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# MONOGENEAN TREMATODS OF CHUB *LEUCISCUS CEPHALUS ALBUS* BONAPARTE, 1838 FROM THE LAKE OHRID (MACEDONIA)

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## ABSTRACT

During the parasitological investigations on the gills of *Leuciscus cephalus albus* from Lake Ohrid (Macedonia), are found 4 monogenean species: *Dactylogyrus sphyrna*, *Dactylogyrus folkmanovae*, *Dactylogyrus vistulae* and *Paradiplozoon ergensi*. The total prevalence of infestation is 58,0% and the highest prevalence is of *Dactylogyrus sphyrna* (found in 26,0% of chubs). The average intensity of infestation is 5,50, and the highest level is that of *Paradiplozoon ergensi*. All monogenean species mentioned in this study represents a first record for the fishes from natural lakes in Macedonia, with the exception of *Paradiplozoon ergensi*, previously found in the Lake Ohrid. Among the monogenean species, found out in Lake Ohrid, the greatest pathological influence is associated with *Dactylogyrus vistulae* and *Paradiplozoon ergensi*.

**Keywords:** Monogenea, chub, Lake Ohrid

## Introduction

Lake Ohrid occupies the farthest southwest part of the Republic of Macedonia, while a part of its surface belongs to the Republic of Albania. It is situated on 693 m above sea level. It is one of the biggest European lakes with a surface area of 358,2 km<sup>2</sup> and maximum depth of 288,7 m. It belongs to the category of oligotrophic lakes. The lake is more than 2 millions years old, and it's the oldest lake in Europe. The geographic isolation of the whole West Balkan area, especially Lake Ohrid from the other parts of the Balkan Peninsula and its age, were the primary reasons for maintaining in this region the great number of tertiary fauna remainings. The lake is inhabited by 17 autochthonous species, of which 10 species (60%) are endemic.

Shinzar (16) found *Cyatocephalus truncatus* among 2% of examined belvica (*Salmothymus ohridanus*) and *Metechinorhynchus truttae* in the Ohrid trout (*Salmo letnica*).

He carried out the primarily investigations of the parasite fauna of the Lake Ohrid fishes.

Hristovski (8) and Stojanovski (13) found 9 parasite species at the chub from the Lake Ohrid: *Paradiplozoon ergensi*, *Allocreadium isoporum*, *Ligula intestinalis* (plerocerkoid), *Philometra ovata*, *Raphidascaris acus*, *Contracaecum microcephalum* (larva), *Metechinorhynchus truttae*, *Acanthocephalus anguillae* and *Pomphorhynchus bosnicus*. The highest prevalence was with *Pomphorhynchus bosnicus* (45.0%). The greatest number of parasite specimens was evident in the cases of infection with *Allocreadium isoporum* (19) and *Paradiplozoon ergensi* (18).

Monogenean trematods have a great importance in the fish pathology. Certain species cause very serious diseases of fishes, particularly in the young ones. A great number of monogenean species has very clear speciality to a respective host - fish or a narrow circle of related hosts. Monogenean trematods are presented in a vast number in the environment, because of their being ectoparasites, they are even more

subject to changes of the physical-chemical characteristics of the aquatic habitat, which they have to adjust to. Monogenean trematods could be a sensitive indicator for the changes of the lake' ecosystems, because the data about their prevalence and intensity of infestation, together with the knowledge of the biology of parasites reveal on the health of the environment.

## Materials and Methods

Fish material was sampled over several years, from the Macedonian part of Lake Ohrid. Fishing was carried out by seasons, in the period from spring 2000 to spring 2005.

Fishes were subjected to the routine methods of identification, dissection and observation (6, 7, 14), during that is important the fact that fishes for investigations should be fresh. Cleaned parasites were separated and put in certain fixatives, prepared for determination with determined techniques of staining and clearing.

For an identification of the parasite species we used the following key (1, 7). The most successful preparations for every parasite species are photographed and displayed.

## Results and Discussion

During the parasitological investigations on the gills of *Leuciscus cephalus albus* from Lake Ohrid (Macedonia), are found 4 monogenean species: *Dactylogyrus sphyrna* (Fig. 1), *Dactylogyrus folkmanovae* (Fig. 2), *Dactylogyrus vistulae* (Fig. 3) and *Paradiplozoon ergensi* (Fig. 4).

The total prevalence is 58,0%, i.e. 87 infested fishes of 150 examined. Prevalence with *Dactylogyrus sphyrna* is the highest (26,0%), followed by *Dactylogyrus vistulae* (18,0%), *Paradiplozoon ergensi* (14,67%), whereas the lowest prevalence of infestation was caused by *Dactylogyrus folkmanovae* (11,33%) (Table 1).

The average intensity of infestation is 5,50, and the highest level is that of *Paradiplozoon ergensi* (11,29), followed by *Dactylogyrus sphyrna* (5,06), *Dactylogyrus folkmanovae* (4,25%) and the lowest intensity of infestation was with *Dactylogyrus vistulae* (3,0%).

