

Research Article

**Seasonal Infection of Metazoan Parasites on Mosul Bleak (*Alburnus mossulensis*)  
Inhabiting Murat River and Its Tributaries in Eastern Anatolia, Turkey**

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Received: 02.02.2018

Received in Revised: 15.03.2018

Accepted: 21.03.2018

**Abstract**

This study was conducted to determine the frequency of metazoan parasitic infections of Mosul bleak (*Alburnus mossulensis*) in Murat River in Eastern Anatolia, Turkey. A total of 182 host fish were investigated, from January 2015 to March 2016. There were 972 metazoan parasites recorded in collected samples. Six species of Monogenea (*Dactylogyrus holciki*, *Dactylogyrus lenkorani*, *Dactylogyrus alatus*, *Dactylogyrus vistulae*, *Gyrodactylus* sp., and *Paradiplozoon homoion*), one species of Digenea (*Diplostomum spathaceum*), two species of Cestoda (*Caryophyllaeus laticeps*, *Ligula intestinalis*), one species of Nematoda (*Rhabdochona denudata*), one species of Hirudinea (*Piscicola geometra*), and one species of Copepoda (*Eergasilus* sp.) observed respectively. According to their prevalence from high to low ranks; *Eergasilus* sp. (34.6%), *D. spathaceum* (33%), *P. homoion* (19.8%), *D. holciki* (12.1%), *C. laticeps* (7.1%) *D. alatus* (6.6%), *D. lenkorani* (4.9%), *R. denudata* (4.9%), *Gyrodactylus* sp. (3.8%), *P. geometra* (1.6%), *D. vistulae* (1.1%) and *L. intestinalis* (0.5%) were calculated. Among these parasites *D. lenkorani*, *D. vistulae*, *P. homoion*, *C. laticeps* and *R. denudata* are the first record on Mosul bleak and *D. holciki* is the first record for Turkey freshwater fish parasites.

**Key words:** *Alburnus mossulensis*, Monogenea, Digenea, Cestoda, *Rhabdochona denudata*, *Eergasilus* sp., *Piscicola geometra*

**Murat Nehri ve Kollarında (Doğu Anadolu Bölgesi, Türkiye) Yaşayan Musul İnci Balığı  
(*Alburnus mossulensis*)'nin Metazoan Parazitlerinin Mevsimsel Enfeksiyonu**

**Özet**

Bu çalışma Murat Nehri (Doğu Anadolu Türkiye)'indeki Musul İnci balığı (*Alburnus mossulensis*)'nda bulunan metazoan parazitlerin enfeksiyon dağılımını saptamak amacıyla yapılmıştır. Ocak 2015 - Mart 2016 tarihleri arasında incelenen 182 balık örneğinde 12 farklı parazit türünden toplam 972 parazit kaydedilmiştir. Bu parazitlerden sırasıyla Monogenea'dan altı tür (*Dactylogyrus holciki*, *Dactylogyrus lenkorani*, *Dactylogyrus alatus*, *Dactylogyrus vistulae*, *Gyrodactylus* sp. ve *Paradiplozoon homoion*), Digenea'dan bir tür (*Diplostomum spathaceum*), Cestoda'dan iki tür (*Caryophyllaeus laticeps*, *Ligula intestinalis*), Nematoda'dan bir tür (*Rhabdochona denudata*), Hirudinea'dan bir tür (*Piscicola geometra*), ve Copepoda'dan bir tür (*Eergasilus* sp.) görülmüştür. Bu parazit örneklerinin prevalanslarının sırasıyla en yüksek orandan en düşük orana doğru; *Eergasilus* sp. (%34.6), *D. spathaceum* (%33), *P. homoion* (%19.8), *D. holciki* (%12.1), *C. laticeps* (%7.1) *D. alatus* (%6.6), *D. lenkorani* (%4.9), *R. denudata* (%4.9), *Gyrodactylus* sp. (%3.8), *P. geometra* (%1.6), *D. vistulae* (%1.1) ve *L. intestinalis* (%0.5) olarak bulunmuştur. Kaydedilen bu parazitlerden *D. lenkorani*, *D. vistulae*, *P. homoion*, *C. laticeps* ve *R. denudata* *A. mossulensis* için ve *D. holciki* ise Türkiye tatlı su balık parazitleri için ilk kayıt olmaktadır.

