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Tylodelphys sp. infection of some cyprinid fish species from Lake Dam Kunduzlar, Turkey

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Abstract
In this study, metacercariae of *Tylodelphys* sp. infection was examined in seven fish species viz. (*Cyprinus carpio, Carassius gibelio, Barbus plebejus, Capoeta tinca, Chondrostoma nasus, Leuciscus cephalus,* and *Alburnus escherichii*) through on-site surveys. Three host fish species were infected with metacercariae of *Tylodelphys* sp: (prevalence 5.1% and mean parasite number and standard deviation 67.5±92.6 in *Chondrostoma nasus*; 10.6%, 5.6±1.8 in *Capoeta tinca*; 12.5%, 2.5±2.1 in *Barbus plebejus* respectively). Infection data of the parasite species were evaluated for seasons, host fish size and sex. The period of the study covered the four seasons: spring, summer, autumn, winter. Occurrence of the infection of *C. tinca* was shown in all seasons. For the other two fish species, *B. plebejus* and *C. nasus,* occurrence of the infection was found only in winter. Host fish specimens were divided into mention size groups. It was recorded only in the second group of *B. plebejus*. In the other two fish species, *C. nasus* and *C. tinca,* occurrence of the parasite was found in the first and second groups. The infection achieved a maximum value in the first group for *C. tinca* and in the second for *C. nasus*. On the other hand, both the infection prevalence of the parasites achieved a maximum value in the male group of *C. nasus* and in the female group of *C. tinca*. Moreover, the metacercariae of *Tylodelphys* sp. was recorded for the first time in three host fishes, *C. nasus, C. tinca,* and *B. plebejus* in Turkey. Thus, a new locality has been added to the geographical spread of the metacercariae species.

Keywords: *Alburnus, Capoeta, Cercariae, Chondrostoma, Tylodelphys*

1. Introduction
The genus *Tylodelphys* sp. parasites affect fish communities is of great interest to fish ecologists, since fish serve as intermediate or final hosts. Parasites might change the functional importance of a free-living species directly via pathological effects [4]. A number of parasites cause lethal or sub lethal effects in their hosts and thus, they are potential pathogen organisms for fish population [25, 29].
Metacercariae parasitic infection values were studied on different host fishes. At this content, *Diplostomum* sp., which is a metacercariae parasite such as *Tylodelphys* sp. was recorded in eyes of *Acanthobrama marmid* [8, 9]. The metacercaria parasite was found in two species of catfish *Silurus glanis* and *Clarias lazera* [30, 31]. And the highest prevalence of the parasite was recorded during the summer [2, 30, 32]. In addition, the parasite was found to be higher in elderly of the host fish specimens [33].
There was a study on the length-weight relation change of some fish [11]. Until today, only one ichthyoparasitological paper was published about Kunduzlar Dam Lake [21]. The aim of the present study was to investigate metacercariae of *Tylodelphys* sp. infections in fishes from Kunduzlar Dam Lake, Turkey. In addition, the prevalence and intensity of *Tylodelphys* sp. were assessed in relation to the seasons, size and gender of the host fish.

2. Materials and Methods
Kunduzlar Dam Lake's geographical coordinates are $39^0$20'30" N and $30^0$32'25". The Lake Dam was constructed in 1983 on the Kunduzlar Stream for irrigation purposes. The minimum altitude is 1011.50 m and the maximum 1027.10 m, and the dam lake surface area is 4.40 km^2 [21].
4 *Cyprinus carpio*, 17 *Carassius gibelio*, 16 *Barbus plebejus*, 47 *Capoeta tinca*, 39 *Chondrostoma nasus*, 14 *Leuciscus cephalus* and 38 *Alburnus escherichii* specimens were caught with trammel nets at depths from approximately one to two meters in the study area.

The fish specimens were placed in plastic tanks with local lake water and transferred to the research laboratory where they were kept in an aquarium. They were examined within 24 hours. During the study, *Tylodelphys* sp. specimens were examined in the skin, fin, gill, eyes and body cavity of the fish with a stereo microscope. Then, specimens were taken to a physiological water environment with the help of a scalpel, washed with tap water and their mucus was cleaned. They were placed in warm AFA (Alcohol-Formaldehyde-Acetic acid) fixative and left for 12-24 hours. Then, the dehydration process was applied to parasites with the help of ethyl alcohol series (35%, 50, 70). Following this, a hundred parasites were preserved in 70% ethyl alcohol. 68 parasite specimens were made into a preparation of glycerin-gel [15].

For species definition of the parasite, Bykhovskaya-Pavlovskaya *et al*. (1962) [6] was used. Infection prevalence, parasite intensity and minimum-maximum numbers of parasites were calculated according to Bush *et al*. (1997) [5]. The obtained parasitological data were evaluated using the random sampling variation test of Quantitative Parasitology Software 3.0 [26] according to seasons, length, and sex of the host fish.

