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Trichostrongylina (Nematoda) parasitic in *Phyllotis* sp. (Rodentia: Sigmodontinae) from Argentina, with description of three new species

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Abstract

The Trichostrongylina parasitic in the leaf-eared mouse *Phyllotis* sp. (Sigmodontinae) from the Province of Catamarca, Argentina are studied. Three new species of *Stilestrongylus* Freitas, Lent and Almeida, 1937 (Heligmosomoidea: Heligmonellidae: Nippostrongylinae) are described. *Stilestrongylus andalgala* n. sp. is distinguished from the most closely related species *S. moreli* Diaw, 1976 parasitic in *Auliscomys boliviensis* from Bolivia, by the absence of a common trunk of right rays 2 and 3, by left ray 4 shorter than ray 5, and by the shape of the female tail, without a mucron. *Stilestrongylus catamarca* n. sp. is distinguished from all the other species in the genus by hypertrophied rays 2, larger than rays 3, and from the closely related species *Stilestrongylus barusi* Durette-Desset, 1971, parasitic in *Sigmodontomys alfari* from Colombia, by right ray 4 longer than ray 5 and left ray 4 shorter than ray 5, by a larger spicule length/body length ratio (22.6% vs. 7.2%), and by the presence of a mucron on the female tail. *Stilestrongylus gracielae* n. sp. most closely resembles *Stilestrongylus azarai* Durette-Desset and Sutton, 1985, parasitic in *Akodon azarae* and in *Graomys griseoflavus*, and *Stilestrongylus franciscanus* Digiani and Durette-Desset, 2003, also parasitic in *G. griseoflavus*, both from Argentina. These latter differ from the new species by the right lobe of the caudal bursa: in *S. azarai* rays 4, 5 and 6 arise at same level from their common trunk and in *S. franciscanus* right rays 4 and 5 diverge at their distal extremity. *Lamanema chavezi* Becklund, 1963 (Molineoidea: Molineinae), a parasite of South American camelids, is reported in rodents for the second time.

Keywords: *Stilestrongylus andalgala* n. sp.; *Stilestrongylus catamarca* n. sp.; *Stilestrongylus gracielae* n. sp.; *Lamanema chavezi* Becklund, 1963, *Phyllotis* sp., Argentina

1. Introduction

This paper is part of a major study on the diversity and phylogeny of the Nippostrongylinae (Nematoda: Trichostrongylina) parasitic in Neotropical sigmodontine rodents [1–4]. The Trichostrongylina parasitic in the leaf-eared mouse *Phyllotis* sp. from the province of Catamarca, Argentina, were studied. Three new species of the genus *Stilestrongylus* Freitas, Lent and Almeida, 1937 (Nippostrongylinae) were recognized and are here described. *Lamanema chavezi* Becklund, 1963 (Molineinae), a parasite of South American camelids, was also found in the hosts studied, and some comments on this finding are provided.

2. Materials and methods

Rodents ($n=17$) were captured in May, 1997. The viscera, fixed in 10% formalin and preserved in 70% ethanol, were provided by the Instituto Miguel Lillo (San Miguel de Tucumán, Argentina) in agreement with the División Zoología Invertebrados of the Museo de La Plata (La Plata, Argentina), for helminthological studies. For unknown reasons, the rodents were lost prior to identification to species level. However, collection data are very precise, and only two species of *Phyllotis* are found at the locality and altitude recorded: *Phyllotis xanthopygus* (Waterhouse, 1837) and *Phyllotis osilae* Allen,

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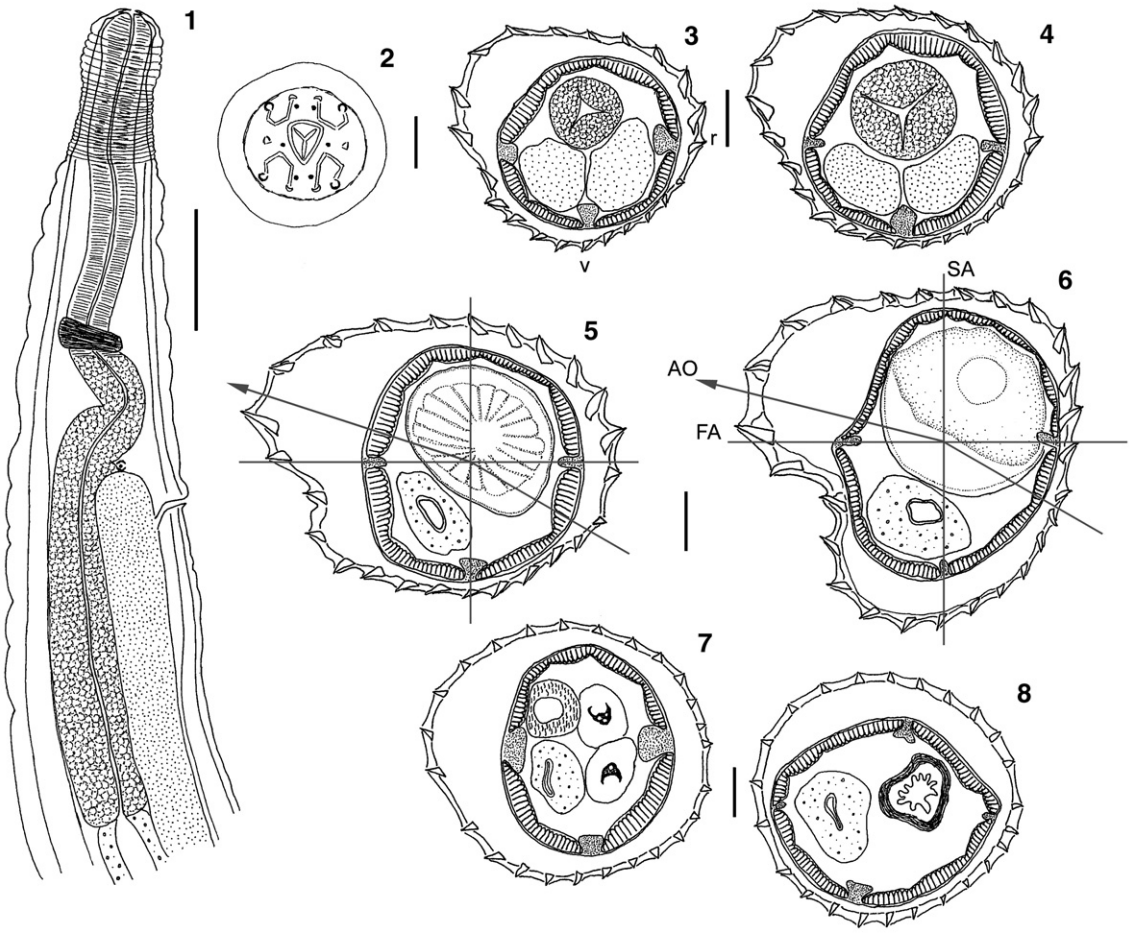


Figs. 1–8. *Stilestrongylus andalgala* n. sp. 1. Male, anterior extremity, right lateral view. Scale bar: 1 — 50 μm. 2. Female, head, apical view Scale bar: 2 — 10 μm. 3. Transverse section of body, at oesophago-intestinal junction, male. Abbreviations: r, right, v, ventral. Scale bar: 3 — 20 μm. 4. Transverse section of body, at oesophago-intestinal junction, female. Scale bar: 4 — 20 μm. 5. Transverse section of body, at mid-body, male, at 50% of body length. Scale bar: 5 — 50 μm. 6. Transverse section of body, at mid-body, female, at 50% of body length. Abbreviations: SA, sagittal axis, FA, frontal axis, AO, axis of orientation of ridges. Scale bar: 6 — 50 μm. 7. Transverse section of body, male, at 94% of body length. Scale bar: 7 — 50 μm. 8. Transverse section of body, female, just anterior to vulva. Scale bar: 8 — 50 μm.

