Parasitol Res
DOI 10.1007/s00436-017-5508-9

ORIGINAL PAPER

A new species of *Moniliformis* from a Sigmodontinae rodent in Patagonia (Argentina)

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Received: 8 February 2017 / Accepted: 8 May 2017
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Abstract The majority of species of Acanthocephala known thus far from South America have been recorded mostly in fish and wild birds. In particular, rodents in Argentina have been poorly studied for acanthocephalans. The genus *Abrothrix* (Sigmodontinae-Cricetidae) ranges from the Altiplano of southern Peru through the highlands of Bolivia, northern Chile, and Argentina south through Tierra del Fuego. The purpose of this paper was to study Acanthocephala species parasitizing different populations of *Abrothrix* from Santa Cruz province (Patagonia Argentina). Specimens of Acanthocephala were found in the small intestine of *Abrothrix olivaceus*, showing values of P 14.7%, IM = 2.8, and AM = 0.41. All the rodents parasitized were collected in Punta Quilla, Santa Cruz, Argentina. The specimens of *Abrothrix longipilis* were not parasitized. *Moniliformis amini* n. sp. is described with features such as the long, cylindrical, and pseudo-segmented body; proboscis receptacle double walled, outer wall with muscle fibers usually arranged spirally, and a combination of several morphometric characters, mainly the very small size of the proboscis receptacle and length of the testes and lemnisci. A marked proportion of arthropods was found in the diet of *A. olivaceus*, characterizing it as arthropodivorous. Possibly, a larger sampling effort and specific projects dealing with the study of acanthocephalans will shed light on several questions of the rodent-*Moniliformis* relationship.

Keywords Acanthocephala · *Moniliformis* · Rodents · Sigmodontinae · Argentina

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Introduction

The phylum Acanthocephala is divided into four classes: Archiacanthocephala, Palaeacanthocephala, Eoacanthocephala, and Polyacanthocephala (Amin 2013). Members of the class Archiacanthocephala are strictly terrestrial and use terrestrial insects and myriapods as intermediate hosts and predatory birds and mammals as definitive hosts (Ribas and Casanova 2006). The majority of species of Acanthocephala known thus far from South America have been recorded mostly in fish and wild birds (Tantaleán et al. 2005). Although rodents are hosts to a great number of parasites, the number of acanthocephalan species that they harbor is relatively small (Ribas and Casanova 2006).

Studies of Acanthocephala in vertebrates of Argentina have been rare: fishes (e.g., Arredondo and Gil de Pertierra 2010), amphibians (e.g., Lajmanovich and Martinez de Ferrato 1995; Arredondo and Gil de Pertierra 2009), birds (e.g., Capasso and Díaz 2016) other Sauropsida (e.g., Ávila and Silva 2010), and mammals (e.g., Navone et al. 2009). In particular, Sigmodontinae rodents (Cricetidae) in Argentina have been poorly studied for acanthocephalans (Navone et al. 2010). The only records in Sigmodontinae to date are an unidentified acanthocephalan with a low prevalence (6.9%) from *Scapteromys aquaticus* (Navone et al. 2009) and a single acanthocephalan in one specimen of *Akodon azarae* from the wetlands of the Rio de la Plata (http://www.conicet.gov.ar/new_scp/detalle.php?keywords=navone&id=22298&congresos=yes&detalles=yes&congr_id=2586136).

In this subfamily, the *Abrothrix* ranges from the Altiplano of southern Peru through the highlands of Bolivia, northern Chile, and Argentina south through Tierra del Fuego (Patton

Published online: 06 June 2017

et al. 2015). *Abrothrix longipilis* is abundant in dense forests of *Nothofagus*, but also occurs in other habitats such as marshes, shrubby steppes, tussock grass, or rocky areas (Kelt 1994; Pearson 1995). They may be active in the morning, afternoon, and at night. In Argentina, the diet included berries, seeds, fern spores, insect, fungi, worms, and slugs (Pearson 1983). *Abrothrix olivaceus* in Patagonia occupies semiarid bushy steppes and bunchgrass habitats (Kelt 1994; Pearson 1995) and dense *Nothofagus* forests from western Neuquén, western Río Negro, and northwestern Chubut, Argentina (Pearson 1995). It is partly diurnal, climbs well, builds simple nests of grass, underground or shelters in roots or rocks, and, when living in dense grass, creates runways (Mann 1978; Pearson 1983). The diet includes berries, seeds, arthropods, green vegetation, and fungi (Pearson 1983).

