www.trjfas.org
ISSN 1303-2712
Turkish Journal of Fisheries and Aquatic Sciences 15: 737-744 (2015) DOI: 10.4194/1303-2712-v15_3_18

First Report of Several Myxosporean (Myxozoa) and Monogenean Parasites from Fish Species off Sinop Coasts of the Black Sea

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Received 14 April 2015
Accepted 21 October 2015

Abstract

Round goby *Neogobius melanostomus*, common sole *Solea solea*, rusty blenny *Parablennius sanguinolentus*, tentackled blenny *Parablennius tentacularis*, peacock blenny *Salaria pavo* and annular seabream *Diplodus annularis* collected by angling in Sinop coasts of the Black Sea in the period from March to July 2014 were investigated for myxosporean and monogenean parasites at the Faculty of Fisheries and Aquatic Sciences in Sinop using conventional methods. Parasite species identified were Ortholinea gobiusi from round goby, *Sinuolinea rebae* from common sole, *Sphaeromyxa sevastopoli*, *Myxobolus asymmetricus* and *Ortholinea divergens* from rusty blenny, *Myxidium parvum* from peacock blenny and tentackled blenny and *Lamellodiscus elegans* and *Lamellodiscus fraternus* from annular seabream. All morphometric data are presented in tables. These parasites are the first in Turkish Black Sea coasts and all parasite species are new records for Turkish parasite fauna. Moreover, *S. rebae* is a new myxosporean parasite of the Black Sea fauna.

Keywords: Myxozoa, *Ortholinea*, *Sinuolinea*, *Sphaeromyxa*, *Myxobolus*, *Myxidium*, *Lamellodiscus*, Sinop, Black Sea.

Karadeniz'in Sinop Kıyılarından Yakalanan Balıkların Bazı Mikzospor ve Monogenea Parazitlerinin İlk Bildirimleri

Özet

Mart – Temmuz 2014 tarihleri arasında Karadeniz'in Sinop kıyılarından olta ile yakalanan kaya balığı *Neogobius melanostomus*, dil balığı *Solea solea*, horozbina balıkları *Parablennius sanguinolentus*, *Parablennius tentacularis* ve *Salaria pavo* ve isparoz *Diplodus annularis* bilinen mevcut yöntemler uygulanarak Sinop Su Ürünleri Fakültesi'nde miksozoa ve monogenea parazitleri yönünden incelendi. Kaya balığında *Ortholinea gobiusi*; dil balığında *Sinuolinea rebaee*; *Parablennius sanguinolentus* türü horozbina balığında *Sphaeromyxa sevastopoli*, *Ortholinea divergens* ve *Myxobolus asymmetricus*; *Parablennius tentacularis* türü horozbina balığında *Myxobolus asymmetricus* ve *Myxidium parvum*; *Salaria pavo* türü horazbina balığında *Myxidium parvum* ve isparoz balığında *Lamellodiscus elegans* ve *Lamellodiscus fraternus* türleri tanımlandı Tüm morfometrik ölçüm değerleri tablolarda gösterildi. Bu araştırmadaki tüm bulgular Karadeniz'in Türkiye kıyıları için yenidir ve tanımlanan tüm miksozoa türleri de Türkiye parazit faunası için yeni kayıttır. Ayrıca, *S. rebae* Karadeniz miksozoa faunası için de yenidir.

Anahtar Kelimeler: Miksozoa, *Ortholinea*, *Sinuolinea*, *Sphaeromyxa*, *Myxobolus*, *Myxidium*, *Lamellodiscus*, Sinop, Karadeniz.

Introduction

Parasites are among the important components of global biodiversity (Poulin and Morand, 2004) and myxosporeans and monogeneans are recognized among the most common parasites of numerous fish species. Myxosporeans proliferate in different target organ and tissues and monogeneans are obligatory parasites of the gills and skin of marine and freshwater fishes.

