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ORIGINAL ARTICLE / ARTÍCULO ORIGINAL

A NEW SPECIES OF *HASSALSTRONGYLUS* (NEMATODA: HELIGMONELIDAE) FROM *EURYORYZOMYS RUSSATUS* (RODENTIA: SIGMODONTINAE) IN THE ATLANTIC FOREST, BRAZIL

UNA NUEVA ESPECIE DE *HASSALSTRONGYLUS* (NEMATODA: HELIGMONELIDAE) DE *EURYORYZOMYS RUSSATUS* (RODENTIA: SIGMODONTINAE) EN LA MATA ATLÁNTICA, BRASIL

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Abstract

Hassalstrongylus luquei n. sp. is described from the small intestine of *Euryoryzomys russatus* (Rodentia: Sigmodontinae) collected in the Atlantic Forest (Rio de Janeiro State, Angra dos Reis, Brazil). The genus *Hassalstrongylus* includes 16 Neotropical species. The main characters of new species are subsymmetrical caudal bursa with a type 2-2-1, rays 8 branching at midlength of dorsal trunk, right lateral trunk larger than the left and the longest spicules in the genus. Only three species of *Hassalstrongylus* have the rays 8 not emerging at the base trunk, these are: *H. mazzai*; *H. aduncus;* and *H. echalieri*. However, the present species is distinguished from *H. mazzai* by having the dorsal rays divided at fourth part of the trunk, *H. bocqueti* by having rays 5 bifurcating at third part of trunk and *H. echalieri* by having a pattern of 2-2-1.

Keywords: nematode - rodent - Rio de Janeiro - species.

Resumen

Hassalstrongylus luquei n. sp. es descrito en el intestino delgado de *Euryoryzomys russatus* (Rodentia: Sigmodontinae) colectado en la Mata Atlantica (Estado de Río de Janeiro, Angra dos Reis, Brasil). El género *Hassalstrongylus* Durette-Desset de 1971 incluye 16 especies neotropicales. Las características más importantes de la nueva especie son: la bursa caudal subsimétrica con un tipo 2-2-1, rayos 8 ramificados en la mitad de la longitud del tronco dorsal, el tronco lateral derecho es mayor que el izquierdo y las espículas son las más grandes del género. Sólo tres especies de *Hassalstrongylus* tienen los rayos 8 no emergentes en la base del tronco, éstas son: *H. mazzai, H. aduncus* y *H. echalieri*. Sin embargo, la presente especie se distingue de *H. mazzai* por presentar los radios dorsales divididos en la cuarta parte del tronco, *H. bocqueti* por tener los rayos 5 bifurcados en tercera parte del tronco y *H. echalieri* por tener un patrón de 2-2-1.

Palabras clave: nematodo - especie - roedor - Rio de Janeiro.

INTRODUCTION

The genus *Hassalstrongylus* Durette-Desset, 1971 (Trichostrongylidae: Heligmosomoidea) includes 16 Neotropical species, of which 13 are parasites of rodents Sigmodontinae and 3 of Murinae rodents. This genus is broadly distributed across the Neotropical region (Digiani & Durette - Desset, 2007).

The rice rat, *Euryoryzomys russatus* (Wagner, 1848) (syn. *Oryzomys russatus*) (Cricetidae: Sigmodontinae), is frequently found in fragmented and continuous areas in the Atlantic Forest in Brazil (Naxara *et al*., 2009; Umetsu & Pardini, 2007; Passamani & Fernandez, 2011). These rodents are terrestrial; feed on seeds, fruits, and insects (Emmons & Feer, 1997).

The vegetation of Ilha Grande is a marine island near the coast belonging Angra dos Reis. It`s vegetation is characterized by a diverse set of backgrounds: Rain Forest (montane and lowland), Restinga, mangrove and rocky outcrops. This variety of biological environments attaches great importance to the Island and ranks as an ecological sanctuary and Biosphere Reserve of the Atlantic Rainforest (Ribeiro *et al.*, 2009).

Here we describe a new species of *Hassalstrongylus* (Trichostrongylina: Nippostrongylinae), found parasitizing *E. russatus* in the Atlantic Forest Coast, in Ilha Grande, Angra dos Reis municipally of Rio de Janeiro state.

