

Full Length Research Paper

Seasonal distribution and ecology of some *Dactylogyrus* species infecting *Alburnus alburnus* and *Carassius carassius* (Osteichthyes: Cyprinidae) from Porsuk River, Turkey

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In this research, gill parasites of two Cyprinid fish (*Alburnus alburnus* and *Carassius carassius*) from the upper basin of Porsuk river were studied. Fish samples were obtained monthly at intervals during 2003 to 2004. The intensity of infection was investigated depending on the parasite species, the years and seasons, and host fish species. Four *Dactylogyrus* species were identified in the gills of host fishes *Dactylogyrus fraternus* (Wegener, 1909), *Dactylogyrus alatus* (Linstow, 1878) and *Dactylogyrus minutus* (Kulwiec, 1927) on *A. alburnus* and *D. minutus* and *Dactylogyrus anchoratus* (Dujardin, 1845) on *C. carassius*. The prevalence, abundance and mean intensity of *Dactylogyrus* infection for each parasite species was determined as follow: *D. fraternus* (49.6%, 2.58 and 5.20), *D. alatus* (28.1%, 0.61 and 2.18) and *D. minutus* (35.1%, 1.61 and 4.61) in *A. alburnus* and *D. minutus* (40.5%, 1.00 and 2.49), *D. anchoratus* (37.6%, 0.38 and 4.63) in *C. carassius*. The highest intensity was recorded for *D. fraternus* while the lowest was recorded in *D. alatus*. However, no marked difference was recorded among the parasite species.

Key words: *Alburnus alburnus*, *Carassius carassius*, *Dactylogyrus fraternus*, *Dactylogyrus alatus*, *Dactylogyrus minutus*, *Dactylogyrus anchoratus*, seasonal distribution.

INTRODUCTION

The monogeneans are typically and often economically important ectoparasites of the skin or gills of fish. They are attached to the host surface by a characteristic opisthaptor which is species-specific and has hooks and hooklets (order Monopisthocotylea) or clamps (order Polyopisthocotylea). The monogenea are hermaphroditic flatworms and mainly ectoparasites of aquatic vertebrates. They are often found in the gills or on the external surface of the fish. In general, fish are seldom affected by monogenes (Schmahl and Mehlhorn, 1985). Dactylogyrosis is an overall parasite and the presence of this parasite on cichlid fish in Uganda was first reported by Thurston (1970). The aim of this investigation was to determine the seasonal variation of the *Dactylogyrus* species and their infestation effect. Pathogenicity of monogenean gill parasites from cultured fishes was widely recognized by Paperna (1963) and Molnar (1972), but thorough investigations on the impact of such

helminths on Turkey river and lake environment are almost lacking (Koyun and Altunel, 2007). According to Oktener (2003), the first record from Turkey for *Dactylogyrus* was made by Geldiay and Balık (1974). Later, some related studies were documented from Manyas lake (Ozturk and Altunel, 2001, 2002).

MATERIALS AND METHODS

The study was conducted at the west of Turkey in the western Anatolia region with 38° latitude, is located at 30° longitude, (Figure 1). The river has a variable flow that is very high in winter and low in summer. In winter, the average temperature is about 4.5°C, while in summer it is 23 to 23.5°C. The river has a short-term freeze in winter. *Dactylogyrus* samples were taken from host fishes at a monthly interval. Each month, approximately 8 to 18 *Alburnus alburnus* and 4 to 7 *Carassius carassius* were examined during April 2003 to November 2004. Fish specimens were caught by gill-nets and placed in plastic containers containing river water, and

