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HELMINTHES OF GOBY FISH OF THE HRYHORYIVSKY ESTUARY (BLACK SEA, UKRAINE)

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Helminthes of Goby Fish of the Hryhoryivsky Estuary (Black Sea, Ukraine). Kvach Yu. — In the paper the data about the helminthofauna of *Neogobius melanostomus*, *N. ratan*, *N. fluviatilis*, *Mesogobius batrachocephalus*, *Zosterisessor ophiocephalus*, and *Proterorhynchus marmoratus* in the Hryhoryivsky Estuary are presented. The fauna of gobies' helminthes consist of 10 species: 5 trematods (*Cryptocotyle concavum* met., *C. lingua* met., *Pygidiopsis genata* met., *Acanthostomum imbutiforme* met.), *Asymphylogora pontica*, one cestoda (*Proteocephalus gobiorum*), 2 nematods (*Streptocara crassicauda* l., *Dichelyne minutus*), and 2 acanthocephalans (*Acanthocephaloides propinquus*, *Telosentis exiguus*). Only one of trematods species was presented by adult stage. The modern fauna of helminthes and published data are compared. The relative stability of the goby fish helminthofauna of the Estuary is mentioned.

Key words: goby, helminth, infection, Hryhoryivsky Estuary.

Гельминты бычковых рыб Григорьевского лимана (Черное море, Украина). Квач Ю. — Исследована гельминтофауна *Neogobius melanostomus*, *N. ratan*, *N. fluviatilis*, *Mesogobius batrachocephalus*, *Zosterisessor ophiocephalus* и *Proterorhynchus marmoratus* из Григорьевского лимана. Фауна гельминтов бычковых включает 10 видов. Из них 5 видов трематод (*Cryptocotyle lingua* met., *C. concavum* met., *Pygidiopsis genata* met., *Acanthostomum imbutiforme* met., *Asymphylogora pontica*), один вид цестод (*Proteocephalus gobiorum*), 2 вида нематод (*Streptocara crassicauda* l., *Dichelyne minutus*), 2 вида скребней (*Acanthocephaloides propinquus*, *Telosentis exiguus*). Из пяти видов трематод только один представлен взрослой стадией. Проведено сравнение современной фауны гельминтов с литературными данными. Отмечена относительная стабильность в гельминтофауне бычковых лимана.

Ключевые слова: бычок, гельминты, инвазия, Григорьевский лиман.

Introduction

The Hryhoryivsky Estuary is an opened water area of the North-Western Black Sea region. The average depth of the Estuary is 6 m and maximal one is 20 m (Starushenko, Bushuyev, 2001). A 500-m width navigation canal connects the Estuary to the Sea in southern part since 1978. A salinity of the Estuary varies of 6.62 up to 18.8‰ at average one 14.85‰ (Polishchuk et al., 2000). But before the canal was made of the Estuary waters had the salinity of 17.8 up to 22.6‰. The Estuary has substantial fishing source with a low fishery pressing. The most important commercial species of the Estuary are mussels *Mytilus galloprovincialis* Lamarck, 1819 and goby fish (Gobiidae) (Starushenko, Busheyev, 2001). Now the ecosystem of the Estuary has relatively good condition (Zaitsev, 2000).

The gobiids' parasite fauna of the Hryhoryivsky Estuary published by A. S. Chernyshenko (1960) covers 11 helminth species. But the explore was carried out in 1958 when the Estuary was connecting to the Sea periodically (Starushenko, Bushuyev, 2001). Thus nowadays there are no modern data of fish parasites in the Estuary.

Material and methods

The materials of the present study were 157 specimens of six gobiid species: monkey goby *Neogobius fluviatilis* (Pallas, 1811), round goby *N. melanostomus* (Pallas, 1811), ratan goby *N. ratan* (Nordmann, 1840), toad goby *Mesogobius batrachocephalus* (Pallas, 1811), grass goby *Zosterisessor ophiocephalus* (Pallas, 1811) and tubenose goby *Proterorhynchus marmoratus* (Pallas, 1811). The toad goby was presented by two individuals. Also only one tubenose goby caught in spring 1999 was necropsied as well. The fishes have been caught using fishnets and hooks on three sites (2–8-m depth) of the Hryhoryivsky Estuary since 1999 up to 2001 (fig. 1). Fresh fishes were examined for helminths (skin, fins, alimentary canal, internal organs, cavities, muscles, brain, gills, and eyes were examined). Metacercariae were isolated from cysts and stained with



Fig. 1. Schematic map of the Hryhoryivsky Estuary: 1 — sampling sites; 2 — mooring lines.