MATERIAL AND METHODS

Seven specimens of *E. russatus* were trapped in the Atlantic Forest Coast, Angra dos Reis municipally of Rio de Janeiro state, Brazil (23°09'07.50" S; 44°13'44.20" W), using a Sherman® trap (Model XLK; 7.6 x 9.5 x 30.5 cm). Collection permits for rodents were issued by the State Environmental Institute (INEA, Permit Number 019/2011) and by Oswaldo Cruz Foundation (FIOCRUZ) Ethical Committee on Animal Use (Permit Number: L – 0049/08). The rodents were killed using a CO_2 chamber and necropsied.

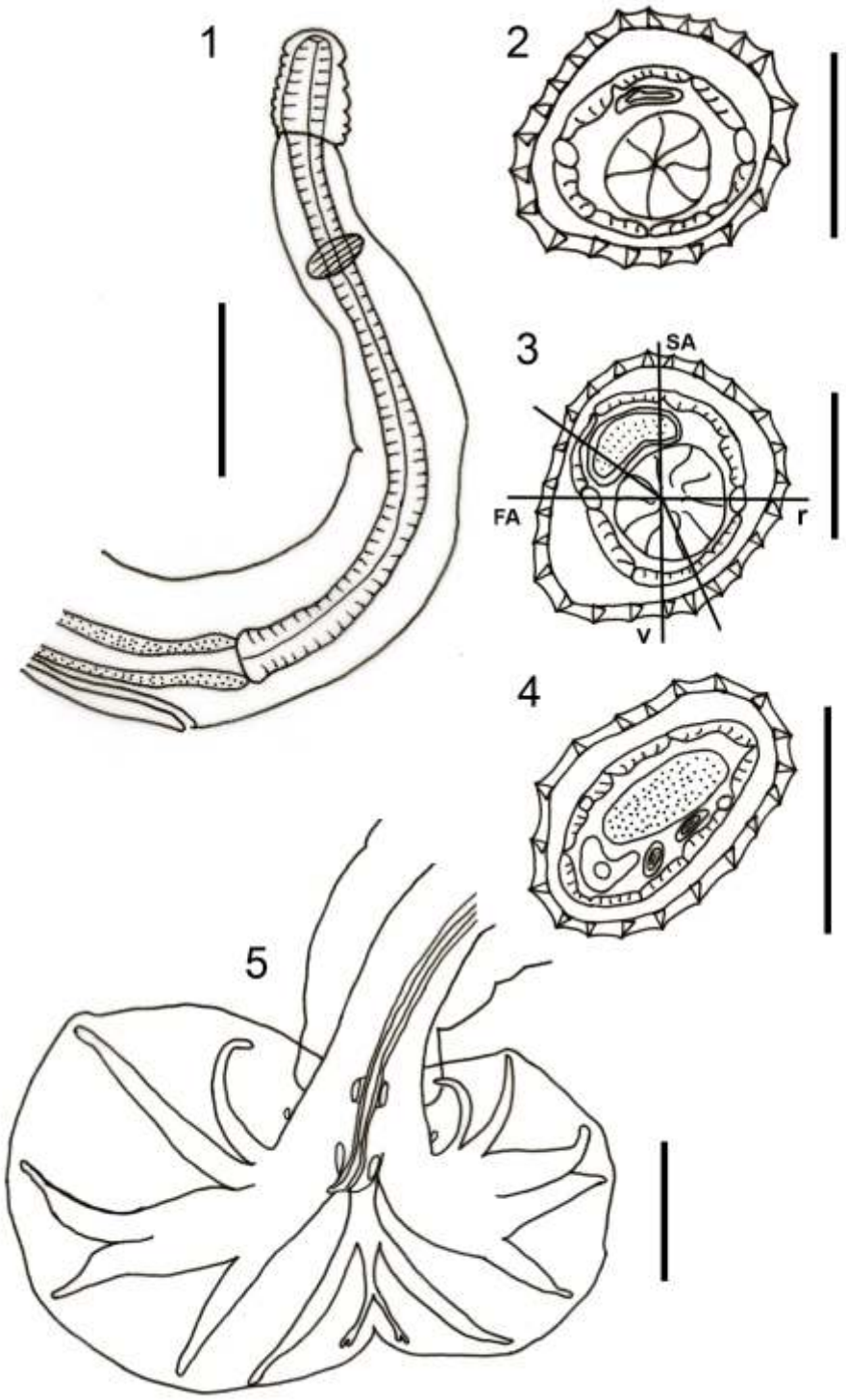
The nematodes were collected from the small intestine, washed twice in a 0.85% NaCl solution and fixed in hot A.F.A. (2% acetic acid, 3% formaldehyde, and 95% ethanol) and further clarified in lactophenol. Drawings were made with the aid of a camera lucida attached to a Zeiss standard microscope. Measurements are given in micrometers (unless otherwise stated) for Holotype specimen, followed by range for paratypes in brackets and mean in parenthesis. The synlophe was studied in 1 male from following Durette-Desset (1985) and Durette-Desset & Digiani (2005), and the terminology related to the caudal bursa follows Durette-Desset & Chabaud (1981). Females were not found. The number of dorsal and ventral ridges was counted with respect to the axis(es) of orientation.

