

## RESEARCH ARTICLE

# Digenean trematodes of fish in the waters off Gökçeada, the Aegean Sea, Turkey

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### Abstract

In the present study, a total of 50 marine fish species were examined for parasites and a total of 22 digenean species (*Anisocladium fallax*, *Stephanostomum minutum*, *Bucephalus varicus*, *Prosorhynchus crucibulum*, *Anoiktostoma coronatum*, *Paracryptogonimus aloysiae*, *Baciger israelensis*, *Tergestia laticollis*, *Stringotrema pagelli*, *Schikhobalotrema*, *Aphanurus stossichi*, *Lecithochirium fusiforme*, *Lecithocladium exicum*, *Holorchis pycnopus*, *Lepocreadium album*, *Opechono ollsoni*, *Mesometra orbicularis*, *Elstia stossichianum*, *Helicometra fasciata*, *Opecoeloides furcatus*, *Pachycreadium carnosum*, *Bathycreadium* sp.) belonging to ten families (Acanthostomidae, Bucephalidae, Cryptogonimidae, Faustulidae, Fellodistomidae, Haploplanchnidae, Hemiuridae, Lepocreadiidae, Mesometridae, Opecoelidae) were identified in 19 fish species.

**Keywords:** Digenea, fish parasites, Gökçeada.

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### Introduction

Parasites are accepted among the most detrimental effects on fish stocks all over the world. They cause retardation in growth, lead to diseases and may even cause the deaths of whole school of host fish. Only a small number of parasites do not cause noticeable defects on fish, however, when they increased in numbers an increase in ratio of the harm also occur.

The digenea are one of the major taxa of parasitic Platyhelminthes and they are invariably endoparasites. Digeneans are heteroxenous and require more than one host to complete their life cycle. The most important limiting factor for digenean dispersal is the intermediate host such as gastropoda and bivalvia (Paperna and Dzikowski 2006).

There are a lot of studies about digenean trematodes in fish in the world and they provided details on the morphology and anatomy of parasites species, their life cycle, infection rates, seasonal variations and geographical locations.

A total of 144 fish species (from 60 families) around Gökçeada Island have been reported by Ulutürk (1987) and this characterises its high fish species richness and the importance of this marine ecosystem. Most of these fish species have commercial value in the Turkish fisheries.

The goals of this study is to determine the digenean parasite fauna of 50 fish species collected off Gökçeada and their infections levels and to provide short descriptions of identified parasites.

## **Materials and Methods**

Fish samples were caught using various fishing gears such as trawl, gill-net, long-line, vertical long-line near Gökçeada located in the northeastern Aegean Sea in Turkey between April 2011 and April 2012. Fish samples were transported to laboratory at the Faculty of Fisheries and kept alive until parasitological investigation. Fish samples were identified according to the keys provided Ekingen (2004), Golani *et al.* (2006). Fish were dissected carefully for observing internal organs and then placed in separate Petri dishes containing physiological saline water. Examination for digenean parasites was conducted under a stereomicroscope. Live parasites were slightly compressed between a slide and a coverslip prior to be examined under light microscope. Some digenean parasites were fixed in AFA solution and then cleared and mounted in Canada balsam. Measurements were made using an ocular micrometer or BEL view camera programs. Identification of the parasites was made according to relevant papers (Yamaguti 1958; Dawes 1968; Gibson *et al.* 2002; Jones *et al.* 2005; Bray *et al.* 2008).

## **Results and Discussion**

In the present study, digenean parasite fauna of fish off Gökçeada were determined in a total of 887 individual fish specimens belonging to 50 different fish species. Twenty-two digenean species were identified in only 19 out of 50 fish species. Abundance, prevalence and mean intensity of identified digenean species in their respective hosts are presented in Table 1.

