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A NEW MOLINEID (NEMATODA: TRICHOSTRONGYLINA) PARASITE OF *DASYPUS HYBRIDUS* (XENARTHRA: DASYPODIDAE) FROM ARGENTINA

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ABSTRACT: *Delicata abbai* n. sp. collected from the small intestine of the southern long-nosed armadillo, *Dasyopus hybridus*, from Argentina is herein described. This new species is characterized by vulvar opening within second half of body length, female tail conical, ending bluntly with a terminal spine, complex spicules, presence of a bursal membrane supported by 2 small rays, and a synlophes with bilateral symmetry and 26 cuticular ridges. By the morphology of the caudal bursa, caudal end of female, and shape of spicules, the new species resembles *Delicata cameroni* Travassos, 1935 and *Delicata variabilis* Travassos, 1935. However, it differs from *D. cameroni* by having rays 5 and 6 diverging more proximally, rays 8 shorter than the dorsal ray, and spicules with a different shape. *Delicata abbai* n. sp. is distinguished from *D. variabilis* mainly by the spicules, which have a different shape and proportion of their constitutive parts. This is the first report of a species of *Delicata* in Argentina.

Dasyopus hybridus (Desmarest, 1804) (southern long-nosed armadillo) is distributed in Argentina, Uruguay, Paraguay, and southern Brazil (Abba and Superina, 2010). It is typically found in the grasslands and pampas of northern and central Argentina. It is also present, but less common, in woodland and forest habitats, and can be found in some degraded habitats such as arable land, pastures, and plantations (Abba and Cassini, 2008; Abba et al., 2012). A few species of nematodes have been found in this host, i.e., *Delicata cameroni* Travassos, 1935, *Macielia macieli* (Travassos, 1915), and *Moennigia lutzi* (Travassos, 1935) (Molineidae) (Vicente et al., 1997); these species were reported from Brazil. In Argentina, *Aspidodera fasciata* (Schneider, 1866) (Aspidoderidae), *Mazzia bialata* Chabaud, Navone and Bain, 1983 (Spirocercidae), and *Pterygodermatites* (*P.*) *chaetophracti* Navone and Lombardero, 1980 (Rictulariidae) were found in hosts collected in Buenos Aires and Corrientes Provinces (Navone, 1990).

As part of a proposed investigation on the diversity of helminths in some species of Dasypodidae, we observed several specimens of a species belonging to *Delicata* Travassos, 1935 in *D. hybridus* from Buenos Aires Province, Argentina. *Delicata* (Molineidae) includes 11 species distributed in the Neotropical region; of these species, 6 parasitize dasypodids from Brazil (Travassos, 1937), and 5 are known from *Tamandua tetradactyla* (L.) (Myrmecophagidae) in Trinidad (Cameron, 1939) and Brazil (Durette-Desset et al., 1977). Comparison with the known species showed that the specimens found in *D. hybridus* represent an undescribed species. The aim of the present study is to describe this new species of *Delicata*.

MATERIALS AND METHODS

Ten specimens of *D. hybridus* were collected from the localities of Bolívar, Castelli, General Pinto, Magdalena, Pehuajó, and Pellegrini situated in the northeast and center of Buenos Aires Province. The digestive tracts of host specimens were fixed in a 10% formaldehyde solution and dissected in the laboratory. Nematodes found were preserved in 70% ethanol, cleared in lactophenol, mounted on a slide under a cover slip, and examined using a compound microscope. Cross sections of the head of both males and females were made to obtain en face views. The synlophes was studied by the method of Durette-Desset (1985), and the caudal bursa was described in accordance with Durette-Desset and Digiani (2012). Drawings were made with the use of an Olympus BX 51

and Leitz Laborlux 12 microscopes, both equipped with drawing tubes. Measurements are given in micrometers, unless otherwise stated, with those of the types, followed by those of the paratypes. These latter are expressed by range values in parentheses followed by the mean in square brackets. Nematodes were deposited in the Colección de Helmintos Museo de La Plata (CHMLP), and hosts in the Colección de Mastozoología Museo de La Plata (MLP), La Plata, Buenos Aires, Argentina.

DESCRIPTION

Delicata abbai n. sp.