**Anahtar kelimeler:** *Alburnus mossulensis*, Monogenea, Digenea, Cestoda, *Rhabdochona denudata*, *Eergasilus* sp., *Piscicola geometra*

## Introduction

In almost all fishes are affected by the metazoan parasites which caused some chemical parametric changes in the infected tissues and change their physiology, inducing stress in the host animal (Cheng, 1974; Chubb, 1977). Metazoan parasites play a vital role in freshwater ecosystems and are accepted as fish pathogens in some conditions (Wyatt and Kennedy, 1989). Most parasites found in freshwater fishes are pathogenic and lead to weakening in the host fishes. In addition, they affect behavior, migration, survival status, reproduction ways and community structure of fishes, and regulate their populations as well (Soares and Aluque, 2015).

*A. mossulensis* is a freshwater fish species from cyprinid, found in the Euphrates, Tigris and Ceyhan rivers in Turkey and in their adjacent basins in Iran (Kuru, 2004; Geldiay and Balık, 2007; Coad, 2010). Although there are numerous studies about inland freshwater fish parasites, the parasites of genus *Alburnus* have not been elucidated clearly.

The first record of monogenean parasite *D. holciki*, which is unfamiliar to Turkey, was reported for the first time by Molnar and Jalali (1992) on *A. mossulensis* in Iran. Records of the same parasite in *A. mossulensis* were stated in the following studies; Gussev et al. (1993), Barzegar and Jalali (2006; 2009) and Barzegar et al. (2008). Also, in Syria, Al-Samman et al. (2006) detected *D. holciki* on *C. mossulensis*, the synonym of *A. mossulensis*.

In Turkey, *D. alatus* records were reported on *A. alburnus* (Aydoğdu and Selver 2006; Koyun and Altunel, 2007), *C. regium* (Özgül, 2008) and *Alburnus heckeli* (Koyun, 2011). Also, Neary et al. (2012) detected the same parasite on *Alburnus orontis* and *C. regium*. In France, Lambert (1977) reported *D. fraternus* and *D. alatus*, host-specific to *A. alburnus*, Gelnar et al. (1994) stated *D. alatus* on the same host. In Iran, Jalali and Molnar (1990) recorded *D. alatus* on *C. chalcoides* in their study. In a similar manner, only a single monogenean parasite species *D. holciki* on *C. mossulensis* proved to be endemic for the Gulf Basin, while *D. alatus* represents a parasite commonly occurring in Europe on *A. alburnus*.

The number of *D. lenkorani* records are limited in Turkey and they were detected on *C. umbla* and *C. trutta* (Koyun, 2012; 2015; Korkut, 2014). The studies from Iran and Iraq showed the presence of *D. lenkorani* (Jalali and Molnar, 2011; Jalali et al., 2000; Pazooki and Masoumian, 2012; Abdullah and Abdullah, 2015). *D. vistulae* was detected on *Leuciscus cephalus* (Aydoğdu et al., 2001; Neary et al., 2012), *Chondrostoma regium* (Özgül, 2008; Koyun, 2011; Neary et al., 2012), *Squalius cephalus* (Koyun, 2011).

The early studies about *Gyrodactylus* genus was carried out in 1956 by Malmberg. The presence of *Gyrodactylus* sp. was detected on *A. mossulensis* in Beshar River located in Iran-Euphrates (Hanzelova and Zitnan, 1985; Jalali et al., 2005). Various studies from Turkey about *P. homoion* belonging to the *Paridiplozoon* genus from the Diplozoidae family given as follows; Öktener (2003), Aydoğdu and Selver (2006), Koyun and Altunel (2007), Öztürk (2005), Soylu (2007), Soylu and Emre (2007), Civanova et al. (2013).

