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Fish blood parasites from middle Kura basin of Azerbaijan

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Abstract

It was studied blood parasites of fish belonging to 5 families and 15 species of 4 reservoirs of Azerbaijan (Shamkirchay River, Garayazi Lake, Gravel pit and Shamkir water reservoir). Parasites of the genera *Trypanosoma* and *Cryptobia* were found in the blood of fish.

We studied 235 specimens of fish and found that 8 species had blood parasites. These species are: Pike, Vobla, Murzo, Bream, Prussian carp (Goldfish), Carp, Catfish, Zander. Other species of fish such as Trout, Chub, hybrid of Vobla and Bream, Kura khramulya, Kura barbel, Kura shemaya and Grass carp were free from the blood parasites.

To infect aquatic vertebrates with blood parasites in water reservoirs there should be first of all conditions for living and development of leeches – carriers of blood parasites which prefer well-warmed stagnant or slow-flowing water reservoirs with abundant vegetation.

This article presents the hydro-biological characteristics of the studied water reservoirs.

Keywords: River, lake, parasites, extensity and intensity of invasion

1. Introduction

Parasitic protozoa of blood of aquatic vertebrates are a large group of organisms with a great variety of morphological and biological characteristics. Many representatives of this group of parasites are the causative agents of dangerous diseases of their hosts, among which there are many species of commercial value, grown as aquaculture or are the subject of environmental protection.

Despite the fact that the study of protozoan parasites in the blood of aquatic vertebrates, is of great practical and theoretical interest, to date they are still relatively poorly studied group of organisms. There is relatively little published data on the hosts and distribution of these parasites within the range. Until now, there is no single view on the pathogenicity of many species to their hosts, life cycles of most species were studied poorly, many of the details of reproduction of invertebrates carriers (leech, bloodsucking insects) are not found out as well as in vertebrates hosts (fish, amphibians, reptiles, etc.). Ideas about the origin of blood parasites and the evolution of their life cycles were presented very poorly.

Insufficient knowledge on blood parasites connected with certain methodological difficulties of collecting and desktop study of these organisms, which have a very small size and relatively small number of signs to identify them under a light microscope. It is also necessary to note that among blood parasites of various vertebrates the most poorly studied blood parasites of fish, amphibians, and water reptiles.

2. Materials and Methods

352 specimens from 4 water reservoirs of Azerbaijan belonging to 5 families and 15 species were examined for blood parasites infection.

The number of fish species studied in the aforementioned water reservoirs are shown below in Table 1.

In order to study fish it was caught by fish stakes and minnow seine. In order to get some fish blood the tail-stems of fish were cut at a short distance from the base of a caudal fin and then the blood was taken from caudal artery. Sometimes the blood was taken from heart. A drop of the blood was applied at the edge of ungreased microscope glass and prepared smear by polished glass, dried and then fixed by methyl alcohol and stained with azure eosin according to the method of Giemsa.

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Table 1

Family Types of fish	Shamkirchay River	Garayazi Lake	Gravel pit Lake	Shamkir reservoir
SALMONIDS				
River trout – <i>Salmo fario</i> L.	20	-	-	-
ESOXCIDAE				
Pike - <i>Esox lucius</i> L.	-	-	-	15
CYPRINIDAE				
Vobla – <i>Rutilus rutilus caspicus</i> (Jakowlew)	-	15	11	15
Hybrid of Vobla and Bream – <i>R.rutilus caspicus</i> (Jakowlew) x <i>Abramis brama orientalis</i> Berg	-	-	-	2
Caucasus chub – <i>Leuciscus cephalus orientalis</i> (Nordmann)	-	-	-	12
Kura khramulya – <i>Varicorhinus capoeta</i> Gldenstdt	-	-	16	12
Kura barbel – <i>Barbus laceta cyri</i> Filippi	-	-	12	15
Murza – <i>B. mursa</i> (Gldenstdt)	-	-	1	-
Kura shemaya – <i>Chalcalburnus chalcoides</i> (Gldenstdt)	-	-	-	15
Oriental bream - <i>Abramis brama orientalis</i> Berg	-	30	15	16
Prussian carp (Goldfish) – <i>Carassius auratus gibelio</i> (Bloch)	-	-	11	11
Sazan (Carp) - <i>Cyprinus carpio</i> L.	-	34	12	10
Grass carp - <i>Ctenopharyngodon idella</i> (Valenciennes)	-	13	-	-
SILURIDAE				
Catfish - <i>Silurus glanis</i> L.	-	-	-	12
PERCIDAE				
River zander - <i>Schizostedion luciopercae</i> (L.)	-	14	-	13

To assess the degree of infection with blood parasites we used the indices of extensivity of invasion (EI). This is the percentage proportion of infected fish, in total number of examined fish [3, 4, 14], and intensity of invasion (II), which is the number of parasites of one species in a single fish species and index of abundance (IA) which is the number of parasites of one examined fish [9].

