BIOLOGICAL SCIENCES, BIOMECHANICS

LARVAL TREMATODE INFECTIONS IN FRESHWATER SNAILS
 VIVIPARUS VIVIPARUS, LYMNAEA STAGNALIS & PLANORBARIUS
 CORNEUS FROM THE OREDEZH RIVER AND THE PARK ZONE
 OF ST. PETERSBURG

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A bstract

The article presents generalized data of research of the trematode fauna in mollusks *Lymnaea stagnalis*, *Planorbarius corneus* and *Viviparus viviparus* from the reservoirs of the park zone of St. Petersburg and the Oredezh reservoir for 2014, 2015 and early 2016.

Keywords: *Lymnaea stagnalis*, *Planorbarius corneus*, *Viviparus viviparus*, Trematoda, Mollusca, Snail, Larval Trematoda, Cercariae.

Introduction

To view the state of health of the population of the country or its individual region can be on the situation with parasitic diseases. The problem of helminthiasis as a part of parasitic diseases has not yet received its final solution in any part of the globe.

Parasitic organisms are found in virtually all aquatic and terrestrial ecosystems. By interacting with the organisms of intermediate and definitive hosts, they affect the species composition and bioproductivity of biocenoses.

Among the parasites of humans and animals, the trematode should be specially noted as a unique object of research with a complex life cycle.

To monitor the spread of trematodes, it is necessary to have an idea of the morphology, systematics, biology and ecology of parasites. Life cycle of trematodes consists of several stages, which sometimes take up to four hosts with a change, which is why the complexity of their study is related. The territory of St. Petersburg and the Leningrad region is rich in fresh water bodies, whose beaches are a popular vacation spot for residents of the city in summer. In the region, all the components of the life cycle of trematodes are present, among which mollusks are the first and indispensable intermediate host. In this connection, the study of the trematode fauna in the reservoirs of the recreational zones of St. Petersburg and the Leningrad Region is of great interest.

Since the sexually mature and parthenogenetic generations of trematodes are

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currently the most studied the actual object of research are cercariae – free-floating larvae of the hermaphrodite generation of trematodes.

The first stage of our work was the study of the species composition of mollusks in the study areas, as well as the identification of the main hosts of trematodes among them and the species of mollusks that was least studied in this matter.

For what it was laid 10 stations: three of them in the park zone of St. Petersburg and seven on the 5-kilometer stretch of the Oredezh River.

Initial collection showed the presence of the following species of mollusks in water bodies (by stations):

Table 1

Malakofauna reservoirs (by stations)

Stations number	Molluscs
Station 1	<i>Lymnaea stagnalis</i> ; <i>Planorbarius corneus</i>
Station 2	<i>Viviparus viviparus</i>
Station 3	<i>Viviparus viviparus</i> ; <i>Planorbarius corneus</i> ; <i>Lymnaea stagnalis</i> ; <i>Anodonta cygnea</i>
Station 4	<i>Lymnaea stagnalis</i> ; <i>Planorbarius corneus</i> ; <i>Lymnaea auricularia</i> ; <i>Lymnaea palustris</i>
Station 5	<i>Lymnaea stagnalis</i> ; <i>Planorbarius corneus</i>
Station 6	<i>Lymnaea stagnalis</i> ; <i>Planorbarius corneus</i> ; <i>Anodonta cygnea</i>
Station 7	<i>Lymnaea stagnalis</i> ; <i>Planorbarius corneus</i> ; <i>Viviparus viviparus</i> ; <i>Bithynia tentaculata</i>
Station 8	<i>Lymnaea stagnalis</i> ; <i>Planorbarius corneus</i>
Station 9	<i>Lymnaea stagnalis</i> ; <i>Viviparus viviparus</i> ; <i>Bithynia tentaculata</i> ; <i>Anodonta cygnea</i>
Station 10	<i>Lymnaea stagnalis</i> ; <i>Planorbarius corneus</i>

Lymnaea stagnalis is a dominant in the reservoirs of the Oredezhsky basin; Subdominant – *Planorbarius corneus*. Both these species were also present in the investigated reservoirs of the recreational zones of St. Petersburg.

Viviparus viviparus mollusks were found both at the stations of the Oredezh reservoir and in the reservoir of the park zone of St. Petersburg, and in this pond this type of mollusks is an absolute dominant.