According to the data collected so far, *D. alatus*, *D. lenkorani*, *D. vistulae*, *Gyrodactylus* sp. and *P. homoion* which belong to monogenean parasites, were the first records on *A. mossulensis* in the freshwater fishes. Freshwater fishes are intermediate host to *D. spathaceum* metacercaria that found on different fishes in numerous studies in Turkey; Aydoğdu and Selver (2006) reported it on *A. alburnus*, Dörücü and Ispir (2005), and Karaman (2010) identified *Diplostomum* sp. on *A. mossulensis*, and Barata and Dörücü (2014) detected *D. spathaceum* on *A. mossulensis* as well.

*C. laticeps* was recorded on different species in Turkey; Türkmen (1990) on *C. caprio*, Aksoy and Sarieyyüpoğlu (2000) on *C. capoeta umbla*, Aydoğdu and Altunel (2002), Öktener (2003), Karatoy and Soylu (2006) on *A. brama*, Kır et al. (2004) on *C. carpio*, Uzunay and Soylu (2006), on *T. tinca*, Aydoğdu et al. (2008) on *V. vimba*. *C. laticeps* on *A. mossulensis* was a new record in studies related to freshwater fish parasites in Turkey. The international records about *C. laticeps* are; Kulakovskaya (1961; 1964), Kennedy (1968), Bombarová and Špakulová (2015), Hanzelová et al. (2015) and Xi et al. (2016).

*L. intestinalis* was seen on some fishes in several localizations of inland waters in Turkey: Kelle (1978) on *C. mossulensis* in Devegeçidi Dam, Keskin and Erk'akan (1987) and Koyun (2006) on *A. alburnus* in Enne Dam Lake.

González-Solís et al. (1997) reported *R. denudate* on *A. mossulensis* in Kor River (Iran). In Turkey; Aydoğdu and Selver (2006) detected *R. denudate* on *A. alburnus* in Mustafakemalpaşa Creek. A record for *R. denudate* on *A. mossulensis* in Turkey has not been stated.

*P. geometra* is a non-host-specific annelid parasite and there are many *P. geometra* records reported in freshwater fishes in Turkey. The latest record of *P. geometra* was reported on *C. capoeta*, *A. mossulensis* and *C. macrostomum* (Koyun et al., 2015).

*E. sieboldi* was reported by Mirhashemi Nasab and Pazooki (2003) and Mokhayer (1985) Caspian region in Iran. The records for Copepods were found on *T. tinca* by Akbeniz and Soylu (2008)

in Sapanca Lake and Öktener et al. (2008) reported *E. mosulensis* on *C. mossulensis*.

Soylu (1989) reported *D. spathaceum* on *R. rutilus*, *S. erythrophthalmus*, *E. lucius* and *S. glanis* in Sapanca Lake. Also, Karatoy and Soylu (2006), Aydoğdu and Selver (2006) recorded *Diplostomum* sp. on *A. alburnus*, and Özgül (2008) found *Diplostomum* sp. on *C. carpio*, *C. capoeta*, *C. tinca* ve *C. regium* in Almus Dam Lake. Karaman (2010) reported *Diplostomum* sp. on *A. mossulensis* in Elaziğ Kalecik Dam Lake. Çolak (2013) detected *D. spathaceum* records on the species of *P. fluviatilis*, *C. carpio*, *C. gibelio*, *Sander lucioperca*, *Lepomis gibbosus*, *S. erythrophthalmus*, *R. rutilus*, *E. lucius*, *S. glanis* in Sığırcı Lake (Edirne).