Myxosporea are microscopic metazoan parasites that infect a variety of hosts, fish being the mostly reported animals all around the world (Kent *et al.*, 2001; Lom and Dykova, 2006) and there is a rise in research on myxozoans due to increasing interest in their pathogenity, systematics and expansions on geographic areas. The identification of myxozoans is based primarily on spore morphology (Lom and Arthur, 1989; Lom *et al.*, 1997) and, they can be either coelozoic in organ cavities, or histozoic inter-

or intracellularly (Lom and Dykova, 2006). There has been extensive studies on myxosporeans and a total of 856 species belonging to the genus *Myxobolus* Bütschli, 1882 (Eiras *et al.*, 2005, 2014), 232 nominal species belonging to the genus *Myxidium* Bütschli, 1882 (see Eiras *et al.*, 2011 for details), 12 species belonging to the genus *Ortholinea* Shulman, 1962 (Lom and Dykova, 2006; Abdel-Ghaffar *et al.*, 2008), 24 species belonging to the genus *Sinuolinea* Davis, 1917 (El-Matbouli and Hoffmann, 1994; Zhao and Song, 2001; Lom and Dykova, 2006; https://insects.tamu.edu/research/collection/hallan/Myxozoa/Family/Sinuolineidae.txt) and 46 species belonging to the genus *Sphaeromyxa* Thélohan, 1892 (Lom and Dykova, 2006; Karlsbakk *et al.*, 2013) have been reported from all over the world. Thus far, a total of 63 myxosporean, including 7 species of *Myxidium*, 10 species of *Myxobolus*, 5 species of *Sphaeromyxa*, 2 species of *Ortholinea* and 1 species of *Sinuolinea*, have been reported from Ukrainian, Russian and Georgian coasts of the Black Sea (Yurakhno, 2009). On the other hand, to date, 11 species, including 5 *Myxobolus* species (*M. exiguus*, *M. muelleri*, *M. episquamalis*, *M. ichkeulensis*, *M. anatolicus*), 1 *Sphaerospora* (*S. elegans*), 1 *Myxobilatus* (*M. gasterostei*), 2 *Ceratomyxa* (*Ceratomyxa* sp., *C. merlangi*), 1 *Myxidium* (*M. gadi*) and 1 *Enteromyxum* (*Enteromyxum leei*), have been reported in Turkish waters so far and 6 of above mentioned parasite species were from the Black Sea coasts (Altunel, 1983; Özer, 2003; Umur *et al.*, 2010; Özak *et al.*, 2012; Özer and Öztürk, 2011; Özer *et al.*, 2012, 2014; Pekmezci *et al.*, 2014).

Monogenea are very small parasitic flatworms commonly found on skin or gills of aquatic vertebrates and most species are host and even site specific (Reed *et al.*, 2009). The most of the members of the genus *Lamellodiscus* are known to be gill parasites of sparid fish (Desdevises, 2001; Diamanka *et al.*, 2011a, 2011b; Machkewskyi *et al.*, 2014). Fifty nine species, including *Lamellodiscus elegans and Lamellodiscus fraternus*, have been identified from fish inhabiting mainly the Mediterranean Sea (Diamanka, 2011b). *Lamellodiscus elegans* is considered a generalist parasite and has been reported from the gills of *Diplodus puntazzo*, *Diplodus annularis*, *Diplodus vulgaris*, *Diplodus sargus*, *Acanthopagrus sivicolus*, *Oblada melanura* and *Spondyliosoma cantharus* from Adriatic Sea, the Mediterranean Sea and the Black Sea (Bychowsky, 1957; Dmitrieva, 1998; Desdevises *et al.*, 2002a; Mladineo and Marsic-Lucic, 2007; Domingues and Boeger, 2008; Poisot and Desdevises, 2010; Strona *et al.*, 2010). On the other hand, *L. fraternus* is an intermediate specialist and has been reported from the gills of only three sparid fish species *Diplodus annularis*, *Diplodus sargus* and *Diplodus vulgaris* from the Mediterranean Sea and Black Sea (Bychowsky, 1957; Desdevises *et al.*, 2002a, 2002b; Strona *et al.*, 2010; Dmitrieva, 1998; Kaouachi *et al.*, 2012). Scientific and economic efforts are made in order to further develop the potential of new species in aquaculture and some sparid fish are among the main candidates for this purpose (Golomazou *et al.*, 2006). Monogeneans do not pose a threat to their host when present at low abundance and some *Lamellodiscus* species were reported to be causing mild local damage in the gill epithelium (Golomazou *et al.*, 2006), therefore, their occurrences ranked from negligible to low (Katharios *et al.*, 2006; Sanchez-Garcia *et al.*, 2011). However, some parasites such as *Lamellodiscus* that have simple life cycle and are directly transmitted from host to host by filamented eggs or oncomiracidia. They can cause outbreaks when the conditions are favourable. Thus, considering wild fish as vectors for disease propagation, it is important to search and determine their current status in the annular seabream, *D. annularis* which is a commercially important demersal marine fish species distributed along the European coasts of the Atlantic Ocean, from the Bay of Biscay to Gibraltar, and around Madeira and the Canary Islands, the Mediterranean, Black and Azov Seas (Bauchot and Hureau, 1990; Pajuelo and Lorenzo, 2002).

