

The Occurrence of Parasitic Helminths of *Capoeta umbla* in Relation to Seasons, Host Size, Age and Gender of the Host in Murat River, Turkey

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Abstract: In this study, helminth parasites were examined in *Capoeta umbla* (Heckel, 1843, Family; Cyprinidae), collected from Spring 2010-2011 from the Murat river in Turkey, to determine the effects of seasonal changes, host size, ages and sex on the incidence of the parasitic helminth infection. A total of 128 *C. umbla* individuals were examined for parasitic helminth infection. The results show that 84.38% of the examined host fishes were infected with different types of helminth species. Three helminth species were identified: *Dactylogyrus lenkorani* and *Dogielius forceps* (Monogenea) on the gills and *Neoechinorhynchus zabensis* (Acanthocephala) in the intestine. Among these species, *D. lenkorani* was the most common species and a total of 2830 specimens were recorded on 103 fish. The overall prevalence and mean intensity were 80 and 23.11%, respectively. *D. forceps* was the second dominant parasite in this study. A total of 179 parasites were found and the overall prevalence was 64%. The third most prevalent parasite was *N. zabensis* with overall prevalence and mean intensity of 2.3 and 4%, respectively. Regarding seasonal variations, the prevalence of *D. forceps* was observed to peak in Winter. Its mean intensity level was highest in Spring (3, 30). For *D. lenkorani*, the highest prevalence was observed in Summer (100%). Prevalence levels of *N. zabensis* were rather low and this species was also not detected in Spring and Autumn. This is the first record of these three helminth parasites in *C. umbla* for Turkey, so these findings are very important for the parasite fauna of Turkey.

Key words: Murat river, *Capoeta umbla*, *Dactylogyrus lenkorani*, *Dogielius forceps*, *Neoechinorhynchus zabensis*, Turkey

INTRODUCTION

Capoeta umbla (Heckel, 1843) Family; Cyprinidae is commonly found in the Murat river which is a long river (722 km) in the South East Anatolia region of Turkey. The sampling area in this study was located near Bingol city (38.8°N, 41.05°E).

There are some reports on fish parasites at different locations in Turkey but there was no previous report for Murat river and little is known about the parasitic fauna of *C. umbla*. To the knowledge, *Dactylogyrus affinis*, *Dactylogyrus auriculatus*, *Dactylogyrus extensus*, *Dactylogyrus malleus* and *Dactylogyrus minutus* were previously recorded from the gills of *Capoeta capoeta umbla* (Aksoy *et al.*, 2006).

Although, there are some studies on the parasitic fauna of this species, no work has been done in relation to seasonal population dynamics, host size, age and sex of the host *C. umbla* (Amin *et al.*, 2003). Bilal and Abdulla (2009) identified parasites of the fish species of the family Cyprinidae from Bahdinan river in North Iraq to compare the parasite fauna with that reported earlier in the Iraqi literature and to report possible new hosts and locality records.

In addition, the natural structure of Murat river is a difficult area for study and therefore, the fish and parasite fauna have not been studied previously. The most common species in this river is *Capoeta umbla* therefore, the primary aim of this study was to determine the helminth parasite fauna of the host fish and also to determine the prevalence and mean intensity of parasite species in relation to different seasons, host size, ages and sex.

MATERIALS AND METHODS

The study was conducted in Murat river in the South East Anatolia region of Turkey (Fig. 1). Fish specimens were collected by a variety of methods including the use of fishing nets at seasonal intervals from the study river from Spring 2010-2011. Random samples were taken, representing the different fish lengths in the river and a total of 128 fish specimens were examined. Fish were immediately transferred to the research laboratory in river fresh water. They were kept in aquaria until examined and sacrificed within 24 h. Fish were killed by vertebral dislocation and the total and standard length, age and sex of each fish were determined.

