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

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Abstract: Fauna and distribution patterns of the endohelminths of fish from water bodies of the central region of Uzbekistan were investigated. 15 endohelminths 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. Sex 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).

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 - ten species: 5 species of Trematoda, 6 of Cestoda, 3 of Nematoda, and 1 of Acanthocephala. 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.
| Order       | Family            | Endohelminth species                  | Hosts                                                                 | Localization               |
|-------------|-------------------|---------------------------------------|----------------------------------------------------------------------|----------------------------|
| **Trematoda** |                   |                                       |                                                                      |                            |
| Sanguinicola | Sanguinicolida     | 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 | Caryophyllaeae     | Caryophyllaeeus 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, Timca 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 mucus 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                 |
| Diocotophymida | Diocotophymida   | Diocotophyme renale                  | R. rutilus, A. aspius                                               | intestinal wall, liver, gonad |
| Spirurida    | Rhabdochonidae    | Rhabdochona denodata                 | C. auratus gibelio, R. rutilus, S. intermedius                      | Intestines                 |
| **Acanthocephala** |             |                                       |                                                                      |                            |
| Neoechinorhida | Neoechinorhynchida | Neoechinorhynchus rutili             | S. intermedius, C. carpio                                          | Intestines                 |

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

The poor diversity of the parasite fauna in inlandlocked 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 (Petrusheskiy, 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) endohelmints parasitizing fish as definitive hosts;
2) endohelmints parasitizing fish as intermediate hosts;
3) endohelmints 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 Contraacæcum.

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 mammalians) 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 | Intermediate hosts | Hosts | Source                  |
|---------------|--------------------------------|--------------------|-------|-------------------------|
|               |                                | First              | Second|                          |
| Cestoda       | 13                             |                    |       |                         |
| Caryophyllaeidae | 4                              | Oligochaetes       |       | Cypriniformes           |
| Amphicotylidae | 1                              | Cyclops            |       | Cypriniformes           |
| Bothriocephalidae | 1                           | Cyclops            |       | Cypriniformes           |
| Ligulidae     | 2                              | Cyclops            | Cypriniformes | Birds  |
| Proteocephalidae | 1                          | Cyclops            | Cypriniformes | Birds  |
| Dilepididae   | 4                              | Cyclops            |       | Birds                   |
| Trematoda     | 18                             |                    |       |                         |
| Bucephalidae  | 1                              | Mollusks           | Cypriniformes | Cypriniformes and other fish |
| Sanguinicoliidae | 1                         | Mollusks           |       | Cypriniformes and other fish |
| Allocreadiidae | 2                              | Mollusks           |       | Cypriniformes and other fish |
| Gorgoderidae  | 1                              | Mollusks           |       | Cypriniformes and other fish |
| Monorchidae   | 1                              | Mollusks           |       | Cypriniformes and other fish |
| Orientocreadiidae | 1                           | Mollusks           |       | Cypriniformes and other fish |
| Clinostomidae | 1                              | Mollusks           | Fish  | Birds                   |
| Diplostomidae | 8                              | Mollusks           | Fish  | Birds                   |
| Strigeidae    | 2                              | Mollusks           | Fish  | Birds                   |
| Nematoda      | 14                             |                    |       |                         |
| Capillariidae | 1                              |                    |       | Cypriniformes and other fish |
| Dioctophymidae | 1                             | Oligochaetes       | Cypriniformes | Mammalians |
| Rhabdocoecidae | 2                             | Oligochaetes       | Cypriniformes | Birds |
| Desmidocercidae | 1                           |                    | Cypriniformes | Birds |
| Camallanidae  | 1                              | Cyclops            | Cypriniformes |              |
| Philometridae | 3                              | Cyclops            | Cypriniformes |              |
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|---|---|---|---|---|
| Gnathostomatidae | 1 | Cylops | Cypriniformes, amphibians | Mammalians | Osmanov, 1971 |
| Anisakidae | 4 | Oligochaetes and Copepoda | Cypriniformes, dragonflies | Cypriniformes | Birds, predatory fish | the present study |
| Acanthocephala | 4 | | | | |
| Neoechinorhynchidae | 1 | Ostracoda | Megaloptera, Hirudinea | Cypriniformes | Osmanov, 1971 |
| Echinorhynchidae | 2 | Amphipoda | | Cypriniformes and other fish | the present study |
| Pomerhynchidae | 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 endohelmintths 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 endohelmintths 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 endohelmintths.

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.

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