Considering the gap between the numbers of parasite species reported in the Black Sea and its Turkish coasts, the present study aimed to investigate the myxosporean and monogenean parasite fauna of several fish species inhabiting Sinop coasts of the Black Sea and to describe their host occurrence, infection site and prevalence, for the first time.

Materials and Methods

Fish samples were collected by angling in Sinop coasts of the Black Sea (N 42°05′68″ E 35°10′55″) in the period from March to July 2014. Round goby *Neogobius melanostomus* (Pallas, 1814) (n=76), common sole *Solea solea* (Linneaus, 1758) (n=36), rusty blenny *Parablennius sanguinolentus* (Pallas, 1814) (n=37), tentackled blenny *Parablennius tentacularis* (Brünnich, 1768) (n=31), peacock blenny *Salaria pavo* (Risso, 1810) (n=18) and annular seabream *Diplodus annularis* (Linneaus, 1758) (n=6) were investigated for myxosporean and monogenean parasites at the Faculty of Fisheries and Aquatic Sciences in Sinop. Gills, fins, skin, urinary bladder, kidney, gall bladder, intestine and gonads were examined using a light microscope at x400 and x1000 magnification. Parasite species was identified using a phase contrast Olympus microscope (BX53) equipped with a digital camera (DP50) and drawing attachment. Myxosporeans measurements were based on 30 fresh spores and all measurements are in accordance with Lom and Dykova (1992) and provided in micrometer as mean and range. Monogenean measurements of scelatory parts of both *Lamellodiscus* species were made on fresh parasites according to Diamanka *et al.* (2011a, 2011b) and are given in micrometers as mean and range. Calculation of infection prevalence (%)

and mean intensity follow the definition of Bush *et al*. (1997).

Results

A total of 8 parasite species were identified; 6 of which were myxosporean species: *Ortholinea gobiusi* (Naidenova, 1968) from round goby, *Ortholinea divergens* (Thelohan, 1895) from rusty blenny, *Sinuolinea rebae* (Tripathi, 1948) from common sole, *Sphaeromyxa sevastopoli* (Naidenova, 1970) from rusty blenny, *Myxobolus asymmetricus* (Parisi, 1912) Landsberg and Lom, 1991 from tentacled blenny and rusty blenny and *Myxidium parvum* (Yurakhno, 1991) from peacock blenny and tentackled blenny, and 2 of which were monogenean species: *Lamellodiscus elegans* Bychowsky, 1957 and *Lamellodiscus fraternus* Bychowsky, 1957 from annular seabream. Both *Lamellodiscus* species were found co-infesting on the gills of their host fish.

Parasite species, hosts, infection site, infection prevalence and morphometric details of identified myxosporean and *Lamellodiscus* are as follow;

***Ortholinea gobiusi* (Naidenova, 1968)**

Host: *Neogobius melanostomus* (Pallas, 1814), round goby.

Locality: Sinop, Turkish Black Sea coast.

