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A new species of *Syphacia (Seuratoxyuris)* (Nematoda: Oxyuridae) from *Sooretamys angouya* Fischer, 1814 (Rodentia: Cricetidae) in Argentina

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ABSTRACT

Syphacia (*Seuratoxyuris*) *hugoti* n. sp. (Nematoda: Oxyuridae) is described from the cecum of *Sooretamys angouya* (Cricetidae: Sigmodontinae: Oryzomyini) captured in Formosa Province, Argentina. The diagnosis of the subgenus is emended, and the new species is separated from eight congeners by the distribution of submedian papillae and amphids, shape of the cephalic plate, presence of deirids, absence of cervical and lateral alae, length of the spicule, structure of the accessory hook of the gubernaculum and distance of excretory pore and vulva from the anterior extremity. The analysis suggests that *S.* (*Se.*) *oryzomyos* should be removed from *Seuratoxyuris* and redesignated as *S.* (*Syphacia*) *oryzomyos* n. comb. To date, of the species of Syphacia found in South and North American, 7 parasitize Oryzomyini rodents, of which two are distributed in Argentina. The present study constitutes the first record of the subgenus *Seuratoxyuris* from Argentina and the third record of a *Syphacia* species from rodents of the tribe Oryzomyini.

1. Introduction

The Nematode genus *Syphacia* Seurat, 1916 (Oxyuridae: Syphaciinae: Syphaciini) includes more than 60 species parasitic in rodents (e.g., Hugot, 1988; Quentin, 1971; Robles and Navone, 2010). Out of 25 species of *Syphacia* recorded in North and South America, 17 have been described from rodents of the family Cricetidae (13 from Sigmodontinae, 2 from Arvicolinae, 1 from Cricetinae, 1 from Neotominae) and 3 from Muridae (Bernard, 1966; Harkema, 1936; Hugot and Quentin, 1985; Ogden, 1971; Quentin, 1968, 1969, 1971;Quentin and Kinsella, 1972; Quentin et al., 1979; Robles and Navone, 2007a,b; Rojas et al., 2011; Tiner and Rausch, 1950; Travassos, 1937). Only two Syphaciini species that parasitize American rodents belong to other genera; *Syphabulea maseri* Hugot, 1981 and *Caroloxyuris boliviensis* Jiménez Ruiz and Gardner, 2003 (monotypic). The remaining species included in Syphaciini found in rodents belong to *Syphatineria* Chabaud et Biocca, 1955 and *Syphabulea* Gubanov, 1964, and occur outside of North and South America.

To date, of the species of *Syphacia* found in the Americas, seven parasitize Oryzomyini rodents (Cricetidae: Sigmodontinae) of the genera *Melanomys*, *Nectomys*, *Oligoryzomys*, *Oryzomys*, *Sigmodontomys* and *Zygodontomys* (Hugot, 1988; Hugot and Quentin, 1985; Kinsella, 1972; Quentin, 1968, 1969; Robles and Navone, 2007b, 2010; Travassos, 1937). In Argentina, four species have been recorded, two of which parasitize members of this host tribe: *Syphacia (Syphacia) venteli* parasitizes *Nectomys squamipes* (Brants 1827) and *S. (Sy.) kinsellai* parasitizes *Oligoryzomys nigripes* (Olfers 1818) (Robles and Navone, 2007a,b, 2010; Rojas et al., 2011).

The species of *Syphacia* were divided into three subgenera by Hugot (1988). Two of these are distributed in North and South America (*Seuratoxyuris* Hugot, 1988 and *Syphacia* Seurat, 1916). The subgenus *Seuratoxyuris* comprises eight species (*Syphacia peromysci* Harkema, 1936; *S. petrusewiczi* Bernard, 1966; *S. megadeiros* Quentin, 1969; *S. criceti* Quentin, 1969; *S. sigmodoni* Quentin and Kinsella, 1972; *S. oryzomyos* Quentin and Kinsella, 1972; *S. phyllotios* Quentin et al. 1979; *S. evaginata* Hugot and Quentin, 1985). The subgenus *Syphacia* includes seven species (*S. venteli* Travassos, 1937; *S. arctica* Tiner and Rausch, 1950; *S. alata* Quentin, 1968; *S. carlitosi* Robles and Navone, 2007a; *S. kinsellai* Robles and Navone, 2007b; *S. quentini* Robles and Navone, 2010; *S. hodarae* Rojas et al., 2011).

Ever since the valuable original diagnosis which detailed the morphological features of the genera and subgenera of Syphaciini (Hugot, 1988), only a few studies have used additional diagnostic

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tools (e.g., molecular data, SEM) to confirm or supplement the original characterization of those groups (e.g., Hasegawa et al., 1994; Ogden, 1971; Okamoto et al., 2007; Robles and Navone, 2007a, 2010; Rojas et al., 2011).

The purpose of this paper is to describe a new species of *Syphacia* from *Sooretamys angouya* Fischer, 1814 (Cricetidae: Sigmodontinae: Oryzomyini) of Formosa Province, Argentina. In addition, a revision of the diagnosis and composition of species in the subgenus *Seuratoxyuris* is provided.

2. Materials and methods

Two specimens of *S. angouya* were collected at Estación de Animales Silvestres Guaycolec (Guaycolec Wild Animals Station) (25°98′33″S; 58°16′67″W) Formosa Department, Formosa Province in May 2012. Nematodes were collected from the ceca of freshly-killed rodents, fixed in formalin and preserved in 70% ethanol, then cleared in lactophenol and studied under light microscope. Drawings were made with the aid of a drawing tube. Eight specimens were dried using the critical point method, examined and photographed under scanning electron microscope (SEM) (Jeol 6360 LV).

