

Seasonal Distribution of Metazoan Parasites on Kura Barbell (*Barbus lacerta*) in Eastern Anatolia, Turkey

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Abstract.- This study was conducted to determine the frequency of metazoan parasitic infections of Kura barbell (*Barbus lacerta*) in Murat River in Eastern Anatolia, Turkey. A total of 110 host fish were collected, from March 2008 to February 2010. There were 1122 metazoan parasites recorded in collected samples. Four species of Monogenea (701 *Dactylogyrus goktschaeicus*, 2 *Dactylogyrus lankorani*, 27 *Dogielius mokhayeri* and 40 *Gyrodactylus* sp.), one species of Digenea (72 *Allocreadium isoporum*), two species of Cestoda (5 *Bothriocephalus acheilognathi*, 3 *Caryophylleous laticeps*), two species of Nematoda (46 *Rhabdochona denudata*, 7 *Contracaecum* sp.) and two species of Copepoda (121 *Lemproglena pulchella* and 98 *Eergasilus sieboldi*) observed respectively. According to their prevalence; *D. goktschaeicus* (67.3%), *D. lankorani* (0.2%), *D. mokhayeri* (0.4%), *Gyrodactylus* sp. (12%), *A. isoporum* (0.7%), *B. acheilognathi*, (0.5%), *C. laticeps* (0.2%), *R. denudata* (15%), *Contracaecum* sp. (0.2%), *L. pulchella* (40%) and *E. sieboldi* (22%) were observed. Among these parasites *D. goktschaeicus*, and *D. mokhayeri* are the first record on Kura barbell (*B. lacerta*) and in fish parasite fauna of Turkey.

Key Words: *Barbus lacerta*, *Dactylogyrus goktschaeicus*, *Dogielius mokhayeri*, *Bothriocephalus acheilognathi*, *Caryophylleous laticeps*, *Rhabdochona denudata*, *Lemproglena pulchella*, *Ergasilus sieboldi*

INTRODUCTION

Metazoan parasites are a big group, inhabiting almost every organ of the host fish, which cause morphological, pathological, physiological, and biochemical, changes in the infected tissues and affect host physiology, thus inducing stress in the hosts animal (Cheng, 1974; Chubb, 1977; Pardeshi *et al.*, 2012). Metazoan parasites represent an important component of freshwater ecosystems and in some cases are recognized as fish pathogens (Wyatt and Kennedy, 1989). Most of these parasites are pathogenic and virtually lead to weakening of the host fish. They also affect host survival and reproduction, alter fish behavior and migration patterns, and they can even regulate fish populations and affect fish community structure (Gordon and Rau, 1982; Poulin and Fitz Gerald, 1987; Garnick and Margolis, 1990; Barber and Poulin, 2002).

Metazoan parasites mostly cause direct or mortality though sub lethal pathogenic effects, such

as destruction of gill lamellae (Kagel and Taraschewski, 1993). There have been numerous studies on metazoan parasites in Turkey inland waters (Becer and Kara, 1998; Aydogdu *et al.*, 2001a,b, 2003, 2008; Kir *et al.*, 2004; Tekin Ozan and Kir, 2005, 2008; Koyun and Altunel, 2007; Koyun, 2010, 2012; Soylu, 2013).

Basically, parasitic studies of *Barbus lacerta* are documented in the Euphrates-Tigris basin in Iran: Pazooki *et al.* (2006) recorded *D. goktschaeicus* in Zanzan region (Iran) in *B. lacerta*. *D. linstowi* and *R. denudata*, *Contracaecum* sp. were reported on the same host (Bozorgnia *et al.*, 2012). While *D. lankorani*, *Capoeta umbla* observed in our study was also reported by Koyun (2012), *D. goktschaeicus* and *Dogielius mokhayeri* were the initial records for Turkey. The following observations were made during studies in Turkey: *B. acheilognathi* by Tekin-Ozan *et al.* (2008) on *C. carpio* at Beyşehir Lake, *C. laticeps* at Kovada Lake by Becer and Kara (1998), *E. sieboldi* and *C. laticeps* at Dalyan Lagoon by Aydogdu *et al.* (2001b), *C. laticeps* and *B. acheilognathi* at Iznik Lake by Aydogdu *et al.* (2003); *C. laticeps* and *B. acheilognathi* at Karacaören Dam Lake by Kir *et al.* (2004). Tekin-Ozan and Kir (2005) demonstrated *Contracaecum*

