

Digenean and cestode parasites of teleost fish from the Eastern Black Sea Region

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Abstract: A total of 625 fish belonging to 25 fish species were collected from the coastal areas of the Eastern Black Sea Region of Turkey and were examined for fish parasites. The number of specimens of fish parasites collected included 242 digeneans (23 *Anisocoelium capitellatum*, 12 *Anisocladium gracile*, 50 *Anisocladium fallax*, 1 *Stephanostomum minutum*, 131 *Helicometra fasciata*, and 25 *Lecithochirium musculus*) and 517 cestodes (437 *Grillotia erinaceus*, 79 *Progrillotia dasyatidis*, and 1 *Scolex pleuronectis*). New published records for parasite fauna of Turkey included *G. erinaceus*, *A. gracile*, *S. minutum*, and *L. musculus*, while *A. capitellatum*, *A. fallax*, *H. fasciata*, *P. dasyatidis*, and *S. pleuronectis* were recorded for the first time along the Black Sea coast of Turkey. Infection rates, hosts, and the exact locations in the hosts are listed for each parasite.

Key words: Turkey, Black Sea, teleost, Digenea, Cestoda

1. Introduction

There has been a wealth of published articles to date pertaining to the parasites of marine fish from the coasts of Turkey, including the Black Sea. Recent published articles pertaining to the fish parasites from Turkey include those of İsmen and Bingel (1999), Kvach and Oğuz (2007), Oytun (1963), Özer (2007), Öztürk and Özer (2008), Sezen-Akandere (1972), Oğuz (1989, 1991, 1995, 1996), Keser (2002), Tuncel (2003), Oğuz and Kvach (2006), Tuncel and Akmirza (2006), Keser et al. (2007), and Oğuz and Bray (2006, 2008). There is a scarcity of articles about fish parasites from the Black Sea coasts of Turkey and there is no recorded study for the Eastern Black Sea Region of Turkey. The purpose of this investigation was to contribute to the knowledge on fish parasite fauna of the Black Sea coasts of Turkey.

2. Materials and methods

In this study conducted between June 2007 and December 2010, fish from 3 main areas [Trabzon (41°01'59"N, 39°44'50"E), Rize (41°01'51"N, 40°30'50"E), and Artvin (41°25'20"N, 41°22'26"E); Figure] were caught, identified, and dissected at the site. The parasites were isolated and fixed with 70% ethyl alcohol or 5% formalin on site.

The samples were bought to the Parasitology Research Laboratory of the Biology Department of the Science Faculty of Atatürk University. The identification of the

fish was accomplished using Slastenenko (1955), Geldiay (1969), and Can and Bilecenoğlu (2005).

The identification of the parasites was done according to Dawes (1947), Manter (1947), Markevich (1951), Bychovskaya-Pavlovskaya (1964a, 1964b), Yamaguti (1955, 1963), and Schell (1970), and the preparation of the parasites was done according to Kruse and Pritchard (1982) and Rolbiecki (2002). Statistical values were calculated according to Bush et al. (1997). The materials were deposited in the Biology Department of the Science Faculty of Atatürk University.

3. Results

Four of 25 investigated fish species were infected with digenean parasites and 6 species were infected with cestode parasites. The parasite that had the highest rate of infection was *Helicometra fasciata* and the most abundant parasite was *Grillotia erinaceus*. Eighteen fish species were negative for both digenean and cestode parasites (Table 1).

Three species of cestodes (*Gillotia erinaceus*, *Progrillotia dasyatidis*, and *Scolex pleuronectis*) (Table 2) and 6 species of digenetic trematodes (*Anisocladium fallax*, *Anisocladium gracile*, *Anisocoelium capitellatum*, *Helicometra fasciata*, *Lecithochirium musculus*, and *Stephanostomum minutum*) (Table 3) were harvested and fixed from 625 fish from the Eastern Black Sea Region of Turkey. Information for each of the metazoan parasites follows below.