1901 (PE Ortiz, pers. comm.). The nematodes recovered were stored in 70% ethanol. The synlophe was studied following Durette-Desset [5] and the nomenclature referring to the axis of orientation follows Durette-Desset and Digiani [6]. The number of ridges is expressed as the total (dorsal/ventral). The nomenclature used for the study of the caudal bursa is that of Durette-Desset and Chabaud [7]. The nomenclature for parasites above the family group follows Durette-Desset and Chabaud [8]. Measurements are given in micrometres, except where stated otherwise. Type and voucher specimens of parasites are deposited in the Helminthological Collections of the Museo de La Plata, La Plata, Argentina (CHMLP) and the Muséum National d'Histoire Naturelle, Paris, France (MNHN). The nomenclature of the hosts at species level follows Musser and Carleton [9].

3. Results and discussion

Stilestrongylus andalgala n. sp.
(Figs. 1–8 and 9–12)
Material studied:

Types: male holotype, female allotype CHMLP 4627/1a. Paratypes: 6 males, 4 females CHMLP 4627/1b; 2 males, 2 females MNHN 480 MQ. Coparasites with *Stilestrongylus catamarca* n. sp.

Type-host: Phyllotis sp. (*Ph. xanthopygus* (Waterhouse, 1837) or *Ph. osilae* Allen, 1901) (Rodentia, Sigmodontinae).

Site: Small intestine.

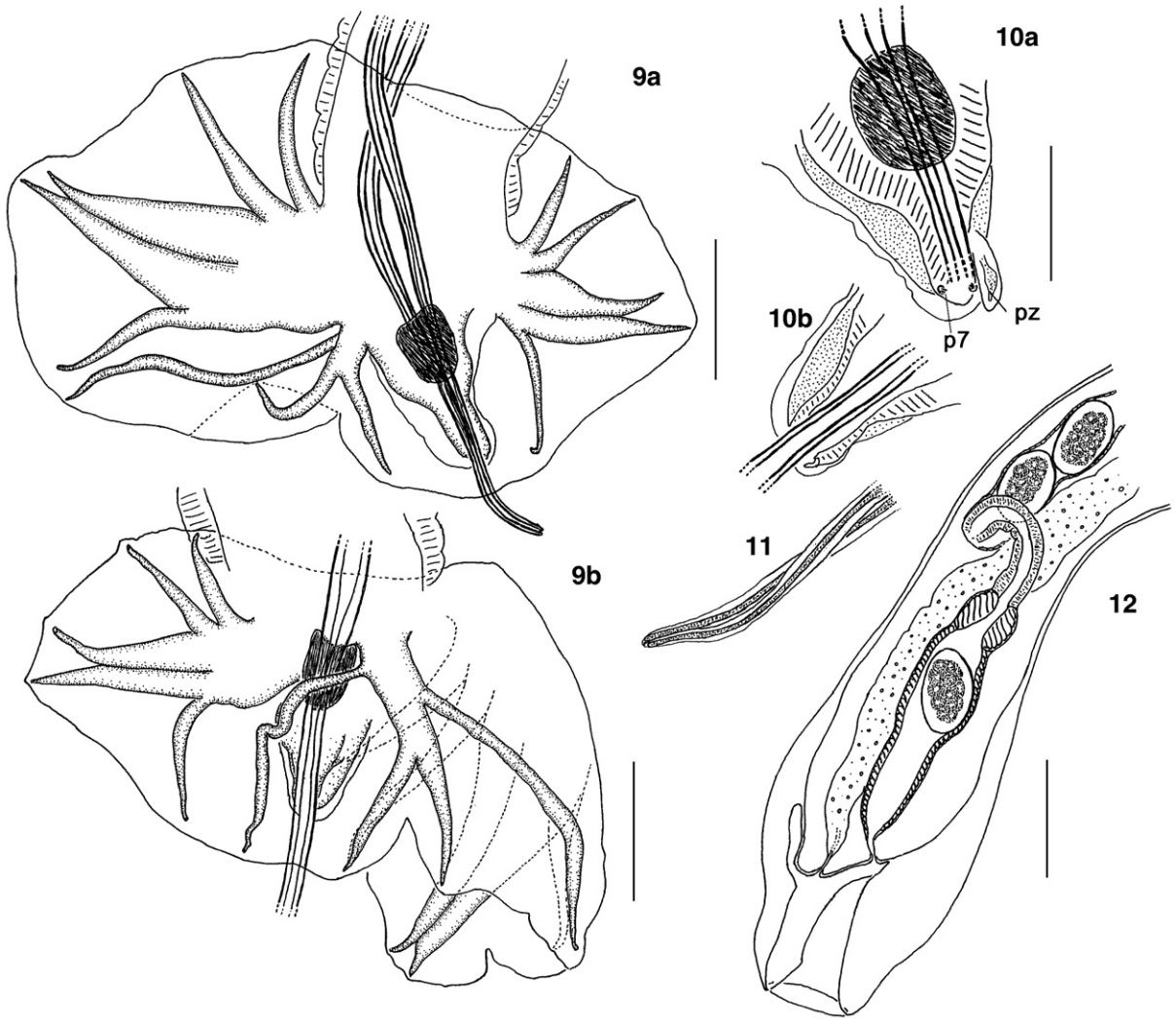
Type-locality: Andalgalá (27°23′ S, 66°15′ W), 2600 m above sea level, Province of Catamarca, Argentina.

Other material studied: 4 males, 1 female CHMLP 4620/1; 1 female CHMLP 4621/1; 4 females CHMLP 4623/1; 2 males CHMLP 4624/1; 1 male, 3 females CHMLP 4626/1; 1 male CHMLP 4630/1; 5 males, 2 females CHMLP 4633/1; 4 males, 2 females MNHN 481 MQ. Same host and locality. For coparasitism: see Table 1.

Prevalence and intensity of infection: 47.1% of the hosts (8 out of 17) were infected, harbouring 1–16 (mean = 5.8) worms.