In the following description, measurements of the holotype (male) and allotype (female) are provided. Table 1 lists the measurements taken from paratypes, including the mean and standard deviation, followed by the range in parentheses, and available data provided by previous authors for species of *Syphacia* (*Seuratoxyuris*). All measurements are in micrometers unless otherwise stated.

The type and paratype specimens are deposited in the Helminthological Collection of Museo de La Plata, La Plata, Argentina (HCMLP); and the Mammal Collection of Centro Nacional Patagónico, Chubut, Argentina (CNP).

Type and voucher specimens of all species listed in Table 1 were compared: MNHN-Muséum National d'Histoire Naturelle, Paris, France: *S. peromysci* n° 41 SB; *S. criceti* n° 101 U; *S. megadeiros* n° 613 M; *S. petrusewiczi rauschi* n° 3615; *S. sigmodoni* n° 40 SB; *S. oryzomyos* n° 827 SA; *S. phyllotios* n° 93 SF; *S. evaginata* n° 216 RL.

3. Results

A total of 632 specimens were found in the cecum of two specimens of the host *S. angouya* from Formosa. These specimens were identified as a new species of *Syphacia* (*Seuratoxyuris*).

3.1. Description

3.1.1. Seuratoxyuris Hugot, 1988

3.1.1.1. Emended diagnosis. Cuticle with characteristic superficial pattern in at least one of the sexes (alternating parallel rings and perpendicular ridges). Cephalic plate round, oval and laterally elongated in females. Submedian papillae located in the first or second third to half of cephalic plate (measuring from position of amphids) (Fig. 1). Cervical alae and/or deirids well developed; lateral alae vestigial or absent in females. Accessory hook of gubernaculum with ornamentation covering its entire surface. Tail short and conical (shorter than 115) in males.

3.1.2. Syphacia (Seuratoxyuris) hugoti n. sp. (Figs. 1–23; Table 1)

3.1.2.1. General. Cuticle with fine striations, fields between transverse striations bearing shallow longitudinal depressions in females (Figs. 11, 23) and fields with only transverse striations in males. Cephalic plate laterally elongated. Lateral diameter of cephalic plate 25–30 in males and 40–50 in females (Figs. 1, 9, 16, 21). Amphids observed in apical view, but submedian papillae located at lateral sides of cephalic plate. Submedian papillae located on second third to half of cephalic plate (Fig. 1). Porous badge situated between papillae, ascending and finishing immediately below amphids (Fig. 22). Lips poorly defined, with cuticular edges around triradiate opening. Cervical alae absent. Lateral alae absent, but different cuticular morphology occurs at the location where the former would be. Deirids present in females, not observed in males (Fig. 9, 10, 21, 23). Excretory pore circular, located in an elliptic depression of cuticle, posterior to esophageal-intestinal junction (Figs. 3, 8, 11).

3.1.2.2. Male (holotype). Body length 0.95 mm (Fig. 2). Body width 270. Deirids not observed and lateral alae absent. Total esophagus 310 long, esophageal bulb 90 long (Fig. 3). Nerve-ring 65, and excretory pore 225 from anterior end (Figs. 2, 3). Body length/distance to excretory pore ratio 4.2 (3.51 ± 0.16 (3.5–4.3) in paratypes). Three ventral *Syphacia*-type mamelons present (Figs. 2, 6, 16, 20). Anterior mamelon protruding, 85 long; middle mamelon 85 long and posterior mamelon 75 long. Anterior edges of each mamelon 250, 420 and 620 from anterior end, respectively. Mamelons not equidistant; distance between anterior edge of first mamelon and anterior edge of second mamelon 85 (72 ± 14 (50–95) in paratypes); distance between anterior edge of second mamelon and anterior edge of third mamelon 115 (135 ± 34 (100–190) in paratypes) (Fig. 2). Spicule 105 long. Gubernaculum 55 long. Accessory hook of gubernaculum with ornamentation covering its whole surface (teeth of equal size) (Figs. 2, 4, 5, 18, 19). Tail short, 110; tip of tail 55 (Figs. 4, 1 7). Three pairs of caudal pedunculate papillae: 1 pre-anal pair, 1 ad-anal pair, and 1 large post-anal pair, located laterally (Figs. 4, 17).

3.1.2.3. Female (allotype). Body length 3.7 mm (Fig. 7). Body width 325. Conspicuous deirids present. Lateral cuticle thickening at anterior end to include the deirids; its superficial texture does not differ from the rest of the cuticle but it presents a rounded button-like interruption (Figs. 9, 10, 21, 23). Lateral alae absent, but different cuticular morphology occurs where the former would be and extends to mid-body. Total esophagus 425 long, esophageal bulb 100 long (Figs. 7, 8). Nerve-ring 115, deirids 110, excretory pore 500, and vulva 680 from anterior end (Figs. 7–10). Body length/distance to excretory pore ratio 5.5 (6.8 ± 0.81 (5.6–7.6) in paratypes). Vulva not prominent, or slightly prominent in some cases, apparently depending on gravid status (Figs. 12–14). Vagina oblique or reaching nearly perpendicular position to body axis from the vulva. Tail relatively long, 875 (Fig. 7). Eggs elliptical and with large operculum, 85×30 (Fig. 15).

