REDESCRIPTION OF *TRICHURIS LAEVITESTIS* (NEMATODA: TRICHURIDAE) FROM *AKODON AZARAE* AND *SCAPTEROMYS AQUATICUS* (SIGMODONTINAE: CRICETIDAE) IN BUENOS AIRES PROVINCE, ARGENTINA

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ABSTRACT: *Trichuris* spp. have a cosmopolitan distribution; the species are typically identified by features related to the reproductive system. *Trichuris laevitestis* was described on the basis of specimens collected from rodents captured in Punta Lara, Buenos Aires Province, Argentina. Here, *T. laevitestis* is redescribed considering new and relevant morphological features of diagnostic importance such as arrangement of spines on the spicular sheath, spicule length, length and shape of proximal cloacal tube, paracloacal papillae, features of the vulva, and ratios between different features. *Akodon azarae* and *Scapteromys aquaticus* specimens captured in the Rio de la Plata and Paraná Guazú River, and at Cerro de la Gloria, Buenos Aires Province, Argentina, were examined. The bacillary band of *T. laevitestis* is described, and several morphological details of this species are illustrated and recorded by scanning electron microscopy for the first time. The redescription of *T. laevitestis* confirms its identity as a valid species. In addition, the present study extends the geographical distribution of the species.

Species of *Trichuris* Roederer, 1761 (Nematoda: Trichuridae) have a cosmopolitan distribution (Cafrune et al., 1999). The identification of different *Trichuris* species is based on features related to the reproductive system (Chandler, 1930; Knight, 1984; Babero and Murua, 1990; Suriano and Navone, 1994; Tenora et al., 1997; Robles et al., 2006). Recent studies have used scanning electron microscopy (SEM) as a diagnostic complement (Kikuchi, 1974a, 1974b; Tenora et al., 1993; Lanfredi et al., 1995). However, some species of *Trichuris* were differentiated mainly on the basis of their host identity (Beer, 1976). Consequently, the ranges of some morphometric features overlap among different population samples (Spakulová, 1994); thus, it is probable that many *Trichuris* species were erroneously identified, and, as a result, the same species were classified under different names (synonyms), and different species were referred to with the same name (homonyms).

Suriano and Navone (1994) described *Trichuris laevitestis* from *Akodon azarae* Fisher, 1829 and *Scapteromys aquaticus* Thomas, 1920, 2 species of sigmodontine rodents abundant in the gallery forest of Río de la Plata, Buenos Aires Province, Argentina (Suriano and Navone, 1994).

The aim of the present article is to redescribe *T. levitestis* on the basis of new specimens recovered from *A. azarae* and *S. aquaticus* captured at different localities of Buenos Aires Province. Moreover, this report extends the geographical distribution of the species.

MATERIALS AND METHODS

The rodents examined were captured in the followings localities: wetlands of Rio de la Plata: 115 *S. aquaticus* with 42 from La Balandra, 39 from Los Talas, and 34 from Palo Blanco (Partido de Berisso, 34°56′S, 57°44′W); also included were 16 *Akodon azarae* with 9 from La Balandra (Partido de Berisso) and 7 from Punta Lara (Partido de Ensenada, 34°47′S, 58°01′W). Finally, in the wetlands of the Paraná Guazú River, there were 35 *A. azarae* from Reserva de Otamendi (Partido de Campana, 34°09′S, 58°57′W) and 30 *A. azarae* from Cerro de la Gloria (Partido de Castelli, 36°06′S, 57°46′W).

The viscera were fixed in 10% formalin and examined in the laboratory. The nematodes were collected from the caeca and preserved in 70% ethanol. The worms were cleared in lactophenol and studied under light microscope. Drawings were made with the aid of a drawing tube. Some specimens were dried using the critical point method, examined under SEM (Jeol 6360 LV, Jeol, Tokyo, Japan), and photographed.

Some authors use different terms to refer to the same structure of the male reproductive system, resulting in confusing terminology. To avoid this confusion, we follow the terminology summarized by Robles et al. (2006). Measurements are given in millimeters (mm); range is followed by mean and standard deviation in parentheses.