To date, *A. olivaceaus* has been reported as a host of *Syphacia obvelata*, *Heterakis spumosa*, *Physaloptera calnuensis*, *Pterygodermatites* sp., *Capillaria* sp., and *Hymenolepis* sp. (Landaeta-Aqueveque et al. 2007), while *A. longipilis* hosts *Protospirura* sp., *Syphacia* sp., *Hymenolepis* sp., *Gonglyonema* sp., *Heligmosomoides* sp., and *Trichuris chiliensis* (Cattan et al. 1992).

The purpose of this paper was to study Acanthocephala species parasitizing different populations of *Abrothrix* from Santa Cruz province (Patagonia Argentina).

Materials and methods

A total of 56 specimens of *Abrothrix* spp. were collected by several collaborators (see Acknowledgments) in Santa Cruz Province, Argentina: 34 specimens of *A. olivaceus* (Waterhouse, 1837): 14 from 4 km W Punta Quilla s/RP 288 (50° 6′ 22.53″ S; 68° 27′ 56.44″ W); 3 from 2 km Estancia Monte Entrance (50° 8′ 30.56″ S; 68° 23′ 24.43″ W); 2 from Estancia Pali Aike (51° 59′ 23.27″ S; 69° 44′ 56.86″ W); 2 from 2 km NE Estancia Pali Aike (51° 58′ 49.23″ S; 69° 43′ 5.95″ W); 1 from 8.2 km NE Estancia Pali Aike (51° 56′ 18.24″ S; 69° 39′ 41.25″ W); 4 from C° Tres Hermanos, Estancia Don Braulio (51° 56′ 12.00″ S; 69° 34′ 21.91″ W); 3 from Estancia Las Tunas, Lago Cardiel (48° 47′ 46.07″ S; 71° 9′ 4.81″ W); 4 from 13 km S C° Volcán Grande, Meseta del Lago Buenos Aires (47° 9′ 0.66″ S; 71° 14′ 3.54″ W); 1 from 15 km NW Estancia Las Coloradas, Meseta del Strobel (48° 40′ 41.65″ S; 71° 7′ 50.68″ W), and 22 specimens of *A. longipilis* (Waterhouse, 1837): 1 from Estancia Las Tunas, Lago Cardiel (48° 47′ 46.07″ S; 71° 9′ 4.81″ W); 17 from 13 km S C° Volcán Grande, Meseta del Lago Buenos Aires (47° 9′ 0.66″ S; 71° 14′ 3.54″ W); 4 from Estancia Tucu Tucu (48° 28′ 26.20″ S; 71° 58′ 41.33″ W).

The research has been conducted according to Argentine laws. Sample collection was carried out during fieldwork under official permits. This study was carried out in accordance with the recommendations in the Guide for the Care and Use of Laboratory Animals of the National Institutes of Health. The specimens obtained with methods for live capture were studied and humanely sacrificed (euthanasia by thoracic compression under ether anesthesia), following the procedures and protocols approved by national laws (Animal Protection National law 14.346 and references in the provincial permits) and Ethics Committee for Research on Laboratory Animals, Farm and Obtained from Nature of National Council of Scientific and Technical Research (CONICET) (Resolution 1047, section 2, annex II).

All parasites found were removed from the rodent's intestines, subsequently fixed in formalin, and preserved in 70% ethanol. Some specimens of Acanthocephala were cleared in temporary mounts of lactophenol for study and then returned to the fixative. Others were overstained with hydrochloric carmine, destained in acid alcohol (1% HCL in 70% EtOH), dehydrated through an alcohol series, cleared in Eugenol, and studied by light microscopy. Drawings were made with the aid of a drawing tube. One specimen was dried using the critical point method, examined and photographed by scanning electron microscopy.