Description

General: Small nematodes, strongly coiled sinistrally along ventral side in 3–5 spirals in males, more loosely and irregularly coiled in females. Excretory pore 60–75% of oesophageal length



Figs. 9–12. *Stilestrongylus andalgala* n. sp. 9. Male, entire caudal bursa, 9a ventral view, 9b, dorsal view. Scale-bars: 9 — 100 μm. 10. Male, genital cone, 10a, ventro-lateral view, 10b, left lateral view. Abbreviations: pz, papilla zero, p7, papillae 7. Scale-bar: 10 — 50 μm. 11. Male, tip of spicules. Scale-bar: 11 — 50 μm. 12. Female, posterior extremity, right lateral view. Scale-bar: 12 — 100 μm.

in males, 56–63% in females. Deirids inconspicuous, situated at level of excretory pore or slightly anterior to it (Fig. 1).

Head: Cephalic vesicle present. In apical view, triangular buccal opening surrounded by very thin ring. Presence of two amphids, six interno-labial papillae, medio-laterals closer to each other than to laterals, four externo-labial papillae and four submedian cephalic papillae. Externo-labial and cephalic papillae connected to each other by weak arc-like cuticular structures (Fig. 2).

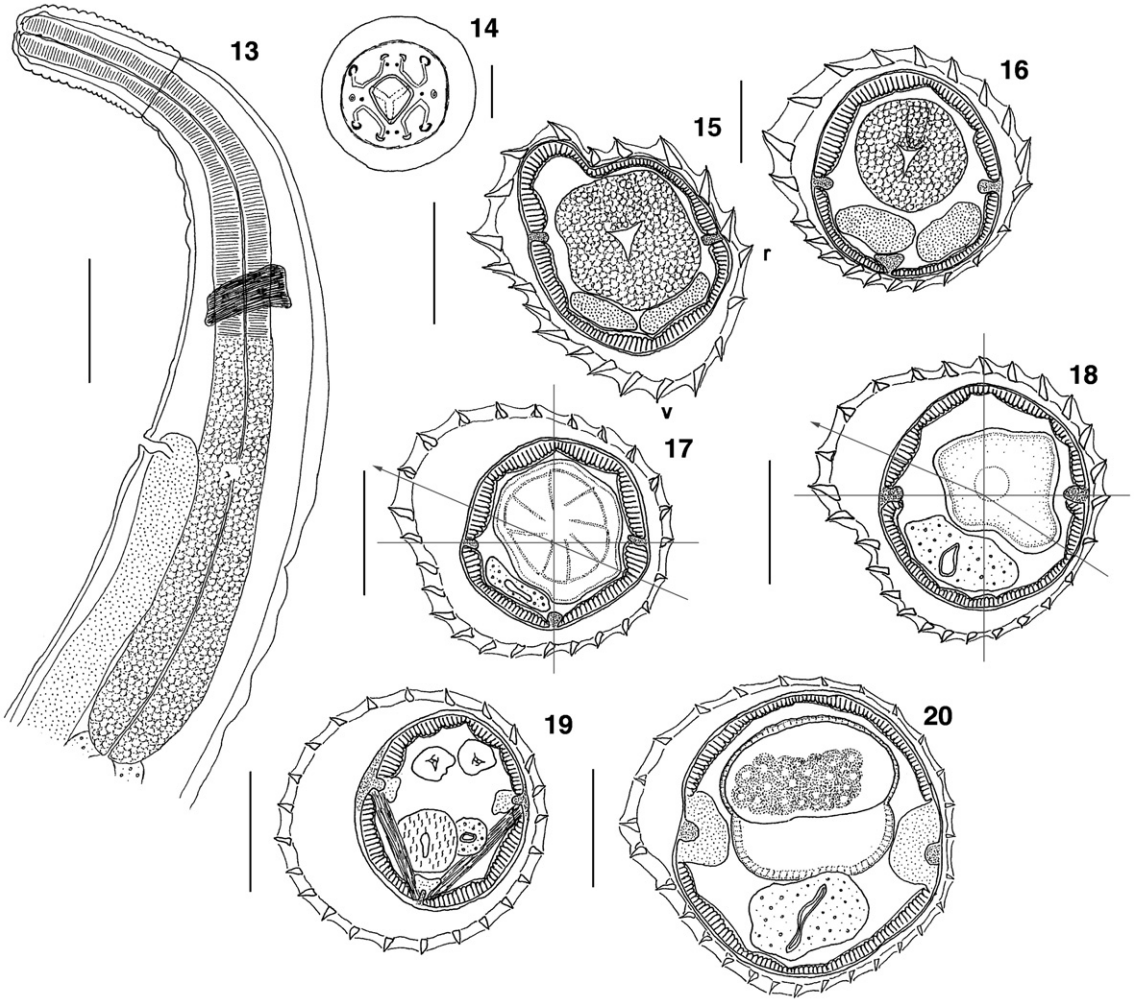
Table 1
Coparasitism in the examined *Phyllotis* sp. Non-parasitized individuals ($n=6$) not included

Individual host	*Stilestrongylus andalgala* n. sp.	*Stilestrongylus catamarca* n. sp.	*Stilestrongylus gracielae* n. sp.	*Lamanema chavezi* Becklund, 1963	Unidentified Molineinae
4620 MLP	X				
4621 MLP	X				
4622 MLP		X		X	
4623 MLP	X				
4624 MLP	X	X		X	X
4626 MLP	X	X		X	
4627 MLP	X	X			
4628 MLP				X	
4630 MLP	X	X			
4632 MLP			X		
4633 MLP	X			X	

Synlophe: (studied in 1 male and 1 female, paratypes). In both sexes, cuticle bearing longitudinal, uninterrupted ridges appearing mainly on left side posterior to cephalic vesicle, up to about 100 μm posterior to oesophago-intestinal junction, disappearing just anterior to caudal bursa in male and posterior to vulva in female. Number of ridges: at level of oesophago-intestinal junction, 22 (11/11) in male and 25 (13/12) in female (Figs. 3 and 4), at mid-body, 25 (12/13) in male and 26 (12/14) in female (Figs. 5 and 6). In male, at 220 μm anterior to caudal bursa, 25 (13/12) and in female, just anterior to vulva, 24 (12/12) ridges (Figs. 7 and 8). At mid-body, ridges slightly unequal in size, with smaller ridges on ventral right quadrant. First left ridge ventral to axis of orientation larger than others (Figs. 5 and 6). Within distal third of body, ridges of equal size in both sexes. At mid-body, double axis of orientation of ridges; right axis inclined at 60° to sagittal axis and left axis at 75° in both sexes. In distal third of body length, most ridges orientated perpendicularly to body surface.

Holotype male: 3.70 mm long, 130 wide at mid-body, cephalic vesicle 65 long, 35 wide, nerve ring, excretory pore and deirids situated 140, 185 and 180 from apex respectively. Oesophagus 265 long (Fig. 1).

Caudal bursa asymmetrical, with hypertrophied right lobe (Fig. 9a). Prebursal papillae not observed. Right lobe: Pattern of type 2–3 with tendency towards type 2-2-1; rays 2 and 3 of similar length, divergent in V-formation; rays 3 arising more proximally than ray 6 from common trunk of rays 3 to 6; ray 4 slightly shorter than ray 5, both divergent at extremities. Left lobe: pattern of type 2-2-1; rays 2 and 3 of similar length, divergent in V-formation; ray 4 slightly shorter than ray 5, both divergent at extremities. Rays 8 arising asymmetrically from proximal third of dorsal ray, left ray 8 slightly longer and arising more proximally than right one. Dorsal ray divided at about mid-length into two branches (rays 9 and 10) (Fig. 9b). Genital cone 90 long by 80 wide at base, covered by a membrane, bearing a large papilla 0 on ventral lip and two small papillae 7 on dorsal lip (Fig. 10a,b). Spicules subequal, alate, 870 long, representing 23.5% of body length, ending in rounded tip (Fig. 11). Gubernaculum 40 long and 35 wide at base in ventral view (Fig. 10a).



