

## Prevalence of Two *Monogenean* Parasites on Different Length Groups of Crucian carp (*Carassius carassius* Linneus, 1758)

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### Abstract

*Dactylogyrus anchoratus* Dujardin, 1857 and *Gyrodactylus katharineri* Malmberg, 1964 were identified on crucian carp, *Carassius carassius* L., 1758 in the present study, which was carried out between February 1999 and January 2000. A total of 117 fish specimens were examined. The infestation prevalence and mean intensity levels for *G. katharineri* was 37.61%, respectively  $27.75 \pm 2.203$  and for *D. anchoratus* was 24.78%,  $4.69 \pm 1.730$  per fish, respectively. The infestation prevalence and mean intensity levels were higher during spring and summer, for the both parasites. No statistically significant preference for either sex of the fish was determined. In this study, we examined a total of 117 fish, out of which 44 (38%) were infested by 1221 *G. katharineri*, and 29 (25%) infested by a total of 136 *D. anchoratus*.

**Keywords:** Enne Dam Lake, *Carassius carassius*, *Dactylogyrus anchoratus*, *Gyrodactylus katharineri*

### Introduction

The importance of fish parasites is directly related to the importance of the fish that they affect (Hoffman, 1967). Metazoan parasites, especially trematodes, can cause gill infestations and inhibit oxygen exchange across gill lamella (Mitchum, 1995). Considering these aspects, fish parasites under favorable conditions, cause economic loss by affecting the health of fishes and causing high mortality (Tripathi, 1959).

Monogenean parasites are still widespread in freshwater wildlife, on farm fishes and marine habitats. The genus *Gyrodactylus* is represented by a great variety of fish parasites, inhabiting both freshwater and sea water environments (Bykhovskaya-Pavlovskaya *et al.*, 1962; Harris, 1985). *Gyrodactylus* members are viviparous, most mature specimens exhibit a well-formed embryo, complete with a full complement of attaching armament, within the uterus. It is often possible to observe a smaller embryo within the uterus of the first embryo and more rarely a third within the uterus of the second one (Price, 1967). *Gyrodactylus* are seen especially in teleost fish, frog larvae and adult amphibians, while they infect and live ectoparasitically on the skin, fins and gills of fish. The gill Monogeneans, due to their microscopic size and technical difficulties, were uncounted in their collection and study, and remained little known until the twentieth century. Monogenetic trematodes of freshwater fishes have been studied by Gussev (1967) and Kulkarni (1969). The majority of *Dactylogyrids* have strictly hosts, as they appear as specific parasites (Jalali, 1992).

The first relevant study about this subject has been done by Nordmann in 1832 on *Gyrodactylus elegans*, after which several studies have been carried on all over the world. High infestation rates of *Gyrodactylus* species on natural population have also been studied by several authors (Hanzelova and Zitnan, 1964; Jansen and Bakke, 1957; Kirby, 1981; Mo, 1957; Rawson and Rogers, 1964).

In this investigation, *G. katharineri* and *D. anchoratus* in crucian carp from Enne Dam Lake (Kütahya) were studied during the year of 1999-2000. Here we report the ectoparasitic infestations of *G. katharineri* as a monogenetic parasite as being noticed for the first time in Turkey.

### Materials and methods

A total of 117 fishes collected on a monthly basis were examined with a stereo microscope to determine their ectoparasite community. The fishes were separated according to their sex and were measured for the total length. The first microscopic examinations were done for observing ectoparasites and identifying any cysts, ulceration and scars. Skin, gills and fins were examined and the parasites were counted separately for each body part of the host fish. Then the gill filaments were dissected out of the branchial cavity and placed in a petridish containing saline solution (0.75% NaCl). Parasites were collected and preserved, and identification was performed according to the characteristics described by Malmberg (1962) and Harris (1982). All of the collected parasites were kept in tap water, fixed in 10% formaldehyde and transferred to 5% glycerol in 70%

ethanol after 1 week. In addition, at least 10 specimens of *Gyrodactylus* and *Dactylogyrus* were placed on glass microscope slides with a drop of 1/4000 formalin while the cover slip was placed over the parasite. They were fixed in glycerin alcohol (90 parts of 70% ethyl alcohol and 10 parts of glycerol), stained in Borax carmine and finally mounted in glycerin jelly. Descriptive terminology follows, with length and width hard parts (Malmberg, 1970).

