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Parasite Fauna of Amur Sleeper *Perccottus glenii* Dybowski, 1877 (Osteichthyes: Odontobutidae) in Some Water Bodies of Kyiv Oblast

N. V. Zaichenko

Institute of Hydrobiology, National Academy of Sciences of Ukraine, pr. Geroev Stalingrada 12, Kyiv, 04210 Ukraine
e-mail: zaichenko_natali@ukr.net

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Abstract—The parasite fauna of Amur sleeper was investigated in three water bodies of Kyiv oblast. Sixteen species of parasites and forms not identified to species level, one of which is *Gyrodactylus perccotti*, a species-specific representative of the parasite fauna of sleeper from the native range, were revealed. Ciliates of the genus *Trichodina* were dominant in all water bodies under study, whose maximum level of invasion in some water bodies reached 100% and 1500 spec./org. The majority of the presented parasite species are widespread in water bodies of Europe and Asia, without restricted host specificity.

Keywords: *Perccottus glenii*, nonnative range, parasite fauna

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INTRODUCTION

The native range of Amur sleeper *Perccottus glenii* Dybowski, 1877 is located in the Amur River basin and in some other rivers of the Russian Far East, in northeast China, and in the northern North Korea. The first introductions of sleeper in water bodies of western regions of Eurasia are dated to 1916 (Reshetnikov, 2009). The increase in rates of expansion of this species, provoked by large scale events in the middle of the 20th century intentional introduction of valuable fish species of the Far Eastern faunistic complex, have been registered since the mid-1950s. Owing to transport of fish material of valuable species (grass carp, silver carps, Amur carp) and further expansion within water basins, as a result of secondary (local) transport of the material, and also activity of amateur aquarists, as of today, sleeper occupies a vast area, covering a considerable part of the territory of Ukraine, Belarus, the Russian Federation, Poland, and other countries (Reshetnikov, 2010). In Ukraine, sleeper was recorded for the first time in 1967 from water bodies of the western part of the country. Since the end of the 1990s, notes about finding large populations of this species in different water bodies have appeared more and more often (Dnieper, Dniester, Yuzhnyi Bug, Danube river basins) (Kvach, 2012; Reshetnikov, 2013). On the territory of Kyiv oblast of Ukraine, it was registered for the first time in 2002 (Sabodash et al., 2002). *Perccottus glenii* is characterized by high ecological plasticity and low requirements on the purity and oxygen regime of the water body, it withstands freezing of water bodies and temporary drought, and it is able to feed on different prey. Biological peculiarities allow it to inhabit water bodies inaccessible to the majority of local fish species. The presence in water bodies of such a quite voracious predator tends to decrease the species diversity of macroinvertebrates, mollusks, fishes, and amphibians (Reshetnikov, 2009). One more negative consequence of the invasion of sleeper can be the bringing of new parasite species and deterioration of epizootic conditions in water bodies. The aim of present study is expanding the knowledge of the parasite species composition of *Perccottus glenii* on the territory of Ukraine.

MATERIALS AND METHODS

The material was collected by complete parasitological dissection of *Perccottus glenii* from some water bodies located in Kyiv oblast, Ukraine. The studies were conducted from 2013 to 2014. It total, 278 fish specimens of this species with the body length from 30 to 115 mm were examined (standard fish length is given) (Bykhovskaya-Pavlovskaya, 1982).

Water Bodies

Oxbow lake of the Desna River (near the village of Novosyolki). It is a right-bank floodplain water body of the Desna River. The ichthyofauna is represented by 20 fish species. The water body is characterized by insignificant anthropogenic load. The ecological condition is characterized as “good.” The area of the water surface is 1.2 ha, and the depth is 1–3 m. The coordinates of the water body are 50°36′47″ N and 30°38′13″ E. Eighty-three specimens of sleeper were examined.

