

THE VALUE OF *BITHYNIA TENTACULATA* MOLLUSCS IN THE LIFE CYCLE OF *PROSTHOGONIMUS CUNEATUS* UNDER THE CONDITIONS OF NORTH-EASTERN UKRAINE

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One hundred examples of *Bithynia tentaculata* mollusks from the north-eastern Ukraine (Sumy region) were explored with a goal to evaluate their infection with the larvae of the *P. cuneatus* trematode. The extensiveness of the invasion was established at the level of 1%.

Comparative morphological analysis of sporocystes and larvae with partenites and cercariae of the same species of trematode, which were described in the literature, confirmed their belonging to the species *P. cuneatus*.

Keywords: *Bithynia tentaculata*, *Prosthogonimus cuneatus*, cercariae, the extensiveness of invasion, North-Eastern Ukraine.

Introduction. Prosthogonimosis is one of the most dangerous trematodosis of birds. Trematodes of the Prosthogonimidae family are exciters of prosthogonimosis in Ukraine: *Prosthogonimus cuneatus* (Rudolphi, 1809), *P. anatinus* (Markov, 1902), *P. ovatus* (Rudolphi, 1809) and *P. spinatus* (Schevzov, 1965).

The birds, which are invaded by *Prosthogonimus*, excrete the eggs of helminth. Miracidium evolve inside of them, then they go out in the water, penetrate into the body of the intermediate host - the molluscs, and turn into sporocystes in his liver. Sporocystes form cercariae after asexual reproduction, which, after maturation, leave the mollusk. Cercariae passively get into the intestine of the additional owner - larvae of dragonflies and turn into the metacercariae. Metacercariae become invasive in 70 days. They keep invasive including the time after the transformation of dragonflies larvae into adult insects. The birds eat dragonfly and their larvae, that is why the further development cycle takes place in the birds organism. The ducks are infected with prosthogonimosis by the catching of dragonflies larvae in the reservoirs. Metacercariae penetrate into the oviduct of adult birds and in the young - into the bursa of Fabricius and in 1-2 weeks, they turn into adult helminths.

Wild birds (starlings, rooks, crows, sparrows) are the source of the spread of infection. They spread on the reservoirs the eggs of prosthogonimus. Invasions is spread by the adult dragonflies too, in the places where they are staying, under favorable conditions, arise a new cases of prosthogonimosis. The birds excrete the eggs of prosthogonimus into the reservoirs, where they infect molluscs.

P. cuneatus and *P. ovatus* are the most pathogenic and widespread pathogens of prosthogonimosis of birds. On the territory of Ukraine, the intermediate hosts of trematodes *P. ovatus* are mollusc *Bithynia leachi* and *B. tentaculata*, for trematodes *P. cuneatus* – *B. leachi*, *B. tentaculata*, *Anisus albus*, *A. acronicus*, for *P. cuneatus* – *B. leachi*, *B. tentaculata*, *B. troscheli*, *B. caeruleans*, *A. acronicus* were registered as the

intermediate hosts for *P. ovatus* abroad of Ukraine [2, 3, 4]. Analysis of the literary sources show us that data about the definition of partenites and trematodes larvae of *P. cuneatus* та *P. ovatus* in freshwater molluscs of Ukraine, are few. Cercariae *P. cuneatus* were discovered only once [5] in the molluscs of *B. leachi* in the reservoir, in the area of the river Siversky Donets. The investigation of invasiveness of molluscs by *P. cuneatus* larvae in Northeast Ukraine was not carried out earlier.

The purpose of our work was to detect and describe sporocystes and *P. cuneatus* larvae in the *B. tentaculata* molluscs from the natural reservoirs of the north-eastern Ukraine, in particular, the Sumy region.

The materials and methods. The material for research was the collection of freshwater *B. tentaculata* molluscs taken in the bays of the river Psel near Vorozhba village, Lebedin district, Sumy region. One hundred intances of molluscs were investigated. The species belonging to *B. tentaculata* was carried out by the conchology method of V. V. Anistratenko, A. P. Stadnichenko [6]. Morphology of sporocystes and cercariae was studied on living intances with the use of vital dyes. Statistical processing of data was carried out by the method of variational statistics for G. F. Lakin [7].