All measurements are given in millimeters. The terms *infestation prevalence* (%) and *mean intensity* are used in accordance with the definitions established. The prevalence (%) was calculated as the percentage of the total number of fishes infested out of the total number of fishes examined (Bush, 1997). The mean intensity was calculated as the average number of parasites on the total number of infected fishes.

**Results**

Out of the 117 fish specimens examined, 44 were infested with *G. katharineri*, resulting a prevalence of 37.61% and mean intensity levels  $27.75 \pm 2.203$ , while 29

fishes were infested with *D. anchoratus*, and its prevalence was 24.78% and mean intensity levels  $4.69 \pm 1.730$  per infested fish (Tab. 1).

During this study, the highest infections with *G. katharineri* and *D. anchoratus* were recorded on 146-184 mm lengths fishes (50%, 34.62%). Totally 215 specimens for *G. katharineri*, and 136 specimens for *D. anchoratus* were recorded in this group. Mean intensity of *G. katharineri* was  $69.22 \pm 20.83$  in 138-142 mm, and for *D. anchoratus* was  $6.12 \pm 2.232$  in 102-124 mm group.

The prevalence and intensity of parasitic infestation in different length groups of female and male crucian carps are given in Tab. 2. These parasite species were found on all sizes of the host fishes. The parasites attained the maximum level on the largest fish specimens (146-184). In addition, total parts and haptor of the recorded parasites were photographed (Fig. 1 and Fig. 2).

**Discussion**

Out of 117 fishes, 60 were found infested by two non-native *C. carassius* parasites. The prevalence of ectoparasite

Tab. 1. Infestation prevalence (%) and mean intensity levels of *G. katharineri* and *D. anchoratus* determined from the crucian carp (*Carassius carassius* L.)

Fish Length groups (mm)	<i>G. katharineri</i>					<i>D. anchoratus</i>				
	Examined fishes	Infected fishes	Prevalence (%)	Number of parasites	Intensity (mean ± sd)	Examined fishes	Infected fishes	Prevalence (%)	Number of parasites	Intensity (mean ± sd)
102-124	28	11	30.28	197	$17.90 \pm 2.587$	28	8	28.57	49	$6.12 \pm 2.232$
124-138	18	5	27.77	63	$12.60 \pm 2.074$	18	4	22.22	9	$2.25 \pm 0.957$
138-142	23	9	39.13	623	$69.22 \pm 20.83$	23	3	13.04	17	$5.66 \pm 1.528$
142-146	22	6	27.27	123	$20.50 \pm 5.24$	22	5	22.72	19	$3.80 \pm 1.483$
146-184	26	13	50.00	215	$16.53 \pm 3.126$	26	9	34.62	42	$4.66 \pm 1.803$
Total	117	44	37.61	1221	$27.75 \pm 2.203$	117	29	24.78	136	$4.69 \pm 1.730$

Tab. 2. Infestation prevalence (%) and mean intensity levels of *G. katharineri* and *D. anchoratus* determined from the different length groups of female and male crucian carp

Fish Length groups (mm)	<i>(C. carassius)</i> male and female									
	<i>G. katharineri</i>					<i>D. anchoratus</i>				
	Examined fishes	Infected fishes	Prevalence (%)	Number of parasites	Intensity (mean ± sd)	Examined fishes	Infected fishes	Prevalence (%)	Number of parasites	Intensity (mean ± sd)
102-124	21	14	66.66	261	$18.64 \pm 4.86$	7	5	71.42	97	$19.40 \pm 2.61$
124-138	12	6	50.00	115	$19.16 \pm 3.76$	6	3	50.00	58	$19.33 \pm 1.53$
138-142	15	7	46.67	133	$19.00 \pm 3.61$	8	5	62.50	93	$18.60 \pm 2.07$
142-146	15	8	53.33	138	$17.25 \pm 1.83$	7	3	42.86	52	$17.33 \pm 2.52$
146-184	16	14	87.50	260	$18.57 \pm 2.76$	10	8	80.00	150	$18.75 \pm 2.96$
Total	79	49	62.02	907	$18.51 \pm 2.71$	38	24	63.15	450	$18.75 \pm 2.94$