REDESCRIPTION

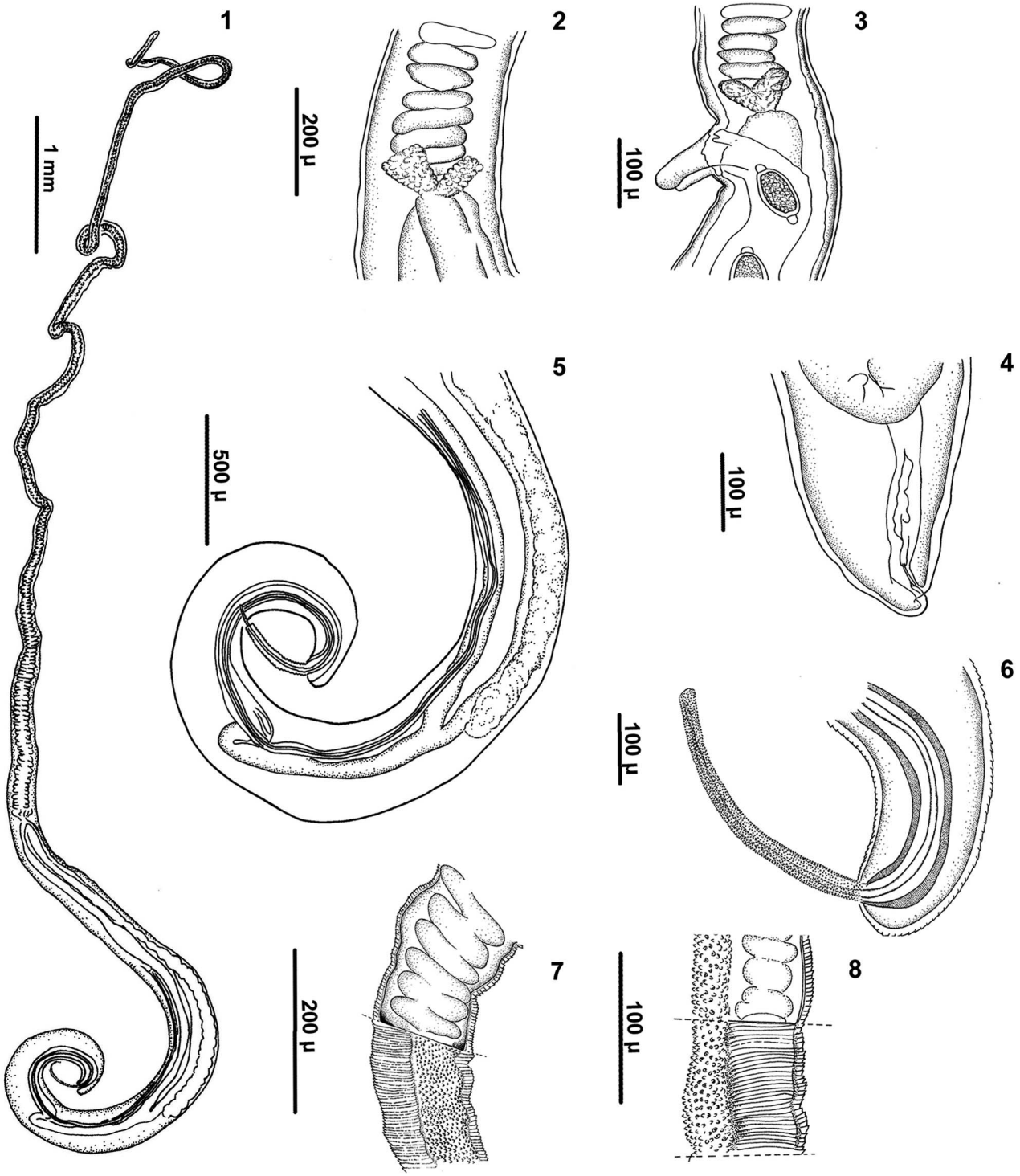
Trichuris laevitestis Suriano and Navone, 1994

(Figs. 1–18)

General: Cuticle with fine transversal striation; anterior part of body long, narrow, tapered, and whiplike. Posterior part of body broad and handlelike (Fig. 1). Stichosome with 1 row of stichocytes, and 1 pair of conspicuous cells at esophagus–intestinal junction level. Female with protrusive vulva located at esophagus–intestinal junction level, or very close to it (Figs. 2, 3), anus subterminal at end of body (Figs. 4, 9). Male with proximal cloacal tube ''U'' or ''8'' shaped, spicular tube present (Fig. 5), spicular sheath with spines uniformly distributed from proximal to distal portion, length of spiny spicular sheath varies according to degree of evagination (Figs. 6, 11, 12, 13), 1 pair of paracloacal papillae (Fig. 10). Testis ends near final third of distal cloacal tube, showing different degree of convolutions. Bacillary band 5.00–7.08 (6.23 ± 1.09) in length, located at middle region with cuticular inflations and bacillary glands (Figs. 7, 8). The bacillary band is 0.15–0.33 (0.24 ± 0.09) from anterior extremity of body and runs at the body width region of 0.078–0.16 (0.10 ± 0.03). With SEM, the cuticular inflations appear bordering the bacillary band (Fig. 16) and bacillary glands are abundant (Figs. 17, 18). The cuticle around the vulvar aperture shows a transversally striated pattern (Fig. 14).

