

HELMINTHOLOGIA, 43, 2: 103 – 108, JUNE 2006

Occurrence of acanthocephalans in Teleost fishes of Gemlik Bay, Sea of Marmara, Turkey

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Summary

The fish acanthocephalan fauna of Turkish waters is poorly known. In this study 8 fish species (*Merluccius merluccius*, *Trachurus trachurus*, *Uranoscopus scaber*, *Gobius niger*, *G. cobitis*, *Scorpaena scrofa*, *Eutrigla gurnardus*, *Solea vulgaris*) were collected from Gemlik Bay and examined for their acanthocephalan fauna. Four species not previously recorded in fish of Turkish waters were found: *Solearhynchus soleae* (Echinorhynchidae), *Acanthocephalooides propinquus*, *Paracanthocephalooides kostylewi* (Arhythmacanthidae), and *Longicollum pagrosomi* (Pomphorhynchidae). The most common species was *A. propinquus*, a parasite that infects mostly gobiids (*G. niger*, *G. cobitis*). *Longicollum pagrosomi* was a new record for the Mediterranean basin.

Key words: acanthocephalans; morphology; fishes; Sea of Marmara; taxonomy

Introduction

Although many studies of acanthocephalans have been conducted in various locations in the Mediterranean basin, Turkish waters are little studied (Altunel, 1983; Oğuz, 1991; Akmirza, 2002). The aim of this study was to conduct an investigation of acanthocephalan species in fishes of the Sea of Marmara, an area not previously investigated.

Material and Methods

The study area was the coastal waters of North-Western Anatolia, geographically located at 40° 22' N, 28° 52' E, specifically Gemlik Bay in the Sea of Marmara (Fig. 1). A total of 236 fish belonging to eight species were caught with fyke and standard nets at various times of the years 1990 – 1993. The samples comprised the European hake *Merluccius merluccius* (L.) (n=39), the scad *Trachurus trachurus* L. (n=39), the stargazer *Uranoscopus scaber* L.

(n=16), the black goby *Gobius niger* L. (n=28), the giant goby *G. cobitis* Pallas, 1811 (n=25), the scorpion fish *Scorpaena scrofa* L. (n=17), the grey gurnard *Eutrigla gurnardus* (L.) (n=16), and the common sole *Solea vulgaris* Quensen, 1806 (n=56). The fish were placed live in plastic containers with regular seawater for transfer to the laboratory, where they were examined for acanthocephalans within 24 hours of capture. The alimentary canal was examined using stereomicroscopy (×12 and ×50).

Parasites were fixed with acetic acid/formaldehyde/ethanol solution (AFA) and stained with Mayer's carmalum. Voucher specimens were deposited in the parasitological collection of Ataturk University, Erzurum, Turkey.

Parasitological parameters used followed Bush *et al.* (1997): prevalence (P, %), intensity range (IR), and mean intensity (MI) of infection.

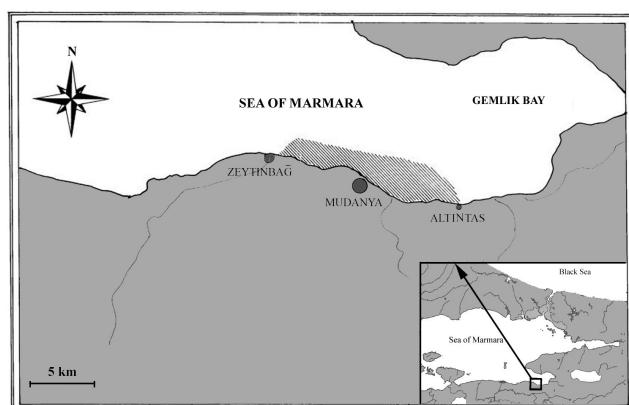


Fig. 1. Schematic map of the sample area

Results

Four acanthocephalan species belonging to three families were recovered from the host intestines.

