

# Helminth fauna of rodents (Mammalia, Rodentia) from Zasavica (Serbia)

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**Summary.** Forty-four individuals of small rodents from the Zasavica locality were examined for the presence of helminth parasites. These included 12 striped field mice (*Apodemus agrarius*), 18 wood mice (*A. sylvaticus*), 2 yellow-necked mice (*A. flavicollis*), 6 house mice (*Mus musculus*) and 6 voles identified only as belonging to the genus *Microtus*. Nine different helminth species were identified, with 8 individual roundworms identified only as genus *Syphacia*, and 19 individual flukes identified only as genus *Brachylaima*. Five species of helminth were roundworms (*Capillaria murissylvatici*, *Heterakis spumosa*, *Heligmosomum costellatum*, *Rictularia proni*, *Trichocephalus muris*), three were tapeworms (*Hymenolepis fraterna*, *Rodentolepis straminea*, *Skrjabinotaenia lobata*) and one was the fluke *Plagiorchis elegans*. The total prevalence of helminth infection was approximately 45%, and the dominant roundworm species was *H. spumosa*, which was found in around 34% of the individuals. The wood mouse was identified as a new host for the roundworms *C. murissylvatici*, *Heterakis spumosa*, *Heligmosomum costellatum* and *R. proni*, and for the tapeworms *R. straminea*, *S. lobata* and *Hymenolepis fraterna* on the territory of Serbia. The flukes *P. elegans* and *Brachylaima* sp. and the tapeworm *S. lobata* are reported for the first time on the territory of Serbia.

**Keywords:** helminth fauna, rodents, Serbia, Zasavica.

## INTRODUCTION

Helminths are widely distributed and present in all types of biocoenoses. A large number of helminth species are recognized, but are often overlooked in diversity studies of environments in which they are present. Nevertheless, their contribution to the overall variety of a biocoenosis is significant, and it is therefore necessary to analyze them thoroughly. Small mammals, especially rodents, are important as reservoirs and disseminators of various helminth species. The helminth faunas of small mammals have been studied and documented in many European countries (Mészáros and Murai 1979; Genov 1984; Mažejka 1992; Ondrikova et al. 2010), but there is a paucity of data for the territory of Serbia, with a relatively small number of authors contributing to the knowledge of mammal helminth fauna in this area (Mészáros et al. 1983; Mikeš et al. 1986; Kataranovski et al. 2008, 2010; Bjelić-Čabrilo et al. 2009, 2011).

Zasavica is a Special Nature Preserve located on the border of Vojvodina and Mačva provinces, south and east from the Sava and Drina rivers respectively. It is mostly comprised of river and wetland ecosystems, as well as fragmented forests and flooded meadows. The area of the Preserve is home to rich and diverse flora and fauna (Amidžić et al. 2007). The aim of this study was to analyze the helminth fauna of several rodent species collected from the Zasavica locality, which has never been investigated in this respect.

## MATERIALS AND METHODS

Animals were trapped using standard methods, with snap traps set in different types of habitats (meadow, forest, near roads). A total of thirty-eight individuals of four rodent species were gathered: 12 striped field mice (*Apodemus agrarius*), 18 wood mice (*A. sylvaticus*), 2 yellow-necked mice (*A. flavicollis*) and 6 house mice (*Mus musculus*). In

addition, there were six voles that could only be identified as members of the genus *Microtus*. Twenty-four animals were females, one of which was gravid, and nineteen were males, with one juvenile vole of undetermined sex. All but three animals were adults. The captured animals were taken to the laboratory, where mass, body and tail length, earlobe length and foot length were measured. The digestive tract (intestine, caecum and colon) was examined for the presence of helminths. Roundworms were illuminated in lactic acid, whereas flukes and tapeworms were dyed in carmine and mounted in Canada balsam to make permanent slides. Identification of helminths was carried out according to identification keys (Ryžikov 1978, 1979; Genov 1984). The data was input into a Microsoft Excel 2010 worksheet, and quantitative parameters according to Bush et al. (1997) were calculated.

## RESULTS

Of the forty-four examined individuals, twenty carried helminth infections, resulting in a prevalence of 45.45%. The total number of nematodes isolated was 96. The total number of tapeworms couldn't be estimated, due to body fragmentation. The total number of flukes was 22.

