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Morphological studies of *Ancyracanthopsis winegardi* Wong & Anderson, 1990 (Nematoda: Acuarioidea) and larval stages of acuariid nematodes parasitic in *Larus dominicanus* Lichtenstein (Aves: Laridae) from Argentina

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Abstract

Ancyracanthopsis winegardi Wong & Anderson, 1990 (Nematoda: Acuarioidea) is described from *Larus dominicanus* Lichtenstein (Aves: Laridae) on the Southwest Atlantic coast (38°42′S, 59°47′W). The main character used to distinguish species of *Ancyracanthopsis* is the morphology of the ptilina. Thus, although the specimens described here have some differences in the morphology and size of the spicules and in the female genitalia, they were referred to *A. winegardi* because they have a very similar ptilina. This is the first record of a member of *Ancyracanthopsis* from larid birds and for *A. winegardi* in the Southwest Atlantic coast. We have also studied acuariid larvae found inhabiting the gizzard alongside adult specimens of *A. winegardi.* Among those larvae, two morphological groups were clearly distinguished. The first group was characterised by the absence of ptilina and the presence of spicular primordia and rectal cells (third-stage larvae). The second group could be distinguished by the presence of ptilina and partly-developed genitalia (fourth-stage larvae). In order to identify the larvae, a Principal Component Analysis was applied to morphometric data taken from the third-stage larvae. These results and the morphology of the partly-developed ptilina of the fourth-stage larvae indicated that the larval stages found in *L. dominicanus* appear to belong to *Sciadiocara haematopodi*, Cremonte, Navone & Etchegoin, 1999.

