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NEW SPECIES OF *ACANTHOCHONDRIA* (COPEPODA: CHONDRACANTHIDAE) INFECTING THE LONGTAIL SOUTHERN COD, *PATAGONOTOTHEN RAMSAYI* (PERCIFORMES: NOTOTHENIIDAE), FROM PATAGONIAN WATERS, ARGENTINA

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ABSTRACT: *Acanthochondria lilianae* n. sp. (Copepoda: Chondracanthidae) is described and illustrated based on specimens of both sexes collected from inner surface of the operculum of the longtail southern cod, *Patagonotothen ramsayi* (Regan) (Perciformes: Nototheniidae), from the Patagonian Shelf, Argentina (42–48°S, 60–63°W). *Acanthochondria lilianae* n. sp. is characterized by the combination of a Type B-III antennule and Type A leg 2, in addition to both the cephalosome and the trunk being wider than long. The new species most closely resembles *Acanthochondria incisa* Shiino, 1955, *Acanthochondria ophidii* (Krøyer, 1863), *Acanthochondria priacanthi* Shiino, 1964, and *Acanthochondria tasmaniae* Heegaard, 1962, but differs from these species in the general measurements and proportions of the body, shape and size of head, shape and size of genitoabdomen, and fine details of appendages such as the armature of antennule, ornamentation of both pairs of legs, number of teeth on mandible and maxilla, and ornamentation on maxilliped. This is the first *Acanthochondria* species recorded from a notothenid and the second southernmost record of a species of this genus in the southwestern Atlantic Ocean.

Acanthochondria Oakley, 1927, is the largest genus among species of Chondracanthidae Milne Edwards, 1840 (Østergaard, 2003). A species key for the genus was provided by Kalman (2003), in which 46 accepted species were listed. Five additional species have been described since, e.g., *Acanthochondria triangularis* Alves, Luque and Paraguassú, 2003, *Acanthochondria serrani* Braicovich and Timi, 2009, *Acanthochondria alleni* Tang, Kalman and Ho, 2010, *Acanthochondria helicoleni* Cantatore and Timi, 2010, and *Acanthochondria saggitta* Alarcos and Timi, 2011 (Alves et al., 2003; Braicovich and Timi, 2009; Alarcos and Timi, 2010; Cantatore and Timi, 2010; Tang et al., 2010). The last authors have made justified additional taxonomic changes to the genus, including the transfer of *Acanthochondria zebriae* Ho, Kim and Kumar, 2000, to *Heterochondria* Yü, 1935, based on a combination of apomorphic features that they felt excluded the species from *Acanthochondria*. Moreover, by slightly expanding the generic diagnosis of *Acanthochondria* to include "head with or without outgrowths (in the form of processes, protrusions or knobs)," monotypic *Pterochondria* Ho, 1973, was considered a junior synonym of *Acanthochondria,* and *Pterochondria alatalongicollis* (Heegaard, 1940), was moved to *Acanthochondria* (Tang et al., 2010). Thus, *Acanthochondria* presently includes 51 valid species.

During a parasitological survey carried out on *Patagonotothen ramsayi* (Regan) (Perciformes: Nototheniidae) captured on the Patagonian Shelf, Argentina, copepods belonging to *Acanthochondria* were found. Those copepods are herein described and illustrated as a new species.

MATERIALS AND METHODS

Fifty-eight specimens of *P. ramsayi*, caught during a research cruise at Patagonian Shelf, Argentina (42–48°S, 60–63°W), in November 2007, were examined for parasites. Copepods were removed from inner surface of the operculum, fixed in 10% formalin, and transferred to 70% ethanol for storage before being studied and measured. A subsample of selected specimens was cleared in lactic acid for a minimum of 24 hr; appendages were dissected and examined using a light microscope, and illustrations were drawn with the aid of a drawing tube. Measurements were based on all specimens examined unless otherwise indicated and given in mm as mean ± standard deviation, with ranges in parentheses. The terms prevalence and mean intensity of infection were used according to Bush et al. (1997). Criteria for identifying the new species followed Ho and Kim (1995) and Kalman (2003); morphological terminology used herein follows Boxshall and Halsey (2004), and host taxonomy is in accordance with FishBase (Froese and Pauly, 2010).