Рис. 1. Схематическая карта Григорьевского лимана: 1 — места лова; 2 — портовые сооружения.

DIGENEA

Heterophyidae

Cryptocotyle spp. met.

These helminthes are common in the north-western Black Sea. The adult stage infects the fish-eating birds, rats, dogs and some other mammals (Gayevskaya et al., 1975). In addition it is capable of infecting humans (Zimmerman, Smith, 1975). Metacercariae cause the blackspot disease of fish. Parthenogenesis stages of these trematods are located in snails of genus *Hydrobia*, *Littorina*, *Paludestrina*, etc. Infection of fishes occurs passively as cercariae penetrate through the skin surface.

Two Holarctic species, *C. lingua* (Creplin, 1825) met. and *C. concavum* (Creplin, 1825) met., were found in the Estuary. Metacercariae of *C. lingua* have been mentioned for the fish in the Hryhoryivsky Estuary for the first time. Oblong dense black cysts (*C. lingua*) and round one (*C. concavum*) were located in skin, fins, eyes and on the internal organs surface.

Table 1. Prevalence and mean intensity of infection of goby the Hryhoryivsky Estuary

Таблица 1. Экстенсивность и средняя интенсивность инвазии бычков из Григорьевского лимана

Species	Round goby (n=68)		Ratan goby (n=18)		Monkey goby (n=27)		Grass goby (n=40)	
	P	MI	P	MI	P	MI	P	MI
<i>Cryptocotyle lingua</i> met.	85.29	564.2±710.1	93.75	62.1±97.3	74.07	129.4±145.1		
<i>C. concavum</i> met.	88.24	184.5±333.3	93.75	71.7±70.92	29.63	124.0±171.1	34.21	5.0±2.83
<i>Pygidiopsis genata</i> met.	26.47	178.8±327.0			40.74	476.5±713.7		
<i>Acanthostomum imbutiformis</i> met.	25.00	10.6±11.2						
<i>Asymphylodora pontica</i>	16.18	18.4±25.7					2.63	1.0±0.0
<i>Proteocephalus gobiorum</i>					3.70	3.0±0.0	26.32	52.4±109.0
<i>Dichelyne minutus</i>	58.82	11.6±16.6	56.25	7.6±6.0	3.70	12.0±0.0		
<i>Streptocara crassicauda</i> l.	1.47	1.0±0.0					7.89	2.7±2.9
<i>Acanthocephaloides propinquus</i>	19.12	1.5±0.8	12.50	2.5±2.12	11.11	2.33±1.15	94.74	60.5±37.0
<i>Telosentis exiguus</i>	4.41	1.0±0.0	31.25	1.0±0.0	7.41	2.0±1.41	2.63	1.0±0.0
Total	100.00	704.1±799.9	100.00	130.4±145.3	96.30	340.3±579.6	97.27	75.1±63.8

Notes: n — number of necropsied fish.

acetic carmine. Cestodes were fixed with 70% ethanol and then stained with alum carmine. Later, stained tapeworms were dehydrated in ethanol and fixed in Canada balsam. Acanthocephalans and nematodes were fixed in 70% ethanol and mounted in glycerin for identification. The identification of the parasites was aided by a key (Gayevskaya et al., 1975).

The prevalence (P, %) and mean intensity (MI) were calculated. The standard deviation for mean intensity is given. The Index of Czeka-nowski-Sorensen (Ics, %) was used to compare the helminthes faunae.

Results

A total of 9 helminth species were recorded from the gobies studied. There are 5 trematods species, one tapeworm species, two acanthocephalans and also one nematode species. Only one of trematod species was presented by the adult stage. Two specimens of the toad goby were free from parasites.

The maximal infection with *C. lingua* met. was noted for the ratan goby (93.75%) but the monkey goby was infected minimally (74.07%). The grass goby was free from these parasites. The round goby had maximum worm number (up to 2500 larvae per fish) but the ratan goby had minimal number of parasites (tabl. 1).

Metacercariae of *C. concavum* were occurred in monkey, round, grass, and tubenose gobies. The ratan goby was infected mostly (93.75%) but the round goby had maximal number of larvae (upto 2000 larvae per fish) (tabl. 1). The tubenose goby had about 200 metacercariae.

***Pygidiopsis genata* Looss, 1907 met.**

A holarctic species. The life cycle of this species is similar to that of representatives of *Cryptocotyle* genus.

Metacercariae in pellucid cysts were occurred in muscles, liver, brain, spleen, eyes, body caviar and on the surface of internal organs of monkey and round gobies. According to the calculated indices the monkey goby was the most infected (up to 2500 larvae per fish) but the round goby was less infected and contained up to 1000 helminthes (tabl. 1).

