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RESEARCH STUDIES ON ANATOMICAL, MORPHOLOGICAL AND PARASITIC CHARACTERISTICS OF *Dactylogyrus vistulae* (PLATYHELMINTHES)

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ABSTRACT

In this study, it was aimed to investigate anatomical, morphological and parasitic specialities of *Dactylogyrus vistulae* on *Squalius cephalus* from Taşoluk Dam Lake, Afyonkarahisar, Turkey. The skin, fins, gills and mouth cavity of 150 *S. cephalus* were investigated in a period between April 2010 and May 2011. A total of 364 *D. vistulae* (32.0%, 7.6±13.9) was found on the gills of host fish. Anatomical and morphological characteristics of the parasite species were described. Minimum-maximum, mean intensity and infection prevalence were determined in relation with season, and age and sex of fish.

Key words: *Dactylogyrus vistulae, Squalius cephalus,* Taşoluk dam lake

Dactylogyrus vistulae (PLATYHELMINTHES)'NIN ANATOMİK, MORFOLOJİK VE PARAZİTİK ÖZELLİKLERİ ÜZERİNE ARAŞTIRMALAR

ÖZET

Bu çalışmayla, Taşoluk Baraj Gölü'ndeki (Afyonkarahisar) *Squalius cephalus* balığında parazit olarak yaşayan *Dactylogyrus vistulae*'nin anatomik, morfolojik ve parazitik özelliklerinin belirlenmesi amaçlandı. Nisan 2010 ile Mayıs 2011 tarihleri arasında temin edilen 150 *S. cephalus*'un deri, yüzgeç, solungaç ve ağız boşluğu *D. vistulae* enfeksiyonu yönünden incelendi. Konak balığın solungaç lamellerinde toplamda 364 adet *D. vistulae* (%32.0, 7.6±13.9) bireyi bulundu. Parazitin morfolojik ve anatomik yapıları tanımlandı. Parazit türüne ait enfeksiyon oranı ile ortalama, minimum ve maksimum enfeksiyon yoğunlukları mevsimlerin yanı sıra konak balığın yaş ve eşey gruplarına göre değerlendirildi.

Anahtar kelimeler: *Dactylogyrus vistulae, Squalius cephalus,* Taşoluk baraj gölü

INTRODUCTION

Fish are one of the significant factor among the aquatic communities and can encounter a series of abiotic factors in habitats where they exist. Parasites are one of these factors that may cause loss of weight, slow growth, abnormalities and even mortality in their hosts, including fish (Dejen et al. 2006). Dactylogyrid parasites may provide up-to-date information about bioecological characteristics of aquatic habitats where they occur (Stojanovski et al. 2010). In the present study, anatomical, morphological and parasitic characteristics of *Dactylogyrus vistulae* were identified and a contribution to the studies describing bioecological structure of the wetland areas was made.

MATERIALS AND METHOD

Fish Material

A total of 150 *S. cephalus* specimens whose lengths varied between 11.4 and 30.8 cm was caught from 1 to 3 m depths of Taşoluk Dam Lake by entangling nets in a period between 14 April 2010 and 14 May 2011. The fishes were transferred alive in plastic containers filled with lake water to a research laboratory of Biology Department, Afyon Kocatepe University.

Fish were kept in aerated aquarium tanks and examined within 24-48 hours.

Parasitic investigation

Fish were examined for parasites according to Pritchard and Kruse (1982). At first, standard lengths of fish were measured. Then, the fins and gills were dissected, placed separately into petri dishes containing physiological water and examined using a stereo microscope. When encountered, place and number of parasites were recorded separately for each fish. Definitions of Bykhovskaya-Pavlovskaya (1962) were followed for the identification of the parasite species. Photographs of parasites were taken via a Tescom micropublisher 3.3 RTV camera mounted on Olympus BX60 light microscope. A statistical software (SPSS 11.5) was used in the evaluation of parasitological data. The parasitological findings obtained were evaluated using the Chi-Square test. ANOVA was used to compare the data obtained according to season, length groups and sex of fish.

RESULTS

A total of 364 *Dactylogyrus vistulae* (Prost 1957) was found on the gills of 48 host fish, corresponding to a infection prevalence of 32.0% and mean parasite intensity of 7.6±13.9.