The results of previous studies on the parasitofauna of pulmonary mollusks have shown that the main hosts of parasites are lithophilic mollusks that live in the littoral of rivers, and among them – mollusks of the families Lymnaeidae and Planorbidae. As for mollusks of the Oredezh reservoir, there is an advantage over infection in *Lymnaea stagnalis* and *Planorbarius corneus*. [12, p.92]

Currently, *Viviparus viviparus*, as an intermediate host trematode, is one of the least studied, which causes a legitimate interest in its study.

Material and methods

Material for this work was collected from June to August 2014, and from June 2015 to March 2016 in still and slightly flowing water bodies of St. Petersburg and Leningrad region.

A total of 2330 mollusks were examined. Of these: *Lymnaea stagnalis* – 550 pieces, *Planorbarius corneus* – 955 pieces and mollusks *Viviparus viviparus* – 825 pieces. It is noteworthy that 5 pieces of *Planorbarius corneus* collected in March 2016 were found in the pond of the park zone of St. Petersburg for the

first time in 2 years of searches (in 2014 and 15 years no instances were found).

Mollusks were sampled with a strainer, scoop-net or hand picked on shores. In the laboratory, they were separated into glass containers with tap water (100 ml).

Shedding of cercariae was stimulated by light and heat for 6-8 hours. After checking for infection, and lack of emission of cercariae, the mollusks were deposited in crystallizers or aquariums of different volume with plants and water from the pond. After some time, the mollusks again settled in vessels with clean water for repeated observations. Afterwards, all of the mollusks were dissected to detect larval stages other than cercariae.

The internal morphology of cercariae was documented by drawings with aid of a drawing apparatus. Neutral red and Nile blue were used for vital staining; urine solution was used to study the excretory system of cercariae. For measurements, cercariae were fixed in hot 4 % formaldehyde solution. In each case, 10 cercariae were measured.

Cercariae were identified with help of publications of Skryabin (1947-1978), Combes (1980).

Results

After studying the species composition of the mollusks in the study areas and identifying the main hosts of trematodes (*Lymnaea stagnalis*, *Planorbarius corneus*) and the least known species of gastropods (*Viviparus viviparus*), we managed to identify 24 different species of cercariae in them, as well as identify a part of them completely, the rest – up to the family. Of the 24 species of cercariae found, 22 belong to 6 families; 2 with an unclear systematic position, namely:

Table 2

List of larvae of trematodes found in three investigated species of mollusks

<i>Planorbarius corneus</i>	<i>Lymnaea stagnalis</i>	<i>Viviparus viviparus</i>
Cem. Notocotylidae Lühe, 1909		
<i>Notocotylus</i> sp. I		
<i>Notocotylus attenuatus</i> (<i>Rudolphi</i> , 1809) <i>Kossack</i> , 1911	<i>Notocotylus attenuatus</i> (<i>Rudolphi</i> , 1809) <i>Kossack</i> , 1911	
<i>Notocotylus</i> sp. II	<i>Notocotylus</i> sp. II	
Cem. Echinostomatidae Dietz, 1909		
<i>Hypoderaeum conoideum</i> (<i>Bloch</i> , 1782) <i>Dietz</i> , 1909	<i>Hypoderaeum conoideum</i> (<i>Bloch</i> , 1782) <i>Dietz</i> , 1909	<i>Hypoderaeum conoideum</i> (<i>Bloch</i> , 1782) <i>Dietz</i> , 1909
<i>Echinostoma revolutum</i> (<i>Froelich</i> , 1802) <i>Looss</i> , 1899	<i>Echinostoma revolutum</i> (<i>Froelich</i> , 1802) <i>Looss</i> , 1899	
<i>Echinoparyphium recurvatum</i> (<i>Linstow</i> , 1873)	<i>Echinoparyphium recurvatum</i> (<i>Linstow</i> , 1873)	
<i>Echinoparyphium aconiatum</i> <i>Dietz</i> , 1909	<i>Echinoparyphium aconiatum</i> <i>Dietz</i> , 1909	<i>Echinoparyphium aconiatum</i> <i>Dietz</i> , 1909
	<i>Cercaria limbifera</i> <i>Seifert</i> , 1926	
Cem. Strigeidae Railliet, 1919		
<i>Apatemon gracilis</i> (<i>Rudolphi</i> , 1819) <i>Szidat</i> , 1928		