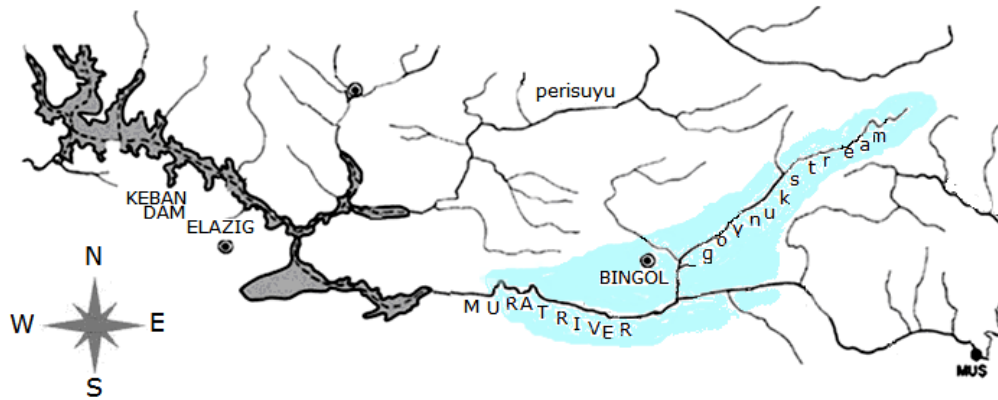


Fig. 1: Murat river (South East Anatolia region of Turkey)

The fish were grouped into five length classes; 72-87, 88-125, 126-155, 156-199, >200 mm. Age calculation was carried out using fish scale. Five ages were classified for the host fish using the keys given by Lagler (1966) and Bagenal (1978). Further, the sex of each individual fish was identified. During the dissection, the viscera, gills, gastrointestinal tract, liver, kidney, heart, swim bladder, gallbladder, eyes, fins and body surfaces were examined separately for helminths with a dissecting microscope. All helminth found in each individual fish were identified and counted. Monogeneans were permanently mounted using the ammonium picrate glycerine procedure according to Gussev (1968) and Fernando *et al.* (1972).

The other helminths were killed in hot saline solution; acanthocephalans were fixed in 70% ethanol stained with iron-carmine (Georgiev *et al.*, 1986) cleared and mounted in entellan. Identification of parasites was carried out according to Yamaguti (1985a, b) and Pugachev *et al.* (2010). The prevalence, mean intensity and mean abundance levels of the parasite species were calculated according to Bush *et al.* (1997).

RESULTS AND DISCUSSION

Seasonality and distribution of helminth species: Three helminth species were recorded during the sampling period. Two of these monogenean gill-parasites species, *Dactylogyrus* and *Dogielius* were observed in *C. umbla* (Teleostei, Cyprinidae). The other one is *N. zabensis* (Acanthocephala). The overall prevalence of these helminths for was 95% *D. lenkorani*, 64% for *Dogielius forceps* and 3% for *N. zabensis*.

A definite seasonal effect was noted for all three helminth species under investigation. In the case of *D. lenkorani*, the prevalence of infection ranged from 58-100% between the seasons (Table 1) with the highest prevalence recorded in Summer. The mean intensity levels

recorded during the sampling period showed that the minimum mean intensity was observed in winter (14.66) and the maximum during Spring (40.89). The seasonal prevalence of *D. forceps* infection ranged from 46-92%. The mean intensity of *D. forceps* was lowest in Winter (1.42) and at its maximum in Spring (3.30) (Table 1).

Seasonal changes in the prevalence and mean intensity of *N. zabensis* also showed variation. Infection was recorded only in Summer (4%) and Winter (4%) and was not seen in Spring and Autumn. The maximum intensity level was recorded in Summer (4) and Winter (4). For *D. lenkorani*, the prevalence of infection was higher in Summer (100%) followed by Spring (95%), Autumn (75%) and Winter (58%). There were some seasonal variations in the mean intensity of *D. lenkorani* which was higher in Spring (40.89) followed by Autumn (23.72), Summer (23.16) and Winter (14.66) (Table 1). For *D. forceps* the prevalence infection was higher in Summer (92%) followed by Spring (71%), Autumn (54%) and Winter (46%). The mean intensity of *D. forceps* was higher in Spring (3.30) followed by Summer (1.83), Autumn (1.62) and Winter (1.42).

Seasonal changes in the prevalence, mean intensity and abundance of the three helminth species from *C. umbla* in the Murat river are shown in Table 1.

