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Seasonal Variation of *Diplostomum sp.* Infection in Eyes of *Acanthobrama marmid* Heckel, 1843 in Keban Dam Lake, Elazığ, Turkey

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Özet: ***Keban Baraj Gölü'ndeki (Elazığ, Türkiye)* Acanthobrama marmid *Heckel, 1843 Gözlerinde* Diplostomum sp. *Enfeksiyonunun Mevsimsel Değişimi***. Bu çalışmada, Keban Baraj Gölü'nden avlanan *Acanthobrama marmid*'de Heckel, 1843 *Diplostomum* sp. enfeksiyonunun mevsimsel dağılımı ve yoğunluğu incelendi. Her bir balıktaki ortalama metaserker sayısı 9.09±1.21 olarak bulundu ve metaserker sayısı 1-135 arasında değişim gösterdi. İncelenen balıkların çoğunluğu I yaşında olurken, az sayıda balığın ise V yaşında olduğu belirlendi. Keban Baraj Gölü'nde bulunan *Acanthobrama marmid*'lerde *Diplostomum* sp. enfeksiyonu aylar arasında istatistiksel olarak anlamlı farklılık göstermemesine rağmen ($p<0.05$), en yüksek enfeksiyon yoğunluğu Haziran 1999 ve en düşük yoğunluk ise Mart 1999'da bulundu. Balık ağırlığı ile parazit yoğunlugu arasında olduğu gibi ($r=0.152$), balık yaşı ile parazit yoğunluğu arasında da zayıf bir korelasyon görüldü ($r=0.227$). Enfeksiyon yönünden balığın yaş grupları arasında istatistiksel olarak önemli farklılık görüldü. ($p<0.05$).

Anahtar Kelimeler: *Diplostomum* sp. *Acanthobrama marmid*, enfeksiyon, mevsimsel değişim.

Abstract: In this study, seasonal variation and intensity of *Diplostomum* sp. infection in *Acanthobrama marmid* Heckel, 1843 which caught from Keban Dam Lake were investigated. Overall, the mean number of the metacercariae per fish was 9.09±1.21 and number of metacercariae ranged between 1-135. While, most of the fish examined were one year old, a few number of fish were 5 years old. Although there was no statistically significant differences between the numbers of parasite in monthly examination of *A. marmid* infected with *Diplostomum* sp. ($p>0.05$), the highest intensity of infection occurred in June 1999 and lowest was found in March 1999. There was a weak correlation between age and parasite intensity ($r=0.227$) as well as weight and parasite intensity ($r=0.152$). However, there was statistically significant differences between the age and the number of parasite in the aspects of infection ($p<0.05$).

Key words: *Diplostomum* sp. *Acanthobrama marmid*, infection, seasonal variation

Introduction

Larva which belong to digenea invade the eyes of fish and cause to parasitic disease is called diplostomiasis. Diplostomiasis is in Nort America and Europe (Hoffmann 1967; Esc and Fernandez, 1993). Species of genus *Diplostomum* can be significant pathogens causing a range of disease symptomps (i.e. exophthalmia, local haemorrhage, lens cataract and growth reduction) which may lead to fish mortality (Chappell *et al*. 1994). If the metacercariae comes through to in the lens of the fish, induce cataractous changes in the lens. This lead to partial or total blindness (Whyte *et al*., 1988; William et al., 1989; Owen *et al*., 1993; Plumb and Rogers, 1990; Waadu and Chappell, 1991). Fish act as the second

intermediate host in the life-cycle of the parasite. The definitive host of *Diplostomum* sp. is piscivorous birds. Eggs pass in the feces of the definitive host develop into free-swimming miracidia within 2-3 week. The miracidia goes snails and develop into sporocysts within the hepatopancreas. Daughter sporocysts eventually produce free-swimming cercariae that emerge from the snail and penetrate the second intermediate host which is a fish species (William *et al*., 1989).