Description of sporogonic stages: round plasmodia was observed in our material up to 23 µm in diameter.

Description of spores: round or ovoid, posteriorly pointed, valves with striation, measurements for spores and polar capsules are provided in Table 1.

Infection site of sporogonic stages: coelozoic, urinary bladder.

Prevalence: 4.1% (n= 76).

***Ortholinea divergens* (Thélohan, 1895)**

Host: *Parablennius sanguinolentus* (Pallas, 1814), rusty blenny.

Locality: Sinop, Turkish Black Sea coast.

Description of sporogonic stages: plasmodia not observed in our material.

Description of spores: round or ovoid, valves with striation, polar capsules pyriform, measurements for spores and polar capsules are provided in Table 1.

Infection site of sporogonic stages: coelozoic, urinary bladder.

Prevalence: 2.7% (n= 37)

***Sinuolinea rebae* (Tripathi, 1948)**

Hosts in the present study: *Solea solea* (Linnaeus, 1758), common sole.

Locality: Sinop, Turkish Black Sea coast.

Description of sporogonic stages: Round or elliptical large polysporous plasmodia.

Description of spores: round or ovoid, posteriorly pointed with smooth surface with S-shaped suture line, polar capsules are spherical, measurements for spores and polar capsules are provided in Table 1.

Infection site of sporogonic stages: coelozoic, urinary bladder.

Prevalence: 11.1% (n= 36).

***Sphaeromyxa sevastopoli* (Naidenova, 1970)**

Host: *Parablennius sanguinolentus* (Pallas, 1814), rusty blenny.

Locality: Sinop, Turkish Black Sea coast.

Description of sporogonic stages: Very large elliptical plasmodia up to 4000 x 2000 µm in gall bladder.

Description of spores: fusiform, valves with longitudinal striation, ends of valves are blunt, polar capsules large, pyriform, measurements for spores and polar capsules are provided in Table 1.

Infection site of sporogonic stages: coelozoic, gall bladder.

Prevalence: 51.4% (n= 37).

Table 1. List of myxosporeans, hosts, site of infection and average values of measurements of species found in Sinop coast of the Black Sea (n=30)

Species	Host	Site of infection	Spore		Polar capsule	
			Length	Width	Length	Width
Ortholinea gobiusi Naidenova, 1968	*Neogobius melanostomus* (Pallas, 1814)	urinary bladder	8.3 (7.5-8.6)	7.2 (6.8-7.5)	4.9 (4.6-5.1)	2.0 (1.9-2.2)
Ortholinea divergens (Thelohan, 1895)	*Parablennius sanguinolentus* (Pallas, 1814)	urinary bladder	9.0 (8.1-9.4)	9.2 (8.4-9.7)	2.0 (1.9-2.2)	2.2 (1.9-2.4)
Sinuolinea rebae (Tripathi, 1948)	*Solea solea* (Linnaeus, 1758)	urinary bladder	12.0 (10.4-12.9)	10.0 (9.3-11.2)	3.3 (2.7-3.6)	2.6 (2.2-2.8)
Sphaeromyxa sevastopoli (Naidenova, 1970)	*Parablennius sanguinolentus* (Pallas, 1814)	gall bladder	18.1 (17.0-19.3)	4.5 (4.1-4.7)	6.2 (5.9-6.5)	3.2 (3.1-3.3)
Myxobolus asymmetricus (Parisi, 1912) Landsberg and Lom, 1991	*Parablennius tentacularis* (Brünnich, 1768)	kidney	10.1 (8.9-10.8)	6.5 (5.9-6.9)	4.9 (4.4-5.3)	3.0 (2.7-3.2)
	Parablennius sanguinolentus (Pallas, 1814)	kidney	10.1 (9.0-10.7)	6.6 (5.1-7.0)	5.0 (4.5-5.3)	3.1 (2.9-3.4)
Myxidium parvum (Yurakhno, 1991)	*Parablennius tentacularis* (Brünnich, 1768)	gall bladder	7.1 (6.7-7.3)	4.3 (4.0-4.5)	2.6 (2.4-2.7)	1.6 (1.4-1.8)
	Salaria pavo (Risso, 1810)	gall bladder	7.2 (6.8-7.5)	4.4 (4.1-4.6)	2.4 (2.3-2.6)	1.5 (1.4-1.7)

***Myxobolus asymmetricus* (Parisi, 1912) Landsberg and Lom, 1991:**

Host: *Parablennius tentacularis* (Brünnich, 1768), tentacled blenny; *Parablennius sanguinolentus* (Pallas, 1814), rusty blenny.