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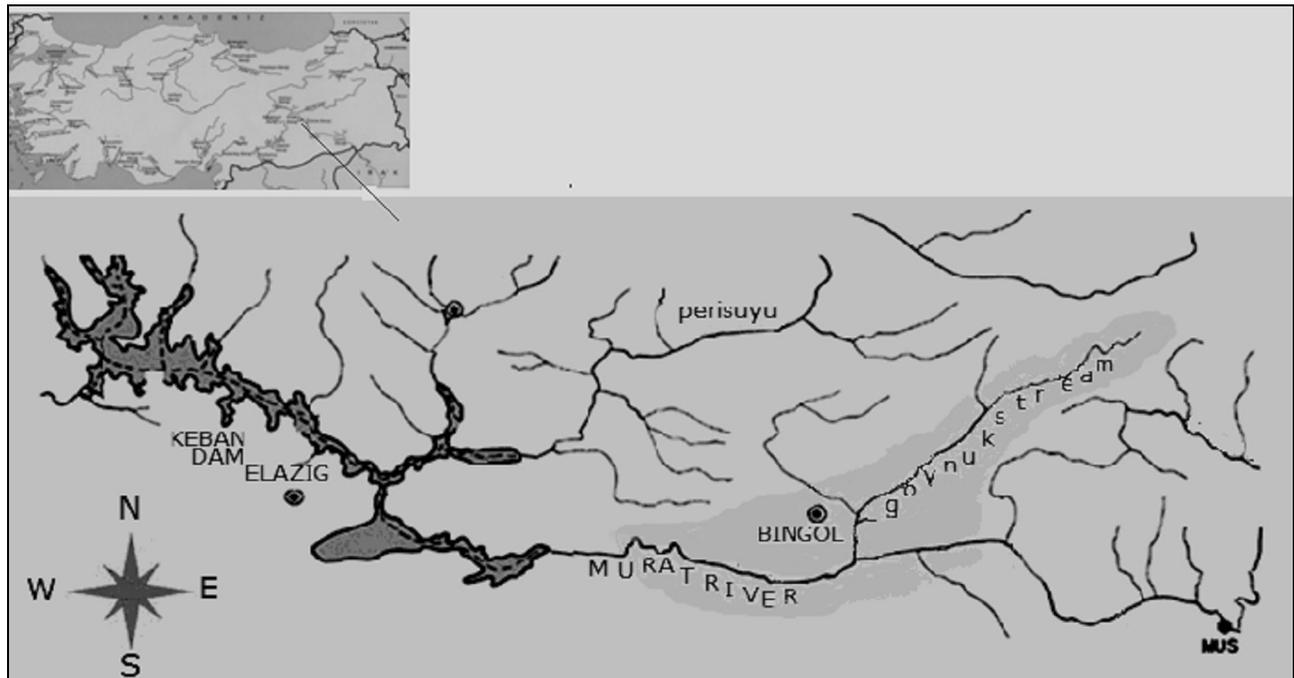


Fig. 1. Study area (selected).

sp. and *C. laticeps* at Kovada Lake and on *C. carassius*, at Gölbaşı Dam Lake, Aydogdu *et al.* (2008) showed *C. laticeps* and *Contracaecum* sp. on *Vimba vimba*, Koyun and Altunel (2007) demonstrated at Enne Dam Lake *Contracaecum* sp. on *C. carassius* and *C. auratus*, *B. acheilognathi* on *A. alburnus*, *A. isoporom* and *B. acheilognathi* on *Barbus plebejus escherichi*.