Infection of *Perccottus glenii* with parasites in studied water bodies of Kyiv oblast

	Studied water body					
	Lake Shaparnya		Lake Verbnoe		oxbow lake of the Desna River	
	IE, %	II	IE, %	II	IE, %	II
*Trichodina**	100 (0)**	424.3 (27.9)	68. 7 (0.04)	75.8 (12.2)	89.1 (0.02)	115 (6.1)
Gyrodactylus perccotti	1.8 (0.01)	1.0 (0.06)	–	–	–	–
Proteocephalus percae	3.57 (0.01)	1 (0)	–	–	–	–
Paradilepis scolecina	0.89 (under 0.01)	1 (0)	–	–	–	–
Spiroxys contortus	4.46 (0.02)	1 (0)	–	–	2.4 (0.01)	1 (0)
Raphidascaris acus	–	–	2.4 (0.09)	1 (0)	–	–
Echinostomatidae gen. sp.	–	–	1.2 (0.09)	1.5 (0.06)	1.2 (0.01)	3 (0.3)
Echinochasmus coaxatus	–	–	–	–	1.2 (under 0.01)	1 (0)
Diplostomum spathaceum	–	–	12.0 (0.08)	1 (0)	2.4 (0.02)	1 (0)
Opistioglyphe ranae	1.78 (0.01)	1.5 (0.06)	–	–	9.6 (0.03)	2.1 (0.1)
Acanthocephalus lucii	–	–	–	–	1.2 (under 0.01)	1 (0)
Unionidae gen. sp.	–	–	–	–	2.4 (0.01)	3 (0.1)

IE—invasion extensity, II—invasion intensity; *—parameter of extensity and intensity of invasion for all revealed species of ciliates of the genus *Trichodina*; values of the mathematical error are given in brackets; **—zero value of the mathematical error of the IE with ciliates of the genus *Trichodina* is due to the fact that 100% of all observed fishes from Lake Shaparnya were infected by the indicated parasites during all periods of investigation; zero value of the II error was obtained when the II by a parasite was 1 spec./org.

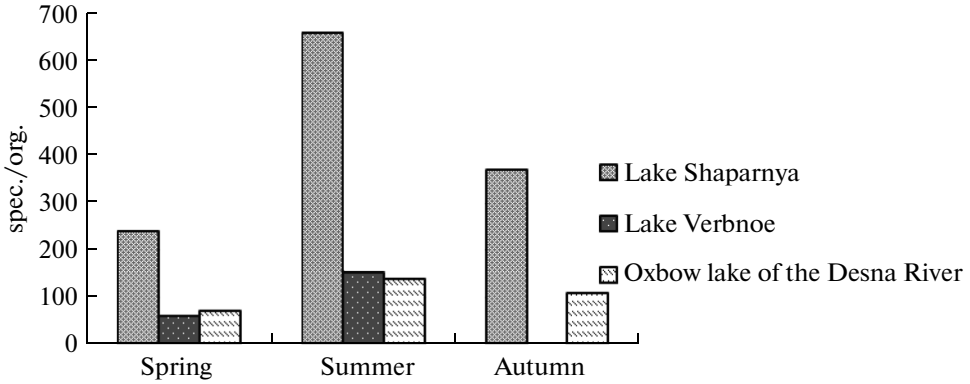
Lake Verbnoe (in Kyiv). It is relatively young water body, which was created due to pit-run hydraulic fill in the 1960s. The ichthyofauna comprises 12 species, among which the silver carp and sleeper dominate. The coordinates of the water body are 50°29′24″ N and 30°31′0″ E. Among the studied water bodies, Lake Verbnoe (located in the city) has the greatest anthropogenic and recreational loads. With respect to ecological condition, the water body can be characterized as the most unfavorable (Sytnik, 2005). Eighty-three specimens of *Perccottus glenii* were examined.

Lake Shaparnya. It is located on the territory of the Holosiivskyi National Nature Park, in the Dnieper River basin. The area of the water surface is about 6 ha; the lake is marshy and heavily overgrown with higher aquatic plants. The ichthyofauna is represented by 14 species; the most abundant species are sleeper and silver carp. Located on the territory of a gardening cooperative, the lake has significant anthropogenic load (being a place of burial of construction waste and municipal sewage) (Afanas'ev, 1996). The coordinates of the water body are 50°16′46″ N and 30°33′48″ E. One hundred twelve specimens were examined.

Ciliates (trichodins) were studied on permanent slides, impregnated with silver according to Klein's dry silver impregnation technique (Klein, 1958); monogenea were studied on glycerin-gelatin slides; cestodes and trematodes were studied on permanent slides stained with acetocarmine; nematodes and acanthocephalids were studied on glycerin slides (*Opredelitel'...*, 1984, 1985, 1987).