Anatomical, morphological and parasitic characteristics

Body length and ovary width of *Dactylogyrus vistulae* were measured as 1300-1800 (1650) and 160-240 (215) μm, respectively. Parasite had tentacle-like cephalic glands in the anterior terminal and two pairs of eye spots on the posterior side of these glands (Figure 1). The haptor length was 110-125 (122) μm whereas its width was 127-152 (135) μm (Figure 2). The haptor had 14 lateral and two median hooks. While the distal section of the hook was in the shape of a sharp needle, the proximal section had strong hook roots in the form of two arms. Dorsal root extension was located on the same axis with the hook body. Dorsal and ventral root extension were 10-11 (11) and 41-43 (40) μm respectively while total hook length was 58-60 (59) μm, main body length 23-25 (24) μm, and edge section 12-13 (12) μm. Points of the dorsal connecting bar that interlocks central hooks to each other were elliptical and the central section was in the shape of a thin bar resembling to a wide angled arch. Width and length of this connecting bar were measured as 22-23 (22) and 5-4 (4) μm respectively. There were 7 pairs of lateral hooks on the sides of the haptor. The seventh pair of these hooks was well grown with a length of 42-43 (42) μm. The length of the hook pairs that was equal in terms of shape and length was recorded as 23-24 (24) μm. The pharynx was sub-terminally located on median line in the anterior of the body and measured as 65-76 (73) μm in length and 65-76 (73) μm in width (Figure 1,4). This structure was followed by a short oesophagus. Intestine went down until the haptor level by separating into two branches in the shape of a flat caecum without a lateral branching, and it was ended with a connection at this section.

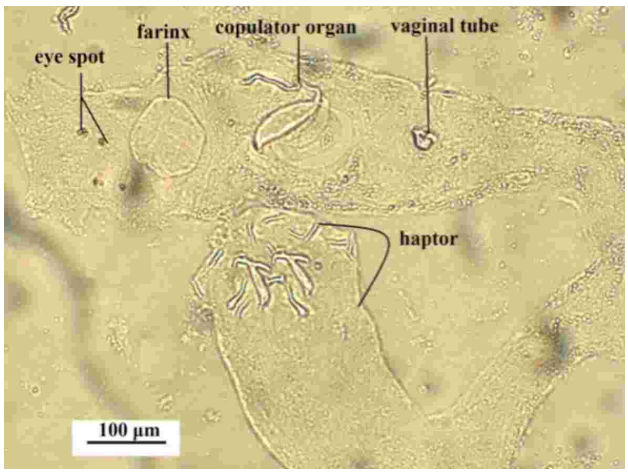

Figure 1. General view of *Dactylogyrus vistulae* (original)

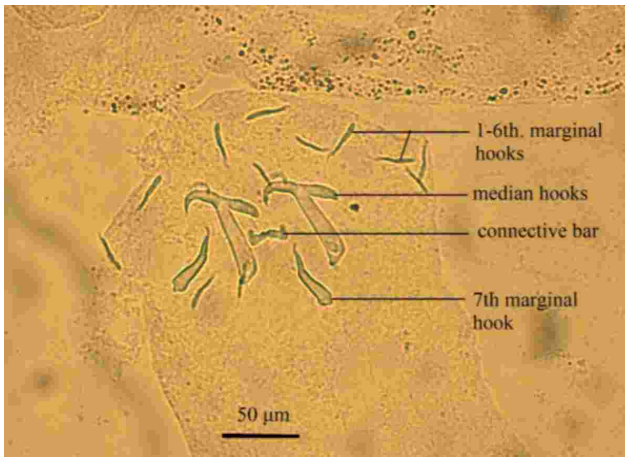

Figure 2. Median and marginal hooks in the haptor of *D. vistulae* (original)

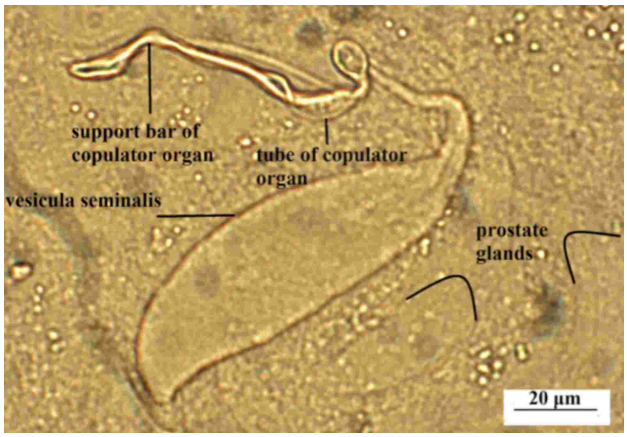

Figure 3. Copulator organ of *D. vistulae* (original)

