ISSN: 2707-1146
e-ISSN: 2709-4189

DOI: https://doi.org/10.36719/2707-1146/55/4-8

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The Influence of Age-Related Changes on the Parasite Fauna of Silver Carp (*Hypophthalmichthys Molitrix* Val., 1844)

Abstract

The article analyzes the changes in the parasitic fauna of the silver carp depending on its age. Studying the morphometric dimensions of the silver carp and conducting studies on its impact on the parasitic fauna allows us to track the development of diseases in their hosts. As a result of the studies, six species of parasites belonging to different taxonomic groups were recorded in the fish. The fish were conditionally divided into three groups according to age: the +1 group (body size up to 10 cm), the +2 group (between 10 and 20 cm), and the +3 group (greater than 20 cm). It was found that a small number of parasite species are observed in the +1 groups of fish. They are mainly infected with parasites that lack an intermediate host. As they grow, they are infected with new parasites. In terms of species, the most infections (five species) are observed in fish of the third age group. A decrease in fullness is observed in fish that are more infected with trematode larvae.

Keywords: *silver carp, parasite fauna, age of fishes, fullness*

Introduction

The territory of the Republic of Azerbaijan has various water bodies suitable for the development of fishing. Therefore, in recent years, lake fishing has been widely used to meet the growing demand of the population for fish products. Fishes that are considered more favorable than other fish species due to their rearing conditions, endurance and food requirements are brought to the republic for artificial lake fishing.

In order to achieve high productivity in lake fishing, the parasitological situation must be constantly monitored and thoroughly studied. Sometimes there is a possibility of parasites not belonging to the local fauna being introduced through imported fish. What makes the parasitological study of such fish relevant is that the parasites they bring to the basin have certain effects on the ecological characteristics of the local parasitic fauna. All these allow us to foresee the process of preventing the damage that parasites can cause to farms.

Research

One of the main fish used in lake fishing in Azerbaijan is the silver carp (*Hypophthalmichthys molitrix*). Ichthyopathological monitoring conducted on such fish grown in fish farms allows us to find more effective methods in combating parasites. Studying the morphometric dimensions of fish

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ISSN: 2707-1146
e-ISSN: 2709-4189

and analysing their impact on the parasitic fauna provides a basis for seeing how diseases develop. Therefore, obtaining such information in fisheries helps plan the density of fish breeding and prevent the entry of disease-causing parasites into the farm. It should also be noted that in recent years, studies have been carried out on the changes in the parasitic fauna of a number of commercial fish in the country depending on various ecological factors (Ibrahimova & Rzayev, 2018; Seyidli et al, 2021, 2022, 2023; Nasirov et al., 2024). There are also a number of literature on the study of parasites of silver carp in the country (Abdullayeva, 2010, 2012; Suleymanova, 2004). Parasites of the mentioned fish have also been studied in other countries (Alam et al., 2012; Mhaisen & Al-Rubaie, 2016; Yakhchali, 2018; Thakur et al., 2020). Concidering all these, in the present research work, a morphobiological and parasitological analysis of the silver carp reared in the lakes of the Mingachevir scientific and experimental laboratory was carried out.

Material and methods

Materials for the study were collected from 50 silver carp caught in the lakes in the territory of the Mingachevir scientific and experimental laboratory. To study the parasitological state of silver carp with different morphometric dimensions, they were divided into three approximate age groups according to body size: fish up to 10 cm were classified into age group +1, fish 10-20 cm were classified into +2, and fish over 20 cm were classified into age group +3. Analysis of materials on age, growth, and other morphometrics (total size, mass, and Fulton fullness) was carried out based on the Pravdin method (Pravdin, 1966), and the collection, fixation, storage, and processing of parasitological material were carried out based on generally accepted methods (Dogel, 1933; Bykhovskaya-Pavlovskaya, 1985; Markevich, 1950; Gusev 1983; Shigin 1986). Freshly caught fish, and sometimes preserved in 4% formalin solution were used for the study. MBS-1 binocular magnifier, Ergaval and MBI light microscopes were used for the work. Parasites collected from the hosts were identified based on the Key Books (Bauer, 1985, 1987).

Results and discussion

In the study area, six species of parasites belonging to different taxonomic groups were recorded in the silver carp - *Gyrodactylys* sp. (monogenean), *Diplostomum chromatophorum* (trematoda), *Contracaecum spiculigerum* (nematode), *Lernea cyprinacea* (crustacean), *Argulus foliaceus* (crustacean), *Anodonta cyrea* (mollusk). As can be seen from the table, the number of parasite species is fewer in younger age (+1) groups and they are mainly infected with parasites that lack intermediate hosts in their development. Only the larvae of the parasitic crustacean *A. foliaceus* and mollusk *A. Cyrea,* attached to the body surface, were recorded on them. These are ectoparasites and attach to the skin. The thin skin of young fish facilitates the attachment of these parasites. In +2 fish group, with the increase in body size, in addition to the *A. cyrea* species, three additional species (*C. spiculigerum, D. chromatophorum, L. cyprinacea*) also added to the parasitic fauna. Therefore, at this age group, ectoparasites predominate in fish. However, +2 year old fish are also infected with metacercariae of the trematode *D. chromatophorum*, whose cercariae are actively penetrating into eyes of host. Infection with these occurs when swimming near aquatic plants. In +1 and +2 year old fish, infection with the mollusk larva of *A. cyrea* is mainly observed. The main reason for the low number of parasite species among +1 year old fish is that their parasitic fauna is not yet fully formed in artificial lakes. As they grow older, they become infected with different groups of parasites.