3.2. Taxonomic summary

3.2.1. Symbiotype

S. angouya Fischer, 1814 (Cricetidae: Sigmodontinae: Oryzomyini), male, voucher specimen deposited in CNP, with the number CNP 3633. *Other specimen* CNP 3634.

3.2.2. Type locality

Estación de Animales Silvestres Guaycolec (25°98′33″S; 58°16′67″W), Formosa Department, Formosa Province.

3.2.3. Site of infection

Cecum.

Table 1
Main morphological features and measurements of *Syphacia (Seuratoxyuris)* species from North and South America. dfae = distance from anterior end.

Species	*S. peromysci*	*S. criceti*	*S. megadeiros*	*S. petrusewiczi rauschi*	*S. sigmodoni*
Reference	Harkema, 1936; Kruidenier et al., 1961; Quentin and Kinsella, 197 2	Quentin, 1969	Quentin, 1969	Quentin, 1969; Quentin and Gran, 1976	Quentin and Kinsella, 1972
Type host	*Peromyscus leucopus leucopus*	*Cerradomys subflavus*[b]	*Rhipidomys latimanus*	Myodes rutilus[d]	*Sigmodon hispidus*
Other hosts	*P.maniculatus bairdii, P. m. rufinus*	*Calomys callosus*	*"Handleyomys" alfaroi*[c]	–	–
Family	Cricetidae	Cricetidae	Cricetidae	Cricetidae	Cricetidae
Subfamily (Tribe)	Neotominae (Reithrodontomyini)	Sigmodontinae (Oryzomyini-Phyllotini)	Sigmodontinae (Thomasomyini-Oryzomyini)	Arvicolinae (Myodini)	Sigmodontinae (Sigmodoni)
Localities	Durham County, Minnesota, Wisconsin, Utah, Arizona (USA); Quebec (Canada)	Pernambuco (Brasil)	Pichiude (Colombia)	Anchorange (Alaska)	Florida (USA)
Male (N)	44+	2	–	–	8
Body length (mm)	0.64–1.5	1.45–1.72	–	1.04	0.8–1.08
Body width	85	150–160	–	95	90
Nerve ring (dfae)	64–90	115	–	90	80
Deirids (dfae)	80	115	–	Present	–
Excretory pore (dfae)	132–274	180	–	230	260
Cervical alae (dfae)	Absent	Absent	–	Present	Absent
Lateral alae	Absent	Absent	–	Absent	Absent
Total esophagus	132–230[a]	270	–	170	213
Diameter esophageal bulb	40–80	66	–	45	52–58
Anterior mamelon length	39–60	70	–	54	55
Middle mamelon length	39–52	80	–	52	52
Posterior mamelon lenght	44–68	80	–	60	62
Anterior mamelon (dfae)	270	220	–	280	300
Middle mamelon (dfae)	365	360	–	370	410
Posterior mamelon (dfae)	480	540	–	500	500
Spicule	58–70	96	–	56	64
Gubernaculum length	26–38	46	–	35	38
Gubernaculum width	4.5–5	8	–	3	4
Shape of accessory hook	15–19	14 × 32	–	15 × 13	13–16 × 13
Tail	64	115	–	60	65–69
Tip of tail	23–32	70	–	24	26–32
Female (N)	88+	25	34	104	17
Body length (mm)	2.1–4	3.8–5.8	5.8–5.9	4.4–4.5	3.03
Body width	120–172	330	280	210	160
Nerve ring (dfae)	97–160	150	240	165	130
Deirids (dfae)	160	125	220	160	155
Excretory pore (dfae)	300–500	320	850	515	500
Cervical alae (dfae)	26.2[a]	Absent	Absent	42	37[a]
Cervical alae length	430–477	–	–	400–500	450[a]
Cervical alae width	28	–	–	21	18[a]
Lateral alae	Present	Absent	Present	Absent	Absent, cuticular fold
Total esophagus	400[a]	450	480	360	380
Diameter esophageal bulb	100	105	120	80	110
Vulva (dfae)	500–700	490	1200	740	700
Tail	650	780	740	600	540
Egg length	85	83–87	66	100	83–90
Egg width	25	27–34	23	37	30–33

Species	*S. oryzomyos*	*S. phyllotios*	*S. evaginata*	*S. hugoti* n. sp.
Reference	Quentin and Kinsella, 1972	Quentin et al., 1979	Hugot and Quentin, 1985	Present study
Type host	*Oryzomys palustris*	*Phyllotis darwini*	*Oryzomys sp.*	*Sooretamys angouya*
Family	Cricetidae	Cricetidae	Cricetidae	Cricetidae
Subfamily (Tribe)	Sigmodontinae (Oryzomyini)	Sigmodontinae (Phyllotini)	Sigmodontinae (Oryzomyini)	Sigmodontinae (Oryzomyini)
Localities	Paynes Prairie, Alachua County, Florida (USA)	Malleco (Chile)	Belem (Brasil)	Formosa (Argentina)
Male (N)	4	2	2	16
Body length (mm)	1.0–1.7	1.4	1.71	1.12 ± 0.14 (0.93–1.4)
Body width	150	140	130	195 ± 16 (160–285)
Nerve ring (dfae)	110	110	120	76 ± 13 (55–90)
Deirids (dfae)	200	110	Present	–
Excretory pore (dfae)	420	265	480	285 ± 50 (225–365)
Cervical alae (dfae)	Absent	–	Absent	Absent
Lateral alae	Absent	–	–	Absent
Total esophagus	300	210	280	260 ± 35 (230–325)