In cases when we did not give all quantity of blood parasites of an animal but just quantity of parasites in one blood drop from which we took a smear, we used the index of specific intensity of invasion (SII), i.e. the quantity of not all parasites in the organism of one host but the quantity of parasites accrue to smear. The index of specific abundance index (SAI) also was used. This is the sum of parasites found in one smear of each infected host and divided on the quantity of studied hosts [9].

3. Results and Discussion

This article presents the hydro-biological characteristics of the studied water reservoirs.

Shamkirchay River flows from the north-eastern slope of Shahdag ridge of the Minor Caucasus and is formed by the confluence of the Rivers Sarysu and Agdashsu. Shamkirchay River joins Kura River 812 km from the mouth. The River length is 95 kilometers, the spillway area is 1170 km². According to the physical, geographical and hydrological conditions the River basin is divided into two parts: the upper mountain part, which is located at a height of the source up to Mansurly village (570 m) and plain low-pitched part, which is located at the height that is lower than 570 m.

Such fish as Trout and Kura barbell are in Shamkirchay River.

Garayazi Lake is located in the foothills of the Greater Caucasus, on the border of Azerbaijan and Georgia on the height of 285 m. above sea level. The water of Kura River flows into this lake through the special channel of Mariinsk Canal System. The lake area is 1220 hectare and the depth is 2.8 m. High aquatic vegetation consists of reeds, pondweed and hornwort. Benthic fauna of Garayazi Lake consists of oligochaetes, mollusks, larvae of dragonflies, mayflies and chironomids. This lake is a fishery water body, and such fish as Vobla, Bream, Sazan and Grass carp live here.

Gravel pit Lake is located on the left bank of Kura River near Poylu station. The lake has a rectangular shape, its length is

280, width is 130 m, and maximum depth is 15 m. The main bottom of the reservoir is rocky and gravel-sand, occasionally meets muddy and clay soil. Here we can find such high aquatic plants as reed, cattail and bulrush. Such fish as Vobla, Kura khramulya, Kura barbel, Murzo, Bream, Sazan and Crucian live in this lake.

Shamkir reservoir was built in 1982 on Kura River for regulation of the flow of this river for the purpose of serving the needs of energy, water and fisheries. Reservoir length is 36 km, maximum width is 6 km, the area is 11,600 ha, the average depth is about 23 m, maximum depth is 70 m. Due to the strong river breathing the vegetal invasion of waters here is very weak, reeds and typha is rarely found. 41 species of invertebrates identified in the composition of the zooplankton (rotifers, cladocerans, copepods). In Shamkir reservoir live such fish as Pike, Vobla, Caucasus chub, Kura khramulya, Kura barbell, Asp (Zherekh), Shemaya, Kura gudgeon, South Caucasus and Kura bleak, Silver bream, Bream, Silver carp, Prussian carp, Sazan, Grass carp, Catfish, Zander and others. Physics, geographical and hydro biological characteristics of water reservoirs were made up according to information of a number of references [10, 13] and partly according to our own data [9].

15 fish species (including one hybrid) were checked for the presence of blood parasites in 4 water reservoirs of Azerbaijan: Shamkirchay River, Garayazi Lake, Gravel pit Lake and Shamkir water reservoir. Blood parasites were founded in representatives of 8 species such as Pike, Vobla, Murzo, Oriental bream, Prussian carp, Sazan, Catfish, Zander. Blood parasites were not found in Trout, hybrid of Vobla and Bream, Chub, Kura khramulya, Kura barbell, Shemaya and Grass carp.

Brief information on the biology of each host species was taken from the appropriate works: [1, 5, 16, 18].

As it was indicated above protozoa parasites were found in blood of 8 fish species, that belong to the genus *Trypanosoma* and *Cryptobia* [2, 6-9, 12, 15].

Pike is a freshwater, non-migratory predatory fish, lives both in the Rivers and lakes, chooses not deep and grassy places, live not far from the shores. Only very large pikes live in depths of water reservoirs, where live large fish and which they feed. Pikes have commercial value, and are also an important object of amateur fishing.

We examined 15 specimens of Pike from Shamkir water reservoir for the presence of blood parasites. *Trypanosoma carassii* was found in blood of one of the examined fish.

Indicators of infestation (EI, SII, SAI) of fish blood parasites are given in Table 2.

