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Parasitology and Helminthology

The Role of Terrestrial Mollusks in Propagation of Trematodes in Urban Environment

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ABSTRACT. Parasitological studies of terrestrial mollusks *Helix lucorum* and *Helicella derbentina* have been carried out in urban ecosystems of Tbilisi. Sporocysts, cercariae and metacercariae of trematodes from the Dicrocoeliidae and Brachylaemidae were detected in *H. lucorum*. Parthenites and larvae of Dicrocoelids were registered in *H. derbentina*. The peak of the invasion occurred in April, May and September. Helicidae are the most distributed terrestrial mollusks in Tbilisi and represent a potential resthole of propagation and settling of pathogenic trematodes in animals inhabiting in the urban environment. © *2010 Bull. Georg. Natl. Acad. Sci.*

***Key words**: terrestrial mollusks, trematoda, larval form, urban environment.*

Terrestrial mollusks constant, comembers of biocenosis, can easily inhabit new places and can be met everywhere. Being bridging hosts of trematodes, they actively take part in all the life cycles and contribute to distribution of invasion. Complex morphophysiological processes in development of trematodes occur in the organisms of mollusks. Terrestrial mollusks become the main distributors of trematodes of the families Dicrocoeliidae, Brachylaemidae, Lecithodendriidae among birds and mammals in the regions of the South Caucasus [1-5].

The study of the role of different species of terrestrial mollusks in propagation of animals, helminthoses and the nature of parthenites are actively going on today [6-10]. However, the data on the significance of these mollusks in distribution of trematodes in urban environment are still scarce.

Materials and Methods. Material for the present paper was parasitological investigation of terrestrial mollusks, conducted since April till December 2008-09 in Tbilisi in recreational zones close to natural (territory of the banks of Tbilisi storage lake and in the urban ecosystems, green open places of Tbilisi (Zoological Park, "Mziuri" park, squares in Vake-Saburtalo). 2237 mollusks of three species were collected and investigated: *Helix lucorum*, *Helicella derbentina* and *Limax flavus*. *H. lucorum* and *H. derbentina* are widely distributed species of mollusks in urban ecosystems of Tbilisi. Specimens of *L. flavus* were revealed only in the wet places of the banks of water storage on the ground and trees. *H. lucorum* were collected in the grass, near bushes and from the stems of fig-trees in spring. *H. derbentina* were found in the grass, under stones and in the subshrubs.

The study of the morphology of parthenitas and larva stages of trematodes was carried out mostly on live objects. Methods generally accepted in helminthology were used.

Results and Discussion. The results obtained were summed in the Table. On the banking territory of Tbilisi water storage in the ecosystem close to natural in the limits of the city *H. lucorum* species of mollusk appeared to be the most invaded by parthenites and