Indices of prevalence (*P*), mean intensity (MI), and mean abundance (MA) were calculated according to Bush et al. (1997). In the description, measurements of species are presented as follows: holotype male or allotype female and paratype females with mean, standard deviations, and range in parentheses. All measurements are given in millimeters (mm) unless otherwise indicated. The scales of figures are given in micrometers (μm).

The nomenclatural acts have been registered in ZooBank, the online registration system for the ICZN. The type specimens are deposited in the Helminthological Collection of Museo de La Plata, La Plata, Argentina (HCMLP).

Results

A total of 14 (1 male; 13 female) specimens of Acanthocephala were found in the small intestine of 5 of 34 (P 14.7%) specimens of *A. olivaceus*, showing values of IM = 2.8 and AM = 0.41. All the rodents parasitized were collected in Punta Quilla, Santa Cruz, Argentina. The 22 specimens of *A. longipilis* were not parasitized.

***Moniliformis amini* n. sp.**

Description

General: Moniliformida: Moniliformidae. The characters observed in the specimens agree with the genus *Moniliformis* Travassos, 1915 by the long, cylindrical, and pseudo-segmented body (Fig. 1d–e). Sexual dimorphism is exhibited in general body size. The proboscis is approximately cylindrical (Fig. 1b–c) with 12–14 longitudinal rows of 8–12 rooted

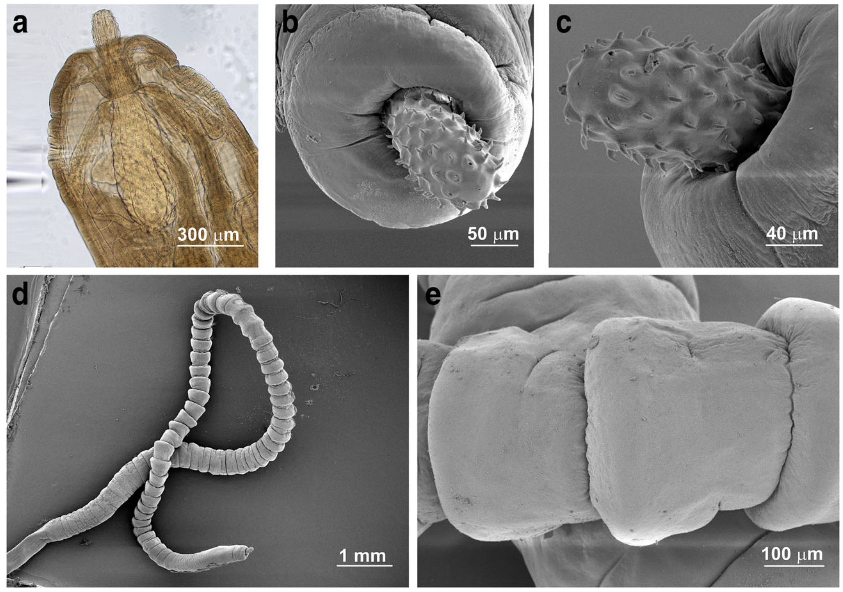

Fig. 1 Stained whole mounts and scanning electron micrographs of adult of *Moniliformis amini* n. sp. from *A. olivaceus*. **a** The anterior part of a female specimen showing the proboscis receptacle with muscle fibers arranged spirally. **b** The proboscis of an adult male specimen, apical view. **c** The proboscis of an adult male specimen, lateral view. **d** Complete male specimen showing pseudosegmentation. **e** Detail of pseudosegmentation

hooks (Figs. 1b–c, 2e–f). The proboscis receptacle is double walled, outer wall with muscle fibers usually arranged spirally (Fig. 1a). The lemnisci are long, flat, not bound to the body wall. The testes are tandem, near posterior and eight cements gland are in compact mass, each one with a single giant nucleus. The gonopore is terminal in both sexes (Fig. 2d–h).

Male (based on one mature adult male): Body length is 20.21 by 0.82 in maximum width. The proboscis is 0.27 long by 0.09 wide. The proboscis receptacle is 0.40 long by 0.17 wide. The proboscis hooks are in 12 to 14 longitudinal rows of 8 to 10 hooks each, decreasing in size posteriorly. The length of the proboscis hooks in the anterior circle is 24 µm. The neck is 59.69 µm long by 84.96 µm wide. The lemnisci are 5.40 long. The testes are posterior in tandem (Fig. 2c). The anterior testis is 1.80 long by 0.60 wide. The posterior testis 1.80 long by 0.50 wide. Eight cement glands, located in compact group posterior to the testes are 0.40 long by 0.17 wide. The genital pore is terminal (Fig. 2d).

