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Comparative Study on Parasite Fauna of the Whiting *Merlangius merlangus* in the Northern and Southern Zones of the Black Sea

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Abstract

The comparative parasite fauna of the whiting *Merlangius merlangus* (Linnaeus, 1758) in the Black Sea was determined using samples collected from the southern zone of the Sea near Sinop, Turkey and from the northern zone in Balaklava Bay, Sevastopol, Russia. The parasitological survey was conducted monthly between May 2011 and April 2014 on 690 fish from Sinop and 423 fish from Sevastopol. A total nine parasite species were identified which eight of were found at both sampling localities. *Trichodina gobii* Raabe, 1959, *Eimeria merlangi* Zaika, 1966, *Ceratomyxa merlangi* Zaika, 1966, *Myxidium gadi* Georgevitsch, 1916, *Gyrodactylus alviga* Dmitrieva and Gerasev, 1997, *Hysterothylacium aduncum* (Rudolphi, 1802) larvae and adults, *Scolex pleuronectis* Müller, 1788 plerocercoids and *Grillotia erinaceus* (van Beneden, 1858) plerocerci were recorded from both sampling localities whereas *Prodistomum polonii* (Molin, 1859) Bray and Gibson, 1990 was found only once in the Sevastopol samples. This study revealed considerable differences in the prevalence and abundance values of *T. gobii*, *Gy. alviga*, *Gr. erinaceus* and *H. aduncum* between the two regions indicating two distinct groups of whiting thus supporting other studies suggesting a complex structure of whiting stocks in the Black Sea.

Keywords: Whiting, *Merlangius merlangus*, comparative parasite fauna, Black Sea, Turkey, Russia.

Mezgit Balığının *Merlangius merlangus* Karadeniz'in Kuzey ve Güney Bölgelerindeki Parazit Faunaları Üzerine Karşılaştırmalı Çalışma

Özet

Mezgit balığının *Merlangius merlangus* (Linnaeus, 1758) Karadeniz'deki karşılaştırmalı parazit faunası güneyde Türkiye'nin Sinop kıyılarından ve kuzeyde de Rusya'nın Sivastopol'daki Balaklava Körfezinden yakalanan bireylerde belirlendi. Parazitolojik inceleme Sinop'ta 690 adet ve Sivastopol'da 423 adet balık üzerinde Mayıs 2011 ile Nisan 2014 tarihleri arasında aylık olarak gerçekleştirildi, Toplamda 9 adet parazit türü tanımlandı ve bunlardan 8 tanesi her iki araştırma bölgesinde de bulundu. *Trichodina gobii* Raabe, 1959, *Eimeria merlangi* Zaika, 1966, *Ceratomyxa merlangi* Zaika, 1966, *Myxidium gadi* Georgevitsch, 1916, *Gyrodactylus alviga* Dmitrieva and Gerasev, 1997, larva ve ergin *Hysterothylacium aduncum* (Rudolphi, 1802), pleroserkoid evrsindeki *Scolex pleuronectis* Müller, 1788 ve pleroserki evresindeki *Grillotia erinaceus* (van Beneden, 1858) her iki araştırma bölgesinde tespit edilirken, *Prodistomum polonii* (Molin, 1859) Bray & Gibson, 1990 sadece Sivastopol'da incelenen bir adet balıkta bulundu. Bu araştırmada *T. gobii*, *Gy. alviga*, *Gr. erinaceus* ve *H. aduncum* türlerine ait enfeksiyon oranı ve parazit yoğunluklarındaki farklılıklar, diğer araştırmalarda belirtilen ve Karadeniz'deki mezgit balığının kompleks yapıda iki farklı populasyonunun varlığını gösteren araştırmaları desteklemektedir.

Anahtar Kelimeler: *Merlangius merlangus*, karşılaştırmalı parazit faunası, Karadeniz, Türkiye, Rusya.