Acanthostomatidae

***Acanthostomum imbutiformis* (Molin, 1859) met.**

A mediterranean species. Larvae of these trematods were mentioned by A. S. Chernyshenko (1960) for 12 fish species include 6 gobiid species: monkey goby, round goby, mushroom goby (*N. cephalarges* (Pallas, 1811)), grass goby, tubenose goby and marbled goby (*Pomatoschistus marmoratus* (Risso, 1810)).

According to the given data metacercariae of this worm were localized in muscles of the round goby and were absent in the other gobies autopsied (tabl. 1).

Monorchidae

***Asymphyrodora pontica* (Tschernyschenko, 1949)**

This species is related to the group of Ponto-Caspian endemic species. This helminth species is reported for the Estuary fauna for the first time. Earlier they were mentioned only for the Odessa Bay (Chernyshenko, 1955).

Maritae were found in the intestines of round and grass gobies (tabl. 1). The maximal number of round gobies was infected in summer 2000 (28.13% gobies were parasitized). The parasites were absent in spring but only one helminth has been found in autumn of the same year. The round goby is more parasitized with this parasite than the grass goby. In contrast to the round goby only one worm was found in the grass goby (tabl. 1).

CESTODA

Proteocephalidae

***Proteocephalus gobiorum* Dogiel et Bychowsky, 1939**

A representative of the Ponto-Caspian fauna. Adult stage of this parasite infects gobies. Infection with these worms is a result of consumption of planktonic crustaceans (Cyclopidae and Diaptomidae in most part) where the cestoda larvae are located (Scholtz, 1999).

These helminthes were isolated from intestines of monkey and grass gobies (tabl. 1). The monkey goby had only one case of infection with this parasite (3 helminthes were found). In turn in some cases up to 360 specimens of the tapeworm have been occurred in the grass goby.

NEMATODA

Cucullanidae

Dichelyne minutus (Rudolphi, 1819)

A Boreo-Atlantic species. The widespread species of intestinal fish helminth in the north-western Black Sea. Nematodes infect fish while they are swallowing the larvae (Gibson, 1972).

The parasite was occurred in round, monkey and ratan gobies. The round goby is the most infected (56.82%) but the monkey goby had the maximal percent of infected fish (3.7%). The minimal number of helminthes was mentioned for the ratan goby but maximum one for the round goby (tabl. 1).

Acuariidae

Streptocara crassicauda (Creplin, 1829) l.

A Cosmopolitan species. The final hosts are different species of fish-eating birds. The intermediate hosts are various amphipods, mainly gammarids; the fish serve as paratenic host (Moravec, 1994). This nematodes have economical importance because they can parasitize poultries and cause their death (Kovalenko, 1960).

The larvae of this species were found in the grass goby and in the round goby (one case) (tabl. 1). Earlier the nematodes *Agamonema* sp. that is the combined species of indefinite larvae (Gayevskaya et al., 1975) was found in the water area (Chernyshenko, 1960). So it is not except that *Streptocara crassicauda* was presented in the Estuary sooner. Because *Agamonema* sp. (in Chernyshenko's paper (1960) is *Nematodes* sp.) might be also implied other nematod species it's possible to mention that species record for the Estuary fauna firstly.

ACANTHOCEPHALA

Echinorhynchidae

Acanthocephaloides propinquus (Dujardin, 1845) Meyer, 1933

It concerns to the group of Mediterranean emigrants. The parasite was occurred in all goby species except the toad goby (tabl. 1). Two acanthocephalans were found in the tubenose goby. Only one case of infection with the acanthocephalan was mentioned for the monkey goby. The grass goby was the most infected (up to 120 individuals per fish) due to a fact that this fish is commonly feeding on gammarids (Dezfuli et al., 1996).

Earlier the other acanthocephalan *A. incrassatus* (Molin, 1858) that infect 6 goby species (round goby, mushroom goby, toad goby, tubenose goby, grass goby, common goby, and also other fishes) was noted for the fauna of the Estuary by A. S. Chernyshenko (1960). But a key for identification of *Acanthocephaloides* genus used for that time (Petrochenko, 1956) has a mistake. In the key the species mentioned as *A. incrassatus* suited the description of *A. propinquus* by its morphology (Dezfuli et al., 1992). It is possible that A. S. Chernyshenko found in the water area just *A. propinquus* but confused it with *A. incrassatus*. Therefore later in the paper both species will be mentioned as *Acanthocephaloides* sp.