Localities: Sinop, Turkish Black Sea coast.

Description of sporogonic stages: plasmodia not observed in our material.

Description of spores: ovoid, with smooth surface, pyriform polar capsules shifted to one side of spore, measurements for spores and polar capsules are provided in Table 1.

Infection site of sporogonic stages: kidney.

Prevalence: *P. tentacularis*–32.2% (n= 31); *P. sanguinolentus*–37.8% (n= 37).

***Myxidium parvum* (Yurakhno, 1991):**

Host: *Parablennius tentacularis* (Brünnich, 1768), tentacled blenny; *Salaria pavo* (Risso, 1810), peacock blenny

Locality: Sinop, Turkish Black Sea coast.

Description of sporogonic stages: plasmodia not observed in our material.

Description of spores: ovoid, somewhat S-shaped with pointed ends and pyriform polar capsules at each end of the spore, measurements for spores and polar capsules are provided in Table 1.

Infection site of sporogonic stages: coelozoic, gall bladder.

Prevalence: *P. tentacularis*–6.4% (n=31); *S. pavo*–50.0% (n= 18).

***Lamellodiscus elegans* Bychowsky, 1957**

Host: *Diplodus annularis* (L., 1758), annular seabream.

Locality: Sinop, Turkish Black Sea coast.

Infection site: Gills.

Measurements of body and scletorized parts: Provided in Table 2.

***Lamellodiscus fraternus* Bychowsky, 1957**

Host: *Diplodus annularis* (L., 1758), annular seabream

Locality: Sinop, Turkish Black Sea coast

Infection site: Gills

Measurements of body and scletorized parts: Provided in Table 2.

Both *Lamellodiscus* species were found to be co-infesting the gills of host fish with the prevalence of 83.3%. (n=6) and mean intensity (mean + SE, range) of 56.2±15.58, 26–232, per infested fish.

Discussion

Present study aimed to investigate myxosporean and monogenean parasite fauna of several fish species inhabiting Sinop coasts of the Black Sea in Turkey and revealed 6 myxosporean and 2 monogenean species, all were new records for the region.

Ortholinea gobiusi (Naidenova, 1968) was found earlier in the urinary bladder of *Zosterisessor ophiocephalus* in the Black Sea near Sevastopol (Russia) and from *Z. ophiocephalus* in the Sea of Azov near Genichesk (Ukraine) (Iskov, 1989). In the present study, it was found in the urinary bladder of round goby *N. melanostomus.* This fish species is a new host for *O. gobiusi* as well as Sinop is a new locality in the Black Sea. Our result, thus, expands its host list but still shows its strict host specificity to gobiid fishes with strict organ specificity to the respective organ. The spore measurements of *O. gobiusi* in our material from round goby basically correspond well in both spore diameter and polar capsule dimensions to those reported original description from *G. ophiocephalus* (Lom and Dykova, 1992).

Ortholinea divergens, on the other hand, was first described from American plaice *Hippoglossoides platessoides* (Fabricius, 1780) in the North Atlantic coast (cited in Lom and Dykova, 1992) and since then, it has been reported from a wide range of host fish grey wrasse *Symphodus cinereus* (Bonnaterre, 1788), five-spotted wrasse *Symphodus roissali* (Risso, 1810), *Symphodus ocellatus* (Linnaeus, 1758), golden

Table 2. Measurements (µm) of *Lamellodiscus elegans* and *Lamellodiscus fraternus* body parts (n=20)