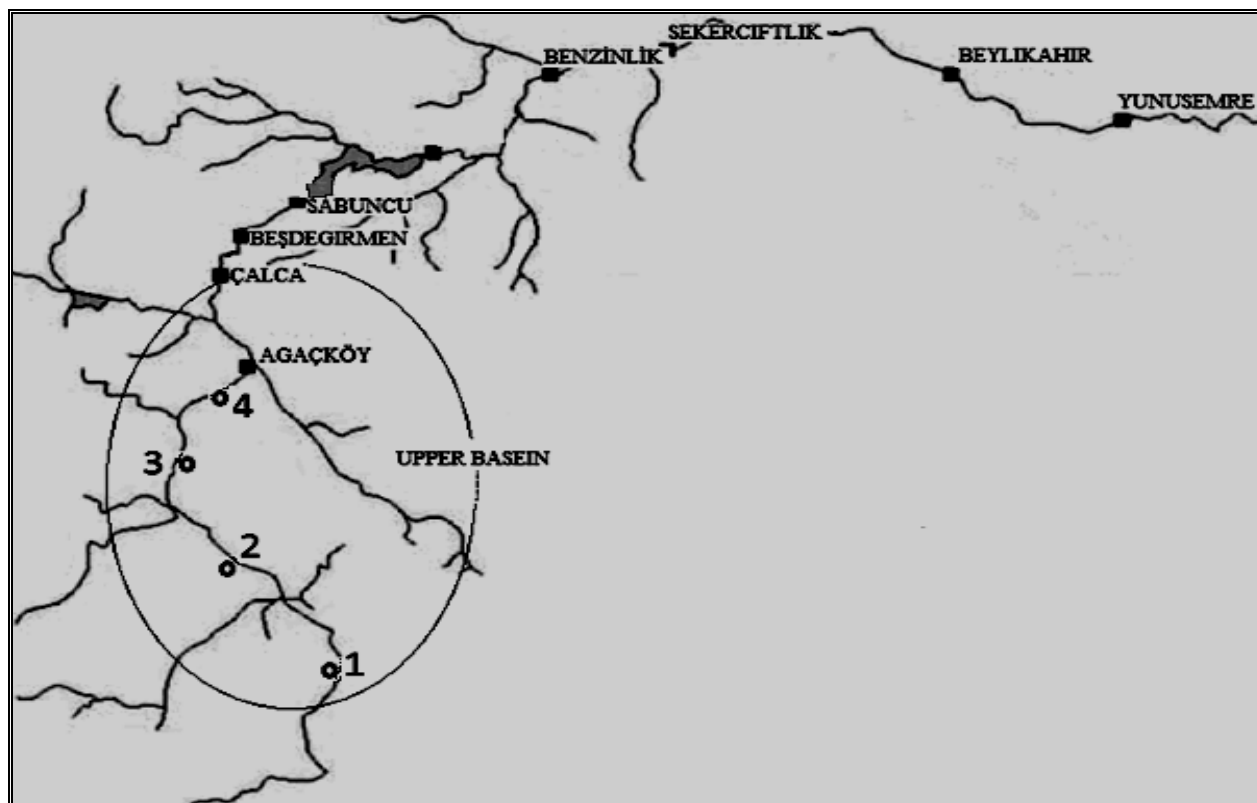


Figure 1. Fish samples taken from Porsuk River upper basin [map adapted from Aslan (2008) (1:4100 map)].

Table 1. List of *Dactylogyrus* species found on two cyprinid fishes in Porsuk River.

Parasite species	Host fish	Number of examined fish	Number of Infested fish	Abundance	Prevalence (%)	Minimum-maximum	Mean intensity \pm S.D.	Σ (Total parasites)
<i>D. fraternus</i>	<i>A. alburnus</i>	242	120	2.58	49.6	1-15	5.20 \pm 1.62	624
<i>D. alatus</i>	<i>A. alburnus</i>	242	68	0.61	28.1	1-6	2.18 \pm 1.04	148
<i>D. minutus</i>	<i>A. alburnus</i>	242	85	1.61	35.1	1-11	4.61 \pm 0.93	392
<i>D. minutus</i>	<i>C. carassius</i>	101	41	1.00	40.5	1-5	2.49 \pm 0.88	102
<i>D. anchoratus</i>	<i>C. carassius</i>	101	38	0.38	37.6	1-8	4.63 \pm 1.44	176