RESULTS

General: Small nematodes tightly coiled in small intestine. Excretory pore below of esophagus (Fig.1). Females were not found in the small intestine in specimens of *E. russatus*.

Synlophe: Males with cuticle bearing longitudinal, uninterrupted ridges appearing posterior to cephalic vesicle and ending just anterior to caudal bursa. Number of ridges: 22 (12 dorsal, 10 ventral) at level of esophagus-intestinal junctions (Fig.2); 24 (13 dorsal, 11 ventral) at the midbody (Fig. 3); 19 (9 dorsal, 10 ventral) at the posterior end (Fig. 4). Double axis of orientation of ridges directed from right ventral quadrant to left dorsal quadrant. Right axis inclined 62º to sagittal axis and left axis at 73º.

Male (*holotype and 7 paratypes, except otherwise stated*): 4.07 [2.74 - 4.46 (3.35)] mm long and 145 [127-190 (160)] wide at mid-body; Cephalic vesicle 59 [36-59 (47)] long and 22 [18-31 (25)] wide (n=6). Nerve ring and excretory pore situated at 81 [81-172(113)], 304



Figures 1-5. *Hassalstrongylus luquei* n. sp. (**1**) Anterior extremity, lateral view. (**2**) Transverse section of body, at anterior extremity. (**3**) Transverse section of body, at mid-body. Axes of orientation represented. Abbreviations: r: right side; v: ventral side; SA: sagittal axis; FA: frontal axis passing through the lateral fields. (**4**) Transverse section of body, just anterior to caudal bursa. (**5**) Caudal bursa, ventral view. Scale bar: 100 µm.

[304-681 (471)] from apex (n=5), respectively. Oesophagus 345 [345-745 (480)] long (n=4). Subssymetric caudal bursa, pattern of type 2-2-1. Right lobe slightly more developed than left lobe. Rays 2 and 3 bifurcating at the base trunk. Rays 4 and 5 joined on third part of length, diverging at extremities. Left ray 6 longer than right one, both arising at about same level as rays 3 and separated from rays 5. Rays 8 branches at midlength of dorsal trunk, reaching the margin of the caudal bursa. Dorsal ray divided at third fourth part into 2 branches, each branches divided into 2 subequal subbranches (rays 9 and 10). Genital cone 31 [22-36 (27)] long and 22 [18-31 (22)] wide (n=6). Papilla 0 and 7 not observed. Spicules filiformes, equal and short 640 [472-708 (629)] long. Gubernaculum 27 [22-31 (28)] long and 22 [18-27 (22)] wide (n=6) at the base in ventral view (Fig. 5 and 6).

Taxonomic summary

Type host: *Euryoryzomys russatus* (Rodentia: Sigmodontinae).

Site of infection: Small intestine.

Type locality: Ilha Grande (23°09'07.50" S; 44°13'44.20" W) municipality in Angra dos Reis, Rio de Janeiro state, Brazil.

Prevalence and intensity of infection: 43% (3 rodents infected/ 7 rodents collected), 1-5 (3 mean intensity).

