THE PARASITES OF SOME ASIAN CARP SPECIES FROM THE AQUATIC BIOTOPES FROM THE REPUBLIC OF MOLDOVA

Ion GOLOGAN[1]

e-mail: gologanionel@gmail.com

Abstract

As a result of the parasitological examination of some Asian carp species (common carp, prussian carp, silver carp, bighead carp) from a few fish ponds from Fălești district, 14 species of parasites were found, systematically classified into 7 classes, 12 families, 14 genera. The degree of infestation varied depending on the species: *Trichodina* sp. - common carp (EI-53.84%, II 1-10 ex.); *Dactylogyrus* sp. - common carp (EI-92.0%, II-1-45 ex.), prussian carp (EI-100%, II-1-45 ex.), silver carp (EI-72.7%, II-12-81 ex.), bighead carp (EI-100%, II-74-160 ex.); *Eudiplozoon nipponicum* - common carp (EI-38.46%, II-1-7 ex.), prussian carp (EI-16.0%, II-1-2 ex.); *Khawia sinensis* - common crap (EI-46.15%, II-1-15 ex.); *Schyzocotyle acheilognathi* – bighead carp (EI-9.09%, II-1 ex.); *Valipora campylancristrota* - common carp (EI-7.69%, II-1 ex.), silver carp (EI-9.09%, II-1 ex.), bighead carp (EI-44.4%, II-1-3 ex.); *Aspidogaster limacoides* – prussian carp (EI-4.0%, II-1 ex.); *Diplostomum spathaceum* - common carp (EI-30.76%, II-1-4 ex.), prussian carp (EI-20%, II-1-8 ex.), silver carp (EI-54.5%, II-1-15 ex.), bighead carp (EI-100%, II-1-92 ex.); *Posthodiplostomum cuticola* - common carp (EI-7.69%, II-1-2 ex.), silver carp (EI-54.5%, II-5-12 ex.); *Phillodistomum* sp. – prussian carp (EI-0.25%, II-1 ex.); *Phylometroides sanguinea* – prussian carp (EI-4.0%, II-1-2 ex.); *Sinergasilus lieni* – silver carp (EI-72.7%, II-7-26 ex.), bighead carp- (EI-100%, II-5-24 ex.); *Lernaea* sp. – common carp (1 ex.); Glochidium - common carp (EI-7.69%, II-1-10 ex.), prussian carp (EI-4.0%, II-4 ex).

Key words: (parasites, common carp, prussian carp, silver carp, bighead carp)

INTRODUCTION

In fish farming the mass death of both juveniles and adult fish is often recorded. This fact is closely related to the overpopulation of ponds with fish, which favors the accumulation of a large number of pathogens that can cause epizootics. Moreover, the infested fish can cause damage to other fish ponds as long as it is used to populate them (Gorchakova, 2000; Golovyna, 2014).

Among the diseases of fish, a great importance belongs to the invasive diseases, produced by parasitic agents with a great taxonomic diversity. The most common are parasites produced by protists (flagellates, ciliates, sporozoans, cnidosporidians) and those produced by worms or helminths (monogeneans, trematodes, cestodes, nematodes and acanthocephalans). These parasites parasitize both fish in natural and artificial waterbodies (Vasylkov, 1983, 1989).

Given the economic importance of fish, our goal was to perform the parasitological examination in order to detect potentially dangerous species for both fish and humans.

MATERIALS AND METHOD

The parasitological research was carried out in the laboratory of Parasitology and Helminthology of the Institute of Zoology, and performed according to the standard method proposed by Skryabin K.I. (1928) and the method proposed by Dogel and modified by Bykhovskaya Pavlovskaya (1985). The determination of the helminths was done acording to Bauer (1985, 1987). The microscopy of the detected helminths was performed using the stereomicroscope MBS, as well the examination at the optical microscope Novex Holland B, as fresh preparation slide-coverglass, with the objective 4x, 10x, 20x and ocular WF10X DIN/20MM. The detected nematodes were stored in Barbagallo solution (3% formaldehyde and 0,9% sodium chloride), and the trematodes were stored in 70% ethanol. For the parasitological evaluation, extensivity (%) and intensivity of invasion were used.