The results and its discussion. As a result of the research carried out with a using of 100 *B. tentaculata* molluscs, the fact, that a very small amount them were infected by *P. cuneatus* larvae was revealed. The extensiveness of the invasion was only 1 %. Such a low infection can be explained by the considerable distance of the reservoir, where the catch of molluscs was hold, from the locality, where poultry are concentrated, that is why, there is the impossibility of its participation in the life cycle of helminthes. In our opinion, exclusively wild birds are included in the *P. suneatus* life cycle as definitive hosts in the study area. These can be: *Larus argentatus*, *L. melanocephalus*, *L. genei*, *Chlidonias nigra*, *Hydroprogne caspia*, *Dendrocopos major*, *Cyanosylvia svecica*, *Turdus viscivorus*, *Sturnus vulgaris*, *Garrulus glandarius*, *Corvus frugilegus*, *C. cornix*, *Gallinula chloropus*, *Fulica atra*, *Gallus gallus dom.*, *Squatarola squatarola*, *Tringa totanus*,

Numenius arquata, *Phalaropus lobatus*, *Philomachus pugnax*, *Gallinago gallinago*, *Stercorarius pomarinus*, *Anser anser dom.*, *Anas platyrhynchos dom.*, *A. crecca*, *A. acuta*, *Aythya fuligula*, *A. nyroca*, *A. ferina*, *Hypotriorchis subbuteo* [8].

We know that *P. anatinus*, *P. ovatus*, and *P. spinatus* are also the agents of prosthogonimosis of birds except *P. cuneatus*. With a goal to clarify the species membership of the identified cercariae, we have made their detailed morphological description and hold the analysis of the measured data of sporocysts and *P. cuneatus* larvae with partenites and cercariae of the same type trematodes which were described by T. O. Krasnolobskaya, 1961, L. V. Filimonova, V. I. Shalyapina, 1980, and E. Aristanov, 1986, from *B. tentaculata*, *B. inflata* and *B. caerulans* molluscs. Cercariae, which were detected by us, had a small size of the body, were a little transparent, had an oval shape. Body length: 0.099 ± 0.003 mm, width: 0.040 ± 0.002 mm. Cuticle is

smooth. The mouth sucker is almost 1.5 times greater than the abdomen. The length of the mouth sucker is 0.027 ± 0.001 mm at width – 0.021 ± 0.001 mm. The abdominal sucker is smaller in size, its length is 0.0182 ± 0.0003 mm at 0.0157 ± 0.0002 mm width. Stylet has a developed bulb, it can pull and protrude from the sucker. The length of stylet is 0.0129 ± 0.0002 mm. The digestive system is underdeveloped and presented only by the pharynx, the diameter of which is 0.0159 ± 0.0002 mm, and a short esophagus and front sections of the intestine. The germ of penetration is four pairs, located at the level of the abdominal sucker. Excretory bladder is thickened, V-shaped. Excretory formula $2 [(2+2+2)+(2+2+2)] = 24$. Well-developed caudal bursa is situated on the end of the body, which includes the proximal part of the tail. The length of the tail is 0.078 ± 0.004 mm, the width is 0.0169 ± 0.0003 mm. The variability of body size and organs of *P. cuneatus* is presented in the table 1.

Table 1

The main dimensions (mm) of sporocysts and *P. cuneatus* cercaria and related species

Indexes	<i>P. cuneatus</i> (own data)	<i>Cercaria acris</i> Skw (Chornohorenko- Bidulina, 1958)	<i>P. cuneatus</i> (Krasnolobova, 1961)	<i>P. cuneatus</i> (Filimonova, Chaliapina 1980)	<i>P. cuneatus</i> (Aristanov, 1986)
Sporocysts (n=15)					
Length	0,18-0,42	0,2015	0,18	-	0,168-0,530
Width	0,14-0,3	0,124	0,12	-	0,112-0,280
Cercaria (n=27)					
Body length	0,08-0,14	0,124	0,150-0,160	0,103-0,157	0,093-0,140
Body width	0,03-0,05	0,062	0,067-0,07	0,040-0,063	0,029-0,050
The length of the mouth sucker	0,025-0,03	-	-	0,028-0,030	0,025-0,030
The width of the mouth sucker	0,018-0,026	-	-	0,022-0,030	0,017-0,025
d oral sucker	-	0,0279	0,027-0,030	-	-
The length of the abdominal sucker	0,016-0,02	-	-	0,020-0,022	0,016-0,02
The width of the abdominal sucker	0,015-0,018	-	-	0,017-0,020	0,015-0,018
d abdominal sucker	-	0,0155	0,021-0,025	-	-
Length of stylet	0,012-0,014	0,01	0,012	0,017	0,018
d. pharynx	0,015-0,018	-	-	0,008	0,015-0,017
Tail length	0,05-0,102	0,108-0,124	0,065-0,075	0,097-0,123	0,050-0,103
Tail width	0,015-0,018	-	0,02-0,022	0,014-0,017	-

Cercaria *P. cuneatus* develops in sporocysts oval and rounded forms 0.258 ± 0.031 mm of length and 0.456 ± 0.088 mm of width. 2-3 cercariae and their embryos develop in sporocysts. The *P. cuneatus* cercariae which were found by L. F. Filimonova and V. I. Chaliapin [3], in the *B. inflata* molluscs have larger stylet and smaller size of the pharynx.