**Table 1.** Digenean parasites in some fish species collected off Gökçeada and their infection rates

Family	Parasite species	Host	NFI	P (%)	MI	Min-Max	
Acanthostomidae	<i>Anisocladium fallax</i> (Rudolphi, 1819)	<i>Uranoscopus scaber</i> (Linnaeus, 1758)	29	89.66	9.1	1-19	
	<i>Stephanostomum minutum</i> (Looss, 1899)	<i>Uranoscopus scaber</i> (Linnaeus, 1758)	29	6.89	4.5	2-7	
Bucephalidae	<i>Bucephalus varicus</i> (Manter, 1940)	<i>Lichia amia</i> (Linnaeus, 1758)	10	70	5.57	3-9	
	<i>Prosorhynchus crucibulum</i> (Rudolphi, 1819)	<i>Conger conger</i> (Linnaeus, 1758)	28	14.29	>25		
Cryptogonimidae	<i>Anoiktostoma coronatum</i> (Wagener, 1852)	<i>Sciaena umbra</i> (Linnaeus, 1758)	53	30.19	11.19	3-25	
	<i>Paracryptogonimus aloysiae</i> (Stossich, 1885)	<i>Sciaena umbra</i> (Linnaeus, 1758)	53	66.04	14.57	3-30	
Faustulidae	<i>Bacciger israelensis</i> (Fischthal, 1980)	<i>Boops boops</i> (Linnaeus, 1758)	7	41.86	8.3	3-15	
		<i>Spicara flexuosa</i> (Rafinesque, 1810)	35	8.57	6.33	2-11	
Fellodistomidae	<i>Tergestia laticollis</i> (Rudolphi, 1819)	<i>Trachurus mediteraneus</i> (Steindachner, 1868)	28	7.14	5	3-7	
	<i>Steringotrema pagelli</i> (Van Beneden, 1871)	<i>Spicara flexuosa</i> (Rafinesque, 1810)	35	5.71	5.5	3-8	
Haplospilachnidae	<i>Schikhobalotrema sparismoae</i> (Manter, 1937)	<i>Liza aurata</i> (Risso, 1810)	26	3.85	3	3	
Hemiuridae	<i>Aphanurus stossichi</i> (Monticelli, 1891)	<i>Boops boops</i> (Linnaeus, 1758)	7	14.29	5	5	
		<i>Conger conger</i> (Linnaeus, 1758)	28	78.57	>25		
	<i>Lecithochirium fusiforme</i> (Lühe, 1901)	<i>Muraena helena</i> (Linnaeus, 1758)	3	66.66	8.5	6-11	
	<i>Lecithocladium exicum</i> (Rudolphi, 1819)	<i>Scomber japonicus</i> (Houttuyn, 1782)	71	7.04	5.5	4-9	
Lepocreadiidae	<i>Lepocreadium album</i> (Stossich, 1890)	<i>Holorchis pycnopus</i> (Dolfuss, 1946)	<i>Lithognathus mormyrus</i> (Linnaeus, 1758)	15	13.33	9	3-15
		<i>Diplodus annularis</i> (Linnaeus, 1758)	72	15.28	6.82	1-17	
		<i>Diplodus vulgaris</i> (Geoffroy Saint-Hilarie, 1817)	35	8.57	6.33	4-9	
		<i>Spondyllosoma cantharus</i> (Linnaeus, 1758)	19	5.26	8	8	
		<i>Boops boops</i> (Linnaeus, 1758)	7	14.28	7	7	
<i>Opechono ollsoni</i> (Yamaguti, 1934)	<i>Scomber japonicus</i> (Houttuyn, 1782)	71	5.63	6.75	1-13		

**Table 1.** Continued

Family	Parasite species	Host	NFI	P(%)	MI	Min-Max
Mesometridae	<i>Mesometra orbicularis</i> (Rudolphi, 1819)	<i>Sarpa salpa</i> (Linnaeus, 1758)	32	18.75	17.28	3-41
	<i>Elstia stossichianum</i> (Monticelli, 1892)	<i>Sarpa salpa</i> (Linnaeus, 1758)	32	9.38	16.53	1-45
Opecoelidae	<i>Helicometra fasciata</i> (Rudolphi, 1819)	<i>Pagellus erythrinus</i> (Linnaeus, 1758)	13	7.69	13	13
		<i>Conger conger</i> (Linnaeus, 1758)	26	3.85	7	7
	<i>Opecoeloides furcatus</i> (Bremser in Rudolphi, 1819)	<i>Mullus surmuletus</i> (Linnaeus, 1758)	46	73.91	8.32	4-27
	<i>Pachycreadium carnosum</i> (Rudolphi, 1819)	<i>Pagellus acerna</i> (Risso, 1827)	24	4.17	6	6
	<i>Bathycreadium</i> sp. (Maillard, 1970)	<i>Phycis phycis</i> (Linnaeus, 1766)	16	6.25	11	11