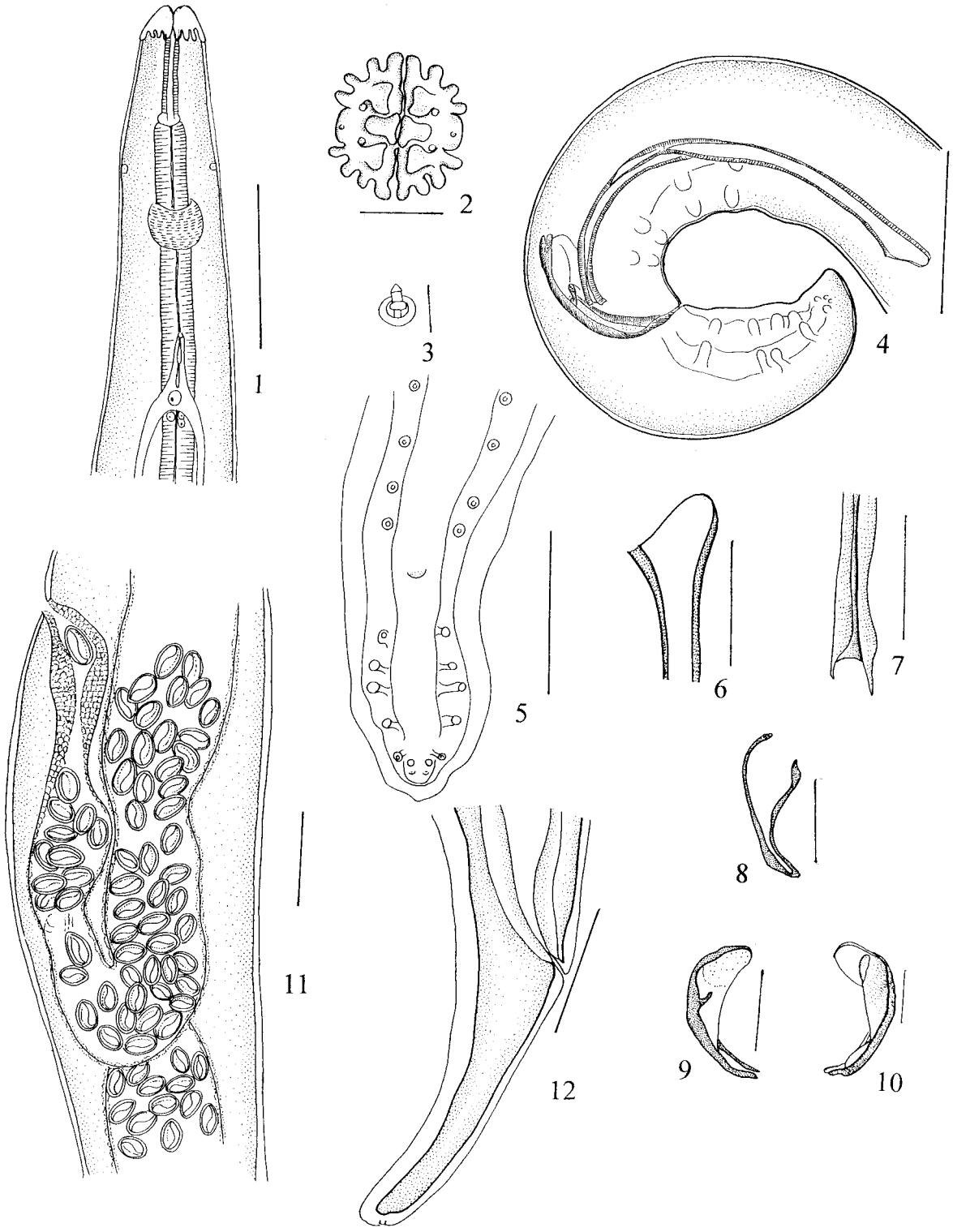
Introduction

The genus *Ancyracanthopsis* Diesing, 1861 (Nematoda: Acuariidae) was revised by Wong & Lankester (1985), who designated *A. coronata* (Molin, 1860) as the type-species. Later, Wong & Anderson (1990) again revised the genus and described *A. winegardi* from *Pluvialis squatarola* (Aves: Charadriidae) from Alberta, Canada. These authors synonymised *A. coronata* sensu Wong & Lankester (1985) with *A. winegardi.* To date, there are two records of the genus from South America: *A. coronata* (Molin, 1860) in Brazil from Charadriiforme, Coraciforme and Gruiforme birds (Vicente et al., 1995) and *A. winegardi* on the Pacific coast of Peru from willets (Wong & Anderson, 1990). During parasitological studies of shorebirds, adults of *Ancyracanthopsis, Sciadiocara haematopodi* Cremonte, Navone & Etchegoin, 1999 and unidentified acuariid larvae were found in *Larus dominicanus* (Aves: Laridae) from the Buenos Aires coast, Argentina.