RESULTS AND DISCUSSION

In total, 16 species of parasites and forms not identified to species level were found in sleeper from the studied water bodies. They belong to the following classes: Peritricha—five species (*Trichodina cobitis* Lom, 1960, *T. rostrata* Kulemina, 1968, *T. nigra* Lom, 1960, *T. pediculus* Ehrenberg, 1838, *T. mutabilis* Kazubski et Migala, 1968); Monogenea—one species (*Gyrodactylus perccotti* Ergens et Yukhimenko, 1973); Cestoda—two species (*Proteocephalus percae* Müller, 1780, *Paradilepis scolecina* Rudolphi, 1819); Nematoda—two species (*Spiroxys contortus* Rudolphi, 1819, *Raphidascaris acus* Bloch, 1779); Trematoda—four species (*Diplostomum spathaceum* Rudolphi, 1819, *Opistioglyphe ranae* Froelich, 1791, *Echinochasmus coaxatus* Dietz, 1909, *Echinostomatidae* gen.sp. Dietz, 1909); Acanthocephala—one species (*Acan-*



Seasonal dynamics of intensity of infection of *Perccottus glenii* with ciliates of the genus *Trichodina* in the studied water bodies.

thocepalus lucii Müller, 1776); Bivalvia—one species (*Unionidae* gen. sp.). The species composition of parasites in each of the studied water bodies is different (table).

Sixty species of parasites are recorded for *Perccottus glenii* in conditions of the native range (Sokolov and Frolov, 2012). Approximately 10% of species are highly specific; they are registered only for sleeper. The parasite fauna of sleeper in conditions of the nonnative range can include almost 100 species of parasites (Sokolov et al., 2014), which is evidence of the large potential of *Perccottus glenii* to be a host for different groups of parasitic organisms. The parasite fauna of sleeper in water bodies of Kyiv oblast is mainly represented by species with broad host range, which are able to infect a large number of hosts.

The revealed ciliates of the genus *Trichodina* are species capable of infecting a wide range of hosts and are widespread in the Dnieper River basin; moreover, they were repeatedly noted in *Perccottus glenii* from different water bodies of the nonnative range. Ciliates are mainly localized on the gills, fins, and body surface, but they infect the gills more intensely. *T. rostrata*, *T. nigra*, and *T. pediculus* were found in *Perccottus glenii* from Lake Shaparnya, where *T. rostrata* was a dominant species and the total abundance of *T. nigra* and *T. pediculus* did not exceed 15% of all revealed ciliates. Ciliates of sleeper from the oxbow lake of the Desna River were represented by four species—*T. cobitis*, *T. mutabilis*, *T. nigra*, and *T. pediculus*. *T. cobitis* and *T. nigra* mainly occurred with equal frequency and the invasion intensity was not more than 15%. In sleeper from Lake Verbnoe, only *T. nigra* and *T. pediculus* were observed with 80% dominance of *T. nigra*. *Trichodina cobitis* is characterized by the maximum specificity, and more frequently it is registered in cobitids and loaches; infection of *Perccottus glenii* can be explained by the confinement of fish to shoals with heavy thickets of higher aquatic plants; fish with loaches are also attracted to similar conditions. Such conditions become sufficient for infection of *Perccottus glenii* with *T. cobitis*.

A certain seasonal dynamics of invasion intensity of sleeper with ciliates has been registered. In all studied water bodies, the maximum values of invasion are characteristic of the summer period, a decline occurs in the spring and autumn periods. This is quite natural and results from the fact that these species of ciliates are thermophile and give the maximum population in the warmer period (figure).

The monogenea *Gyrodactylus perccotti* found on gills is a sleeper-specific parasite species registered in conditions of the native range. Owing to a simple life cycle, asexual reproduction directly on the body of a host, and viviparity, the appearance of *G. perccotti* in water bodies utilized by *Perccottus glenii* is quite natural.

The cestode *Proteocephalus percae* is characterized by a considerable range, it mainly infects predatory fish species (perch, zander, pike), and infection occurs by eating of infected copepods (an intermediate host of cestode). In view of the fact that *Perccottus glenii* remains carnivorous throughout its life (switching from feeding on zooplankton to aquatic insects, mollusks, and fishes), there is a high probability of its infection with parasites, characteristic of predatory fish species. The same is related to *Paradilepis scolecina*, a parasite of cyprinids with wide range, whose definitive hosts are birds with participation of two intermediate hosts—plankton copepods and fishes.