Distribution of helminth species according to length classes of the host fish: Both the prevalence and mean intensity levels of the parasite species varied in different size classes of host fish (Table 2). Higher prevalence was observed for *D. lenkorani* (100%) in fish >200 mm and also for *D. forceps* (83%) and *N. zabensis* (8%) in hosts of the same size. The prevalence of *D. lenkorani* was 17, 81, 83, 86 and 100% in host fish of size classes 72-87, 88-125, 126-155, 156-199 and >200 mm, respectively. The mean intensity of *D. lenkorani* was higher in fish between 126-155 mm (30) followed by fish >200 mm (28.9),

Table 1: Seasonal changes in helminth parasites from *C. umbla* in Murat river

Helminth species	Seasons															
	Spring (n:38)				Summer (n:25)				Autumn (n:24)				Winter (n:41)			
	P	MA	MI	Range	P	MA	MI	Range	P	MA	MI	Range	P	MA	MI	Range
<i>D. lenkorani</i>	95	38.70	40.89	5-94	100	23.160	23.160	2-71	75	17.790	23.720	3-109	58	8.59	14.660	1- 47
<i>D. forceps</i>	71	2.34	3.30	1-6	92	1.680	1.830	1-4	54	0.880	1.620	1- 4	46	0.66	1.420	1-2
<i>N. zabensis</i>	0	0.00	0.00	0	4	0.160	4.000	4	0	0.000	0.000	0	4	0.20	4.000	1-7

P: Prevalence (%); MA: Mean Abundance; MI: Mean Intensity

Table 2: Prevalence and mean intensity of helminth infection in (*C. umbla*) in relation to host fish size

Size classes	I	II	III	IV	V
Length (mm)	72-87	88-125.00	126-155.00	156-199.00	>200.0
Samples size	6	21.00	53.00	36.00	12.0
<i>D. lenkorani</i>					
Prevalence (%)	17	81.00	83.00	86.00	100.0
Mean intensity	1	20.10	30.00	26.32	28.9
<i>D. forceps</i>					
Prevalence (%)	17	57.00	72.00	67.00	83.0
Mean intensity	1	2.08	1.82	2.45	2.5
<i>N. zabensis</i>					
Prevalence (%)	0	0.00	2.00	3.00	8.0
Mean intensity	0	0.00	1.00	1.00	1.0

156-199 mm (26.32), 88-125 mm (20.1) and the lowest in fish of 72-87 mm (1). *D. forceps* was found in all sizes of host fish with slight changes in prevalence rates. Higher prevalence was observed in the >200 mm (83%) size class, followed by 126-155 (72%), 156-199 (67%), 88-125 (57%) and 72-87 mm (17%) size classes. Mean intensity was highest (2.5) in fish of >200 mm size class. The highest prevalence of *N. zabensis* was found in fish between >200 mm (8%) compared to other size classes, 72-87 mm, 88-125, 126-155 mm and 156-199 mm cm⁻¹ (0, 0, 2 and 3%, respectively). Mean intensity levels were the same (1) in fish between 126-155, 156-199 and >200 mm size class.

Distribution of helminth species by age of fish host:

Prevalence and mean intensity of parasitic helminth infection varied in fish of different ages (Table 3). *D. lenkorani* was found in fish of all ages, varying in prevalence from 17% in age group I, to 100% in age group V; mean intensity ranged from 0.5 in age group I to 28.9 in age group V. *D. forceps* was found in fish of all ages, varying in prevalence from 17% in age group I to 85% in age group V and mean intensity ranged from 0.5 in age group I to 2.08 in age group V (Table 3). *N. zabensis* did not occur in all host fish ages and was only seen age groups III, IV and V with prevalence of 8, 4 and 2.3%, respectively mean intensity ranged from 0.33 in age group V, 0.15 in age group III and 0.03 in age group IV.