Table

A number of parameters of the fish and detected parasites.

№	Total length (in cm)	Mass (in g)	Fullness	Parasites
1	6.1	5.6	2.5	-
2	4.8	3.6	3.3	-
3	6.0	5.6	3.2	-
4	6.5	5.8	2.1	-

ISSN: 2707-1146
e-ISSN: 2709-4189

5	6.2	5.5	2.3	-
6	5.8	4.2	2.2	-
7	5.9	5.1	2.5	-
8	5.7	4.1	2.2	-
9	6.0	5.7	3.1	-
10	6.3	5.8	2.0	-
11	6.5	5.2	2.1	*A. cyrea*
12	6.6	5.3	2.2	*A. cyrea*
13	6.2	5.4	2.3	*A. cyrea*
14	6.7	5.8	1.9	*A. cyrea*
15	6.9	5.8	1.8	*A. cyrea*
16	6.2	5.1	1.8	*A. foliaceus*
17	6.7	5.9	2.0	-
18	12.5	23.5	1.2	-
19	11.3	20.1	1.4	*A. cyrea*
20	11.5	20.4	1.3	*A. cyrea*
21	12.3	23.2	1.2	*A. cyrea*
22	11.7	20.7	1.3	*A. cyrea*
23	12.0	22.9	1.3	*A. cyrea*
24	10.5	18.3	1.6	*A. cyrea*
25	11.2	20.5	1.5	-
26	10.3	18.2	1.7	*L. cyprinacea, A. cyrea*
27	11.1	19.6	1.4	-
28	9.5	12.6	1.5	*A. cyrea*
29	10.7	18.3	1.5	*D. chromaophorum*
30	10.1	18.0	1.7	-
31	11.2	19.9	1.4	-
32	10.2	17.8	1.8	-
33	10.5	18.1	1.6	*C. spiculigerum*
34	23.0	45.0	0.4	-
35	25.0	50.1	0.3	*D. chromatoporum*, *Gyrodactylus sp.*
36	24.5	50.0	0.3	*D. chromatoporum*
37	28.0	60.0	0.3	*D. chromatophorum*
38	22.0	45.0	0.04	*D. chromatoporum, C. spiculigerum, A. cyrea*
39	24.0	45.1	0.3	*D. chromatoporum, A. cyrea*
40	24.6	48.2	0.4	*D. chromatoporum*
41	25.0	50.2	0.3	*D. chromatoporum*
42	24.5	45.3	0.3	*D. chromatoporum*
43	25.2	50.1	0.3	*D. chromatoporum*
44	25.5	50.3	0.3	*D. chromatophorum*
45	24.8	45.9	0.3	*D. chromatophorum*
46	25.5	46.0	0.3	*D. chromathophorum*
47	23.6	44.8	0.3	*D. chromathophorum*
48	25.2	44.9	0.3	*D. chromatophorum*
49	54.3	103.2	0.1	*D. chromatophorum*, *Gyrodactylus sp.*
50	52.0	102.0	0.1	*D. chromatophorum, L. cyprinacea*

ISSN: 2707-1146
e-ISSN: 2709-4189

According to the results of the study, the maximum number of parasites in the silver carp was recorded at the age of +3. Five species of parasites (*Gyrodactylus sp., A. cyrea, C. spiculigerum, D. chromatophorum, L. cyprinacea*) were detected in this age group. Here, unlike the +1 and +2 age groups, it was found that a monogenetic worm belonging to the genus *Gyrodactylus* also parasitizes. On the other hand, not only was the species diversity of parasites observed, but also the increase in the intensity of infection was determined. One of the main reasons for this is the increase in food selectivity of fish at different ages and also their belonging to different biotopes of water bodies. As the fish grow, their food requirements increase. At this time, infection increases in them, especially due to feeding on intermediate hosts of the parasite. However, parasites that infect through feeding on intermediate hosts are rare in the silver carp. Only *C. spiculigerum* nematode, whose intermediate host is crustaceans is found. This shows that although the diet of the silver carp is composed of phytoplankton, sometimes there is variation in the diet. There is also a number of literature on the change in the parasite fauna depending on the age of the fish. Thus, the parasitic fauna of Caspian salmon (*Salmo trutta caspius*) and rainbow trout (*Salmo gairdneri*) bred in the Chukhur-Gabala and Chaykend fish farms in the country was studied depending on the age. It was found that, as in the silver carp, infection with parasites is higher in salmon and trout at older groups (Mikayilov et al., 2013, 2015a, 2015b).

We have also determined the dependence of fish parasites on their fullness. Information on the negative effect of metacercariae of the parasitic trematode *D. chromatophorum* of the *Diplostomum* genus on the abundance of fish was also obtained. When silver carp in third group are infected with diplostomum, a decrease in fullness is observed. Thus, the fullness is very high in +1 year old fish, where no parasites are found. However, as age increases and fish became rich in parasites, the fullness decreases. For example, if +1 year old fish have a fullness of 3.3 in the absence of parasites, this value decreases to 0.1 in conditions of high parasite intensity. Thus, a strong infection with parasites is observed in groups of fish with a low fullness level.

Conclusion

Based on the materials of fish groups +1, +2 and+ 3, which allow us to trace the development of the parasitic fauna of the carp, the maximum number of parasites (five species) is recorded at the age of +3. In fish of this age, not only the species diversity of parasites was observed, but also the intensity of infection increased. Most of the parasites recorded in the silver carp finish its life cycle without an intermediate host.

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 ISSN: 2707-1146
e-ISSN: 2709-4189

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Received: 20.10.2024
Accepted: 09.03.2025