The highest prevalence and intensity of infestation with monogeneans in the Lake Ohrid' fishes occur during the spring (75,0%), because of the spawning of this cyprinid fish.

**TABLE 1**

Prevalence and intensity of infestation with monogenean trematods of chub *Leuciscus cephalus albus* from the Lake Ohrid (Macedonia)

Parasite species	Season	Prevalence			Mean intensity of infestation by seasons (in relation to the number of infested fishes)
		No. of exam. fishes	No. of infest. fishes	% of infest. fishes	
<i>Dactylogyrus sphyrna</i>	Winter	48	18	37.5	2.29
	Spring	68	19	27.94	6.87
	Summer	30	4	13.33	10.0
	Autumn	4	0	0	0
<b>In total - D. sphyrna</b>		<b>150</b>	<b>39</b>	<b>26.0</b>	<b>5.06</b>
<i>Dactylogyrus folkmanovae</i>	Winter	48	5	10.42	2.0
	Spring	68	12	17.65	5.0
	Summer	30	0		
	Autumn	4	0	0	0
<b>In total - D. folkmanovae</b>		<b>150</b>	<b>17</b>	<b>11.33</b>	<b>4.25</b>
<i>Dactylogyrus vistulae</i>	Winter	48	15	31.25	1.50
	Spring	68	12	17.65	3.50
	Summer	30	0		
	Autumn	4	0	0	0
<b>In total - D. vistulae</b>		<b>150</b>	<b>27</b>	<b>18</b>	<b>3.0</b>
<i>Paradiplozoon ergensi</i>	Winter	48	2	4.17	10.0
	Spring	68	17	25.0	12.33
	Summer	30	3	10.0	2.50
	Autumn	4	0	0	0
<b>In total - P. ergensi</b>		<b>150</b>	<b>22</b>	<b>14.67</b>	<b>0</b>
<b>Totally inf. - winter</b>		<b>48</b>	<b>30</b>	<b>62.50</b>	<b>3.95</b>
<b>Totally inf. - spring</b>		<b>68</b>	<b>51</b>	<b>75.0</b>	<b>6.93</b>
<b>Totally inf. - summer</b>		<b>30</b>	<b>6</b>	<b>0.20</b>	<b>6.25</b>
<b>Totally inf. - autumn</b>		<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>TOTALLY INFESTED</b>		<b>150</b>	<b>87</b>	<b>58.0</b>	<b>5.50</b>

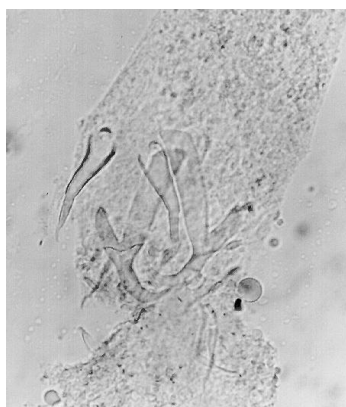


Fig. 1-a. *Dactylogyrus sphyrna* - adhesive disk (original), x 320

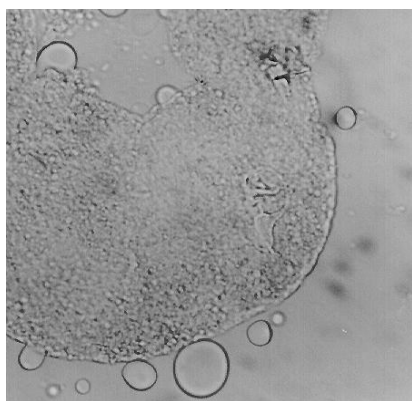


Fig. 1-b. *Dactylogyrus sphyrna* - copulatory organ (original), x 320



Fig. 1-c. *Dactylogyrus sphyrna* - anterior part (original SEM photography)

This conclusion complies with the findings of (17), who, likewise, holds the opinion that maximum prevalence and intensity of parasites occur in the course of a vernal period. Alongside that, he emphasizes 3 factors because of which the female trout are physiologically less resistant to parasites during the spawning period: weaker condition, stress and

disruption in the production of estrogen. Also, after the winter period, which is a latent period, the vernal period provides better conditions for development and reproduction of the parasites, which is mainly why they increase in number (Table 1).

The greatest pathological influence is associated with the monogeneans *Dactylogyrus vistulae* and *Paradiplozoon ergensi*.

The monogenean fauna of *Leuciscus cephalus albus* from the Lake Ohrid is in common with that of the fishes of the family Cyprinidae from the Balkan Peninsula and more widely (1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 14, 15, 18).

All monogenean species mentioned in this study represents a first record for the fishes from natural lakes in Macedonia, with the exception of *Paradiplozoon ergensi*, previously found in the Lake Ohrid by Nedeva-Lebenova (12).