(Figs. 1–13)

General diagnosis: Small nematodes, uncoiled. Cephalic vesicle present. Excretory pore situated between 58 and 90% of esophagus length (Fig. 1). Deirids situated anteriorly to excretory pore. In apical view, head possessed rounded oral opening surrounded by thin ring; 2 amphids, 6 externo-labial papillae observed (Fig. 2).

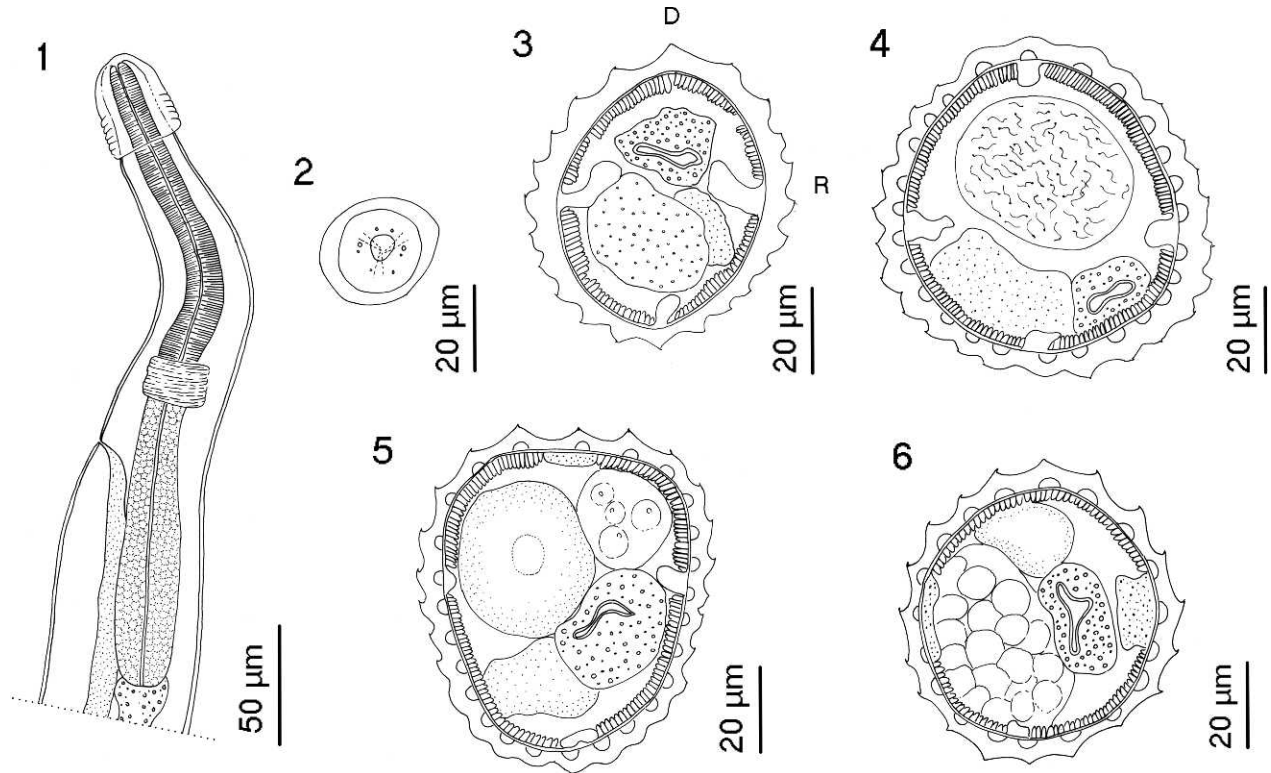
Synlophes (studied in 1 male and 2 female paratypes): In both sexes, body bearing continuous cuticular ridges with broad cuticular support, appearing just posterior to cephalic vesicle and extending just anterior to caudal bursa in males and to caudal extremity in females. Synlophes with bilateral symmetry determined by number, size, and orientation of ridges. Number of ridges in both sexes 22 at level of distal esophagus (Fig. 3), and 26 at midbody and within posterior third of body length (Figs. 4, 5). In females, number of ridges decreased gradually from ovjector level (Fig. 6), accompanying decreasing body diameter. Ridges subequal in size, with slight ventral–dorsal orientation. Axis of orientation of the ridges coincident with sagittal axis. In females, no modified ridges at ovjector level.