Introduction

Whiting, *Merlangius merlangus* (Linnaeus. 1758), is a gadid fish with a geographical distribution in the northeast Atlantic from the southern Barents Sea and Iceland to Portugal, and in the Black, Adriatic and Aegean Seas (Froese and Pauly, 2014). It prefers mainly muddy and gravely bottoms, but also occur in sandy and rocky areas, feeds on shrimps, crabs, molluscs, polychaetes, cephalopods, small fish such as anchovy, horse mackerel, goby and sprat (Hislop *et al.*, 1991; Samsun *et al.*, 2011). In the Black Sea, whiting is one of the main commercially significant fish species for Turkey and annual catch amount in 2013 was 9,397 tonnes (TUİK, 2013). On the other hand, due to low demand and market value, catches of

whiting in Ukrainian waters in 2001-2007 years were between 10-40 tons per year (Chesalin, 2011). More than 85% of catches of this fish species in the Black Sea are taken in Turkish waters, mainly near the western Turkish coasts including Sinop.

Parasites are recognized as an excellent source of information on the distribution of their hosts as they provide more information about their host's biology, ecology, phylogeny and population structure and can be used as biological tags (Marques *et al.*, 2009). Since some parasites may confer considerable economical losses to both aquaculture and fisheries, and many parasites can pose a threat to humans via the consumption of raw, undercooked or inadequately salted, pickled or smoked sea foods (Ward *et al.*, 1997). It is important to identify the parasite fauna of commercially important fish species. It is known that Black Sea whiting are divided into different populations and their reproductive isolation is determined by spatially isolated spawning areas (Volodin, 1995), hence we might expect regional differences in the component structure of Black Sea whiting parasites. Despite the fact that there is considerable information on the parasite fauna of whiting mainly from northern coasts of the Black Sea, only a limited number of studies have been presented on the parasite fauna of whiting close to Turkish coasts (Table 1).

In the present study, the parasite fauna of whiting inhabiting the southern and northern coastal zones of the Black Sea were investigated and compared in order to determine whether there is any difference in two parasite fauna in these sampling areas.

Materials and Methods

Whiting samples were collected monthly by trawl and demersal nets throughout a period between May 2011 and April 2014 from local fishermen. A total of 690 fishes from Sinop, Turkey (42°05′68″ N E 35°10′55″) and 423 fish specimens from Balaklava Bay near Sevastopol, Russia (44°49′54″N 33° 59′48″E) were examined for parasites in the parasitology laboratories at Sinop University, Faculty of Fisheries and Aquatic Sciences in Turkey, and the Institute of Biology of the Southern Seas in Sevastopol, Russia. Gills, skin, fins, eyes, the peritoneal cavity, mesenteries and peritoneal viscera were examined for parasites using conventional methods. Endoparasites were placed in separate Petri dishes with physiological saline and immediately observed. Parasite preparations were conducted according to methods indicated by Paradiznik and Radujkovic (2007) for digeneans, Moravec and Muzzall (2007) for nematodes, Yurakhno (1988) for myxosporeans, Özer *et al.* (2014) for cestodes, Lom and Dykova (1992) for trichodinids, All parasite species were examined and identified using a phase contrast Olympus microscope (BX53) equipped with a digital camera (DP50) and hand drawing attachment (U-DA). Identification keys were also used (Gaevskaya *et al.*, 1975, Bray and Gibson, 1990, Dmitrieva and Gerasev, 1997, Lom and Dykova, 1992).

The ranges (min–max) of infection prevalence, mean intensity and abundance were calculated for each parasite species according to Bush *et al.* (1997). The whiting parasite fauna similarity in the two sampling zones was evaluated using the Czekanowski-Sørensen Index (Sørensen, 1948).