Male (37 specimens): Body length 13–25.2 (17.25 ± 4.25). Anterior portion of body 7.8–14.88 (9.99 ± 2.64) long. Thick portion of body 4–11.31 (7.69 ± 2.24) long (Fig. 1). Anterior body width 0.039–0.19 (0.08 ± 0.03), maximum posterior body width 0.17–0.39 (0.29 ± 0.05), width at esophagus–intestinal junction level 0.1–0.25 (0.17 ± 0.04) (Fig. 2). Total length of esophagus 7.9–14.88 (10.06 ± 2.74), muscular portion 0.38–0.9 (0.6 ± 0.18) long, stichosome portion 7.02–14.18 (9.49 ± 2.7) long. Spicule length 2.73–6.8 (4.5 ± 1.38) (Fig. 5). Spicular sheath densely spinose, 1.02–1.96 (1.44 ± 0.37) long (Figs. 6, 11, 12, 13). Proximal cloacal tube 0.84–1.8 (1.33 ± 0.33) long, distal cloacal tube 0.52–2.25 (1.14 ± 0.44) long (Fig. 5). Ratio between total body length and posterior portion length 2.02–2.86 (2.34 ± 0.26). Ratio between total body length and spicule length 3.23–6.0 (4.60 ± 0.90). Ratio between posterior portion length and spicule length 1.26–2.69 (1.76 ± 0.35).

Female (30 specimens): Body length 13.45–27.56 (20.88 ± 4.29). Anterior portion of body 8.19–16.77 (11.57 ± 2.59) long. Thick portion

