Helminth infections of the brown rat (*Rattus norvegicus* Berkenhout, 1769) in the biocenoses of South-West Belarus

V. V. Shimalov¹

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Abstract The result of helminthological examination of 20 brown rats from various biocenoses of South-West Belarus during 1996–2011 is presented. Twelve animals were infected. Six species of helminths were found: 1 trematode species, 3 cestode species and 2 nematode species. The most often, the brown rat infected with mesocercariae of trematode *Alaria alata* (Goeze, 1782). The helminth fauna of brown rats living in the biocenoses are specified for the first time in Belarus.

Keywords Helminths · Brown rat · *Rattus norvegicus* · Biocenoses · South-West Belarus

Introduction

The brown rat (*Rattus norvegicus*) is a common rodent in world fauna. This animal lives in human settlements and various biocenoses. Large epidemiological and epizootiological role of this rodent, as it can be a carrier of many diseases (plague, tularemia, leptospirosis, brucellosis, trichinellosis, etc.).

More than 40 species of helminths parasitize brown rats and more than 10 species are of medical and veterinary importance (Ryzhikov et al. 1978, 1979). For example, 1 species of helminth was found in Qatar (Abu-Madi et al. 2001), 3 in South Korea (Seong et al. 1995), 4 in Argentina (Gomez Villafañe et al. 2008) and Peru (Iannacone and Alvarino 2002), 6 in Grenada (Coomansingh et al. 2009), 8

in Croatia (Stojčević et al. 2004), 9 in Bulgaria (Genov 1984), 10 in Serbia (Kataranovski et al. 2010a, b), 12 in Italy (Milazzo et al. 2010). The cestode *Hymenolepis diminuta* (Rudolphi, 1819) and the nematode *Heterakis spumosa* Schneider, 1866 is dominant species of helminth infection in rat in Serbia (30.46 and 36.75 %, respectively) and Croatia (36.9 and 25.9 %). 82.52 % of brown rats had been infected with *H. spumosa* in Italy. The larvae of cestode *Taenia taeniaeformis* (Batsch, 1786) and the nematode *Nippostrongylus braziliensis* (Travassos, 1914) more than other helminths parasitize rats in South Korea (65.1 %) and Grenada (76.8 %), respectively.

The brown rat is more common in human settlements, more rarely in natural biocenoses in Belarus. The helminth fauna of this animal was not investigated in Belarus. This report is the first data on the helminth fauna of the brown rats that lives in the biocenoses of Belarus.

Materials and methods

The material for this report was collected during 1996–2011 in the South-West Belarus (Brest region: Brest and Malorita districts). The brown rats (*Rattus norvegicus*) were caught by mousetraps placed in lines (25 traps over 4 days = 100 mousetrap-days) along the banks of drainage channels (15,500 mousetrap-days), and the border of mixed forests near the main roads Brest-Kovel and Brest-Moscow (1700 mousetrap-days) also in the landscape reserve «Bugskiy» (4800 mousetrap-days). The total number of mousetrap-days was 22,000. A total of 20 brown rats (11 males and 9 females) were caught at a rate of 0.1 per 100 mousetrap-days.

The animals were subjected to a full helminthological examination (dissection and organ compression).

✉ V. V. Shimalov
shimalov@brsu.brest.by

¹ Brest State University, Boulevard of Cosmonauts 21, 224665 Brest, Belarus

Identification of rat helminths was carried out with the aid of Genov (1984), Ryzhikov et al. (1978, 1979). For classification of helminths the system for trematodes (Gibson et al. 2002; Jones et al. 2005; Bray et al. 2008), cestodes (Khalil et al. 1994) and nematodes (Anderson 2000) was used.

Results and discussion

The total rate of infection of brown rats by helminths was 60.0 % (12 animals were infected), of which males had 54.6 % infection and females 66.7 %. The animals are hosts for 6 species of helminths: 1 trematode species, 3 cestode species and 2 nematode species. Infections by 2–3 species of helminths were found in 20.0 % of examined rats. The result of helminthological examination is illustrated in Table 1.

Most often, the brown rat was infected with mesocercariae of trematode *Alaria alata* (Goeze, 1782). This parasite was found in 8 specimens of brown rats. The range of number of parasites is from 1 to 22. Mesocercariae were localized in adipose and muscle tissue in the neck, in the adipose tissue in the chest cavity, on the heart, in the liver and the diaphragm. All infected rats were caught in the landscape reserve «Bugskiy». There this trematode has a

wide distribution. These metacercariae affected a large number of species of amphibians (Shimalov 2008b), insectivorous mammals (Shimalov 2008a) and small rodents (Shimalov 2003). The percentage of infestation reached 20.0 (common shrew), 34.4 (pool frog), 34.8 (moor frog), 37.7 (striped field mouse) and 47.4 (tree frog). Metacercariae of trematode *A. alata* have unique adaptive abilities. In the stomach of three rats infected by metacercariae, partially digested rodents were found. It can be assumed that the infection of rats with this parasite occurs from eating small rodents and possibly other animals. Migration of the larvae from infected female rats to her young through the placenta and mammary gland when fed milk is possible.

The larvae of cestode *Taenia taeniaeformis* (Batsch, 1786) were found in the liver, nematode *Liniscus papillosus* (Polonio, 1860) in the urinary bladder, other species of helminths in the intestine.

All species of helminths are ordinary parasites of rats.

Trematode *A. alata*, cestodes *T. taeniaeformis*, *H. diminuta* and *Rodentolepis fraterna* (Stiles, 1906) have medical and veterinary significance. These helminths are known as parasites of humans. *A. alata* and *T. taeniaeformis* also parasitize dogs, cats and pigs.

The brown rat can migrate from the biocenoses in human settlements and back, participate in the circulation of the infestation, and can also be one of the participants of synanthropic and natural centers of helminthoses, which worsens the epidemiological and epizootiological situation in the region of dwelling.

Table 1 Helminth infections of brown rats in the biocenoses of South-West Belarus

Species of helminths	Number of	
	Infected	Helminths (min–max, total)
Trematoda Rudolphi, 1808		
Strigeida (La Rue, 1926)		
Diplostomidae Poirier, 1886		
<i>Alaria alata</i> (Goeze, 1782), larvae	8	1–22, 46
Cestoda Rudolphi, 1808		
Cyclophyllidea Beneden in Braun, 1900		
Hymenolepididae (Ariola, 1899)		
<i>Hymenolepis diminuta</i> (Rudolphi, 1819)	2	1–3, 4
<i>Rodentolepis fraterna</i> (Stiles, 1906)	2	5–16, 21
Taeniidae Ludwig, 1886		
<i>Taenia taeniaeformis</i> (Batsch, 1786), larvae	2	1–1, 2
Nematoda Rudolphi, 1808		
Enoplida Chitwood, 1933		
Capillariidae Neveu-Lemaire, 1936		
<i>Liniscus papillosus</i> (Polonio, 1860)	2	1–3, 4
Ascaridida Skrjabin et Schulz, 1940		
Heterakidae Railliet et Henry, 1914		
<i>Heterakis spumosa</i> Schneider, 1866	2	3–36, 39

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