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Features of the parasite fauna of fish in extreme conditions of the Samur-Absheron canal

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Abstract

In 2011-2014 a parasitological study of 312 fish belonging to 11 species caught in three sections of the Samur-Absheron Canal was carried out. Without a doubt, the parasitic fauna of fish of the canal was formed exclusively by species that came here from the Samur River. It was determined that in this watercourse in the direction from upper part to the down part there is a clear tendency to the reduction of the number of species of the fish parasite and a decrease in the degree of infestation of fish with parasites. It can be assumed, that some of the parasites, in particular, the species, poorly adapted to the rapid flow infect fish in the Samur River, and only after that they are brought by fish in the canal. For this reason, these parasites are found by us only in the upper reaches of the canal.

Keywords: Fish, parasites, canal, River, Azerbaijan

1. Introduction

The Samur-Absheron Canal (195 km long) takes its beginning from the Samur River that flows by the border of Azerbaijan and Russia, and, crossing the entire Northeast Azerbaijan, reaches the large Jeyranbatan Reservoir. For the most part of the canal, water moves by gravity, but at the its end this watercourse its level becomes lower than the level of the reservoir, therefore at this place the water from the canal to the Jeyranbatan Reservoir is pumped by powerful pumps. Some hydrobionts are carried by rapid water flow from the canal into the reservoir, but no any fish or invertebrate can swims against the strong stream and enter the canal from the reservoir. The bottom of the canal in its greater part is covered with concrete slabs that prevent the strong development of benthos (Fig. 1). Together with a high flow velocity (up to 5 m³/sec.) this makes the extreme living conditions for fish and many other aquatic organisms. Despite the extreme conditions of this watercourse, eleven species of fish of two families – Cyprinidae and Poeciliidae live here. However prior to our research, the parasites of fish of the Samur-Absheron Canal have not been studied. In this regard, the purpose of our research was to identify the complete fauna of the parasites of fish of this watercourse and to study the characteristics of the distribution of ichthyoparasites throughout its length.



Fig 1: General view of the Samur-Absheron Canal. There are concrete slabs covering the bottom of this watercourse

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2. Material and Methods

In 2011-2014 we carried out a parasitological study of fish caught in three sections of the Samur-Absheron Canal: the

upper section – near the Samur River, middle section – near the Siyazan settlement, lower section – near the Jeyranbatan reservoir (Fig. 2).



Fig 1: Map of the area of our research (▲ - the points of parasitological dissections).

By the method of complete parasitological dissection [4, 5, 9, 11] we studied 312 fish belonging to 11 species (Table 1). Due to the uneven distribution of fish species along the whole length of the canal, Caspian roach, oriental chub, chanari barbel, schneider, carp and mosquito fish were studied in all three

sections, Caucasian gudgeon and Caucasian bleak – in the upper and middle sections, crucian carp – in the upper and the lower sections, and Terek nase and Terek barbel – only in the upper section.

Table 1: The number of fish that we subjected to parasitological autopsies in different sections of the Samur-Absheron Canal

Fish species	Top section	Middle section	Lower section
Caspian roach – <i>Rutilus rutilus caspius</i>	15	14	12
Oriental chub – <i>Leuciscus cephalus orientalis</i>	15	15	15
Terek nase – <i>Chondrostoma oxyrhynchum</i>	17	-	-
Caucasian gudgeon – <i>Gobio ciscaucasicus</i>	15	13	-
Terek barbel – <i>Lusibarbus ciscaucasicus</i>	30	-	-
Chanari barbel – <i>L. capito</i>	14	18	15
Caucasian bleak – <i>Alburnus charusini charusini</i>	19	14	-
Schneider – <i>Alburnoides bipunctatus eichwaldi</i>	17	15	15
Carp – <i>Cyprinus carpio</i>	16	15	15
Crucian carp – <i>Carassius auratus gibelio</i>	15	-	19
Mosquito fish – <i>Gambusia affinis affinis</i>	15	14	22
Total	188	118	113

All the organs and tissues of fish subjected to parasitological dissection were examined. Flagellates were fixed on degreased glass slides, fixed with methyl alcohol, then stained with azure-II-eosine (Giemsa stain). The infusors were dried on glass slides and then impregnated with silver nitrate. Permanent preparations in glycerol-gelatin were made from myxosporeans and monogeneans. Trematodes, nematodes, acanthocephales and crustaceans were enclosed in test tubes with a 70% solution of ethanol and delivered to the stationary laboratory at the Baku State University for subsequent cameral processing and identification.