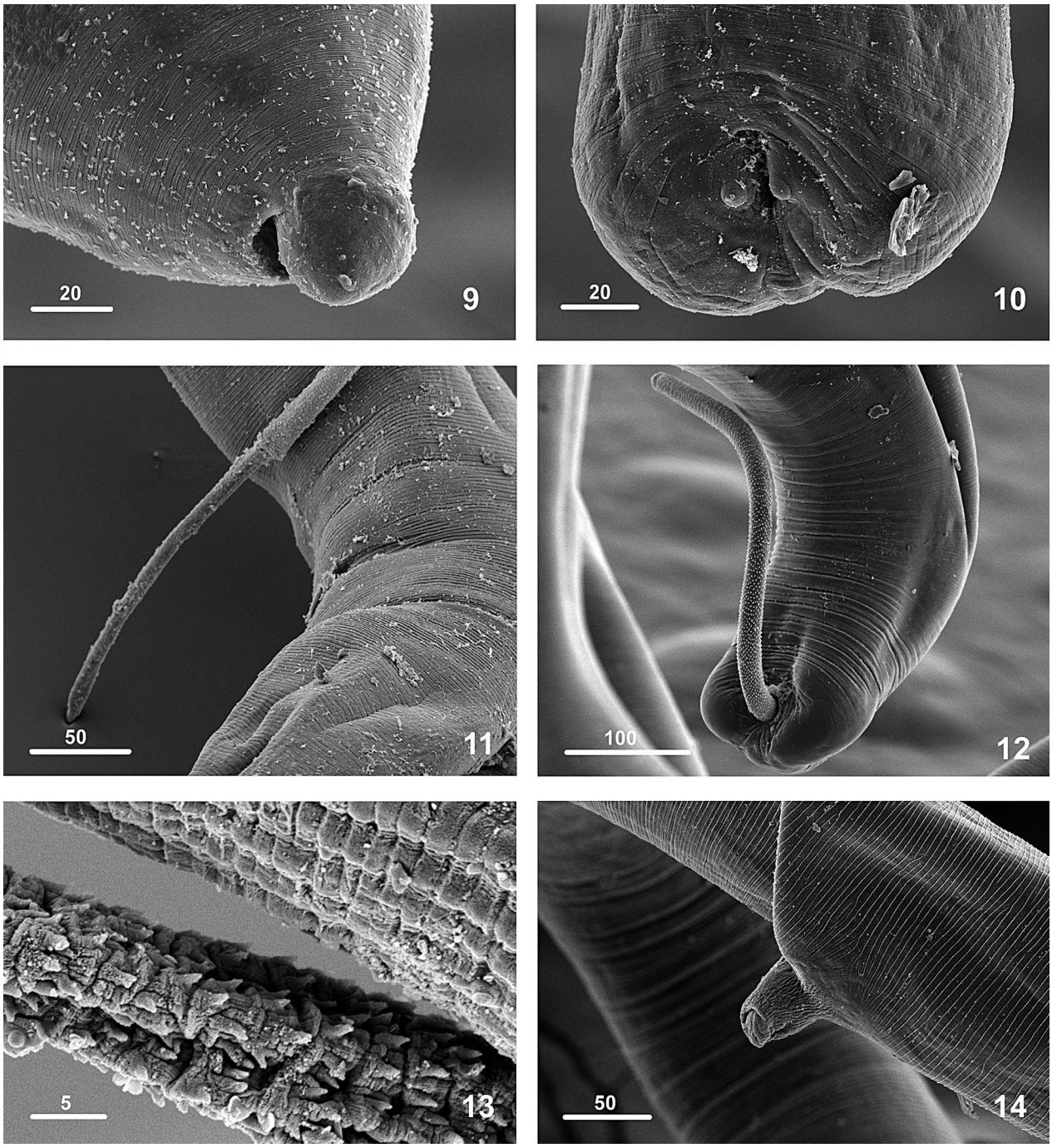


FIGURES 1–8. *Trichuris laevitestis*. (**1**) Complete male specimen. (**2**) Esophagus–intestinal junction and proximal portion of testis. (**3**) Esophagus–intestinal junction and vulva. (**4**) Female posterior end, lateral view. (**5**) Male, detail of the posterior extremity, lateral view. (**6**) Posterior end, spiny spicular sheath and spicule, lateral view. (**7**) Bacillary band, middle region view. (**8**) Bacillary band, lateral view.

of body 6.24–13.06 (9.19 ± 1.89) long. Anterior body width 0.039–0.14 (0.07 ± 0.02), maximum posterior body width 0.25–0.4 (0.33 ± 0.04), width at esophagus–intestinal junction 0.1–0.26 (0.19 ± 0.04) (Fig. 3). Total length of esophagus 8.19–16.76 (11.59 ± 2.74), muscular portion 0.57–0.8 (0.65 ± 0.09) long, stichosome portion 7.62–16.03 (10.94 ± 2.70) long. Distance between esophagus–intestinal junction and vulva 0–0.18 (0.08 ± 0.15). Ratio between total body length and posterior portion length 1.95–2.55 (2.27 ± 0.16). Eggs with oval flat and pugs, 0.066–0.08 × 0.027–0.04 (Figs. 3, 15).

Taxonomic summary

Hosts: Akodon azarae Fisher, 1829 and *Scapteromys aquaticus* Thomas, 1920. Voucher specimens deposited in the Colección de Mas-



FIGURES 9–18. Scanning electron micrographs of *Trichuris laevitestis*. (**9**) Female, posterior end, lateral view. (**10**) Male, posterior end, detail of paracloacal papillae. (**11**) Detail of the distal portion of spiny spicular sheath, similar size and morphology of spines, and spicule. (**12**) Detail of the proximal portion of spiny spicular sheath. (**13**) Detail of the spines of distal spicular sheath, lateral view. (**14**) Female, detail of the protrusive vulva, lateral view. (**15**) Eggs. (**16**) Detail of the cuticular inflations bordering the bacillar band. (**17**) Bacillary band, middle region view. (**18**) Detail of bacillary glands and transversal striation.

tozoología del Museo de la Plata, Buenos Aires, Argentina, MLP 08.IV.97.7, MLP 08.IV.97.89, MLP 08.IV.97.89.