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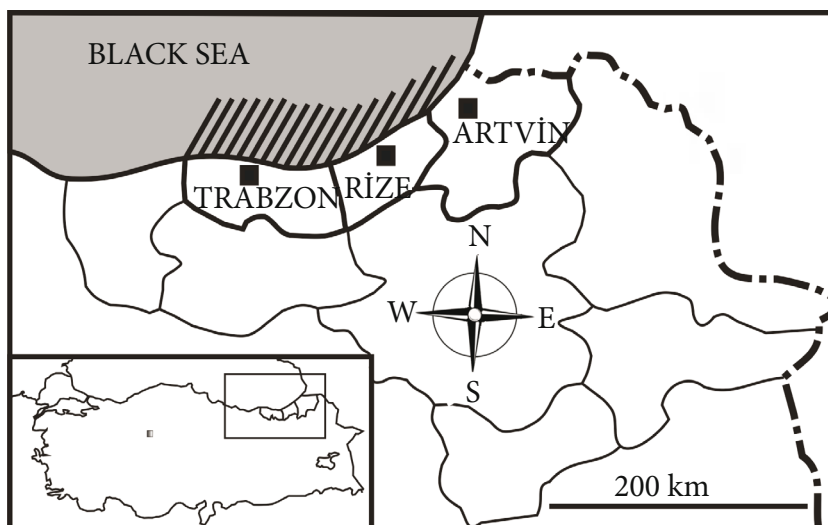


Figure. Research area.

Table 1. Logistic values of the parasites (L: locality, T: Trabzon, R: Rize, A: Artvin, TPN: total parasite number, EFN: examined fish number, IFN: infected fish number, %: infection rate, MA: mean abundance, MI: mean intensity).

Host	Parasite	Infection site	L	TPN	EFN	IFN	%	MI	MA
<i>Uranoscopus scaber</i>	<i>Anisocladium fallax</i>	Intestine	T, R	50	50	14	28	3.6	1.00
<i>Uranoscopus scaber</i>	<i>Anisocladium gracile</i>	Intestine	T, R	12	50	8	16	1.5	0.24
<i>Uranoscopus scaber</i>	<i>Anisocoelium capitellatum</i>	Gall bladder	T, R	23	50	11	22	2.1	0.46
<i>Merlangius merlangus euxinus</i>	<i>Grillotia erinaceus</i>	Intestine Pyloric ceca	T, R, A	437	147	108	74	4.0	2.97
<i>Scorpaena porcus</i>	<i>Helicometra fasciata</i>	Intestine	T	131	115	17	15	7.7	1.14
<i>Ophidion rochei</i>	<i>Lecithochirium musculus</i>	Intestine	T	25	3	3	100	8.3	8.33
<i>Uranoscopus scaber</i>	<i>Progrillotia dasyatidis</i>	Intestine	T, R	9	50	2	4	4.5	0.18
<i>Ophidion rochei</i>	<i>Progrillotia dasyatidis</i>	Intestine	T	41	3	2	67	20.5	13.67
<i>Mullus barbatus</i>	<i>Progrillotia dasyatidis</i>	Intestine	T	10	17	3	18	3.3	0.59
<i>Gobius niger</i>	<i>Progrillotia dasyatidis</i>	Intestine	T, R	16	9	4	44	4.0	1.78
<i>Gaidropsarus mediterraneus</i>	<i>Progrillotia dasyatidis</i>	Intestine	T	3	6	2	33	1.5	0.50
<i>Ophidion rochei</i>	<i>Scolex pleuronectis</i>	Intestine	T	1	3	1	33	1.0	0.33
<i>Uranoscopus scaber</i>	<i>Stephanostomum minutum</i>	Intestine	R	1	50	1	2	1.0	0.02

Digenea: Trematoda

Cryptogonimidae Ward, 1917

Anisocladium fallax (Rudolphi, 1819) Looss, 1902

Synonyms: *Distoma fallax* Rudolphi, 1819;
Echinostomum fallax (Rudolphi, 1819) Cobbold, 1960;
Anoiktostoma fallax (Rudolphi, 1819) Stossich, 1899;
Anisogaster fallax (Rudolphi, 1819) Looss, 1901

Host: *Uranoscopus scaber*

Uranoscopus scaber is a definitive host of *A. fallax*.
A. fallax is generally found in the pyloric ceca, and

occasionally in the duodenum and rectum. This parasite was found in *U. scaber* in the Mediterranean Sea by Papoutsoglou (1976) and Bartoli and Gibson (2000) and in the Sea of Marmara by Oğuz (1995) and Oğuz and Bray (2006).

Anisocladium gracile (Looss, 1901) Looss, 1902

Synonym: *Anisogaster gracilis* Looss, 1901

Host: *Uranoscopus scaber*

Anisocladium gracile is found in the rectum of *Uranoscopus scaber* (Bartoli and Gibson, 2000). Previously

Table 2. Morphometric measurements (μm) for the cestode parasites (L: total length; W: max. width; SL: scolex length; SW: scolex width; BL: bothria length; PL: proglottid length; PW: proglottid width; TSL: tentacle sac length; PSL: plerocercoid length; PSW: plerocercoid width).