Males (based on holotype and 9 paratypes unless otherwise indicated): Body length 3.05 (2.47–3.56) [2.97] mm, width at midbody 80 (65–90) [78]. Cephalic vesicle 38 (36–45) [41] long and 31 (27–35) [31] wide. Nerve ring, deirids, and excretory pore situated at 140 (90–160) [133], 155 (103–165) [142] (n = 7), and 190 (140–210) [175] (n = 7) respectively, from apex. Esophagus 268 (230–280) [259] long. Caudal bursa subsymmetrical, with dorsal lobe distinct, with pattern of type 2-1-2. Lateral and dorsal lobes with transversal striation. Prebursal papillae conspicuous, pedunculated. Rays 2 and 3 joined for about half of their length, with distal extremities directed anteriorly, approaching bursal margin. Rays 4, 5, and 6 sharing common trunk, divergence of rays 5–6 slightly distal to that of rays 4–5 on the right lobe, at same level on the left lobe. Ray 4 straight and short, not reaching bursal margin. Rays 5 and 6 forceps-shaped, both directed posteriorly, with distal extremity of rays 6 recurrent, convergent with extremities of rays 5 (Fig. 7). Rays 8 thick and blunt, arising from base of common trunk of rays 2–6, reaching same level at distal end of dorsal ray, not reaching bursal margin. Dorsal ray bifurcated at distal third into 2 branches, each branch divided into 3 small subbranches (rays 9, 10, and phasmids of similar size); rays 9 arising first, rays 10 and phasmids sharing a small trunk. Genital cone well developed, nearly spherical, projected in bilobed membrane. Membrane supported by pair of small rays trifurcated distally, in which central projections bear paired papillae 7 (Fig. 8). Papilla zero not seen. Spicules complex, 56 (45–60) [51] long, handle distinct from

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FIGURES 1–6. *Delicata abbai* n. sp. (1) Female, anterior extremity, left lateral view. (2) Female, apical view. (3–6) Transverse sections of body: (3) at level of distal esophagus, (4, 5) at midbody: (4) male, (5) female. (6) Female at level of ovijector. Abbreviations: D, dorsal side; R, right side. Sections are oriented as in 3.

lamina (Fig. 9). Distal third tapering, curved toward median line (Fig. 10). Gubernaculum simple, poorly sclerotized, not always visible, 34 (35–50) [43] (n = 6) long and 6 wide (Fig. 11).

Females (based on allotype and 9 paratypes): Body length 4.00 (3.08–4.90) [3.70] mm, width at midbody 70 (70–102) [87] (n = 8). Cephalic vesicle 45 (37–47) [41] long and 30 (25–35) [31] (n = 8) wide. Nerve ring, deirids and excretory pore situated at 97 (110–168) [148], 110 (117–215) [171] (n = 8) and 130 (170–285) [228] (n = 6), respectively, from apex. Esophagus 262 (264–313) [289] (n = 9) long. Vulva situated at 1.025 (730–1,170) [975] mm from posterior extremity. Vagina vera 21 (10–25) [16] (n = 8) long. Anterior branch of ovijector with vestibule 47 (39–60) [51] long, sphincter 20 (19–25) [22] long and 22 (25–31) [28] wide, infundibulum 45 (35–55) [41] long. Posterior branch of ovijector with vestibule 50 (37–55) [48] long, sphincter 20 (18–26) [22] long and 25 (20–30) [26] wide, infundibulum 40 (30–52) [40] long (Fig. 12). Anterior uterine branch 552 (325–650) [482] long with 9 (5–10) eggs. Posterior uterine branch 425 (290–640) [446] long with 8 (3–8) eggs. Eggs 62.6 (59–70) by 38.5 (34–43) (n = 15). Tail 155 (100–155) [129] (n = 8) long, bearing 3 subventral tubercles and dorsal caudal spine. Phasmids visible in median view, 34 (24–97) [57] from posterior extremity. Caudal spine 12 (10–20) [13.6] (n = 8) long (Fig. 13).

Taxonomic summary

Type host: *Dasyus hybridus* (Desmarest, 1804) (Xenarthra, Dasypodidae) deposited at Colección de Mastozoología, Museo de la Plata, La Plata, Argentina.