Vobla is a semi-anadromous fish, it carry eggs in Kura River. This fish is a typical benthophage, it feeds maggots, worms, crustaceans, mollusks, and plants. Vobla is of significant industrial value in the water reservoirs of Caspian Sea.

We studied 41 specimens of Vobla in 3 water reservoirs: in Shamkir reservoir, Garayazi Lake and in Gravel pit.

The parasite *Trypanosoma carassii* was found in the blood of Vobla of Shamkir reservoir. The blood parasites were not found in fish of Garayazi Lake and Gravel pit.

We believe that absence of parasites in the blood of Vobla of Garayazi Lake and Gravel pit is connected with autumn and summer period when we did our research, because at that period there were semi-anadromous Vobla, which at the period of migration do not get infection.

Murzo is a freshwater fish which primary lives in swift running Rivers with rocky ground. It feeds with water maggots, primarily caddis worms and dayfly and also seeds of plants and phytodetritus.

We discovered just one specimen of Murzo in Gravel pit Lake, where the fish could somehow get from mountain streams, for which it is characteristic. We found 2 specimens of *Cryptobia borelli* in the blood of this fish.

Oriental bream is a freshwater fish which has semi-anadromous way of life. The fish lives primarily near cattails and reeds, feeds water plants especially various insects and

their maggots. The fish has commercial value.

We examined 61 specimens in 3 water reservoirs: in Shamkir reservoir, Garayazi Lake and in Gravel pit.

Two species of parasites - *Trypanosoma carassii* and *Cryptobia borelli* were found in the blood of bream. The bream was infected with these parasites, but it was not in all water reservoirs.

Prussian carp (Goldfish) is a freshwater fish, lives in slow running Rivers and ditch well warmed reservoirs, with thickets of aquatic vegetation. The fish feeds both planktonic and benthic invertebrates and also aquatic vegetation.

We examined 22 specimens of carps in 2 water reservoirs: Shamkir reservoir and in Gravel pit Lake.

Two species of parasites were found in the blood of fish. It was *Trypanosoma carassii* and *Cryptobia cyprini*, where *Trypanosoma carassii* has the wide range of hosts, and *Cryptobia cyprini* is a specific parasites of cyprinid fish.

If we compare Prussian carp from various water reservoirs it turns out that the highest extensity of invasion (36,4%) was found in this fish with species *Cryptobia cyprini* in Shamkir reservoir, and then extensity of invasion with this parasite is high in Gravel pit Lake (27,3%) Sazan (Carp) is a freshwater fish; it widely spread in water reservoirs of Azerbaijan. The fish lives primarily in well warmed water reservoirs with low waters and with thickets of aquatic vegetation. It refers to pantophagous fish, but prefers benthic organisms. The fish is the object of fishing industry.

We examined 56 of carp in 3 water reservoirs: Shamkir reservoir, Garayazi Lake and Gravel pit Lake.

Table 2

Type of fish	Points of research	<i>Trypanosoma carassii</i>			<i>T. markewitschi</i>			<i>T. luciopercae</i>			<i>Cryptobia borelli</i>			<i>C. cyprini</i>		
		EI (%)	SII (in specimens)	SAI	EI (%)	SII	SAI	EI (%)	SII	SAI	EI (%)	SII	SAI	EI (%)	SII	SAI
Pike	Shamkir reservoir	6.7	1	0,07	-	-	-	-	-	-	-	-	-	-	-	-
Vobla	Shamkir reservoir	13.3	1-2	1,5	-	-	-	-	-	-	-	-	-	-	-	-
Murzo	Gravel pit Lake	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
Bream	Shamkir reservoir	-	-	-	-	-	-	-	-	-	8,3	2	0,16	-	-	-
Prussian carp	Shamkir reservoir	18,2	1-3	0,36	-	-	-	-	-	-	-	-	-	36,4	1-8	1,4
	Gravel pit Lake	-	-	-	-	-	-	-	-	-	-	-	-	27,3	1-12	1,5
Sazan	Shamkir reservoir	40,0	1-2	0,50	-	-	-	-	-	-	-	-	-	19,0	1	0,20
Catfish	Shamkir reservoir	-	-	-	20,0	1	0,20	-	-	-	-	-	-	-	-	-
Zander	Shamkir reservoir	-	-	-	-	-	-	7,7	2	0,15	-	-	-	-	-	-

Two species of blood parasites - *Trypanosoma carassii* and *Cryptobia cyprini* were found in the carp. Both type of blood parasites were found in bream from Shamkir reservoir - *Trypanosoma carassii* and *Cryptobia cyprini*. The parasites of blood were not found in carps from Garayazi Lake and Gravel pit Lake.