Table1 (*Continued*)

Species	*S. oryzomyos*	*S. phyllotios*	*S. evaginata*	*S. hugoti* n. sp.
Diameter esophageal bulb	80	55	70	73 ± 10 (60–90)
Anterior mamelon length	90	80	90[d]	67 ± 8.4 (55–85)
Middle mamelon length	90	75	90[d]	70 ± 11 (55–85)
Posterior mamelon lenght	80	85	90[d]	60 ± 7.5 (50–75)
Anterior mamelon (dfae)	480	360	610	301 ± 63 (200–405)
Middle mamelon (dfae)	600	510	770[d]	467 ± 72 (400–625)
Posterior mamelon (dfae)	760	750	980[d]	713 ± 98 (600–910)
Spicule	99	76–82	87	98 ± 8 (90–110)
Gubernaculum length	45	33–42	52	48 ± 7 (40–55)
Gubernaculum width	10	5.5	–	10 ± 7 (8–12)
Accessory hook	33 × 22	18–22 × 14.5	–	17 ± 6 (14–21) x 8 ± 5 (7–10)
Tail	140	80	75	96 ± 10 (80–110)
Tip of tail	110	46	40	53 ± 6 (45–65)
Female (N)	14	5	5	16
Body length (mm)	3.0–3.6	6	4.8	4.1 ± 0.7 (3–5.4)
Body width	325	375	300	366 ± 36 (300–410)
Nerve ring (dfae)	180	185	170	151 ± 40 (100–230)
Deirids (dfae)	220	185	Present	156 ± 24 (110–200)
Excretory pore (dfae)	360	650	750	583 ± 43 (500–650)
Cervical alae (dfae)	Absent	?	Absent	Absent
Cervical alae length	–	–	–	–
Cervical alae width	–	–	–	–
Lateral alae (dfae)	Absent	?	–	Absent
Total esophagus	375	462	440	476 ± 43 (420–570)
Diameter esophageal bulb	100–120	125	110	122 ± 11 (100–140)
Vulva (dfae)	620	1000	850 (protusive)	788 ± 75 (700–920)
Tail	630	940	750	797 ± 144 (625–975)
Egg length	102	109–112	75	84 ± 5 (80–90)
Egg width	30	34–38	30	34 ± 5 (30–40)

[a] Measurement obtained from drawing.
[b] Mentioned as *Oryzomys subflavus* by Quentin (1969).
[c] Mentioned as *Oryzomys alfaroi* by Quentin (1969).
[d] Mentioned as *Clethrionomys rutilus* by Quentin (1969).

3.2.4. Specimens deposited

Holotype male (n° 6700), allotype female (n° 6701), and a total of 20 paratypes (n° 6702) were deposited at HCMLP.

3.2.5. Etymology

This new species was named in honor of Dr. Jean Pierre Hugot, a well known parasitologist who has contributed valuable knowledge on pinworms from many host groups and different parts of the world, and whose surveys have motivated our research group.

3.3. Differential diagnosis

Among the species of *Syphacia* (*Seuratoxyuris*) spp. occurring in American murid rodents, *S.* (*Se.*) *hugoti* n. sp. differs from *S.* (*Se.*) *peromysci*, *S. (Se.) petrusewiczi rauschi* and *S.* (*Se.*) *sigmodoni* by the absence of well developed cervical alae in the females. It differs from *S. (Se.) peromysci*, *S. (Se.) criceti, S.* (*Se.*) *petrusewiczi rauschi, S.* (*Se.*) *oryzomyos, S.* (*Se.*) *phyllotios* and *S.* (*Se.*) *evaginata* by the absence of deirids in males. Furthermore, the new species has a longer spicule than *S.* (*Se.*) *peromysci, S.* (*Se.*) *petrusewiczi rauschi, S.* (*Se.*) *sigmodoni*, *S.* (*Se.*) *phyllotios* and *S.* (*Se.*) *evaginata* (90–110 μm vs. 58–70; 56; 64; 76–82; 87 μm, respectively). The tail of the males of *S.* (*Se.*) *hugoti* n. sp. is short and similar in length to all abovementioned species (shorter than 115 μm) except for *S.* (*Se.*) *oryzomyos* (140 μm).

Moreover, the size and shape of the lips, the patterns of distribution of the submedian papillae and amphids, and the shape of the cephalic plate appear to be different among the *Syphacia* species mentioned above (e.g., cephalic plate round and submedian papillae located in the first third to half of cephalic plate in *S.* (*Se.*) *peromysci*, *S.* (*Se.*) *petrusewiczi rauschi* and *S.* (*Se.*) *sigmodoni*, cephalic plate oval and submedian papillae located in the second third to half of cephalic plate in *S. (Se.) criceti, S.* (*Se.*) *megadeiros*, *S.* (*Se.*) *oryzomyos*, *S.* (*Se.*) *evaginata* and *S.* (*Se.*) *hugoti* n. sp., and cephalic plate laterally elongated and submedian papillae located in the second third to half of cephalic plate in *S.* (*Se.*) *phyllotios*). Another important diagnostic feature to distinguish among species is the shape and structure of the accessory hook of the gubernaculum. The species compared have an accessory hook with ornamentation covering its whole surface; however, the sizes of the ornamental teeth are different in each case (Harkema, 1936; Hugot and Quentin, 1985; Quentin, 1968, 1969; Quentin and Gran, 1976; Quentin and Kinsella, 1972; Quentin et al., 1979; Robles and Navone, 2007a,b; Rojas et al., 2011; Tiner and Rausch, 1950; Travassos, 1937).

