

Fauna and Distribution Endohelminths of Fish From Waterbodies Of The Central Region Of Uzbekistan



Feruza Safarova, Feruza Akramova, Djaloliddin Azimov, Oybek Abduganiyev

Abstract: Fauna and distribution patterns of the endohelminths of fish from water bodies of the central region of Uzbekistan were investigated. 15 endohelminth species were recorded from fish in this region, including 5 species of trematodes, 6 species of cestodes, 3 species of nematodes and 1 species of acanthocephalans. Six species are first reported from this region. Original data on the composition and structure of endohelminth communities are given.

Key words: Endohelminths, cestodes, trematodes, acanthocephalans, nematodes, fauna, Cypriniformes, Siluriformes, Zarafshan, Uzbekistan.

I. INTRODUCTION

The basin of the Zarafshan River is a natural geographic complex lying in the transboundary territory, where waterbodies with different ecological conditions are situated. Currently, a large number of reservoirs covering hundreds of thousands hectares have been created for an integrated use. The reservoirs are a new type of water bodies distinguished by their specific ecological conditions (Isaev, Karpov, 1989). Studies of biocenoses and fish populations in the water bodies of the River Zarafshan will serve as the basis for sustainable activities in the sphere of nature use at a national level.

Due to intensive human commercial activities connected with the use of water resources, noticeable qualitative and quantitative changes take place in the biocenoses and fish populations. Parasitic diseases inevitably occur in fish, causing declines in the numbers of valuable species and deterioration of epizootic situation in water bodies. Parasitic diseases of fish not only cause a significant economic loss connected with fish yields, they are also dangerous for human health (Osmanov, 1971).

Revised Manuscript Received on January 30, 2020.

* Correspondence Author

Feruza Safarova*, The Institute of the Zoology, Uzbek Feruza Safarova, Feruza Akramova, Djaloliddin Azimov, Oybek Abduganiyev Academy of Sciences, Bagishamol str. 232b, Tashkent 100125, Uzbekistan

Feruza Akramova, The Institute of the Zoology, Uzbek Feruza Safarova, Feruza Akramova, Djaloliddin Azimov, Oybek Abduganiyev Academy of Sciences, Bagishamol str. 232b, Tashkent 100125, Uzbekistan

Djaloliddin Azimov, The Institute of the Zoology, Uzbek Feruza Safarova, Feruza Akramova, Djaloliddin Azimov, Oybek Abduganiyev Academy of Sciences, Bagishamol str. 232b, Tashkent 100125, Uzbekistan

Oybek Abduganiyev The Institute of the Zoology, Uzbek Feruza Safarova, Feruza Akramova, Djaloliddin Azimov, Oybek Abduganiyev Academy of Sciences, Bagishamol str. 232b, Tashkent 100125, Uzbekistan

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an [open access](https://creativecommons.org/licenses/by-nc-nd/4.0/) article under the CC-BY-NC-ND license [http://creativecommons.org/licenses/by-nc-nd/4.0/](https://creativecommons.org/licenses/by-nc-nd/4.0/)

The analysis of literature (Kolesnikova, 1965; Allamuratov, 1966; Agapova, 1966; Osmanov, 1971; Karaev, 1975; Karimov, 2007) has shown that the fish inhabiting the water bodies lying in the water bodies of the central region of Uzbekistan plain are parasitized by a diverse fauna of parasites, which were mainly noted in the fish of the upper and lower streams of this river. Available data (Kolesnikova, 1965; Agapova, 1966; Osmanov, 1971; Karimov, 2007) on the fauna of fish endohelminths in the water bodies of the central region of Uzbekistan are fragmentary and insufficient. As the endohelminths are important in the pathology of fish in natural and artificial water bodies, the study of the species composition of endohelminths in inhabiting the water bodies of the central region of Uzbekistan is quite important. The aim of this work is the study of fauna and distribution of parasitic worms of fish inhabiting the water bodies of the in the basin of the central region of Uzbekistan.

II. MATERIAL AND METHODS

The study was conducted in 2009-2019 in the water bodies of the central region of Uzbekistan (the Zarafshan River, lake Aidarkul, Tuyabuguz reservoir and fish farms), in Samarkand, Navoiy and Bukhara provinces.