The aim of the present study was to describe metazoan parasites fauna of *A. mossulensis*, their prevalence and intensities, as well as the quantitative changes in parasite species according to seasons and fish gender.

### Materials and Methods

Mosul bleak fish was collected from Murat River and its tributary from January 2015 to March 2016. Collected fishes were brought alive to the laboratory and examined at list in two days for the presence of metazoan parasites. Examined fishes were sacrificed and the following information was recorded; date and place of capture, weight (g), total, fork and standard length (mm), and sex. Sacrificed fishes dissected out and examined under stereo microscope. Each gill arches were removed separately from each side and placed separately into tap water added petri dishes to examine monogeneans and other ectoparasite.

The intestine tract was removed and examined for endoparasites using a stereomicroscope. Isolated parasites were fixed and preserved in accordance with the methods described in Bylund et al. (1980). Nematodes samples collected and washed thoroughly to remove debris. The specimens were counted and fixed in hot 70% alcohol. After fixation the worms were stored in glycerin 70% alcohol mixture (5ml glycerin, 100ml alcohol). Their identification was done according to Bykhovskaya-Pavlovskaya (1962) and Pugachev et al. (2009).

### Result and Discussion

The diversity and the existence of metazoan parasites in relation to seasons and size levels of the *A. mossulensis* were investigated and discussed for the first time for Murat River in Eastern Anatolia, Turkey. The life cycle, prevalence and intensity of parasites and host depends on many biotic and abiotic factors of water in their inhabiting area (Zaidi and Khan, 1976). Parasitic organisms are

highly sensitive to changes in ecological factors, and these factors influence the distribution and abundance of the parasite population. Seasonal change factors; especially temperature and oxygen levels in the water are important abiotic factors affecting parasite populations (Hanzelova and Zitnan, 1985). Generally parasites are found in all fish so it is important to know their reproductive, life cycle and host relationships to determine control strategies in fish farms (Neary et al., 2012).

In this study the frequency of parasitic infections of *A. mossulensis* to determine was conducted. A total of 182 host fish were investigated, from January 2015 to March 2016. There were 972 metazoan parasites recorded in examined samples. Table 1. shows 71% rate of infection, a total of 12 parasite taxa from 182 Mosul bleak fish, whereas in same table shows distribution of parasites in the host fish on seasonally basis. Six species of Monogenea (48 *D. holciki*, 25 *D. alatus*, 11 *D. lenkorani*, 4 *D. vistulae*, 25 *Gyrodactylus* sp., 67 *P. homoion*), one species of Digenea (362 *D. spathaceum*) two species of Cestoda (16 *C. laticeps*, 1 *L. intestinalis*), one species of Nematoda (13 *R. denudata*), one species of Copepoda (393 *Ergasilus* sp.) and one species of Hirudinea (7 *P. geometra*) were found on the gills, fin and in the intestinal tract of Mosul bleak collected at the Murat River and its tributaries, with their infection levels comparing to male and female listed in Table 2.

According to their prevalence and comprised of the total parasite specimens recorded; *Ergasilus* sp. (34.6%, 40.43%), *D. spathaceum* (33%, 37.24%), *P. homoion* (19.8%, 6.9%), *D. holciki* (12.1%, 4.94%), *C. laticeps* (7.1%, 1.65%) *D. alatus* (6.6%, 2.6%), *D. lenkorani* (4.9%, 1.13%), *R. denudata* (4.9%, 1.34%), *Gyrodactylus* sp. (3.8%, 2.6%), *P. geometra* (1.6%, 0.72%), *D. vistulae* (1.1%, 0.41%) and *L. intestinalis* (0.5%, 0.1%) were calculated. The most prevalent and abundant species in all recorded parasites were the copepodit *Ergasilus* sp. and latest one was recorded cestod *L. intestinalis*.