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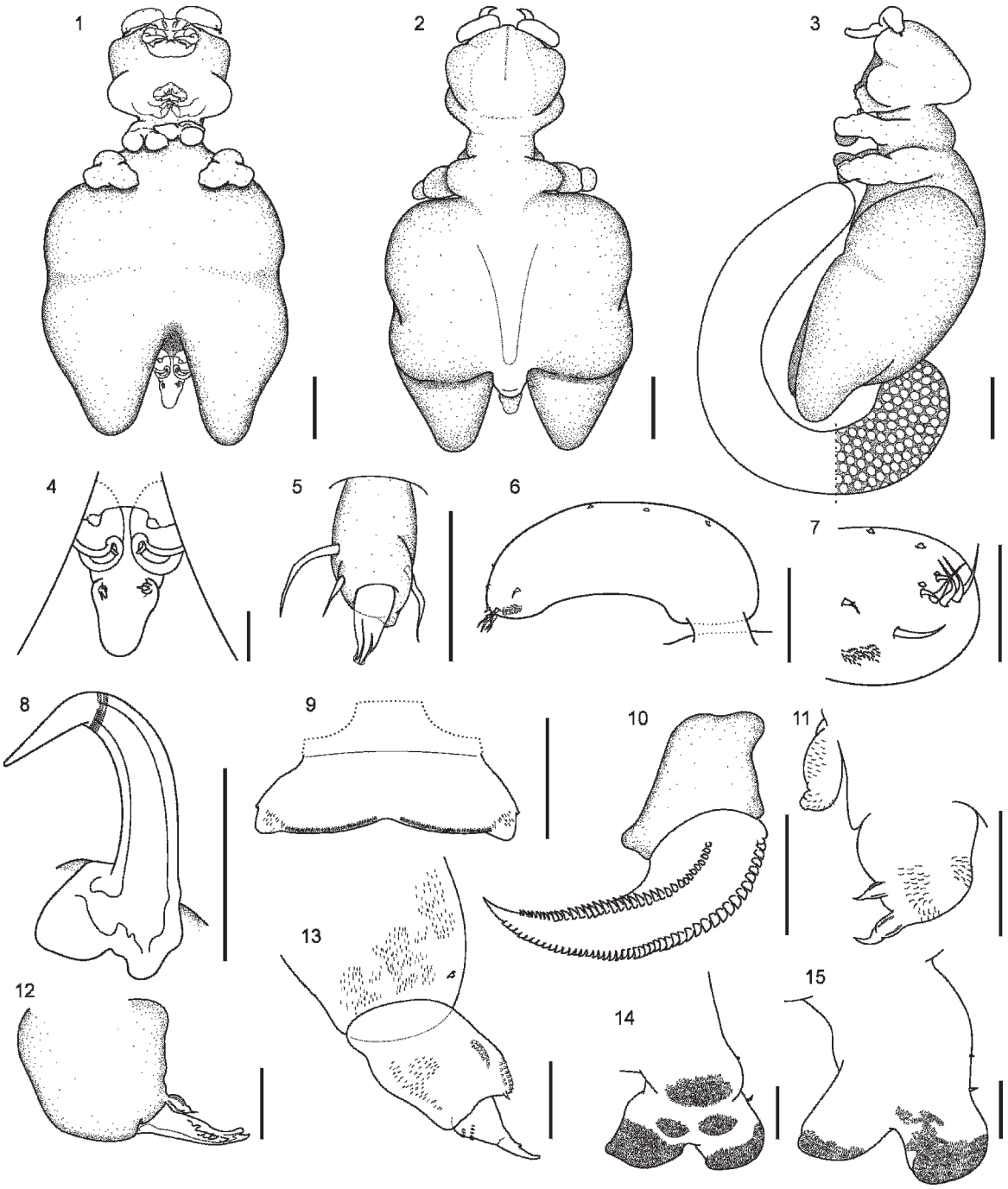
DESCRIPTION

Acanthochondria lilianae n. sp.