Type locality: Ruta Provincial 205 km 307, Bolívar (36°06'66"S, 60°57'81"W), Province of Buenos Aires, Argentina.

Site of infection: Small intestine.

Specimens deposited: Holotype CHMLP 6544; allotype CHMLP 6545; paratypes CHMLP 6546.

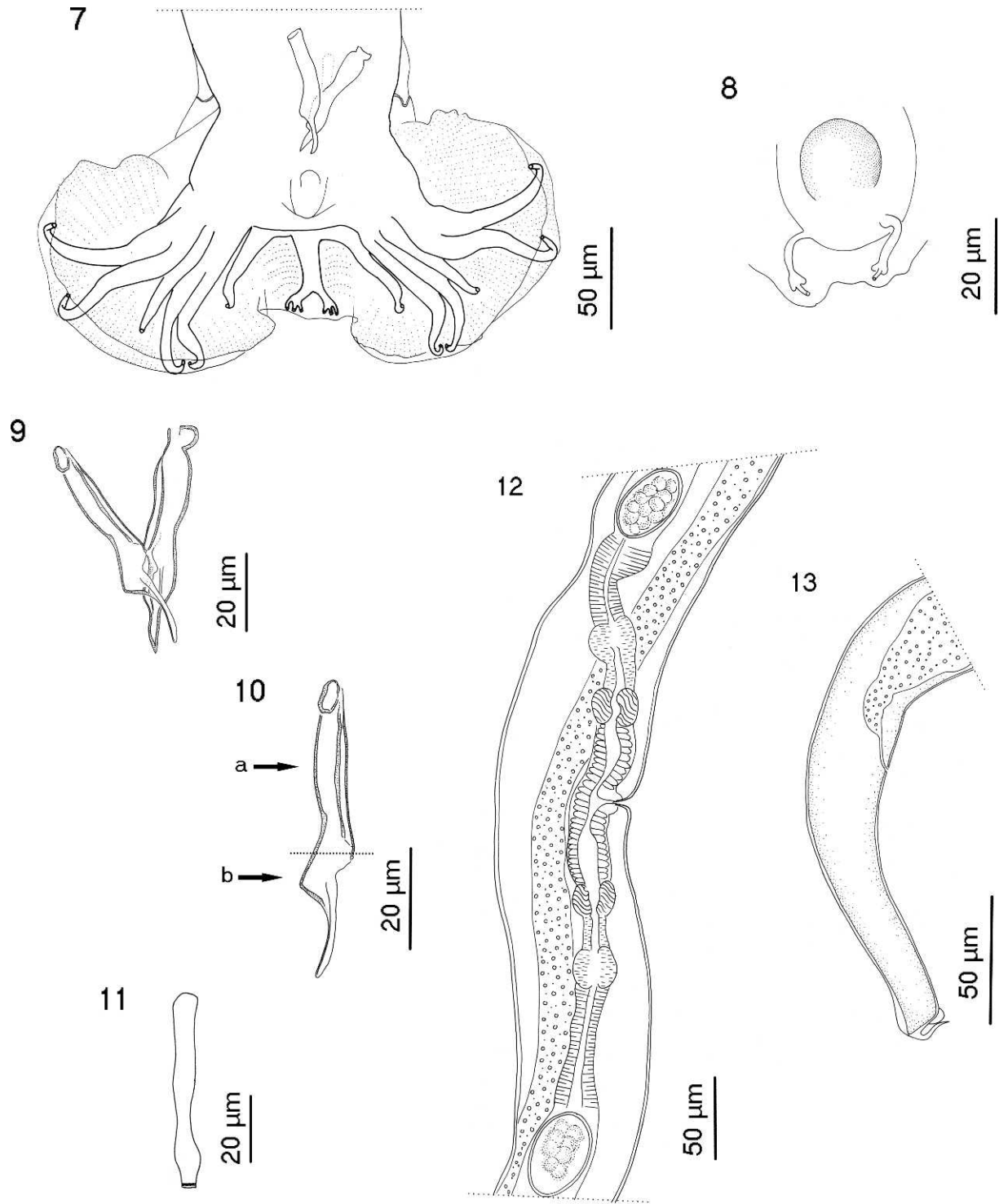
Prevalence and intensity of infection: One of 10 hosts examined, with 196 worms.

