

# Parasite Fauna of Chub (*Squalius squalus* Bonaparte, 1837) from Lake Ohrid (FYRMacedonia)

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**Abstract:** During the parasitological investigations on *Squalius squalus* from Lake Ohrid (FYRMacedonia), 13 parasite species: *Myxobolus müelleri*, *Dactylogyrus sphyrna*, *D. folkmanovae*, *D. vistulae*, *Paradiplozoon ergensi*, *Allocreadium isoporum*, *Ligula intestinalis* (plerocerkoid), *Philometra ovata*, *Raphidascaris acus*, *Contracaecum microcephalum* (larva), *Metechinorhynchus truttae*, *Acanthocephalus anguillae* and *Pomphorhynchus bosniacus* were found. The total prevalence of infestation is 77.87% and the highest prevalence is of *Pomphorhynchus bosniacus* (found in 42.13% of chubs). The average intensity of infestation is 6.51, and the highest level is that of *Allocreadium isoporum* (5.83). Findings of *Myxobolus müelleri*, *Allocreadium isoporum* and *Acanthocephalus anguillae* represent first record for *Squalius squalus* from Lake Ohrid. Among the parasite species found out in chub from it, the greatest pathological influence is associated with *Dactylogyrus vistulae*, *Paradiplozoon ergensi*, *Ligula intestinalis* (plerocercoid), *Metechinorhynchus truttae* and *Pomphorhynchus bosniacus*.

**Key words:** parasite fauna, chub, Lake Ohrid

## Introduction

Lake Ohrid occupies the farthest southwest part of FYRMacedonia. The lake is more than 4 million years old, and it is the oldest lake in Europe. The lake is inhabited by 17 autochthonous species, of which 10 species (60%) are endemic. STOJANOVSKI *et al.* (2010) found 4 monogenean species on the gills of chub from Lake Ohrid: *Dactylogyrus sphyrna*, *D. folkmanovae*, *D. vistulae*, *Paradiplozoon ergensi*,

pared for determination with determined techniques of staining and clearing (VASILJKOV 1983, GUSSEV 1983, STOJANOVSKI 1997, 2003).

For identification of the parasite species we used the following keys: LOM & DYKOVA (1992) and BAUER (1985, 1987). The most successful preparations for every parasite species were photographed and are displayed.

## Materials and Methods

Fish material was sampled over three years, by seasons, from the Macedonian part of Lake Ohrid. Only fresh fish were subjected of routine identification, dissection and observation methods. Cleaned parasites were separated and put in certain fixatives, pre-

## Results and Discussion

During the parasitological investigations on *Squalius squalus* from Lake Ohrid, 13 parasite species: *Myxobolus müelleri*, *Dactylogyrus sphyrna* (Figure 1-a, 1-b, 1-c), *D. folkmanovae* (Fig. 2-a, 2-b), *D. vistulae* (Fig. 3-a, 3-b), *Paradiplozoon ergensi*

(Fig. 4), *Allocreadium isoporum* (Fig. 5), *Ligula intestinalis* (plerocercoid) (Fig. 6), *Philometra ovata* (Fig. 7-a, 7-b), *Raphidascaris acus* (Fig. 8-a, 8-b), *Contracaecum microcephalum* (larva), *Metechinorhynchus truttae* (Fig. 9), *Acanthocephalus anguillae* (Fig. 10) and *Pomphorhynchus bosniacus* (Fig. 11) are found.

The total prevalence is 77.87%, i.e. 183 infested fishes of 235 examined. Prevalence with *Pomphorhynchus bosniacus* is the highest (42.13%), followed by *Dactylogyrus sphyrna* (25.11%) and *D. vistulae* (18,0%), whereas the lowest prevalence of infestation was caused by *Myxobolus müelleri* and *Philometra ovata* (0.43%) (Table 1).

The average intensity of infestation is 6.51, and the highest level is that of *Allocreadium isoporum* (5.83), followed by *D. sphyrna* (4,90) and *D. folkmanovae* (4,08%) and the lowest intensity of infestation was with *Ph. ovata* (1,0).

Among the parasite species, found out in Lake Ohrid, the greatest pathological influence is associated with *D. vistulae*, *P. ergensi*, *L. intestinalis* (plerocercoid), *M. truttae* and *P. bosniacus*.

The parasite fauna of *S. squalus* from Lake Ohrid is in common with that of the fishes of the family Cyprinidae from the Balkan Peninsula and more widely (ERGENS, 1960, 1970 CHANKOVIC *et al.*, 1968, KAKACHEVA-AVRAMOVA 1983, HRISTOVSKI, 1983, BAUER 1985, 1987, DUPONT & LAMBERT 1986, NEDEVA-LEBENOVA 1991, CAKIC 1992, STOJANOVSKI 1997, 2003), etc.), with exception of *M. truttae*, which is found among salmonids.