Females (based on seven adult females with eggs): The body length is 62.80, 85.85 ± 26.64 (63.96–120.83) by 0.89, 1.06 ± 0.15 (0.90–1.22) wide. The proboscis (Fig. 2e) is 0.29, 0.29 ± 0.01 (0.28–0.30) long, 0.09, 0.10 ± 0.007 by (0.10–0.11) wide. The proboscis receptacle (Fig. 2b) 0.50, 0.58 ± 0.03 (0.54–0.64) long by0.17, 0.21 ± 0.02 (0.18–0.25) wide. The proboscis hooks (Fig. 2f) are in 12 to 14 longitudinal rows of 10 to 12 hooks each, decreasing in size posteriorly. The length of the proboscis hooks in the anterior circle is 24.44, 23.63 ± 1.01 (22.21–24.47) µm, the middle circle (based on one paratype) is 15.50 µm, and the posterior circle (based on one paratype) is 12 µm. The neck is 59.14, 71.46 ± 8.32 (65.58–77.35) µm long by 92.64, and 98.36 ± 3.72 (95.73–101) µm wide. The lemnisci (Fig. 2a) are 6.45, 8.48 ± 2.30 (6.90–11.90) long. The uterine bell (Fig. 2h) is 1.17; 1.08 from genital pore (including the vagina, utero, uterine bell) (based in two paratypes). The eggs (Fig. 2g) are 63.21, 61.69 ± 1.35 (60.73–62.65) µm long by19.27, 26.86 ± 0.33 (26.62–27.10) µm wide. The genital pore is terminal.

Taxonomic summary

Type host: *Abrothrix olivaceus* (Waterhouse, 1837)

Symbiotype: Female CNP 2554. Other hosts housed: CNP 2562, 4675, 4677, 4718

Type locality: Punta Quilla, Santa Cruz, Argentina (50° 6′ 22.53″ S; 68° 27′ 56.44″ W)

Site of infection: The Small intestine

Specimens deposited: Holotype male (no. 7304), allotype female (no. 7305), and a total of 10 paratypes (no. 7306) were deposited at MLP-He

Etymology: The specific epithet *amini* is for Dr. Omar Amin in recognition of his valuable contributions to knowledge and understanding of the Acanthocephala group

Recorded in URN as urn: lsid:zoobank.org:pub:4CE7135F-A678-4443-9C19-AC297667934E

Remarks

Eighteen species of *Moniliformis* were listed by Amin (2013), of which 14 were considered valid by Amin et al. (2016). The species excluded were *M. soricis* (Rudolphi, 1819), *M. myoxi* (Galli-Valerio, 1929), *M. monechinus* (Von Linstow, 1902), and *M. merionis* Golvan & Théodoridès (1960). Only 7 of the 14 species have been recorded from rodents, and these are compared with *M. amini* n. sp. in Table 1.

The new species is distinguished from the species of *Moniliformis* from rodents by a combination of several morphological characters, mainly the very small size of the proboscis receptacle and length of the testes and lemnisci (Table 1).

