10.7251/AGRENG1607342

# INTESTINAL PARASITES OF SALMO OHRIDANUS (STEINDACHNER, 1892) FROM OHRID LAKE

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## Abstract

With the aim to investigate the presence of parasites in the gastrointestinal tract of Ohrid belvica (*Salmo ohridanus,* Steindachner, 1892), investigations were conducted on individuals captured in vegetative and reproductive development period of Ohrid belvica, on three localities of Ohrid Lake (located between southwestern Macedonia and eastern Albania): Kalista, Kaneo and Elesec, on depth from 45 to 70 m. Tests were performed on a total of 60 samples with average body mass from 90 to 100 g and average total body length from 217 to 225 mm. It has been established the presence of the following parasites in the gut content of fish: *Cyathocephalus truncatus* (Class Cestoda), *Pseudocapillaria salvelini* and *Salmonema ephemeridarum* (Class Nematoda). *Cyathocephalus truncatus* was present on the locality Kalista, in both stages of the development of Ohrid belvica, and on the locality Elesec only in the reproductive stage. *Pseudocapillaria salvelini* was registered in the samples from locality Kalista and Kaneo in both stages of the development of Ohrid belvica. *Salmonema ephemeridarum* was found in the vegetative stage of Ohrid belvica only in locality Elesec. The presence of parasites was higher during the reproductive phase of development of the Ohrid belvica, i.e during the winter, unlike during the vegetative phase, actually autumn. The highest proportion (100% of the tested fish) of tapeworm *Cyathocephalus truncatus* was found during the reproductive phase of the individuals from the locality Kalista.

**Keywords:** Lake Ohrid, Salmo ohridanus, intestinal parasites

## Introductıon

Ohrid Lake (located between southwestern Macedonia and eastern Albania) is a rare natural phenomenon of tectonic origin, one of the oldest oligotrophic lakes in the world and represents a complex ecological system, where its wildlife takes a special place. According to its geomorphological and biological values it represents a single entity in which there is a preserved part of the old tertiary world, with numerous archaic forms, such as relics and endemics.

Ohrid belvica (*Salmo ohridanus*, Steindachner, 1892) as one of the representatives of "living fossils" represents tertiary relict and endemic trout species belonging to macrostom salmonids and lives only in Ohrid Lake. It is a small endemic trout which represents expressively a lake and depth type of fish. It feeds mainly on zooplankton, and benthic fauna elements.

Primarily investigations of the parasitofauna of Ohrid belvica were carried out by Šinžar (quoted by Blaželković Dimovska, 2013), who found *Cyatocephalus truncatus* among 2% of examined belvica (*Salmo ohridanus* Steindachner, 1892). Hristivski et al. (1999) were found that the most likely, Ohrid belvica was infected with Cyathocephalus truncatus. Blaželković Dimovska et al. (2013) established the following parasites in the intestines of Ohrid belvica: *Nicolla testiobliqua* (Class Trematoda), *Eubothrium salvelini* (Class Cestoda),

*Metechinorhynchus truttae, Metechinorhycchus salmonis, Acanthocephalus anguillae* and *Pomphorhycchus bosniacus* (Class Acanthocephala), of which the most common was *Metechinorhynchus truttae* (12.66%). Ohrid belvica is an insufficiently investigated fish. That was the reason for this investigation.

## Material and methods

Investigations were conducted on fish species of Ohrid belvica (*Salmo ohridanus,* Steindachner, 1892). The samples were captured in the reproductive phase of development of Ohrid belvica, i.e during the winter, the season of natural reproduction of belvica, when most individuals in the population of belvica participate in the natural breeding – spawning and the period of vegetative phase or autumn, on three localities of Ohrid Lake: Kalista, Kaneo and Elesec, on depth from 45 to 70 m. Tests were performed on 10 samples of each locality and each phase of development or a total of 60 fish.