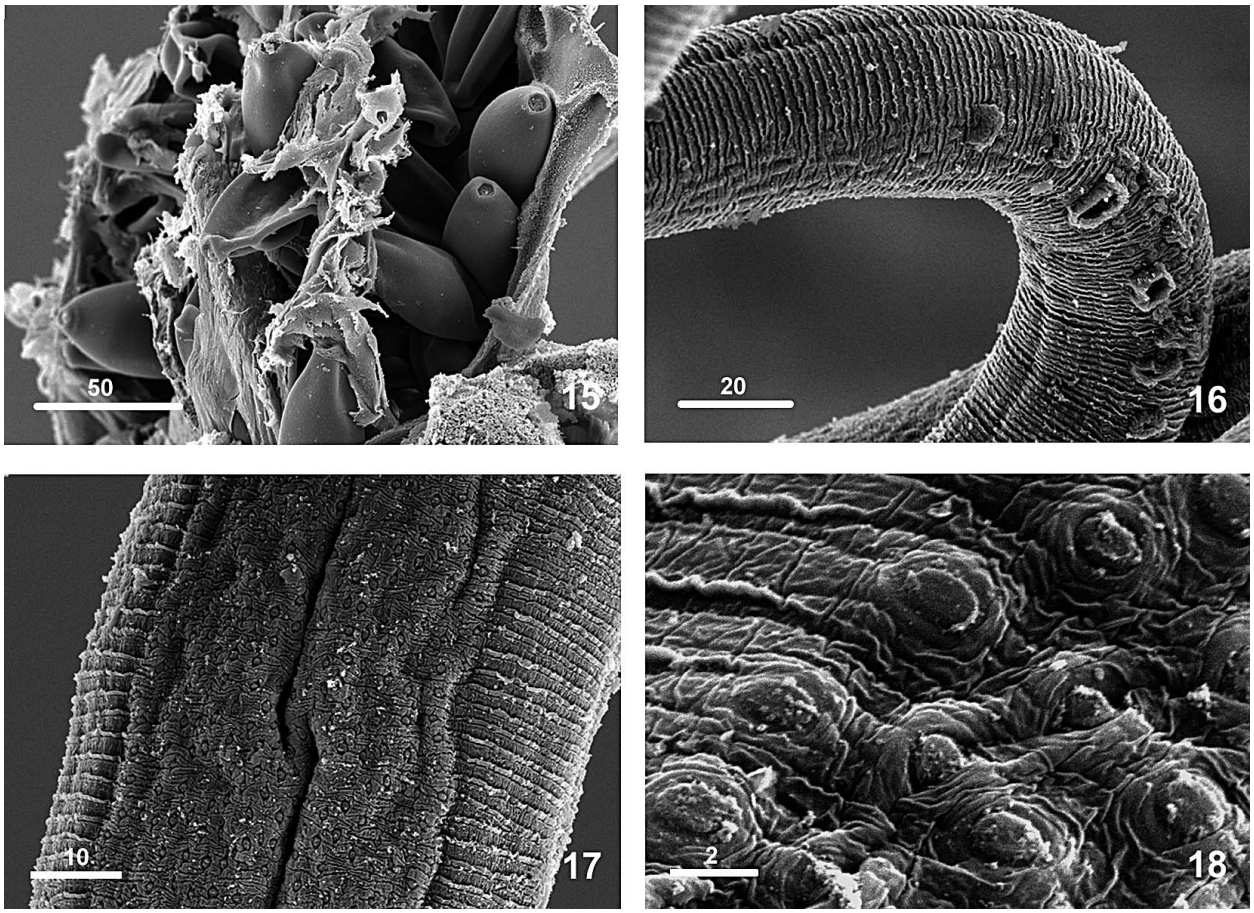
Additional localities: La Balandra, Los Talas, Palo Blanco, Punta Lara, Reserva de Otamendi, and Cerro de la Gloria (Buenos Aires Province, Argentina).

Site of infection: Caecum.

Specimens: Male paratypes (n = 16) and female paratypes (n = 13) deposited in the Colección Helmintologica del Museo de La Plata, Buenos Aires, Argentina, CHMLP (5545, 5546, 5547, 5548, 5549, 5550, 5551).

Remarks

Eleven *Trichuris* species are parasites of Cricetidae, Octodontidae, Dasyproctidae, and Myocastoridae rodents in South America. *Trichuris laevitestis* can be differentiated mainly by the absence of spicular tube



FIGURES 9–18. Continued.