Data shows that parasites recorded in the study were also demonstrated in previous study. Our findings demonstrate that parasites mentioned above are widely common for freshwater fish. However, not much is known about parasite on barb fish, except for a few studies (Chubb, 1977; Kennedy, 1974; Molnar and Jalali, 1992; Iyaji and Eyo, 2008). Much less is known about the relationship between biological parameters of the host and the success of the related parasite (Kennedy, 1974; Dence, 1957).

Barbus lacerta is an endemic fish for inland waters of Eastern Anatolia Region in Turkey and it has been recorded in the Euphrates and Tigris basin region (Geldiay and Balık, 2007). The aim of the present study was to describe metazoan parasites fauna of *B. lacerta*, their prevalence and intensities, as well as the quantitative changes in parasite

species. The diversity and the existence of parasites in relation to seasons and size levels of the *B. lacerta* were investigated and discussed for the first time for Murat River in Eastern Anatolia, Turkey.

MATERIALS AND METHODS

Murat River is a sharp shallow flow, at least 15 km northeast of the city of Bingöl and is fed by various tributary sources and small streams (Fig. 1). Fish were caught at monthly intervals during a two-year span, from March 2008 to February 2010, using seine and dip nets and transported back to the laboratory in river water alive. Fish species were identified according to Geldiay and Balık (2007).

Fish were killed with a sharp blow on the head, followed by exsanguinations. Total and fork length were measured (to the nearest mm) and total weight (to the nearest gram) for each individual fish and recorded. The stomach, intestine and gills of each fish were examined for metazoans within 24 h after sampling.

Each gill arch was removed to examine monogeneans. 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). The parasites were counted and preserved in 70% ethanol for further examination. Their identification was done according to Pugachev *et al.* (2010) and Bychowskaya-Pavlovskaya (1962).

Correlation test was applied to define correlations between the values of parasite prevalence, fish length, fish weight and water temperature for each parasite species (Little and Hills, 1978).

RESULTS

Table I shows 92% rate of infection, a total of 11 parasite taxa from 110 barbell fish, whereas Table II shows distribution of parasites in the host fish on monthly basis. Four species of Monogenea (701 *Dactylogyrus goktschaicus*, 2 *Dactylogyrus lankorani*, 27 *Dogielius mokhayeri* and 40 *Gyrodactylus* sp.), one species of Digenea (72 *Allocreadium isoporum*), two species of Cestoda (5 *Bothriocephalus acheilognathi*, 3 *Caryophylleous laticeps*), two species of Nematoda (46 *Rhabdochona denudata*, 7 *Contracaecum* sp.) and two species of Copepoda (121 *Lemproglena pulchella* and 98 *Ergasilus sieboldi*) were found on the gills and in the intestinal tract of *B. lacerta* caught at the Murat river, with their infection levels listed in Table III. The most prevalent and abundant parasite species were the monogenean *D. goktschaicus*, which were observed in 67.3% of the studied fish and comprised 62.4% of the total parasite specimens recorded. The copepodit *L. pulchella* were observed in 40% of studied fish, and 10.8% of the total parasite specimens recorded and *E. sieboldi* were observed in 21.8% of studied fish and 8.7% of the total parasitic specimens recorded, *R. denudata* were observed in 15.4% of studied fish and 4.1% of the total parasite specimens recorded; *A. isoporum* were observed in 7.2% of studied fish and 6.4% of the total parasite specimens. The remaining parasite species comprised less than 5% each.