Collection and study of fish endohelminths were conducted using conventional methods (Skrjabin, 1928; Dogel, 1933; Bykhovskaya-Pavlovskaya, 1985). We studied 1547 individuals of 15 species (Cypriniformes - 12,

Siluriformes - 2). Besides, we carried out incomplete dissections of 1053 fish individuals and prepared 1026 temporary and permanent whole mounts.

The cameral treatment and identification of trematode species was carried out at the Laboratory of General Parasitology of the Institute of Zoology of Uzbek Academy of Sciences. Endohelminth species were identified by using the Reference Guide of Freshwater Fishes (Bykhovskaya-Pavlovskaya, 1985; Agapova, 1966; Shigin, 1986; Khokhlova, 1986) and the Catalogues (Pugachev, 2002, 2003, 2004).

The mounts were examined under the microscope MBI-3 and MBI-4, the drawings were produced using the drawing tubes RA-4 and RA-5.

III. RESULTS AND DISCUSSION

We found that the endohelminths of fish in the basin of the central region of Uzbekistan belong to five - teen species: 5 species of Trematoda, 6 of Cestoda, 3 of Nematoda,

and 1 of Acantocephala. The most numerous were trematodes: 5 species from 3 orders (Table 1), represented predominantly by Prosostomidea Skrjabin et Guschanskaja, 1962. The core of the trematode fauna are representatives of the order Strigeida La Rue, 1926 - 3 species.

Two orders of Cestoda were found in the fish. The most widespread are the orders Caryophyllida Beneden in Carus, 1863 and Cyclophyllida Braun, 1900 – on 3 types.

The Acanthocephala class is represented by a single species: *Neoechinorhynchus rutili* Müller, 1780.

The phylum Nematoda is notable for its significant species diversity in the water bodies of the Central region of Uzbekistan; we recorded three species belonging to three orders. Trichocephalida Skrjabin et Schulz, 1928 is represented by one species, *Contracaecum squali* (Linstow, 1907), which was found in most fish in natural and artificial water bodies in Central region of Uzbekistan. The highest species diversity was observed in the Spirurida Chitwood, 1933 and Dioctophymida Skrjabin, 1927, for which we recorded one species. Worthy of note are the findings of *Dioctophyme renale* Goeze, 1782 larvae III in Cypriniformes in the studied region.

Previously this species was reported in many fish inhabiting water bodies along the Amydarya River and in the lower reaches of the Syrdarya River (Karmanova, 1961; Osmanov, 1971).

The conducted studies revealed the highest number of endohelminth species in the water bodies of the Central region of Uzbekistan (15), followed by the Zarafshan River (12). The lowest number of endohelminths was recorded in the lake Aidarkul, where only three endohelminth species were found: 2 cestodes; and 1 nematodes. In our opinion, this is connected with peculiar ecological conditions in different water bodies (table 2). Eight endohelminth species were found in the fish farms. Of these, the most frequently recorded were *Sanguinicola inermis* Plehn, 1905, *Diplostomum spathaceum* (Rudolphi, 1819), *Ligula intestinalis* (Linnaeus, 1758) larvae and *Dioctophyme renale* Goeze, 1782 larvae.