3. Results and Discussion

As a result of our research, 57 species of parasites that belong to different taxonomic groups of the animal kingdom were found. As can be seen from the data presented in the table 2, 56 species of ichthyoparasites were noted in the upper course of the Samur-Absheron, 46 species – in the middle course, and 39 species – in the lower course. Of them, mixosporeans *Myxidium macrocapsulare*, *Zschokkella nova*, *Chloromyxum fluviatyle*, *Myxosoma branchiale*, *Myxobolus bramae*, *M. cyprini*, *M. ellipsoides*, *M. muelleri*, and *M. musculi*, infusorians *Chilodonella hexastica*, *C. piscicola*, *Ichthyophthirius multifiliis*, *Trichodina nigra*, and

Trichodinella epizootica, monogeneans *Dactylogyrus affinis*, *D. caucasicus*, *D. crucifer*, *D. extensus*, *D. jamansajensis*, *D. kulwieci*, *D. linstowi*, *D. nanoides*, *D. sphyrna*, *D. turaliensis*, *D. vastator*, *G. katharineri*, *Paradiplozoon homoion* and *P. schulmani*, trematodes *Asymphyldora imitans*, *Phyllodistomum elongatum*, *Allocreadium isoporum*, *Diplostomum chromatophorum*, *D. paraspathaceum*, *Posthodiplostomum cuticola*, and *Clinostomum complanatum*, nematodes *Capillaria tomentosa*, *Rhabdochona denudata* and *Rh. gnedini*, crustacean *Lamproglena compacta* were found in all three sections of the canal; infusorian *Apiosoma companulatum*, monogeneans *Dactylogyrus cryptomeres*, *D. fraternus*, *D. parvus* and *Gyrodactylus gracilihamatus*,

acanthocephalen *Pomphorhynchus laevis* – in the upper and middle sections; flagellates *Cryptobia branchialis* and *Costia necatrix*, mixosporean *Sphaerospora carassii*, infusorian *Apiosoma piscicolum*, monogenean *Dactylogyrus chondrostomi*, castodes *Ligula intestinalis*, and *Paradilepis scolecina*, nematodes *Contraecaecum microcephalum* and *C. spiculigerum*, crustaceans *Lernaea cyprinacea* and *Argulus foliaceus* – only in the upper section; infusorian *Trichodina rectangli* – only in the middle section of the canal. Among the parasites of the fish of this watercourse, there were no species that were recorded in the lower section and were not found in the upper or middle sections.

Table 2: The distribution of parasites of fish by the different sections of the Samur Absheron Canal