*D. holciki* is new records for Turkey freshwater fish, it was reported as a new species for the first time on *A. mossulensis* by Molnar and Jalali (1992). Occurrence of this monogenean parasite on male and female fish shows but parasite was stumbled across in all seasons. *D. holciki* cannot be seen in female host in summer and in autumn, seen less common in male in all seasons and only 48 parasites were recorded on during the whole year for this species. *D. alatus* is also specific for *Alburnus* genus, out of total of 25 parasites were found in all year on males and female, recorded late winter, spring and autumn but in summer was not recorded. *D. lenkorani* is not specific for this host

fish, only in winter 11 parasites were found in nine of 32 examined fish in total. *D. vistulae*, a total of four parasites in only two of the 182 fishes surveyed were found in summer, but in other seasons was not seen.

*Gyrodactylus* sp.; out of total of 25 parasites, 16 were found on female fish in spring, summer and winter whereas in males 9 were detected in spring and in summer. *Gyrodactylus* sp. was encountered more likely in spring and numbers showed inverse relationship with temperature. Neary et al. (2012) has also reported similar data about *Gyrodactylus* sp. study was reported in summer, autumn and spring seasons.

*P. homoion* was first described by Bychovskaya and Nagibina in 1959 infecting various freshwater fish in Europe; (Gelnar et al., 1989; Matejusová et al., 2002; Pečínková et al., 2007; Stojanovski et al., 2009 and Konstanová et al., 2017).

*A. mossulensis* is endemic species of Euphrates-Tigris river system. Therefore, there is no study related to this species in other regions of Turkey. In the light of this study, it is the first record of *P. homoion* on *A. mossulensis*. Diplozoons are resistant to complex metabolism and environmental conditions, so these gill parasites can be seen on both male and female host fish in every season of the year and this situation is confirmed by the current study. While in Turkey recordings of different studies about *P. homoion* are given as follows; *R. rutilus* Öktener (2003), *A. alburnus*, Aydogdu and Selver (2006), Koyun and Altunel (2007), *C. chalcoides* Öztürk (2005), *Pseudophoxinus antalyae* Soylu (2007), *C. carpio* Soylu and Emre (2007). *P. homoion* (Bychowsky and Nagibina, 1959) is a monogenean, oviparous and have direct development and blood-feeding, as are other diplozooids, but there is no information about the pathogenicity of these parasites (Gelnar et al., 1989).

*D. spathaceum* is a non-host-specific, cosmopolite and digenetic parasite detected at metacercaria levels in fishes. Through this study, the prevalence of encysted metacercariae of *D. spathaceum* was 33%. This finding was lower than those reported in different fresh water bodies in Egypt 100% Rifaat et al. (1980), 87% Mwita and Nkwengulila (2008), 67% Soliman et al. (2004) and 70% Salah et al. (2005). Such variation in prevalence may be related to the difference in the habitat, food supply, abundance of both aquatic snails (the

intermediate host), and the aquatic piscivorous birds, which play the main role to complete the life cycle of some digenetic trematodes. Additionally, this figure was also supported by previous investigations who mentioned that the prevalence levels of *D. spathaceum* in the lenses of fish eye was generally higher in the winter, autumn and spring compared to the summer season (Turgut and Ozgul, 2012).

Records of *Rhabdochona* genus was showed in the following studies; Moravec (1994), Moravec et al. (2012), Pereira and Pellitero (1979) and Pereira (1980). Also, González-Solís et al. (1997) detected *R. denudata* on *A. mossulensis* in the drainage of Maharlu Lake connected to Kor River. In Turkey, several researchers determined *R. denudata* in a variety of fish species (Saygı and Bardakçı, 1990; Oguz, 1991; Oguz and Ozturk, 1993; Aydoğdu and Selver, 2006). There is no research detected a record of *R. denudata* on *A. mossulensis* in Turkey, therefore it is the first record.