Body parts	*L. elegans*	*L. fraternus*
Length of body	350 (340–364)	330 (320–340)
Length of ventral bar	52 (50–54)	43 (42–44)
Length of dorsal bar	56 (51–62)	43 (42–45)
Length of total dorsal anchor	42 (38–46)	40 (38–43)
Length of shaft-point distance of dorsal anchor	41 (39–45)	38 (35–40)
Length of guard-point distance of dorsal anchor	30 (26–31)	26 (25–27)
Length of total ventral anchor	46 (41–49)	39 (38–40)
Length of shaft-point distance of ventral anchor	44 (42–46)	38 (37–39)
Length of guard-point distance of ventral anchor	34 (31–37)	24 (23–25)
Length of shaft-guard distance of ventral anchor	10 (8–13)	14 (13–15)
Shaft length of ventral anchor	16 (15–17)	19 (18–20)
Guard length of ventral anchor	7 (6–8)	6 (5.5–6.5)
Length of lamellodisc	18 (17–19)	12 (11–13)
Length of total simple piece	-	5 (4.5–5.5)

grey mullet *Liza aurata* (Risso, 1810), annular seabream *Diplodus annularis* (Linnaeus, 1758), peacock blenny *S. pavo* (Syn; *Lipophrys pavo* Risso, 1810), sphynx blenny *A sphynx*, tentacled blenny *P. tentacularis* near Sevastopol and Karadag in the Black Sea (Yurakhno, 2009, 2013), corkwing wrasse *Crenilabrus melops* (Linnaeus, 1758) (Syn: *Symphodus melops* Linnaeus, 1758), east Atlantic peacock wrasse *Symphodus tinca* (Linnaeus, 1758), shanny *Lipophrys pholis* (Linnaeus, 1758) (Syn: *Blennius pholis* Linnaeus, 1758) in the Mediterranean (Yurakhno, 2009). Our host rusty blenny *P. sanguinolentus* expands its host ranges in the Black Sea and Sinop is a new locality for this parasite species in the Black Sea. The spore measurements of *O. divergens* in our material from the urinary bladder of rusty blenny basically correspond well in both spore diameter and polar capsule dimensions to those reported from American plaice *H. platessoides* (cited by Abdel-Ghaffar *et al.*, 2008). *Ortholinea divergens* was previously reported with infection prevalence values between 8 - 25% (Yurakhno, 2013). However, infection prevalence of 2.7% recorded in the present study is lower than that of above mentioned authors.

Sinuolinea rebae has been reported from urinary bladder of common sole in Plymouth, England (Tripathi, 1948). In the present study, it was also found at the same organ and host with a prevalence of 11.1%, however, *S. rebae* is a new myxosporean parasite of the Black Sea fauna. Reported infection prevalence 10% from *S. mai* from Yellow Sea (Zhao and Song, 2001), 100% from freshwater *S. tetraodoni* from Southeast Asia (El-Matbouli and Hoffmann, 1994) and 11.1% for *S. opacita*, 11.1% for *S. brachiophora* and 88.9% from *S. capsularis* from marine *Paralichthyes albiguttus* and 100% from marine *S. dimorpha* from *Cynoscion regalis* from Beauafort, the U.S.A. (Davis, 1917). Due to only a limited number of fish examined at both studies when compared to ours, the range differences in these fish should be considered acceptable and could be related with the availability of alternate host around. The spore measurements of *S. rebae* in our material from common sole correspond well in spore and polar capsule dimensions to those reported original description from common sole (Tripathi, 1948).