Although the seasonal patterns of occurrence and abundance of *Diplostomum* spp. was not studied deeply, only a few studies were carried out by Chappell (1969), Kennedy (1975), Burrough, (1978) and Pennycuick (1971 a,b,c). Occurrence, distribution and seasonal variation of *Diplostomum sp*. in *A. marmid* in Keban Dam Lake was tried to determine in this paper.

Materials and Methods

The fish samples were caught every month with gill nets between January 1999 and November 1999 in Keban Dam Lake, Elazığ Turkey. Number of fish examined, intensity and prevalence of *Diplostomum* sp. (Figure 1) infection are given in Table I. Whole eyes were removed and lens dissected from each eye then teased apart under stage of a 4 and 12 power dissecting microscope. The number of parasite were counted if it is present. All parasites recovered were identified by references to publications by Bychouskaya - Poulovskaya (1964); Hoffman (1967); Kennedy (1974). Weight and fork length of fish were measured and scales are also removed from dorsal of each fish for use in estimating age (Chugnova, 1963). Gender of fish was determined. The picture of parasites found in eyes of fish were taken and fixed in Alcohol-Formalin-Acetic Acid (AFA) (Pritchard and Kruse 1982) . Prevalence and intensity of parasites were determined as explained by Margolis *et al*., (1982).

Differences in monthly intensity of *Diplostomum* sp in *A. marmid* were investigated by the One-way ANOVA. Product Moment Correlation Coefficient was used to test relationships between the parasite intensity and the age of the fish and also between weight of fish and parasite intensity. Chi-square test was used to test relationships between intensity of infection and age groups of fish.

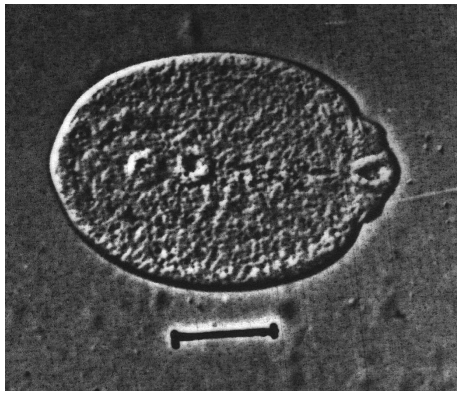

Figure 1. Light micrograph of metacercarial stage of *Diplostomum* sp. in the eyes of *Acanhobrama marmid*. Bar represents 30 μm.

Results and Discussion

The number of infected and uninfected fish in each age groups are given in Figure 2. Most of the fish examined were in I. age group and the least number was in V. Age group. Frequency of *Diplostomum* sp. in eyes of *A. marmid* is also given in Figure 3.

Examinations of the lenses of *A. marmid* usually revealed high numbers of *Diplostomum* sp. metacercariae. Number of *Diplostomum* sp. ranged from 1 to 135. 125 of the 223 *A. marmid* examined

between January 1999- November 1999 had at least 1 metacercariae. Chappell (1967) recorded 231 *D. spathaceum* from the lenses of a six year old roach and Wootten (1974) also recovered 550 metacercariae from a mature rainbow trout. In the study carried out by Chappell (1969), number of eyeflukes exceed 40 per sticleback, moreover, it was revealed that individuals could have more than 200 parasites.

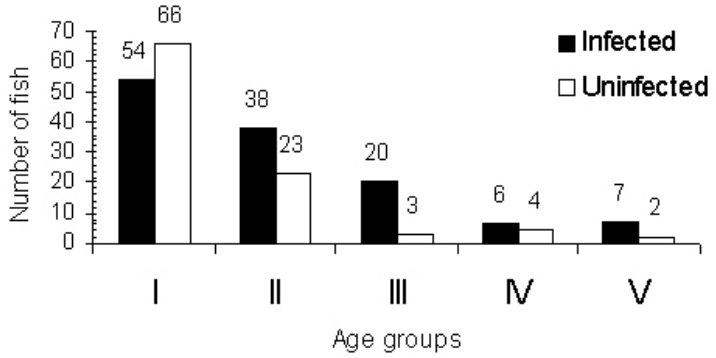

Figure 2. Infection of *Diplostomum* sp. in age groups of *Acanthobrama marmid*.