NFI: Number of Fish Investigated, P:Prevalence, MI: Mean Intensity, Min-Max:Minimum-Maximum

### Description of trematodes

Family: Acanthostomidae Poche, 1926

*Anisocladium falax* (Rudolphi, 1819) (Figure 1)

Body very elongate (7-15 mm in length, at level of gonads 0.2-0.4 mm in breadth). Oral sucker terminal, relatively elongate, funnel-shaped, surrounded by regular spines. Spine number varies between 23 and 25. Prepharynx present. Pharynx stout, cylindrical. Oesophagus short. Intestinal bifurcation at level of ventral sucker.

Testes two, longitudinally ovoid, post-ovarian. Ovary round, well-separated from anterior testes. Uterus in hindbody. *A. falax* is a host specific parasite to *Uranoscopus scaber* and shows wide distribution from the Mediterranean (Adriatic, Greece, France) to the Black Sea (Bartoli and Gibson 2000; Oğuz and Bray 2006; Akmirza 2001).



**Figure 1.** *Anisocladium alax*



**Figure 2.** *Stephanostomum minutum*

***Stephanostomum minutum*** (Looss, 1901) Manter, 1940 (Figure 2)

Body elongate (1.5-2.5 mm in length, 0.1- 0.2 mm in breadth). Oral sucker terminal, surrounded by a ring with 18-20 spines. Ventral sucker larger than oral sucker. Prepharynx long, pharynx cylindrical, oesophagus short. Testes two, large and tandem in posterior half of hindbody. Ovary oval, pretesticular. This species is host specific to *Uranoscopus scaber* and is found in the Mediterranean and Black Sea (Bartoli and Bray 2001).

Family: Bucephalidae Poche, 1907

***Bucephalus varicus*** Monter, 1940 (Figure 3)

Body elongate (1.5-2 mm in length, 0.2-0.25 mm in breadth). Rhynchus sucker-like, oval with terminal aperture, crowned by tentacle series. Mouth at ventral surface and middle of body. Testes two, oval, tandem, posterior to middle of body. Ovary oval, pretesticular, posterior to middle of body.

Seven species of *Bucephalus* has been reported from various fish species such as *Dicentrarchus labrax*, *Seriola dumerili*, *Anguilla anguilla* in the Mediterranean. *B. varicus* has a world wide distribution and has been reported in *Lichia amia* from Israel's Mediterranean coast (Bartoli *et al.* 2006).



**Figure 3.** *Bucephalus varicus*



**Figure 4.** *Prosorhynchus crucibulum*

***Prosorhynchus crucibulum*** (Rudolphi, 1819) Odhner, 1905 (Figure 4)

Body flattened and elongate, truncated anteriorly, rounded posteriorly (1-3 mm in length, 0.4-0.8 mm in breadth). Cuticle spinous, spines more abundant anteriorly. A very large rhynchus, funnel-like mouth and pharynx near the midbody. Testes oblique, ovary spherical and pretesticular. Vitellarium always anterior to ovary, in two separated groups of follicles. Cirrus sac elongated, located at the posterior of body.

*P. crucibulum* is a specific parasite to *Conger conger* and *Murena helena* in various infection rates in various areas of the Mediterranean (Costa *et al.* 2009; Radujkovic *et al.* 1989; Culurgioni *et al.* 2006).