RESULTS AND DISCUSSIONS

As a result of the parasitological examination of 4 species of fish (common carp, prussian carp, silver carp, bighead carp) species of parasites with various locations, systematically classified in-

[1] Instititute of Zooology, Chisinau

to 7 classes, 12 families, 14 genera were detected (*table 1*).

Table 1

The parasites found in the examined Asian carp specimens

Class	Family	Species
Oligohymenophorea	Trichodinidae Claus, 1951	*Trichodina* sp.
Monogenea	Dactylogyridae Bychowsky, 1933	*Dactylogyrus* sp.
	Diplozoidae Palombi,1949	*Eudiplozoon nipponicum* (Goto, 1891)
Trematoda	Diplostomidae Poirier, 1886	*Diplostomum spathaceum* (Rudolphi, 1819) Olsson, 1876
		Posthodiplostomum cuticola (von Nordmann, 1832) Dubois, 1936
	Gorgoderidae Looss, 1899	*Phillodistomum sp.*
	Aspidogastridae Poche, 1907	*Aspidogaster limacoides* Diesing, 1834
Cestoda	Lytocestidae Hunter, 1927	*Khawia sinensis* Hsü, 1935
	Bothriocephalidae Blanchard, 1849	*Schyzocotyle acheilognathi (Yamaguti, 1934)* Brabec, Waeschenbach, Scholz, Littlewood & Kuchta, 2015
	Gryporhynchidae Blanchard, 1849	*Valipora campylancristrota* (Wedl, 1855)
Enoplea	Philometridae Baylis & Daubney, 1926	*Philometroides sanguinea* (Rudolphi, 1819)
Hexanauplia	Lernaeidae Cobbold, 1879	*Lernaea* sp.
	Ergasilidae Burmeister, 1835	*Sinergasilus lieni* Yin, 1949
Bivalvia	-	Glochidium

As a result of the examination of the gill lamellae, helminths from the class Monogenea, genera *Dactylogyrus* (*figure 1*) and *Eudiplozoon* were detected. From the genus *Dactylogyrus*, the most dangerous to fish are *Dactylogyrus vastator*, *D. extensus* and *D. anchoratus*.

Figure 1. **Specimen of *Dactylogyrus* sp. detected on the gills of prussian carp**

The representatives of this genus are worms with a flattened body, 0.75-1 mm long, 0.15-0.38 mm wide, that ataches to the epithelium of the gill lamellae of various fishes, through a complex adhezive organ called opisthaptor, which is armed with 2 large central hooks and 14 small hooks arranged marginally (*figure 2*). The shape, size of the hooks, and the attachment disc, vary depending on the species, and are an important taxonomic feature for determination (Gibson, 1986).

The performed parasitological examination revealed the infestation with *Dactylogyrus* sp. of the following fish species: common carp (EI-92%, II-1-45ex.), silver carp (EI-100%, II-1-45 ex.), silver carp (EI-72.7%, II- 12-81 ex.), bighead carp (EI-100%, II-74-160ex.).

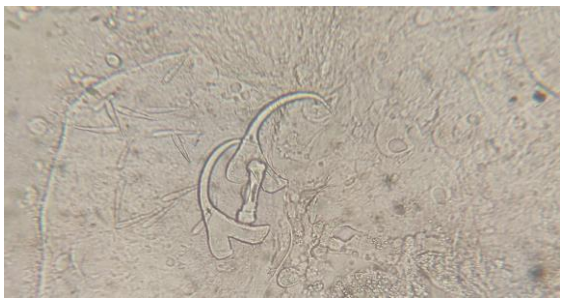

Figure 2. **Large hooks and marginal hooks of *Dactylogyrus* sp.**

One of the representatives of the genus *Eudiplozoon* is *E. nipponicum* (*figure 3*). This species parasitizes on gill lamellae of common carp, crucian carp, bream and other cyprinids. It is a hematophagous parasite which, according to Kawatsu (quoted by Bauyer, 1985), in case of massive infestations, can cause hypochromic anemia.