Table 1. Species diversity of endohelminths in fish in the studied region

Order	Family	Endohelminth species	Hosts	Localization
Trematoda				
Sanguinicolida	Sanguinicolidae	Sanguinicola inermis	Cyprinus carpio, Carassius auratus gibelio, Hypophthalmichthys molitrix	circulatory system
Fasciolida	Allocreadiidae	Allocreadium isoporum	C. carpio, S. intermedius	Intestines
Strigeiida	Diplostomidae	Diplostomum spathaceum	R. rutilus, S. erythrophthalmus, Ctenopharyngodon idella, A. aspius, S. intermedius, C. auratus gibelio, C. carpio, Hypophthalmichthys molitrix	lens, sometimes eyeball
		Diplostomum clavatum	R. rutilus, S. erythrophthalmus, Ctenopharyngodon idella, A. aspius, S. intermedius, C. auratus gibelio, C. carpio, Hypophthalmichthys molitrix	lens, sometimes eyeball
		Tetracotyle sogdiana	R. rutilus, S. erythrophthalmus, Ctenopharyngodon idella, A. aspius, S. intermedius, C. auratus gibelio, C. carpio, Hypophthalmichthys molitrix	lens, sometimes eyeball
Cestoda				
Caryophyllidea ¹	Caryophyllaeidae	Caryophyllaeus laticeps	R. rutilus, A. orientalis, C. carpio	Intestines
		C. fimbriceps	C. carpio, C. auratus gibelio	Intestines
Pseudophyllidea	Ligulidae	Ligula intestinalis	S. erythrophthalmus, R. rutilus, S. intermedius, Hemiculter leucisculus, A. orientalis	body cavity
Cyclophyllidea	Dilepididae	Gryporhynchus cheilancristrotus	R. rutilus, A. aspius, C. carpio, S. erythrophthalmus, Tinca tinca, A. orientalis	intestinal wall and gallbladder
		G. pusillus	C. auratus gibelio, C. carpio, R. rutilus, A. aspius, A. orientalis, S. erythrophthalmus, C. idella	in the mucous membrane of the anterior intestine
		Dilepis unilateralis	R. rutilus, S. erythrophthalmus, A. aspius, C. auratus gibelio, C. carpio, H. molitrix	gallbladder
Nematoda				
Trichocephalida	Capillariidae	Capillaria tomentosa	S. erythrophthalmus, R. rutilus, A. aspius, S. intermedius	Intestines
Dioctophymida	Dioctophymidae	Dioctophyme renale	R. rutilus, A. aspius	intestinal wall, liver, gonad
Spirurida	Rhabdochoniidae	Rhabdochona denudata	C. auratus gibelio, R. rutilus, S. intermedius	Intestines
Acanthocephala				
Neoechinorhida	Neoechinorhynchidae	Neoechinorhynchus rutili	S. intermedius, C. carpio	Intestines

¹ Name of the order of Cestoda class is given by L. F. Khalil et al., 1994.

Table 2. Distribution of endohelminths of fish in water bodies of different types of the Central region of Uzbekistan (2009-2019)

Endohelminths	Total number of species	Water bodies		
		Zarafshan River	Aidarkul lake	Fish farms
Cestoda	6	5	2	4
Trematoda	5	4	-	2
Nematoda	3	2	1	2
Acanthocephala	1	1	-	-
Total	15	12	3	8

Cestoda	6	5	2	4
Trematoda	5	4	-	2
Nematoda	3	2	1	2
Acanthocephala	1	1	-	-
Total	15	12	3	8

The poor diversity of the parasite fauna in in landlocked waterbodies and an almost complete absence of a number of specific parasites are undoubtedly associated with the process of acclimatization, where natural processes of the formation of respective groups of considered endohelminth hosts were disturbed.

During acclimatization, fish get to water bodies with different hydro chemical conditions and fish, plankton and benthos composition, which results in significant changes in their parasite fauna. Total regularities of these changes established by a number of researchers (Petrushevsky, 1954; Agapova 1966; Osmanov, 1971), provided an opportunity to formulate the following principles: 1) a general impoverishment of the parasite fauna of fish takes place at the acclimatization of fish; 2) a complete or partial loss of parasites typical for fish in original water bodies; 3) beginning of parasitism by new parasites, which are common for these fish or widespread there, and conservation at acclimatization of parasites with direct development.

These principles hold true for the parasite fauna of fish in the studied region of Uzbekistan.

The data that we obtained on the quantitative composition of the Cypriniformes helminth fauna in the basin of the mid-course of the Syrdarya River enabled us to identify three types of communities:

- 1) endohelminths parasitizing fish as definitive hosts;
- 2) endohelminths parasitizing fish as intermediate hosts;
- 3) endohelminths parasitizing fish as paratenic hosts;

The distribution of indicated endohelminth communities in the region depends on a number of well-known biotic and abiotic factors. The first type includes 12 endohelminth species: 5 cestodes; 3 trematodes; 3 nematodes and 1 acanthocephalans (Table 3). Fish are infected here mainly through the digestive canals of hosts, as well as directly by a free-swimming penetration of trematode cercariae (*Sanguinicola inermis* Plehn, 1905) through the cover of fish. Nevertheless, we find acceptable the viewpoints of Ginetsinskaya (1958) and Ergashev (1965), who consider fish as second intermediate hosts of *Raphidascaris acus*. We also find this view reasonable for the species of *Contracaecum*.

The second type is characterized by the fact that some species of fish are the second intermediate hosts for 19 endohelminth species: 2 cestodes; 12 trematodes and 5 nematodes. Definitive hosts (predatory fish, fish-eating birds and mammals) are infected consuming fish fish infected by endohelminth larvae.

Participation of fish as paratenic hosts in the transmission of the considered endohelminths is in many respects questionable. Nevertheless, fish, according to literature, were noted as paratenetic hosts (Pugachev, 2004).