Differences among the species can also be observed in some measurements (Table 1). The deirids from females of *S.* (*Se.*) *hugoti* n. sp., *S.* (*Se.*) *peromysci*, *S.* (*Se.*) *petrusewiczi rauschi, S.* (*Se.*) *sigmodoni* and *S.* (*Se.*) *phyllotios* are similar in their distance from the anterior end; but their position is more anterior than in *S.* (*Se.*) *megadeiros* and *S.* (*Se.*) *oryzomyos*. The new species can be distinguished from males of *S. (Se.) peromysci*, *S. (Se.) sigmodoni* and *S. (Se.) phyllotios*, and from females of *S. (Se.) peromysci*, *S. (Se.) petrusewiczi rauschi*, *S. (Se.) sigmodoni* and *S.* (*Se.*) *oryzomyos*, by having a longer esophagus. *Syphacia* (*Se.*) *hugoti* n. sp. differs from *S.* (*Se.*) *peromysci, S.* (*Se.*) *criceti*, *S.* (*Se.*) *sigmodoni, S.* (*Se.*) *oryzomyos;* and *S.* (*Se.*) *megadeiros, S.* (*Se.*) *evaginata* by having a longer or shorter distance from anterior end to excretory pore in females, respectively. In addition, the new species can be differentiated from *S.* (*Se.*) *megadeiros, S.* (*Se.*) *phyllotios* and *S.* (*Se.*) *peromysci*, *S.* (*Se.*) *criceti, S.* (*Se.*) *oryzomyos* by having a longer or shorter distance from anterior end to the vulva, respectively (Harkema, 1936; Hugot and Quentin, 1985; Quentin, 1969; Quentin and Kinsella, 1972; Quentin et al., 1979) (Table 1).

The species most similar to *S. hugoti* n. sp. are *S.* (*Se.*) *criceti, S.* (*Se.*) *evaginata* and *S.* (*Se.*) *phyllotios.* The type specimens available for review were few (1–2 males for each species) and it would be interesting for future studies to obtain new samples in order to