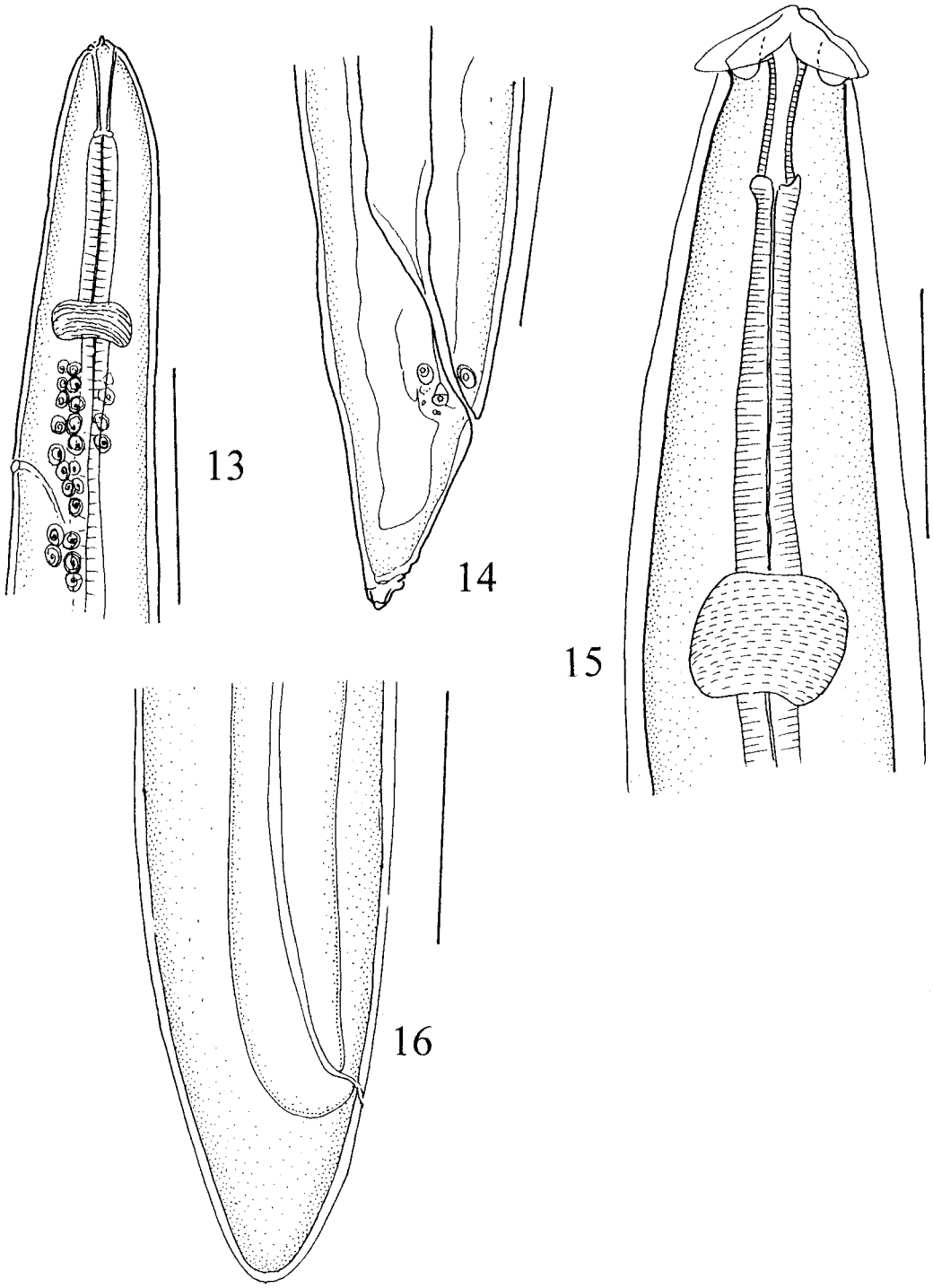
The aims of this paper are to describe *A. winegardi* from *L. dominicanus* on the Southwest Atlantic coast and to compare those acuariod larvae found inhabiting the gizzard alongside adult specimens *A. winegardi* and *S. haematopodi* using multivariate statistics, in order to determine their likely identity.

Materials and methods

A juvenile kelp gull was collected at Balneario Orense (38°42′S, 59°47′W), a rocky part of the coast of Buenos Aires Province, Argentina. After dissection, the digestive tract was fixed in the field using 10% formalin. In the laboratory, the nematodes found under the koilin lining of the gizzard were removed and preserved in 70% alcohol. Some specimens were



Figures 1–12. Ancyracanthopsis winegardi. 1. Anterior region of male, nerve-ring, deirids and exretory pore, ventral view. 2. *En face* view (female). 3. Detail of deirid (female), ventral view. 4. Posterior region of male, lateral view. 5. Posterior region of male, ventral view. 6. Proximal end of left spicule, ventral view. 7. Distal end of left spicule, ventral view. 8. Right spicule, ventral view. 9. Right side of right spicule. 10. Left side of right spicule. 11. Medial region of female, vulva, vagina and uteri, lateral view. 12. Posterior region of female, lateral view. *Scale-bars*: 1,4,5,11,12, 100 μm; 2,6,7,10, 30 μm; 3, 10 μm; 8,9, 50 μm.



Figures 13–16. 13–14. Third-stage acuariid larva from gizzard of *Larus dominicanus.* 13. Anterior region, lateral view. 14. Posterior region, lateral view. 15–16. Fourth-stage acuariid larva from gizzard of *Larus dominicanus.* 15. Anterior region, lateral view. 16. Posterior region, lateral view. *Scale-bars*: 13, 50 μm; 14–16, 100 μm.