3. Results

3.1. Metacercariae of *Tylodelphys* sp. infection on the host fish species

In the present study, a total number of 175 fish specimens belonging to seven host fish species were examined for metacercariae of *Tylodelphys* sp. infection from Kunduzlar Lake Dam. Three host fish species were infected with *Tylodelphys* sp. From the two out of 39 *Chondrostoma nasus* (prevalence 5.1%, mean intensity per fish and standard deviation 67.5±92.6), five out of 47 *Capoeta tinca* (10.6%, 5.6±1.8) and two out of 16 *Barbus plebejus* (12.5%, 2.5±2.1) it was found, *Tylodelphys* sp. (as seen in Table 1). *Tylodelphys* sp. was not recorded of the other host fish species.

Table 1: Occurence of *Tylodelphys* sp. infection of host fish species from Lake Dam Kunduzlar. Exm: Examined fish number, Inf: Infected fish number and prevalence (%), Mpn: Minimum-maximum parasite number, X& Sd: Mean parasite number and standard Deviation.

Fish species	Exm/ Inf	(%)	X & Sd	Mpn
Barbus plebejus	16/ 2	12.5	2.5±2.1	1-4
Capoeta tinca	47/ 5	10.6	5.6±1.8	3-8
Chondrostoma nasus	39/ 2	5.1	67.5±92.6	2–133

3.2. Metacercariae of *Tylodelphys* sp. infection according to seasons, size and sexes of fish species

Metacercariae of *Tylodelphys* sp. infection was recorded in *C. tinca* in all seasons. The prevalence of infection for the host fish achieved a maximum value in winter. Occurrence of the infection of the other two fish species, *B. plebejus* and *C. nasus*, was found only in autumn (Table 2).

Table 2: Distribution of *Tylodelphys* sp. infection of host fish species according to the seasons.

Seasons	Infection Parameters	*B. plebejus*	*C. tinca*	*C. nasus*
Spring	Exm/ Inf	4/0	16/ 1	5/ 0
	(%)	0	(6.2)	0
	M & Sd	0	5.0±0.0	0
	Mpn	0	5-5	0
Summer	Exm/ Inf	8/0	12/ 2	12/ 0
	(%)	0	(16.6)	0
	M & Sd	0	4.5±2.1	0
	Mpn	0	3-6	0
Autumn	Exm/ Inf	4/ 2	13/ 1	10/ 2
	(%)	(50.0)	(7.7)	(20.0)
	M & Sd	2.5 ±2.1	6.0±0.0	67.5±92.6
	Mpn	1-4	6-6	2-133
Winter	Exm/ Inf	-	6/ 1	12/ 0
	(%)	-	(16.6)	0
	M & Sd	-	8.0±0.0	0
	Mpn	-	8-8	0

The distribution of *Tylodelphys* sp. infection with respect to size groups of fish species is shown in detail in Table 3. Host fish specimens were divided into three groups according to their sizes. It was recorded only in the second group of *B. plebejus*, and in the other two fish species, *C. nasus* and *C. tinca*, occurrence of the infection was shown in the first and second groups.

Host fish specimens were also divided into two groups according to gender (Table 4). The infection prevalence of the parasites achieved a maximum value in male group for *C. nasus* and in female group for *C. tinca*. On the other hand, it was found only in female group of *B. plebejus*.

Table 3: Distribution of *Tylodelphys* sp. metacercar infection according to the host fish size groups.

Size	Infection parameters	*B. plebejus*	*C. tinca*	*C. nasus*
I. grup	Exm/ Inf	4/ 0	7/ 2	9/ 1
	(%)	0	(28.5)	(11.1)
	M & Sd	0	7.0±0.0	2.0±0.0
	Mpn	0	6-8	2-2
II. grup	Exm/ Inf	10/ 2	37/ 3	30/ 1
	(%)	(20.0)	(8.1)	(3.3)
	M & Sd	2.5 ±2.1	4.6±1.5	133.0±0.0
	Mpn	1-4	3-6	133-133
III. grup	Exm/ Inf	2/ 0	3/ 0	-
	(%)	0	0	-
	M & Sd	0	0	-
	Mpn	0	0	-

Table 4: Distribution of *Tylodelphys* sp. metacercar infection according to the host fish sex groups.

Sex	Infection parameters	*B. plebejus*	*C. tinca*	*C. nasus*
Male	Exm/ Inf	8/ 0	26/ 2	20/ 1
	(%)	0	(7.7)	(5.0)
	M & Sd	0	4.0±0.0	133.0±0.0
	Mpn	0	3-5	133-133
Female	Exm/ Inf	8/ 2	21/ 3	19/ 1
	(%)	(25.0)	(14.2)	(5.2)
	M & Sd	2.5 ±2.1	6.6±1.1	2.0±0.0
	Mpn	1-4	6-8	2-2

4. Discussion

Tylodelphys sp. infection of the eye diseases of host fish is associated with impairment of vision that leads to exophthalmoses, cataracts and even complete collapse of the eye, which may be the cause of growth inhibition or death [23]. However, neither exophthalmoses nor cataract diseases were found in the infected host fish specimens in the study area.