Figs. 13–20. *Stilestrongylus catamarca* n. sp. 13. Female, anterior extremity, left lateral view. Scale bar: 13 — 50 μm. 14. Female, head, apical view. Scale bar: 14 — 10 μm. 15. Transverse section of body, at oesophago-intestinal junction, male. Abbreviations: r, right, v, ventral. Scale bar: 15 — 25 μm. 16. Transverse section of body, at oesophago-intestinal junction, female. Scale bar: 16 — 25 μm. 17. Transverse section of body, at mid-body, male at 51% of body length. Scale bar: 17 — 50 μm. 18. Transverse section of body, at mid-body, female, at 44% of body length. Scale bar: 18 — 50 μm. 19. Transverse section of body, male, at 84% of body length. Scale bar: 19 — 50 μm. 20. Transverse section of body, female, at 86% of body length. Scale bar: 20 — 50 μm.

Measurements (range and average) of 8 male paratypes: 3.35–4.00 (3.81) mm long, 130–160 (145) wide at mid-body. Cephalic vesicle 50–70 (65) long, 35–40 (37) wide. Nerve ring, excretory pore and deirids situated 120–155 (134), 160–240 (208) and 180–215 (200) (n=3) from apex, respectively. Oesophagus 260–350 (312) long. Spicules 900–970 (930) long, 22.8–26.3% of body length.

Allotype female: 5.00 mm long, 150 wide at mid-body. Cephalic vesicle 70 long, 40 wide. Nerve ring, excretory pore and deirids situated 180, 270 and 230 from apex, respectively. Oesophagus 340 long.

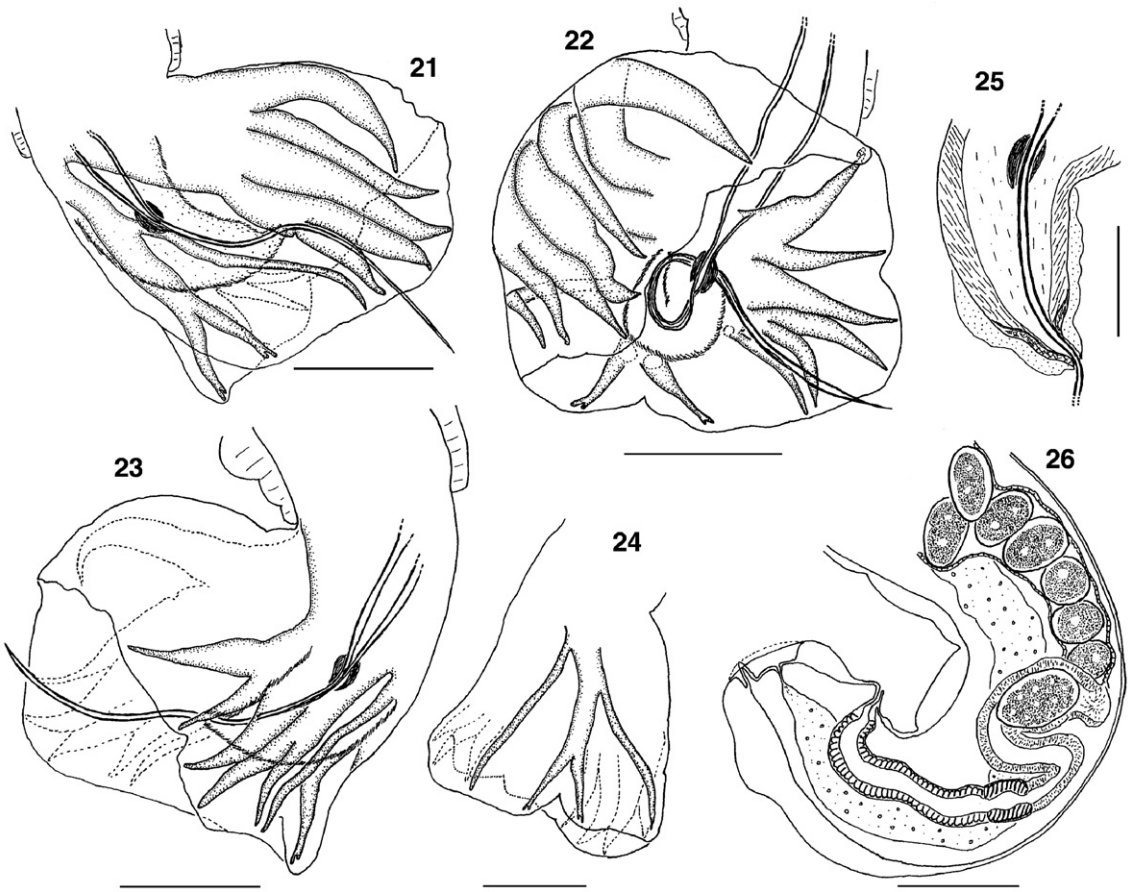
Monodelphic. Vulva situated 80 from caudal extremity. Vagina vera 30 long, vestibule 220, sphincter 50 long and 50 wide, infundibulum 180 long (Fig. 12). Infundibulum usually folded, proximal end not clearly observed. Uterus 880 long, 18% of body length, containing 17 embryonated eggs, 70–80 long and 30–45 wide. Tail 25 long. Distal end retracted to level of vulva (Fig. 12), resulting in terminal dilatation.

Measurements (range and average) of 5 female paratypes: 4.45–5.40 (4.88) mm long, 130–150 (143) wide at mid-body. Cephalic vesicle 60–70 (66) long, 30–40 (37) wide. Nerve ring, excretory pore and deirids situated 135–170 (146), 195–225 (215) and 185–230 (205) from apex, respectively. Oesophagus 310–400 (360) long. Vulva situated 60–85 (78) from caudal extremity. Vagina vera 25–30 (28) long, vestibule 200–225 (209), sphincter 45–50 (49) long, 45–50 (49) wide, infundibulum 180 (180) (n=2). Uterus 620–900 (720) long, 13–16% (14%) of body length. Number of eggs 18–27 (20), embryonated, 65–80 (74) long, 35–50 (43) wide. Tail 20–30 (23) long.