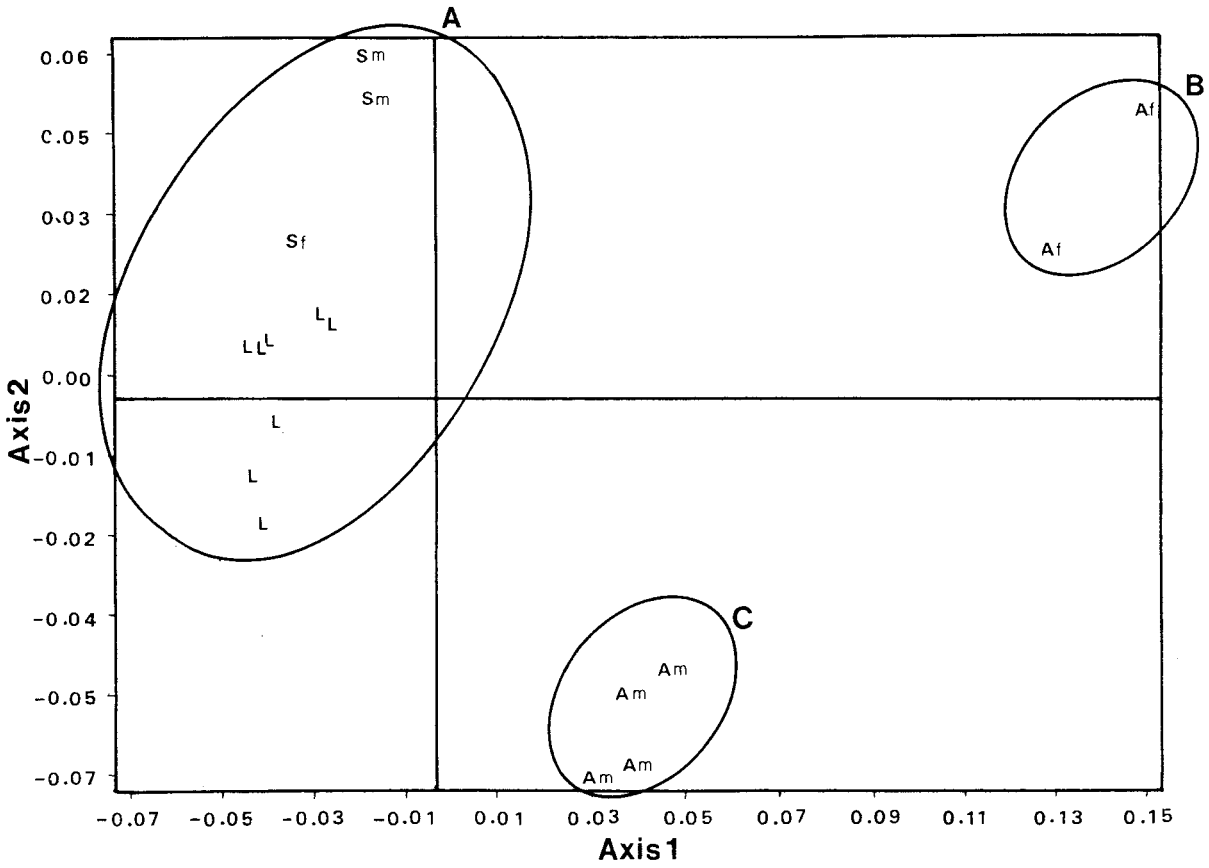


Figure 17. Plot of two first components of PCA. *Abbreviations*: L, third-stage larvae; Sm, *Sciadiocara haematopodi*, male; Sf, *S. haematopodi*, female; Am, *Ancyracanthopsis winegardi*, male; Af, *A. winegardi*, female.