Species of parasites	Top section	Middle section	Lower section
<i>Cryptobia branchialis</i>	+	-	-
<i>Costia necatrix</i>	+	-	-
<i>Myxidium macrocapsulare</i>	+	+	+
<i>Zschokkella nova</i>	+	+	+
<i>Sphaerospora carassii</i>	+	-	-
<i>Chloromyxum fluviatile</i>	+	+	+
<i>Myxosoma branchiale</i>	+	+	+
<i>Myxobolus bramae</i>	+	+	+
<i>M. cyprini</i>	+	+	+
<i>M. ellipsoides</i>	+	+	+
<i>M. muelleri</i>	+	+	+
<i>M. muscoli</i>	+	+	+
<i>Chilodonella hexastica</i>	+	+	+
<i>C. piscicola</i>	+	+	+
<i>Ichthyophthirius multifiliis</i>	+	+	+
<i>Apiosoma companulatum</i>	+	+	-
<i>A. piscicolum</i>	+	-	-
<i>Trichodina nigra</i>	+	+	+
<i>T. rectangli</i>	-	+	-
<i>Trichodinella epizootica</i>	+	+	+
<i>Dactylogyrus affinis</i>	+	+	+
<i>D. caucasicus</i>	+	+	+
<i>D. chondrostomi</i>	+	-	-
<i>D. crucifer</i>	+	+	+
<i>D. cryptomeres</i>	+	+	-
<i>D. extensus</i>	+	+	+
<i>D. fraternus</i>	+	+	-
<i>D. jamansajensis</i>	+	+	+
<i>D. kulwieci</i>	+	+	+
<i>D. linstowi</i>	+	+	+
<i>D. nanoides</i>	+	+	+
<i>D. parvus</i>	+	+	-
<i>D. sphyrna</i>	+	+	+
<i>D. turaliensis</i>	+	+	+
<i>D. vastator</i>	+	+	+
<i>Gyrodactylus gracilihamatus</i>	+	+	-
<i>G. katharineri</i>	+	+	+
<i>Paradiplozoon homoion</i>	+	+	+
<i>P. schulmani</i>	+	+	+
<i>Ligula intestinalis</i>	+	-	-
<i>Paradilepis scolecina</i>	+	-	-
<i>Asymphyldora imitans</i>	+	+	+
<i>Phyllodistomum elongatum</i>	+	+	+
<i>Allocreadium isoporum</i>	+	+	+
<i>Diplostomum chromatophorum</i>	+	+	+
<i>D. paraspathaceum</i>	+	+	+
<i>Posthodiplostomum cuticola</i>	+	+	+
<i>Clinostomum complanatum</i>	+	+	+
<i>Capillaria tomentosa</i>	+	+	+
<i>Rhabdochona denudata</i>	+	+	+
<i>Rh. gnedini</i>	+	+	+

<i>Contracaecum microcephalum</i>	+	-	-
<i>C. spiculigerum</i>	+	-	-
<i>Pomphorhynchus laevis</i>	+	+	-
<i>Lamproglena compacta</i>	+	+	+
<i>Lernaea cyprinacea</i>	+	-	-
<i>Argulus foliaceus</i>	+	-	-