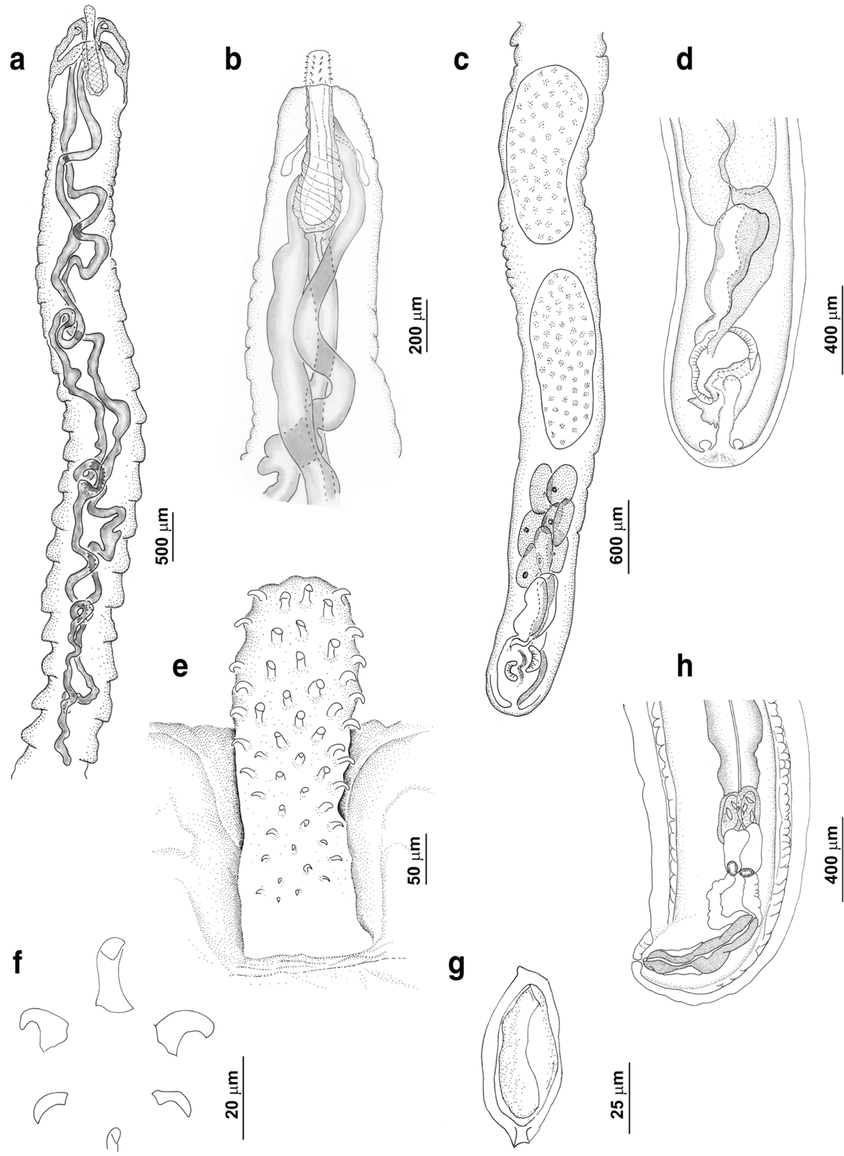

Fig. 2 *Moniliformis amini* n. sp. from *A. olivaceus*. **a** Adult female, anterior regions with proboscis and lemnisci. **b** Adult female, anterior regions, with detail of the proboscis receptacle. **c** Adult male, posterior region. **d** Posterior extremity of male. **e** Detail of the proboscis. **f** Hooks from the proboscis. **g** Eggs. **h** Posterior extremity of female

Moreover, *M. amini* n. sp. has a shorter proboscis than *M. aegyptiacus* (Meyer, 1933), *M. clarki* (Ward, 1917) Chandler, 1921 (*nec* Van Cleave, 1924), *M. moniliformis* (Bremser, 1811) Travassos, 1915, *M. spiralis* (Subrahmanian, 1927), and *M. siciliensis* (Meyer, 1933). The new species can be distinguished from *M. acomysi* (Ward and Nelson 1967), *M. clarki*, *M. spiralis*, *M. travassosi* (Meyer, 1933), *M. aegyptiacus*, and *M. siciliensis* by the number of hooks in each longitudinal row (10–12 vs. 6–10, 6–7, 12–14, 15, 8, 8, respectively). In addition, *M. amini* n. sp. differs from *M. spiralis* by the size of the hooks. The specimens here studied differ from *M. spiralis*, *M. clarki*, and *M. moniliformis* by body size. Also, *M. amini* n. sp. can be separated from all the species from rodents by the ratio between the body length and lemnisci. In addition, the new species differs from *M. acomysi*, *M. moniliformis*, *M. travassosi*, *M. aegyptiacus*, and *M. siciliensis* by the size of the eggs.