*L. intestinalis* is a non-host-specific and larval parasite presents in freshwater fishes, therefore, numerous records stated; Kelle (1978) found on *A. marmid* and *C. mossulensis* in Devegeçidi Dam, Keskin and Erkakan (1987) did studies about *L. intestinalis* presence on different fish species in various inland water localizations in Turkey. *L. intestinalis* plerocercoids were found on *C. carpio* by Türkmen (1990) in Iznik Lake, on *A. marmid* by Türk ve Dörücü (2000) in Keban Dam Lake, on *C. carpio* by Kır et al. (2004) in Beyşehir Lake, on *A. alburnus* by Koyun (2006) in Enne Dam and Özbek and Öztürk (2010) in Kunduzlar Dam Lake. Demirtaş and Altındağ (2011) investigated the prevalence the helminth fauna of *S. erythrophthalmus* in Terkos Lake.

The records of *P. geometra*, cosmopolite annelid parasite, were detected on different hosts such as *C. carpio*, *C. umbla*, *C. trutta*, *R. rutilus* *B. rajanorum mystaceus*, *B. bjoerkna*, *E. lucius*, *T. tinca*, *A. brama*, *S. erythrophthalmus* in Turkey (Saglam, 1992; Bielecki, 1997; Öztürk, 2002; Karatoy, 2006; Öktener et al., 2007; Akbeniz and Soylu, 2008; Arslan and Emiroğlu, 2011; Koyun, 2011). Also, Demirtaş and Altındağ (2011) detected *P. geometra* by investigating the seasonal prevalence of the helminth fauna of *S. erythrophthalmus* in Terkos Lake and Koyun et al. (2015) had records of *P. geometra* on *C. capoeta*, *A. mossulensis* and *C. macrostomum* in Euphrates-Tigris basin, Dumlu creek (Erzurum) and Göynük stream (Bingöl) as well.

**Table 1.** Prevalence and mean intensity of infestation with metazoan parasites of *A. mossulensis* during different seasons

	Recorded parasites	Infected Fish	Prevalence (%)	Mean intensity	Min.-Max. Parasites	Total Parasites
Spring (n:58/38)	<i>D. holciki</i>	10	17	2.9	1-14	29
	<i>D. alatus</i>	5	9	2.6	1-5	13
	<i>D. lenkorani</i>	-	-	-	-	-
	<i>D. vistulae</i>	2	3	2	2	4
	<i>Gyrodactylus</i> sp.	3	5	5.7	1-11	17
	<i>P. homoion</i>	7	12	1.7	1-4	12
	<i>D. spathaceum</i>	16	28	2.8	1-21	45
	<i>Ergasilus</i> sp.	16	28	8.8	1-43	141
	<i>C. laticeps</i>	-	-	-	-	-
	<i>R. denudata</i>	7	12	1.6	1-2	11
	<i>P. geometra</i>	1	2	1	1	1
	<i>L. intestinalis</i>	1	2	1	1	1
	Total	38	66	7.2	1-43	274
Summer (n:52/42)	<i>D. holciki</i>	1	2	1	1	1
	<i>D. alatus</i>	-	-	-	-	-
	<i>D. lenkorani</i>	-	-	-	-	-
	<i>D. vistulae</i>	-	-	-	-	-
	<i>Gyrodactylus</i> sp.	2	4	2	2	4
	<i>P. homoion</i>	15	29	2.2	1-3	33
	<i>D. spathaceum</i>	19	37	7.4	1-25	140
	<i>Ergasilus</i> sp.	16	31	5.3	1-20	85
	<i>C. laticeps</i>	10	19	1.2	1-2	12
	<i>R. denudata</i>	-	-	-	-	-
	<i>P. geometra</i>	-	-	-	-	-
	<i>L. intestinalis</i>	-	-	-	-	-
	Total	42	81	6.5	1-25	275
Autumn (n:21/11)	<i>D. holciki</i>	2	10	2	1-3	4
	<i>D. alatus</i>	2	10	2	2	4
	<i>D. lenkorani</i>	-	-	-	-	-
	<i>D. vistulae</i>	-	-	-	-	-
	<i>Gyrodactylus</i> sp.	-	-	-	-	-
	<i>P. homoion</i>	6	29	2	1-4	12
	<i>D. spathaceum</i>	5	24	13.4	1-55	67
	<i>Ergasilus</i> sp.	4	19	2.3	1-3	9
	<i>C. laticeps</i>	-	-	-	-	-
	<i>R. denudata</i>	-	-	-	-	-
	<i>P. geometra</i>	-	-	-	-	-
	<i>L. intestinalis</i>	-	-	-	-	-
	Total	11	52	8.7	1-55	96
Winter (n:51/32)	<i>D. holciki</i>	9	18	1.6	1-3	14
	<i>D. alatus</i>	5	10	1.6	1-2	8
	<i>D. lenkorani</i>	9	8	1.2	1-2	11
	<i>D. vistulae</i>	-	-	-	-	-
	<i>Gyrodactylus</i> sp.	2	4	2	1-3	4
	<i>P. homoion</i>	8	16	1.3	1-2	10
	<i>D. spathaceum</i>	20	39	5.5	1-30	110
	<i>Ergasilus</i> sp.	27	53	5.9	1-44	158
	<i>C. laticeps</i>	3	6	1.3	1-2	4
	<i>R. denudata</i>	1	2	2	2	2
	<i>P. geometra</i>	2	4	3	2-4	6
	<i>L. intestinalis</i>	-	-	-	-	-
	Total	32	63	10.2	1-44	327