then transferred to the research laboratory. After been sacrificed, fish length and weight were measured and recorded, and gill arches were cut from the body and transferred to the Petri dishes. The gills were examined and the parasites were isolated with the help of a binocular stereo microscope with $\times 12$ and $\times 30$ magnification. Some of the parasites were fixed in glacial acetic acid and preserved using glycerin-gel under the cover glass in accordance with Pritchard and Kruse (1982). For the identification of the parasite specimens, based on Bychowskaya-Pavlovskaya, (1962), a light microscope with $\times 100$ and $\times 400$ magnifications was used. The data on parasite species were categorized according to the years, months and seasons. To establish the connection with the seasonal changes, water temperature for each season was recorded throughout the study period as shown in Tables 1 to 5. The research clearly shows that the temperatures were remarkably different for each season: spring (March to May), summer (June to August), autumn (September to November) and winter (December

to February).

Margolis et al. (1982) was reviewed by Bush and Holmes, (1986) and is now widely used. Also, Arthur and Albert (1994) and Ash and Orihel (1987) studied the parasites examination of fish for parasites, treatment and fixation of parasites recovered.

RESULTS

The parasites were isolated from the body, skin and gill of the studied fish species. Results are given in Table 1. The four *Dactylogyrus* species were: *Dactylogyrus fraternus*, *Dactylogyrus alatus*, *Dactylogyrus minutus* and *Dactylogyrus anchoratus*. Only three of the *Dactylogyrus* species (*D. fraternus*, *D. alatus* and *D. minutus*) were

Table 2. Mean intensity, abundance and prevalence of *Dactylogyrus* species of *A. alburnus* in Porsuk River.

Year	Parasite species	Number of Examined fish	Number of Infested fish	Abundance	Prevalence (%)	Minimum-maximum	Mean intensity \pm S.D.	Σ (Total parasites)
2003	<i>D. fraternus</i>	117	58	1.85	49.50	1-9	3.74 \pm 1.34	217
	<i>D. alatus</i>	117	29	0.69	24.79	1-4	2.79 \pm 1.53	81
	<i>D. minutus</i>	117	40	1.01	34.18	1-8	2.95 \pm 0.87	118
2004	<i>D. fraternus</i>	125	62	3.26	49.60	1-15	6.56 \pm 1.78	407
	<i>D. alatus</i>	125	39	0.54	31.20	1-7	1.74 \pm 0.69	67
	<i>D. minutus</i>	125	45	2.19	36.00	1-11	6.08 \pm 0.99	274

Table 3. Mean intensity, abundance and prevalence of *Dactylogyrus* species of *C. carassius* in Porsuk River.

Year	Parasite species	Number of examined fish	Number of Infested fish	Abundance	Prevalence (%)	Minimum-maximum	Mean intensity \pm S.D.	Σ (Total parasites)
2003	<i>D. minutus</i>	45	16	0.76	35.6	1-3	2.13 \pm 0.84	34
	<i>D. anchoratus</i>	45	18	2.20	40.0	1-11	5.50 \pm 1.32	99
2004	<i>D. minutus</i>	56	25	1.21	44.6	1-4	2.72 \pm 0.91	68
	<i>D. anchoratus</i>	56	20	1.38	35.7	1-7	3.85 \pm 1.54	77

recorded for *A. alburnus*, while one of them (*D. anchoratus*) was recorded for *C. carassius* but *D. minutus* was found both on *A. alburnus* and *C. carassius*.

