A-B	498.65 (456.6-523.1)	440-620
Dist A-O	49.6 (33.63-70.07)	-
Dist O-T	769.12 (711.29-816.45)	-
Dist T-B	619.92 (585.3-647.7)	450-670
Ovary		
Length	262.33 (241.1-291)	260-320
Width	296.23 (269.4-321.9)	290-320
Anterior testis		
Length	389.62 (333.4-459.2)	440-780
Width	458.32 (422.4-503.6)	580-670
Posterior testis		
Length	454.02 (412-540.9)	500-730
Width	507.55 (468.4-557.3)	620-750
Cirrus pouch		
Length	347.95 (301.7-392.8)	260-400
Width	149 (117-170.9)	150-190
Eggs		
Length	22.72 (18.19-25.35) (n=20)	22.9-25.6
Width	12.8 (11.59-14.47) (n=20)	11.4-12.1

Dist A-B, distance between acetabulum and anterior border body; Dist A-O, distance between posterior border acetabulum and anterior border ovary; Dist O-T, distance between anterior border ovary and posterior border anterior testis; Dist T-B, distance between posterior border posterior testis and posterior border body. * 22 specimens were deposited, but the exact number of species analyzed was not reported.

DESCRIPTION

Body foliaceous, longer than wide. Tegument with fine and small spines that extend beyond the posterior border of the anterior testis. Oral sucker round and subterminal. Acetabulum round, larger than the oral sucker, in the first third of the body. Prepharynx absent. Pharynx small, longer than wide, Esophagus short. Intestinal caeca with smooth borders without lateral diverticula extending from anterior end to posterior testis, exceeding it. Ovary intercaecal, post-acetabular, dextral. Mehlis' gland lateral to the ovary. Uterus inter and extracaecal, from the ovary to posterior extremity of the body, full of eggs. Vitellarium lateral, formed by ovoid follicles, principally extracaecal and caecal with some follicles intercaecal, from the anterior end of the acetabulum to the anterior end of the anterior testis. Seminal receptacle not observed. Eggs, smooth-shelled, operculated, and yellowish. Testis in tandem, large, ovoid, smooth, intercaecal, in the posterior half of body. Pyriform and angular cirrus pouch, sinistral, contains well-developed seminal vesicle. Genital pore opens into well-developed U-shaped muscular atrium in the posterior end of the body.

DISTRIBUTION AND HOSTS

The species was originally found in the small intestine of *Holochilus brasiliensis* (Desmarest 1819) (Rodentia, Cricetidae) in Uruguay (Mané-Garzón and Telias 1965). The present study registers the first occurrence of the species in Brazil and in bats.

REMARKS

Because *Urotrema* spp. are found in several groups of insectivorous vertebrates, finding them in endoparasitic surveys is not uncommon. Although *U. macrotestis* is currently considered valid, Bray et al. (1999) classified the species as belonging to a complex of species associated with *U. scabridum*.

However, the authors did not present justifications for this proposition and morphologically these species are very different. Mané-Garzón and Telias (1965) believed that the finding of the species infecting the rodent *H. brasiliensis* is a case of accidental parasitism case since the authors found only one specimen parasitized with *U. macrotestis* among several rodents necropsied, as well as the fact that urotrematids are more frequently found in bats.

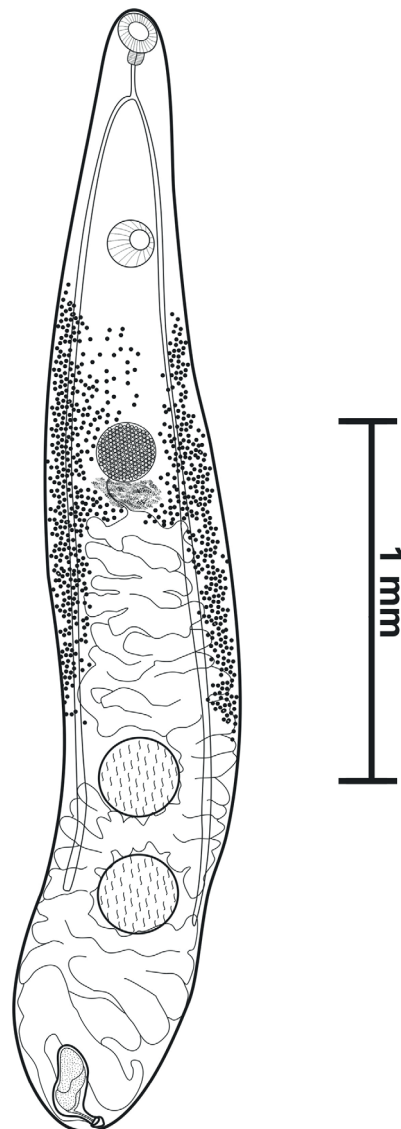
Urotrema scabridum Braun 1900

Figure 2 - *Urotrema scabridum* Braun 1900 found in *Eumops glaucinus* (Wagner, 1843).