Etymology: The species is named after Dr. Agustín M. Abba, a young researcher who has made significant contributions to the knowledge of ecology of xenarthrans in Argentina.

Remarks

These specimens are included in *Delicata* Travassos, 1935 (Trichostromylinina, Molineidae, Anoplostrongylinae) with the use of the following characters: females amphidelphic, with vulvar opening within second half of body length, tail conical, ending bluntly with a terminal spine; spicules complex, presence of a bursal membrane supported by peduncle of papillae 7. To date, *Delicata* is comprised of 11 species: *D. delicata* (Travassos, 1921); *Delicata ransomi* (Travassos, 1921); *Delicata khalili* (Travassos, 1928); *Delicata appendiculata* (Travassos, 1928); *Delicata uncinata* Travassos, 1935; *Delicata variabilis* Travassos, 1935; *Delicata similis* Travassos, 1935; *D. cameroni* Travassos, 1935; *Delicata pseudoappendiculata* Cameron, 1939; *Delicata perronae* Durette-Desset, Chabaud and Cassone, 1977; and *Delicata soyerai* Durette-Desset, Chabaud and Cassone, 1977. *Delicata khalili*, *D. appendiculata*, *D. pseudoappendiculata*, *D. perronae*, and *D. soyerai* are parasites of *T. tetradactyla* (L.) (Xenarthra: Myrmecophagidae) from Trinidad (*D. pseudoappendiculata*) and Brazil (remaining 4 species). These species can be characterized by having relatively long spicules, with poorly distinct handle and lamina and complex distal ends: serrated, crenulated, or divided; a caudal bursa with rays 5 and 6 joined up to their extremities with tips pointing in the same direction toward rays 8 (or parallel in *D. khalili*). Of these species, synlophes have been described only from *D. perronae* and *D. soyerai*, which differ from *D. abbai* n. sp. by the presence of 2 conspicuous lateral alae (Durette-Desset et al., 1977).

Delicata delicata, *D. ransomi*, *D. similis*, *D. uncinata*, *D. cameroni*, and *D. variabilis* possess relatively short spicules, with a handle more or less



FIGURES 7–13. Male, showing (7) caudal bursa, ventral view, (8) genital cone, ventral view, (9) spicules in situ, ventral view, (10) right spicule, lateral-ventral view, (11) gubernaculum, ventral view. Female, showing (12) ovijector, right lateral view, (13) caudal extremity with caudal spine, right lateral view. Abbreviations: a, handle, b, lamina.

distinct from lamina, a caudal bursa with rays 5 and 6 divergent with tips pointing in opposite directions toward each other, as in our specimens. However, *D. delicata*, *D. ransomi*, *D. similis*, and *D. uncinata* possess spicules more complex, bearing diverse projections at midlength or apical ends hooked or recurrent; in contrast, the females lack terminal caudal tubercles. These 4 species are parasites of *Cabassous unicinctus* (L.); *D.*

ransomi and *D. similis* are also parasites of *Dasybus novemcinctus* L. and *Euphractus sexcinctus* (L.), respectively, from Brazil.

By the morphology of the caudal end of the female, and the shape of the spicules, the specimens studied here strongly resemble *D. cameroni*, a parasite of *D. novemcinctus* and *D. hybridus*, and *D. variabilis*, which is a

parasite of *D. novemcinctus*, both from Brazil. The synlophes of both species remain undescribed.

Both species are characterized by females with a vulvar cuticular dilatation, which distinguishes them from the specimens studied here. In males of *D. cameroni*, rays 5 and 6 diverge more distally than in our specimens, and rays 8 are longer than the dorsal ray. Also in *D. cameroni*, the proximal extremity of the spicules lacks the constriction observed in *D. abbai* n. sp. and the distal end was not illustrated. In addition, Travassos (1937) mentioned the presence of 12 longitudinal lines for *D. cameroni*, and in the present specimens there are 26 cuticular ridges at midbody.

The males of *D. variabilis* are also very close to those described here; however, they can be differentiated because the distal portion of the spicules narrows abruptly and represents $\frac{1}{4}$ of the total spicule length, whereas in the new species described here, the distal portion tapers gradually and represents one-third of the spicule length.