The performed parasitological examination revealed the infestation with *E. nipponicum* of the following fish species: common carp (EI-38.46%, II-1-7ex.), prussian carp (EI-16.0%, II-1- 2 ex.).

Figure 3. ***Eudiplozoon nipponicum*** **detected on the gill lamellae of comon carp**

Also, as a result of the parasitological examination of the gill lamellae of common carp, protists from the genus *Trichodina* were detected (*figure 4*). The extensivity of invasion reached 53.84% and the intensivity of the invasion 1-10 specimens in a microscope field of view.

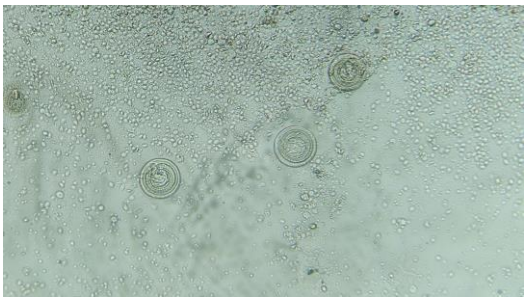

Figure 4 ***Trichodina*** **sp. detected on the gills of common carp**

Parasitological examination of the gills of common carp and prussian carp revealed the presence of parasitic larval stages of freshwater mussels, aquatic bivalve mollusks, from the genera *Unio*, *Anodonta*, *Margaritana*, known also as glochidium (*figure 5*). During the parasitological examination, glochidia were detected in common carp and prussian carp. In the case of the common carp, the extensivity of invasion with glochidia was 7.69%, and the intensivity of invasion 1-10 specimens. In the case of silver carp the extensivity of invasion was 4.0%, and the intensivity of invasion 4 specimens.

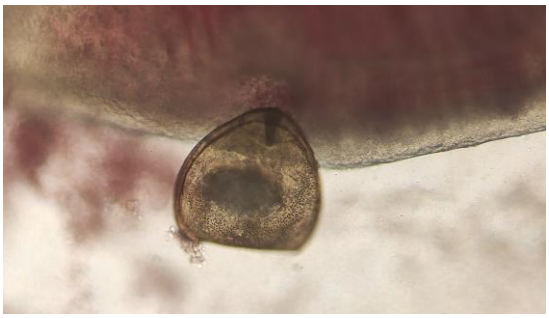

Figure 5. **Glochidium on the gills of a common carp specimen**

From the group of parasitic crustaceans *Sinergasilus lieni* and *Lernaea* sp. were detected (only one specimen of *Lernaea* sp. was detected on a common carp, attached to the ventral aorta).

S. lieni (*figure 6*) is a parasitic crustacean, specific to silver carp and bighead carp, that parasitizes on the gills. In case of a high degree of infestation, *S. lieni* cause inflammation, necrosis of the gills, poor blood circulation and gas metabolism that results in asphyxiation of the infested fish.

In the carried parasitological research, the extensivity of invasion of silver carp with *S. lieni* was 72.7%, and the intensivity of invasion – 7-26 specimens. In bighead carp the parasite was found in 100% of cases, and the intensivity of invasion was 5-24 specimens.