It should be noted that cercariae, which were found by us, look like *Cercaria acris* Skw larvae, which are described in detail by M. I. Chornohorenko-Bidulina [9]. This form was detected by her in the molluscs *B. tentaculata* from the lower Dnieper. For the first time, *Cercaria acris* Skw. was discovered by Skvortsov in the body of *B. tentaculata* from the Volga and Vetluga [9]. Described by M. I. Chornohorenko-Bidulina [9] cercaria differed from the mentioned form by the presence of not two, but four pairs of germs of

penetration and form of stylet.

Information about the location of the cercariae *P. cuneatus* is presented in the work of Y. V. Belyakova [10]. It has been noted by her that *P. cuneatus* is an analogue of cercariae *Cercaria helvetica* XI Dubois, 1929, (*Prosthogonimus cuneatus* (*Cercaria helvetica* XI – Dubois)), description of which is given in the work of T. O. Ginetsinska, O. O. Dobrovolsky [11]. The analysis of published data showed that *Cercaria helvetica* XI – Dubois, differs from *P. cuneatus* by sucker size, the abdominal sucker is larger than mouth.

In general, the cercariae discovered by us, have no statistically significant morphological differences from the cercariae *P. cuneatus*, which were described by other authors.

Conclusions. Partenites and *P. cuneatus* larvae were discovered for the first time on the territory of Sumy region. The results and analysis of

the literature show that the form of cercariae which were found, can be attributed to the type *P. cuneatus*.

In the future, with a goal to increase the effectiveness of preventive measures and understanding of the epizootic situation which is connected with prostogonimosis of birds in the region, it is necessary to conduct a detailed survey.

Literature:

1. Краснолобова Т. А. Жизненный цикл возбудителя заболевания домашних птиц - *Prosthogonimus cuneatus* Rudolphi, 1809. *Helminthologia*. 1961. Т. III. С.183-191.
2. Арыстанов Е. Фауна парентит и личинок трематод моллюсков дельты Амударьи и юга Аральского моря. Ташкент, 1986. 157 с.
3. Филимонова Л. В., Шалыпина В. И. Церкарии трематод в переднежаберных моллюсках *Bithynia inflata* из озёр северной Кулунды. *Тр. ГЕЛАН*. 1980. Т. XXX. С.113-124.
4. Шарпило В. П., Искова Н. И. Фауна Украины. Плагиорхиаты (*Plagiorchiata*). Киев, 1989. Т. 34. Вып. 3. 276 с.
5. Вергун Г. И. О фауне личинок трематод в моллюсках реки Северский Донец и его пойменных водоёмах в районе среднего течения. *Тр. Н. И. ин-та биол. и биологического ф-та Харьк. гос. ун-та*. 1957. Т. 30. С. 147-166.
6. Анистратенко В. В., Стадниченко А. П. Фауна Украины. Литторинообразные, риссоиобразные. Киев, 1994. Т. 29. Вып.1. 175 с.
7. Лакин Г. Ф. Биометрия. Москва, 1973. 348 с.
8. Искова Н. И., Шарпило В. П., Шарпило Л. Д., Ткач В. В. Каталог гельминтов позвоночных Украины. Трематоды наземных позвоночных. Киев, 1995. 93 с.
9. Черногоренко-Бидулина М. И. Фауна личинок форм трематод в моллюсках Дніпра. Київ, 1958. 109 с.
10. Белякова Ю. В. Церкарии Кургальджинских озёр. *Паразиты – компоненты водных и наземных биоценозов Казахстана*. Алма-Ата. 1981. С. 28-57.
11. Гинецинская Т. А., Добровольский А. А. К фауне личинок трематод пресноводных моллюсков Дельты Волги. *Тр. Астраханского заповедника: сб. гельминтол. работ*. 1964. Вып. IX. С. 64-91.

