Research Note

New Morphological Details and First Records of *Heterakis spumosa* and *Syphacia muris* from Argentina

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ABSTRACT: *Heterakis spumosa* and *Syphacia muris* are among the most common species parasitizing mammals. Although these nematodes have been reported from many hosts on several continents, in South America, they have only been recovered from the cecum of *Rattus norvegicus* from Brazil and Peru. This study provides morphological details of *H. spumosa* and *S. muris*. Moreover, this is the first record of these species in Argentina. *Heterakis spumosa* and *S. muris* were collected from specimens of *R. norvegicus* from Partido de Exaltación de la Cruz, Buenos Aires Province, Argentina. This note presents relevant features observed with scanning electron microscopy (SEM) for *H. spumosa*, such as the presence of 4 papillae on the lips, the lateral alae forming a cuticular fold inside a groove that extends to the posterior end, double papillae on the tip of tail of the male, vulva with 5 cuticular processes, and 2 pair of sessile papillae on the female tail. *Syphacia muris* has a porous badge posterior to the amphids, and the excretory pore is located in an oval depression.

KEY WORDS: Nematoda, Heterakidae, *Heterakis spumosa*, Oxyuridae, *Syphacia muris*, Rodentia, *Rattus norvegicus*, Buenos Aires, Argentina.

Heterakis spumosa Schneider, 1886, and *Syphacia muris* (Yamaguti, 1935) have been reported in numerous worldwide studies, but most of these reports occur in species lists or as new host or locality records, and they do not provide complete measurements, drawings, or photographs (Ayulo and Dammert, 1947; Zaldívar, 1991, Smales, 1997; Milazzo et al., 2003). These species were reported from the cecum of the rodents, such as *Hydromys chrysogaster* (Geoffroy, 1804), *Rattus sordidus* (Gould, 1858), *Rattus fuscipes* (Waterhouse, 1839), *Rattus lutreolus* (Gray, 1841), *Rattus tunneyi* (Thomas, 1904) (Australian rodents), *Cricetomys gambianus* Waterhouse, 1840 (African rodents), *Bandicota bengalensis* (Gray and Hardwicke, 1833) (Indian rodents), and *Rattus rattus* (Linnaeus, 1758) (cosmopolitan rodents) (Yamagutti, 1961; Yorke and Maplestone, 1969; Ogden, 1971; Smales, 1997). However, in South America, *H. spumosa* and *S. muris* had previously been recovered from only *Rattus norvegicus* (Berkenhout, 1769) in Brazil and Peru (Travassos, 1913; Yamaguti, 1961; Vicente et al., 1997; Cabrera and Mendoza, 2001; Pinto et al., 2001).

This study provides morphological details of *H. spumosa* and *S. muris* observed with scanning electron microscopy (SEM), including previously undocumented features. Additionally, this is the first record of these species in *R. norvegicus* from Argentina.

A total of 72 specimens of *R. norvegicus* was collected from autumn 2000 to winter 2001 during a survey of rodents in Partido de Exaltación de la Cruz (34°17′S; 59°07′W), Buenos Aires Province, Argentina. The viscera were fixed in 10% formalin and examined in the laboratory. Males and females of *H. spumosa* and females of *S. muris* were collected from the large intestine and ceca, preserved in 70% ethanol, cleared in lactophenol, and studied under a light microscope. Drawings were made using a drawing tube. Eight specimens were dried using the critical-point method, examined by SEM (Jeol 6360 LV), and photographed. Voucher specimens were deposited in the Helminthological Collection of Museo de La Plata (*H. spumosa* 5579 and *S. muris* 5580), and the hosts were deposited in the Mammals collection of Museo de La Plata (MLP 1.I.03.11, MLP 1.I.03.12, MLP 1.I.03.13), La Plata, Buenos Aires Province, Argentina.

The measurements of the present specimens and those reported by previous authors from South America are presented in Tables 1 and 2. Morphological details observed with light microscopy and SEM are shown in Figs. 1–14.

Males and females of *H. spumosa* had 4 conspicuous papillae on the lips; 2 on the dorsal lip, and 1 on each subventral lip (Fig. 1). The lateral alae arise near the anterior end (Figs. 2, 3) and posteriorly originate as a fold inside a groove that extends to the posterior

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Table 1. Morphological features and measurements of *Heterakis spumosa*; measurements are presented in micrometers unless otherwise indicated as mean values and standard deviation followed by range values in parentheses.