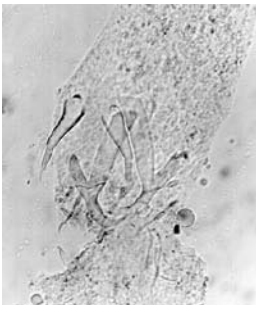
The parasitofauna of *S. squalus* is mostly freshwater, with some elements that are meet both in marine and fresh waters (*R. acus*, *M. truttae* etc.).

One part of established parasites is with wide area of distribution and wide specter of hosts, like: *Allocreadium isoporum*, *Ligula intestinalis*, *Raphidascaris acus*, *Contracaecum microcephalum* (larva), and *Metechinorhynchus truttae*. Other part of established parasites are stenoparasites or on the border of stenoparasitism, like: *Paradiplozoon ergensi*, *Philometra ovata* and *Pomphorhynchus bosniacus*.

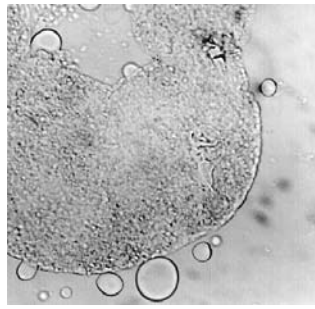
Findings of *M. müelleri*, *A. isoporum* and *A. anguillae* represent first record for *S. squalus* from Lake Ohrid.

**Table 1.** Parasite fauna of chub (*Squalius squalus*) from Lake Ohrid.

Parasite species	Prevalence			Intensity of infection
	No. of examined fishes	No. of infected fishes	% of infected fishes	
<i>Myxobolus müelleri</i>	235	1	0.43	-
<i>Dactylogyrus sphyrna</i>		59	25.11	4.90
<i>Dactylogyrus folkmanovae</i>		26	11.06	4.08
<i>Dactylogyrus vistulae</i>		45	19.15	3.24
<i>Paradiplozoon ergensi</i>		32	13.62	3.97
<i>Allocreadium isoporum</i>		6	2.55	5.83
<i>Ligula intestinalis</i> (plerocercoid)		5	2.13	1.20
<i>Philometra ovata</i>		1	0.43	1.0
<i>Raphidascaris acus</i>		9	3.83	1.78
<i>Contracaecum microcephalum</i> (larva)		35	14.89	1.80
<i>Metechinorhynchus truttae</i>		37	15.75	2.46
<i>Acanthocephalus anguillae</i>		13	5.53	1.62
<i>Pomphorhynchus bosniacus</i>		99	42.13	2.93
<b>Total infection</b>	235	183	77.87	6.51



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



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



**Fig. 1-c.** *Dactylogyrus sphyrna* – anterior part (original SEM photograph) (right).



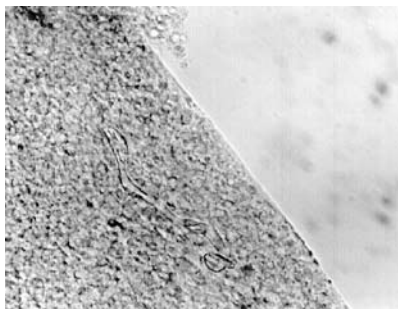
**Fig. 2-a.** *Dactylogyrus folkmanovae* – adhesive disk (original), x 340 (left).



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



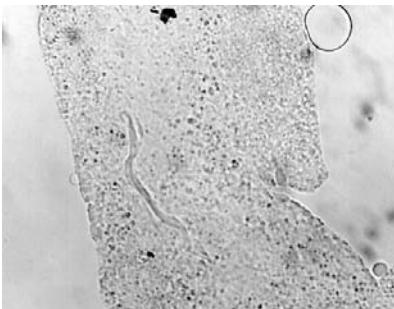
**Fig. 4.** *Paradiplozoon ergensi* (clamps) – original.



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



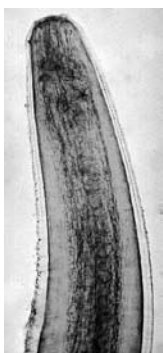
**Fig. 5.** *Allocreadium isoporum* – original.



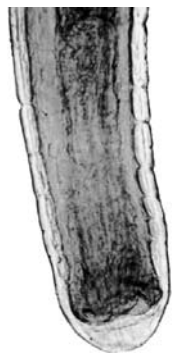
**Fig. 3-b.** *Dactylogyrus vistulae* – copulatory organ (original), x 320 (right).



**Fig. 6.** *Ligula intestinalis* (anterior part of plerocercoid) – original.



**Fig. 7-a.** *Philometra ovata* (anterior part) – original (left).



**Fig. 7-b.** *Philometra ovata* (posterior part) – original (right).



**Fig. 8-a.** *Raphidascaris acus* (anterior end) – original (left).



**Fig. 8-b.** *Raphidascaris acus* (posterior end) – original (right).



**Fig. 9.** *Acanthocephalus anguillae* (proboscis) – original (left).



**Fig. 10.** *Metechinorhynchus truttae* (proboscis) – original (middle).



**Fig. 11.** *Pomphorhynchus bosniacus* (proboscis) – original (right).

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**PART  
II ECOLOGY**