Six nematode species were identified, along with 8 individuals of the genus *Syphacia* which weren't determined to the species level. *Heterakis spumosa* (Fig. 1) was the

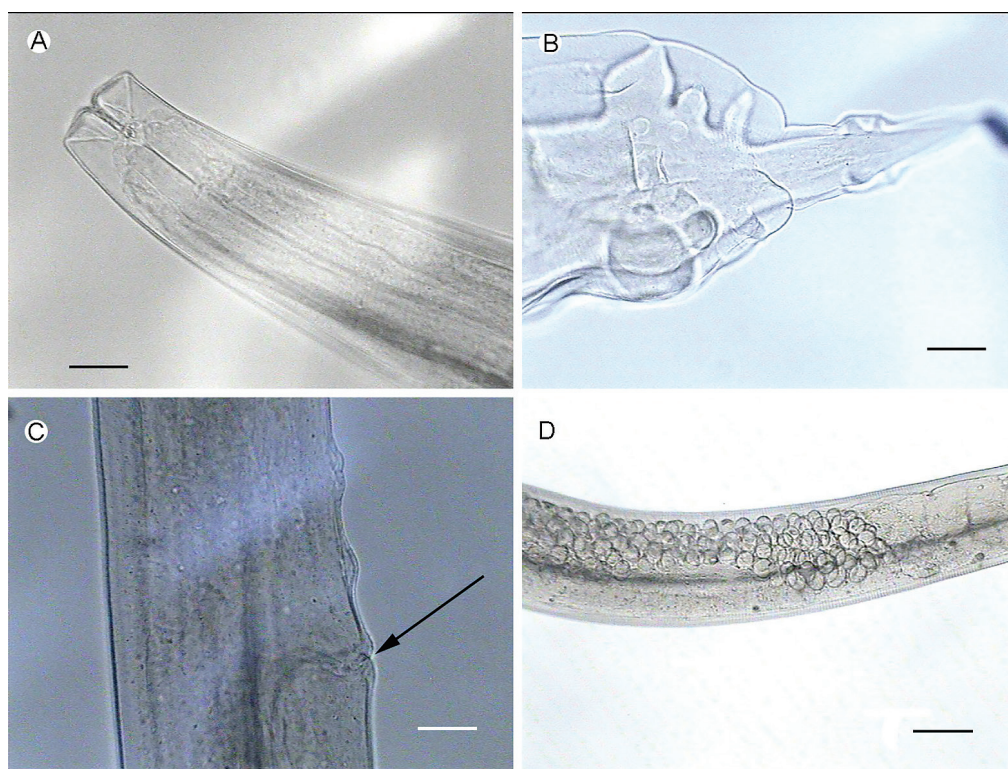
dominant species with respect to the number of host species infected (3), number of infected hosts (15) and infection intensity (77). The remaining roundworm species were represented by a small number of individuals, and infected few hosts (Table 1).

Three species of tapeworms were identified in the sample: *Hymenolepis fraterna*, *Rodentolepis straminea* and *Skrjabinotaenia lobata* (Fig. 2). The same host (a wood mouse) carried both *H. fraterna* and *S. lobata*, whereas *R. straminea* was found in five rodent individuals belonging to three different species (Table 2).

Flukes were registered only in the striped field mouse (*A. agrarius*). Three individuals were identified as *Plagiorchis elegans* (Fig. 3). The remaining 19 were identified as belonging to the genus *Brachylaima* (Table 2).

## DISCUSSION

The helminth fauna of small rodent species has been investigated by various European researchers in the past, from a variety of countries including Spain (Feliu et al. 1997; Ribas et al. 2009), Poland (Behnke et al. 2001, 2008), Slovakia (Ondrikova and Stanko 2009; Ondrikova et al. 2010), Belarus (Shimalov 2002) and Lithuania (Mažejka 1992, 2004; Mažejka et al. 2003; Grikeniene 2005). However, data of this type is relatively scarce from the territory of Serbia. The first



**Figure 1.** *Heterakis spumosa* (A, anterior end; B, posterior end of male; C, vulva; D, segment of body containing eggs). Scale bars: A, B, C = 50  $\mu$ m, D = 200  $\mu$ m.



**Table 1.** List of roundworm species collected from the Zasavica sample, with quantitative parameters calculated for each species.