	<i>Grillotia erinaceus</i>	<i>Progrillotia dasyatidis</i>	<i>Scolex pleuronectis</i>
L	-	4474	1827
W	-	604	284
SL	6885	1028	-
SW	1118	-	-
BL	1042	294	210
PL	-	3446	-
PW	-	604	-
TSL	1467	411	-
PSL	3998	-	-
PSW	2330	-	-

this species was recorded in the Black Sea by Vlasenko (1931) and Koval and Sariçkova (1964) and in the Mediterranean Sea by Papoutsoglou (1976). This is the first record from Turkey.

***Anisocoelium capitellatum* (Rudolphi, 1819) Lühe 1900**

Synonym: *Distomum capitellatum* Rudolphi, 1819

Host: *Uranoscopus scaber*

Anisocoelium capitellatum, which is found in gall bladder of *Uranoscopus scaber*, has been recorded in the Mediterranean and Black Sea by Bartoli and Gibson (2000) and Papoutsoglou (1976) and in the Sea of Marmara by Oğuz and Bray (2006).

Opecoelidae Ozaki, 1925

***Helicometra fasciata* (Rudolphi, 1819) Odhner, 1902**

Synonyms: *Distoma fasciatum* Rudolphi, 1819; *Distoma gobii* Stossich, 1883; *Laborchis mutabilis* Stossich, 1902; *Allocreadium fasciatum* Rudolphi, 1819; *Distoma (Dicrocoelium) fasciatum* Rudolphi, 1819; *Helicometra mutabilis* Stossich, 1903; *Helicometra gobii* Stossich, 1883; *Helicometra flava* Stossich, 1903

Host: *Scorpaena porcus*

The definitive hosts of *Helicometra fasciata* are teleost fish. Metacercariae of the parasite are found in shrimp (*Palaemon elegans*, *P. adspersus*) (Korniychuk, 2009). *H. fasciata* was reported in *Scorpaena porcus*, *Crenilabrus tinca*, and *Onos tricirrata* by Vlasenko (1931); in *Labrus viridis*, *Symphodus ocellatus*, *Symphodus roissali*, and *Symphodus tinca* by Korniychuk (2001) in the Black Sea; in *Mullus barbatus*, *Sciaena umbra*, and *Scorpaena scrofa* by Naidenova and Mordvinova (1997) and in *Serranus scriba* by Arcuelo et al. (1997) in the Mediterranean Sea;

in the family Sparidae by Akmirza (2000a); in *Pagellus erythrinus* by Akmirza (2000b); in *Scorpaena porcus*, *Conger conger*, and *Trigla lucerna* by Akmirza (2001) in the Aegean Sea; and in *Gaidropsarus mediterraneus*, *Gobius cobitis*, *Symphodus tinca*, *Zosterisessor ophiocephalus*, and *Scorpaena scrofa* by Oğuz (1995) and Oğuz and Bray (2006) in the Sea of Marmara.

Acanthocolpidae Lühe, 1906

***Stephanostomum minutum* (Looss, 1901) Manter, 1940**

Synonyms: *Stephanochasmus minutus* Looss, 1901; *Stephanochasmus bicoronatus* Vlasenko (1931); *Stephanostomum (Stephanochasmus) bicoronatum* Osmanov (1940)

Host: *Uranoscopus scaber*

Stephanostomum minutum is only found in the rectum of *Uranoscopus scaber* in the Mediterranean Sea and Black Sea (Bartoli and Bray, 2001). It was recorded in the Mediterranean Sea by Bartoli and Bray (2001) and Bray et al. (2005), and in the Black Sea by Pogoreltseva (1952). This report extends the range for the first time for *S. minutum* into the Black Sea of Turkey.

Hemiuridae Lühe, 1901

***Lecithochirium musculus* (Looss, 1907) Nasir & Diaz, 1971**

Synonyms: *Sterrhurus musculus* (Looss, 1907) Nasir & Diaz, 1971; *Brachiphallus musculus* (Looss) Skrjabin & Guschanskaja, 1955; *Lecithochirium branchialis* Stunkard & Nigrelli, 1966; *Lecithochirium floridensis* (Manter, 1974)

Host: *Ophidion rochei*

L. musculus was previously found in *Scorpaena scrofa*, *Solea lutea*, *Trachinus draco*, and *Trachurus mediterraneus*

Table 3. Morphometric measurements (μm) for the digenean parasites found (L: length; W: width; OSL: oral sucker length; OSW: oral sucker width; VSL: ventral sucker length; VSW: ventral sucker width; PL: pharynx length; PW: pharynx width; ATL: anterior testis length; ATW: anterior testis width; PTL: posterior testis length; PTW: posterior testis width; OL: ovary length; OW: ovary width; SCL: short ceca length; LCL: long ceca length; EL: egg length; EW: egg width; ECS: escoma). Values are mean \pm standard deviation (min-max).