DISCUSSION

Although Travassos (1935, 1937) did not describe the synlophe in any species of *Delicata*, he mentioned the presence of “longitudinal lines” (number not specified) in the definition of the genus (Travassos, 1935) and of 12 and 20 longitudinal cuticular lines in the descriptions of *D. cameroni* and *D. khalili*, respectively (Travassos, 1937). Durette-Desset et al. (1977) described for the first time the synlophes of 2 species from *T. tetradactyla*, which they assigned to *Delicata* (*D. perronae* and *D. soyeriae*). They also observed the presence of 2 lateral alae directed to the dorsal side in both species and also 7 small ventral ridges perpendicular to the body surface in *D. soyeriae*. Durette-Desset (1983) in the taxonomic keys to the Trichostrongyloidea included the presence of lateral alae as a character of *Delicata*, though only the synlophes of *D. perronae* and *D. soyeriae* were known. The synlophes of the remaining species of the genus, including the type species, *D. delicata*, are still unknown.

Some years later, Hoppe and Nascimento (2007) described a new genus and species, *Hadrostrongylus speciosum* Hoppe and Nascimento, 2007, parasitic in *Dasyypus novemcinctus*, characterized by a synlophe with 4 ventral ridges and 2 small lateral cuticular dilatations, without lateral alae. In their discussion, they separate their species from the remaining species of *Delicata* by the absence of lateral alae, based on the keys of Durette-Desset (1983). However, in the definition of *Hadrostrongylus*, all the characters used are shared with those of *Delicata* Travassos, 1935, with the only addition of “synlophe with ventral–dorsal orientation” and no reference is made to the presence or absence of lateral alae.

Hoppe et al. (2009) reported from *E. sexcinctus* a species they identified as *D. ransomi*, and described its synlophe as having 4 main ventral crests and 10 secondary smaller crests with ventral–dorsal orientation. Probably based on these characters and on the absence of lateral alae, they transferred the species to *Hadrostrongylus*. Accordingly, *Hadrostrongylus* is now composed of 2 species, i.e., *H. speciosum* and *Hadrostrongylus ransomi*.

The definition of *Hadrostrongylus* seems to us ambiguous because the reference to the synlophe is too vast. Because there is no reference to the presence or absence of lateral alae, it potentially may include species having lateral alae, with the condition that the synlophe have a ventral–dorsal orientation. A species having both characters could thus be included either in *Hadrostrongylus* or in *Delicata*. Moreover, because the genus *Delicata* was not redefined, and the synlophe of the type species remains unknown, any species having a ventral–dorsal-orientated

synlophe and lacking lateral alae also, could be included in either *Hadrostrongylus* or *Delicata*.

The existence of several types of synlophes among species of *Delicata* is being evidenced with the descriptions of *D. perronae*, *D. soyeriae*, *D. abbai* n. sp., and the redescription of *D. ransomi*. However, the erection of new genera based on the synlophe should be avoided while the synlophe of the type species, *D. delicata*, remains unknown. We prefer to consider *Hadrostrongylus* as a synonym of *Delicata* and to continue with *Delicata ransomi*, as well as to propose *Delicata speciosa* n. comb. for *H. speciosum*.

Delicata speciosa n. comb. differs from *D. abbai* n. sp. mainly by the following characters: synlophe with 4 ventral ridges and 2 small lateral cuticular dilatations; morphology of the caudal bursa, with rays 8 longer than the dorsal ray and reaching the bursal margin and rays 2–3 shorter and less divergent; membrane of the genital cone strongly bilobate; and spicules unequal in size and bearing a lateral projection (Hoppe and Nascimento, 2007).

As stated above, the existence of several types of synlophes among species of *Delicata* is being evidenced, and it is very likely that *D. perronae* and *D. soyeriae* should be separated to another genus. In this sense, not only the type species should be redescribed, but also species parasitic in myrmecophagids must be reviewed with an aim to describe the synlophes and to determinate their similarity with *D. perronae* and *D. soyeriae*. This is in accordance with the suggestions of Durette-Desset et al. (1977) when they discriminated the species of *Delicata* in supraspecific groups (parasitic in dasipodids and in myrmecophagids).

In conclusion, *D. abbai* n. sp., here described, represents the first record of the genus *Delicata* in Argentina and of a trichostrongylid for Argentinean *D. hybridus*.

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