DISCUSSION

Metazoan parasites are generally found in all

freshwater fishes. The parasite prevalence and intensity depend on many factors like parasite and its life cycle, host and its feeding habits and the physical factors of water body where the fish lives (Zaidi and Khan, 1976). Parasites are very sensitive to changes in environmental factors as a part of the natural environment and these factors affect the distribution and abundance of the parasite population. Seasonal variation factors; especially temperature is one of the important abiotic factors that affects the parasite populations (Hanzelova and Zitnan, 1985). Determination of seasonal parasite dynamics is important in terms of understanding of parasite biology, determination of fishes which are delicate against disease in which periods and regulation of aquaculture activities with control strategies (Neary *et al.*, 2012).

In this study the distribution of the parasites shows change according to the seasons. *D. goktschaicus*, a monogenean parasite, is never seen in January, 109 parasites were recorded on 6 female fishes in August and 108 were recorded on 6 of 7 male fishes in the same month.

D. lenkorani is mostly specific for *Capoeta* species but its occurrence on male and female fishes shows that parasite was stumbled across. *Dogielus makhoyeri* is also not specific for this fish. Out of total of 27 parasites, 20 were found only on one female fish in August whereas in males 3 were detected in July and 4 in August.

Gyrodactylus species were encountered more likely in spring and autumn, and numbers showed inverse relationship with temperature. Twenty three parasites were recorded on 5 female fishes in spring, 2 on 2 fishes in autumn, and ten were recorded on one fish in December. Similar results are also seen in male fishes. Neary *et al.* (2012) have also reported similar type of data. *Gyrodactylus* sp. was reported 25% in summer, 22% in autumn and 100% in spring.

E. sieboldi shows distribution on wide range of freshwater fishes but sometimes cosmopolitan distribution is seen as a free form. We encountered, Copepodit parasites (*L. pulchella* and *E. sieboldi*), in our studies. *E. sieboldi* was first described by Nordmann in 1832 infecting various freshwater fish in Europe and is the type species of the genus *Ergasilus*. Tildesley (2008), Mokhayer (1985),

Table I.- Prevalence and mean intensity of infestation with metazoan parasites of Kura barbell during different seasons.

Parasites recorded	Fish examined	Infected fish	Infected fish number	Prevalence (%)	Mean No. of parasites	Mean intensity	Min.-Max. Parasite number	Total parasites
Spring	40	43						
<i>Dactylogyrus goktschaicus</i>			25	58	5.16	3	1-17	129
<i>Dactylogyrus lenkorani</i>			-	-	-	-	-	-
<i>Dogielius mokhayeri</i>			-	-	-	-	-	-
<i>Gyrodactylus</i> sp.			8	19	3.25	0.60	1-18	26
<i>Allocreadium isoporum</i>			2	4.7	2.5	0.11	1-4	5
<i>Bothriocephalus acheilognathi</i>			4	9.3	1	0.09	1	4
<i>Caryophylleous laticeps</i>			2	4.7	1.5	0.07	1-2	3
<i>Rhabdochona denudata</i>			10	23	2.7	0.63	1-7	27
<i>Contraecum</i> sp.			2	4.7	3.5	0.16	1-6	7
<i>Lemproglena pulchella</i>			13	30	2.46	0.74	1-5	32
<i>Eergasilus sieboldi</i>			3	6.9	2.67	0.19	1-5	8
								241
Summer	42	39						
<i>Dactylogyrus goktschaicus</i>			35	83	13.62	11.4	1-94	477
<i>Dactylogyrus lenkorani</i>			2	5	1	0.05	1	2
<i>Dogielius mokhayeri</i>			4	9.5	6.75	0.64	1-20	27
<i>Gyrodactylus</i> sp.			1	2.3	1	0.02	1	1
<i>Allocreadium isoporum</i>			3	7.1	1.66	0.12	1-3	5
<i>Bothriocephalus acheilognathi</i>			-	-	-	-	-	-
<i>Caryophylleous laticeps</i>			-	-	-	-	-	-
<i>Rhabdochona denudata</i>			7	16.7	2.71	0.45	1-7	19
<i>Contraecum</i> sp.			-	-	-	-	-	-
<i>Lemproglena pulchella</i>			19	45.2	3.05	1.38	1-11	58
<i>Eergasilus sieboldi</i>			16	38.1	4.93	1.88	1-46	79
								668
Autumn	20	18						
<i>Dactylogyrus goktschaicus</i>			13	65	6.92	4.5	1-11	90
<i>Dactylogyrus lenkorani</i>			-	-	-	-	-	-
<i>Dogielius mokhayeri</i>			-	-	-	-	-	-
<i>Gyrodactylus</i> sp.			3	15	1	0.15	1-2	3
<i>Allocreadium isoporum</i>			3	15	20.67	3.10	-	62
<i>Bothriocephalus acheilognathi</i>			1	5	1	0.05	1	1
<i>Caryophylleous laticeps</i>			-	-	-	-	-	-
<i>Rhabdochona denudata</i>			-	-	-	-	-	-
<i>Contraecum</i> sp.			-	-	-	-	-	-
<i>Lemproglena pulchella</i>			9	45	2.78	1.25	1-8	25
<i>Eergasilus sieboldi</i>			5	25	2.20	0.55	1-3	11
								192
Winter	5	3						
<i>Dactylogyrus goktschaicus</i>			19	20	21	22	23	24
<i>Dactylogyrus lenkorani</i>			1	20	5	1	5	5
<i>Dogielius mokhayeri</i>			-	-	-	-	-	-
<i>Gyrodactylus</i> sp.			-	-	-	-	-	-
<i>Allocreadium isoporum</i>			1	20	10	2	10	10
<i>Bothriocephalus acheilognathi</i>			-	-	-	-	-	-
<i>Caryophylleous laticeps</i>			-	-	-	-	-	-
<i>Rhabdochona denudata</i>			-	-	-	-	-	-
<i>Contraecum</i> sp.			-	-	-	-	-	-
<i>Lemproglena pulchella</i>			-	-	-	-	-	-
<i>Eergasilus sieboldi</i>			3	60	2	1.2	2-4	6
			100					45