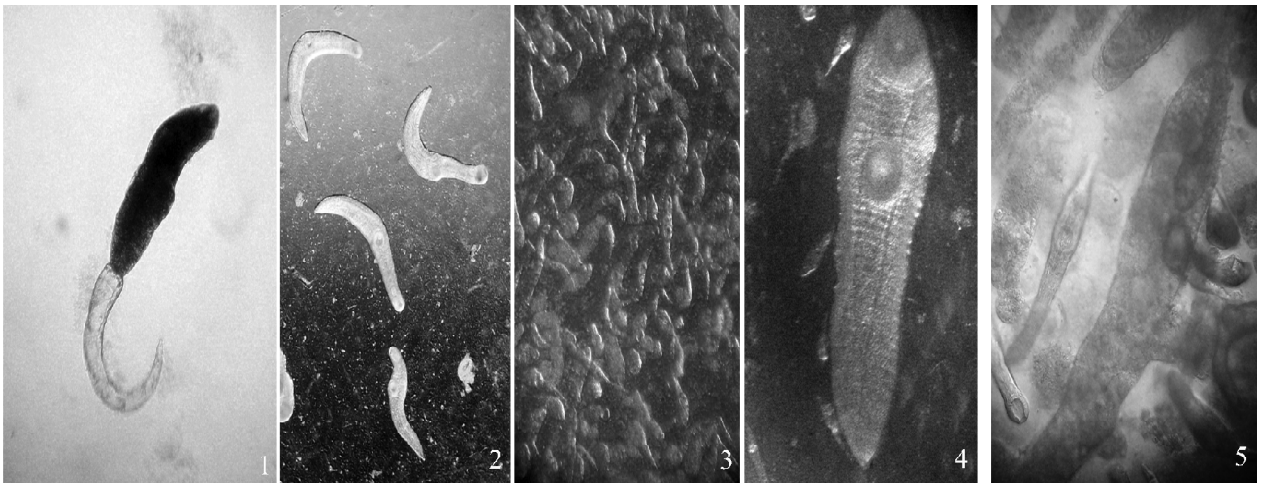

Fig. 1. Photomicrographs of larval trematodes of the Terrestrial Mollusks *Helix lucorum* and *Helicella derbentina:* 1 - cercaria Dicrocoeliidae from *H. derbentina;* 2 - metacercariae Dicrocoeliidae from *H. derbentina;* 3 - cercariae Brachylaemidae from *H. lucorum;* 4 - metacercaria Brachylaemidae from *H. lucorum;* 5 - cercariae and sporocystes Brachylaemidae from *H. lucorum.*

trematodes larvae. Out of 275 specimens of the examined mollusks 193 (70.1%) were infected. On the basis of morphometric study of parthenites, cercariae and metacercariae, their belonging to the families of Dicrocoeliidae and Brachylaemidae was established (Fig.1). Simultaneous invasion with prevailing Dicrocoeliidae was noted in 181 mollusks. Parthenites and larvae of trematodes in different stages of evolution were revealed in the liver, lungs and body of *H.lucorum*. At intensive invasion, particularly by Dicrocoeliidae, liver tissue was completely destroyed and presented a mass consisting of thousands of parthenites, cercariae and hundreds of metacercariae. The sizes of the latter depended on the intensity of invasion.

The most interesting material from the parasitological point of view was collected on the territory of the city's Zoological Park. It is located on the bank of the river Vere at the crossing of the main roads, being a place strongly contaminated with exhaust gases. In the examined 130 specimens of *H. lucorum* found there a great quantity of metacercariae of Brachylaemidae were detected. The extensity of the invasion reached 91.5%. The intensity of the invasion was also significant. This fact allows us to assume great resistance of metacercariae of the mentioned trematodes to contamination of the environment in the given ecosystem.

Out of the studied 85 specimens of *H. lucorum*, found on the territory of the park "Mziuri" situated at a distance not far from the Zoological Park, 52 (61.1%) were infected with larvae of Dicrocoeliidae. Out of the 47 specimens of the same species of mollusks detected in the squares of Kipshidze street, 16 (34%) also were infected with larvae of Dicrocoeliidae and only 2 (4.2%) had Brachylaemidae larvae.

Parthenites and larvae of trematodes registered in *H. derbentina* were only from the family of Dicrocoeliidae. High percent of extensity and invasion intensity by filial sporocysts, cercariae and metacercariae of Dicrocoeliidae was revealed in mollusks collected in urbanized ecosystem on the territory of Nutsubidze Plateau in September, 2009. Out of the 365 studied specimens, 146 (40%) were invasive. Low percent of Dicrocoelidae invasion was noted in August, when 1300 specimens of *H. derbentina* were detected on the territory close to Tbilisi water storage. Parthenites and larvae of Dicrocoelidae were registered only in 57 (4.3%) specimens. Such a variety of infection extensity can be explained by the peculiarities of the biology of mollusks and ecological factors (mainly, temperature of the air and humidity), connected with a particular season of the year.

A small quantity of bare slugs, *L. flavus* inhabited the territory close to Tbilisi water storage, only 35 specimens were studied. Dicrocoeliidae larvae were detected only in 7(20%) with low invasion intensity. This species was infected mostly by larvae forms of *Protostrongilus tauricus* and is not an active chain in the protection and distribution of trematodes in the investigated ecosystem.