	<i>A. gracile</i>	<i>A. fallax</i>	<i>A. capitellatum</i>	<i>L. musculus</i>	<i>H. fasciata</i>	<i>S. minutum</i>
L	5747 \pm 989 (4527–6902)	9424 \pm 1223 (7734–10,373)	4813 \pm 1822 (1259–8161)	1538 \pm 294 (893–2253)	2526 \pm 959 (609–6069)	1172
W	358 \pm 31 (325–406)	457 \pm 35 (426–508)	928 \pm 248 (690–1 482)	572 \pm 125 (325–792)	796 \pm 168 (589–1319)	234
OSL	194 \pm 14 (178–210)	184 \pm 26 (162–210)	290 \pm 64 (142–365)	119 \pm 26 (65–170)	230 \pm 30 (186–323)	89
OSW	155 \pm 19 (137–186)	206 \pm 14 (186–218)	408 \pm 83 (203–487)	135 \pm 24 (89–186)	248 \pm 30 (186–339)	137
VSL	79 \pm 6 (73–89)	166 \pm 15 (145–178)	241 \pm 51 (142–284)	251 \pm 48 (62–364)	369 \pm 64 (307–558)	137
VSW	80 \pm 5 (73–89)	166 \pm 17 (145–186)	241 \pm 46 (142–284)	259 \pm 49 (178–356)	382 \pm 68 (323–630)	154
FL	99 \pm 8 (89–113)	119 \pm 9 (113–129)	203 \pm 61 (102–264)	78 \pm 14 (57–113)	92 \pm 16 (60–145)	73
FW	95 \pm 17 (73–121)	77 \pm 23 (52–97)	206 \pm 61 (89–264)	76 \pm 18 (32–113)	120 \pm 21 (72–178)	97
ATL	276 \pm 48 (202–331)	536 \pm 25 (509–558)	317 \pm 110 (137–467)	97 \pm 19 (73–129)	282 \pm 83 (160–541)	65
ATW	190 \pm 36 (129–242)	218 \pm 28 (202–251)	178 \pm 79 (73–284)	107 \pm 17 (81–129)	445 \pm 99 (315–687)	57
PTL	301 \pm 68 (218–436)	572 \pm 55 (509–622)	443 \pm 136 (305–670)	99 \pm 12 (89–129)	353 \pm 139 (200–768)	65
PTW	221 \pm 40 (154–267)	208 \pm 8 (202–218)	203 \pm 73 (122–305)	100 \pm 15 (81–121)	439 \pm 136 (267–929)	57
OL	169 \pm 23 (129–210)	248 \pm 17 (234–267)	156 \pm 31 (122–183)	109 \pm 29 (65–162)	172 \pm 82 (100–445)	40
OW	144 \pm 22 (121–186)	208 \pm 12 (202–226)	149 \pm 31 (122–183)	165 \pm 26 (129–218)	364 \pm 100 (136–566)	40
SCL	–	–	2976 \pm 724 (2132–3756)	–	–	–
LCL	–	–	2144 \pm 467 (1685–2720)	–	–	–
EL	18 \pm 2 (16–20)	19 \pm 1 (18–20)	18 \pm 3 (14–20)	20 \pm 2 (16–22)	70 \pm 11 (44–105)	65
EW	9 \pm 1 (8–10)	10 \pm 1 (8–10)	10 \pm 1 (8–10)	13 \pm 2 (10–14)	43 \pm 8 (36–76)	57
ECS	–	–	–	845 \pm 417 (365–1462)	–	–

by Naidenova and Mordvinova (1997); in *Lophius piscatorius* by Bartoli and Gibson (2006); in *Conger conger*, *Lophius piscatorius*, and *Muraena helena* by Bartoli and Gibson (2007); and in *Trachurus trachurus*, *Serranus hepatus*, *Crenilabrus cinereus*, *Conger conger*, and *Atherina hepsetus* by Paradižnik and Radujković (2007) in the Mediterranean Sea. This report is the first record for *L. musculus* from Turkey.