Specimens deposited: Holotype male (CHIOC no. 35928a) and paratypes (CHIOC no. 35928b - c) were deposited in the Helminthological Collection of the Institute Oswaldo Cruz, Rio de Janeiro, Brazil.

Etymology: New species is named in honor of Dr. José Luis Fernando Luque Alejos for his contribution to helminthology.

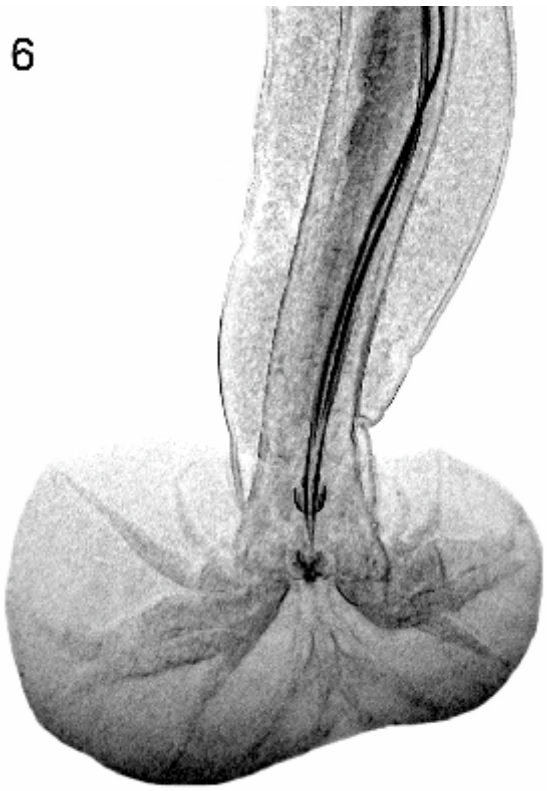


Figure 6. Light microscopy of *Hassalstrongylus luquei* n. sp., ventral view of caudal bursa. Scale bar: 100 µm.

Table 1. Locality, host and main morphological features and measurements of *Hassalstrongylus* species.

	H. dessetae	***H. epsilon*** *(=Longistriata epsilon)*	***H. chabaudi***	***H.hoineffae*** *(=Longistriata hoineffae)*	***H.puntanus***	***H.echalieri***	***H. argentina*** *(=longistriata argentina)*	***H.aduncus*** *(=longistriata adunca; longistriata norvegica)*
Length	4,72 – 5,25	3,1	4,37 – 4,45	5,2	3,52	2,3 – 2,6	4,08 – 5,40	4 – 4,5
Width	50 – 70	100	140 – 150	150	150	80 – 100	184 – 208	45 – 50
Cephalic vesicle	-	60 x 25	-	80 - 50	65x35	55x25	640x720	-
esophagus	280 – 320	230	322	420	340	250	420/440	275/300
excretory pore	-	240	306	365	270	200	-	20/27
nerve ring	140 - 180	160	95	245	170	75	189	-
spicule	140/150	115	470 / 480	410	450	150/175	472/520	350/375
Caudal bursa	140 – 180 x 230	-	-	220 - 500	-	250/247	-	-
Dorsal ray	120	-	-	-	-	-	-	-
Gubernaculum	-	-	45 x 27	30 x 10	170/120	400/350	400-490 x 240-320	-
Gemital cone	210 x 360	-	50 x 40	50 x 42	450/400	40 – 35	-	-
Synlophe	34	22	24 (13v 11d)	22 – 24	24	205	-	-
Locality	Porto Terezinha – AP	Formosa – GO	Exú – PE	Exu – PE	Argentina	Guiana Francesa	Salta – Argentina	Louisiana – USA
Host	*Neacomys* sp.	*Nectomys squamipes*	*Wiedomys pyrrhoinus*	*Calomys callosus* *Oryzomys nigripes* *Wiedomys*	*Holochilus balnearum*	*Oryzomys* sp.	*Holochilus balnearum*	*Rattus* sp.

Table 1. Continuation.