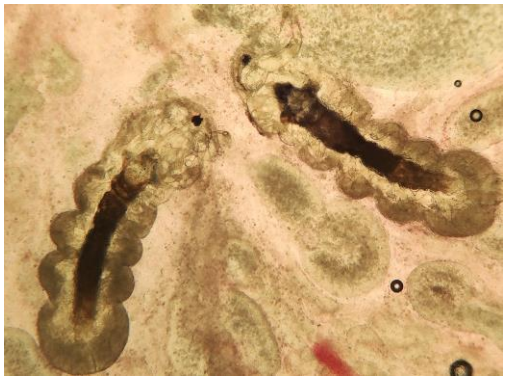

Figure 6**. Specimens of *Sinergasilus lieni* detected on the gills of bighead carp**

From de Diplostomidae family, trematode species *Diplostomum spathaceum* and *Posthodiplostomum cuticola* were found. *D. spathaceum* (*figure 7*) is a trematode, the larval stage (metacercariae) of which causes a very dangerous disease called diplostomiasis or ,,white eye" disease. Diplostomiasis, depending on age, can develop acute and chronic. Specific for the chronic form are the lesions of the eye lens, manifested by cataract. In chronic form, due to cataract, the fish does not feed enough and, respectively, the body weight decreases, compared to that of healthy fish (Shigin, 1976).

Figure 7.***Diplostomum spathaceum*** **– metacercariae found in the lens of common carp**

The infested fish swim more on the surface of the water, thus being predisposed to be eaten by

piscivorous birds. In the acute form, the infested fish is agitated, does not feed and has punctiform hemorrhages on the opercula and in the eyeballs.

In the examined fishes, *D. spathaceum* was found in common carp (EI-30.76%, II-1-4 ex.), prussian carp (EI-20.0%, II-1-8 ex.), silver carp (EI-54.5%, II-1-15ex.), and bighead carp (EI-100%, II-1-92ex.).

The second species of trematodes from family Diplostomidae found in the examined fishes is *Posthodiplostomum cuticola*, which causes an invasive disease called postodiplostomiasis (*figure 8*), which is characterized by the initial appearance of black spots of various size on the fish skin, which then turns into small cysts surrounded by melanic pigment - hemomelanin, which is the product of the degradation of hemoglobin and chromatophores. Inside the cyst the metacercariae is located (*figure 9*). Spots and cysts appear in different regions of the body: on the fins, gills, caudal peduncle, in the dorsal and lateral region of the body, on the cornea, in the oral cavity, and their number can vary from a few tens to several hundred. In case of a massive infestation, the deformity and the loss of the flexibility of the spine can be noticed. The fish remains undeveloped, being predisposed to be caught by the piscivorous birds (Goloshchapova, 2014).

Infested with *P. cuticola* were common carp and silver carp. The extensivity and intensivity of invasion in common carp were 7.69%, 1-2 ex., and 54.5%, 5 -12ex. in silver carp.

Figure 8. **Silver carp infested with *Posthodiplostomum cuticola***

Figure 9. ***Posthodiplostomum cuticola* – metacercariae extracted from the cyst**

Also, as a result of the inspection of the prussian carp tegument, the nematode *Philometroides sanguinea* (*figure 10*) was detected. The location of the parasite in the host differs. Males parasitize inside the abdominal cavity, between the walls of swim bladder, and females between the bony rays of the caudal fin, less often the dorsal fin.

The extensivity of invasion with *P. sanguinea* was 4.0%, and the intensivity of the invasion 1-2 specimens.

Figure 10. **Prussian carp infested with *Philometroides sanguinea***

During parasitological examination 4 species of parasites were detected in the organs of the digestive system: *Khawia sinensis*, *Schyzocotyle acheilognathi*, *Aspidogaster limacoides* in the intestine, and *Valipora campylancristrota* in the gallbladder.

K. sinensis (*figure 11*) is a flatworm from the class Cestoda, with a white, non-segmented body, 80-175 mm long and 2.5-3.5 mm wide, specific to common carp and grass carp. The parasite can be found in all fish ponds were common carp is farmed, susceptible to infestation being all age groups. However, the extensivity and intensivity of invasion in adult fishes is lower than in youth. Also, the degree of infestation with this helminth is influenced by the environmental conditions. In water bodies with a stagnant, muddy water, preferred by aquatic oligochaetes (intermediate hosts), the level of fish infestation is much higher (Mirzoyeva, 2016).