Over the entire length of the canal upstream, each species of ichthyoparasites was, as a rule, noted by us on a greater number of fish species, and the fishes were more strongly infected than it was downstream. So, myxosporean *Chloromyxum fluviatile* in the upper section of the canal was found in the bleak, carp and crucian carp, in the middle section – in the bleak and carp, and in the lower section – only in the crucian carp. In the upper section, the extensiveness of infection of fish to these parasites was in the range of 10.1-12.5%, and in the middle and lower sections it was significantly lower – 10.1-12.5% and 10.5% respectively. Myxosporean *Myxosoma branchiale* in the upper section of the canal was found in the Terek barbel and chanari barbel, but in the middle and lower sections, due to the absence of the Terek barbel there, it is noted only in the chanari barbel. The extensiveness of infection with this parasite in the upper section was 27.8-33.3%, in the middle section – 27.8%, and in the lower section – 33.3%. *Myxobolus bramae* in the upper section of the canal is registered in the roach, nase, Terek barbel, barbel, chanari barbel and carp, in the middle section – in a roach, chanari barbel and carp, in the lower section – in roach, chanari barbel, schneider and carp. The extensiveness of infection of various fishes with this parasite in the upper section was within 11.8-42.8%, in the middle section – 21.4-27.8%, and in the downstream – 6.7-20.0%. *M. cyprini* in the upper course of the canal is noted in the gudgeon, carp and crucian carp, in the middle section – in the gudgeon and carp, and in the lower one – in the carp and crucian carp. Extensiveness of infection in the upper section ranged from 20.0 to 43.8%, in the middle section – 15.4-40.0%, in the lower section it was 33.3%. *M. ellipsoides* in the upper reaches is found in the chub, gudgeon and chanari barbel, in the middle section – in the chub and chanari barbel, and in the lower one – only in the chub. In the upper course, the extensiveness of infection was 13.3-33.3%, in the middle section – 11.1-20.0%, and in the lower section – 6.7%. *M. muelleri* in the upper reaches is noted in the chub, nase, Terek barbel, chanari barbel, and crucian carp, in the middle section – in the chub, chanari barbel and crucian carp, and in the lower section – only in chanari barbel and crucian carp. In the upper course, the extensiveness of infection was 17.7-46.7%, in the middle section – 26.7-33.3%, and in the lower section – 10.5-26.7%. *M. muscoli* in the upper reaches is registered in the roach, chub, chanari barbel, bleak, stripe, carp and crucian carp, in the middle section – in the roach and chub, and in the lower one – only in the roach. The extensiveness of infection of various fish by this parasite in the upper reaches was 5.3-33.3%, in the middle section – 11.1-14.3%, in the lower reaches – 16.7%. *Myxidium macrocapsulare*, which was found only in the carp in all three areas, infected this fish in the upper section by 13.3%, in the middle section – by 7.1%, and in the lower section – by 8.3%. The ciliates of *Chilodonella hexastica* in the upper course of the canal are found in bleak and carp, in the middle course – in carp, and in the lower flow – in crucian carp. *C. piscicola* in the upper reaches is also found in bleak and carp, in the middle section – in bleak, and in the lower flow – in crucian carp. In the upper course, the extensiveness of infection with both of these

parasites ranged from 6.3 to 10.5%, in the middle course, it was respectively 6.7% and 7.1%, in the lower course both of these parasites infected fish by 5.3%. *Ichthyophthirius multifiliis* in the upper course was found in the roach, bleak and carp, in the middle course – in the bleak and carp, and in the lower course – in the crucian carp. Extensiveness and intensity of infection in the upper course was 10.5–13.3% and 1–14 specimens, in the middle section – 6.7-14,3% and 1-3 2 specimens, in the lower section – 5,3% and 2 specimens. *Apiosoma companulatum* is registered in the upper and middle currents in the shneider, the extensiveness of infection of which with this parasite in the upper course was 13.3%, and in middle section 6.7%. *Trichodina nigra* in the upper section was found in the Terek barbel and chanari barbel, and in the middle and lower sections it was found only in the chanari barbel. In the upper course, the extensiveness of the infection ranged from 7.1–13.3%, middle section it was 5.6%, and in the lower course – 6.7%. *Trichodinella epizootica* in the upper and middle currents was found in the carp, and in the lower stream – in the crucian carp. The extensiveness of infection with this parasite in the upper course was 12.5%, in middle section – 6.7%, and in the lower course – 5.3%. The extensiveness and intensity of the bleak with monogenean *D. fraternus* in the upper part of the canal amounted to 52.6% and 3-16 specimens, and in middle section – 42.9% and 2-12 specimens. For *D. parvus*, these figures were respectively 44.4% and 2-17 specimens, 35.4% and 1-9 specimens. The infection of the gudgeon with monogenean *D. cryptomerus* in the upper part of the canal was 26.7% and 1-8 specimens, in the middle section 7.7% and 4 specimens. Extensiveness and intensity of infection of the roach with specific for it monogeneans *D. crucifer*, *D. sphyrna*, and *D. turaliensis* were higher in the upper part than in other areas and were respectively 66.7% and 5-29 specimens, 26.7% and 1-7 specimens, 53.3% and 3-18 specimens. In the middle section it was respectively 50.0% and 3-18 specimens, 21.4% and 1-5 copies, 35.4% and 1-10 specimens, 33.3% and 1-9 specimens, 16.7% and 1-2 specimens, 16.7% and 1-3 specimens. The specific parasites of the barbels – monogeneans *D. affinis*, *D. jamansajensis*, *D. kulwieci* and *D. linstowi* were recorded in two species of fish (Terek barbel and chanari barbel) in the upper reaches, and only in one species (chanari barbel) in the middle and lower currents. This is due only to the fact that in upper section of the canal live both of the Terek barbel and chanari barbel, but in the middle and lower sections lives only the chanari barbels. In the upper reaches, the infection with all these parasites was higher than in the middle course, and in the middle course higher than in the lower course. The extensiveness and intensity of infection by these parasites in the upper reaches were 60.0-71.4% and 1-23 specimens, 46.7-57.1% and 2-19 specimens, 40.0-50.0% and 3-20 specimens, 64.3-66.7% and 3-32 specimens, in the middle course they were equal to 44.4% and 3-15 specimens, 38.9% and 1-14 specimens, 44, 4% and 3-14 specimens, 50.0% and 1-21 specimens, in the lower course were 26.7% and 2-8 specimens, 33.3% and 1-12 specimens, 40.0% and 1-12 specimens, 46.7% and 1-9 specimens. In contrast with this,