Family Echinorhynchidae (Cobbold, 1879)

Solearhynchus soleae (Porta, 1905)

Synonyms: *Echynorhynchus soleae* Porta, 1905, *E. rhytidotes* Monticelli, 1905, *E. aurantiacus* Monticelli, 1887 (?), *E. corrugatus* Monticelli, 1900, *Acanthocephaloides soleae* (Porta, 1905), *A. rhytidotes* (Monticelli, 1905) sensu Belostova and Korniyuk, 2000.

Host: *S. vulgaris* (Tab. 1). Number of parasites collected: 10 (4 ♂♂, 6 ♀♀), number of parasites measured: 10. Voucher reference number: HWML 216145.

Diagnostic features: The body was 9464 (5382 – 20328) µm long and 728 (693 – 1200) µm wide (Tab. 2, Fig. 2).

The proboscis was 251 (224 – 320) µm long and the proboscis sac was 320 (277 – 480) µm long. There were 12 – 14 rows of hooks on the proboscis each comprising 5 – 6 hooks. The lemnisci were longer than the proboscis sac, measuring 348 (312 – 350) µm and 340 (312 – 349) µm long. The longest hooks were in the middle of the proboscis (Tab. 2). The smallest basal hooks were unrooted and resembled spines.

Males had two testes in the posterior part of the body (Fig. 2). They were distant from six piriform cement glands. The eggs measured 46 (56 – 68) µm long and 15 (12 – 20) µm wide.

Table 1. Distribution of acanthocephalan species in teleost fish from Gemlik Bay

Host fish species	Parasite species	N	N _i	P	MI	IR
<i>Merluccius merluccius</i>	<i>Acanthocephaloides propinquus</i>	39	8	20.5	4.1	1 – 16
<i>Trachurus trachurus</i>	<i>Longicollum pagrosomi</i>	39	2	5.2	1.5	1 – 2
<i>Uranoscopus scaber</i>	<i>A. propinquus</i>	16	1	6.2	1	1
<i>Gobius niger</i>	-/-	28	11	39.3	4.6	1 – 20
<i>G. cobitis</i>	-/-	25	10	40	10.7	1 – 24
<i>Scorpena scrofa</i>	-/-	17	7	41.2	2.8	1 – 2
<i>Eutrigla gurnardus</i>	-/-	16	1	6.2	1	1
<i>Solea vulgaris</i>	<i>Solearhynchus soleae</i>	56	6	10.7	1.6	1 – 3
	<i>A. propinquus</i>	56	11	19.6	1.7	1 – 11
	<i>Paracanthocephaloides kostylewi</i>	56	2	3.6	2.5	2 – 3

N – number of fishes examined; N_i – number of fishes infected; P – prevalence (%); MI – mean intensity; IR – intensity range (min-max)

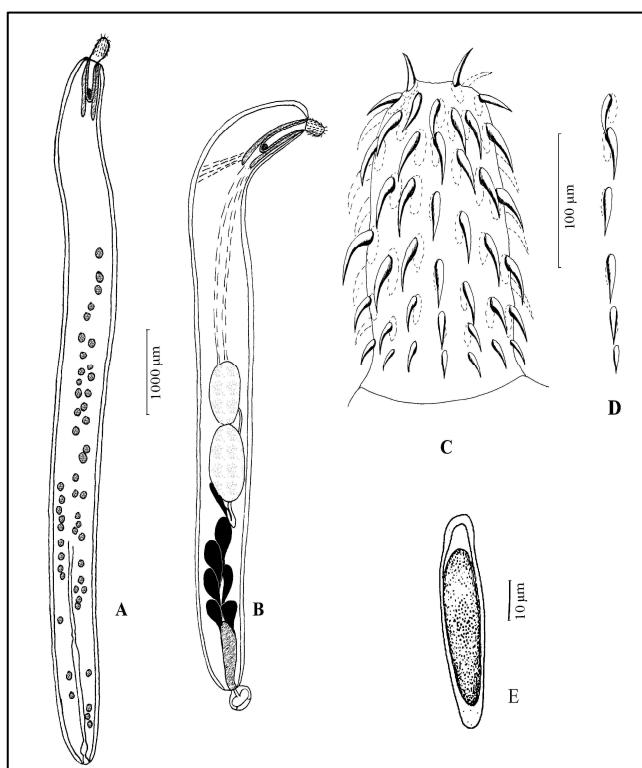


Fig. 2. *Solearhynchus soleae*. Host: *Solea vulgaris*. A – female in toto; B – male in toto; C – proboscis; D – hooks row; E – egg