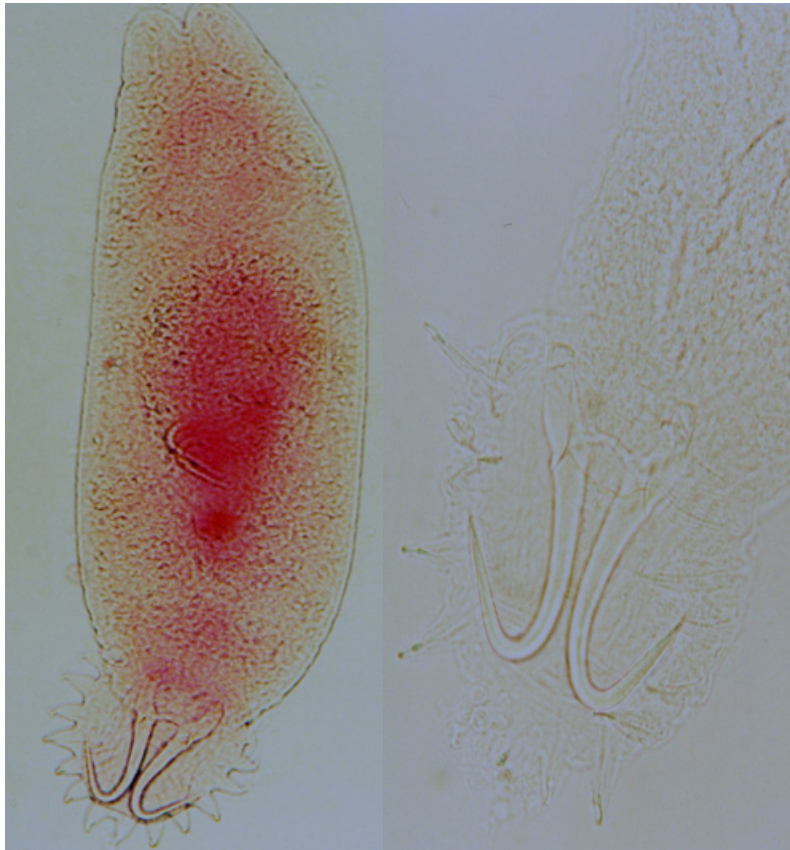


Fig. 1. *G. katharineri* total view and haptor part (original)

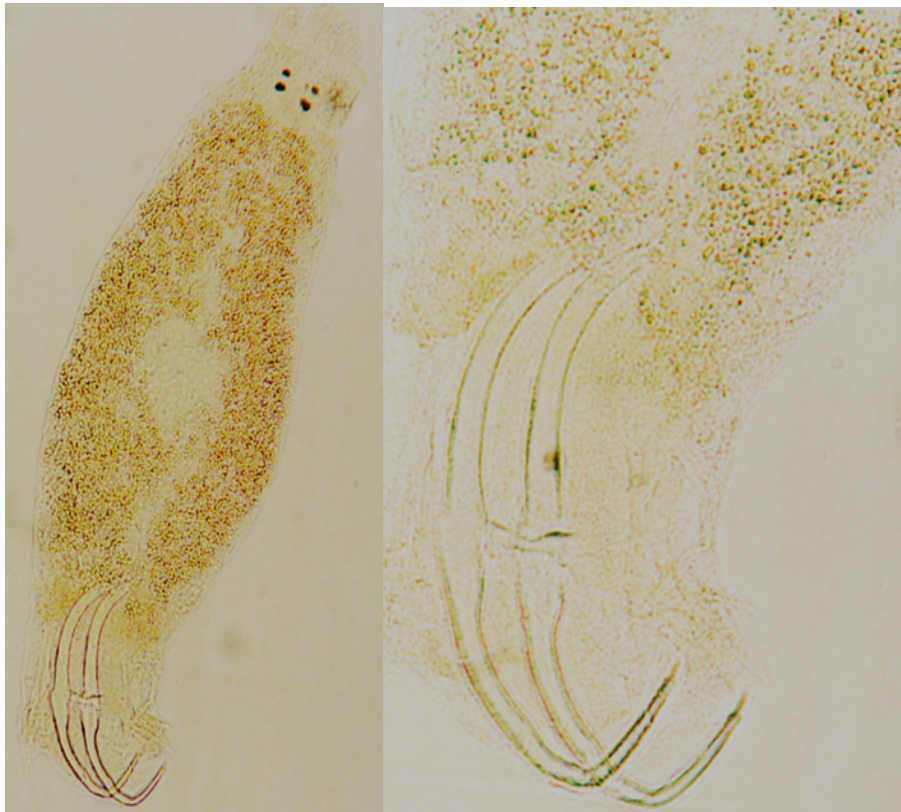


Fig. 2. *D. anchoratus* total view and haptor (original)