Sphaeromyxa sevastopoli was first identified from gall bladder of monkey goby *Neogobius fluviatilis* from Karadag region in Russian Black Sea coast and since then it has been reported from a wide range of host species (*Parablennius sanguinolentus*, *Atherina boyeri*, *Gaidropsarus mediterraneus*, *Mesogobius batrachocephalus*, *Neogobius fluviatilis*, *N. melanostomus*, *N. platyrostris*, *N. eurycephalus*, *Gobius bucchichi*, *G. cobitis*, *G. niger*, *Pomatoschistus microps leopardinus*, *Proterorhinus marmoratus*, *Sprattus sprattus*, *Lypophris pavo*, *Parablennius tentacularis*, *Uranoscopus scaber*, *Mugil cephalus*, *Syngnathus typhle*) near Sevastopol and Karadag in the Black Sea and (*Mesogobius batrachocephalus*, *Neogobius fluviatilis*) in the Azov Sea, including the host in the present study, the rusty blenny *P. sanguinolentus* in the Black Sea (Yurakhno, 2009, 2013). However, Sinop is a new locality for this parasite species in the Black Sea. Infection prevalence of *S. sevastopoli* in the present study was 51.4% and Yurakhno (2013) reported lower prevalence values of 25% in only a couple fish specimens in the Black Sea and, prevalence of 100% from gall bladder of *Triglops murrayi* from off Newfoundland (Khan *et al.*, 1986) and gall bladder of from *Siphostoma floridae* and *S. louisianae* from Beauafort, the U.S.A. (Davis, 1917) for *S. balbiani* were also reported. Our prevalence value simply place within the range reported for *Sphaeromyxa* species thus far. The spore measurements of *S. sevastopoli* in our material from rusty blenny correspond well in spore and polar capsule dimensions to those reported original description from monkey goby (Naidenova, 1970). A very large, up to 2x4 mm in diameter, plasmodium (Karlsbakk *et al.*, 2013) seems to be a common for this parasite species and it was also the case in our material.

Myxobolus asymmetricus was described from the kidney of east Atlantic peacock wrasse *Crenilabrus pavo* (Syn: *Symphodus tinca* Linnaeus, 1758) from off Italy in the Mediterranean coast (Landsberg and Lom, 1991), from labrid fishes of genus *Symphodus* near Novorossiysk, Sudak, Sevastopol in the Black Sea (Pogoreltseva, 1964; Iskov, 1989). İt is found in the kidney of both tentacled blenny *P. tentacularis* and rusty blenny *P. sanguinolentus* with the prevalence of 32.3% from *P. tentacularis* and 37.8% from *P. sanguinolentus*. *Parablennius tentacularis* and *P. sanguinolentus* are new hosts for *M. asymmetricus* and Sinop is a new locality in the Black Sea. The spore measurements of *M. asymmetricus* in our material from rusty blenny and peacock blenny correspond well in spore and polar capsule dimensions to those reported original description from east Atlantic peacock wrasse *Crenilabrus pavo* (Landsberg and Lom, 1991).

Myxidium parvum (Yurakhno, 1991) was described from tentacled blenny *Parablennius tentacularis* and sphynx blenny, *Aidablennius sphynx* near Sevastopol and Karadag in the Black Sea with infection prevalence values between 33 and 75% (Yurakhno, 2009, 2013). In the present study, it was found in the gall bladder of *P. tentacularis* as well as peacock blenny *Salaria pavo* (Risso, 1810) in prevalence values of 6.4% and 50%, respectively, the latter being a new host record for this parasite species. Moreover, Sinop is a new locality in the Black Sea. While prevalence value recorded in type host *P. tentacularis* was lower than that of original report, this value recorded in new host *S. pavo* suited well into the range reported by above mentioned authors. However, it is clear from our and previous data obtained so far that this parasite has a strict organ specificity to gall bladder and host specificity to only

blenny fishes. The spore measurements of *M. parvum* in our material from tentacled blenny and peacock blenny basically correspond well in spore diameter but slightly smaller in thickness and polar capsule dimensions are larger than those reported original description from tentacled blenny *P. tentacularis* (Eiras *et al.*, 2011).