Results

Parasitological examination of whiting yielded nine parasite species in total, eight at both sampling localities, comprising one ciliophoran, one monogenean, one sporozoan, one nematode at larval and adult stages, one digenean, two myxosporean and two larval cestodes. These are; *Trichodina gobii* Raabe, 1959 (Figure 1A), *Gyrodactylus alviga* Dmitrieva and Gerasev, 1997 (Figure 1B), *Eimeria merlangi* Zaika, 1966 (Figure 1C), *Ceratomyxa merlangi* Zaika, 1966 (Figure 1D), *Myxidium gadi* Georgevitsch, 1916 (Figure 1E), *Grillotia erinaceus* (van Beneden, 1858) plerocercus (Figure 1F) *Hysterothylacium aduncum* (Rudolphi, 1802) (Figure 1G,H) and *Scolex pleuronectis* Müller, 1788 plerocercoid (Figure 1I) and *Prodistomum polonii* (Molin, 1859) (Figure 1J). The latest species was found only off Sevastopol, Russia (Table 2). Microhabitats were determined to be the gills for *T. gobii*, the gills, skin and fins for *Gy. alviga*, the mesentery and gall bladder for *E. merlangi*, the gall bladder for *C. merlangi* and *M. gadi*, the pyloric caeca for *P. polonii* and *S. pleuronectis*, the stomach for adult *H. aduncum*, the pyloric caeca and intestine for *H. aduncum* larvae, subserosa of the anterior oesophagus, stomach, pyloric caeca, liver, ovaries and mesenteries for *Gr. erinaceus* plerocerci. Ranges for prevalence, mean intensity and mean abundance values of theses parasites obtained throughout sampling period at both sampling localities are provided in Table 2.

Off Sinop, the most prevalent (i.e. the dominant group or core species) were *T. gobii, Gy. alviga* and *H. aduncum*, followed by the predominant *C. merlangi*, then *M. gadi* and *Gr. erinaceus* (Table 2). Whereas, the core species in the whiting parasite community off Sevastopol were *M. gadi* and *H. aduncum*, with predominant *T. gobii* and *C. merlangi* followed by *Gy. alviga*. The most common parasite of whiting in both of the Black Sea regions studied was *H. aduncum.*

An extremely high level of the Czekanowski-Sørensen Index, 94.1%, indicated that eight out of the nine parasite species recorded from whiting in this investigation are common in the whiting populations inhabiting both studied sites.

Table 1. List of the *Merlangius merlangus* parasites in the Black Sea on the basis of literature data and present study