Mean intensity, abundance and prevalence of *Dactylogyrus* species of *A. alburnus* and *C. carassius* is shown in Tables 2 and 3. Prevalence, abundance and mean intensity of the parasite species was higher in 2004 than in 2003; 38.93 compared to 36.16%, 1.99 compared to 1.18, and 4.79 \pm 1.15 compared to 3.16 \pm 1.25, respectively, and also number of total parasites were higher in 2004 than in 2003 (748 and 416, respectively) while, maximum intensity was recorded for *D. fraternus* while the lowest was recorded for *D. alatus*, but there were no significant differences among the parasite species. In 2004, the maximum intensity was found for *D. fraternus* with 15 specimens in summer on *A. alburnus*. In 2004, *D. fraternus* and *D. minutus* were significantly higher than that in 2003 but *D. alatus* was higher in 2003 than in 2004. The highest intensity level was again found for *D. Anchoratus* with 11 specimens in summer on crucian carp.

The last findings of the study was linked to seasonal changes in the prevalence and intensity levels of the parasite species which clearly showed that the changes in the water temperature in the study area were not constant, that is, it changed sharply during different seasons. From the data presented in this study, the intensity of the species was highest in summer and autumn. The population of the three parasite species except for *D. fraternus* decreased or was nearly absent between late

autumn and winter.

DISCUSSION

This study showed the faunistic seasonal distribution of gill parasites in Porsuk River (Kutahya, Turkey). The four monogeneans found in the study belong to the genus *Dactylogyrus*. Three of them (*D. fraternus*, *D. alatus* and *D. minutus*) were found in bleak and two (*D. minutus* and *D. anchoratus*) were found in crucian carp. All the monogeneans found during the study were considered as new locality records.

Previous studies were mainly focused on the existence of *Dactylogyrus* species in connection with host fish species and seasonal changes (Koskivaara et al., 1991; Ozturk, 2002). Such studies showed that the *Dactylogyrus* species variety and richness changed from locality to locality. Similarly, the study determined the existence of four dactylogyrid species in Porsuk River on the basis of seasonal dynamics and host fish species.

The parasites that caused higher infection are *D. fraternus* in bleak and *D. anchoratus* in crucian carp. *Dactylogyrus* species were found in Cyprinidae (85 to 90%) in African freshwater (Price, 1967). An interesting result from this study was that the parasites were genus specific not species specific; that is why the parasite of bleak was different from crucian carp (*D. anchoratus*). In several studies, it has been shown that *D. fraternus* and *D. alatus* are specific for *Alburnus* genus (Lambert, 1977;

Table 4. Mean intensity, abundance and prevalence of *Dactylogyrus* species of *A. alburnus* in Porsuk River according to seasons.

Host fish	Parasite	Year	Season	Number of examined fish	Number of infested fish	Abundance	Temperature (°C)	Prevalence (%)	Minimum-maximum	Mean intensity	Σ (Total parasites)
<i>A. alburnus</i> L.1758	<i>D. fraternus</i>	2003	Spring	21	13	1.24	14.5	61.9	1-4	2.00	26
			Summer	46	32	3.52	23	69.5	1-13	5.10	162
			Autumn	40	11	0.56	11	27.5	1-4	2.10	23
			Winter	31	7	0.52	4.5	22.5	1-4	2.30	16
		2004	Spring	34	20	4.35	13	58.8	1-13	7.40	148
			Summer	40	26	5.43	22.5	65	1-15	8.40	217
			Autumn	30	11	1.07	12	36.6	1-5	2.90	32
			Total	242	120	2.58	-	49.5	1-15	5.20	624
	<i>D. alatus</i>	2003	Spring	21	4	0.66	14.5	19	1-5	3.50	14
			Summer	46	23	1.30	23	50	1-6	2.60	60
			Autumn	40	2	0.15	11	5	1-4	3.00	6
			Winter	31	2	0.06	4.5	13	1	1.00	2
		2004	Spring	34	13	0.52	13	38	1-2	1.38	18
			Summer	40	20	0.80	22.5	50	1-3	1.60	32
			Autumn	30	4	0.53	12	13	1-4	4.00	16
			Total	242	68	0.61	-	28	1-6	2.18	148
	<i>D. minutus</i>	2003	Spring	21	7	0.48	14.5	33.3	1-2	1.42	10
			Summer	46	24	2.02	23	52.1	1-8	3.88	93
			Autumn	40	9	0.38	11	22.5	1-3	1.67	15
			Winter	31	1	0.03	4.5	3.2	1	1.00	1
		2004	Spring	34	16	3.44	13	47	1-10	7.31	117
			Summer	40	22	3.58	22.5	55	1-11	6.5	143
			Autumn	30	6	0.43	12	20	1-3	2.17	13
			Total	242	85	1.61	-	35.1	1-11	4.61	392