(the spicule lies entirely within the distal cloacal tube) from the following 9 species: *T. gracilis* (Rudolphi, 1819); *T. myocastoris* Enigk, 1933; *T. bradleyi* Babero, Cattan and Cabello, 1975; *T. chilensis* Babero, Cattan and Cabello, 1976; *T. robusti* Babero and Murua, 1990; *T. travassosi* Correa Gomes, Lanfredi, Pinto and Souza, 1992; *T. bursacaudata* Suriano and Navone, 1994, *T. pampeana* Suriano and Navone, 1994; and *T. pardinasi* Robles, Navone and Notarnicola, 2006. Moreover, *T. laevitestis* also can be distinguished from the above-mentioned species by the arrangement of spines on the spicular sheath, the spicule length, the absence of the accessory caudal structure (pseudobursa or bulb of the spicular sheath), the shape of the proximal cloacal tube, and features of the vulva (Cameron and Reesal, 1951; Babero et al., 1975, 1976; Babero and Murua, 1980; Correa Gomes et al., 1992; Suriano and Navone, 1994; Vicente et al., 1997; Rossin and Malizia, 2005; Robles et al., 2006).

Trichuris laevitestis Suriano and Navone, 1994 resembles *T. fulvi* Babero and Murua, 1987 by the presence of spicular tube; however, the latter species has a nonprotrusive vulva (Babero and Murua, 1987; Suriano and Navone, 1994).

The comparison between length of the bacillary bands and the size, shape, and distribution of the bacillary glands as well as their number with respect to the tranversal cuticular striations showed no differences between *T. myocastoris*, *T. travassosi*, *T. pampeana*, and *T. laevitestis*. However, the bacillary band of *T. laevitestis* begins posteriorly to that reported for *T. myocastoris*, *T. travassosi*, and *T. padinasi* (0.15–0.33 vs. 0.075, 0.070–0.098, and 0.06–0.09, respectively).

DISCUSSION

The redescription of *T. laevitestis* was performed on the basis of a large number of specimens from different localities. Using light microscopy, the bacillary band can be differentiated from the remaining transversal striated cuticle (Wright, 1975). However, Suriano and Navone (1994) did not provide a description of this structure. In the present article, we photographed the bacillary band of *T. laevitestis* for the first time by using SEM; morphological details of this structure could be clearly observed and are described here. This is an important contribution, because the bacillary band is often covered by remains of host tissues, and the cuticular inflation is not always easily observed by SEM. Previously, the bacillary band was only found and studied in 4 of the 11 *Trichuris* species parasitic of rodents (Correa Gomes et al., 1992; Lanfredi et al., 1995; Rossin and Malizia, 2005; Robles et al., 2006). The bacillary band offers several features for observation, such as the length of the band; size, shape, and distribution of the bacillary glands and their number with respect to the transversal cuticular striations; and the number and disposition of cuticular inflations. Some authors consider these features of taxonomic importance for the specific differentiation (Correa Gomes et al., 1992), whereas other authors treat them as complementary (Bird and Bird, 1991). In this study, the bacillary bands of *T. laevitestis*, *T. myocastoris*, *T. travassosi*, *T. pampeana*, and *T. pardinasi* did not show large differences. However, because the bacillary bands are not known for all *Trichuris* species, we think that the importance of this structure will be assessed when new studies with detailed descriptions, illustrations, and photographs are provided.

In the present article, the stichosome, the bacillary band, and the posterior extremity of males were illustrated. We present details that were not supplied in the original description, mainly those referred to the following structures: rows of stichocytes, cells at esophagus–intestinal junction level, bacillary glands, spicule, spicular tube, and proximal and distal cloacal tube. Additionally, some of the above-mentioned structures and other structures were observed with SEM.

In addition to their identical morphological features, the morphometric ranges of the worm populations sampled from *A. azarae* and *S. aquaticus* overlap. In contrast, despite the great similarity between the specimens of *T. laevitestis* studied here and those described by Suriano and Navone (1994), some minor morphometric discrepancies were found, such as total esophagus length in males (7.9–14.88 vs. 10.4–12.1), spicule length (2.58–6.8 vs. 3.00–3.65), proximal cloacal tube length (0.84–1.8 vs. 0.9–1.2), distal cloacal tube length (0.52–2.25 vs. 0.65–1.2), and distance between esophagus–intestinal junction and vulva (0–0.18 vs. 0.10–0.20). These differences could be related to the different sample sizes of worms and hosts that were, in this case, larger than in the original description, and also to population differences, given that the specimens come from different localities.

The present redescription confirms the identity of *T. laevitestis* as a valid species. New morphological and morphometric data are useful for clearer differentiation of this species from others of the genus. *Trichuris laevitestis* was originally described for Punta Lara, but the present report extends its distribution with new records from other localities in Buenos Aires Province.

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