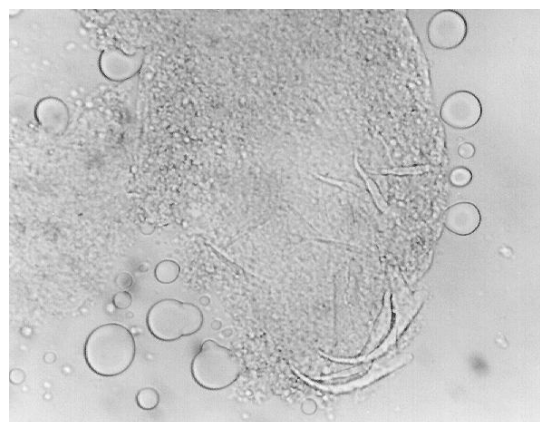


Fig. 2-a. *Dactylogyrus folkmanovae* - adhesive disk (original), x 340

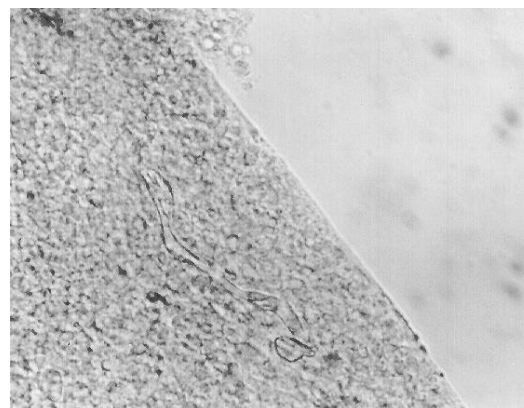
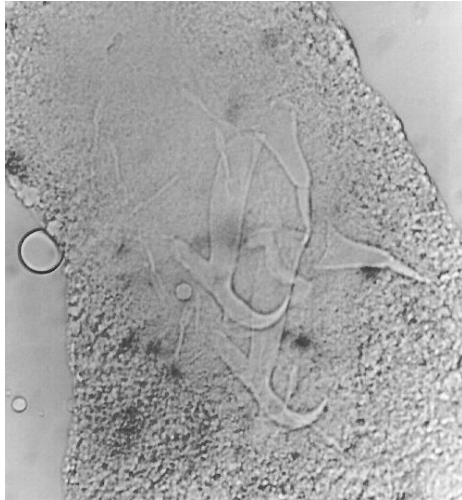


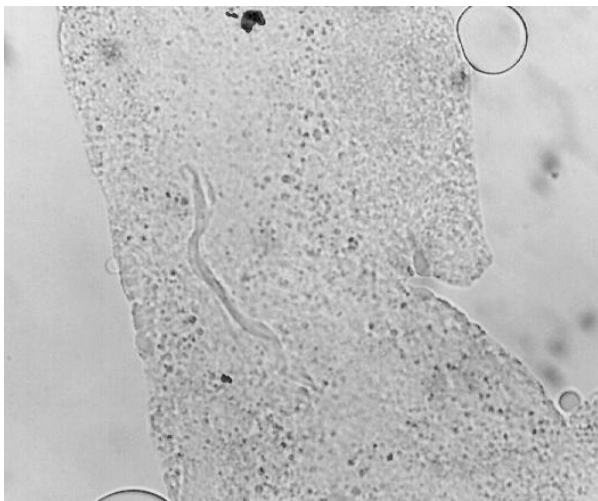
Fig. 2-b. *Dactylogyrus folkmanovae* - copulatory organ (original), x 320



**Fig. 3-a.** *Dactylogyrus vistulae* - adhesive disk (original), x 320



**Fig. 4-b.** *Paradiplozoon ergensi* - egg (original), x 126



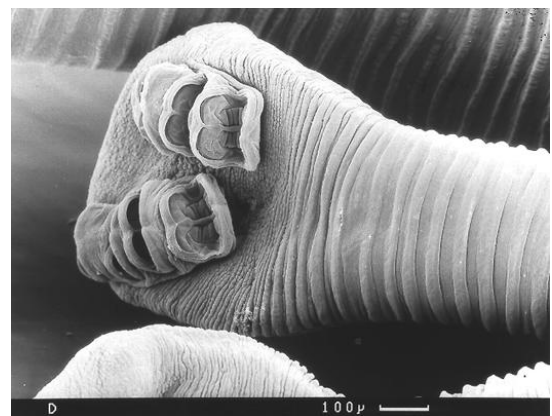
**Fig. 3-b.** *Dactylogyrus vistulae* - copulatory organ (original), x 320



**Fig. 4-c.** *Paradiplozoon ergensi* - suckers (original SEM photography)



**Fig. 4-a.** *Paradiplozoon ergensi* - clamps (original), x 200



**Fig. 4-d.** *Paradiplozoon ergensi* - clamps (original SEM photography)

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