METAZOAN PARASITES ON KURA BARBELL (*BARBUS LACERTA*)

Table II.- Recorded parasites of female and male specimens of Kura barbell according to months.

Months	Examined	Found infected	Mean weight (g)	Main length (mm)	Recorded parasites												
					1	2	3	4	5	6	7	8	9	10	11	12	
Female fish																	
March	7	7	24.97	140	19	-	-	-	2	-	-	1	5	1	2	7	37
April	12	11	22.75	148	34	-	-	-	3	-	-	2	6	-	4	-	49
May	5	4	30.34	153	30	-	-	-	18	-	1	2	2	-	8	-	59
June	9	8	31.55	146	40	1	-	-	-	-	2	2	4	-	4	5	52
July	7	7	34.42	148	99	-	-	-	1	-	1	1	1	-	2	58	161
August	6	6	49.00	179	109	-	20	-	2	-	2	-	6	-	14	5	156
September	6	5	22.95	148	32	-	-	-	1	8	-	-	-	-	7	7	53
October	5	4	30.02	147	9	-	-	-	1	-	1	-	-	-	2	2	13
November	1	1	36.1	162	-	-	-	-	-	4	-	-	-	-	4	-	8
December	3	3	51.8	182	5	-	-	-	10	-	-	-	-	-	6	6	21
January	1	-	114.2	240	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	62	56			377	1	20	36	14	2	3	22	22	1	53	80	609
Male fish																	
March	5	5	16.32	137	8	-	-	-	1	-	-	1	-	-	-	-	10
April	10	9	17.63	126	37	-	-	-	2	5	3	-	13	6	11	-	77
May	4	4	18.93	131	1	-	-	-	-	-	-	-	-	-	7	1	9
June	8	7	27.23	140	36	1	-	-	3	-	-	8	-	8	8	4	60
July	5	5	26.80	143	85	-	3	-	-	-	-	-	-	9	9	5	102
August	7	6	29.28	148	108	-	4	-	-	-	-	2	-	21	2	2	137
September	3	3	31.00	149	6	-	-	-	1	50	-	-	-	-	1	1	60
October	3	3	28.56	147	39	-	-	-	-	-	-	-	-	-	9	3	52
November	2	2	28.80	164	4	-	-	-	-	-	-	-	-	-	2	-	6
December	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
January	1	-	22.20	167	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	48	44			324	1	7	4	58	3	-	24	6	68	18	513	