the extensiveness and intensity of infection of the schneider with monogenean *D. caucasicus* and of the carp with monogenean *D. extensus* in the lower section were higher (respectively 20.0% and 1-2 specimens, 40.0% and 1-14 specimens) than in middle section (13.3% and 1-6 specimens, 33.3%; 2-13 specimens), and in the upper section (respectively, 29.1% and 2-11 specimens, 50.0% and 4-19 specimens.) were higher than in the lower section. The extensiveness and intensity of infection of the carp with monogenean *D. vastator* in the middle section (6.7% and 2 specimens) and lower (6.7% and 1 specimens) of the canal turned out to be almost identical, and on the upper slightly higher (6.7-12.5% and 1-4 specimens.). The infection of the bleak with monogenean *Gyrodactylus gracilihamatus* in the upper reaches (15.8% and 3-8 specimens) was approximately two times higher than in the middle section (7.1% and 4 specimens). The monogenean *G. katharineri* in the upper reaches is found on fins and gills of the Terek barbel, carp and crucian carp, while in the middle course it is found only on the carp, and in the lower stream – only on the crucian carp. In the upper reaches, the extensiveness and intensity of infection of these fish were 6.7-18.8% and 2-9 specimens, in middle section – 13.3% and 1-3 specimens, and in the lower section – 10.5% and 1-2 specimens. Extensiveness and intensity of infection with of the roach with monogenean *Paradiplozoon homoion* in the upper reaches were 13.3% and 1-6 specimens, in the middle course – 7.1% and 1 specimen, and in the lower course – 8.3% and 2 specimens. The infection of the schneider with its specific parasite – monogenean *Paradiplozoon schulmani* also decreased as it went downstream: in the upper reaches they were 17.6% and 1-7 specimens, in middle section 13.3% and 1-3 specimens, in the lower section 6.7% and 2 specimens.

Of the helminthes that enter the fish while it eating benthic invertebrates, the extensiveness and intensity of infection with the trematode *Asymphylogora imitans* in the upper course of the canal were 17.7% and 1-4 specimens, in middle section – 6.7% and 3 specimens, in the lower section – 6.7% and 2 specimens. For the trematode *Phyllodistomum elongatum*, these indicators in the upper reaches were 13.3–20.0% and 1–4 specimens, in the middle flow – 6.7-14.3% and 4-5 specimens, and in the lower flow – 6.7% and 4 specimen. For the trematode *Allocreadium isoporum*, these indicators were in the upper course – 13.3-35.7%; 1-9 specimens, in the middle course – 7.1-7.7%; 2-3 specimens, and in the lower course – 6.7%; 1 specimen. Extensiveness and intensity of infection with rheophilic nematodes of *Rhabdochona denudata* and *Rh.gnedini* in the upper reaches were respectively 23.5-53.3% and 1-21 specimens, 85.7-86.7% and 2-39 specimens, in the middle section – 6.7-20.0% and 1-8 specimens, 38.9% and 1-12 specimens, in the lower course – 6.7% and 2 specimen, 26.7% and 1-4 specimens. The acanthocephalen *Pomphorhynchus laevis* in the Samur-Absheron Canal was recorded only in a chanari barbel in two sites: in the upper section extensity and intensity of this fish were 14.3% and 1-4 specimens, in the middle section – 11.1% and 1-2 specimens. The nematode of *Capillaria tomentosa*, noted only in carp, in the lower reaches infested this fish a little more (13.3% and 4-9 specimens) than in the upper (12.5% and 3-12 specimens) and middle (6.7% and 6 specimen) sections.