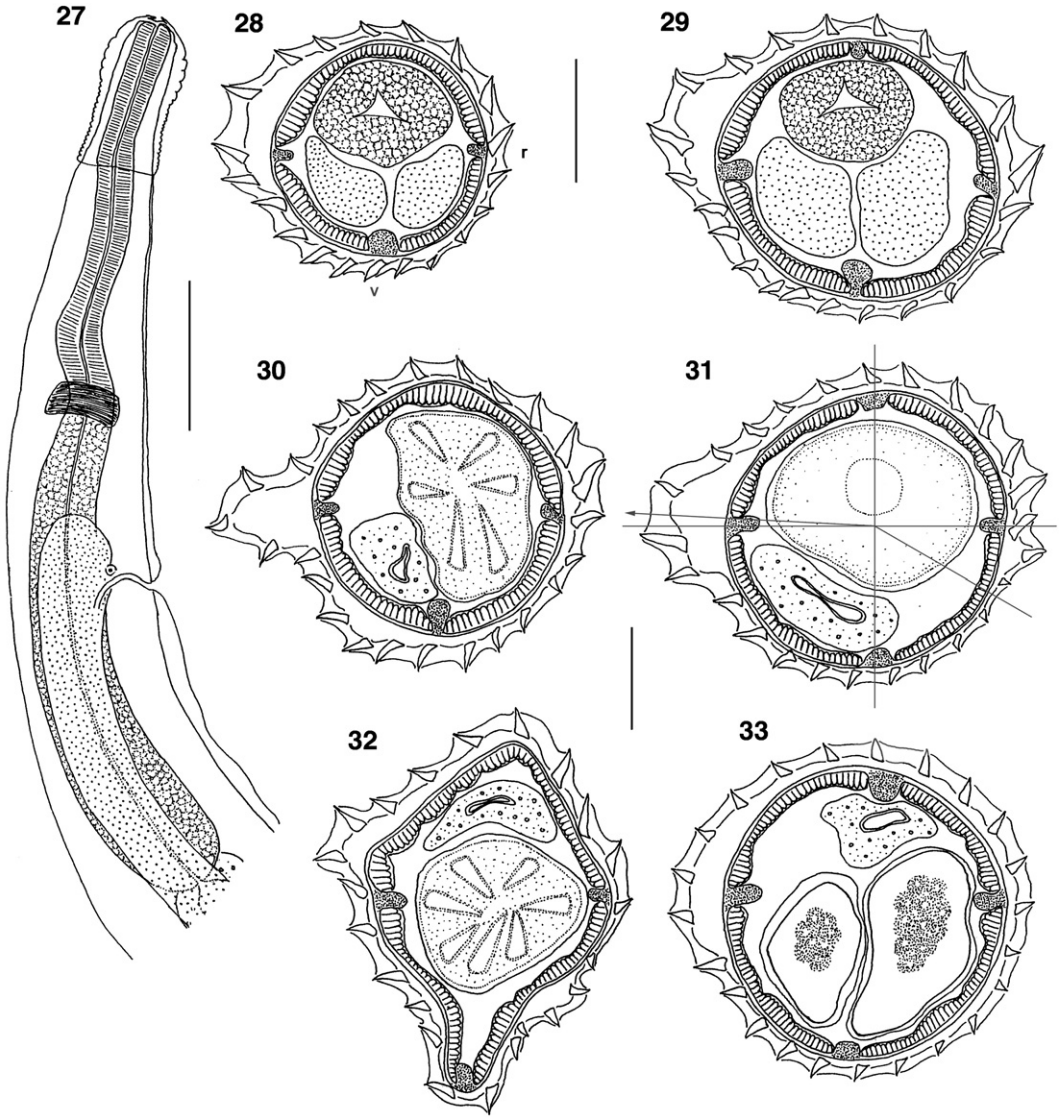
Diagnosis

Despite the difference in the size of the ridges, characteristic of the genus *Hassalstrongylus* Durette-Desset, 1971 (Nippostrongylinae), the number of ridges (more than 24 at mid-body), and especially the characters of the caudal bursa (asymmetrical, with a hypertrophied genital cone), place these specimens in the genus *Stilestrongylus*. This genus includes 20 Neotropical species, of which 19 are parasitic in Sigmodontinae and Neotominae, and one in Echymyidae.

Among the species of *Stilestrongylus*, our specimens share a pattern of type 2–3 on the right lobe of the caudal bursa and 2-2-1 on the left lobe with *Stilestrongylus stilesi* Freitas, Lent and Almeida 1937, a parasite of *Holochilus balnearum* from Argentina [10] and *Stilestrongylus moreli* Diaw, 1976, parasitic in *Auliscomys boliviensis* (=*Phyllotis boliviensis*) from Bolivia [11]. In addition, the three species have a similar dorsal lobe, with an asymmetrical origin of rays 8 from the dorsal ray. *S. stilesi* differs from our species by not rays 2 and 3 in a V-formation, i. e. parallel for nearly their entire length on the right



Figs. 21–26. *Stilestrongylus catamarca* n. sp. 21. Male, caudal bursa, right lobe, latero-dorsal view. Scale-bar: 21 — 100 μm. 22. Male, caudal bursa, right lobe, ventral view. Scale-bar: 22 — 100 μm. 23. Male, caudal bursa, left lobe, lateral view (right lobe in dotted lines). Scale-bar: 23 — 100 μm. 24. Male, caudal bursa, dorsal lobe. Scale-bar: 24 — 100 μm. 25. Male, caudal bursa, genital cone, ventro-lateral view. Scale-bar: 25 — 50 μm. 26. Female, posterior extremity, left lateral view. Scale-bar: 26 — 100 μm.



Figs. 27–33. *Stilestrongylus gracielae* n. sp. 27. Male, anterior extremity, right lateral view. Scale bar: 27 — 50 μm. 28. Transverse section of body, at oesophageal region, male. Abbreviations: r, right, v, ventral. Scale bar: 28 — 25 μm. 29. Transverse section of body, at oesophageal region, female. Scale bar: 29 — 25 μm. 30. Transverse section of body, at mid-body, male, at 57% of body length. Scale bar: 30 — 25 μm. 31. Transverse section of body, at mid-body, female, at 57% of body length. Scale bar: 31 — 25 μm. 32. Transverse section of body, male at 85% of body length. Scale bar: 32 — 25 μm. 33. Transverse section of body, female, at 88% of body length. Scale bar: 33 — 25 μm.

lobe and for the proximal half of their length on the left lobe; and by having left ray 4, longer than ray 5. *S. moreli*, the closest species, also has rays 2 and 3 in a V-formation, but differs from our specimens in having right rays 2 and 3, which form a common trunk, left ray 4 longer than ray 5, and by the shape of the female tail, which bears a mucron. We thus consider our specimens to belong to a new species we have named *Stilestrongylus andalgala* n. sp., after the type locality.

Stilestrongylus catamarca n. sp.

(Figs. 13–20 and 21 – 26)

Material studied:

Types: male holotype, female allotype CHMLP 4626/2a. Paratypes: 2 males, 7 females CHMLP 4626/2b; 4 females MNHN 482 MQ. Coparasites with *Stilestrongylus andalgala* n. sp. and *Lamanema chavezi* Becklund, 1963.

Type-host: Phyllotis sp. (*Ph. xanthopygus* (Waterhouse, 1837) or *Ph. osilae* Allen, 1901) (Rodentia, Sigmodontinae).

Site: Small intestine.

Type-locality: Andalgalá, (27°23′S, 66°15′W), 2600 m above sea level, Province of Catamarca, Argentina.