Table 3. Biological peculiarities of endohelminths of fish in the studied region

Taxa	Number of endohelminth species	Hosts			Source	
		Intermediate hosts		Paratenic		Definitive
		First	Second			
Cestoda	13					
Caryophyllaeidae	4	Oligochaetes			Cypriniformes Osmanov, 1971	
Amphicotyliidae	1	Cyclops			Cypriniformes Osmanov, 1971	
Bothriocephalidae	1	Cyclops			Cypriniformes the present study	
Ligulidae	2	Cyclops	Cypriniformes		Birds the present study	
Proteocephalidae	1	Cyclops			Cypriniformes Karimov, 2007	
Dilepididae	4	Cyclops			Birds Kolesnikova, 1965	
Trematoda	18					
Bucephalidae	1	Mollusks	Cypriniformes		Cypriniformes and other fish the present study	
Sanguinicolidae	1	Mollusks			Cypriniformes and other fish the present study	
Allocreadiidae	2	Mollusks			Cypriniformes and other fish Osmanov, 1971	
Gorgoderidae	1	Mollusks			Cypriniformes and other fish Shakarboev, 2009	
Monorchidae	1	Mollusks			Cypriniformes and other fish Shakarboev, 2009	
Orientocreadiidae	1	Mollusks			Cypriniformes and other fish Shakarboev, 2009	
Clinostomidae	1	Mollusks	Fish		Birds Shakarboev, 2009	
Diplostomidae	8	Mollusks	Fish		Birds Shakarboev, 2009 and the present study	
Strigeidae	2	Mollusks	Fish		Birds Shakarboev, 2009 and the present study	
Nematoda	14					
Capillariidae	1				Cypriniformes and other fish the present study	
Dioctophymidae	1	Oligochaetes	Cypriniformes		Mammalians the present study	
Rhabdochonidae	2	Oligochaetes			Cypriniformes the present study	
Desmidocercidae	1			Cypriniformes	Birds the present study	
Camallanidae	1	Cyclops			Cypriniformes the present study	
Philometridae	3	Cyclops			Cypriniformes the present study	

Fauna and Distribution Endohelminths of Fish From Waterbodies Of The Central Region Of Uzbekistan

Gnathostomatidae	1	Cyclops		Cypriniformes, amphibians	Mammalians	Osmanov, 1971
Anisakidae	4	Oligochaetes and Copepoda	Cypriniformes, dragonflies	Cypriniformes	Birds, predatory fish	the present study
Acanthocephala	4					
Neoechinorhyn-chidae	1	Ostracoda	Megaloptera, Hirudinea		Cypriniformes	Osmanov, 1971
Echinorhynchidae	2	Amphipoda			Cypriniformes and other fish	the present study
Pomphorhynchidae	1	Amphipoda			Cypriniformes and other fish	Osmanov, 1971

According to our findings, they are noted for two nematode species of the genera *Desmidocercella* and *Gnathostoma*, which should be assigned to the third type.

IV. CONCLUSION

In the last few years, a tendency of intensive use of waterbodies situated in the mid-stream of the Syrdarya River for rearing fish, mainly fish, has surfaced. In this connection, we set ourselves the task to specify species diversity of parasitic worms and their distribution. It is noteworthy that in the past efforts were made to study endohelminths of fish in waterbodies of the Syrdarya River. In some fish twenty-five endohelminth species were found (Osmanov, 1961; Kolesnikova, 1965; Agapova, 1966; Karimov, 2007).

However, in the studied waterbodies of the Central region of Uzbekistan we found forty-nine species of parasites including cestodes, trematodes, nematodes and acanthocephalans in fish. Trematodes (18 species) were dominant. Species diversity of cestodes and nematodes reached 13 and 14 species, respectively. The numbers of fish endohelminths were different in various parts of the Zarafshan River: in the upper course there were 10 species; in the mid-course, 49 species and in the lower reaches, 25 species. These findings suggest that the most optimal conditions for the functioning of respective endohelminth communities are, perhaps, in the waterbodies of the mid-course. A high number of groups of invertebrate animals inhabit aquatic ecosystems; some are the intermediate hosts of parasites of fish, while the aggregation of waterfowl and mammals in these areas enable circulations of respective endohelminths.