(Figs. 1–28)

Diagnosis (based on 7 ovigerous females and 6 adult males): Female body (Figs. 1–3) divided into head, short neck, and stout trunk bearing moderately large posterior processes, and small genitoabdomen. Total body length 6.88 ± 0.38 (6.51–7.66) (from anterior margin of head, excluding antennules, to distal end of posterior processes of trunk). Head (Figs. 1–3) composed of cephalosome only, with 2 pairs of lateral outgrowths (1 antero-dorsal and 1 postero-ventral), slightly wider than long; 1.59 ± 0.06 (1.53–1.71) long, 1.75 ± 0.05 (1.69–1.84) wide; triangular in lateral view, with conspicuous oral region (Fig. 3). Neck region (Figs. 1–3) composed of first and second pedigers, 1.20 ± 0.21 (0.96–1.46) long, 1.10 ± 0.05 (1.03–1.19) maximum width, length/maximum width 1.09 ± 0.19 (0.88–1.34). Leg 1 located immediately posterior to head; leg 2 located 0.70 ± 0.10 (0.53–0.83) from head. Trunk (Figs. 1–3) dorsoventrally depressed, 2.96 ± 0.18 (2.75–3.18) long (excluding processes), slightly constricted at about midlength, 3.52 ± 0.34 (3.25–4.28) wide at constriction and slightly narrower anteriorly, 3.65 ± 0.37 (3.25–4.28) wide, than posteriorly, 3.79 ± 0.27 (3.48–4.20) wide; posterolateral processes 1.13 ± 0.17 (0.90–1.41) long, blunt, extending beyond distal limit of genitoabdomen. Pair of nuptial organs (Østergaard and Boxshall, 2004) on posteroventral surface of trunk near junction with genitoabdomen. Genitoabdomen (Fig. 4) almost as long as wide, 0.66 ± 0.07 (0.58–0.75) (n = 6) long, 0.70 ± 0.00 (n = 5) wide; genital somite with pair of short setae on anterior margin of genital apertures; abdominal somite small, pear shaped, with rounded posterior margin. Caudal ramus (Fig. 5) small, conical, longer than wide, swollen basal portion armed with 2 setae on ventral surface, 1 seta on dorsal surface, and 1 knob near junction with terminal process; terminal process trifurcate. Egg sac (Fig. 3) cylindrical, curving ventrally then anteriorly to lie beneath trunk, 8.66 ± 0.95 (7.58–9.40) (n = 4) long, 1.13 ± 0.10 (1.00–1.37) wide, with multiseriate arrangement of eggs.

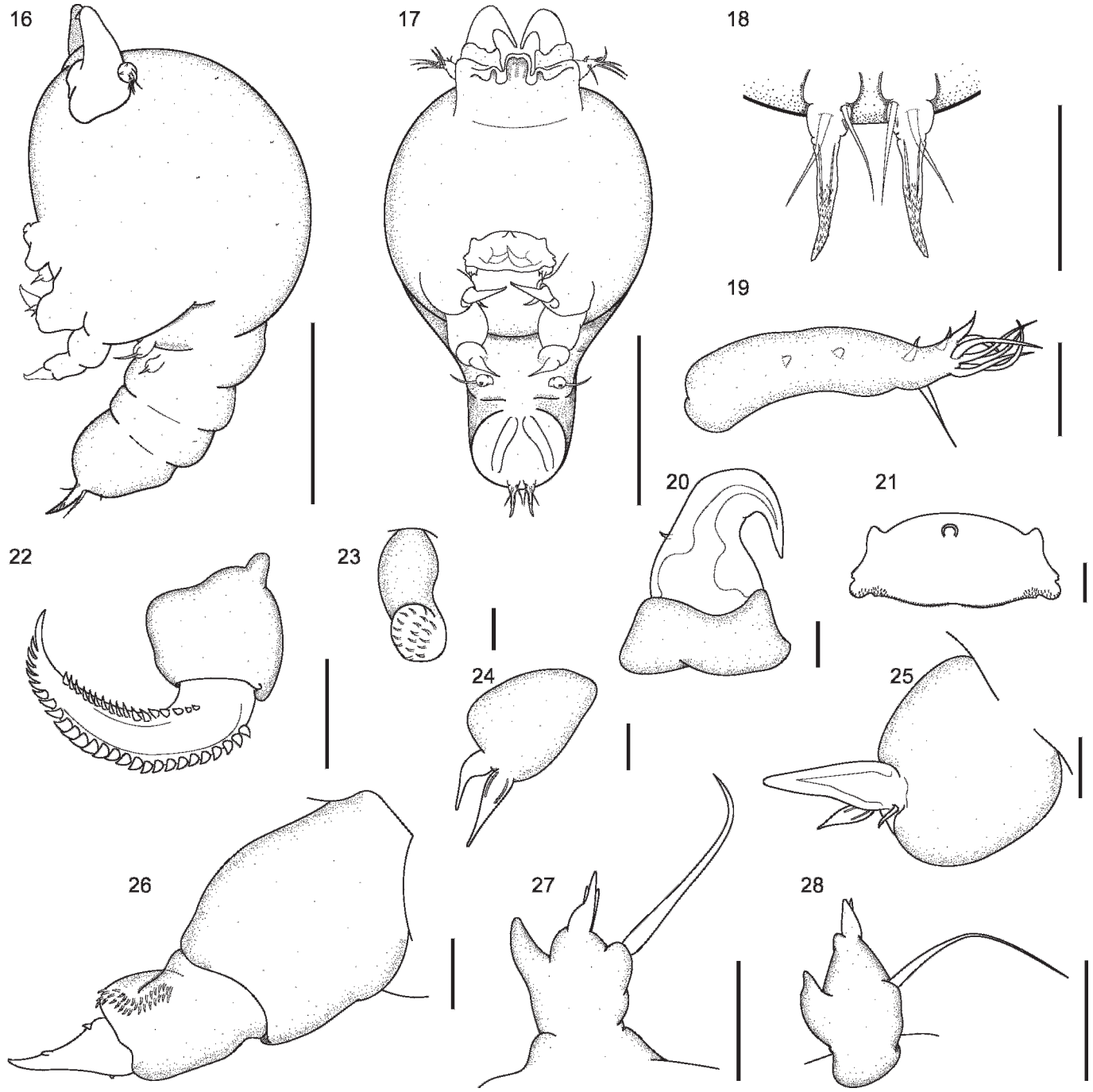
Antennule (Fig. 6) unsegmented, cylindrical (Type B-III); basal portion armed with 3 isolated stout setae along anterior margin, tip with patch of spinules on ventral margin and 12 elements (Fig. 7), including subdistally 2 stout anterior setae and 2 slender ventral setae; 6 slender apical setae (2 small) and 2 knobs. Antenna (Fig. 8) 2 segments; basal segment unarmed; terminal segment a heavily sclerotized, curved claw with pointed tip and band of transverse surface striations near tip. Labrum (Fig. 9) with row of spinules along posterior margin and small knobs on lateral margins.