Other material studied: 2 males, 1 female CHMLP 4622/1; 1 male, 4 females CHMLP 4624/2; 1 male CHMLP 4627/2; 1 male MNHN 483 MQ. Same host and locality. For coparasitism: see Table 1.

Prevalence and intensity of infection: 23.5% of the hosts (4 out of 17) were infected with 1–15 (mean=4.5) specimens.

Description

General: Small nematodes, tightly coiled sinistrally in 3 to 4 spirals along ventral side. Excretory pore situated 66–76% of oesophageal length in males, 57–74% in females. Deirids at

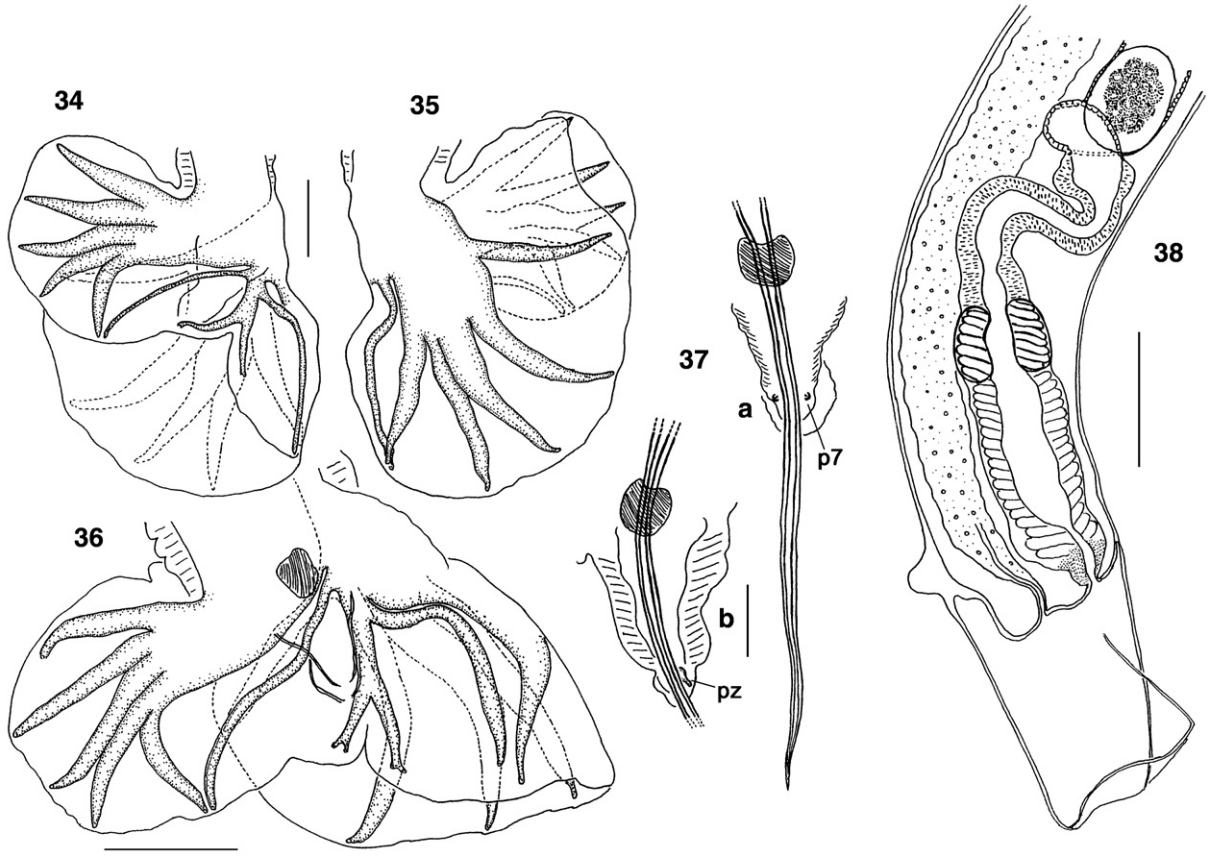
same level as excretory pore or slightly anterior or posterior to it (Fig. 13).

Head: Cephalic vesicle present. In apical view, triangular buccal opening surrounded by thin ring. Presence of two amphids, six interno-labial papillae, medio-laterals closer to each other than to laterals, four externo-labial papillae and four submedian cephalic papillae. Externo-labial and cephalic papillae connected to each other by weak arc-like cuticular structures (Fig. 14).

Synlophe: (studied in 2 males, voucher specimens and 2 female paratypes). In both sexes cuticle bearing longitudinal, uninterrupted ridges appearing mainly on left side posterior to cephalic vesicle, to oesophago-intestinal junction. Ridges disappearing just anterior to caudal bursa in male and just anterior to vulva in female. Number of ridges: 21 (8/13) in male, 21 (9/12) in female at level of oesophago-intestinal junction (Figs. 15 and 16), 25 (12/13) in male and 26 (12/14) in female at mid-body (Figs. 17 and 18), 24 (10/14) in male and 28 (13/15) in female within distal third of body length (Figs. 19 and 20). At mid-body, ridges slightly unequal in size, with those of ventral right quadrant smaller (Figs. 17 and 18). Within distal third of body length, ridges of equal size in both sexes. Axis of orientation of ridges directed from ventral right to dorsal left quadrant. At mid-body, in male, single axis of orientation inclined at about 67° to sagittal axis. In female, double axis of orientation: right axis inclined at 57° and left axis at 67° (Figs. 17 and 18). In distal third of body length, most ridges orientated perpendicularly to body surface in males and axis of orientation almost subfrontal in females.

Holotype male: 3.10 mm long, 110 wide at mid-body, cephalic vesicle 65 long, 30 wide. Nerve ring, excretory pore and deirids situated 160, 265 and 265 from apex respectively. Oesophagus 335 long.

Caudal bursa bell-shaped, asymmetrical, with hypertrophied right lobe (Figs. 21–23). Prebursal papillae not observed. Rays 2 hypertrophied, larger than rays 3. Right lobe: pattern of type 1–4 (rays 2 arising first from common trunk of rays 2 to 6); common trunk very long; rays 3 and 6 arising at same level, at distal quarter of common trunk; rays 4 and 5 of equivalent length and divergent at extremity (Figs. 21 and 22). Extremities of rays 3 to 6 approximately equidistant. Left lobe: pattern of type 2–3, with tendency towards 2-2-1; rays 2 and 3 in V-formation; rays 4 and 5 of equivalent length and divergent at distal third; ray 3 arising from common trunk more proximally than ray 6 (Figs. 22 and 23). Rays 8 thin, arising asymmetrically from dorsal ray, right ray 8 from proximal third and left ray 8 from base of dorsal ray. Dorsal ray divided at distal third into two branches, each branch divided into two subequal branches: external (rays 9) slightly longer than internal (rays 10) (Fig. 24). Genital cone well-developed, 120 long by 80 wide at base (Fig. 25). Papillae 0 and 7 not observed.