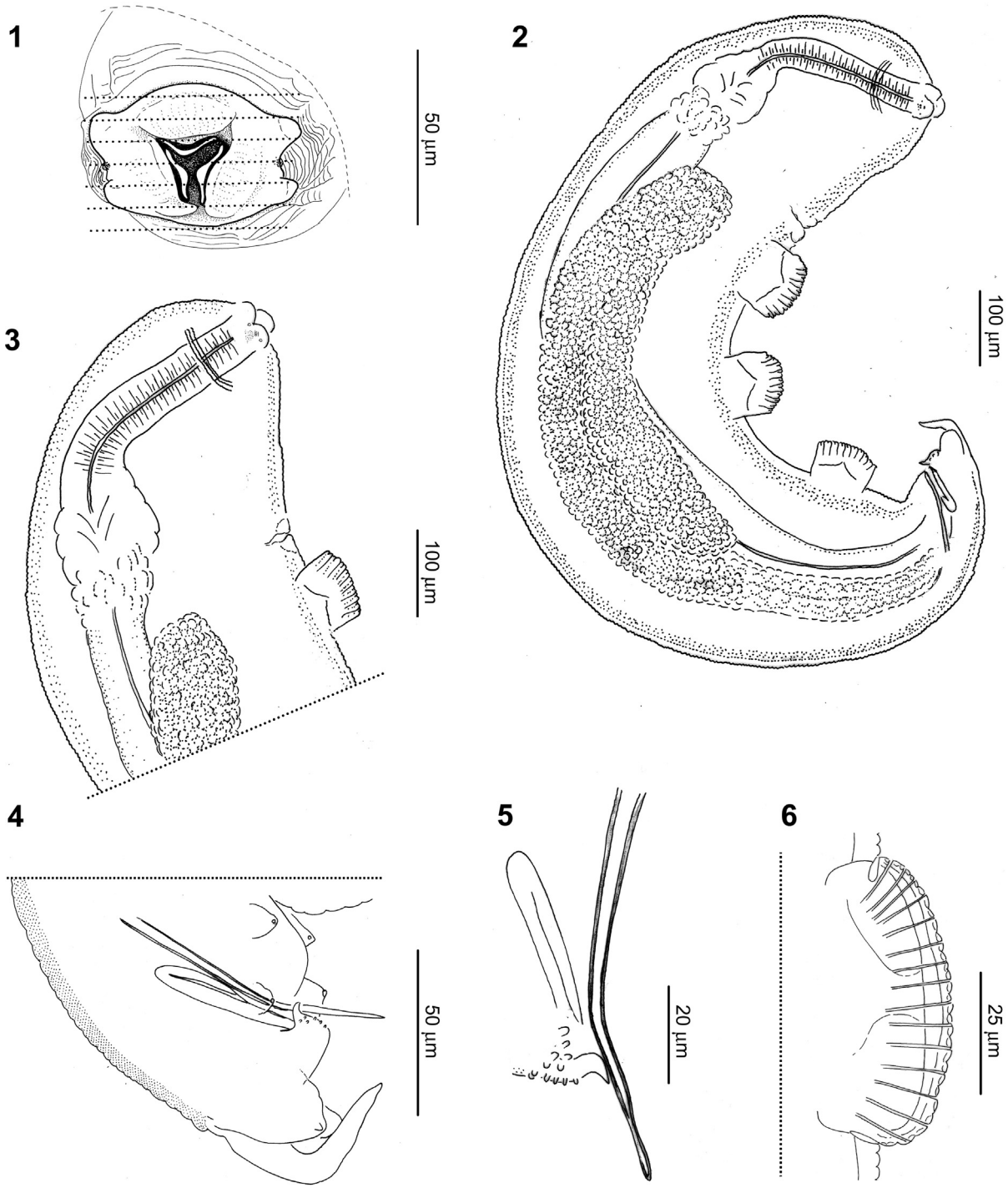

Fig. 1. Figs. 1–6 *Syphacia* (*Seuratoxyuris*) *hugoti* n. sp. Female. (1) Cephalic plate with detail of position of submedian papillae relative to amphids. Male. (2) Complete male (holotype). (3) Anterior extremity, lateral view (holotype). (4) Three pairs of caudal pedunculate papillae, spicule, gubernaculum and accessory hook of gubernaculum, latero-ventral view (paratype). (5) Detail of spicule, gubernaculum and accessory hook of gubernaculum, lateral view (paratype). (6) Mamelon, lateral view.

confirm the diagnostic features (e.g., deirids in males, lateral alae in females). In addition, *S.* (*Se.*) *megadeiros*, whose male form is undescribed, needs to be restudied (Hugot and Quentin, 1985; Quentin, 1969; Quentin et al., 1979).

Regarding *Syphacia (Seuratoxyuris)* spp. from rodents outside of the Americas, *Syphacia* (*Se.*) *pahangi* Hugot and Quentin, 1985) differs from the new species by having well developed cervical alae in the females (Hugot and Quentin, 1985).

4. Discussion

Sigmodontine rodents occur only in the Americas, and are represented by approximately 71 genera and 373 species (D'Elía, 2003; Musser and Carleton, 2005). Among them, 16 species of Oryzomyini are distributed in Argentina. *S. angouya* is widely distributed in northeastern Argentina, eastern Paraguay and southeastern Brazil (Cirignoli et al., 2005; Percequillo et al.,