Thus, dixenic and trixenic life cycles, which have been established in the relations between the components of the parasitic system, are characteristic for most endohelminths of fish of the waterbodies situated in the mid-stream of the Central region of Uzbekistan. The species diversity of fish in the studied region is relatively rich and various. This is supported by the monitoring of parasitological situation relating to fish helminthoses in specific waterbodies of the region, which must be taken into account while developing preventive measures.

REFERENCES

1. Agapova A.I. The parasites of fish in the waterbodies of Kazakhstan. - Alma-Ata: Nauka Publishers, 1966. -342 pp.
2. Allamuratov B.A. Parasites of fish in the basin of the Surkhandarya River: Summary of the thesis for the Degree of Candidate of Sciences (Biology). - Kiev, 1966. - 20 pp.
3. Byhovskaya-Pavlovskaya I.E. Parasites of fishes. The manual. - Leningrad: Nauka Publishers, 1985. - 121 pp.
4. Ginetsinskaya T.A. Life cycles and the biology of the larval stages of parasitic worms of fish. In book: main problems of fish parasitology. - Leningrad: Leningrad State University, 1958. - P. 144-184.
5. Dogel V.A. Problems of the study of fish parasites (techniques and problems of ichthyo-parasitological studies). The book of scientific works of the Leningrad Naturalist Society. - Leningrad, 1933. Vol. 62. - Issue 3. - P. 247-268.
6. Engashev V.G. Biology of *Raphidascaris acus* (Bloch, 1779), epizootology and prevention of fish *Raphidascaris* infection: Summary of the thesis for the degree of Candidate of Sciences in biology. - Moscow, 1965 - 19 pp.
7. Isaev A.I., Karpov E.I. Fish farming of reservoirs. Reference guide. - Moscow: Agropromizdat Publishers. 1989. - 256 pp.
8. Karaev R.M. The fauna of fish parasites in the basin of the River Kashkadarya: Summary of dissertation for the degree of Candidate of Biology. - Tashkent, 1975. - 22 pp.
9. Karimov S.B. Parasites of fish in the Ferghana Valley: Dissertation for the degree of Doctor of Sciences. -Tashkent, 2007. - 187 pp.
10. Karmanova E.M. The first report of finding the larvae of the *Dioctophyme renale* (Goeza, 1782) in fish in the USSR. The book of collected articles of the Helminthological Laboratory of All-Union Academy of Sciences. - Moscow, 1961. Vol. 2. - P. 118-121.
11. Khokhlova I.G. Acanthocephalans of the terrestrial vertebrate animals in the fauna of the USSR. - Moscow, 1986. - 276 pp.
12. Kolesnikova M.N. Parasite fauna of fish in the basin of the lower reach of the Syrdarya River: Summary of dissertation for the degree of Candidate of Biology. Kiev, 1965. - 24 pp.
13. Osmanov S.O. On the forthcoming scientific-industrial conference on the Aral. The bulletin of the Karakalpak Branch of the Academy of Sciences of UzSSR. - Nukus, 1961. No 4. -P. 40-43.
14. Osmanov S.O. Fish parasites in Uzbekistan. - Tashkent: Fan, 1971. - 532 PP.
15. Petrushevsky G.K. A change in the parasite fauna of fish due to their acclimatization. Book of collected scientific works of problematic and thematic cworkshops of the Zoological Institute of the All-Union Academy of Sciences. - Leningrad: Publishing House of All-Union Academy of Sciences, 1954. - Issue 4. - P. 29-38.
16. Pugachev O.N. Component parasitic communities and fish spawning. Parasitology. 2002. Vol. 36. - No 1. - P. 3-10.
17. Pugachev O.N. A catalogue of parasites of freshwater fishes in northern Asia (trematodes). Proceedings of the Zoological Institute of the Russian Academy of Sciences. - St. Petersburg, 2003. Vol. 298. - P. 218.
18. Pugachev O.N. A catalogue of parasites of freshwater fishes in northern Asia (nematodes, acanthocephalans, Hirudinea, mollusks, crustaceans, ticks). The proceedings of the Zoological Institute of the Russian Academy of Sciences. - St. Petersburg, 2004. Vol. 304. - P. 244.
19. Shigin A.A. Trematodes in the fauna of the USSR: the genus *Diplostomum*. Metacercariae. - Moscow: Nauka Publishers, 1986. - 253 PP.
20. Skrjabin K.I. The methods of complete helminthological dissections of vertebrate animals, including humans. - Moscow: The First Moscow State University Publishing House, 1928. - 45 PP.