Reference*	Travassos, 1913	Cabrera and Mendoza, 2001	This paper
Host	*Rattus norvegicus*†	*Rattus norvegicus*	*Rattus norvegicus*
Localities	Rio de Janeiro, Brazil	Parcona, Peru	Buenos Aires, Argentina
Male (*N*)	?	3	10
Body length (mm)	7	7.15–8.10	6.24 ± 0.66 (5.1–7.28)
Body width	—	150–180	300 ± 28 (270–350)
Deirids (dfae)	—	220–230	380 ± 20 (340–400)
Cervical alae (dfae)	—	76–77	130 ± 30 (80–170)
Total esophagus length	820	530–640	800 ± 74 (700–900)
Esophageal bulb	—	133–155	220 ± 60 (140–340)
Sucker width	54	—	70 ± 7 (55–75)
Sucker length	—	—	80 ± 12 (70–100)
Sucker (dfpe)	—	220–240	420 ± 50 (350–490)
Spicule der	270	220–240	230 ± 37 (170–270)
Spicule izq	270	240–250	240 ± 21 (220–270)
Tail	270	—	290 ± 30 (220–270)
Female (*N*)	?	3	10
Body length (mm)	9	9–11.10	8.9 ± 0.8 (7.5–10.19)
Body width	—	150–200	320 ± 10 (300–340)
Deirids (dfae)	—	—	0.420 ± 30 (370–460)
Cervical alae (dfae)	—	74–77	140 ± 30 (80–180)
Total esophagus	—	550–630	930 ± 80 (790–1020)
Esophagus bulbe	—	141–155	230 ± 50 (180–300)
Vulva (dfae) (mm)	—	3.11–3.77	4.65 ± 0.43 (3.75–5.2)
Tail	630	360–460	760 ± 45 (700–840)
Eggs length	59	54–58	60 ± 4 (57–65)
Eggs width	44	38–42	40 ± 2 (36–42)

* dfae, distance from anterior end; dfpe = distance from posterior end.

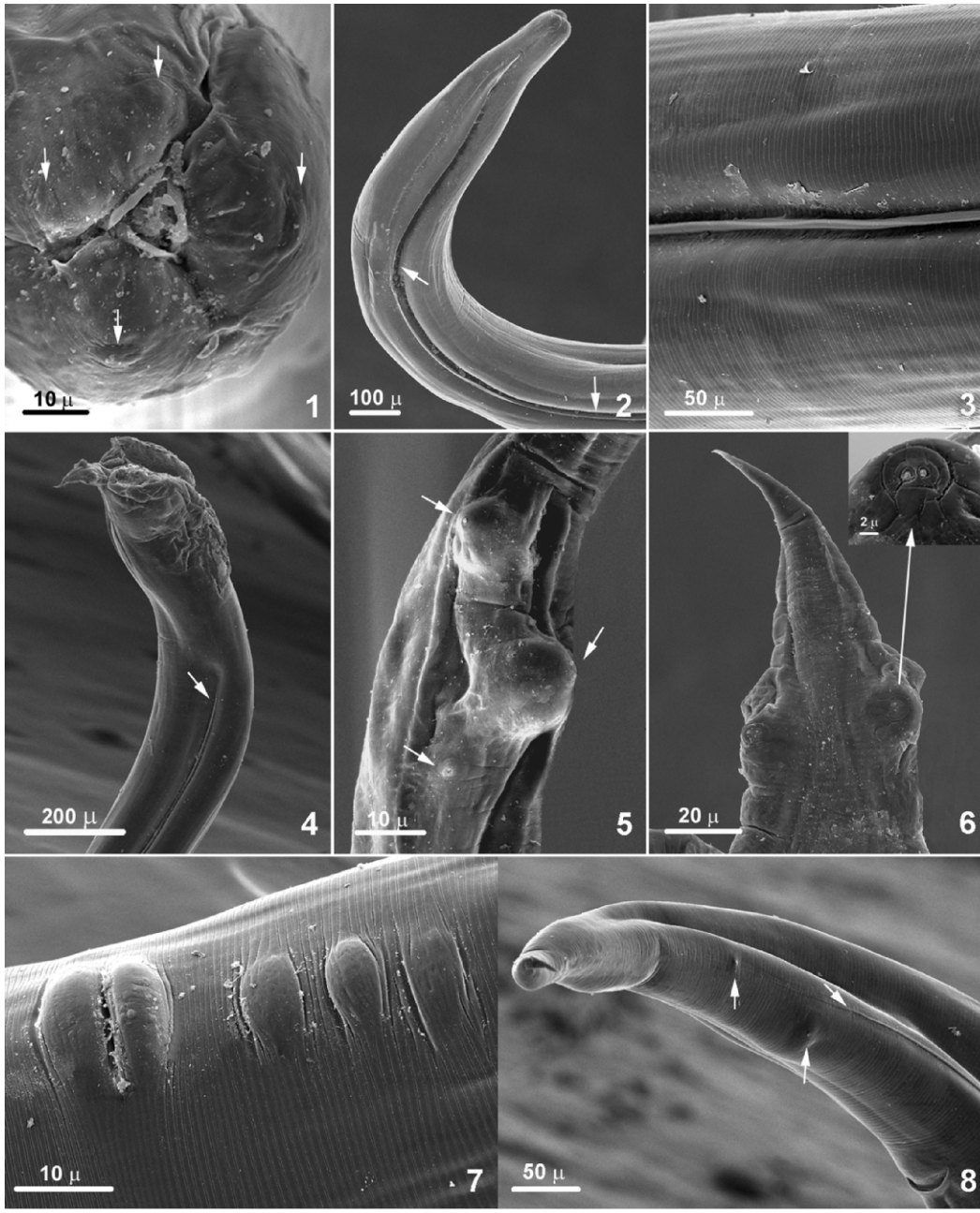
† This was originally described as *Mus decumanus*.