1, *D. goktschalcus*; 2, *D. lankorani*; 3, *D. mokhayeri*; 4, *Gyrodactylus* sp.; 5, *A. isoporini*; 6, *B. acheilognathi*; 7, *C. laticeps*; 8, *R. denudata*; 9, *Contractaecum* sp.; 10, *L. pilchella*; 11, *E. sieboldi*; 12, total parasites

Table III.- Fish length - parasitic relationship.

Fish length groups (mm)	Examined of number	Total infected of number	M: Male F: Female												
			1	2	3	4	5	6	7	8	9	10	11	12	
126-137	19	18	46	-	-	3	5	3	-	14	6	18	1	96	M (19), F (-)
140-146	29	27	180	2	3	-	3	-	1	15	1	23	21	251	M (13), F (16)
147-149	43	39	327	-	4	7	58	1	2	9	-	46	71	525	M (13), F (30)
158-167	9	7	34	-	-	18	4	1	-	2	-	14	-	73	M (3), F (6)
179-240	10	9	114	-	20	10	2	-	-	6	-	20	5	177	M (-), F (10)
Total	110	100	701	2	27	40	72	5	3	46	7	121	98	1122	M (48), F (62)

1, *D. goktschaticus*; 2, *D. lankorani*; 3, *D. mokhtayeri*; 4, *Gyrodactylus* sp.; 5, *A. isoporum*; 6, *B. acheilognathi*; 7, *C. laticeps*; 8, *R. denudata*; 9, *Contracaecum* sp.; 10, *L. pulchella*; 11, *E. sieboldi*; 12, total parasites

Mirhashemi Nasab and Pazooki (2003), reported *E. sieboldi*, respectively, on *Barbus brachycephalus* in Persia Caspian Sea Region, in Mahabad Reservoir and Uromia and Zanjan (Persia) Region. Jalali (1998) reported *L. pulchella* on *Barbus luteus* and *E. sieboldi* on *Barbus sharpeyi* in Karoon Lake (Persia). From these parasites, *L. pulchella* prevails in especially cyprinid fish gills (Saglam, 1998; Soyulu, 2012; Oktener *et al.*, 2008). In this study, *E. sieboldi* and *L. pulchella* were recorded first time in Turkey on *Barbus* sp.

In this study 68 parasites were found in male fishes 38 parasites on 9 hosts in summer, 18 on 6 hosts in spring and 12 parasites on 5 hosts in autumn. Similar results were also recorded for female fishes with 53 parasites. For female fishes, 58 parasites were mostly seen in July and 5 were seen on male fishes. A total of 80 parasites were recorded on female hosts and 18 parasites on male fishes during the study. Tombi and Bilong Bilong (2004) also reported that male fishes get infected less by this parasite especially in reproductive period because of their increased activity.

A. isoporum is not specific endoparasite for host species that commonly seen in more than 16 cyprinid fish, viz., *Alburnoides bipunctatus*, *Alburnus filippi*, *Aphanius vladkovii*, *Barbus lacerta*, *Barbus barbus*, *Capoeta aculeata*. *C. capoeta*, *C. damascina*, *Cobitis taenia*, *Leusiscus lepidus*, *G. gobio*, *Leusiscus cephalus*, *L. leusiscus*, and *A. alburnus* (Moravec, 1994; Pazooki, 2012). Tieri *et al.* (2006) from Italy and Moravec (1994) from Czechoslovakia reported *A. isoporum* on *L. cephalus*; and Rantanen *et al.* (1998) reported it on *Pisidium amnicum*. In Turkey, Koyun and Altunel (2007) have reported it in *B. plebejus escherichi* and *A. alburnus* from Enne dam; Aydogdu *et al.* (2001a) has been reported it from Doğançı dam. The rate of *A. isoporum* in the study is 7% as against Aydogdu *et al.* (2001a). Total of 14 parasites were found in the 4 female hosts and 58 individuals in the 4 male hosts. With this inference, distribution of *A. isoporum* on *B. lacerta* doesn't have an importance in terms of seasons.