mounted in lactophenol and rolled under a coverslip in order to study various parts of the body from different angles. Drawings were made with the aid of the camera lucida (Olympus, CHB). Measurements are given in micrometres with the range in parentheses, except when otherwise indicated. A Principal Component Analysis (PCA) (NTSYS-pc, Rohlf, 1993) was performed to observe how the larval stages and the adult specimens of two species were grouped based on their morphometric similarities. The basic data matrix was transformed using $\log_{10}$. The matrix was based onn 19 OTUs and eight characters as follows:

OTUs: 10 third-stage larvae (L), two males (Sm) and one female (Sf) of *Sciadiocara haematopodi* and four males (Am) and two females (Af) of *Ancyracanthopsis winegardi*, all of them from under the koilin of the gizzard. *Characters*: Buccal capsule (BC), total oesophagus length (OL), muscular oesophagus length (MO), distance of the nerve-ring from the anterior extremity (NR), distance of the excretory pore from the anterior extremity (EP), and the ratios: total length (L)/BC, L/NR, OL/MO.

Ancyracanthopsis winegardi Wong & Anderson, 1990

Description (Figures 1–12)

General morphology. Acuarioidea, Acuariidae, Schistorophinae, *Ancyracanthopsis* Diesing, 1861. Oral opening with 4 pairs of small teeth present on lateral walls. Ptilina extending from dorsoventral sides of oral opening to lateral sides; each divided into 4 lobes.

Male (N = 4). Length 6.78 (6.11–7.33) mm. Width at mid-body 110 (99–123). Buccal capsule 62 (60–63) in length. Deirids 94 (90–99), nerve-ring 121 (114–126) and excretory pore 153 (138–165) from anterior extremity. Ptilina 23 (21–27) in length. Oesophagus

2.32 (2.10–2.44) mm in length. Muscular oesophagus 559 (465–615) and glandular oesophagus 1.76 (1.62–1.82) mm in length. Spicules dissimilar and unequal. Right spicule 87 (81–90), crescent-shaped with conical cuticularised process near middle on right side; left spicule 299 (270–330). Distal end of left spicule dorsally expanded, flattened and truncated. Tail 148 (105–168) in length. Caudal extremity curved ventrally, with caudal alae bearing 4 pre-anal and 5 post-anal pairs of pedunculate papillae. One pair of sessile papillae present mid-ventrally to last pair of papillae. Phasmids located near tip of tail.

Female (N = 2). Length 18.48 (17.49–19.47) mm. Width at level of vulva 205 (195–216). Buccal capsule 69 (60–78) in length. Deirids 107 (105–108), nerve-ring 135 (135–135) and excretory pore 223 (210–237) from anterior extremity. Ptilina 32 (30–33) in length. Oesophagus 3.51 (3.18–3.84) mm in length. Muscular oesophagus 645 (585–705) and glandular oesophagus 2.86 (2.47–3.25) mm in length. Vulva in posterior part of body, 8.52 (7.41–9.64) mm from tip of tail. Uterus didelphic, amphidelphic. Vagina surrounded by thick muscle fibers, distinctly divided into vagina vera 78 (75–81) and vagina uterina 125 (114–135). Eggs 39 (36–42) × 23 (21–24), contain larva. Anus 246 (245–247) from tip of tail. Phasmids located near tip of tail.

Host: *Larus dominicanus* Lichtenstein (kelp gull) (Aves: Laridae).
Locality: Balneario Orense (38°42′S, 59°47′W), coast of Buenos Aires Province, Argentina.
Material: Specimens deposited in the Museo de La Plata, La Plata, Argentina, Helminth. Coll. No. 4552.
Site: Gizzard.
Intensity of infestation: 4 males and 5 females (only 2 gravid) from one host.

Comments

Although the general characteristics show a close resemblance to *Ancyracanthopsis winegardi*, which was described by Wong & Anderson (1990), there are some points of difference. The right spicule is crescent-shaped, but it lack the prominent protuberance on left side near distal end, which was noted by Wong & Anderson (1990). Instead, it has a conical cuticularised process close to the middle on the right side (Figure 9). Moreover, there are morphometrical differences: the right spicule is shorter [87 (81–90)] than that described by Wong & Anderson (1990) [93 (90–95)] and the left spicule is longer [290 (270–330)] [Wong & Anderson: 275 (265–295)]. The tail of the male is shorter [148 (105–168)] [Wong & Anderson: 182 (170–195)]. The female is larger [18.48 (17.49–19.47) mm] [Wong & Anderson: 10.4 (9.7–11.4) mm] with a longer tail [246 (245–247)] [Wong & Anderson: 149 (134–175)]. The ratio vagina uterina/vagina vera is 1:0.60 [Wong & Anderson: 1:0.89].

