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Research Note

Helminth fauna and zoonotic potential of the European hamster *Cricetus cricetus* Linnaeus, 1758 in agrobiocoenoses from Vojvodina province (Serbia)

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Summary

A total of 359 European hamsters (*Cricetus cricetus*) captured at four localities in Vojvodina Province were examined for the presence of helminths. The majority of the captured animals (88 %) were infected with nematode species *Heligmosomoides travassosi* and six species of cestodes (*Hymenolepis diminuta*, *Rodentolepis fraterna*, *R. straminea*, *Paranoplocephala omphalodes* and *Mesocestoides* sp. – in larval stages). Nematodes were the dominant group. The dominant cestode species was *H. diminuta*. All of the tapeworm species reported here represent new findings for the European hamster in Serbia. The tapeworms *H. diminuta* and *Mesocestoides* sp. are capable of infecting humans and causing pathological symptoms, making the hamster a carrier of zoonoses and a potential threat to public health. In order to uncover the full range of helminths utilizing the European hamster as a host in Serbia and understanding the scope of its zoonotic potential, further research on the subject must be carried out.
Keywords: cestodes; European hamster; nematodes; Vojvodina; zoonoses

Introduction

When it comes to studies focusing on the helminth fauna of wild animals, small mammals in particular, Serbia can be described as something of a "black hole" on the European continent. While prior research, undertaken by various authors in the early to late eighties (as cited in Habijan-Mikeš, 1990) provided a suitable foundation for further exploration of the field, this area of interest was completely neglected until recently, with the publication of new articles on the parasites of urban house mice (Vukićević-Radić *et al*., 2007; Kataranovski *et al*., 2008) and the bank vole (Bjelić-Čabrilo *et al*., 2009, 2011). Consequently, data on the topic is very scarce, which is an unfortunate situation considering the significance of small mammals such as rodents and insectivores in the dissemination and maintenance of parasites in natural and urban environments. This becomes even more apparent through comparison with information available from other European countries where these studies are abundant, such as Hungary (Mészáros, 2001), Lithuania (Grikienienė, 2005; Binkienė, 2006), Poland (Behnke *et al*., 2001, 2008a, 2008b) and Italy (Ferrari *et al*., 2004) to name just a few.

Taking into account the limited amount of data collected in the preceding years, it comes as no surprise that entire portions of the country, as well as many common rodent species, have yet to be subjected to thorough research of parasitic fauna. One such species is the European hamster, *Cricetus cricetus*, a well-known inhabitant of agrobiocoenoses. The hamster, a herbivore and a notorious pest of crops, is widespread throughout Europe. However, recent data shows that its population may be declining in the western part of the continent (Nechay, 2000). This is also true for Serbia, where the species has been protected under national law since February 2010, being classified as a "strictly protected species". Due to its habitat, and its close relationship with man, especially in rural areas, the hamster is an excellent candidate for studies of helminth fauna, now more than ever in light of its declining numbers.

There are two main questions that we propose and attempt to answer in this study. The first is of a strictly faunistic nature: what are the helminth species, if any, found in the European hamster on the territory of Serbia? Answering this question will provide an important contribution to the increasing pool of knowledge on the helminth fauna of small mammals in the country. The second question has a decidedly more anthropocentric tone: the negative effect this rodent has on crops is widely documented and undisputed, but is it the only way this animal can threaten humans? In other words, do Serbian hamsters carry any helminth species that are causative agents of zoonoses and can be transferred to man?

Material and Methods

After obtaining the necessary permits, hamsters were captured over a nine year period (2000-2009) on arable lands at four separate localities in Serbia, in the northern province of Vojvodina which is a lowland region with large patches of agricultural land. The localities in question are Inđija (119 individuals) (45° 18' N, 20° 10' E), Bačko Gradište (97) (45° 32' N, 20° 02' E) and Senta (33) (45° 56' N, 20° 05' E). All four localities are arable lands with crops that fall in the category of agro-ecosystems. Spring-loaded and Longworth traps were used, set up in three lines of 50 traps each, with the distance between traps being 5 m. Bread with fried onion was used as bait. Traps were set in the evening and checked for hamsters in the morning. A total of 359 European hamsters were captured. All of the caught animals were sacrificed, their biometric data was recorded and the condition of the reproductive system was assessed. The next step in the procedure was the examination of the digestive tract, liver and peritoneal cavity for helminth parasites. The intestines were opened via longitudinal section, and their contents were repeatedly rinsed with normal saline (0.9 % NaCl) until the supernatant was clear. All parasites were extracted and preserved in 75 % ethanol. Nematodes were treated with lactophenol and observed under a microscope. The procedure for tapeworms consisted of rinsing them in distilled water for 24 hours, dying with carmine and dehydrating them in a series of alcohol solutions of increasing concentration (15 minutes each in 70 %, 80 % and 90 % ethanol and 5 minutes in absolute ethanol). After the dehydration process, the dyed tapeworms were cleared in cedar wood oil for 24 hours. Mounting in Canada balsam followed, resulting in the creation of permanent slides which were then examined under a microscope. This procedure was used both for adult tapeworms and their larval stages. Identification of species was carried out by using identification keys, provided by Ryzhikov *et al*. (1978, 1979) and Genov (1984). For quantitative analysis, prevalence (P %) and mean abundance (A) were calculated according to Bush *et al*. (1997).