Parasite Species	Sampling area	Author(s)
CILIOPHORA		
Trichodina domerguei Wallengren, 1897	Russia – Sevastopol, Kerch Streit; Georgia – Batumi	Gaevskaya *et al.* (1975)
	Russia – Sevastopol	Zaika (1966)
	Russia – Sevastopol; Turkey-Sinop	Özer *et al.* (2012a)
T. gobii Raabe, 1959	Russia – Sevastopol, Karadag, Karkinitsky Gulf, Kerch Streit	Gaevskaya *et al.* (1975)
		Present study
T. ovonucleata Raabe, 1958	Russia – Sevastopol, Turkey-Sinop	Gaevskaya *et al.* (1975)
T. rectuncinata Raabe, 1958	Russia – Sevastopol, Kerch Streit; Georgia – Batumi	Zaika (1966)
	Russia – Sevastopol, Kerch Streit; Romania - Konstanza	Gaevskaya *et al.* (1975)
T. puytoraci Lom, 1962		Öğüt and Palm (2005)
	Russia – Sevastopol, Kerch Streit; Romania - Konstanza	Öğüt and Altuntaş (2011)
T. claviformis Dobberstein & Palm, 2000		Öğüt and Palm (2005)
	Turkey – Trabzon	Öğüt and Altuntaş (2011)
Trichodina sp.	Turkey – Trabzon	Öğüt and Palm (2005)
	Turkey – Trabzon	Öğüt and Altuntaş (2011)
Trichodinella inversa Dogiel, 1948	Turkey – Trabzon	Gaevskaya *et al.* (1975)
	Turkey – Trabzon	
	Turkey – Trabzon	
	Russia – Sevastopol, Kerch Streit; Georgia – Batumi	
KINETOPLASTIDA		
Cryptobia sp.	Russia – Sevastopol	Zaika (1966)
COCCIDIA		
Eimeria merlangi Zaika, 1966	Russia – Sevastopol	Zaika (1966)
	Russia – Sevastopol; Turkey-Sinop	Özer *et al.* (2012a)
	Russia – Sevastopol; Turkey-Sinop	Present study
MYXOZOA		
Ceratomyxa merlangi Zaika, 1966	Russia -Sevastopol	Zaika (1966)
	Russia -Crimea, Ukraine (all the northwestern part of the Black Sea); Russia, Georgia (all the northeastern part of the Black Sea)	Yurakhno (1988; 1997a,b; 2004; 2008; 2009b; 2010)
	Russia – Sevastopol; Turkey-Sinop	Özer *et al.* (2012a)
Myxidium gadi Georgevitsch, 1916	Russia – Sevastopol; Turkey – Sinop	Present study
	Russia – Crimea, Ukraine (all the northwestern part of the Black Sea); Russia, Georgia (northeastern part of the Black Sea)	Yurakhno (1987; 1988; 1997a,b; 2000; 2004; 2008; 2009a,b; 2010)
	Russia – Sevastopol	Shchepkina and Yurakhno (2004; 2008)
	Russia – Sevastopol	
Ceratomyxa informis Auerbach, 1910	Russia – Sevastopol; Turkey – Sinop	Skuratovskaya *et al.* (2012)
	Russia – Sevastopol; Turkey – Sinop	Özer *et al.* (2012a)
	Russia, Novorossiysk	Present study
		Pogoreltseva (1964)
MONOGENEA		
Gyrodactylus alviga Dmitrieva and Gerasev, 1997	Russia – Sevastopol	Dmitrieva and Gerasev (1997; 2000)
	Russia – Sevastopol; Turkey – Sinop	
	Russia – Sevastopol; Turkey – Sinop	Özer *et al.* (2012a)
	Turkey - Sinop	Present study
		Yaman (1997)
DIGENEA		
Prodistomum polonii (Molin, 1859) Bray & Gibson, 1990	Russia – Sevastopol	Present study
	Russia – Novorossiysk	Pogoreltceva (1952b)
Hemiurus communis Odhner, 1905	Russia – Sevastopol; Russia, Novorossiysk	Gaevskaya *et al.* (1975)
	Russia – Karadag	Najdenova and Solonchenko (1989)
	Russia – Karadag	
	Russia – Novorossiysk	Miroshnichenko (2004)
Stephanostomum pristis (Deslongchamps, 1824) Looss, 1901	Russia – Karadag	Pogoreltceva (1952b)
	Russia – Karadag	Gaevskaya *et al.* (1975)
	Russia – Alushta, Karadag	Miroshnichenko (2004)
Prosorhynchoides gracilescens (Rudolphi, 1819) metacercariae	Russia – along Crimean coasts	Mange (1993)
	Russia – Kerch Strait	Gaevskaya *et al.*, (1975)
Stephanostomum sp. metacercariae	Georgia – Batumi	Pogoreltceva (1952b)
Nemathobothrium sp. metacercariae	Black Sea	Chulkova (1939)
Galactosomum lacteum (Jägerskiöld, 1896) metacercariae	Georgia – Batumi	Gaevskaya *et al.* (1975)
	Russia – Novorossiysk	Chulkova (1939)
Bucephalus marinus Vlasenko, 1931	Black Sea	Pogoreltceva (1952b)
Lecithochirium rufoviride (Rudolphi, 1819) Lühe, 1901	Bulgaria – Sozopol	Gaevskaya *et al.* (1975)
	Russia – Novorossiysk	Dimitrov (1989)
	Russia – Sevastopol, Novorossiysk	Pogoreltceva (1952b)
		Gaevskaya *et al.*, (1975)
NEMATODA		
Hysterothylacium aduncum (Rudophi, 1802)	Georgia – Batumi	Chulkova (1939)
	Russia – Sevastopol	Osmanov (1940)
	Russia - Novorossiysk	Pogoreltceva (1952a)
	Bulgaria	Gaevskaya *et al.*, (1975)