Previous studies were carried out on the metacercariae trematode recorded in various fish species: Infection prevalence was 78% in *Acanthobrama marmid* [8]; 100% in *Chondrostoma regium*, 85.7% in *Capoeta trutta*, 100% in *Capoeta capoeta* [10]; 95.8% in *Blicca bjoerkna* [28]; 51% in *Scardinus erythrophthalmus* [7]; 70% in *Clarias* sp. [20], 46.8% in *Vimba vimba* [2], 92.5% in *Abramis brama* [12] and 50% in *C. tinca* and *B. plebejus* [33]. In the present study, metacercariae of *Tylodelphys* sp. infection was examined in seven fish species (*Cyprinus carpio*, *Carassius gibelio*, *Barbus plebejus*, *Capoeta tinca*, *Chondrostoma nasus*, *Leuciscus cephalus* and *Alburnus escherichii*). But, the parasite species was recorded of only three host fish species, *B. plebejus*, *C. tinca* and *C. nasus*. Prevalence of the parasite species was recorded as 5.1% in *Chondrostoma nasus*, 10.6% in *Capoeta tinca* and 12.5% in *Barbus plebejus*.

The metacercariae trematode, *Tylodelphys* sp. was recorded of different intensity in various fish species. For example, mean parasite intensity was found 2.7 in *Scardinius erythrophthalmus* [7]; 1.4 in *Abramis brama* [12]; 8.3 in *Vimba vimba* [2]; 15 in *Tinca tinca* [1]; and 50 in *Blicca bjoerkna* [28]. In the present study, mean intensity of the metacercariae parasite was recorded as 67.5±92.6 in *Chondrostoma nasus*, 5.6±1.8 in *Capoeta tinca* and 2.5±2.1 in *Barbus plebejus*.

According to Poulin (2007) [25], local conditions, the nutrition type of host fishes, and the biotic or abiotic ecological properties of the geographic location are the main factors effective on parasite communities. In this connection, variation of the *Tylodelphys* sp. infection is probably caused by the diversity in hormonal balance of the host fish during the life period. Another reason is that some piscivorous species present temporarily in habitats [13, 33]. Or some fish specimens stay deeper in the coastal area much longer than the other species, and so they have much more infection [17, 20]. The infection value of the metacercariae can change according to seasonal conditions. Voutilainen *et al*. (2009) [34] have stated that the parasite infection completely disappeared in summer and reappeared in autumn. However, Demirtaş and Altındağ, (2011) [7] recorded infection prevalence for the parasite group at high levels in June while it was found at low levels in autumn. According to Turgut and Özgül (2012) [33], infection values of the metacercariae species in some cyprinid fish species, such as *Leuciscus cephalus*, *Chondrostoma regium*, *Capoeta tinca*, *Capoeta capoeta*, *Barbus plebejus* and *Cyprinus carpio* were recorded at higher levels in spring and autumn than in summer. In the same way as for the present study, the infection values of *C. tinca* were shown in all seasons. For the other two fish species, *B. plebejus* and *C. nasus*, occurrence of the infection was shown only in winter. When the above data are evaluated, the following conclusion can be reached. Parasite fauna on various fish species in different geographical localities, especially those with different limnologic properties, exhibit little homogeneity [16, 25, 27].

Occurrence of *Tylodelphys* infection can be linked to host fish size. In this study, the metacercariae parasite was recorded only in the second group of *B. plebejus*, and in the other two fish species, *C. nasus* and *C. tinca*, it was shown in the first and second groups. However, the infection of parasite species was recorded at the maximum level in older host fish specimens [33]. In connection with these data, it can be suggested that the size of the fish play a significant role in the increase, decrease, or disappearance of the infection of parasite species [3, 18, 19, 22]. Moreover, the special diet of host fish specimens, preferring potential parasite intermediate hosts like freshwater snails, seems to be the main reason for the low or high diversity of their helminth parasite [25].

In the present study, host fish specimens were also divided into two groups according to gender. Both the infection prevalence and the mean intensity of parasites were higher in the male group of *C. nasus* and in the female group of *C. tinca* than the other sex group. Kennedy (1969) [14] emphasized that the density of parasitic infections changes according to the sex and nutrition of fish, and lists some reasons for host fish being infected by parasites. One of them is the variation in the hormonal balance of the fish during the spawning season. The other reason is that females of the host fish species stay on the ground for longer than males and therefore feed on the infected snails in the benthic fauna.

5. Conclusion

In conclusion, *Tylodelphys* sp. infection on the host fish species from Lake Dam Kunduzlar was detected for the first time in this study. Thus, a new locality was added to the geographical distribution of *Tylodelphys* sp. from Turkey, which is located in the south-eastern region of Europe. The present study also contributed to a comparison between the survey area and the data obtained from other localities.

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