Discussion

Four classes (Archiacanthocephala, Eoacanthocephala, Polyacanthocephala, and Palaeacanthocephala) with more than 1000 species belonging to 147 genera are recognized in the phylum Acanthocephala (Monks and Richardson 2011). The proposal of Amin (1987, 2013) on four classes included in Acanthocephala is followed in the present paper; this is based on a combination of morphological and ecological characters, such as location of the lacunar system, number and shape of the cement glands in males, ligament sacs in females, nature of subcuticular nuclei, the number, size, and orientation of proboscis hooks, trunk spination, acanthor spination, and intermediate host types (Bullock 1969; Kennedy 2006; Amin 2013). In addition, this classification is supported by several studies on molecular phylogenies (using different molecular markers), which

Table 1 Morphological characters and measures (mm) of *Moniliformis* spp. rodent parasites

Species	*M. acomysi*		*M. clarki*		*M. moniliformis*		*M. spiralis*	
Author	Ward and Nelson 1967		(Ward, 1917) Chandler, 1921 (*nec* Van Cleave, 1924)		(Bremser, 1811) Travassos, 1915		Subrahmanian, 1927	
Reference	Ward and Nelson 1967		Amin and Pitts 1996		Naidu 2012		Naidu 2012	
Locality (country/-area)	South Sinai (Egypto)		North America		Cosmopolitan		Rangoon, Burma (Birmania)	
Host groups (species)	Muridae (*Acomys cahirinus*)		Sciuridae, Muridae		Muridae (*Rattus rattus*, *R. norvegicus*, *Bandocita bengalensis*)		Muridae (*Nesokia bengalensis*, *R. rattus*)	
Sex	Male	Female	Male	Female	Male	Female	Male	Female
Body L	12–76	22–89	61–85	120–250	77	140	16.94	40
Body W	0.26–1.50	0.56–1.50	1.60–2.00	2.10–2.80	1.66	1.24	0.56	0.91
Proboscis L	0.19–0.36	0.20–0.43	0.41–0.52	–	0.50	0.50	0.43	0.35–0.47
Proboscis W	0.12–0.21	0.14–0.22	0.13–0.14	–	1.19–1.24	1.19–1.24	0.11	0.17–0.18
Proboscis receptacle L	0.68–0.84	0.68–0.84	0.65–0.67	–	0.89–1.07	0.89–1.07	0.64–0.85	0.98
Proboscis receptacle W	0.24–0.33	0.24–0.33	0.32–0.33	–	0.27–0.28	0.27–0.28	0.24–0.30	0.31
Longitudinal rows	11–16	11–16	12–13	12–13	11–12	11–12	12–14	12–14
Hooks per rows	6–10	6–10	6–7	6–7	9–14	9–14	12–14	12–14
Largest hooks (um)	Apical, 21–29	Apical, 23–31	23–28	23–28	20–30	31	40	40
Lemnisci	2.73–4.42 × 0.13–0.23	2.73 4.42 × 0.13–-0.23	3.46–4.79 × 0.13–0.18	–	4.00–7.50 × 0.15–0.17	4.00–7.50 × 0.15–0.17	0.81 × 0.25	0.81 × 0.25
Testis	2.31 × 0.52–0.65	–	–	–	2.20–3.00 × 0.50–0.80	–	–	–
Testis ant	–	–	3.30–5.62 × 0.72–1.15	–	–	–	0.81 × 0.25	–
Testis post	–	–	3.97–4.29 × 0.72–1.17	–	–	–	0.85 × 0.28	–
Cement glands	8	–	–	–	8	–	6–8	–
Cement glands L/A	300 diameter	–	–	–	0.6–1.26 × 0.40–0.60	–	0.53 × 0.21	–
Eggs L	–	0.07–0.09	–	0.05–0.09	–	0.11–0.12	–	0.06
Eggs W	–	0.03–0.05	–	0.03–0.05	–	0.04–0.06	–	0.03
Uterine bell	–	–	–	–	–	–	–	0.91 × 0.48
Genital pore	–	–	–	–	–	–	Terminal	Terminal
Species	*M. travassosi*		*M. aegypticus*		*M. siciliensis*		*M. amini* n. sp.	
Author	Meyer, 1932		Meyer, 1932		Meyer, 1932			
Reference	Petrochenko 1958		Petrochenko 1958		Petrochenko 1958			
Locality (country/-area)	(Brazil)		(Egypt)		Sicily (Italy)		Santa Cruz (Argentina)	