FIGURES 1–15. *Acanthochondria lilianae* n. sp., female. (**1**) Habitus, ventral view. (**2**) Habitus, dorsal view. (**3**) Habitus, lateral view. (**4**) Genitoabdomen, ventral view. (**5**) Caudal ramus, ventral view. (**6**) Antennule. (**7**) Distal end of antennule, detailed. (**8**) Antenna. (**9**) Labrum. (**10**) Mandible. (**11**) Maxillule and paragnath. (**12**) Maxilla. (**13**) Maxilliped. (**14**) Leg 1. (**15**) Leg 2. Scales bars: Figs. 1–3 = 1 mm; Figs. 4, 6, 9, 14, 15, = 0.25 mm; Figs. 5, 7, 8, 10–13 = 0.1 mm.

Mandible (Fig. 10) 2 segments, with 45–47 teeth on convex margin and 34–36 teeth on concave margin of terminal falcate process. Paragnath lobate, ornamented with spinules (Fig. 11). Maxillule (Fig. 11) suboval, with 2 unequal setae, and 2 patches of spinules on outer surface. Maxilla (Fig. 12) 2 segments; first segment squat and unarmed; terminal segment claw-like, armed with row of 4–5 denticles in addition to single subterminal denticle, and seta near base. Maxilliped (Fig. 13) 3 segments; first segment stout, covered with patches of spinules; second segment bearing 2 patches of denticles on inner and inner-distal surfaces in addition to patch of spinules on surface; terminal segment a curved claw-like structure bearing hooklet on inner surface and 2 basal rows of denticles on outer surface. Leg 1 (Fig. 14) slightly smaller than leg 2 (Fig. 15); both legs bilobate, type A, carrying outer seta on protopod and on exopod, and ornamented with patches of spinules.

Male body (Figs. 16–17) divided into globose cephalothorax and ventrally flexed genitoabdomen; 0.66 ± 0.04 (0.60–0.68) long (measured from base of antennae to distal end of genital segment, excluding caudal rami), 0.44 ± 0.03 (0.40–0.46) maximum width. Genital segment with pair of ventral ridges. Caudal ramus (Fig. 18) with spinules on terminal processes and 3 setae on basal portion, 1 dorsal and 2 ventral (1 small).