end of the body (Figs. 4, 8, see arrows). Deirids located near the anterior end of the lateral alae (Fig. 9). Males had 10 pairs of caudal papillae: 2 pairs of pedunculate papillae at the level of the sucker, 3 pairs of lateral pedunculate papillae support the caudal alae (1 pair precloacal, 1 pair adcloacal, and 1 pair postcloacal), 2 pairs of sessile papillae are closer to cloaca (adcloacal) (Fig. 10), and 3 pairs of lateral

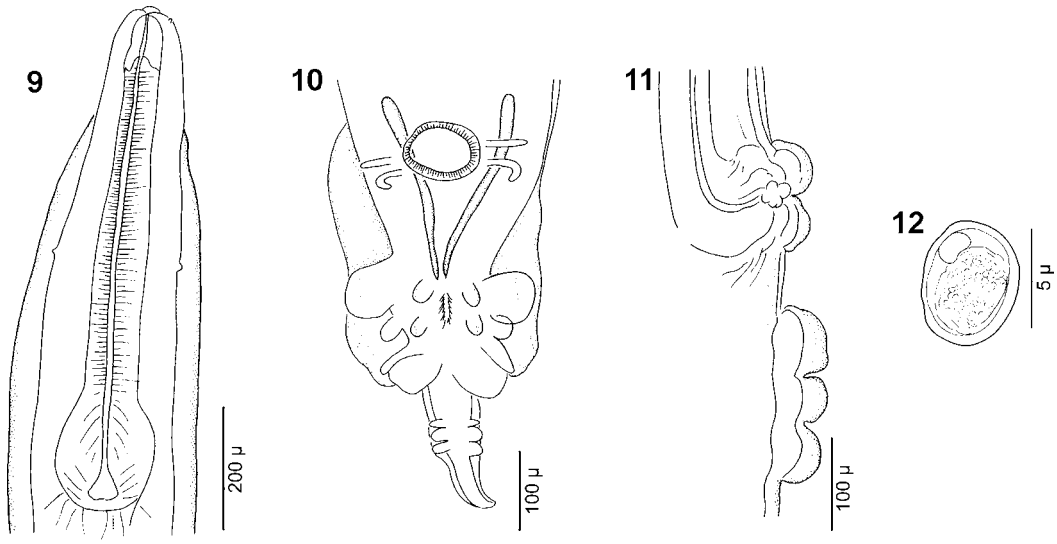
Table 2. Morphological features and measurements of *Syphacia muris*; measurements are presented in micrometers unless otherwise indicated as mean values and standard deviation followed by range values in parentheses.

Reference*	Pinto, Gonçalves, Noronha, and Correa Gomes, 2001	This study
Host	*Rattus norvegicus*	*Rattus norvegicus*
Localities	Río de Janeiro, Brazil	Buenos Aires, Argentina
Female (*N*)	5	10
Body length (mm)	2.5–2.8	2.72 ± 0.33 (1.9–3)
Body width	170–200	180 ± 10 (170–200)
Nerve ring (dfae)	100	110 ± 10 (110–130)
Excretory pore (dfae)	400–500	420 ± 20 (390–450)
Total esophagus	190–210	290 ± 80 (280–310)
Esophageal bulb	40–80	75 ± 5 (69–87)
Vulva (dfae)	720–750	690 ± 50 (640–790)
Tail	340–360	470 ± 47 (370–550)
Eggs length	60–70	70 ± 5 (63–72)
Eggs width	28–30	26 ± 3 (27–30)

* dfae = distance from anterior end.