Metacercariae of trematodes that parasite in the tissues of fish, were found in all three parts of the canal. Of these, *Diplostomum chromatophorum* was found in the upper

reaches (21.1-43.8% and 2-21 specimens) in five species of fish, in the middle section (7.1-33.3% and 2-7 specimens) in four species, and in the lower section (8.3-15, 8% and 1-3 specimens) in three species of fish. *D. paraspathaceum* in the upper reaches was found (11.8-31.3% and 1-19 specimens) in four species of fish, in the middle section (7.1-13.3% and 1-2 specimens) in two species of fish, and in the lower section (6.7% and 2 specimens) in one species of fish. *Clinostomum complanatum* in the upper reaches was found in six species of fish (15.8–46.7%; 1-18 specimens), in the middle section in two species of fish (16.7-26.7% and 1-6 specimens), in the lower section – in one species of fish (13.3% and 1-2 specimens). *Posthodiplostomum cuticola* throughout the canal was found only in a roach, the infection of which with this parasite in the upper part of the canal was 13.3% and 1-3 specimens, in the middle part – 7.1% and 3 specimens, and in the lower part – 16.7%; 1-3 specimens.

The rheophilic crustacean *Lamproglana compacta*, which is specific for barbels, was found in all three parts of the canal, and the infection rate was quite high. However, even this species in the middle course (83.3% and 1–12 specimens) infects fish less than in the upper course (100.0% and 2–13 specimens), and in the lower course (46.7% and 1-8 specimens) – less than in middle course.

In natural watercourses, the flow velocity in the lower reaches is usually lower, and the ichthyofauna and the fauna of fish parasites, as a part of all hidrofauna, is richer than in the upper reaches. This situation is observed, in particular, in all the rivers of the Caucasus, which is also due to the fact that fishes enter the lower reaches of the river from the reservoir into which the river falls, and bring their parasites [1-3, 6-8, 10]. However, as our studies have shown, in the Samur-Absheron Canal, due to its hydrological features, the number of species of fish parasites decreases from the top part to the downstream.

4. Conclusion

An analysis of the distribution of various species of ichthyoparasites throughout the Samur-Absheron Canal shows that in this watercourse in the direction from upper part to the down part there is a clear tendency to the reduction of number of species of the fish parasite and a decrease in the degree of infestation of fish with parasites. It can be assumed, that some of the parasites, in particular, such species, poorly adapted to the rapid flow as flagellates *Cryptobia branchialis* and *Costia necatrix*, myxosporidians *Sphaerospora carassii*, cestodes *Ligula intestinalis* and *Paradilepis scolecina*, nematodes and *Contraecaecum microcephalum*, *C. spiculigerum*, crustaceans *Lernaea cyprinacea* and *Argulus foliaceus*, possibly infect fish in the Samur river, and only after that they are brought by fish in Samur-Absheron Canal. For this reason, these parasites are found by us only in the upper reaches of the canal. Without a doubt, the parasitic fauna of fish of the canal was formed exclusively by species that came here from the Samur River, and similar species, apparently, continued to come here, in the body of infected fish, also during our research. This is the reason of fact that the number of species of ichthyoparasites and number of their specimens in the upper part of the canal was greater than in its lower reaches.

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