Family: Cryptogonimidae Ward, 1917

*Anoiktostoma coronatum* (Wagner, 1852) Stossich, 1899 (Figure 5)

Body small (0.6-0.8 mm in length), oval to fusiform, oral sucker (0.1 x 0.12 mm) terminal, funnel-shaped, surrounded by crown of large, sharp spines of 18-20. Ventral sucker (0.05 x 0.055 mm) small, circular, situated close to middle of body. Prepharynx very short, pharynx large, ovoid, oesophagus long. Caeca terminated close to posterior extremity. Testes two, large, ovoid (100 x 150 µm), in hind body.

Ovary intracaecal, in hind body, slightly lobed. Uterus coiled from level of pharynx to close to posterior extremity in forebody and hind body. Vitellarium follicular in two lateral area. Eggs small, ovoid, numerous. *A. coronatum* is specific to *Sciaena umbra* and is a rare, little-known cryptogonimid species. This species was found in the Adriatic Sea and in Corsica (Bartoli and Gibson 1995; Bartoli *et al.* 2005). This is the first record of *A. coronatum* off Gökçeada, in the Aegean Sea.



Figure 5. *Anoiktostoma coronatum*

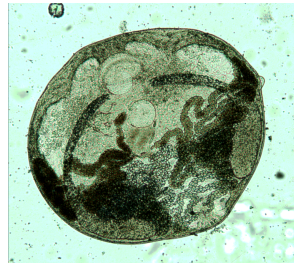


Figure 6. *Paracryptogonimus aloysiae*

*Paracryptogonimus aloysiae* (Stossich, 1885) (Figure 6)

Body small, long (0.6-1.2 mm in length, 0.6-0.9 mm in breadth), rounded to oval. Oral sucker (0.11 x 0.12 mm) ventro-terminal; aperture surrounded by 75-80 small spines. Ventral sucker circular (90 µm in diameter) embedded in a sac. Prepharynx and oesophagus short, pharynx ovoid, stout. Intestinal bifurcation between pharynx and ventral sucker. Caeca ends close to posterior extremity. Testes two, ovoid, intracaecal. Ovary in the middle of body, inter-testicular; multiloped. Uterus in hind body, extends close to posterior extremity. Vitellarium follicular in two lateral groups.

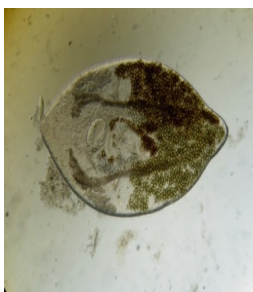
*P. aloysiae* is the first species of this genus found in the Mediterranean region and is specific to *Sciaena umbra* (Bartoli and Gibson 1995; Bartoli *et al.* 2005). This is the first report of this species in Turkey.

Family: Faustulidae Poche, 1926

***Bacciger israelensis*** Fischthal, 1980 (Figure 7)

Body oval (0.6-0.7 mm in length, 0.25-0.35 mm in breadth). Oral sucker subterminal, oval. Ventral sucker in anterior of mid-body. Prepharynx short, oesophagus long. Ceaca short. Testes two, symmetrical. Cirrus sac oval. Ovary divided into three separate bodies. Uterus fills post testicular region.

*B. israelensis* was found previously in *Boops boops* from Tunisian coasts (Abdallah and Maamouri 2011), Corsica coasts (Bartoli *et al.* 2012), Bulgarian Black Sea coastal waters (Dimitrow and Bray 1994) and in *B. boops* and *Sarpa salpa* from Israel coasts (Fischthal 2008). It was detected in *B. boops* and *Spicara flexuosa* in this study.



**Figure 7.** *Bacciger israelensis*



**Figure 8.** *Tergestia laticollis*

Family: Fellodistomidae Nicoll, 1913

***Tergestia laticollis*** (Rudolphi, 1819) (Figure 8)

Body elongate, cylindrical (2-3 mm in length, 0.4-0.6 mm in breadth). Oral sucker oval, subterminal, surrounded by ring of cephalic lobes. Muscular collarettes on lateral surface at level of pharynx. Ventral sucker oval, large (0.2-0.3 mm in diameter). Oesophagus long. Cirrus suck bipartite. Testes two, tandem, oval. Ovary oval intercaecal, between ventral sucker and testes.