Distributions of helminth species by sex of fish host:

A total of 128 *C. umbla* (54 female, 58 male and 16 juvenile) were examined for helminth parasites. The prevalence of infection was higher in males than females. Of the 58

Table 3: Prevalence and mean intensity of helminth infections in *C. umbla* from Murat river in relation to host age

Age cohort	I	II	III	IV	V
Sample size	6.0	21.00	53.00	36.00	12.00
Infected fish	2.0	18.00	46.00	31.00	12.00
<i>D. lenkorani</i>					
Prevalence (%)	17.0	81.00	83.00	86.00	100.00
Mean intensity	0.5	19.00	28.78	26.32	28.90
Total parasite no	1.0	342.00	1324.00	816.00	347.00
<i>D. forceps</i>					
Prevalence (%)	17.0	46.00	66.00	62.00	85.00
Mean intensity	0.5	1.38	1.50	1.90	2.08
Total parasite no	1.0	25.00	69.00	59.00	25.00
<i>N. zabensis</i>					
Prevalence (%)	0.0	0.00	2.300	4.00	8.00
Mean intensity	0.0	0.00	0.150	0.03	0.33
Total parasite no	0.0	0.00	7.000	1.00	4.00

males, 52 males were found to be infected by one or more parasites species. Overall prevalence of parasitic infection was found to be 89.65, 81.48 and 68.78% in males, females and juveniles, respectively. In terms of seasonal variations, the highest prevalence of infection was observed during summer for the three groups (100%) (Table 4).

D. lenkorani occurred in male, female and juvenile fish in all seasons except Autumn. During Spring this species was recorded in males (100%), females (87%) and juveniles (100%).

The mean intensity of *D. lenkorani* showed similar results with high intensity in males (50.9) during Spring and lower values with little variation during the other three seasons (28.3, 22.57, 17); higher intensity among females during Spring and Autumn (28.45, 24.45) and Summer and Winter showing very similar values (18.1, 18.88) and high intensity among juveniles during Spring (28) with lower values of 2 5.16, respectively in Summer and Winter.

During Spring, the prevalence and mean intensity levels of *D. forceps* were higher in juveniles and in males (100%, 2; 80% and 3.69) than in females (53%, 3). For *N. zabensis*, a total of 12 parasites were found in 1 of 24 fish during Summer and 2 of 41 fish during Winter. The prevalence of infection was found to be 7 and 6% in winter in female and 7% only in male fish, respectively. *D. lenkorani* were found in 20 of 20 male fish prevalence of 100% and in 3 of 3 juvenile fish prevalence of 100% and 13 of 15 female fish prevalence of 87% in Spring. In Summer, the prevalence of *D. lenkorani* was higher in all groups

Table 4: Prevalence and mean intensity of helminth infections from *C. umbla* in relation to host sexes from Murat river

Parameters	Parasites								
	<i>D. lenkorani</i>			<i>D. forceps</i>			<i>N. zabensis</i>		
	Juvenile	Female	Male	Juvenile	Female	Male	Juvenile	Female	Male
Spring	(n:3)	(n:15)	(n:20)	(n:3)	(n:15)	(n:20)	(n:3)	(n:15)	(n:20)
Prevalence (%)	100	87	100	100	53	80	0	0	0
Mean intensity	28	28.45	50.9	2	3	3.69	0	0	0
Total parasite no.	84	370	1018	6	24	59	0	0	0
Summer	(n:1)	(n:10)	(n:14)	(n:1)	(n:10)	(n:14)	(n:1)	(n:10)	(n:14)
Prevalence (%)	100	100	100	-	90	100	0	0	7
Mean intensity	2	18.1	28.3	-	1.66	1.93	0	0	4
Total parasite no.	2	181	396	-	15	27	0	0	4
Autumn	(n:2)	(n:14)	(n:8)	(n:2)	(n:14)	(n:8)	(n:2)	(n:14)	(n:8)
Prevalence (%)	-	79	88	0	57	63	0	0	0
Mean intensity	-	24.45	22.57	0	1.63	1.6	0	0	0
Total parasite no.	-	269	158	0	13	8	0	0	0
Winter	(n:10)	(n:15)	(n:16)	(n:10)	(n:15)	(n:16)	(n:10)	(n:15)	(n:16)
Prevalence (%)	60	53	63	50	40	50	0	7	6
Mean intensity	5.16	18.88	17	1.2	1.5	1.5	0	7	1
Total parasite no.	31	151	170	6	9	12	-	7	1

(100%) while their mean intensity was in juveni 2 in female 18.1 and in male 28.3, respectively. During Spring, the prevalence and mean intensity levels of *D. forceps* were (100%, 2) in juveniles, (53%, 3) in females and (80 and 3.69%) in males. *N. zabensis* was found on both females and males but not in juvenile fish. The prevalence of *N. zabensis* was similar in male and females (7%) in Summer in and in male (6%) in Winter (Table 4).