Figs. 34–38. *Stilestrongylus gracielae* n. sp. 34. Male, caudal bursa, left lobe, dorsal view (right rays in dotted lines). Scale bar: 34 — 50 μm. 35. Male, caudal bursa, right lobe, dorsal view (left ray in dotted lines). Scale bar: 35 — 50 μm. 36. Male, caudal bursa, dorsal and left lobe, dorsal view. Scale bar: 36 — 50 μm. 37. Male, caudal bursa, genital cone, a, dorsal lip, ventral view (ventral lip not figured), b, lateral view. Abbreviations: pz, papilla zero, p7, papillae 7. Scale bar: 37 — 25 μm. 38. Female, posterior extremity, right lateral view. Scale bar: 38 — 50 μm.

Thin, alate, subequal spicules, 700 long, 22.6% of body length, ending in sharp tip (Figs. 21–23). Gubernaculum 25 long, 15 wide at base in ventral view (Fig. 25).

Measurements of 2 male paratypes: 3.15, 2.95 mm long, 110, 110 wide at mid-body. Cephalic vesicle 50, 65 long, 30, 30 wide. Nerve ring, excretory pore and deirids 160, 150; 230, 230 and 225, 225 from apex respectively. Oesophagus 335, 315 long. Spicules 710, 730 long, 22.5% and 24.7%, of body length respectively.

Allotype female: 4.00 mm long, 110 wide at mid-body. Cephalic vesicle 60 long, 30 wide. Nerve ring, excretory pore and deirids 160, 235 and 225 from apex, respectively. Oesophagus 360 long (Fig. 13).

Monodelphic. Vulva situated 105 from caudal extremity. Vagina vera 22 long, vestibule 140, sphincter 35 long, 35 wide, infundibulum 200 long. Uterus 770 long, 19% of body length, containing 13 eggs at morula stage, 70–75 long and 38–40 wide. Distal end retracted to level of anus. Tail conical, 35 long, bearing mucron, 15 long (Fig. 26).

Measurements (range and average) of 10 female paratypes: 3.65–4.85 (4.17) mm long, 110–140 (124) wide at mid-body. Cephalic vesicle 60–70 (68) long, 30–40 (35) wide. Nerve ring, excretory pore and deirids situated 120–170 (147), 200–260 (227) and 190–255 (222) from apex respectively. Oesophagus 320–390 (353) long. Vulva 90–140 (116) from caudal extremity. Vagina vera 22–35 (27) long, vestibule 120–150 (135), sphincter 35–42 (39) long, 30–40 (38) wide, infundibulum 215–240 (226) long. Uterus 650–840 (749) long, 15–20 (18%) of body length, containing 11–18 (15) eggs, 55–80 long, 32–50 wide. Tail 25–40 (31), including mucron, 15–20 (16) long.

Diagnosis

For the same reasons as those discussed for *S. andalgala* n. sp. (see diagnosis above), these specimens are assigned to the genus *Stilestrongylus*. They can be easily distinguished from all other species in the genus by the hypertrophy of rays 2. Among the remaining species of *Stilestrongylus*, only *Stilestrongylus barusi* Durette Desset, 1971, parasitic in *Sigmodontomys alfari* (=*Nectomys alfari*) from Colombia, shares with the specimens described above a type 1–4 pattern on the right lobe and 2–3 on the left lobe [12]. However, *S. barusi* differs from the new species in having rays 2 shorter than rays 3, right ray 4 shorter than ray 5 and left ray 4 longer than ray 5. On the other hand, in *S. barusi*, the ratio of spicule length/body length is of 7.2% (vs. 22.6%) and the mucron on female tail is absent. We thus consider these specimens from *Phyllotis* sp. as belonging to a new species we have named *Stilestrongylus catamarca* n. sp. after the province of Catamarca where the hosts were collected.

Stilestrongylus gracielae n. sp.

(Figs. 27–33 and 34–38)

Material studied:

Types: male holotype, female allotype CHMLP 4632/1a. Paratypes: 2 males, 2 females CHMLP 4632/1b; 1 male, 1 female MNHN 484 MQ.

Type-host: Phyllotis sp. (*Ph. xanthopygus* (Waterhouse, 1837) or *Ph. osilae* Allen, 1901) (Rodentia, Sigmodontinae).

Site: Small intestine.

Type-locality: Andalgalá (27°23′S, 66°15′W), 2600 m above sea level, Province of Catamarca, Argentina.

Prevalence and intensity of infection: 1 of 17 hosts (5.9%) was infected with 8 specimens.

Description

General: Small nematodes, loosely coiled sinistrally along ventral side in both sexes. Excretory pore situated 49–56% of oesophageal length in males and 43–44% in females. Deirids at same level as excretory pore or slightly anterior to it (Fig. 27).

Head: Cephalic vesicle present. In apical view, triangular buccal opening surrounded by thin ring. Other cephalic structures difficult to observe.

Synlophe: (studied in 1 male and 1 female, paratypes). In both sexes, cuticle bearing longitudinal, uninterrupted ridges appearing mainly on left side posterior to cephalic vesicle, to oesophago-intestinal junction. Ridges disappearing just anterior to caudal bursa in male, continue to distal end in female. Number of ridges: 20 (9/11) in males, 22 (10/12) in females at oesophago-intestinal junction (Figs. 28 and 29), 25 (11/14) in both sexes at mid-body (Figs. 30 and 31), 22 (10/12) in male and 23 (10/13) in female within distal third of body length (Figs. 32 and 33). Ridges unequal in size, with those of ventral right quadrant slightly smaller. In females, first left ridge ventral to axis of orientation larger. Axis of orientation of ridges directed from ventral right to dorsal left quadrant. At mid-body, in female, double axis of orientation: right axis inclined at 60° to sagittal axis, left axis at 87° (Fig. 31). In male, inclination difficult to calculate due to the deformation of section (Fig. 30).

Holotype male: 2.60 mm long, 100 wide at mid-body, cephalic vesicle 50 long, 30 wide. Nerve ring, excretory pore and deirids situated 115, 170 and 165 from apex, respectively. Oesophagus 330 long (Fig. 27).

Caudal bursa asymmetrical, with hypertrophied right lobe. Pattern of type 1–4 (rays 2 arising first from common trunk of rays 2 to 6) (Figs. 34–36). Prebursal papillae not observed. Right lobe: all rays of equivalent length; long common trunk to rays 3 to 6; rays 3 and 6 arising at same level; rays 4 and 5 diverge at mid-length (Fig. 35). Left lobe: Same pattern as right lobe, with short common trunk 3–6 (Fig. 34). Rays 8 arising asymmetrically from dorsal ray, right ray 8 from proximal third and left one from base of dorsal ray (Fig. 36). Left ray 8 thinner than right ray. Dorsal ray divided at distal third into two branches, each branch divided into two subequal sub-branches: external (rays 9) slightly longer than internal (rays 10) (Fig. 36). Genital cone well-developed, covered by membrane, 60 long by 45 wide at base, bearing papillae 7 on dorsal lip (Fig. 37a) and single papilla 0 on ventral lip (Fig. 37b). Thin, alate, subequal spicules, 440 long, 16.9% of body length, ending in sharp tip (Fig. 37a). Gubernaculum 18 long, 18 wide at base in ventral view (Fig. 37a,b).