*T. laticollis* was originally described from the Mediterranean Sea in *Trachurus trachurus* and has been reported from the Pacific and Atlantic Oceans in different hosts such as *Charanx* and *Euthynnus*. This species has already been reported in the same host species and region (Akmirza 1998).

***Steringotrema pagelli*** van Beneden, 1871 (Figure 9)

Body small, globular to oval. Oral sucker subterminal. Ventral sucker, in the middle of body, large, globular. Prepharynx absent. Pharynx elongate-oval.

Oesophagus long. Testes two, large, symmetrical, just posterior to ventral sucker. Cirrus sac just anterior to ventral sucker. Ovary small, between testes. Excretory vesicle V-shaped. *Steringotrema pagelli* was found in - Spanish Atlantic coasts in *Boops boops* (Olmo *et al.* 2006) and in Tunisia coasts in *Spondyliosoma cantharus* (Ben Abdallah *et al.* 2011). This is the first report in *Spicara flexuosa* in Gökçeada, Turkey.



Figure 9. *Steringotrema pagelli*



Figure 10. *Schikhobalotrema sparisomae*

Family: Haplospilichnidae Poche, 1926

***Schikhobalotrema sparisomae*** Manter, 1937 (Figure 10)

Body small, fusiform (1-2mm in length, 0.4-0.7 mm in breadth). Oral sucker well-developed, ventroterminal. Ventral sucker larger than oral sucker. Pharynx short, well-developed. Intestine a single caecum; caecum tubular.

This species has already been reported in mullets in the Mediterranean Basin by Oğuz and Bray (2006), Keser *et al.* (2007), Derbel *et al.* (2012).

Family: Hemiuridae Lühe, 1901

***Aphanurus stossichi*** (Monticelli, 1891) (Figure 11)

Body plump, elongate, oval (800-900  $\mu\text{m}$  in length, 180-200  $\mu\text{m}$  in width). Body surface plicated. Oral sucker subterminal, prepharynx absent. Ventral sucker large. Testes two, oblique. Ovary posttesticular.

*A. stossichi* has been found in various fish species such as *Boops boops*, *Sardina pilchardus*, *Trachurus trachurus*, *Lichia amia*, *Engraulis encrasicoulis* and from various localities in the Mediterranean, Black Sea, NE Atlantic (Kostatinova 2004). This parasite species has been reported previously from the same fish species and region (Akmirza 1998).





**Figure 11.** *Aphanurus stossichi*



**Figure 12.** *Lecithochirium fusiforme*

***Lecithochirium fusiforme*** Lühe, 1901 (Figure 12)

Body elongate, rounded anteriorly but truncate posteriorly, 2-4 mm in length, 0.4-1 mm in width at ovarian level, escoma well-developed. Oral sucker subterminal, 0.15- 0.25 mm in diameter. Ventral sucker circular, large (0.3-0.5 mm in diameter). Prepharynx absent.

Pharynx large, oesophagus short, caeca ending at base of escoma. Testes two, symmetrical, spherical, postacetabular. Ovary spherical, posttesticular. Uterine coils numerous, fill much of somatic hindbody. Vitellarium equatorial, consist of seven lobes.

***Lecithocladium exicum*** (Rudolphi, 1819) (Figure 13)

Body elongate (1.4-2.3 mm in length, 0.3-0.4 mm in width). Escoma well developed. Body surface with plications. Oral sucker funnel shaped and larger than ventral sucker. Testes two, tandem. Ovary oval, posttesticular. Vitelline lobes long and tubular.

This species is a very common parasite of *Scomber* spp. and widely distributed in the Atlantic coasts, Mediterranean and Black Sea (Cisse and Belghgti 2005; Dimitrov 1991; Keser *et al.* 2007).