Family Arhythmacanthidae (Yamaguti, 1935)

Acanthocephaloides propinquus (Dujardin, 1845) Meyer, 1933

Synonyms: *Echinorhynchus propinquus* (Dujardin, 1845), *E. fabri* (Rudolphi, 1819), *E. globulosus* (Rudolphi, 1819), *E. pumilio* (Rudolphi, 1819), *E. scorpaenae* (Rudolphi, 1819), *E. zenii* (Rudolphi, 1819)

Host: *U. scaber*, *G. niger*, *G. cobitis*, *M. merluccius*, *S. scrofa*, *E. gurnardus*, *S. vulgaris* (Tab. 1). Number of parasites collected: 223, number of parasites measured: 50 (25 ♂♂, 25 ♀♀). Voucher reference number: HWML216141, HWML 216142.

Diagnostic features: The body was 4054 (2600 – 6237) µm long and 182 (140 – 280) µm wide (Tab. 2, Fig. 3). The metasoma was covered with small cuticular spines 4.5 (3.75 – 5.25) µm long. The proboscis was cylindrical, 182 (140 – 280) µm long, armed with 12 rows of hooks each with 4 – 5 (rarely 5 or 5 – 6) rooted hooks. The middle hooks were longest, and the basal ones were smallest (Tab. 2). The lemnisci were longer than the proboscis sac. The proboscis sac was cylindrical and the ganglion was clearly visible in the base of the sac (Fig. 3).

The male copulatory bursa sucker was spherical with small suckers on its structure. The spherical testes occupied the middle part of the body (Fig. 3). There were six piriform posttesticular cement glands. Saefftigen's pouch was piriform. The uterus of the female was funnel-shaped and the selector cells were in clusters. The eggs were 56 (30 – 64)

Table 2. Mean measurements (μm) of acanthocephalans from fishes of Gemlik Bay

Parameters	<i>Solearhynchus soleae</i>		<i>Acanthocephalooides propinquus</i>		<i>Paracanthocephalooides kostylewi</i>		<i>Longicollum pagrosomi</i>	
	♂	♀	♂	♀	♂	♀	♂	♀
Body size (length \times width)	6115 \times 589	14400 \times 935	3490 \times 531	4523 \times 670	6583 \times 900	7680 \times 889	7300 \times 660	10164 \times 478
Proboscis length	230	282	178	232	360	320	3542	5313
Proboscis sac length	320	277	406	372	750	628	350	1617
Hook length:								
Apical	27	29	59	58	30	25	34	42
Middle	35	35	34	37	40	44	42	44
Basal	45	49	15	15	74	78	61	70
Testes sizes (width \times length):								
Anterior	338 \times 569	-	277 \times 391	-	240 \times 320	-	216 \times 272	-
Posterior	288 \times 595	-	274 \times 361	-	240 \times 312	-	216 \times 272	-
Egg size (width \times length)	-	15.0 \times 46.0	-	13 \times 56	-	6.8 \times 57.4	-	34 \times 140