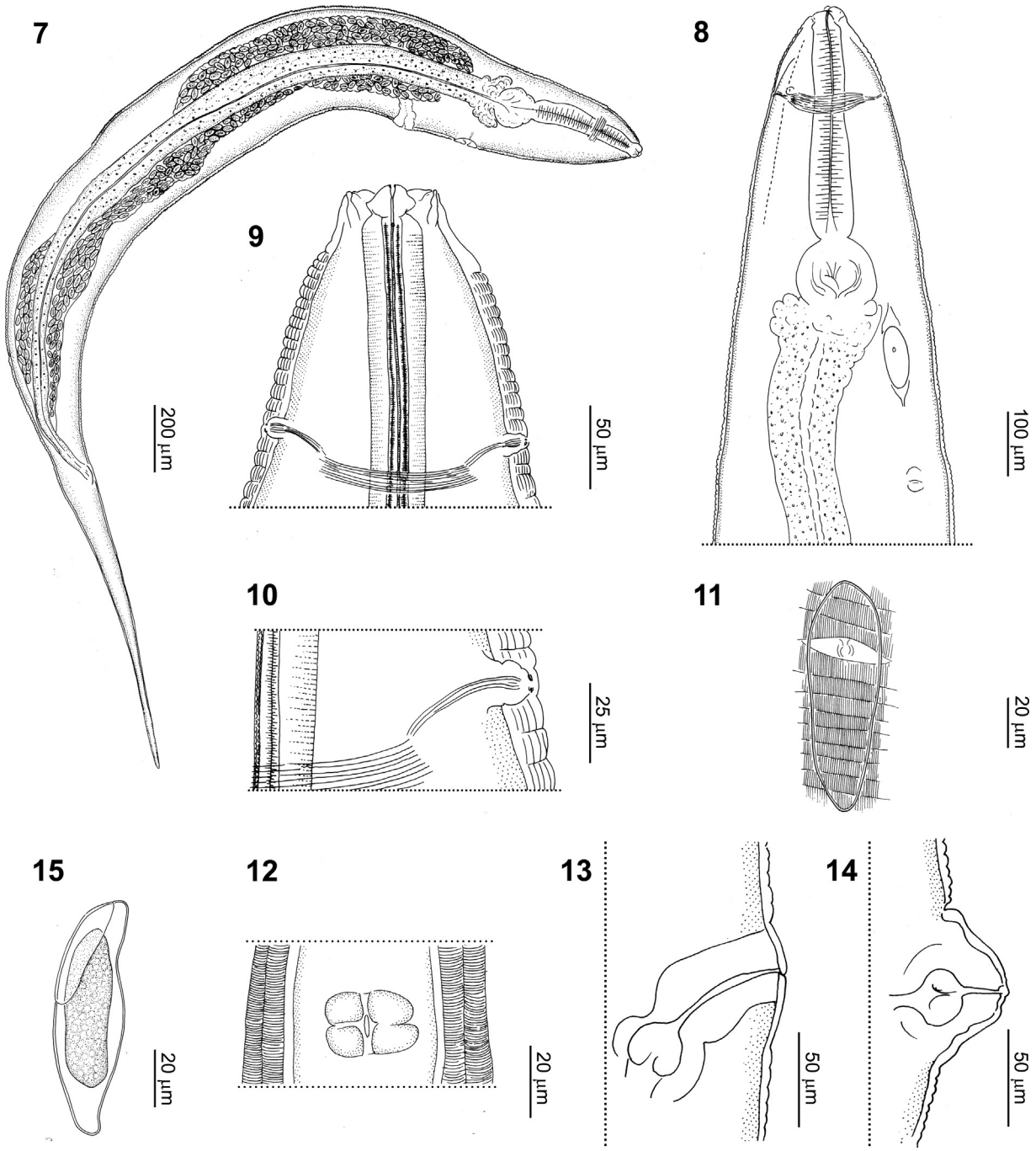

Fig. 2. Figs. 7–15 *Syphacia* (*Seuratoxyuris*) *hugoti* n. sp. Female. (7) Complete female specimen (allotype). (8) Anterior extremity, ventral view (paratype). (9) Anterior extremity, ventral view [paratype]. (10) Detail of deirid (paratype). (11) Detail of excretory pore and cuticle (paratype). (12) Detail of vulva, ventral view (paratype). (13) Detail of vulva, lateral view (paratype). (14) Detail of slightly prominent vulva, lateral view (paratype). (15) Egg (paratype).

2008; Teta et al., 2007). Some species phyllogenetically close to *S. angouya* have been reported as hosts of *Syphacia* spp.; *Cerradomys subflavus* Wagner, 1842 as host of *S.* (*Se.*) *criceti* and *Oryzomys* sp. as host of *S.* (*Se.*) *evaginata* (Quentin, 1969; Hugot and Quentin, 1985).

Some studies have suggested that *S. angouya* and *C. subflavus* are sister species (Bonvicino, 2003; Bonvicino and Moreira, 2001; Musser et al., 1998), while others do not provide any evidence that *Sooretamys* and *Cerradomys* are more closely related to one another than they are to other species-groups (Weksler, 2003, 2006; Weksler et al., 2006). Moreover, *Oryzomys* sp. from Belem, Brazil could actually belong to a different genus, and may be closer to *S. angouya* and *C. subflavus* (Weksler et al., 2006).

Several studies have demonstrated high host specificity among Oxyuridae (e.g., Hasegawa et al., 2003; Hugot et al., 1996). In particular, these studies showed that the phylogeny of Syphaciinae is closely parallel to the phylogeny of their hosts (e.g., Hugot, 1990; Weaver and Smales, 2008). In these studies, the comparisons were performed at suprageneric level. Recently, other studies have shown that each *Syphacia* species appears to be specific to a host genus (Robles, 2008, 2010). In the present study, the species