**Figure 13.** *Lecithocladium exicum*



**Figure 14.** *Holorchis pycnopus*

Family: Lepocreadiidae

***Holorchis pycnopus*** Dolfuss, 1946 (Figure 14)

Body elongate (2-4 mm in length, 0.6-1 mm in width). Oral sucker subterminal. Pharynx spherical. Oesophagus long. Testes two, spherical, tandem. Ovary spherical, pretesticular, below ventral sucker. Vitellaria fill space between ventral sucker and posterior extremity.

This species has been recorded previously from many fish species such as *Pagellus erythrinus*, *Diplodus vulgaris*, and *Mullus surmuletus*.

***Lepocreadium album*** (Stossich, 1890) (Figure 15)

Body oval (2-2.5 mm in length, 0.8-1 mm in width), oral sucker subterminal, prepharynx short, pharynx spherical, large, oesophagus short. The ceaca reach close to posterior extremity. Testes two, tandem. Ovary oval, pretesticular. Uterus with low number of the eggs in the middle of body. Vitellaria fill all the lateral place of the body.

This parasite has been reported in various host fish of Sparidae such as *Diplodus annularis*, *Diplodus vulgaris*, *Spondylisoma cantharus*, *Boops boops* (Akmirza 2000).



**Figure 15.** *Lepocreadium album*



**Figure 16.** *Opechona ollsoni*

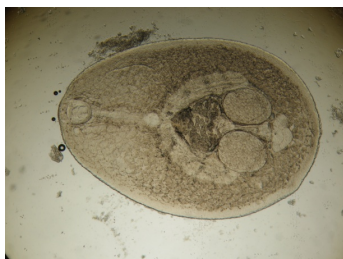
***Opechona ollsoni*** (Yamaguti, 1934) (Figure 16)

Body elongate (1.4-3.2 mm in length, 0.25-0.4 mm in width). Oral sucker funnel-shaped. Oesophagus long. Testes two, oval, tandem in posterior hindbody. Ovary loped, pretesticular. Uterus restricted the area between ovary and ventral sucker. This species is common in *Scomber* spp. and has been reported in the Atlantic Ocean, Mediterranean, Black Sea (Akmirza 1997; Bartoli *et al.* 2005; Cisse *et al.* 2005).

Family: Mesometridae Poche, 1926

***Mesometra orbicularis*** (Rudolphi, 1819) Lühe, 1901 (Figure 17)

Body broadly oval (2.5-3 mm in length, 2-2.5 mm in width). Oral sucker ventral, oesophagus long, ventral sucker absent. Testes two, symmetrical, intended. Ovary lobed, posttesticular near posterior extremity. This parasite was reported only from *Sarpa salpa* in the Mediterranean (Abdallah *et al.* 2011) and also found in this region in *S.salpa* and this is the first record in Turkey.



**Figure 17.** *Mesometra orbicularis*



**Figure 18.** *Elstia stossichianum*

***Elstia stossichianum*** (Monticelli, 1892) (Figure 18)

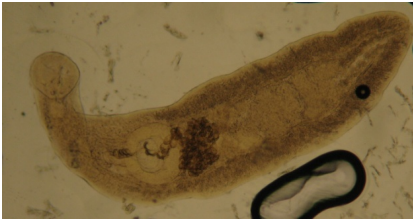
Body elongate, oval (2.5-3.5 mm in length, 0.8-1 mm in width). Oral sucker subterminal, pharynx absent, oesophagus long. Ventral sucker absent. Testes longitudinally oval, symmetrical near to posterior extremity. Ovary oval, posttesticular near to posterior extremity. Vitellarium follicular, between region of intestinal bifurcation and anterior of testes. Eggs with filament.

*E. stossichianum* was found only in the Mediterranean and off Canary Island in *Sarpa salpa* (Abdallah *et al.* 2011) and this is the first report in Turkey.

Family: Opecoelidae Ozaki, 1925

***Helicometra fasciata*** (Rudolphi, 1819) (Figure 19)

Body oval (2.5-4 mm in length, 0.5-0.7 mm in width), oral sucker subterminal, prepharynx short, esophagus spherical, caeca reaching the end of body, ventral sucker bigger than oral sucker. Testes two, lopped, tandem, post ovarian. Ovary lopped. Uterine coils spherical between ovary and ventral sucker. Eggs having long tails.