infestation in these fishes was 62.39%. The prevalence of *G. katharineri* was 37.61% and that of *D. anchoratus* was only 24.78%. The intensity of infestation was 27.25 and 4.69% in *G. katharineri* and *D. anchoratus* respectively (Tab. 1). On female fish the infestation intensity was slightly higher (18.75%) than on male fishes (18.51%). The prevalence of *G. katharineri* was found highest (50%) in 146-184 mm length group while the highest intensity (69.22 and 20.50) was found in 138-142 mm and 142-146 mm groups, respectively. Similarly, the prevalence and intensity of *D. anchoratus* were found highest (34.62% and 4.66) in the length group of 146-184 mm. The effect of fish length on parasite infestation has been observed during the study period (Tab. 1). In different length groups of *C. carassius*, it was observed that the fishes of the 1<sup>st</sup> and 2<sup>nd</sup> intermediate length groups were more infested than the smaller and larger group of fishes.

Bashirullah (1973) reported that the degree of parasitism was obviously related to the age of the host fishes. As shown in Tab. 2, the prevalence and intensity of parasites in males and females of *C. carassius* in different length groups also varied. The prevalence of parasite infestation in male fish (63.15%) was higher than for the female fishes (62.02%). The intensity of infection was nearly equal (18.75%) in male and in female (18.51%).

In the smallest length group (102-124 mm), the prevalence of infected male (71.42%) was higher than on female (66.66 %). In the 1<sup>st</sup> intermediate length group (138-142 mm), the prevalence of male (62.50%) was higher than that of female (46.67%), but the intensity was higher on female fishes. In the 2<sup>nd</sup> intermediate length group (142-146 mm) the highest prevalence of infestation was shown by female fish (53.33%). In the highest length group (146-184mm) the prevalence of infestation was higher in female (87.50%) than in male (80%). The intensity was also higher in male (18.75%) than in female (18.57%).

Out of the two non-native types of parasites, *Gyrodactylus* showed a higher prevalence of infestation. The prevalence and intensity of *Gyrodactylus* were 37.61% and 27.75% respectively. *Dactylogyrus* showed therefore a lower prevalence of infection. The prevalence and intensity of *Dactylogyrus* were 24.78% and 4.69% respectively.

The majority of parasites showed higher intensity in the case of male hosts (18.75%). It was observed that the infestation of *G. katharineri* started from very early stages of fishes (102-124 mm). The prevalence was highest (50%) in the second intermediate length group and lowest (27.27%) in the fifth intermediate length group. The intensity was highest (69.22) in 3<sup>rd</sup> intermediate length group and lowest (12.6) in the smallest length group.

In the case of *D. anchoratus*, 136 parasites infested 29 fishes, grouped in five length intervals. The prevalence was highest (34.62%) in the 2<sup>nd</sup> largest length group and lowest (13.04%) in the 3<sup>rd</sup> intermediate length group. The highest intensity (6.12) was in the largest length group and the lowest one (2.25) in the 5<sup>th</sup> intermediate length

group (Tab. 1). Among the gill inhabiting parasites, *G. katharineri* has been reported for the first time by Malmberg (1962). Harris (1985) reported about *Gyrodactylus* species in different places of the fish body and that they are widespread throughout freshwater and marine habitats.

The present work states for the first time that *G. katharineri* parasites were noticed on *C. carassius* fishes in Turkey. Monogenetic trematodes have been studied by Leuckart (1827), Mamaev (1981) and Hargis (1955). As hosts, the female fishes were more infected than the male ones. Thomas (1964), Bibbly (1972), Watson and Dick (1980) concluded that due to lower physiological resistance, the female sex of the fishes is responsible for a higher infestation rather than ecological conditions. The present study recorded a significant relationship between the host length and the intensity of parasites in *C. carassius*.

The study revealed that the fishes of the 2<sup>nd</sup> intermediate (146-184 mm) and the ones of 102-124 mm length were more heavily infested than the smallest and the 1<sup>st</sup> intermediate length groups. These results are in accordance with those of Stromberg and Crites (1975), who reported that the prevalence and intensity of infestation generally increased with the host's size, up to a certain point and then declined.

## Conclusions

The aim of this study was to determine the distribution of parasites, according to the fish size and gender. As seen in Tab. 1 and Tab. 2, showing differences in parasite prevalence, the density was close to each other in all cases. Similar studies confirm the data recorded in Turkey (Altunel, 1981; Kartal and Ozturk, 2009; Ozturk, 2000; Ozer *et al.*, 2004).

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