Figures 1–8. Scanning electron micrographs of *Heterakis spumosa*. **1.** Cephalic papillae on the lips. **2.** Lateral alae. **3.** Lateral alae forming a fold inside a groove. **4.** Male, posterior end with tail and tip of tail, lateral view. **5.** Male, tip of the tail, details of proximal and distal dorsal papillae, and double middle ventral papilla, lateral view. **6.** Male, tip of the tail, detail double middle papillae, ventral view. **7.** Female, vulva with 5 cuticular processes, ventral view. **8.** Female, tail with 2 pairs of sessile papillae, lateral view.

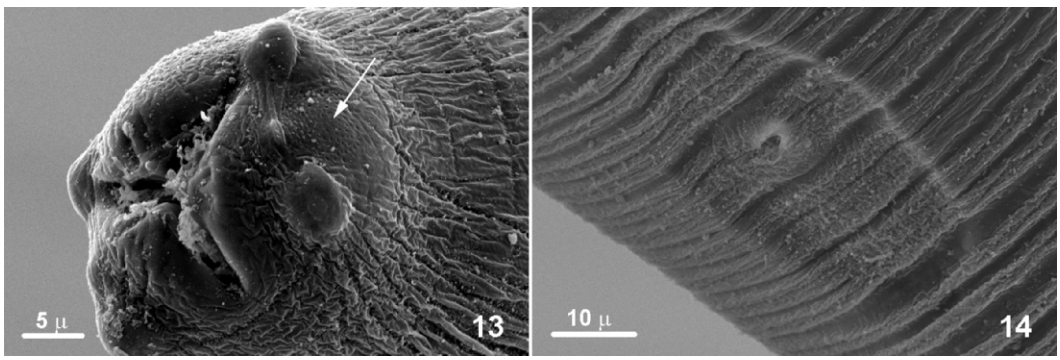


Figures 9–12. *Heterakis spumosa*. **9.** Male, detail of the anterior extremity, dorsal view. **10.** Male, detail of the posterior end, ventral view. **11.** Female, vulva with 5 cuticular processes, lateral view. **12.** Egg.

papillae (the proximal and distal papillae are located dorsally, whereas the middle papilla is double and located ventrally) at the tip of the tail (Figs. 4–6). Females had 5 cuticular processes associated with vulva: 1 anterior to the vulvar opening, 1 posterior to it, and 3 located posteriorly to the latter (Figs. 7, 11); tail had 2 pairs of sessile papillae: 1 proximal pair ventrolateral and the other pair distal located laterally. The last pair of papillae is asymmetrical, and they are probably phasmids (Fig. 8). Eggs are slightly longer than they are wide and morulated (Fig. 12).

The female of *Syphacia muris* has a small quadrangular cephalic plate. The amphids lie close to the ventral submedian pair of papillae. A porous badge is situated immediately posterior to the amphids (Fig. 13). Deirids, cervical alae, and lateral alae are absent. Excretory pore is located in an oval depression (Fig. 14). The vulva opens on a small elevation. The tail is tapered, and the anal opening is transversal.

The general morphology and measurements of the *H. spumosa* examined in the present study agree with the data presented by Travassos (1913), Hall (1916), Vicente et al., (1997), and Cabrera and Mendoza (2001), with a few exceptions. Cabrera and Mendoza (2001) report only 2 vulvar processes, 1 anterior and 1 posterior to the vulva, whereas here, 5 are reported. Other minor discrepancies include the length of esophagus in both sexes, the distance between the sucker and the posterior end, the distance of deirids



Figures 13–14. Scanning electron micrographs of *Syphacia muris*. **13.** Detail of the anterior end. **14.** Excretory pore located within an oval depression.

to the anterior end in the males, and the length of the tail in females (Table 1).

Syphacia muris is commonly found in laboratory and wild rats and mice and has been reported once from humans (Hussey, 1957). Therefore, its morphological features have been well documented (Yamaguti, 1941; Hugot and Quentin, 1985; Vicente et al., 1997; Pinto et al., 2001). The morphological details of the anterior end were observed and photographed with SEM by Tenora et al. (1978). However, the present study provides new features not previously reported, including the possession of a porous badge situated immediately posterior to the amphids, and the excretory pore located in an oval depression. Although only females of genus *Syphacia* were found in the cecum of *R. norvegicus* in this study, their morphological features and measurements largely agree with those reported in previous studies (Yamaguti, 1935, 1941; Ogden, 1971; Pinto et al., 2001). However, the specimens of *S. muris* described by Hugot and Quentin (1985) parasitizing *R. fuscipes* and *R. tunneyi* from Australia are smaller than those from South America. These differences could be explained by geographical and host influences because no differences were observed among specimens from Brazil and Argentina (Table 2) (Pinto et al., 2001).

This study confirms the presence of these species in Argentina, extending their southern distribution. Moreover, the results obtained here demonstrate that the application of a different tool can reveal new information regarding unexplained variation in these broadly distributed species.

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