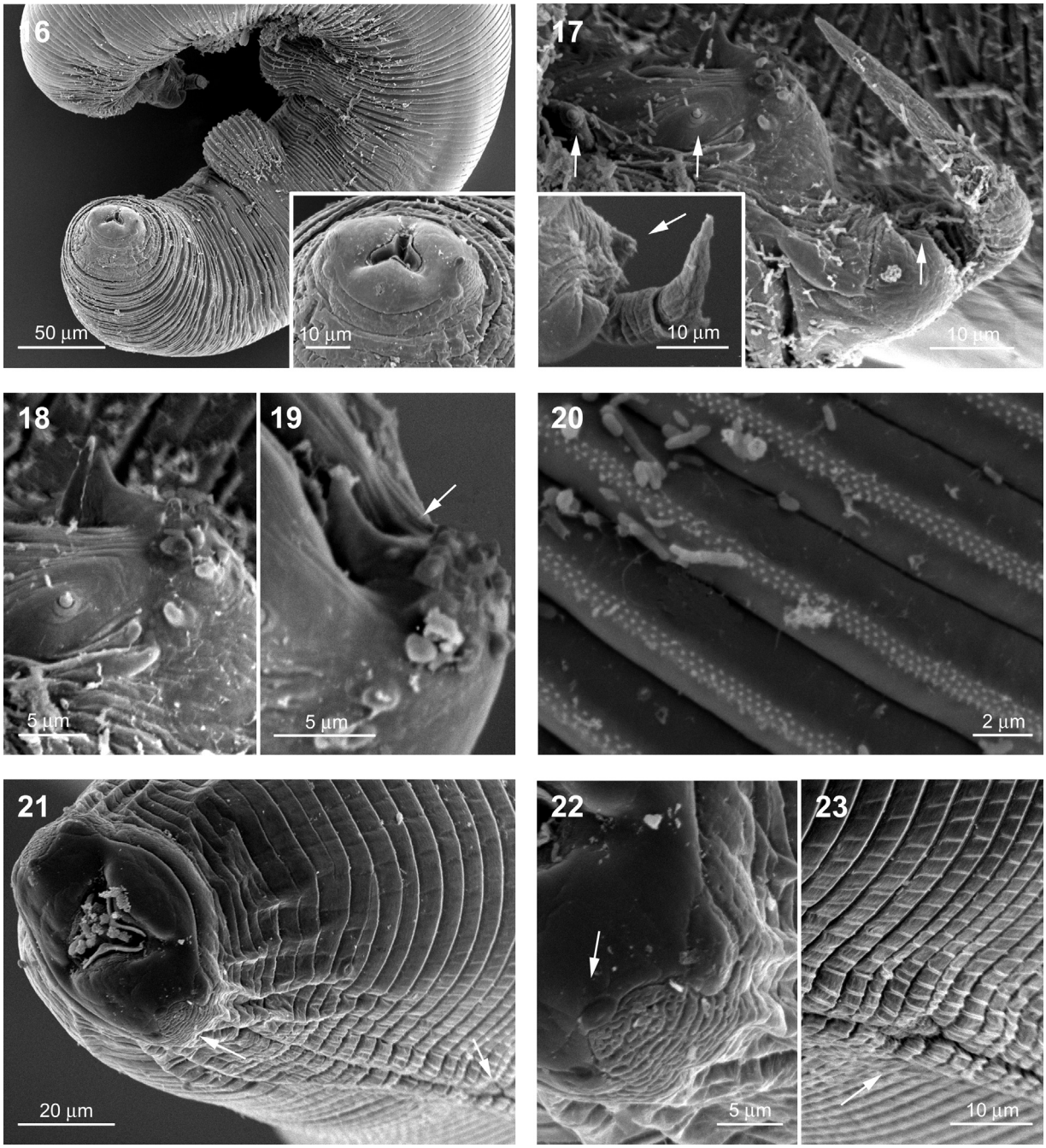

Fig. 3. Figs. 16–23 Scanning electron micrographs of *Syphacia* (*Seuratoxyuris*) *hugoti* n. sp. Male (paratype). (16) Complete male specimen and detail of cephalic plate. (17) Three pairs of caudal pedunculate papillae, accessory hook of gubernaculum and tail, lateral view; and detail of third pair of papillae, latero-ventral view. (18) Detail of accessory hook of gubernaculum, specimen in ventral view. (19) Detail of accessory hook of gubernaculum, specimen in ventral view 2. (20) Detail of mamelon surface. Female (paratype). (21) Cephalic plate. (22) Submedian papillae, amphids and porous badge, lateral view. (23) Detail of deirid.

morphologically closest to *S.* (*Se.*) *hugoti* n. sp, *S. (Se.) criceti* and *S.* (*Se.*) *evaginata* were found to parasitize host species closely related to *S.* angouya,. In any case, the distribution of some *Syphacia* species is still difficult to correlate with the phylogenetic position of their hosts, as in *S.* (*Se.*) *sigmodoni* and *S.* (*Se.*) *phyllotios*.

Nevertheless, some species parasitic of Oryzomyni rodents, such as *S. (Se.) criceti* and *S.* (*Se.*) *megadeiros*, have been reported from different host genera (Hugot, 1988; Quentin, 1969; Table 1). The records of second hosts were re-studied based on specimens deposited in helminthological and mammal collections (MNHN), and in those cases, very few *Syphacia* specimens (and no males) were found and/or the host specimens are currently lost. The present study suggests that the identity of some host species of *Syphacia* should be revised in order to confirm the actual number of host species.

In this context, knowledge of the macroevolutionary history of the genus *Syphacia* will be ensured when the true phylogenetic patterns of the hosts can be established. Moreover, in order to support those possible hypotheses about co-evolutionary patterns,

the species included in each parasite group should be reviewed (e.g., *Syphacia* subgenera).

In this paper, the diagnosis of *Seuratoxyuris* was reconsidered and some features, such as the cuticle, patterns of distribution of the submedian papillae and amphids, shape of the cephalic plate, and length of the tail were modified and clarified. Moreover, a new species was included in *Seuratoxyuris.* Remarkably, no new species have been included in this subgenus since 1988, perhaps because in some cases morphological details were difficult to observe in the available specimens, and in other cases, the diagnostic features were not sufficient. Hasegawa et al. (1994) did suggest that *S. frederici* Roman, 1945 should be transferred to *Seuratoxyuris*. However, Okamoto et al. (2007) studied several species with molecular evidence (COI) showing that *S. frederici* should be included in the subgenus *Syphacia* as suggested by Hugot (1988). On the other hand, in this paper, the analysis of *S.* (*Se.*) *oryzomyos* showed that the tail is longer than 115 μm, suggesting that this species should be removed from *Seuratoxyuris* and redesignated as *S.* (*Syphacia*) *oryzomyos* n. comb.

Some previous publications have demonstrated the value of scanning electron microscopy as a tool to detect new features and clarify previous diagnostic characters of *Syphacia* spp. Structures such as the shape of the cephalic plate**,** details and distribution of the submedian papillae and amphids, development of a porous badge**,** and shape and structure of the accessory hook of the gubernaculum are poorly visualized with light microscopy, but become clear with the SEM (Dick and Wright, 1973a,b, 1974; Dick et al., 1973; Ogden, 1971; Wiger et al., 1978). To date, all known *Syphacia* species from Argentina have been studied with SEM and, in future studies, it will be interesting to compare these features with those of different species from around the world (Robles and Navone, 2007a,b, 2010; Robles et al., 2008; Rojas et al., 2011).

To date, very few studies have explored phylogenetic group of pinworms using molecular techniques (e.g., Okamoto et al., 2007, 2009), but in the future, such studies may support or change the existing morphology-based phylogenetic hypotheses (e.g., subgenera).

In summary, although current evidence indicates that Syphaciini Nematodes could be useful as taxonomic markers of the evolutionary history of their hosts, several aspects that underlie these assumptions should be corroborated. Thus, further studies are necessary to review the diagnostic features at each level (tribe, genus and subgenus), provide new features with the support of new techniques (e.g., SEM, molecular studies), and re-study the known *Syphacia* species and verify the species identity of their hosts.

The present paper constitutes the third record of a *Syphacia* species from Oryzomyini rodents, and the fifth species report from Argentina. The new species described here represents the first record of the subgenus *Seuratoxyuris* in Argentina.

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