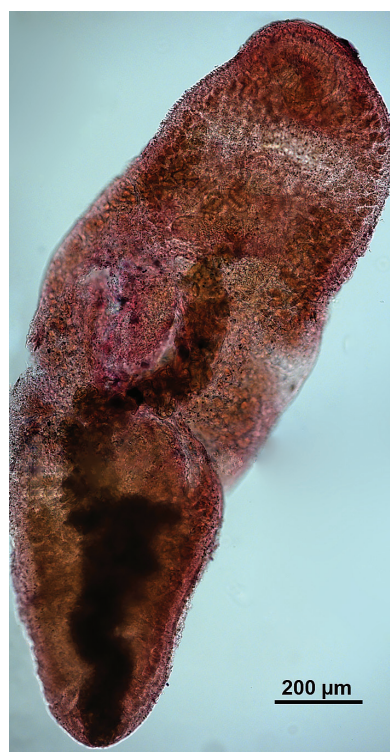
Species	B	P%	n	MI	AB
<i>Capillaria murissylvatici</i>	1	2.27	2	2.00	0.05
<i>Heligmosomum costellatum</i>	1	2.27	1	1.00	0.02
<i>Heterakis spumosa</i>	15	34.09	77	5.13	1.75
<i>Rictularia proni</i>	1	2.27	3	3.00	0.07
<i>Syphacia</i> sp.	2	4.55	8	4.00	0.18
<i>Trichocephalus muris</i>	3	6.82	5	1.67	0.11

B-number of infected host individuals, P%-prevalence, n-number of roundworm individuals, MI-mean intensity, AB-abundance.

**Table 2.** List of identified helminth species and their distribution among rodent hosts from the Zasavica sample.

	Aa	Af	As	Msp	Mm
Trematoda					
<i>Brachylaima</i> sp.	+				
<i>Plagiorchis elegans</i>	+				
Cestoda					
<i>Hymenolepis fraterna</i>			+		
<i>Rodentolepis straminea</i>	+		+	+	
<i>Skrjabinotaenia lobata</i>			+		
Nematoda					
<i>Capillaria murissylvatici</i>			+		
<i>Heligmosomum costellatum</i>				+	
<i>Heterakis spumosa</i>	+		+		+
<i>Rictularia proni</i>	+				
<i>Syphacia</i> sp.			+	+	
<i>Trichocephalus muris</i>			+		

Aa-Apodemus agrarius, Af-A. flavicollis, As-A. sylvaticus, Msp-Microtus sp., Mm-Mus musculus.

**Figure 2.** *Skrjabinotaenia lobata* – scolex.**Figure 3.** *Plagiorchis elegans*.

helminthological study in this area was undertaken in the early eighties in Vojvodina (Mészáros et al. 1983). Further studies have been few and far between, but have been increasing in number in recent years (Mikeš et al. 1986; Kataranovski et al. 2008, 2010; Bjelić-Čabrilo et al. 2009, 2011).

The roundworm and tapeworm species identified in the present study are characteristic of small rodents throughout Europe (Genov 1984; Mažejka et al. 2003; Grikeniene 2005; Ondrikova et al. 2010); thus, their presence in this area was expected. The only exception is the roundworm *R. proni*, which is usually found at higher altitudes (Genov 1984) and in different habitats from those present at Zasavica. Its presence here warrants further study.

The significance of the present study lies in the fact that many helminth species have been reported for the first time on the territory of Serbia, and that new hosts are reported for previously detected species. This is the first finding of the fluke species *P. elegans* and *Brachylaima* sp. in Serbia. This find is in accordance with data reported by other authors on similar rodent hosts in other countries (Shimalov 2002; Ondrikova and Stanko 2009; Ondrikova et al. 2010). The wood mouse (*A. sylvaticus*) is a new host for all three tapeworms described here within the territory of Serbia; in addition, the tapeworm *S. lobata* is reported for the first time in Serbia. The wood mouse (*A. sylvaticus*) is a new host for the nematode species *H. spumosa*, *C. murissylvatici*, *H. costellatum* and *R. proni* in Serbia. This is also the first published finding of *H. spumosa* in the striped field mouse (*A. agrarius*) in Serbia. The yellow-necked mouse (*A. flavicollis*) was found to be uninfected in the Zasavica sample.

Small mammals, especially rodents, figure prominently in the life cycle and dispersal of various helminth species, some of which are potentially hazardous to man. Helminthological studies of these animals provide important insight into the presence of parasites in a specific locality, which is important from faunistic, epizootiological and epidemiological aspects. Thus, further helminthological research of small rodents is necessary at the Zasavica locality, as well as at other localities throughout the country.

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