The present study investigated parasitic fauna of *C. umbla* in Murat river, Turkey where *C. umbla* represents an important part of the fish assemblages. Three parasitic helminth species were recorded from *C. umbla*: *D. lenkorani*, *D. forceps* (Monogenea) and *N. zabensis* (Acanthocephala: Neoechinorhynchidae). To the best of the knowledge this is the first study showing the prevalence and mean intensity of parasitic infections with regard to seasonal population dynamics, host size, age and sex of the host.

Previously, Jalali and Barzegar (2006) examined this *Capoeta* species from Zarivar lake for parasites and found *Dactylogyrus lenkorani* in minnows. Raissy *et al.* (2010) found *Dactylogyrus lenkorani* in *Capoeta damascina*. In the present study, *D. lenkorani*, *D. forceps* and *N. zabensis* showed a definite seasonal cycle in prevalence of infection. The highest prevalence and mean intensity of infection were observed in summer for *D. lenkorani* in the spring for *D. forceps* and in the winter for *N. zabensis* compared with other seasons.

Previous studies have reported a positive relationship between the level of parasitic infection and the size and age of the host fish (Dogiel, 1970; Zelmer and Arai, 1998). In the present study, the infection prevalence and mean intensity values varied according to the size and age of the fish. Highest prevalence and mean intensity of

D. lenkorani was observed in the largest (class V, >200 mm) group and smallest (class I, 72-87 mm) group, respectively compared with the other groups. In *D. forceps*, highest prevalence and mean intensity were found in the >200 mm group. *N. zabensis* infection also showed highest prevalence and mean intensity in the largest fish group (>200 mm). These results for host size were parallel to infection rates. The prevalence and mean intensity of infection also varied in relation to the size of the fish; the highest prevalence and mean intensity of *D. lenkorani* was in the age class V group and age group IV, respectively compared with the other groups. In *D. forceps*, the highest prevalence and mean intensity were observed in the oldest fish (age group V) and in younger fish (age group III), respectively compared with other groups. *N. zabensis* infection showed the highest prevalence and mean intensity in older fish of age group V studied the occurrence of *Dactylogyrus extensus* in *Cyprinus carpio* and found a positive relationship between host size and parasite intensity. Koyun and Altunel (2007) reported a significant positive correlation between fish length, fish weight and infection rate in *Carassius* but there was no significant correlation in *A. alburnus*. In this respect researchers can say that the relationship between fish length, fish weight and fish infection is genus specific therefore, the results can not be generalized for all fish species.

Similarly, Sasal *et al.* (1997) reported that the prevalence and intensity of acanthocephalan infection was not correlated with fish size.

There are biological differences between host sexes which could lead to one sex to be more parasitized than another (Poulin, 1996). In this study, the overall

prevalence of *D. lenkorani* and *D. forceps* was higher in male fish hosts than in females and juveniles. Whereas *N. zabensis* shows higher prevalence in males than females and juveniles, there was no record of any acanthocephalan infection.

Seasonal changes in the prevalence and mean intensity of parasitic infection might be influenced by various factors such as water temperature, parasite biology, host hormonal status, host immunological response, host migration, changes in the feeding habits of the host and the availability of infected intermediate hosts (Hanzelova and Zitnan, 1985; Simkova *et al.*, 2005; Kennedy, 1969; Pennycuick, 1971; Chubb, 1963). However, the influence of these factors is difficult to distinguish because they are probably interrelated and influence each other.

CONCLUSION

In this study, *D. lenkorani* and *D. forceps* on the gill arch had the highest prevalence amongst the 3 parasite families found in this study and they are the most important in terms of pathological potential to fishes.

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