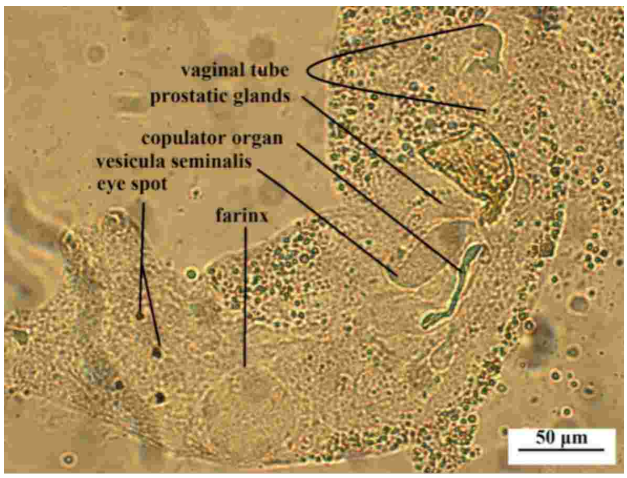

Figure 4. Anatomical characteristics from anterior part of *D. vistulae* (original)

The genital organs were located between the intestine bend. One of these formations was post-ovary positioned and elliptically shaped testes with a size of 95-115 (104) x 65-76 (72) μm. The vas deferens coming out of the testes was attached to elliptical vesicular seminal. This caecum was associated with a chitin-like copulatory organ consisting of the copulator tube and supportive section. The copulator organ was 67-73 (68) μm length (Figure 3). Its tube was spring-shaped, shorter than the supportive structure, and curled evenly on the initial segment. The supportive section, on the other hand, was stretched towards the distal edge of the copulator tube in a form of a strong supportive part. Additionally, the prostatic caecum on both sides of the vesicular seminal was also attached to this organ. The vaginal tube was in the shape of a racket and its distal side was flattened (Figure 4). Total size of this organ was measured as 44-45 (45) x 6-7 (7) μm. Elliptical, non-filament and operculum egg

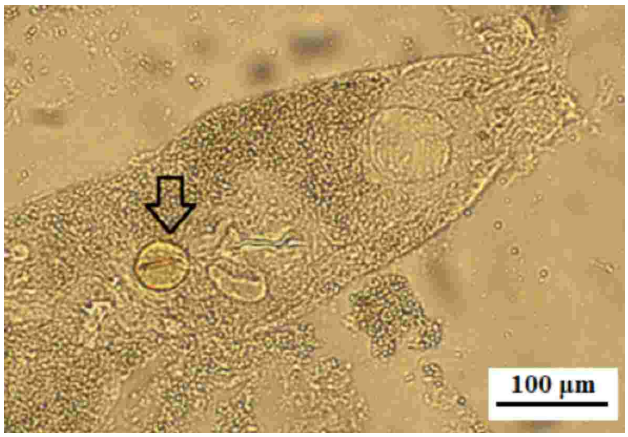

Figure 5. Egg of *D. vistulae* (original)

was measured in size of 50-52 (50) x 45-47 (47) μm (Figure 5).

Parasitological findings according to season, host age and sex

Infection values of parasite species over four seasons are given in Table 1. *D. vistulae* was found in all the seasons. Parasite prevalence reached the highest level in the spring and decreased to the lowest in the autumn. However, the differences between the infection values of *D. vistulae* by the seasons were not significant (P>0.05). Infection values of the parasite by age groups of host fish are given in Table 2. *D. vistulae* was prevalently found in all age groups with a fluctuation. The highest infection prevalence was found in the 3-year age group with 85.7%, the highest mean parasite density was in the 4-year age group with 35 parasite/fish, and the maximum number of parasite recorded was in a fish in the same age group with 97 individuals.

Table 1. Parasitological data according to season

Seasons	Examined Fish Number	Infection parameters	
Spring	42	Infected fish number and (%)	26 (61,9)
		Mean parasite number std. dev	7,3±4,3
		Min.-max. parasite number	1-18
Summer	39	Infected fish number and (%)	10 (25,6)
		Mean parasite number std. dev	13,7±29,6
		Min.-max. parasite number	1-97
Autumn	42	Infected fish number and (%)	4 (9,5)
		Mean parasite number std. dev	3,7±2,8
		Min.-max. parasite number	2-8
Winter	27	Infected fish number and (%)	8 (29,6)
		Mean parasite number std. dev	2,5±0,9
		Min.-max. parasite number	2-4

Table 2. Parasitological data according to host age

Fish age	Examined Fish Number	Infection parameters	
1	92	Infected fish number and (%) Mean parasite number std.dev Min.-max. parasite number	24 (26,0) 5,2±3,3 1 -12
2	45	Infected fish number and (%) Mean parasite number std.dev Min.-max. parasite number	15 (33,3) 6,7±5,5 1 -18
3	7	Infected fish number and (%) Mean parasite number std.dev Min.-max. parasite number	6 (85,7) 4,8±5,6 1-16
4	6	Infected fish number and (%) Mean parasite number std.dev Min.-max. parasite number	3(50) 35,6±53,2 2-97