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H. mazzai *(=Heligmonoides mazzai)*	***H. musculi*** *(=longistriata musculi)*	***H.litchenfelsi***	***H. schadi*** *(=longistriata schadi)*	***H. beta*** *(=longistriata beta)*	***H. dollfusi*** *(=longistriata dollfusi)*	***H. forresteri***	***H. bocqueti***	***H. luquei n.sp.***
2,81 – 3,60	3,25 – 4,5	2,1	2,6	2,2 – 2,6	3,53	2,7	4,7	4,07
105 - 131	95 – 100	65	80	130 – 170	140	110	110	145
-	65 – 75	40 – 22	-	560 – 630	65-70 x 33 – 35	-	87 - 43	59x22
328 - 381	320-450 x 30-40	240	250	350 – 390	310 – 25	270	420	345
210 - 240	-	170	180	-	250	155	350	304
121 - 162	-	115	120	-	-	120	230	81
202 – 221	390 – 420	185	220	530 – 560	625 – 660	390	450	64
-	-	-	-	-	430-500x180-220	-	-	-
-	-	-	-	-	-	-	-	
130	-	-	-	-	-	62	-	-
270x110	-	-	-	-	-	-	17	27x22
-	-	25 – 10	-	-	-	-	50 – 30	-
-	-	-	-	-	-	-	-	-
-	-	23	20	-	-	23 – 25	-	24
Salta – Argentina	Louisiana - USA	Florida - USA	Rio Raposo - Colombia	-	Aragua - Venezuela	Florida - USA	Les Tuxtlas - México	Ilha Grande - Brazil
Holochilus balnearum	*Mus musculus*	*Oryzomys palustris*	*Nectomys alfari*	Wild rat	*Mus musculus*	*Oryzomys palustris*	*Oryzomys alfaroi*	*Euryoryzomys russatus*

DISCUSSION

Seven *E. russatus* were collected in the study area and only three were positive with a low parasite burden which limited the study, being found only male specimens. However, the male morphological characteristics are crucial to identify the species.

The genus *Hassalstrongylus* is characterized by having non hypertrophied genital cone, caudal bursa symmetric or subsymmetric, cuticular ridges ranging 19 to 24 with different sizes and parasiting rodents mainly from the family Cricetidae (Durette-Desset, 1971) (Table 1). The characteristics of the caudal bursa are essential to identify and separate this genus from *Stilestrongylus* Freitas, lent, and Almeida, 1937 because there is an overlap in the number of ridges in both genera (Digiani and Durette-Desset, 2007). By the number of ridges (24 at the midbody) and the characteristics of the caudal bursa (subsymmetric with non hypertrophied genital cone), the studied specimens can be included in the genus *Hassalstrongylus*.

The main characters of new species are subsymmetrical caudal bursa with a type 2-2-1, rays 8 branching at midlength of dorsal trunk, right lateral trunk larger than the left and the longest spicules in the genus. The new species can be distinguished from *H. dessetae* Magalhães Pinto, 1978; *H. epsilon* Durette – Desset, 1971; *H. chabaudi* Diaw, 1976; *H. honiffae* Durette – Desset, 1971; *H. bocqueti* Denke, 1977*; H. puntanus* Digiani and Durette – Desset, 2003; *H. argentina* Freitas, Lent, and Almeida*, 1937; H. lichtenfelsi* Durette – Desset, 1974; *H. forresteri* Durette – Desset, 1974; *H. schadi* Durette – Desset, 1970; *H. beta* and *H. dolfusi* Diaz – Ungria, 1963; by having rays 8 emerging from the middle of the dorsal trunk. In addition, *H. luquei n. sp.* is differed from *H. musculi* Dikmans, 1935; by having the rays 2 and 3 bifurcating at the base trunk.

Only three species of *Hassaltrongylus* present the rays 8 not emerging at the base trunk, these are: *H. mazzai* Freitas, Lent and Almeida, 1937; *H. aduncus* Durette – Desset, 1971; and *H. echalieri* Diaw, 1976. However, *H. luquei n. sp.* is distinguished from *H. mazzai* by presenting the dorsal rays divided at fourth part of the trunk , *H. bocqueti* by having rays 5 bifurcating at third part of trunk and *H. echalieri* by having a pattern of 2-2-1.

Thus, the presence of specific characters of caudal bursa allow us to consider the specimens from *E. russatus* as a new species.

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