Terrestrial mollusks infected by trematodes were revealed in spring, summer, autumn and at the beginning of winter. Only the extensity and intensity of invasion changed. The peak of invasion, fell to April-May and September, when the air temperature (18-24°C) and humidity were optimal for larvae development. At that, percentage ratio totaled: parthenites 40%, cercariae 45%, and metacercariae 15%. The invasion in summer and late autumn was significantly lower.

Table 1

Infection of Terrestrial Mollusks by Larvae of Trematodes in Tbilisi

Species of mollusks	Studied / Infected / %	Banks of Tbilisi water storage			Territory of the Zoological Park			Mziuri Park			Kipshidze Street			Nutsubidze Plateau		
		Studied / Infected / %	D*	B*	Studied / Infected / %	D*	B*	Studied / Infected / %	D*	B*	Studied / Infected / %	D*	B*	Studied / Infected / %	D*	B*
Helix lucorum	537 / 381 / (70.9)	275 / 193 / (70.1)	190	181	130 / 118 / (91.5)	-	118	85 / 52 / (61.1)	52	-	47 / 18 / (38.2)	16	2	-	-	-
Helicella derbentina	1665 / 203 / (12.1)	1300 / 57 / (4.3)	57	-	-	-	-	-	-	-	-	-	-	365 / 146 / (40)	146	-
Limax flavus	35 / 7 / (20)	35 / 7 / (20)	7	-	-	-	-	-	-	-	-	-	-	-	-	-

D* - Dicrocoeliidae; B* - Brachylaemidae

Our observations on dimensions of the shells of *H. lucorum* and trematodae invasion correspond to the ecological rule of V.A.Dogel and data by Zatravkin and Lobanov [11], according to which invasion of mollusks increases with age and, correspondingly, dimensions of the shells.

Larvae of trematodes of Dicrocoeliidae and Brachylaemidae families, detected by us in terrestrial mollusks, have epyzootic and epidemic significance, to which a wide circle of definite hosts of parasites contribute [12, 13]. The final hosts of these trematodes in the close to natural ecosystem of the city, investigated by us, may be birds, rodents and cattle grazing on the meadows of Tbilisi water storage.

In Tbilisi Zoological Park and other places of urbanized ecosystem many animals may be potential hosts, having close food connections with bridging hosts. They can be animals in the open-air cages, synanthropic animals and sparrow birds. The latter are the usual multiple city inhabitants feeding on different invertebrates.

Our studies show that helicidae are the most distributed terrestrial mollusks in Tbilisi and create potential pesthole of propagation and settling of pathogenic trematodes in urban conditions. *H. lucorum* and *H. derbentina* play the main role in preserving and circulation of helminths among animals, inhabiting urban environment, in the food chain of which invertebrates take part. They are bridging and additional hosts of trematodes from the families of Dicrocoeliidae and Brachylaemidae. *L. flavus* does not play a significant part in the distribution of those helminths.

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პარაზიტოლოგია და ჰელმინთოლოგია

ხმელეთის მოლუსკების როლი ტრემატოდების გავრცელებაში ურბანიზებულ გარემოში

ლ. მურვანიძე*, ც. ლომიძე*, ქ. ნიკოლაიშვილი*, ი. გოგებაშვილი*, ლ. არაბული*, ქ. ასათიანი*

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ჩატარებულია ქ.თბილისის ურბანიზებულ ეკოსისტემაში გავრცელებული ხმელეთის მოლუსკების – ჰელიციდების (Helicidae) პარაზიტოლოგიური გამოკვლევა. *Helix lucorum*-ში გამოვლენილია Dicrocoeliidae და Brachylaemidae-ს ოჯახების ტრემატოდების პართენიტები, ცერკარიები და მეტაცერკარიები. *Helicella derbentina*-ში აღინიშნა მხოლოდ Dicrocoeliidae-ს პართენიტები და ლარვული ფორმები. ინვაზია პიკს აღწევს გაზაფხულზე – აპრილსა და მაისში, შემოდგომით – სექტემბერში. კვლევის შედეგებმა უჩვენა, რომ ჰელიციდები წარმოადგენენ ურბანულ გარემოში პათოგენური ტრემატოდების გამრავლების კერებს და აქ მობინადრე ცხოველებში ქმნიან ტრემატოდული ინვაზიების გავრცელების საფრთხეს.

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