Table 1 (continued)

Host groups (species)	Muridae (*R. norvegicus*)		Muridae, Dipodidae, Erinaceidae (*Meriones sinaiticus*, *Scarturus tetradactylus*, *Erinaceus algiris)*		Muridae, Gliridae (*Mus decumanus*, *Eliomys quercinus*)		Muridae (*Abrothrix olivaceus*)	
Sex	Male	Female	Male	Female	Male	Female	Male	Female
Body L	60–80	100–110	–	115	40–45	70–80	20.21	85.85 (63.96–120.83)
Body W	1.0–1.5	1.5	–	–	1.0–1.50	1.0–1.50	0.82	1.06 (0.90–1.22)
Proboscis L	–	–	0.35	0.35	0.42–0.45	0.42–0.45	0.27	0.29 (0.28–0.30)
Proboscis W	–	–	0.16–0.18	0.16–0.18	0.17–0.19	0.17–0.19	0.09	0.10 (0.10–0.11)
Proboscis receptacle L	–	–	0.75	0.75	–	–	0.40	0.58 (0.54–0.64)
Proboscis receptacle W	–	–	–	–	–	–	0.17	0.21 (0.18–0.25)
Longitudinal rows	14	14	12	12	14	14	12–14	12–14
Hooks per rows	15	15	8	8	8	8	10–12	–
Largest hooks (um)	24–28	24–28	–	–	–	–	24	Apical 23.63 (22.21–24.47); middle 15.50; posterior 12
Lemnisci	10.0	10.0	5.25–6.0	5.25–6.0	10.0 × 0.17	10.0 × 0.17	5.40	8.48 (6.90–11.90)
Testis	2.50–3.0 × 0.80	–	–	–	–	–	–	–
Testis ant	–	–	–	–	–	–	1.80 × 0.60	–
Testis post	–	–	–	–	–	–	1.80 × 0.50	–
Cement glands	8	–	–	–	–	–	8	–
Cement glands L/A	–	–	–	–	–	–	0.40 × 0.17	–
Eggs L	–	0.12–0.12	–	0.09–0.1	–	0.08		0.06 (0.06–0.06)
Eggs W	–	0.07–0.07	–	0.04–0.05	–	0.04		0.02 (0.02–0.02)
Uterine bell	–	–	–	–	–	–		1.17; 1.08
Genital pore	–	–	–	–	–	–	Terminal	Terminal

L length, *W* width, *pos* posterior, *ant* anterior have provided significant insights into acanthocephalan phylogeny, i.e., the monophyly of Acanthocephala, monophyly of Archiacanthocephala, monophyly of Eoacanthocephala, and monophyly of Polyacanthocephala (Near et al. 1998; Near 2002; García-Varela et al. 2002; García-Varela and Nadler 2006). However, on the other hand, phylogenetic issues regarding monophyly/paraphyly of Palaeacanthocephala and the phylogenetic position of Polyacanthocephala within the phylum have not been fully resolved (Gazi et al. 2016). In addition, some studies suggest that Polyacanthocephala either is sister to (all other) Eoacanthocephala (García-Varela et al. 2002; Verweyen et al. 2011), and others propose a nested position within of Eoacanthocephala (Gazi et al. 2016). In this context, a monophyletic origin of Polyacanthocephala and Eoacanthocephala is further supported by the shared presence of an epidermis cone at the proboscis apex, frequently referred to as the apical organ (e.g., Taraschewski and Mackenstedt 1991; Amin and Dezfuli 1995; Amin et al. 1996; Herlyn 2001; Smales et al. 2012; Herlyn and Taraschewski 2017). The increase in morphological and molecular knowledge of acanthocephalus will clarify these still ambiguous aspects.

In many surveys of small mammals, acanthocephalans have been only identified to the generic level. Reasons may include the difficulty in their identification, the absence of interest of specialists, or the low sampling of host species, due to the low prevalence of this group.