Results

Overall, 88 % of the captured hamsters (319 individuals) carried at least one helminth. In the infected animals, only two of the major helminth groups were identified: nematodes and cestodes. The prevalence of the former was much higher than that of the latter: while 286 (nearly 80 %) of the animals carried roundworms, tapeworms were found in 121 (nearly 34 %) individuals. In addition, the total number of parasites uncovered from the intestinal tract was far greater for nematodes than for cestodes (5240 and 779 respectively). The average number of parasites per hamster, expressed through mean abundance, was also higher for nematodes. The single nematode species had a mean abundance of 15, whereas the most abundant tapeworm had a value of approximately 1 individual per host (Table 1). Based on these parameters, nematodes were unequivocally the dominant helminth group in the studied sample.

However, if we turn our attention to species diversity, the situation is reversed. While nematodes were much more numerous and infected more hosts, they are represented here by a single species, *Heligmosomoides travassosi*. On the other hand, five different cestode species were recovered from the sample. Four of them (*Hymenolepis diminuta*, *Rodentolepis fraterna*, *R. straminea* and *Paranoplocephala omphalodes*) were found as adults, whereas *Mesocestoides* sp. was found only in larval stages, in the peritoneal cavity. The most prevalent and abundant tapeworm species was unquestionably *H. diminuta*, which infected a higher percentage of hosts than the other four species combined (Table 1).The maximum number of helminth species per individual host was 2, although the majority of hamsters only carried a single species of parasite. *H. travassosi* was found together with cestodes in a number of hosts. When present, tapeworms were almost exclusively represented by one species, except in four hamsters which harboured *H. diminuta* – *R. fraterna* and *H. diminuta* – *P. omphalodes* pairs.

Discussion

Owing to the fact that prior investigations on European hamster helminth fauna in Serbia are virtually non-existent, the species is a new host for all of the cestodes reported here on the territory of the country. *Heligmosomoides travassosi* has been reported

Table 1. The number of infected hosts (n), prevalence (P%), total number of individuals (N), mean abundance (A), minimum (min) and maximum (max) number of individuals per host and standard deviation (SD) for all of the helminth species found in the European hamster sample from Serbia

	n	P%	N	A	min	max	SD
Nematodes							
Heligmosomoides travassosi	286	80	5240	15	1	426	300.52
Cestodes	121	34	779	2	1	77	53.74
Hymenolepis diminuta	76	21	429	1	1	35	24.04
Rodentolepis fraterna	41	11	162	0.5	1	20	13.43
Rodentolepis straminea	5	1	10	0.03	1	3	1.41
Paranoplocephala omphalodes	8	2	98	0.3	1	40	27.58
Mesocestoides sp. (larvae)	2	1	80	0.2	3	77	52.32

by Mészáros *et al*. in 1983 in the northern province of Vojvodina, where our research took place as well. It was the only helminth species found in *C. cricetus* in the study, although Mészáros previously recorded 3 roundworm species in the European hamster in neighbouring Hungary (Mészáros, 1977). Of those three species, one is *H. travassosi*, whereas the other two nematodes, *Physocephalus quadridilatus* and *Aonchotheca* (*Capillaria*) *annulosa* reported by Mészáros in his 1977 article were not found in our sample. Of the tapeworm species, *R. straminea* and *P. omphalodes* were reported from hamsters in Hungary by Murai (1970). Seeing as the northern part of Serbia is geographically continuous with Hungary, both being part of the Pannonian plain, the presence of similar species is understandable.

Broadening the perspective, each of the tapeworm species noted here has been previously reported in other rodent hosts. *Hymenolepis diminuta*, being cosmopolitan in its distribution, is known from a wide range of taxa. Genov (1984) lists wood, yellow-necked and striped field mice, as well as the brown and black rat as its hosts in Bulgaria. Grikienienė (2005) reports it from the bank vole in Lithuania, and Yokohata *et al*. (1989) detected it in Japanese moles. *Rodentolepis fraterna*, which was once considered synonymous with *Hymenolepis nana*, was found by Kataranovski *et al*. (2008) in Serbian house mice. Its congener, *R. straminea*, primarily parasitizes striped field and yellow-necked mice, but also infects the forest dormouse according to Bulgarian data (Genov, 1984). *Paranoplocephala omphalodes* was noted in a large number of rodent species in France, including the bank, common and European snow voles, two *Apodemus* species, and several *Pitymys* voles (Feliu *et al*., 1997). Finally, *Mesocestoides* species were previously noted in bank voles in Serbia (Bjelić-Čabrilo *et al*., 2009), and in common voles in Lithuania (Grikienienė, 2005). The aforementioned striped field mouse (*Apodemus agrarius*) is interesting in the context of this study because it is a species that is ecologically similar to the European hamster. The two are very much alike in their preferred habitats and dietary requirements; thus, *A.agrarius* is often used as a basis for comparison due to the paucity of data on the hamster's parasite fauna. Indeed, *H. diminuta*, *R. fraterna* and *R. straminea* were all found in the striped field mouse in Slovakia (Ondrikova *et al*., 2010), whereas the former two cestodes are reported from the same species in Belarus (Shimalov, 2002). Furthermore, nematodes are also the dominant helminth group in *A. agrarius* with regards to prevalence and mean abundance, the key difference being the species present. The stenoxenous *H. travassosi* is characteristic of the hamster, and is substituted by the congeneric species *H. polygyrus* in *Apodemus* species (Genov, 1984).