Table 2

Planorbarius corneus	Lymnaea stagnalis	Viviparus viviparus
	Apatemon cobitidis cobitidis (Linstow, 1890) Vojek, 1964	
	Apatemon sp.	
	Cotylurus sp.	
	Cem. Diplostomatidae (Poirier, 1886)	
	Diplostomum spathaceum (Rudolphi, 1819) Braun, 1893	
Cercaria sp. I		
	Cem. Cyathocotylidae Poche, 1925	
		Cyathocotylus sp. I
		Cyathocotylus sp. II
		Cyathocotylus sp. III
	Cem. Plagiorchidae Luhe, 1901	
		Plagiorchis sp. I
		Plagiorchis sp. II
		Plagiorchis sp. III
	Plagiorchis sp. IV	
	Cercaria sp. II	
	Cercariae an unclear systematic position	
		Furcocercaria sp.
		Leucochloridiummorpho sp.

Discussion

The most vulnerable to infection were the mollusks *Lymnaea stagnalis* and *Viviparus viviparus*, in which 13 and 10 species of cercaria of trematodes were found, respectively, of 24, which we detected during the study. There are 9 species of cercariae found in mollusks of *Planorbarius corneus*.

Moreover, the forebrain mollusk *Viviparus viviparus* was susceptible to infection in the reservoir of the park zone of St. Petersburg, while the collected and studied mollusks from the Oredez River during the studies showed no cases of invasion.

In general, the collected and analyzed material on the contamination of mollusks in biotopes, characterized by different hydrobiological and ecological conditions, is consistent with the literature data on the dependence of invertebrate infection of trematodes on their habitat.

The analysis of the material collected by us for 2 consecutive years showed that in the flooded water bodies of the Oredez River the locality in the infection of mollusks is distinct and characterized by the repetition of foci at the same points in the reservoir from year to year. We found several such trematodes.

In conclusion, it should be noted that the vast majority of trematodes, which we were able to identify in mollusks, are parasites of birds, especially ducks, which nest in large numbers and feed in the water bodies of St. Petersburg and the suburbs. Due to the fact that ducklings are migratory birds, they are able to spread tremor infections over considerable distances.

According to the extent of invasion, the absolute leader is *Leucochloridiummorpho* sp., Presumably a representative of the family *Leucochloridiidae*. It can be assumed that the chemical contamination of the investigated reservoir is

the reason for the decrease in immune responses in the organisms of freshwater malacofauna and, as a consequence, the high degree of invasiveness of mollusks by the cercariae of trematodes.

Also the extent of invasion is high in representatives of the families Cyathocotylidae, Plagiorchiidae, and also Echinostomatidae.

Conclusion

1. In the study of the Oredezh reservoir, the following species composition of mollusks is established in the study areas: *Lymnaea stagnalis*; *Planorbarius corneus*; *Lymnaea auricularia*; *Lymnaea palustris*; *Anodonta cygnea*; *Viviparus viviparus*; *Bithynia tentaculata*.

In the study of a reservoir located in the park zone of St. Petersburg, the following mollusks are established: *Anodonta cygnea*; *Viviparus viviparus*; *Lymnaea stagnalis*; *Planorbarius corneus*.

2. Species – dominant in the reservoirs of the Oredezhsky basin *Lymnaea stagnalis*, subdominant – *Planorbarius corneus*. Both these species were also present in the investigated reservoir of the recreational zone of St. Petersburg. *Viviparus viviparus* mollusks were found both in separate stations of the Oredezh reservoir and in the reservoir of the park zone of St. Petersburg, and in this pond this type of mollusks is an absolute dominant.

3. The main hosts of trematodes among the above-mentioned species of mollusks are *Lymnaea stagnalis*; *Planorbarius corneus*. The species of mollusks, *Viviparus viviparus*, is the least studied in this matter.

4. In the study of mollusks *Lymnaea stagnalis*, *Planorbarius corneus* and *Viviparus viviparus*, 24 species of cirraria of trematodes were found, 22 of which belong to 6 families and 2 to an unclear systematic position, namely:

5. The vast majority of cercariae of these species at the marita stage are parasites of birds. According to the extent of infestation, the absolute leader is *Leucochloridium morpha* sp., And the extent of invasion in representatives of the families Cyathocotylidae, Plagiorchiidae, and Echinostomatidae is also high.

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