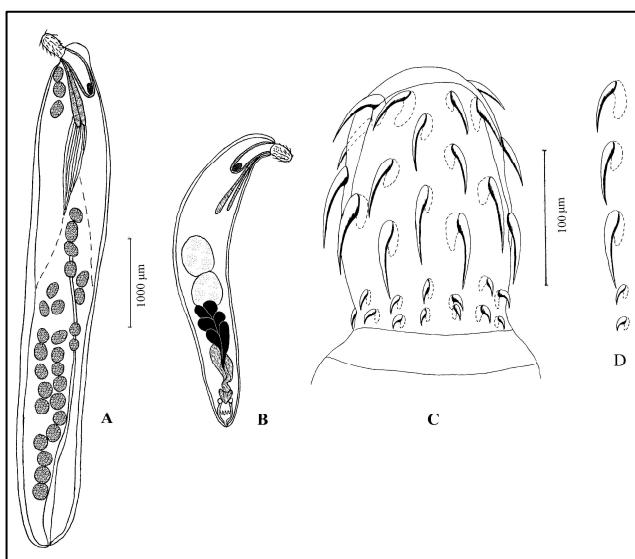


Fig. 3. *Acanthocephalooides propinquus*. Host: *Gobius niger*. A – female in toto; B – male in toto; C – proboscis; D – hooks row

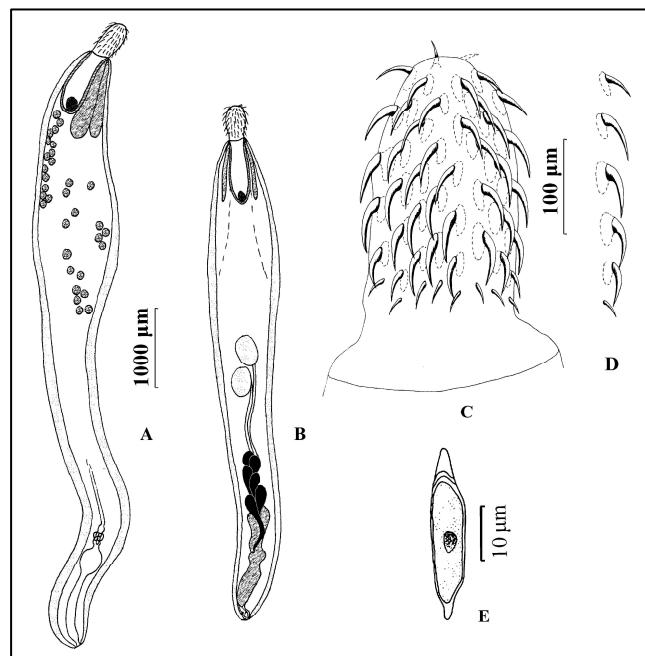


Fig. 4. *Paracanthocephalooides kostylewi*. Host: *Solea vulgaris*. A – female in toto; B – male in toto; C – proboscis; D – hooks row; E – egg

μm long and 13 (10 – 16) μm wide. Polarization was clearly visible in the secondary membrane of the eggs. The acanthor had one unrooted hook. The vitelline tube had a very thin membrane and the wide vagina was funnel-shaped and short. There were four spender located on both sides of the vagina. The genital pores in both sexes were terminal.

Paracanthocephalooides kostylewi (Meyer, 1933)

Synonyms: *Acanthocephalooides kostylewi* Meyer, 1933, *A. propinquus* sensu Kostylew, 1926

Host: *S. vulgaris* (Tab. 1). Number of parasites collected: 3 (1 ♂, 2 ♀♀), number of parasites measured: 3. Voucher reference number: MP9016A1-3.

Diagnostic features: The body was 7507 (7404 – 7854) μm long and 893 (739 – 1040) μm wide (Tab. 2, Fig. 4). The anterior part of the body was wider than the posterior. The proboscis was cylindrical, armed with 16 rows of hooks

each with 5 – 6 hooks the longest hooks being in the middle of the proboscis (Tab. 2). The smallest basal spinelike hooks were unrooted.

The testes were located centrally in the body distant from the cement glands (Fig. 4). There were six cement glands and a well-developed Saefftigen's pouch. The vitelline tube possessed well-developed selector cells. The eggs measured 57.4 (42 – 64) μm long and 17.0 (12 – 20) μm wide.

Family Pomphorhynchidae (Yamaguti, 1938)

Longicollum pagrosomi (Yamaguti, 1935)

Host: *T. trachurus* (Tab. 1). Number of parasites collected: (2 ♂♂, 1 ♀), number of parasites measured: 3. Voucher re-

ference number: MP9016A 5-6.