FIGURES 16–28. *Acanthochondria lilianae* n. sp., male. (**16**) Habitus, lateral view. (**17**) Habitus, ventral view. (**18**) Caudal ramus, ventral view. (**19**) Antennule. (**20**) Antenna. (**21**) Labrum. (**22**) Mandible. (**23**) Paragnath. (**24**) Maxillule. (**25**) Maxilla. (**26**) Maxilliped. (**27**) Leg 1. (**28**) Leg 2. Scale bars: Figs. 1, 2 = 0.25 mm.; Fig. 26 = 0.1 mm; Fig. 18 = 0.05 mm; Figs. 19–25, 27, 28 mm.

Antennule (Fig. 19) unsegmented, with armature formula 1, 1, 2, 2, 6. Antenna (Fig. 20) robust; basal segment unarmed, terminal claw with minute hyaline seta on outer surface. Labrum (Fig. 21) with row of spinules along posterior margin, small knobs on lateral margins and anterior median knob. Mandible (Fig. 22) 2 segments, with 24–27 teeth on convex margin and 15–19 teeth on concave margin of terminal falcate process. Paragnath lobate, armed distally with spinules (Fig. 23). Maxillule (Fig. 24) robust, bearing 2 setae. Maxilla (Fig. 25) similar to that of female except terminal process devoid of teeth. Maxilliped (Fig. 26) 3 segments, first segment unarmed; second segment bearing patch of denticles on inner and distal surfaces; terminal segment a curved claw-like structure bearing hooklet on distal inner surface, and 2 basal denticles. Legs bilobate, leg 1 (Fig. 27) and leg 2 (Fig. 28) similar in size; protopod with long outer setae; endopod reduced to conical lobe; exopod in leg 1 bearing trifurcated element; exopod in leg 2 bearing bifurcated element in addition to rounded knob at base.

Taxonomic summary

Type host: Longtail southern cod, *Patagonotothen ramsayi* (Regan) (Perciformes: Nototheniidae).

Site of infection: Inner surface of operculum.

Type locality: Patagonian Shelf, Argentina (42–48°S, 60–63°W).

Date of collection: November 2007.

Prevalence: Nine fish infected of 58 fish examined (12.06%).

Mean intensity (range): 1.29 (1–2).

Specimens deposited: Holotype No. MLP 26731 (female), allotype No. MLP 26732 (male), and paratypes (2 females each with attached male) No. MLP 26733 are deposited in the Carcinological Collection of the Museo de La Plata (CCMLP), La Plata, Argentina.

Etymology: The species is named in honor of Liliana B. Degrandi, the first author's mother.

Remarks

The identification of *Acanthochondria* species is based on adult female morphology because males do not show species specific features (Ho and Kim, 1995; Kalman, 2003). The criteria widely used for the identification of *Acanthochondria* species are (1) proportion and structure of head; (2) general appearance of antennule; (3) structure and general appearance of legs 1 and 2; (4) fine structure of oral appendages; (5) structure of genitoabdomen; and, finally, (6) host and geographic distribution data (Ho, 1970; Kabata, 1984; Ho and Kim, 1995), despite the latter having been deeply criticized by Poly and Mah (2001).

Acanthochondria lilianae n. sp. is characterized by having a short neck consisting of first and second pedigers, the combination of a Type B-III antennule (with inflated basal region) and a Type A leg 2, in addition to a cephalosome and trunk both wider than long. Considering these features, the new species closely resembles 4 congeners, i.e., *Acanthochondria incisa* Shiino, 1955, *Acanthochondria ophidii* (Krøyer, 1863), *Acanthochondria priacanthi* Shiino, 1964, and *Acanthochondria tasmaniae* Heegaard, 1962. The original descriptions of these 4 species are old and inadequate. Fortunately, *A. ophidii* and *A. priacanthi* were redescribed by Ho (1977) and Ho and Kim (1995), respectively, providing detailed and useful information for appropriate comparisons. Indeed, *A. ophidii,* a parasite of *Ophidiom* sp. (Ophidiidae) from the South Pacific Ocean (Ho, 1977), differs from *A. lilianae* n. sp. in having a larger body size and head and trunk distinctly longer than wide, in fine details of appendages, such as the antennule and maxillule armature, number of mandibular teeth (32 in concave side and 40–42 in convex side), and maxilla teeth (14–16), in having a less ornamented maxilliped, and in the number caudal rami setae and the proportional size of caudal rami relative to abdomen. *Acanthochondria priacanthi* was redescribed based on specimens found at the base of the gill arch of a Japanese sandfish, *Arctoscopus japonicus* (Steindacher) (Trichodontidae), collected in the Sea of Japan (Ho and Kim, 1995). This species differs from the newly described species by the smaller body size, the shape of the head, the antenulle armature, fine details regarding the oral appendages such as number of mandibular teeth (41 on both sides of terminal blade) and maxilla teeth (11), and the ornamentation of the maxilliped, and the distribution of spinules in both legs.