Dupont and Lambert, 1986; Gelnar et al., 1994) and *D. anchoratus* is also specific for genus *Carassius* (Reichenbach-Klinke, 1973).

Temperature is commonly regarded as one of the most important factors determining the existence and abundance of monogenean parasites (Koskivaara et al., 1991) while some of them tend to produce more at a higher water temperature,

others prefer a cool water temperature (Hanzelova and Zitnan, 1985). For example Pojmanska (1995), found that the optimum period for the growth of *Dactylogyrus lamellatus* was in winter and the maximum infection level for *D. nobilis* was in autumn or spring when the water temperature was cool. This study also supports this view partially, observing that three dactylogyrid species;

D. fraternus, *D. alatus* and *D. minutus* reached the maximum infection level on bleak in summer period when the water temperature was the highest and *D. anchoratus* on crussian carp reached the maximum infection level in spring and summer with no infection level in winter.

However, the seasonal abundance of dactylogyrids are sometimes more influenced by other

Table 5. Mean intensity, abundance and prevalence of *Dactylogyrus* species of *C. carassius* in Porsuk River according to seasons.

Host fish	Parasite	Year	Season	Number of examined fish	Number of Infested fish	Abundance	Temperature (°C)	Prevalence (%)	Minimum-maximum	Mean intensity	Σ (Total parasites)
<i>C. carassius</i> L. 1758	<i>D. minutus</i>	2003	Spring	9	4	1.00	14.5	44.4	1-2	2.25	9
			Summer	17	10	1.17	23	58.8	1-4	2.00	20
			Autumn	15	2	0.33	11	13.3	1-3	2.50	5
			Winter	13	1	0.23	4.5	7.6	3	3.00	3
		2004	Spring	16	11	2.06	13	68.8	1-5	3.00	33
			Summer	18	10	1.39	22.5	55.5	1-4	2.50	25
			Autumn	13	3	0.54	12	23.07	1-3	2.33	7
			Total	101	41	1.01	-	40.5	1-5	2.49	102
	<i>D. anchoratus</i>	2003	Spring	9	5	1.33	14.5	55.5	1-4	2.40	12
			Summer	17	11	5	23	64.7	1-8	7.73	85
			Autumn	15	2	0.13	11	13.3	1	1.00	2
			Winter	13	-	-	4.5	-	-	-	-
		2004	Spring	16	10	2.75	13	62.5	1-7	4.40	44
			Summer	18	8	1.77	22.5	44.4	1-5	4.00	32
Autumn			13	2	0.23	12	15.4	1-2	1.50	3	
Total			101	38	1.74	-	37.6	1-8	4.63	176	

biotic and abiotic factors than by temperature such as light, pH, oxygen and salinity (Bauer, 1962).

This suggests that *D. alatus* is not a serious pathogen of *A. alburnus*, although other species mentioned earlier seemed to be more pathogenic to their hosts. As a result, a new locality, Porsuk River (Kutahya, Turkey), was found to contain the four *Dactylogyrus* species. This study contributes to related studies that focus on the relationship between parasite species and host fish species in a different geographical location. In addition, it examined the occurrence, prevalence and intensity levels of the infections that are linked to seasonal changes and host fish species.

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