Many species of *Moniliformis* have been poorly described, generating a large number of synonyms and other nomenclatural difficulties. We support the conclusions of Amin et al. (2016) recognizing only seven species of *Moniliformis* in rodents worldwide: *M. acomysi*, *M. clarki*, *M. aegyptiacus*, *M. moniliformis*, *M. siciliensis*, *M. spiralis*, and *M. travassosi*. In addition, we also suggest that *M. merionis* be considered as a *nomen nudum*, instead of an *incertae sedis*. The use of this latter term is related to lack of agreement among specialists, rather than lack of taxonomic information. We propose to treat this name as a *nomen nudum* because only the eggs were described, with the taxonomic characters of adult specimens unknown. In addition, the type specimens were not designated.

In the context of the descriptions of the species of *Moniliformis*, it is interesting to mention the problems that can be found from the interpretation of some morphological characters. The proboscis receptacle of the archiacanthocephalan *M. moniliformis* is regarded as double walled by some authors (e.g., Schmidt 1972; Taraschewski 2015). But according to the key of Amin (1987), it should be single walled. The latter examples lead to discrepant conceptions regarding the muscular structures in close vicinity to the proboscis receptacle (Herlyn and Taraschewski 2017). Herlyn and Taraschewski (2017) suggest that the receptacle protrusor and outer wall of the proboscis receptacle are synonyms, denoting homologous structures. In this context, a receptacle is commonly regarded as single walled when the receptacle protrusor is not as firmly attached to the (inner wall of) receptacle (as the case of eoacanthocephalans and non-moniliformid archiacanthocephalans).

The records for Acanthocephala in Sigmodontinae rodents are scarce (Navone et al. 2009, 2010; Landaeta-Aqueveque et al. 2007; Cattan et al. 1992), with *M. amini* n. sp. the first new species to be described from mammals in Argentina. The only previous records of helminths from hosts of *Abrothrix* are from Chile (Landaeta-Aqueveque et al. 2007; Cattan et al. 1992). This is the first record of any helminth from *A. olivaceus* in Argentina.

According to Polop et al. (2015), a marked proportion of arthropods was found in the diet of *A. olivaceus*, characterizing it as arthropodivorous. When infected intermediate hosts of acanthocephalans are eaten by the definitive hosts, the cystacanth develops into the adult. Thus, acanthocephalans exploit existing food chains and circulate through predator-prey interactions. The behavior of an insect intermediate host is often altered by larval acanthocephalans, making them more susceptible to predation by small mammals (Ribas and Casanova 2006). Among the 10 sampling sites, the new species was found only in Punta Quilla, parasitizing *A. olivaceus*. From that locus, only specimens of *A. olivaceus* were studied, so we cannot conclude that one rodent species is more susceptible than the other. However, it is likely that the highest prevalence (14.7%), with respect to values reported by Navone et al. 2009 ($P = 6.9\%$), is due to the characteristics of the environment frequented by *A. olivaceus* and the high probability of feeding on intermediate hosts present in water sources.

Possibly, a larger sampling effort and specific projects dealing with the study of acanthocephalans will shed light on several questions of the rodent-*Moniliformis* relationship. In addition, *Moniliformis* has at least one species of human health importance (Sahba et al. 1970), and the knowledge of its ecology and geographic and host distribution has relevance to advance in the understanding of its epidemiological patterns.

Acknowledgements We thank Ulyses Pardiñas, Pablo Teta, Marcela Lareschi, and other collaborators for their help during host collections; Ulyses Pardiñas for identification of the hosts; María Cristina Estivariz for the drawings; Patricia Sarmiento for the SEM photographs; Mike Kinsella for the valuable critical reading of the manuscript and for the revision of the English version.

Compliance with ethical standards The research has been conducted according to Argentine laws. Sample collection was carried out during fieldwork under official permits. This study was carried out in accordance with the recommendations in the Guide for the Care and Use of Laboratory Animals of the National Institutes of Health. The specimens obtained with methods for live capture were studied and humanely sacrificed (euthanasia by thoracic compression under ether anesthesia), following the procedures and protocols approved by national laws (Animal Protection National law 14.346 and references in the provincial permits) and Ethics Committee for Research on Laboratory Animals, Farm and Obtained from Nature of National Council of Scientific and Technical Research (CONICET) (Resolution 1047, section 2, annex II).

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