For the purposes of examination (analyzing) the intestinal parasites of Ohrid belvica it has been performed carefully extracting the digestive tract of the fish after cutting the esophagus and rectum. Then, dissection of the digestive tract was performed and with a spatula gut content was removed. Gut content was fixed in 4% formaldehyde and subsequently determination of the components in the gut content was performed, with stereo-zoom microscope SMC 4 and digital color video camera SONY SSC-DC 54AP, using computer software Metric in the laboratory at the Hydrobiological Institute in Ohrid. Parasites were isolated from the gut content and put into a Petri dishes after which followed procedure of their determination.

The determination of the parasites found was according to: Moravec et al. (1991) and Moravec (1994, 2004).

## Results and discussion

The participation of parasites in the digestive tract of the fish during the vegetative and reproductive phase of development of the Ohrid belvica on three localities of Ohrid Lake (Kalista, Kaneo and Elesec) is shown in Table 1.

Table 1. The findings of parasites in the digestive tract of Ohrid belvica in vegetative and reproductive stages of development (n=10)

| Taxon | Vegetative stage | | Reproductive stage | |
|---|---|---|---|---|
| | No. of infected fish | % of infected fish | No. of infected fish | % of infected fish |
| **KALISTA** | | | | |
| Cestoda | | | | |
| *Cyathocephalus truncatus* | 3 | 30 | 10 | 100 |
| Nematoda | | | | |
| *Pseudocapillaria salvelini* | 2 | 20 | 3 | 30 |
| **KANEO** | | | | |
| Nematoda | | | | |
| *Pseudocapillaria salvelini* | 2 | 20 | 6 | 60 |
| **ELESEC** | | | | |
| Cestoda | | | | |
| *Cyathocephalus truncatus* | 0 | 0 | 7 | 70 |
| Nematoda | | | | |
| *Salmonema ephemeridarum* | 4 | 40 | 0 | 0 |

The investigation of the guts of Ohrid belvica showed some presence of parasites in the digestive tract. There were found representatives of the groups Cestoda and Nematoda (Tab.

1). From the group Cestoda it was recorded endoparasite *Cyathocephalus truncatus* (Fig. 1) at the locality Kalista, in both phases of the development of Ohrid belvica, and on the locality Elesec only in the reproductive stage. This parasite was not found in the digestive tract of the samples from the locality Kaneo. The presence of endoparasite *Cyathocephalus truncatus* in the intestines of Ohrid belvica was found by other authors (Šinžar, 1956; Hristovski, 1983; Stojanovski, 1997; Hristovski et al., 1999). *Cyathocephalus truncatus* is widespread in Europe, Asia and North America, in the fish of the families Salmonidae, Thymallidae, Esocidae and others (Čanković et al., 1968).