The revealed nematodes *Spiroxys contortus* and *Raphidascaris acus* enter the fish body perorally, together with infected water fleas and aquatic invertebrates. In sleeper, *S. contortus* parasitizes at the juvenile third stage, it uses the organism of different fish species as parathenic hosts, and mainly it is localized in the intestine and liver. *R. acus* was localized in the intestine. Both species occurred individually.

For the trematode metacercariae *Echinostomatidae* gen. sp., *Echinochasmus coaxatus*, *Diplostomum spathaceum*, and *Opistioglyphe ranae*, sleeper is one the numerous possible second intermediate hosts. Maritae of these trematode species are parasites of birds and amphibians. *D. spathaceum*, a generalist species, is

characterized by huge range and wide range of hosts. Usually, maritae of *O. ranae* parasitize in tadpoles of anuran amphibians. However, in the oxbow lake of the Desna River, there are conditions for infection of Chinese sleeper with *O. ranae* (a high population density of the lymnaeid snail—an intermediate host of *O. ranae*, inhabiting shoals heavily overgrown with aquatic higher plants). In the summer period, infection of 9.6% of studied fishes was registered.

A single finding of *Acanthocephalus lucii* is explained by the high abundance of aquatic invertebrates, among which isopods often occur (including aquatic sow bugs), which can be an intermediate host for acanthocephalids. The presence of bivalve glohidia of the genus *Unio* in the parasite fauna of *Perccottus glenii* is also due to a number of accompanying factors (high density population of mollusks and concentration of the fish on shoals).

The poorest parasite fauna of sleeper is exhibited in Lake Verbnoe and it includes five species of parasites and forms not identified to species level (*T. nigra*, *T. pediculus*, *R. acus*, *Echinostomatidae* gen. sp., *D. spathaceum*). Unsatisfactory, deteriorating ecological conditions of the water body and poor ichthyofauna (a donor of parasites for Chinese sleeper) probably cause the low diversity of parasites of sleeper.

The richest parasite fauna is exhibited in the oxbow lake of the Desna River and it comprises 11 species (table). In our opinion, this can be explained by several reasons. First of all, the richness of parasite fauna is directly dependent on the number and species representation of parasitic organisms circulating in the water body. In the case of this water body, it should be noted that connection to the Desna River (annually, during spring flood) replenishes hydrobionts with the accompanying parasitic organisms. Secondly, considering environmentally friendly circumstances, different taxonomic groups of aquatic animals develop abundantly in the water body. All this contributes to the enrichment of the parasite fauna of *Perccottus glenii* via different trophic relations (the food spectrum is from zooplankton at early developmental stages to predatoriness, including cannibalism when reaching a certain size). In addition, in a slowly flowing water body, a strong current is absent, which allows infection with parasites entering the host body through integument (*D. spathaceum*, *O. ranae*, *Echinostomatidae* gen. sp., *E. coaxatus*).

Lake Shaparnya, where the parasite fauna is represented by eight species, has an intermediate position in parasite diversity. It should be noted that the highest parameters of infection with ciliates are characteristic of Chinese sleeper from this water body. In summer periods, the intensity of infection with ciliate symbionts reached almost 1500 spec./org., and the invasion extensity in all studied periods was 100%.

CONCLUSIONS

In examination of 278 specimens of Chinese sleeper from three water bodies of Kyiv oblast, 16 species of parasites and forms not identified to species level were revealed: ectoparasitic protists, monogenetic flukes, trematode metacercariae, nematodes, cestodes, acanthocephalids, and glochidia of bivalve mollusks. The Far Eastern species *G. perccotti*, specific to sleeper, has been found. Other parasite species registered for Chinese sleeper belong to widespread species. About 40% of revealed parasites enter the host organism by the alimentary canal; a major fraction of identified parasite species penetrate the integument. The taxonomic diversity of the parasite fauna of *Perccottus glenii* in conditions of the water bodies of Kyiv oblast is evidence that this fish is included in indigenous parasitic systems. Further, one should expect a formation of new parasitic relationships, which will demonstrate a greater degree of integration of Chinese sleeper in ecosystems of new assimilated water bodies.

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