TABLE II
Morphometrical data of *Urotrema scabridum*.

Reference	Present work	Braun 1900	Mañé-Garzón and Telias 1965	Travassos et al. 1969	Lunaschi and Notarnicola 2010	Sutton and Lunaschi 1990
Host	<i>Eumops glaucinus</i>	<i>Molossus</i> sp.	<i>Lasiurus cinereus</i> , <i>Myotis chiloensis</i>	<i>Molossus major crassicaudatus</i> , <i>Molossus rufus</i> , <i>Promops nasutus</i> , <i>Noctilio labialis albiventer</i> , <i>Lasiurus</i> (<i>Dasypterus</i>) <i>intermedius</i> , <i>Myotis</i> <i>nigricans</i> , <i>Phyllostomus</i> sp.	<i>Eumops bonariensis</i> , <i>Molossops temminckii</i> , <i>Tadarida brasiliensis</i> , <i>Myotis levis</i>	<i>Holochilus brasiliensis</i> (Rodentia)
n analyzed	3	-	7**	-	8	8
Origin	Brazil	-	Uruguay	Brazil	Argentina	Argentina, Uruguay
Variables	Mean (range)	Range	Range	Range	Mean (range)	Mean (range)
Body						
Length	3.44 (3.22-3.74) (mm)	4 (mm)	2.12-2.93 (mm)	1.61-2.91 (mm)	2.1 (1.7-2.5) (mm)	1.68 (1.11-2.47) (mm)
Width	500.8 (471.9-530.4)	830	482-534	430-800	412 (360-450)	936 (684-1075)
Oral sucker						
Length	106.26 (85.5-123.4)	187*	117-143	130-160	136 (133-142)	150 (126-175)
Width	112.13 (93.6-124.5)	240	-	130-180	130 (123-142)	152 (140-169)
Pharynx						
Length	42.48 (39.9-45.07)	104	65-104	33	68 (58-76)	100 (70-130)
Width	34.19 (33.91-34.48)	125	65	52	56 (51-61)	80 (58-110)
Esophagus						
Length	215.3 (n=1)	150	-	-	204 (165-256)	-
Acetabulum						
Length	139.7 (134.6-147)	271*	143-169	130-200	138 (128-144)	189 (154-240)
Width	127.5 (123.2-133)	260	130-156	120-180	145 (134-152)	189 (143-230)
Dist A-B	624.7 (n=1)	-	456-665	-	-	-
Dist A-O	505.5 (419.4-642.2)	-	-	-	-	-
Dist O-T	1.31 (1.24-1.45) (mm)	-	-	-	-	-
Dist T-B	651.26 (573.9-736.2)	-	534-586	-	-	-
Ovary						

TABLE II (continuation)

Reference	Present work	Braun 1900	Mañé-Garzón and Telias 1965	Travassos et al. 1969	Lunaschi and Notarnicola 2010	Sutton and Lunaschi 1990
Host	<i>Eumops glaucinus</i>	<i>Molossus</i> sp.	<i>Lasiurus cinereus</i> , <i>Myotis chiloensis</i>	<i>Molossus major crassicaudatus</i> , <i>Molossus rufus</i> , <i>Promops nasutus</i> , <i>Noctilio labialis albiventer</i> , <i>Lasiurus</i> (<i>Dasypterus</i>) <i>intermedius</i> , <i>Myotis</i> <i>nigricans</i> , <i>Phyllostomus</i> sp.	<i>Eumops bonariensis</i> , <i>Molossops temminckii</i> , <i>Tadarida brasiliensis</i> , <i>Myotis levis</i>	<i>Holochilus brasiliensis</i> (Rodentia)
n analyzed	3	-	7**	-	8	8
Origin	Brazil	-	Uruguay	Brazil	Argentina	Argentina, Uruguay
Variables	Mean (range)	Range	Range	Range	Mean (range)	Mean (range)
Length	191.13 (178.5-213)	-	143-208	-	190 (154-218)	155 (140-176)
Width	170.56 (148.9-187.7)	-	147	-	173 (112-209)	204 (160-266)
Seminal receptacle						
Length	135 (n=1)	-	-	-	-	-
Width	55.58 (n=1)	-	-	-	-	-
Anterior testis						
Length	220.86 (194.3-236.7)	450	208-286	-	245 (128-323)	211 (125-351)
Width	204.33 (184.9-217.9)	-	169-195	-	222 (134-285)	312 (225-446)
Posterior testis						
Length	231.06 (205.1-255)	450	286-430	-	256 (112-351)	224 (130-380)
Width	202.5 (190.6-224.9)	-	182-352	-	250 (122-323)	288 (200-427)
Cirrus pouch						
Length	236.3 (204.1-268.5)	-	286-447	-	259 (163-355)	207 (126-250)
Width	116.2 (112.3-120.1)	-	178-104	-	103 (51-154)	109 (75-172)
Eggs						
Length	21.1 (19.19-23.42) (n=15)	18	20.8-21.0	20-21	21-22	21 (18-24)
Width	12.15 (10.34-13.46) (n=15)	9	10-11.7	13-14	10-13	12 (10-13)