Table 1. Continued

Parasite Species	Sampling area	Author(s)
NEMATODA		
Hysterothylacium aduncum (Rudophi, 1802)	Russia – Alushta, Karadag	Pogoreltceva (1952b)
	Turkey – Samsun	Chulkova (1939)
	Russia – Sevastopol	Gaevskaya *et al.* (1975)
	Russia – Sevastopol	Chulkova (1939)
	Turkey – Trabzon	Pogoreltceva (1952b)
	Turkey – Sinop	Gaevskaya *et al.* (1975)
	Turkey – Eastern Black Sea	Dimitrov (1989)
	Russia – Sevastopol; Turkey – Sinop	Pogoreltceva (1952b)
Cucullanus heterochrous Rudolphi, 1802	Russia – Sevastopol; Turkey – Sinop	Gaevskaya *et al.*, (1975)
Contracaecum aduncum (Rudolphi, 1802)	Georgia – Batumi	
	Georgia – Batumi	
Cucullanellus minutus (Rudolphi, 1809)	Turkey - Sinop	
	Turkey - Erzurum	
	Turkey - Erzurum	
CESTODA		
Grillotia erinaceus (van Beneden, 1858)	Russia – Karadag, Kerch Streit	Kornyushin and Solonchenko (1978)
plerocercoid	Russia – Sevastopol	Gaevskaya *et al.* (1975)
	Russia – Sevastopol; Turkey – Sinop	Özer *et al.* (2012a, b)
	Turkey – Eastern Black Sea	Tepe *et al.* (2013)
	Russia – Sevastopol; Turkey – Sinop	Özer *et al.* (2014)
	Russia – Sevastopol; Turkey – Sinop	Present study
	Russia - Novorossiysk	Pogoreltceva (1952a)
Tetrarhynchobothrium Diesing, 1854 larvae	Russia - Novorossiysk	Pogoreltceva (1952a)
Scolex pleuronectis Müller, 1788 plerocercoid	Russia – Sevastopol	Gaevskaya *et al.* (1975)
	Russia – Sevastopol	Present study
Tentacularia sp.	Black Sea	Gaevskaya *et al.*, (1975)
COPEPODA	Russia - Novorossiysk	Pogoreltceva (1952a)
Ergasilus lizae Krøyer, 1863	Black Sea	Gaevskaya *et al.* (1975)

Discussion

Despite its commercial importance, the whiting, *Merlangius merlangus* in the Black Sea, had never previously been a subject of a special parasitological investigation focused on its parasite fauna. Nevertheless, a total of 31 parasite species (including 27 named and 4 unnamed species) have so far been reported from this host in the Black Sea according to literature; these are the members of the Monogenea (1), Kinetoplastida (1), Coccidia (1), Crustacea (1), Nematoda (2), Myxozoa (3), Cestoda (3), Ciliophora (8), and Digenea (9) (Table 1). In the present study, five parasites species (*T. gobii*, *E. merlangi*, *C. merlangi*, *M. gadi*, *Gy. alviga*) are recorded off Turkish Black Sea coasts for the first time. Our study yielded one species which have previously not been recorded from whiting in the Black Sea – i.e. the digenean *Prodistomum polonii*. As it can be seen from Table 1, most of the trichodinid species have been recorded only once in several parts of the Black Sea and, similarly, we have found only one of seven species previously reported from this host indicating that parasites are mostly restricted to this geographical location or different whiting populations in the Black Sea. In previous reports, there were sometimes no data on the prevalence and intensity values of the parasites and it was not possible to compare their dispersion, thus, we believe them to be rare.

Trichodina gobii was the only trichodinid species found at both sampling localities in the present study. Xu (2007) made a detailed revision of the identification of *T. gobii* based on previous reports and considered some previous reports of *T. domerguei gobii* and *T. jadranica*, from several fish species by several authors, to be *T. gobii*, and suggested that *T. gobii* is a widely distributed species with a wide host range that belongs a group of the extraordinary fish trichodinids occurring in both marine and freshwater environments. According to the literature, *T. gobii* has been reported only once on whiting (Table 1), however, Öğüt and Palm (2005) and Öğüt and Altuntaş (2011) reported a *Trichodina* sp. on whiting collected from the eastern part of Turkish Black Sea coasts and, due to similarities in morphology and measurements, we believe that it was in fact *T. gobii*. Thus, this is its second report from the Black Sea at species level and the first from Turkish coasts.