**Figure 19.** *Helicometra fasciata*



**Figure 20.** *Opecoeloides furcatus*

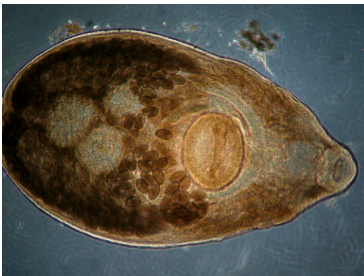
***Opecoeloides furcatus*** (Bremser in Rudolphi, 1819) (Figure 20)

It appeared as a projection arising from the body, measuring 4.5-6.2 x 1.7-2.2 mm length by width. The oral sucker and pharynx are similar in size and the ventral sucker slightly larger. The prepharynx is short, but the oesophagus long. The caeca extend to near the posterior end of body. The vitellaria fill the posterior 3/4 of the body.

The testes lobed and tandem in the posterior body in-between the caecae. The ovary pretesticular. The uterus is relatively long, intercaecal, winding between the ovary and acetabulum. The eggs are few, oval. This parasite species has so far been recorded only in the Mediterranean Sea from *Mullus surmuletus*, *Mullus barbatus*, *Solea vulgaris*, *Gaidropsarus mediterraneus*, *Serranus hepatus* and *Molva molva* (Klimpel *et al.* 2008) and also been reported previously in the same region from *M. surmuletus* (Akmirza 2000). It was found once again only from *M. surmuletus* in this study.

***Pachycreadium carnosum*** (Rudolphi, 1819) (Figure 21)

Body small, stout, oval (2-2.5 mm in length, 1.2-1.5 mm in width). Oral sucker globular, subterminal. Pharynx very short, pharynx globular, well-developed, oesophagus short. Ventral sucker larger than oral sucker. Testes two, spherical, oblique near middle of hindbody. Ovary spherical, pretesticular. This parasite found in the Family Sparidae in various regions of the Mediterranean Sea (Bartoli *et al.* 2010; Abdallah *et al.* 2011). This is the first report of this parasite in this region and Turkey.



**Figure 21.** *Pachycreadium carnosum*



**Figure 22.** *Bathycreadium* sp.

***Bathycreadium* sp.** (Maillard, 1970) (Figure 22)

Body elongate. Ventral sucker larger than oral sucker. Testes two, tandem. Ovary entire, round. Uterus restricted to area between ovary and ventral sucker. This parasite reported in Gadiformes in the Atlantic Ocean and the Mediterranean Sea (Bartoli *et al.* 2005). *B. elongatum* is one of the parasites used as biological tags to distinguish the Atlantic or the Mediterranean origin of the horse mackerel (MacKenzie *et al.* 2008).

## **Gökçeada sularındaki balıkların digenetik trematodları**

### **Özet**

Bu çalışmada toplam 50 deniz balığı türü incelendi ve bunun sonucunda 19 balık türünde farklı familyalara ait (Acanthostomidae, Bucephalidae, Cryptogonimidae, Faustulidae, Fellodistomidae, Haplospilachnidae, Hemiuridae, Lepocreadiidae, Mesometridae, Opecoelidae) 22 digenea türü (*Anisocladium fallax*, *Stephanostomum minutum*, *Bucephalus varicus*, *Prosorynchus crucibulum*, *Anoiktostoma coronatum*, *Paracryptogonimus aloysiae*, *Baciger israelensis*, *Tergestia laticollis*, *Steringotrema pagelli*, *Schikhobalotrema*, *Aphanurus stossichi*, *Lecithochirium fusiforme*, *Lecithocladium exicum*, *Holorchis pycnopus*, *Lepocreadium album*, *Opechono ollsoni*, *Mesometra orbicularis*, *Elstia stossichianum*, *Helicometra fasciata*, *Opecoeloides furcatus*, *Pachycreadium carnosum*, *Bathycreadium* sp.) tanımlandı.

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