Dist A-B, distance between acetabulum and anterior border body; Dist A-O, distance between posterior border acetabulum and anterior border ovary; Dist O-T, distance between anterior border ovary and posterior border anterior testis; Dist T-B, distance between posterior border posterior testis and posterior border body. * According to Braun 1900, suckers have a similar size of 0.229 mm. ** 7 specimens were deposited, but the exact number of species analyzed was not reported.

SYNONYMS

Urotrema shillingeri Price 1931; *Urotrema lasureusis* Alicata 1932; *Urotrema minuta* Nacy 1933; *Urotrematulum attenuatum* Macy 1933; *Urotrema aelleni* Baer 1957.

DESCRIPTION

Body foliaceous, longer than wide. Tegument with fine and small spines. Oral sucker round and subterminal. Acetabulum round, in the anterior third of the body, of similar size to oral sucker. Prepharynx absent. Pharynx small, longer than wide. Esophagus short. Intestinal caeca with smooth borders, without lateral diverticula, extending to the posterior testis. Ovary intercaecal, post-acetabular. Mehlis' gland present and post-ovarian. Uterus inter and extracaecal, from the ovary to the posterior end of the body, full of eggs. Vitellarium lateral, formed by ovoid follicles extracaecal, caecal, and intercaecal, distributed from the acetabulum to the anterior testis. Eggs smooth-shelled, operculated and yellowish. Testis in tandem, ovoid, with smooth margins, intercaecal, in the posterior third of the body. Cirrus pouch pyriform and angular, laterally, contain well-developed seminal vesicle. Genital pore opens into well-developed U-shaped muscular atrium in the posterior end of the body

DISTRIBUTION AND HOSTS

Urotrema scabridum has been found in bats in Argentina, Brazil, Colombia, Costa Rica, Cuba, United States, Jamaica, Mexico, Panama, Paraguay, Uruguay, and Africa (Mané-Garzón and Telias 1965, Travassos et al. 1969, Sutton and Lunaschi 1990, Guzmán-Cornejo et al. 2003, Lunaschi and Notarnicola 2010, Pesenti et al. 2015). In Brazil, this species has already been found in bats in the Rio Grande do Sul state (Pesenti et al. 2015) and in the municipality of Recife, Pernambuco state (Guzmán-Cornejo et al. 2003). In rodents, *U. scabridum* has been reported in *H. brasiliensis* in

Argentina, *Oryzomys flavescens* (Waterhouse 1837) in Uruguay, and *Ondatra zibethicus* (Linnaeus 1766) in the United States (Price 1931, Sutton and Lunaschi 1990). In lizards, this species has already been reported in *Anolis* spp. (Goldberg et al. 1998, Bursey et al. 2003). The present study expands the occurrence of the species for the Minas Gerais state and *E. glaucinus* is here reported as a new host to *U. scabridum*.

REMARKS

Several species of urotrematids have been described and many synonymized, generating a certain confusion of information about the currently valid species. Summaries of the synonyms of some species of *Urotrema* can be found in Caballero (1942), Mané-Garzón and Telias (1965), and Zamparo et al. (2005). *Urotrema scabridum* is the species with the highest number of synonymies among urotrematids. Although the species is found in lizards and rodents, *U. scabridum* is more often associated with bats (Braun 1900, Price 1931, Caballero 1942, Caballero et al. 1957, Mané-Garzón and Telias 1965, Sutton and Lunaschi, 1990, Goldberg et al. 1998, Bray et al. 1999, Guzmán-Cornejo et al. 2003, Zamparo et al. 2005). Due to the low frequency of finding of the species in rodents, the parasitism with *U. scabridum* in these hosts is considered accidental (Price 1931, Sutton and Lunaschi 1990). The size of the testis described by Braun (1900) are similar to the size described for *U. macrotestis*. This author performed the description of *U. scabridum* from specimens deposited in a collection at different preservation status and discussed his doubts about the extent of the identifications and suggested the presence of different species in the deposited specimens. It is suggested that molecular biology studies must be carried out.

AUTHOR CONTRIBUTIONS

A. Érica Munhoz de Mello; B. Élida Mara Leite Rabelo; C. José Reinaldo da Silva.

A. conceived the original idea and wrote the manuscript with support from B. and C.. A and C. photographed, analyzed and identified the animals. B. supervised the project.

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