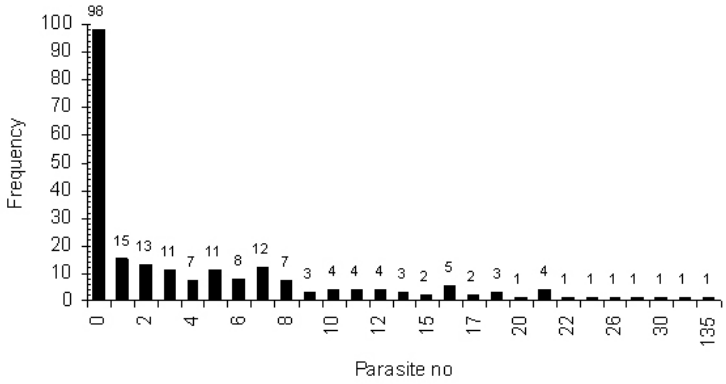

Figure 3. Frequency of *Diplostomum* sp. in the eyes of *Acanthobrama marmid.*

In this study, the mean number of the parasites per fish was 9.09±1.21 and the average estimated age of the fish was 1.77± 0.07 year. There was a weak correlation between age and parasite intensity (r=0.227; Fowler and Cohen, 1992). This shows increase of parasite number by increasing the fish age. But there was no statistically significant correlation between fish weight and parasite intensity (r=0.152) (Fowler and Cohen, 1990).

Statistically significant differences were found between the age groups of fish in the aspects of infection (x^2=17.6, df=4 $p<0.05$). In this study, the lowest percentage of infection was recorded in I. age group (45.0%) and the highest percentage of infection was seen in III. age group (86.9%). It was suggested that *Diplostomum* infection of wild fishes increases with host age (Chappell, 1969); Kennedy, 1984; Pennycuick, 1971c) and according to Kennedy (1981b) this

presumably results both from repeated seasonal exposure to cercariae and to the life-span of the metacercariae. Pennycuick (1971a), Lester (1977), Kennedy (1981a, 1984) suggested that heavily infected fish were lost from the population through either infection with *Diplostomum* or selective predation as a result of infection in the wild. Despite the fact that, there was no statistically significant differences between months in infection of *A. marmid* with *Diplostomum* sp. in Keban Dam Lake (One-Way ANOVA, $F_{11,211}=1.21$, $p>0.05$), the highest intensity of infection occurred in June and lowest was found in March (Table 1). On the contrary to our findings, according to Chappell (1969), Wootten (1974) and Burrough (1978)

Table 1. Intensity and prevalence of *Diplostomum* sp. infection in *A. marmid* in Keban Dam Lake.

Months	No of fish examined	Infected	%	Mean intensity	Abundance	Range
January	15	5	33.3	6.0	2.42	1-13
February	15	13	86.7	13	11.33	1-135
March	17	11	64.7	2.6	0.57	1-7
April	27	13	48.1	9.0	4.37	1-30
May	24	13	54.2	6.07	3.29	2-11
June	21	10	47.6	17.1	2.14	2-8
July	20	10	50	13.3	6.65	5-47
August	20	10	50	15.9	7.95	7-26
September	20	13	65	10.7	6.50	2-21
October	18	9	50	15.0	7.50	7-21
December	22	13	59.1	5.8	3.4	1-11
November	4	3	75	6.3	4.75	3-10

Diplostomum spathaceum and the other eyeflukes showed seasonal pattern of occurrence and abundance in the United Kingdom. In the study conducted by Chappell (1969); incidence of *D. gasterostei* infection in *Gasterosteus aculeatus* was constant in all samples except August incidence was 95% between May to June, however it was sharply decreased to 41% in August. This is attributed to the presence of uninfected young fish in August. Pennyycuick (1971c) also reported that the percentage of infected *G. aculeatus* rose slightly between October and December. It was speculated that as the temperature of the water decreased, heavily infected *G. aculeatus* would be susceptible to predation. Thus, infected fish can be caught more easily than uninfected one. So that density of infected fish would not be found high in cold months

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