Diagnostic features: The body was 7300 (5036 – 10164) µm long and 660 (478 – 878) µm wide (Tab. 2, Fig. 5). The proboscis was cylindrical and wider anteriorly. It was 3542 (2310 – 5313) µm long and armed with 11 – 12 rows of hooks comprising 11 – 13 hooks in each. The anterior hooks were smaller than the posterior, measuring 34 (24 – 42) µm, 42 (40 – 44) µm, to 61 (54 – 70) µm long. The short proboscis sac consisted of two membranes. The lemnisci were level with the proboscis. One immature male sample had two spherical testes, 216 × 272 µm in diameter. The copulatory bursa was 80 × 140 µm. The cement glands were indistinct. The eggs measured 140 (70 – 210) µm long and 34 (17 – 52) µm wide.

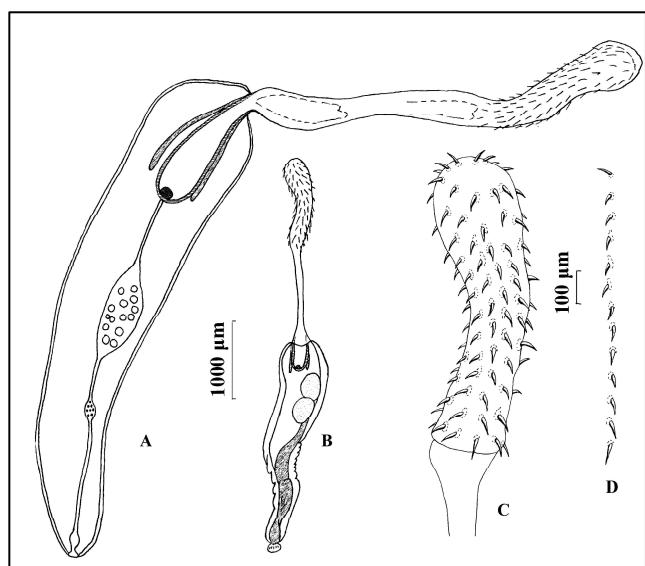


Fig. 5. *Longicollum pagrosomi*. Host: *Trachurus trachurus*.
A – female *in toto*; B – male *in toto*; C – proboscis; D – hooks row

Discussion

Solearhynchus soleae, described as *Echinorhynchus soleae* from sole, *Solea impar*, in the Mediterranean Sea was later re-described by Meyer (1933) as *Acanthocephaloïdes soleae*. De Buron and Maillard (1985) placed it in the genus *Solearhynchus* (Echinorhynchidae). This species was recorded in the Black Sea by Belofastova and Korniychuk (2000) (as *Acanthocephaloïdes rhytidotes*).

Acanthocephaloïdes propinquus, was the most common species in this study (Tab. 1). It is common in marine and brackish water areas of the Mediterranean basin where it has been found in gobies in coastal lagoons of France by Parukhin (1976), de Buron *et al.* (1986), Sasal *et al.* (1996, 2000, 2001), de Buron and Chauvet (2003). *A. propinquus* has been recorded in the Adriatic (Radujković, 1989; Dezfuli, *et al.*, 1992, 1996) and the Black Sea (including the Sea of Azov) (Pogoreltseva, 1952; Solonchenko, 1982; Naideno-va, 1974; Kvach, 2002a-c). In Atlantic waters, *A. propinquus* was found off the Moroccan coastal waters by

Belhgyti *et al.* (1994), and near Galicia by Sanmartin *et al.* (2000a-b, 2001), Alvares *et al.* (2002).

The main hosts for this species are gobiid fishes (Dujardin, 1845, named this acanthocephalan “Echin. des gobies”). Black and giant gobies are most abundantly infected in the Sea of Marmara (Tab. 1). The morphology of the worms was similar to that of the Black Sea specimens. In the North-Western Black Sea, *A. propinquus* has the proboscis armed with 12 rows of hooks each with 4 – 5 hooks (Golvan, 1969; Kvach, 2002a, c). Mediterranean specimens have 5 – 6 hooks in each of 12 rows (de Buron *et al.*, 1986; Dezfuli *et al.*, 1992). Radujković (1989) mentioned those found in gobiids of the waters off Montenegro, Adriatic Sea, having 4 – 6 hooks in each row.