Figure 11. **Specimens of *Khawia sinensins* in the intestine of common carp**

As a result of the parasitological examination, *K. sinensis* was detected in common carp. The extensivity of the invasion with *K. sinensis* was 46.15% and the intensivity of the invasion 1-13 specimens.

S. acheilognathi (*figure 12*) is a cestode that can infest various cyprinids, such as common carp, prussian carp, bighead carp, etc. The most susceptible to the infestation are common carp and bighead carp youth. In these species the extensivity of invasion can reach 80-100%. This parasite is allogen for the aquatic biotopes in the Republic of Moldova. He entered the water bodies via grass carp, brought for acclimatization in the early 60s of the 20th century (Marits, 1968). The causes of *S. acheilognathi* invasion can be: the adult infested fish, which act as vector, the simultaneous farming of fish of different age groups, the invasion of fish ponds with infested crustaceans (Bauyer, 1981).

As a result of the parasitological examination *S. acheilognathi* was detected in bighead carp. The extensivity of invasion was 9.09%, and the intensivity invasion 1-2 specimens.

Figure 12. ***Schyzocotyle acheilognathi*** **detected in the intestine of bighead carp**

From the species of trematodes, that parasitize the digestive system, *A. limacoides* was detected (*figure 13*). Out of the total examined fishes, only prussian carp was infested. The extensivity of invasion of prussian carp with *A. limacoides* was 4.0%, and the intensivity of invasion 1-2 specimens.

Figure 13. ***Aspidogaster limacoides*** **detected in the intestine of prussian carp**

After the examination of gallbladder of the captured fishes, cestodes from the family Gryporhynchidae, represented by the larval stage (plerocerc) of *Valipora campylancristrota* (*figure 14*) were found.

Infested with *V. campylancristrota* were common carp (EI-7.69%, II-1 ex.), silver carp (EI-9.09%, II-1 ex.), and bighead carp (EI-44.4%, II-1-3 ex.).

Figure 14. ***Valipora campylancristrota*** **detected in the gallbladder of bighead carp**

During the parasitological examination of the organs of the urinary tract (ureters, urinary bladder) of prussian carp, trematodes from the family Gorgoderidae, genus *Phillodistomum* (*figure 15*) were detected.

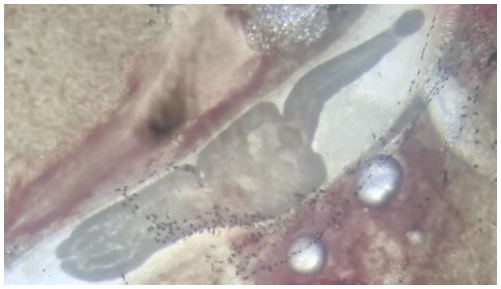

Figure. 15 ***Phillodistomum*** **sp – detected in the ureter of prussian carp**

The extensivity of invasion of prussian carp with *Phillodistomum* sp. was 0.25%, and the intensivity of invasion 1 specimen.

CONCLUSIONS

As a result of the parasitological examination of the studied fish species, 14 species of parasites were detected. Out of the total detected species, 2 were specific: *Sinergasilus lieni* specific for silver carp and bighead carp, and *Philometroides sanguinea* specific for prussian carp.

The highest extensivity of invasion was recorded in the case of infestation with monogenetic trematode *Dactylogyrus* sp. in the following species: common carp (EI-92%), prussian carp (EI-100%), silver carp (EI-72.7%), bighead carp (EI-100%), and the highest intensivity of invasion with this parasite was recorded in bighead carp (II-160ex.).

In the case of trematodes, the highest prevalence showed *Diplostomum spathaceum* found in the following species: common carp (EI-30.76%),

prussian carp (EI-20.0%), silver carp (EI-54.5%), bighead carp (EI-100%). The highest intensivity of invasion with *D. spathaceum* was recorded in bighead carp (II-92 ex.).