Acuariid larvae

Description

Third-stage larva (N = 17) (Figures 13–14)
Length 5.10 (3.58–5.79) mm. Width at mid-body 120 (102–144). Buccal capsule 34 (30–39) in length. Nerve-ring 111 (99–120) and excretory pore 161 (147–186) from anterior extremity. Oesophagus 1.56 (0.85–1.89) mm in length. Muscular oesophagus 701 (531–840) and glandular oesophagus 0.91 (0.78–1.08) mm in length. In some specimens, there is one spicular primordium on each side at end of intestine. Three rectal cells are present, one dorsal and 2 ventral. Tail 86 (72–114) in length, with rounded tip.

Fourth-stage larva (N = 3) (Figures 15–16)
Ptilina partly developed. Cuticle with transverse striations. Length 5.14 (4.62–5.46) mm. Width at mid-body 115 (96–132). Buccal capsule 33 (30–34) in length. Nerve-ring 109 (105–111) and excretory pore 161 (147–175) from anterior extremity. Oesophagus 1.50 (1.04–1.79) mm in length. Muscular oesophagus 751 (675–845) and glandular oesophagus 0.90 (0.81–1.04) mm in length. Tail 94 (78–105) in length. In male, right spicule is present but weakly cuticularised. Testes beginning posteriorly at oesophago-intestine junction and extending to caudal region. Female genitalia with 2 reflexed arms, one just posterior to oesophago-intestine junction and other close to anus. Phasmids present near tip of tail.

Multivariate analysis (Figure 17)

Two axes were obtained, each one being the linear combination of the most significant characters. The cumulative eigenvalue was 86.94%; this was obtained from the first two components which were plotted (Figure 17). The characters which most contributed

to the differentiation of the specimens were: L/NR, BC, OL/MO and OL in component 1; and L/BC, MO, BC and L/NR in component 2. Three groups were determinate: (A) contained the unidentified larvae and adults of *Sciadiocara haematopodi*; (B) contained females of *Ancyracanthopsis winegardi*; and (C) contained males of *A. winegardi*.

Discussion

The main character used to distinguish species of the genus *Ancyracanthopsis* is the morphology of the ptilina (Wong & Anderson, 1990). Thus, although the specimens described here have some differences in the morphology and size of spicules and in the female genitalia (see 'Comments' above), they were referred to *A. winegardi* because they have very similar ptilina. The mentioned differences may be explained by intraspecific variation due to differences in host and geographical distribution.

With respect to the identity of the acuariid larvae found in *L. dominicanus*, they appear to belong to *Sciadiocara haematopodi* Cremonte et al., 1999 based on a number of characters which agree with the adult morphology (i.e. the morphology of the ptilina in the L4, and the buccal capsule and the proportional length of the muscular oesophagus in the L3 [see 'PCA results']). *S. haematopodi* was originally described from specimens collected in *Haematopus palliatus* (Aves: Haematopodidae) and it has also been recorded in *L. dominicanus* by Cremonte et al. (1999). Since both hosts of *S. haematopodi* inhabit the coast of Buenos Aires Province, the intermediate host is likely to be a marine invertebrate, and probably a marine crustacean. On the other hand, *A. winegardi* utilises fiddler crabs (*Uca* spp.) as intermediate hosts (Wong & Anderson, 1990). Since, *L. dominicanus* harboured mixed infection, it is likely that *S. haematopodi* and *A. winegardi* utilise similar intermediate hosts.

This is the first record of a member of the genus *Ancyracanthopsis* from larid birds and for *A. winegardi* on the Southwest Atlantic coast.

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