



ГОДИНИ
МАКЕДОНСКО
ЕКОЛОШКО ДРУШТВО
YEARS
MACEDONIAN
ECOLOGICAL SOCIETY

**6th CONGRESS OF ECOLOGISTS
OF THE REPUBLIC OF NORTH MACEDONIA,
WITH INTERNATIONAL PARTICIPATION**

ABSTRACT BOOK

October 15th-18th 2022, Ohrid

Publisher:

Macedonian Ecological Society
Blvd. Boris Trajkovski, street 7, No 9A, 1000 Skopje,
North Macedonia

Citation:

Abstract book, 6th Congress of Ecologists of the Republic of North Macedonia,
with International Participation.
October 15th-18th 2022, Ohrid,
Macedonian Ecological Society, Skopje, 2022

Editor:

Metodija Velevski

Printed by:

Grafoden, Skopje

Printing run:

250 copies

CIP - Каталогизација во публикација

Национална и универзитетска библиотека "Св. Климент Охридски", Скопје

502/504(062)(048.3)

CONGRESS of ecologists of the Republic of Macedonia with international participation (6 ; 2022 ; Ohrid)

Abstract book / 6th Congress of ecologists of the Republic of North Macedonia, with international participation, October 15th-18th 2022, Ohrid ; [editor Metodija Velevski]. - Skopje : Macedonian Ecological Society, 2022. - 236 стр. ; 25 см

Регистар

ISBN 978-9989-648-44-1

а) Екологија -- Собири -- Апстракти

COBISS.MK-ID 58348293



Rodent hepatic helminths as components of hidden biodiversity

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Helminths represent hidden components of biodiversity in natural communities. Rather than elicit interest in their conservation, these endoparasitic worms tend to cause indifference or even disgust because of their appearance and way of life. However, they are present in every ecosystem and play a key role by integrating themselves into food webs and thereby securing their survival. Over the course of decades of research, 47 helminths were recorded in 10 rodent species in Serbia, with nematodes being the dominant group (29 species). Some helminths have high zoonotic potential due to their ability to infect humans, pets and domestic animals. This study focusses on hepatic helminths in a sample of six host species analysed over an eight-year period. Three tapeworm species and one nematode species were recorded, and their significance is broadly stated.

A total of 770 wild rodents belonging to the species *Apodemus flavicollis*, *A. agrarius*, *A. sylvaticus*, *Myodes glareolus*, *Microtus arvalis*, and *M. subterraneus* were captured from 42 sites in Serbia from 2013-2021, dissected, and examined for cysts and lesions. For confirmation of parasite species, DNA was extracted and mitochondrial marker 12S rDNA was amplified and sequenced. Nematode eggs and larvae were detected based on histological slides made from the liver samples. The livers of 47 hosts contained cysts or visible lesions (6.1%). 12S rDNA fragment amplified successfully in 13 larval samples (1.68%), and three *Taenia* species were identified. *Hydatigera (Taenia) taeniaeformis* was dominant, followed by *T. martis* and *T. crassiceps*. No cysts were found in *A. sylvaticus* and *M. subterraneus*. Histological examination of the liver confirmed the presence of the nematode *Calodium hepaticum* in all three *Apodemus* host species, with a prevalence of 0.9%.

Carnivores act as definitive hosts for all the registered tapeworm species: canids for *T. crassiceps*, felids for *T. taeniaeformis* (including domestic dogs and cats) and mustelids for *T. martis*. Rodents are intermediate hosts and carry cysts (cysticerci) on their livers. All three species have been confirmed to infect humans. Another tapeworm species whose larvae are found in rodent livers is *Echinococcus multilocularis*. This parasite has been found in foxes and jackals in Serbia, and it is only a matter of time before it is reported from rodents as well. Considering the grave clinical presentation of *E. multilocularis* infection in humans, increased vigilance and monitoring of its presence in intermediate and definitive hosts is advised. Both adults and eggs of *C. hepaticum* are found in rodent hepatic tissue but can infect other animals and humans. Infections are most frequently reported in children aged one to five and may be fatal. While far from attractive in the most general sense, helminths are an important component of biodiversity in every ecosystem and affect the behaviour, fitness and abundance of its constituent species. They can indicate the condition and population dynamics of endangered species and overall ecosystem function. Due to their effects on humans and domestic animals, it is of key importance to monitor helminth diversity and populations in intermediate and definitive hosts.

Key words: *Taenia crassiceps*, *T. martis*, *T. taeniaeformis*, *Calodium hepaticum*