According to Kvach (2002a), the malacophagous round (*Neogobius melanostomus*) and monkey (*N. fluviatilis*) gobies are less infected with *A. propinquus* than the grass goby *Zosterisessor ophiocephalus*, which feeds mostly on crustaceans (Smirnov, 1986). De Buron and Chauvet (2003) stated that the intermediate host of *A. propinquus* is the amphipod, *Caprella acutifrons*. However, this amphipod is not significant in the goby diet. It is possible other crustaceans are intermediate hosts for *A. propinquus*.

P. kostylewi was first reported by Kostylew (1926) as *Echinorhynchus propinquus* in the snouted sole, *S. nasuta*, (Pallas, 1811) caught off the Crimean coast. Later, Meyer (1933) described this species as *Acanthocephaloïdes kostylewi*. Bray *et al.* (1988) placed this species in the genus *Paracanthocephaloïdes* because of the lack of cuticular spines. This species is found in the snouted sole in the Black Sea and Sea of Azov (Chernyshenko, 1947; Rădulescu, 1948; Solonchenko, 1982; Florescu & Ieniștea, 1984). It is also found in the grass goby (Florescu & Ieniștea, 1984). de Buron *et al.* (1986) noted that male reproductive structures occupied the posterior third of the body (similar to *Paracanthocephaloïdes incrassatus*). Also *Paracanthocephaloïdes kostylewi* was characterised as a “small species”. In the present study the testes of this species were centrally located (Fig. 5) in agreement with Kostylew’s (1926) observations. The body was large (Tab. 2) in agreement with the data of Chernyshenko (1947) who gave the length as 4500 – 10000 µm.

The Far-Eastern acanthocephalan *L. pagrosomi* was first described in fish from the Mediterranean basin. The specimens from the Sea of Marmara were smaller (Tab. 2) than those described by Yamaguti (1935) from fish in Japanese waters. This is due to the fact that the scad is a host of immature specimens of *L. pagrosomi* (Yamaguti 1935). The intermediate hosts for this species are amphipods (Yamaguti, 1935).

Other acanthocephalans have been recorded previously in Turkish waters. *Neoechinorhynchus agilis* (Rudolphi, 1819) (Neoechinorhynchida: Neoechinorhynchidae) is recorded in a study on grey mullets (Mugilidae) from the Aegean Sea (Altunel, 1983). This is a typical parasite of mugilids in the Mediterranean basin and Far-Eastern waters. Another study off Gökçeada Island revealed *Acanthocephalus lucii* (Müller, 1776) (Echinorhynchida: Echinorhynchidae)

in the annular gilthead, *Diplodus annularis* (L.), the scorpion fish, *Scorpaena porcus* (L.), and the perch, *Perca fluviatalis* (L.), (Akimirza, 2002). This limnetic Euro-Siberian species is atypical for marine fishes. However, in brackish waters of the Black Sea basin this parasite occurs in gobiods. For example, in Sebastopol Bay and the Khadzibey Estuary (Kostylew, 1926; Kvach, 2000c). *Telosentis exiguis* von Linstow, 1901 (Polymorphida: Illiosenthidae) is recorded in flounder, *Pleuronectes flesus luscus* (Pallas, 1811), from the Ekinli Lagoon connected to the Sea of Marmara (Oğuz, 1991). This parasite has a Mediterranean origin.

Although several studies have been conducted on *A. propinquus*, few references were found mentioning the other acanthocephalan parasites recorded in this study. Four acanthocephalan species, not previously recorded in fishes of Turkish marine waters, and one species, *L. pagrosomi*, found for the first time in the Mediterranean basin, have been confirmed.

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RECEIVED AUGUST 2, 2005

ACCEPTED MARCH 20, 2006