Prodistomum polonii was the only digenean species found in whiting in the present study and from only Sevastopol samples; this is its first report from Black Sea whiting. However, it has been reported that this species is common in scads, *Trachurus* spp. in the Black Sea (Korniychuk, 2005) and in *T. mediterraneus* in Marmara Sea (Keser *et al.*, 2007). None of all the other digenean species previously recorded from this host in the Black Sea (Table 1) were observed during our investigation. Populations of digeneans, with their complex life cycles, are restricted to the distribution of their first intermediate hosts. As all of these digeneans previously been mentioned from other localities in the Black Sea, we suggest that the differences in the local mollusc fauna or the density of molluscs hosts populations may be

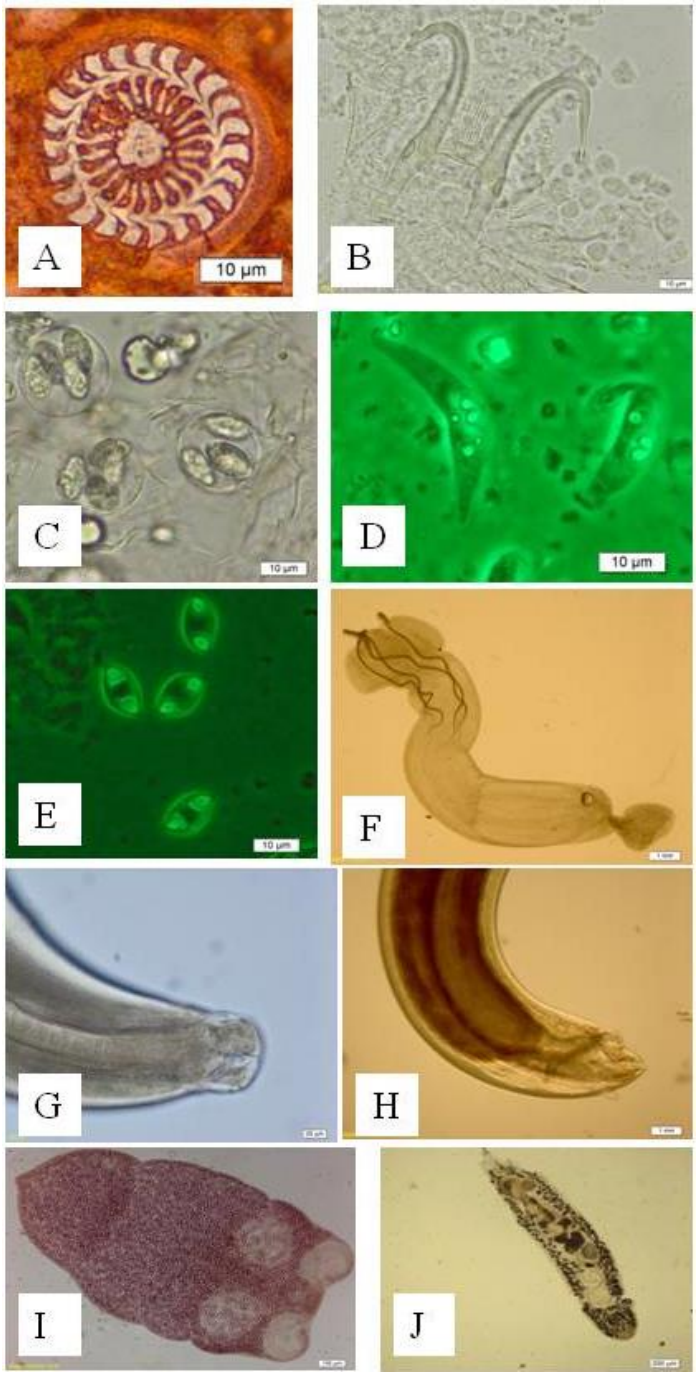

Figure 1. Parasite species identified in *M. merlangus*. A) *T. gobii*, B) *Gy. alviga*, C) *E. merlangi*, D) *C. merlangi*, E) *M. gadi*, F) *Gr. erinaceus*, G,H) *H. aduncum*, I) *S. pleuronectis*, J) *P. polonii*.

the reason for absence of these digeneans in our material, as well as possible differences in the second intermediate host fauna. Nevertheless, an analysis of previous reports (Table 1) reveals that most of them have been recorded from whiting only once and these findings were repeated in the Key to the parasites of vertebrates of Black and Azov seas (Gaevskaya *et al.*, 1975) and a regional checklist (Miroshnichenko, 2004).