In the case o cestodes, the highest prevalence showed *Khawia sinensis* found in common carp (EI-46.15%).

ACKNOWLEGMENTS

The work is developed within the project ”Team up for healthy fish in aquaculture systems of the Prut river basin” (Project code: 2SOFT/1.2./47), and the fundamental institutional project ”Diversity of hematophagous arthropods, zoo-, and phytohelminths, their vulnerability and tolerance strategies to climatic factors and elaboration of the innovative procedures for integrated control of species with socio-economic values” (Project code: 20.80009.7007.12).

REFERENCES

Bauyer O.N. *Opredelitel parazitov presnovodnykh ryb fauny SSSR*. Tom 2. Izdatelstvo Nauka. Leningrad. 1985.

Bauyer O.N. *Opredelitel parazitov presnovodnykh ryb fauny SSSR*. Tom 3. Izdatelstvo Nauka. Leningrad. 1987.

Bykhovskaya-Pavlovskaya I. *Parazity ryb. Rukovodstvo po izucheniyu*. Izdatelstvo Nauka. Leningrad. 1985. p. 90-111.

Vasilkov G.V. Grishchenko V.G. Yengashev M. Bolezni ryb. Agropromizdat. 1989. -288 s.

Vasilkov, G.V. *Gelmintozy ryb*. M.: Izd-vo «Kolos», 1983.-208 s.

Golovina N.A. *Parazitofauna plotvy (Rutilus rutilus* L.*) v vodoyemakh moskovskoy oblasti*. Agrarnyy vestnik Urala № 3 (121), 2014

Gorchakova, N.G. *Gelmintozy ryb Nizhegorodskoy oblasti* / N.G. Gorchakova, Ye.A. Zyuzin, I.P. Smirnova [i dr.] // Mater, mezhdunarodnoy nauch. konf. - Kazan', 2000, - S. 44-45.

Marits N.I., Naberezhnyy A.I., Oleynikova V.L. *Bothriocephalus gowkongensis* Yeh, 1955 *(Cestoda: Pseudophyllidea) v vodoyemakh Moldavii.* Parazity zhivotnykh i rasteniy. Vypusk IV. Moskva 1968. s. 168

Skryabin K.I. *Metod polnykh gelmintologicheskikh vskrytiy pozvonochnykh, vklyuchaya cheloveka*. M.: Izd-vo MGU, 1928. 45 s. 9.

Shigin A.A. *Metatserkarii roda Diplostomum fauny SSSR*. V: Parazitologiya, 1976, vyp. KH, tom.4, c.346-350.

Goloshchapova O.N., Malysheva N.S., Samofalova N.A., Vagin N.A., Yelizarov A.S., Chuvakova N.V. *Rasprostraneniye liguleza i postodiplostomoza v vodoyemakh Kurskoy oblasti*. Teoriya i praktika parazitarnykh bolezney zhivotnykh. 2014(15).

Mirzoyeva N.M., Aliyeva K.G., Kurmanova M.K., Zhitiyeva M.H., Gazayev M.M., Bittirova A.A., Makhiyev I.I., Bittirov A.M. *Epizootologiya kavioza prudovykh ryb v stepnykh vodoyemakh Kabardino-Balkarskoy Respubliki*. In Bioraznoobraziye i ratsional'noye ispol'zovaniye prirodnykh resursov 2016 (pp. 86-88).

Bauyer O. N., Musselius V. A., Strelkov Y.A. *Bolezni prudovykh ryb.* — M.: Logkaya i pishchevaya promyshlennost'. 1981. — 320 s

Gibson D.I., Timofeeva T.A., Gerasev P.I. "A catalogue of the nominal species of the monogenean genus Dactylogyrus Diesing, 1850 and their host genera". Systematic Parasitology. 35 (1): 3–48. (1996) https://doi:10.1007/BF00012180