In contrast, the only descriptions available for *A. incisa* and *A. tasmaniae* are the original ones; therefore, close comparisons with these species cannot be made with accuracy based on criteria mentioned above. We assert that these species need to be redescribed in detail in accord to modern criteria; nonetheless, both species exhibit a suite of morphological features that can be used to readily distinguish them from *A. lilianae* n. sp.

Acanthochondria tasmaniae was described based on 1 female with an attached male found in the buccal cavity of a "Sea Perch" taken on the east coast of Tasmania, Australia (Heegaard, 1962). It can be distinguished from the newly described species by the smaller size of female (4 mm); the shape and size of head (1 mm long, 1.2 mm greatest width, being much narrower anteriorly than posteriorly), the orientation of posterior processes (strongly curved towards the body midline), the size and shape of the genitoabdomen (length of the abdomen is nearly twice the width), and structure of the antennule (with a second and third joint near tip). The setae on antennule might have been overlooked by Heegaard (1962).

Acanthochondria incisa was described based on specimens found in the buccal cavity of *Helicolenus dactylopterus* (Delaroche) (Sebastidae) taken at Owase, Japan (Shiino, 1955). The features that differentiate *A. incisa* from *A. lilianae* n. sp. that can be discerned from the text and from the original figures (see Shiino, 1955), are female body size (4.06 mm), head shape, legs lacking spinules, fewer teeth on mandible (25 on convex margin and 27 on concave margin), more teeth on maxilla (17), maxillule without ornamentation, ornamentation of second and terminal segments of maxilliped (without minute spinules on outer surface of second segment and without 2 basal rows of denticles on outer surface of terminal segment), and the caudal ramus with 1 seta.

The only *Acanthochondria* species previously known from Patagonian waters is *A. phycidis* (Rathbum, 1996) (Ho, 1971). *Acanthochondria lilianae* n. sp. can be distinguished from this species by the cephalosome shape (with straight lateral margins vs. with divergent lateral margins), by the armature and structure of the antennule (large and inflate vs. small and cylindrical), by having legs 1 and 2 distinctly bilobed (Type A) instead of indistinctly bilobed (Type B), by having smaller number of teeth on both sides of the mandible (45–47 on convex margin, 34–36 on concave margins vs. 58 and 44, respectively) and on the terminal segment of maxilla (4–5 vs. 12 teeth), by having a more ornamented maxilliped, and by the proportions of genital and abdominal somites.

DISCUSSION

Five species of *Acanthochondria* have so far been reported from fishes of southwestern Atlantic Ocean. They are *A. phycidis* parasitic on "trout" (Salmonidae) and "mullet" (Mugilidae) from Malvinas Islands (Ho, 1971), *A. triangularis* parasitic on the Brazilian codling, *Urophycis brasiliensis* (Kaup) (Phycidae), and the gulf hake, *Urophycis mystaceus* Ribeiro (Phycidae), from the Brazilian coastal zone (Alves et al., 2003), *A. serrani* parasitic on *Serranus auriga* (Cuvier) (Serranidae) (Braicovich and Timi, 2009), *A. helicoleni* parasitic on the rubio, *Helicolenus lahillei* Norman (Sebastidae) (Cantatore and Timi, 2010), and *A. sagitta* infecting the flounder, *Xystreurys rasile* (Jordan) (Paralichthydae) (Alarcos and Timi, 2011), from Argentinean waters. *Acanthochondria lilianae* n. sp. is the first species in this genus to be reported from a notothenid (Nototheniidae), and this record is the second southernmost register of *Acanthochondria* in the southwestern Atlantic Ocean.

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