Catfish is a freshwater predatory fish. In the area of River mouth comes into shallow waters of the Caspian Sea and forms a semi-anadromous populations. The fish feeds primarily on fish, frogs, nestlings which fall into water and also maggots. This is valuable commercial species.

12 specimens of catfish from Shamkir water reservoir were examined for the presence of blood parasites.

Specific parasite *Trypanosoma markewitschi* was found in blood of catfish.

Zander is a freshwater predatory fish. It forms population in the lakes of Lower Kura River. In the first weeks of life Zander feeds zooplankton, and in the age of half of month or

two month it has predatory way of life. Full grown Zander sometime feeds aquatic insects.

27 specimens of Zander were examined in two reservoirs - Garayazi Lake and Shamkir reservoir.

Trypanosoma luciopercae was found in the blood of Zander from Shamkir reservoir.

Contrary to such predatory fish like Pike and Perch, Zander does not wait for its prey in thickets of aquatic plants, where primarily live leeches, but pursues it in open water spice, where Zander has little contact with the fish leeches. For this reason, Zander infected with blood parasites poorly than other predatory fish.

Among cyprinid fish which live in studied water reservoirs we examined the hybrid of Vobla and Bream, Chub, Kura khramulya, Kura barbell, Shemaya and Grass carp for the presence of blood parasites, but these fish were free from any blood parasites.

As for the absence of blood parasites in River trout, this is

connected with the absence of carriers (leeches) in Rivers with swift waters.

The absence of parasites in the blood of these fish, in each individual case has its own reasons. In some cases this is connected with studied fish were migratory and semi-anadromous fish, which most part of their lives spend in a sea, where fish could not be infected with blood parasites. Others are small in numbers and were studied in a very small number and this fact prevented us to find any presence of blood parasites in these fish. For example we examined 2 samples of hybrids of Vobla and Bream from Shamkir water reservoir which refer to semi-anadromous fish and that is why they were free from blood parasites.

Some of fish, such as Kura khramulya and Kura barbell live in rapid Rivers with lack of favorable conditions for the habitat of the blood-sucking leeches and the chances of infection with blood parasites are minimal.

Thus it is followed from the above specific abundance index (SAI) that not all studied fish from the above mentioned water reservoirs infected with flagellates of genera *Trypanosoma* and *Cryptobia*.

Various water reservoirs differ from each other with living environment. It is quite natural that possibility of infection of fish with blood parasites is different. In order to infect aquatic vertebrates with blood parasites it is necessary first of all the conditions for the development of leeches which are the carriers of blood parasites. These invertebrates prefer well warmed ditch waters or lagging freshwater reservoirs with thickets of aquatic vegetation. The second condition for the infection of fish with blood parasites is the presence of favorable temperature conditions for the development of these parasites.

Besides the conditions for living of the carriers of blood parasites as well as development of these parasites, the species diversity of fish blood parasites in water reservoirs is determined by its dimensions and the number of fish species, living there. The larger water reservoir and more fish species live there the richer is fauna of blood parasites.

It is necessary to list the water reservoirs where for a variety of reasons fish are free from the blood parasites. These are Shamkirchay River, which refer to mountain type Rivers with swift running waters and the absence of aquatic vegetation and Garayazi Lake where the fish leeches were not found. According to data of Pawlowski ^[18] the leeches, carriers of fish blood parasites are not found in a mountain stream and in the initial regions of Rivers which flows from mountains.

4. Conclusions

1. In the result of our research in 4 water reservoirs of Azerbaijan (Shamkirchay River, Garayazi Lake, Gravel pit Lake and Shamkir water reservoir) we studied 352 specimens of fish for the presence of blood parasites belonging to 15 specimens. 8 specimens Pike, Vobla, Murzo, Oriental bream, Crucian, Sazan, Catfish, Zander had blood parasites of the genera *Trypanosoma* and *Cryptobia*.
2. In blood of Trout, Chub, hybrid of Vobla and Bream, Kura khramulya, Kura barbel, Kura shemaya and Grass carp were free from the blood parasites. Absence of parasites in the blood of these fish has its own reasons. In some cases this is due to the fact that some studied fish were of anadrom and semi-anadromous populations. They spend most of their lives at sea and are not infected with blood parasites.
3. Those fish that live in water reservoirs with rapid current

are not infected with blood parasites due to lack of carriers – fish leeches. Trout and Kura barbell are refers to such fish. The absence of leeches in rivers with strong currents due to the fact that they have no vegetation – the habitat of leeches.

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