Hysterothylacium aduncum was determined to be the most common and generalist parasite species (Gaevskaya *et al.*, 2010) in both sampling areas. It lives as a mature adult in the digestive tracts of marine teleosts, with larvae known to occur in marine invertebrates and fish (Køie, 1993a). The third-stage larvae have been found encapsulated in the mesentery and viscera of a wide range of fish that act as transport hosts (Berland, 1961; Køie, 1993b). This cosmopolitan nematode has a circumpolar distribution and is found mainly in marine teleosts in temperate and cold waters (Berland, 1991), the North-eastern Atlantic (Køie, 1993a), the Mediterranean Sea (Petter and Maillard, 1987), the Adriatic Sea (Petter and Radujkovic, 1989) and in the Pacific and Atlantic

Table 2. Identified parasite species and infection indices ranges in southern zone (Sinop, Turkey) and northern zone (Sevastopol, Russia) in the Black Sea

Parasite species	Black Sea		Infection Prevalence Ranges (min–max)		Mean Intensity Ranges (min–max)		Mean Abundance Ranges (min–max)	
	Sinop Turkey	Sevastopol Russia	Sinop	Sevastopol	Sinop	Sevastopol	Sinop	Sevastopol
Trichodina gobii Raabe, 1959	+	+	19.2–100	5.0–47.5	4.4–303.8	2.0–41.1	1.3–283.5	0.1–19.5
Gyrodactylus alviga Dmitrieva and Gerasev, 1997	+	+	29.3–90.9	10.0–32.5	1.9–74.0	2.0–31.8	0.6–60.7	0.2–9.5
Eimeria merlangi Zaika, 1966	+	+	3.3–18.2	2.5	Numerous	Numerous	Numerous	Numerous
Ceratomyxa merlangi Zaika, 1966	+	+	6.7–77.8	15.0–50.0	Numerous	Numerous	Numerous	Numerous
Myxidium gadi Georgevitsch, 1916	+	+	6.7–53.3	10.0–70.0	Numerous	Numerous	Numerous	Numerous
Grillotia erinaceus (van Beneden, 1858) plerocercus	+	+	3.3–54.5	2.5–22.5	1.0–4.3	1.0–1.7	0.07–1.3	0.03–0.4
Scolex pleuronectis Müller, 1788 plerocercoid	+	+	3.2–25.0	5.0	1.0–17.5	2.0	0.03–1.3	0.05
Hysterothylacium aduncum (Rudolphi, 1802)	+	+	41.5–98.6	17.5–60.0	4.0–45.4	1.5–9.1	1.7–40.7	0.3–6.2
Prodistomum polonii (Molin, 1859) Bray & Gibson, 1990	-	+	0	2.5	0	1.0	0	0,02

waters of North America (Margolis and Arthus, 1979; Marcogliese, 1996). It is also reported to be common in the Black Sea (Özer *et al.*, 2000; Gaevskaya and Korniychuk, 2003) and common in whiting from both investigated regions (see Table 1 for references).

A trypanorhynch cestode, *Grillotia erinaceus*, is specific to gadids at the plerocercus stage and is known from haddock (*Melanogrammus aeglefinus*), cod (*Gadus morhua*) and saithe (*Pollachius virens*) and becomes mature in elesmobranch hosts (Lubieniecki, 1976). This species has previously been described from whiting in the northern part of the Black Sea (Kornyushin and Solonchenko, 1978). *Scolex pleuronectis*, another cestode maturing in elasmobranch fish, at plerocercoid stage has also been reported from northern part of the Black Sea (see Table 1 for details), but it was found in whiting samples from southern part of the Black in the present study for the first time. The prevalence and abundance values of *S. pleuronectis* at both localities were very low.

Gyrodactylus alviga was the only monogenean parasite found on the gills of whiting collected from both sampling zones of the Black Sea in the present study. Yaman (1997) reported a *Gyrodactylus* sp. on whiting collected near Sinop where this study was conducted and we believe that it was *Gyrodactylus alviga* (see Table 1 for references). It is a generalist species recorded from many Black Sea fishes, but whiting is known to be its main host (Dmitrieva and Gerasev, 1997). Similarly, *Eimeria merlangi* is the only sporozoan reported previously from whiting (see Table 1 for references). It was found at both sampling localities in the Black Sea. As for myxosporeans, whiting is the only host of *Ceratomyxa merlangi* and the main host of *Myxidium gadi* (*Platichthys flesus* is secondary host). *Ceratomyxa merlangi* and *M. gadi* were the only myxosporeans found in the gall bladder of whiting. *Myxidium gadi* was recorded as the causative agent of the *M. merlangus* disease called myxidiosis (Yurakhno, 2009a). The contents of infected gall bladders were represented by numerous vegetative forms and spores of *M. gadi. Ceratomyxa merlangi* and *M. gadi* were found in mix infection in some whitings.