Bothriocephalus acheilognathi (Asian cestode) is spread from Asia to the other varied regions because of wide distribution of *Ctenopharyngodon idella* (Scholz, and Cave, 1992).

Aydogdu *et al.* (2003) from Iznik Lake and Ozturk *et al.* (2001) in from Manyas Lake reported *C. carpio*, Ozturk *et al.* (2002) reported it on *Gobius fluviatilis* from Uluabat Lake. The same species were also recorded on *A. alburnus* from Enne Dam Lake by Koyun and Altunel (2007). Koyun (2010) and on *B. plebejus escherichi* (Aydogdu *et al.*, 2001a) and reported it on *L. cephalus* from Doğançı Dam Lake. Although, yearly distribution of *B. acheilognathi* was 35% according to the Koyun and Altunel (2007) database, in this study, the rate is totally 6%. Two parasites were recorded on 2 female hosts and 3 parasites in 3 male hosts.

There were 54 species reported according to the Moravec (1994) systematic evaluations associated with *Rhabdochona* genus. He also reported that *Rhabdochona* sp. is mostly found in Percidae, Solmonidae, Siluridae and Gobitidae family fishes. *Rhabdochona* has been recorded by Pereira and Pellitero (1979) in Spain and Moravec (1989) in Czechoslovakia on a variety of freshwater fishes. Larval form of *R. denudata* in Turkey was reported in *L. cephalus* from Doğançı Dam Lake by Aydogdu *et al.* (2001a), in *A. alburnus* by Aydogdu and Selver (2006), in *A. brama* from Durusu Lake by Karatoy and Soylu (2006) and in *Gobius fluviatilis* from Manyas and Uluabat lakes by Ozturk *et al.* (2001, 2002). This study is the first record for *R. denudata* in *B. lacerta*. In this study Aydogdu *et al.* (2001b) has recorded 46 individuals of *R. denudata* during spring and summer months.

Larval form of *Contracaecum* sp. was found in intestinal cavity of *B. lacerta* in our study. Koyun and Altunel (2007) found it on *A. alburnus*, Selver *et al.* (2009) found it on *V. vimba* and also on *C. carassius*, *C. auratus*, *C. tinca*, *B. plebejus escherichi*, and *S. erythrophthalmus*. In our study, totally 6 parasites were found in only March and April.

Considering the correlation between fish length and parasite numbers, the maximum parasite number (525) was seen on 147-167 cm fish group that consists of 43 fishes (30 female and 13 male). The minimum parasite number (73) was recorded on 158-167 cm fish group that consist 6 female and 3 male fishes. According to the Table III data, there is no significant result between fish length and parasite distribution. The parasite distributions are more

heterogeneous in lotic water than lentic that clarifies the accordance of recorded seasonal distributions of parasite species.

Aquatic living organisms have more activity because of continuous flows of river water. During the study, insufficient number of fish samples were obtained in winter due to hypermobility of fish due to sudden change of temperature.

CONCLUSIONS

In this study the prevalence and quantitative changes in 11 endo- and ecto parasites of kura barbell (*B. lacerta*) from Murat River has been described. Among the recorded parasites *Dactylogyrus goktschaicus*, and *Dogielius mokhayeri* are the first records for Kura barbell and in freshwater fish parasite fauna of Turkey.

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