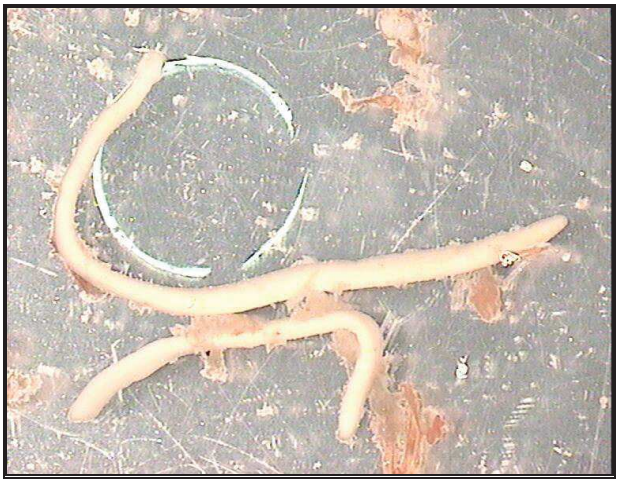

Figure 1. *Cyathocephalus truncatus*

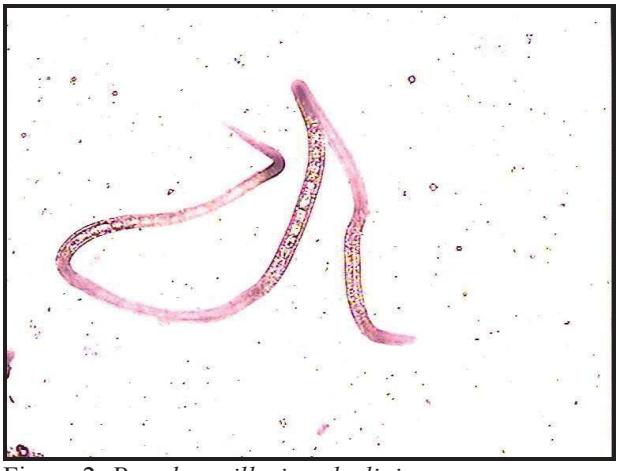

Figure 2. *Pseudocapillaria salvelini*

Figure 3. *Salmonema ephemeridarum*

In the digestive tract of Ohrid belvica was found the presence of two nematode among individuals collected from all three investigated localities. The first was *Pseudocapillaria salvelini* (Polyansky, 1952) from the family Capillariidae (Fig. 2), the only capillarid known from the intestine of European salmonids. It was registered in samples from Kalista and Kaneo localities in both phases of the development of Ohrid belvica (Tab. 1). *Pseudocapillaria salvelini* is a holarctic species widespread in palearctic Eurasia and North America, where it occurs in many species of various salmonids (Salvelinus, Salmo, Brachymystax, Hucho, Stenodus, Oncorhynchus, Thymallus). It was also found in the countries of the former Yugoslavia (Bosnia and Herzegovina, Montenegro) (Moravec, 1994). We could not find evidence that this parasite has been found so far in the digestive tract of Ohrid belvica.

Second isolated nematode was *Salmonema ephemeridarum* (Linstow, 1872) (Fig. 3), with synonymous *Cystidicoloides tenuissima* (Zeder, 1800). It was found in the digestive tract of the samplaes in the vegetative stage from locality Elesec. This parasite in Ohrid belvica for the first time was registered in 1999 (Hristovski et al. 1999). It is a parasite in the digestive tract of holarctic salmonid fish species (Moravec, 1994, 2008; Poulin, 2007).

Varying degree of infection of Ohrid belvca with parasites in the different localities and stages of development was probably due to the different population densities of the Ohrid belvica population and the presence of the intermediate hosts. In larger grouping of fish, the number of parasites present in the digestive tract is greater and vice versa. Lake-dwelling salmonid fish species are known to host several food-transmitted parasites (Kristoffersen, 1993; Knudsen and Klemetsen, 1994; Curtis, 1995; Curtis et al., 1995; Knudsen et al., 1997), some of them having amphipods (*Gammarus lacustris*, *Gammarus pulex*) as their intermediate host (Knudsen, 1995; Amundsen et al., 2003; Atrashkevich et al., 2005; Franceschi et al., 2007).

## Conclusion

Based on the research (analysis, investigations) of the intestinal contents of Ohrid belvica (*Salmo ohridanus*, Steindachner, 1892) from three different localities of the Ohrid Lake (Kalista, Kaneo and Elesec) during the vegetative and reproductive stage, it might be concluded that in the gut contents were present the following parasites: *Cyathocephalus truncatus* (Class Cestoda), *Pseudocapillaria salvelini* and *Salmonema ephemeridarum* (Class Nematoda).

*Cyathocephalus truncatus* was present on the locality Kalista, in both stages of the development of Ohrid belvica, and on the locality Elesec only in the reproductive stage. *Pseudocapillaria salvelini* was registered in the samples from locality Kalista and Kaneo in

both stages of the development of Ohrid belvica. *Salmonema ephemeridarum* was found in the vegetative stage of Ohrid belvica only in locality Elesec.

The presence of parasites was higher during the reproductive phase of development of the Ohrid belvica, i.e during the winter, the season of natural reproduction of belvica, when most individuals in the population of belvica participate in the natural breeding - spawning, unlike the period of vegetative phase or autumn.

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