References:

1. Krasnolobova T. A. (1961), "Life cycle *Prosthogonimus cuneatus* Rudolphi, 1809 – the causative agent of poultry disease" [Zhiznennyy tsikl vzbudatelya zabolevaniya domashnikh ptits - *Prosthogonimus cuneatus* Rudolphi, 1809], *Helminthologia*, Т. III, pp. 183-191. (in Russian)
2. Arystanov E. (1986), *Fauna parthenite and larvae of trematodes of mollusks of the Amudarya River and the southern shore of the Aral Sea* [Fauna partenit i lichinok trematod mollyuskov del'ty Amudar'i i yuga Aral'skogo morya], Tashkent, 157 p. (in Russian)
3. Filimonova L. V. and Chaliapin V. I. (1980), "Cercariae trematodes in prickiebranch mollusc *Bithynia inflata* from the lakes of northern Kulunda" [Tserkarii trematod perednezhabernykh mollyuskov *Bithynia inflata* iz ozor severnoy Kulundy], *Tr. GELAN*, Т. XXX, pp. 113-124. (in Russian)
4. Sharpilo V. P. and Iskova N. I. (1989), *Fauna of Ukraine. Plagiorchiata* [Fauna Ukrainy. Plagiorkhiaty (*Plagiorchiata*)], Kiev, Т. 34, Issue 3, 276 p. (in Russian)
5. Vergun G. I. (1957), "Fauna larvae trematodes in mollusks of the Seversky Donets River and its floodplain reservoirs in the middle current region" [O faune lichinok trematod v mollyuskakh reki Severskiy Donets i yego poymennykh vodoyomakh v rayone srednego techeniya], *Tr. Research Inst. Biol. and Biological Faculty of Kharkiv State University*. Т. 30, pp.147-166. (in Russian)
6. Anistratenko V. V. and Stadnichenko A. P. (1994), *Fauna of Ukraine. Littorinoformes, rissoiformes* [Fauna Ukrainy. Littorinoobraznyye, rissoiobraznyye], Kiev, Т.29, Issue 1, 175 p. (in Russian)
7. Lakin G. F. (1973), *Biometrics* [Биометрия], Moscow, 348 p. (in Russian)
8. Iskova N. I., Sharpilo V. P., Sharpilo L. D. and Tkach V. V. (1995) *Helminth vertebrates of Ukraine catalog. Trematodes of terrestrial vertebrates* [Katalog gel'mintov pozvonochnykh Ukrainy. Trematody nazemnykh pozvonochnykh], Kiev, 93 p. (in Russian)
9. Chornohorenko-Bidulin M. I. (1958), *The fauna of the larvae forms of trematodes in the mollusks of the Dnieper* [Fauna lychynkovykh form trematod v mollyuskakh Dnipra], Kyiv, 109 p. (in Ukrainian)
10. Belyakova Yu. V. (1981), "Cercaria of the Kurgaldzhinsky lakes" [Tserkarii Kurgal'dzhinskikh ozor], *Parasites are components of aquatic and terrestrial biocenoses in Kazakhstan*, Alma-Ata, pp. 28-57. (in Russian)
11. Ginetsinskaya T. A. and Dobrovolsky A. A. (1964), "Fauna larvae trematodes of freshwater molluscs of the Volga Delta" [K faune lichinok trematod presnovodnykh mollyuskov Del'ty Volgi], *Tr. Astrakhan conservancy area: Sat. helminthol. Works*, Issue. IX. pp. 64-91. (in Russian)

Емець О. М., Житова О. П. Значення моллюска *Bithynia tentaculata* в життєвому циклі *Prosthogonimus cuneatus* в умовах північно-східної України.

Проведено дослідження 100 екземплярів моллюсків виду *Bithynia tentaculata* з Північно-Східної України (Сумська область) з метою оцінки їх зараження личинками трематоди *Prosthogonimus cuneatus*. Встановлена екстенсивність інвазії на рівні 1 %.

Порівняльний морфологічний аналіз виявлених спороцист і личинок з парентитами і

церкариями цього ж виду трематоди описаними в літературі підтвердив їх належність до виду *P. cuneatus*.

Ключові слова: *Bithynia tentaculata*, *Prosthogonimus cuneatus*, церкарії, екстенсивність інвазії, Північно-Східна Україна.

Емец А. М., Жимова А. П. Значение моллюсков *Bithynia tentaculata* в жизненном цикле *Prosthogonimus cuneatus* в условиях северо-восточной Украины.

Проведено исследование 100 экземпляров моллюсков вида *Bithynia tentaculata* из Северо-Восточной Украины (Сумская область) с целью оценки их заражения личинками трематоды *Prosthogonimus cuneatus*. Установлена экстенсивность инвазии на уровне 1 %.

Сравнительный морфологический анализ выявленных спороцист и личинок с партенитами и церкариями этого же вида трематоды описанными в литературе подтвердил их принадлежность к виду *P. cuneatus*.

Ключевые слова: *Bithynia tentaculata*, *Prosthogonimus cuneatus*, церкарии, экстенсивность инвазии, Северо-Восточная Украина.