Analyzing the list of known parasite species from Black Sea whiting (see Table 1 for details), we can note that *T. gobii*, *Gy. alviga*, *H. aduncum* and *Gr. erinaceus* are generalist parasite species, as all of them are known in the Black Sea from a wide range of fish hosts (Gaevskaya *et al.*, 1975): *T. gobii* has 15 fish hosts, *Gy. alviga* - 16, *H. aduncum* – about 50 fish species; *Gr. erinaceus* plerocerci are known from 8 fishes (most of them are prey of the main definitive host of this cestode, the ray *Raja clavata*). Of the parasites mentioned above, we believe (comparing indices of infection in the literature and our data) that Black Sea whiting is the main hosts for *Gy. alviga* and the secondary definitive host for *H. aduncum*; As for *P. polonii*, maritae of this species are widely known from *Trachurus mediterraneus* everywhere in the Black Sea (Korniychuk, 2005) and it has previously been found in whiting only once in the Irish Sea (Shotter, 1976). Considering the report of Samsun *et al* (2011) that *T. mediterraneus* was part of whiting diet and the extremely low indices of invasion in our research study (one specimen from Sevastopol), we believe that whiting is an accidental final host for this trematode. On the other hand, *E. merlangi* and *C. merlangi* are specialists, common and abundant parasite species for the Black Sea whiting only, according to our data and the literature (see Table 1). However, *M. gadi* is known in the Black Sea from whiting as well as the flounder, *Platichtys flesus.*

Preliminary comparative analysis revealed considerable differences in the prevalence and abundance values of *T. gobii*, *Gy. alviga*, *Gr. erinaceus* and *H. aduncum* between the regions studied (Table 2). As trichodinid ciliophorans are ectoparasites with direct life cycle, such distinct differences in its abundance (1.3-283.5 off Sinop vs 0.1-19.5 off Sevastopol) reflects the absence of contact between fish stocks in these two regions. The hypothesis regarding two distinct groups of whiting in

the regions studied is supported by significant differences in minimum and maximum abundance values of helminth larvae (*Gr. erinaceus* and *H. aduncum)* infecting whiting via its food. Finally, we suggest the presence of a complex structure of whiting stocks in the Black Sea, and, although, *E. merlangi* and myxozoans are numerous in whiting in both fish stocks.

Conclusion

Modern data on the Black Sea whiting parasite fauna in the northern (off Sevastopol) and the southern (off Sinop) zones of the Black Sea were obtained. Parasitological examination of the Black Sea whiting yielded eight and nine parasite species in Turkish and Russian samples respectively, comprising one ciliophoran, one sporozoan, one monogenean, one digenean, one nematode, two myxosporean and two cestodes. Based on the standard indices of whiting infections by parasites in the investigated populations in the present study and current literature, it can be stated that component structure of digenean community of the Black Sea whiting in northern part of the Sea has strongly changed since its previous investigations. On the other hand, five parasite species (*T. gobii*, *E merlangi*, *C. merlangi*, *M. gadi*, *Gy. alviga*) are recorded off Turkish coasts for the first time.

Comparative analysis of whiting parasites in northern and southern stocks of whiting in the Black Sea revealed very close results and protozoa, myxozoa and helminths are the most common parasitic groups in both regions.

From the historic point of view, the most diverse fauna of whiting parasites is in coastal waters in the northern part of the Black Sea due to the intensive parasitological investigations in the region and recording some new parasite species from whiting off Turkish coasts shows a clear need for parasitological studies in the region.

The current investigation revealed considerable differences in the minimum and maximum prevalence and abundance values of *T. gobii*, *Gy. alviga*, *Gr. erinaceus* and *H. aduncum* between the regions indicating two distinct groups of whiting and supported other studies suggesting a complex population structure of whiting in the Black Sea.

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