Cestoda

Trypanorhyncha Diesing, 1863

Lacistorhynchidae Guiart, 1927

Grillotia erinaceus (van Beneden, 1858)

Synonyms: *Tetrarhynchus erinaceus* van Beneden, 1858; *Rhynchobothrium imparispine* Linton, 1897; *Grillotia pseuderinaceus* Dollfuss, 1969; *Grillotia recurvispinis* Dollfuss, 1969

Host: *Merlangius merlangus euxinus*

Regarding *G. erinaceus*, the adult specimens are found in elasmobranchs and the larvae are found in Teleostei. It is the most common trypanorhynch cestode of marine fish (Campbell and Beveridge, 1994). It was previously reported in *Solea solea* in the Aegean Sea by Papoutsoglou and Papaparaskeva-Papoutsoglou (1977); in *Odontogadus merlangus euxinus*, *Spicara smaris*, and *Trachurus mediterraneus* by Dimitrov (1989); and in *Merlangius merlangus euxinus* by Polyakova (2009) in the Black Sea. In this study, the plerocercoids of the parasite were found in various visceral organs of *Merlangius merlangus euxinus*. Prevalence of the parasite was high in autumn (94%) and low in summer (67%).

Progrillotiidae Palm, 2004

Progrillotia dasyatidis Beveridge, Neifar & Euzet, 2004

Hosts: *Ophidion rochei*, *Mullus barbatus*, *Gobius niger*, *Uranoscopus scaber*, *Gaidropsarus mediterraneus*

Progrillotia dasyatidis was reported in pleuronectiform fish from the coasts of Portugal (Marques et al., 2005). It was also found in the Sea of Marmara by Oğuz and Bray (2008).

Tetracystidae Carus, 1863

Tetracystidae incertae sedis

Scolex pleuronectis Müller, 1788

Host: *Ophidion rochei*

Infections of *Scolex pleuronectis* were recorded in *Engraulis encrasicolus*, *Gadus capellanus*, *Mullus barbatus*, *Scorpaena scrofa*, *Spicara smaris*, *Trachinus draco*, *Trachurus mediterraneus*, and *Trachurus trachurus* by

Naidenova and Mordvinova (1997) in the Mediterranean Sea; in *Solea solea* by Keser et al. (2007) from the Dardanelles Strait; in *Pleuronectes flesus* by Oğuz (1989); in *Anguilla anguilla* by Altunel (1989) in the Ekinli Lagoon; and in *Gobius niger*, *Gobius cobitis*, *Merluccius merluccius*, *Eutrigla gurnardus*, *Solea vulgaris*, and in *Scorpaena scrofa* by Oğuz (1995) and in *Boops boops*, *Solea nasuta*, *Spondylisoma cantharus*, *Ophidium barbatum*, *Smaris smaris*, *Scorpaena porcus*, *Trachurus mediterraneus*, and *Scomber japonicus* by Akmirza (2002) in the Aegean Sea. *Scolex pleuronectis* was also found in *Belone belone euxini* and *Trachurus mediterraneus* by Polyakova (2009); in *Liza aurata*, *Liza saliens*, and *Mugil cephalus* by Dmitrieva and Gaevskaya (2001); and in *Odontogadus merlangus euxinus*, *Ophidion rochei*, *Sarda sarda*, and *Trachurus mediterraneus* by Dimitrov (1989) in the Black Sea.

4. Discussion

According to Öktener (2005), the digenetic trematode fauna of marine fish of Turkey includes 45 species (19 from the Sea of Marmara, 22 from the Aegean Sea, 1 from the Black Sea, and 3 from localities not mentioned). In the present study, 6 trematode species were found in the Black Sea. Of these species, *A. capitellatum* and *A. fallax*, previously recorded in the Sea of Marmara, and *H. fasciata*, which was found in both the Sea of Marmara and the Aegean Sea, had not been previously recorded in fish from the Black Sea coasts of Turkey. *A. gracile*, *S. minutum*, and *L. musculus* were reported for the first time in Turkey.

Cestode fauna in fish from Turkey consisted of 12 species (Öktener, 2005). For this study, 3 species were found in the Black Sea. *S. pleuronectis*, which had been found in fish from both the Sea of Marmara and the Aegean Sea, and *P. dasyatidis*, which had been recorded only from the Sea of Marmara (Oğuz and Bray, 2008), were found in fish from the Black Sea coast of Turkey for the first time. In addition, *G. erinaceus* had not previously been recorded from Turkey.

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