Measurements of 3 male paratypes: 2.35, 2.55, 2.25 mm long, 100, 100, 90 wide at mid-body. Cephalic vesicle 50, 55, 50 long, 28, 30, 30 wide. Nerve ring, excretory pore and deirids situated 100, 105, 125; –, 165, 185 and –, 155, 185 from apex respectively. Oesophagus 310, 335, 320 long. Spicules 440, 410, 435 long, 18.7, 16.1, 19.3% of body length respectively.

Allotype female: 3.2 mm long, 100 wide at mid-body. Cephalic vesicle 50 long, 30 wide. Nerve ring, excretory pore and deirids 115, 165 and 165 from apex respectively. Oesophagus 340 long.

Monodelphic. Vulva 40 from caudal extremity. Vagina vera 20 long, vestibule 65, sphincter 35 long, 40 wide, infundibulum not measured. Uterus 740 long, 23.1% of body length, containing 12 eggs at morula stage, 55–70 long and 30–40 wide. Distal end retracted. Tail rounded, 20 long (Fig. 38).

Measurements of 2 females and a female posterior extremity (paratypes): 3.50, 3.70 mm long, 90, 100 wide at mid-body. Cephalic vesicle 60, 60 long, 30, 35 wide. Nerve ring, excretory pore and deirids 100, 110; 150, 145 and 145, – from apex respectively. Oesophagus 340, 340 long. Vulva 50, 50, 40 from caudal extremity. Vagina vera 20, 25, 20 long, vestibule 75, 75, 70 long, sphincter 30, 40, 25 long, 40, 40, 35 wide, infundibulum 100, 140, 110 long. Uterus –, 570, 550 long, 15.4% ($n=1$) of body length, containing –, 18, 12 eggs 60–70 long, 35–45 wide. Tail 20, 20, 15 long.

Diagnosis

For the same reasons as those discussed for *S. andalgala* n. sp. and *S. catamarca* n. sp. (see above), these specimens are assigned to the genus *Stilestrongylus*. Among members of the genus, three species share, along with these specimens, an asymmetrical caudal bursa with a type 1–4 pattern on both lobes. These species are: *Stilestrongylus eta* (Travassos, 1937), parasitic in *Akodon* sp. from Brazil [13], *Stilestrongylus azarai* Durette-Desset and Sutton, 1985, parasitic in *Akodon azarae* and in *Graomys griseoflavus*, and *Stilestrongylus franciscanus* Digiani and Durette-Desset, 2003, also parasitic in *G. griseoflavus*, both from Argentina [2,14].

S. eta differs from the specimens described above by rays 4, 5 and 6 arising at same level from the common trunk on both lobes. *S. azarai* and *S. franciscanus* both have, as in our specimens, left rays 3 and 6 arising at the same level from a short common trunk of rays 3 to 6. However, they differ from the new species by their right lobes: in *S. azarai* rays 4, 5 and 6 arise at same level from their common trunk and in *S. franciscanus* right rays 4 and 5 diverge at their distal extremity. We thus consider the specimens described above as a new species we have named *Stilestrongylus gracielae* n. sp., dedicated to our colleague Dr. Graciela T. Navone, in recognition to her contributions to the knowledge of parasitic nematodes from Argentina.

Remarks

The genus *Stilestrongylus* was defined as having more than 24 cuticular ridges, small and subequal in size, a markedly asymmetrical caudal bursa and a hypertrophied genital cone, whereas the genus *Hassalstrongylus* was defined as having 19 to 24 cuticular ridges, unequal in size, a symmetrical caudal bursa and a genital cone not hypertrophied [15]. Among the Nippostrongylinae, the synlophe characters are usually the most reliable to attribute a species to a genus. However, since the definition of these genera, several species have been described and the differentiation of *Hassalstrongylus*/*Stilestrongylus* has become somewhat problematic following the description of several species in which the synlophes show characters of both genera. For such species, it is not possible to decide, based only on the synlophe, whether they belong to one genus or the other, and in most cases the generic attribution is based on the bursal characters, as in the species described in this work.

Among the species of *Stilestrongylus*, eight out of 23 (including the three new species described here) show characters of *Hassalstrongylus*. Six of these species (*S. valdivianus* Durette-Desset and Murúa 1977, *S. franciscanus*, *Stilestrongylus manni* Denké and Murúa, 1977, *S. andalgala* n. sp., *S. catamarca* n. sp., *S. gracielae* n. sp.) have synlophes with unequal cuticular ridges [2,16,17]. The other two species, *Stilestrongylus dessetae* Yoyotte-Vado, 1972 and *Stilestrongylus renaudae* Durette-Desset, 1971 have subsymmetrical caudal bursae [12,18].

Among the species of *Hassalstrongylus*, two of 15 (*Hassalstrongylus chabaudi* Diaw, 1976 and *Hassalstrongylus dessetae* Pinto, 1978 have synlophes of the *Stilestrongylus*-type, but the bursal characters correspond with *Hassalstrongylus* [11,19]. One species, *Hassalstrongylus bocqueti* Denké, 1977 has a synlophe of the *Hassalstrongylus*-type, but the bursal characters correspond with *Stilestrongylus* [20].

It appears that the delimitation between genera is increasingly uncertain and that characters such as the number of ridges and their difference in size may be no longer useful in the generic attribution. Until now, for most species, the bursal characters have been more consistent. A detailed study of all species described in both genera should provide new criteria for generic delimitation. With this aim, a careful analysis of all Neotropical Nippostrongylinae is needed to improve our understanding of the relationships among different species and genera as currently defined.

Lamanema chavezi Becklund, 1963.

Material studied: 1 female CHMLP 4622/2; 1 male CHMLP 4624/3; 1 female CHMLP 4626/3; 1 male, 1 female CHMLP 4628/1; 1 male CHMLP 4633/2. For coparasitism: see Table 1.

Host: *Phyllotis* sp. (*Ph. xanthopygus* (Waterhouse, 1837) or *Ph. osilae* Allen, 1901) (Rodentia, Sigmodontinae).

Site: Small intestine.

Locality: Andalgalá (27°23′S, 66°15′W), 2600 m above sea level, Province of Catamarca, Argentina.

Prevalence and intensity of infection: 29.4% of the hosts (5 out of 17) were infected, harbouring 1–2 worms.

Remarks

Lamanema chavezi Becklund, 1963 (Molineoidea, Molineinae) was described from males, parasitic in South American camelids [21]. Since then, the species has been reported repeatedly from its typical hosts, i. e. llamas, alpacas and vicuñas [22–25]. The female of the species was described later on specimens parasitic in *Lagidium viscacia* (Rodentia, Chinchillidae) in Argentina, providing the first report of the species parasitizing a non-camelid host [26]. The males found in *Phyllotis* sp. correspond morphologically with *L. chavezi*; however, the females show some differences to those described Sutton and Durette-Desset [26], especially in the number of ridges of the synlophe: 32 in the females from *L. viscacia* and 43 in those from *Phyllotis* sp., for a similar body size. This finding of *Lamanema* in a new rodent host is interesting and further detailed studies are needed on material from the different hosts. Such studies will contribute to the knowledge on the infraspecific variability of *L. chavezi* and the taxonomy of the genus, currently considered monotypic.

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