Table 3. Parasitological data according to host sex

Fish sex	Examined Fish Number	Infection parameters	
Female	112	Infected fish number and (%) Mean parasite number std.dev Min.-max. parasite number	38 (33,9) 7,5±15,4 1-97
Male	38	Infected fish number and (%) Mean parasite number std.dev Min.-max. parasite number	10 (26,3) 7,9±5,1 1-18

Relationships between the sex groups and infection values of the parasite are shown in Table 3. *D. vistulae* was found in 38 (33.9%) of 112 female individuals, and 10 (26.3%) of 38 male fish. Accordingly, infection prevalence of *D. vistulae* was higher in females. Mean parasite density showed a similar tendency, but without differing significantly (P>0.05).

DISCUSSION

General parasitological evaluation

Parasite species studied in the present study, *Dactylogyrus vistulae*, the phylum of Platyhelminthes, differs from other species considering that their vaginal tube is in the shape of racket, and the edge section of supportive tube on the copulator organ is prongy (Bychovskaya-Pavlovskaya et al. 1962). Although parasite fauna of the same fish species remarkably resembles to each other in close habitats, they may differ between distant habitats as underlined by Moravec and Scholz (1991), Sterud and Appleby (1997), Hanzelová et al. (2001), Galli et al. (2001), Galli et al. (2002), Tieri et al. (2006), Dzika et al. (2007), Retief et al. (2007) and Stonajovski et al. (2010) and Djikanovic et al. (2011) reported *Dactylogyrus folkmanovae, D. vistulae* and A. *isoporum* on *L. cephalus*. Aydoğdu (2001) also found *Dactylogyrus folkmanovae*, *D. vistulae* and *Paradiplozoon meganon* on the gills of the same fish species, while Loot et al. (2007) and Kurupınar and Öztürk (2009) found on *D. vistulae*. Stonajovski et al. (2010) found *Dactylogyrus sphyrna, D. folkmanovea, D. vistulae* and *Paradiplozoon ergensi* on the gills of *Leuciscus cephalus albus*. Açıkel (2011) recorded *D. vistulae* and *Gyrodactylus* sp. on *L. cephalus*. However, in the present study *D. vistulae* was the only monogenean recorded on the gills of *L. cephalus*. Here we can say that the similarities and differences between parasite faunas on the host fish living in different habitats could be effected by the host-parasite specificity, and parasite diversity could be defined as the ecological reflexion of habitats (Poulin 2007).

Season, host age and sex effects

D. vistulae, recorded on the gills of the host fish over all seasons during the study, is in direct contact with the outer environment. Kurupınar and Öztürk (2009) conducted a research on the seasonal density of *D. vistulae* and recorded the highest infection rate in the spring. Stonajovski et al. (2010) reported that *D. vistulae* completely disappeared in the autumn and summer seasons but prevalently existed in the spring and winter. Açıkel (2011) reported a similar trend in infection rate of *D. vistulae* on the gills of *L. cephalus*. It can be concluded that *D. vistulae* found on *L. cephalus* in Taşoluk Dam Lake preferred the spring and summer seasons for its survival and hatching. Tieri et al. (2006) attributed the lower density of ectoparasite infection on older fish specimens to their improved immune system. In agreement with this, in the present study, the prevalence of *Dactylogyrus vistulae*, despite seen at all age groups, reached the highest level in the age groups of 3-4 years. Parasitic infection rates may differ between the sex groups of the same host fish (Kennedy 1969). Accordingly, Kurupınar and Öztürk (2009) recorded a higher prevalence of the infection of *D. vistulae* on male *L. cephalus*, but a higher infection density on female. Açıkel (2011) found the infections of the species of *Gyrodactylus* sp. and *D. vistulae* on the gills of *L. cephalus* were higher in female individuals in terms of both prevalence and density. Prevalence and density

of *D. vistulae* in the current study on *L. cephalus* from Taşoluk Dam Lake were higher in female individuals.

CONCLUSIONS

Anatomical, morphological and parasitic characteristics of *Dactylogyrus vistulae* found on the gills of *Leuciscus cephalus* from Taşoluk Dam Lake are described. This is the first record of this parasite species in Taşoluk Dam Lake. Thus, a new locality has been added to the geographical distribution of the parasite species in question. Additionally, changes in infection parameters of the species were evaluated in accordance with the season, age and sex.

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