Table 2. Helminthes of gobies in the Hryhoryivsky Estuary according the published (Chernyshenko, 1960) (A) and our data (B)

Таблица 2. Гельминты бычков Григорьевского лимана в соответствии с опубликованными (Chernyshenko, 1960) (A) и нашими данными (B)

Species	Round goby		Ratan goby		Mushroom goby		Monkey goby		Grass goby		Toad goby		Tubenose goby	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
<i>Cryptocotyle lingua</i> met.	-	+	0	+	-	0	-	+	-	-	-	-	-	-
<i>C. concavum</i> met.	+	+	0	+	+	0	+	+	+	+	+	-	+	+
<i>Pygidiopsis genata</i> met.	+	+	0	-	+	0	+	+	+	-	-	-	+	-
<i>Galactostomum lacteum</i>	+	-	0	-	-	0	-	-	-	-	-	-	-	-
<i>Acanthostomum imbutiformis</i> met.	+	+	0	-	+	0	+	-	+	-	-	-	+	-
<i>Asymphylodora pontica</i>	-	+	0	-	-	0	-	-	-	+	-	-	-	-
<i>Scolex pleuronectes</i>	-	-	0	-	-	0	+	-	-	-	-	-	-	-
<i>Proteocephalus gobiorum</i>	-	-	0	-	-	0	-	+	+	+	-	-	-	-
<i>Proteocephalus</i> sp. 1.	-	-	0	-	+	0	-	-	+	-	+	-	+	-
<i>Dichelyne minutus</i>	+	+	0	+	-	0	+	-	-	-	+	-	-	-
<i>Streptocara crassicauda</i> l.	-	+	0	-	-	0	-	-	-	+	-	-	-	-
<i>Agamonema</i> sp.	+	-	0	-	-	0	-	-	-	-	+	-	-	-
<i>Acanthocephaloides</i> sp.	+	+	0	+	+	0	-	+	+	+	+	-	+	+
<i>Telosentis exiguus</i>	-	+	0	+	-	0	-	+	-	+	-	-	-	-
Total	7	9	0	5	5	0	5	6	6	6	5	-	5	2
Ics. %	62.50		N		N		36.36		50.00		N		N	

Notes: "+" — worms were found; "-" — worms were absent; 0 — fish were absent; N — index was not counted.

Illiosentidae

Telosentis exiguus von Linstow, 1901

A Mediterranean species. The fish infection occurs by the consumption of gammarids, for example in the river Po delta the host of acanthellae is *Gammarus insensibilis* Stock, 1966 (Dezfuli et al., 1996).

According to the published data this acanthocephalan was occurred in the Hryhoryivsky Estuary in the grass goby only (Chernyshenko, 1960). But according to our data the acanthocephalan was found in four goby species (tabl. 1).

Discussion

While analysing the gobies' helminthofauna of the Estuary it is necessary to note that the helminth diversity less changes in comparison with A. S. Chernyshenko data (1960) (tabl. 2). The maritae *A. pontica*, metacercariae *C. lingua* and larval nematods *Streptocara crassicauda* appeared in the Estuary, but in one's part *Galactostomum lacteum* (Jägerskiöld, 1896) has not been found. Tapeworms *P. gobiorum* were presented with adult stage only while the larval stage *Proteocephalus* sp. was found sooner. Also larvae *Scolex pleuronectes* Müller, 1788 and *Agamonema* sp. those are not determined to species helminthes have not been mentioned for the water area. After a comparison of gobies helminthofauna in 1958 (Chernyshenko, 1960) with our data the Index of Czekanowski-Sørensen are 66.66%. The marbled goby *P. marmoratus* studied by A. S. Chernyshenko (1960) has not been taken into account because it has small size and was not caught by used fishing equipment.

The parasitofauna of the round goby is modified least (tabl. 2). In one's part the fauna of helminthes of the monkey goby was modified most of all. The number of helminth species increased for the both goby species. Because toad and tubenose gobies were presented by several specimens they was not compared.

The mushroom goby *N. cephalarges* was disappeared from the Estuary fauna but such species as ratan goby has appeared (tabl. 2). Two mentioned goby species are related to the group of *Ponticola* and are also very similar in their biology (Zamorov,

Korenyuk, 2000). Nevertheless the Index of Czekanowski-Sørensen for these two goby species is 40% only.

The gobies' helminthofauna of the Hryhoryivsky Estuary is characterized by the relative diversity in comparison with neighbouring water areas of the North-Western Black Sea such as the Odessa Bay and the Khadzhibey Estuary (Kvach, 2001). In spite of the fact that the antropogenous pressing on the Estuary ecosystem is increased the relative well-being of one was mentioned (Zaitsev, 2000). The results of the presented helminthological research may look like confirmation of this data.

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