**Table 2.** Recoded parasites of female and male specimens of *A. mossulensis* according to seasons

Sex	Seasons	Examined fish	Infected fish	Prevalence %	Mean weight (g)	Main length (mm)	<i>D. holciki</i>	<i>D. alatus</i>	<i>D. lenkorani</i>	<i>D. vistulae</i>	<i>Gyrodactylus</i> sp	<i>P. homoion</i>	<i>D. spathaceum</i>	<i>Ergasilus</i> . sp.	<i>C. laticeps</i>	<i>R. denudata</i>	<i>P. geometra</i>	<i>L. intestinalis</i>
Female	Spring	31	21	68	33.13	149.32	11	7	-	4	10	2	17	62	-	5	1	1
	Summer	23	21	91	27.80	138.13	-	-	-	-	2	14	73	17	7	-	-	-
	Autumn	13	6	46	23.24	143.46	-	4	-	-	-	5	2	9	-	-	-	-
	Winter	31	23	74	23.80	141.00	2	2	4	-	4	6	71	111	-	2	5	-
	Total	98	71	72	27.59	142.88	13	13	4	4	16	27	163	199	7	7	6	1
Male	Spring	27	18	67	27.62	142.81	18	6	-	-	7	10	38	79	-	6	-	-
	Summer	29	21	72	31.35	142.00	1	-	-	-	2	19	62	68	5	-	-	-
	Autumn	8	5	63	21.44	138.00	4	-	-	-	-	7	63	-	-	-	-	-
	Winter	20	14	70	24.17	141.55	12	6	7	-	-	4	36	47	4	-	1	-
	Total	84	58	69	27.15	141.77	35	12	7	0	9	40	199	194	9	6	1	0
Total	182	129	71	27.45	142.58	48	25	11	4	25	67	362	393	16	13	7	1	

### Conclusion

In this study the prevalence and quantitative changes in 12 endo and ecto parasites of Mosul bleak (*A. mossulensis*) from Murat River and its tributaries has been described. Among these parasites *D. holciki*, *D. lenkorani*, *D. vistulae*, *P. homoion*, *C. laticeps* and *R. denudata* are the first record on Mosul bleak for Turkey freshwater fish parasites.

### Acknowledgement

This study was supported by Bingöl University with a project of BAP-35-266-2015.

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