Several species of Monogenea have been determined to be pathogens that can cause diseases in fishes either directly or by secondary infection (Thoney and Hargis, 1991). *Lamellodiscus* spp. are diplectanid monogeneans which have not been associated with high mortalities, however, being parasites with direct life cycle, they can be transmitted (active transmission in mature worms and passive transmission via larvae oncomiracidia) from fish to fish in wild and in captivity, and from wild to captive fish in culture cages (Athanassopoulou *et al.*, 1999; Katharios *et al.*, 2006; Mladineo *et al.*, 2013). During the investigation period in the present study, *Lamellodiscus elegans* and *Lamellodiscus fraternus* were the only monogenean species identified on the gills of annular seabream *Diplodus annularis* with a prevalence of 83.3%, mean intensity value of 56.2±15.58 and mean abundance value of 46.83±15.79 for the first time in Turkish coast of the Black Sea. Mladineo and Marsic-Lucic (2007) reported infestation prevalence values ranging between 11.36-32.04% and abundance values ranging between 0.16-0.3 for *L. elegans* from sea bream (*Sparus aurata*) in the Adriatic Sea and Kouachi *et al.* (2012) provided infestation prevalence values between 50-73.3%, 3.3-53.3%, 6.66-66.66% for *L. elegans* from *Diplodus sargus*, *D. annularis*, *D. vulgaris*, respectively; 13.33-63.33% and 3.33% for *L. fraternus* from *D. sargus* and *D. annularis*, respectively, from eastern Algerian coast of the Mediterranean Sea. Our infestation prevalence and intensity results are higher than those above mentioned authors as a possible result of the salinity differences in the investigation areas, having 17‰ in the Black Sea where this study was conducted. Another explanation could be the low number of examined fish (n=6) in the present study when compared to more fishes (n=30) in the latter study have caused this differences in the prevalence and intensity values at both studies. There are many studies indicating infestation and intensity values of several other *Lamellodiscus* species from different fish and investigation areas; prevalence values of 12%, 94%, 27% and 56% for *Lamellodiscus dentex*, *L. toguebayei*, *L. vicinus* and. *L. triacies*, respectively, from *Dentex macrophthalmus* from Senegal and Morocco (Diamanka *et al.*, 2011a); prevalence and mean intensity values of 100% and 100.2±40.1, respectively, for *Lamellodiscus* spp. (*L. ergensi* and *L. bidens*) infestations on the seabream, *D. puntazzo*, in Greece (Katharios *et al.*, 2006); prevalence value of 43% for *Lamellodiscus* sp. from *Puntazzo puntazzo* from Greece (Athanassopoulou *et al.*, 1999); prevalence value of 40% for *L. diplodicus* from *Gerres oyena* from Red Sea (Bayoumy and El-Monem, 2011); prevalence values of 70%, 67%, 100% for *L. euzeti* from *D. canariensis D. gibbosus* and *D. gibbosus*, respectively, from Senegal and Tunisia (Diamanka *et al.*, 2011b); prevalence of 100% for each *L. tubulicornis* and *L. magnicornis* from *Gymnocranius grandoculis*, 100% and 66% for *L. parvicornis* from *G. euanus* and *G. grandoculis*, respectively, from New Caledonia (Justine and Briand, 2010); prevalence value of 65% and intensity value of 2-3 for *L. crampus* from *D. maroccanus* from the Mediterranean Sea (Neifar, 2008); prevalence 48.5%, mean intensity 3.00 ± 0.51 and abundance 1.46 ± 0.30 in autumn and prevalence 61.4%, mean intensity 6.33 ± 0.81 and abundance 3.89 ± 0.93 in spring for *Furnestinia echeneis* (Syn. of *Lamellodiscus echeneis* according to Mladineo *et al.*, 2013) from *Sparus aurata* in the Western Mediterranean (Reversat *et al.*, 1992). These results indicate that different *Lamellodiscus* species have the ability of different infestation intensities in their respective hosts in different environments as the result of environmental differences. On the other hand, measurement values of our two parasite species are in accordance with those values reported by Bychowsky (1957) and Dmitrieva (1998).

In conclusion, data presented in the current study provided new insights to previously known myxosporean and monogenean parasites from the Black Sea fishes by providing new hosts for some parasites, prevalence values for all parasite species, some of which not previously reported, approval of some organ and host specificities. *Sinuolinea rebae* is a new myxosporean parasite for the Black Sea fauna. This is also the first study in Turkish Black Sea coasts and all myxosporean and monogenean parasite species are new records for Turkish parasite fauna.

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