Considering the diet of the European hamster, the indisputable dominance of nematodes is unsurprising. Being an almost exclusive herbivore, the hamster primarily feeds on green parts of plants and seeds, rarely supplementing its nutrition with small invertebrates and vertebrates (Kryštufek *et al*., 2008). Consequently, its exposure to animals such as terrestrial snails and insects, which are transitional hosts of tapeworms, digeneans and acanthocephalans, is comparatively limited. Nematodes, on the other hand, require no intermediate hosts, and the hamster can easily ingest their infective stages, be they eggs or larvae, through plant matter, soil or contaminated water. Comparing the helminth faunas of insectivores and rodents in Great Britain, Lewis (1987) concluded that cestodes were more frequently carried by insectivorous mammals, while nematodes were more often present in rodents, which is congruent with the results presented here. However, while *H. travassosi* was by far the most prevalent and abundant species in the sample, it is irrelevant from the aspect of zoonoses and its danger to man. Thus, it will be excluded from any further discussion, with our attention now shifting to the tapeworm species and their epidemiological significance.

Hymenolepis diminuta has been confirmed to infect humans, with recent data coming from rather unexpected places such as Spain (Tena *et al*., 1998) and Italy (Marangi *et al*., 2003), two European countries with high healthcare and hygiene standards. However, infection is uncommon and occasional, with children as the most likely hosts, certainly due to their less rigorous hygienic practices (Levi *et al*., 1987; Hamrick *et al*., 1990; Varghese *et al*., 1998). *Rodentolepis fraterna* had greater importance in human medicine while it was still considered synonymous with *H. nana*, which is now treated as a separate species that infects only humans. Nevertheless, it is still of great medical and veterinary importance (Shimalov, 2002). The remaining two species found in their adult stages, *R. straminea* and *P. omphalodes*, have yet to be described in man.

The find of *Mesocestoides* larvae in the hamster in Serbia should perhaps be given the most attention here, as this genus contains potentially dangerous species which can spread over large distances through their rodent vectors. The hamster, as well as other rodent species, is an intermediate host for these tapeworms, with carnivores of the Canidae, Felidae and Mustelidae families acting as the definitive hosts (Genov, 1984). Their prevalence in nature can be quite high: 60 % of red foxes examined in Turkey were found to carry *M. lineatus* (Gicik *et al*., 2009). Closer to Serbia, *Mesocestoides* sp. has been found in the beech marten (*Martes foina*) in Italy (Ribas *et al*., 2004). Their presence in these ubiquitous European carnivores and their ability to be carried by rodent synanthropes are particularly worrying since *M. lineatus* is a species that can infect humans. A farm worker in Korea suffering from abdominal and hunger pains and vertigo over the course of several months was found to be infected with *M. lineatus*, with numerous proglottids resembling sesame seeds present in his stool. This was the second case of infection registered in Korea (Choi *et al*., 1967; Eom *et al*., 1992). Other Far East countries, such as Japan (Morisita *et al*., 1975; Ohtomo *et al*., 1983; Nagase *et al*., 1983) and China (Fan, 1988; Jin *et al*., 1990) have also reported cases. The infection is rare, and it appears that other animals besides rodents play a part in its transmission, but the presence of this tapeworm genus in Serbian hamsters should be taken with caution and further research should be undertaken. While European mammals were once thought to be parasitized by a single *Mesocestoides* species (*M. lineatus*), recent research shows that this is not the case (Literák *et al*., 2006; Hrčkova *et al*., 2011). In order to determine which *Mesocestoides* species is found in Serbian hamsters, future studies may need to incorporate molecular methods as opposed to morphological characters used herein.

In conclusion, we have found that the European hamster in Serbia is a host of at least six different helminth species, some of which have been previously shown to infect humans and cause pathological symptoms. While the parasites accounted here do not pose significant health risks, they are conceivably only a small fragment of the full spectrum of helminths that occur in this animal, and other rodents inhabiting the country. The presence of zoonotic tapeworm species in the hamster should be enough to warrant additional, more extensive studies and continuous monitoring of rodent helminth fauna, in the interests of broadening our knowledge on the subject and public health.

References

Behnke, J.M., Barnard, C.J., Bajer, A., Bray, D., Dinmore, J., Frake, K., Osmond, J., Race, T., Sinski, E. (2001): Variation in the helminth community structure in bank voles (*Clethrionomys glareolus*) from three comparable localities in the Mazury Lake District region of Poland. *Parasitology*, 123: 401 – 414. DOI: 10.1017/S0031182001008605

Behnke, J.M., Bajer, A., Harris, P.D., Newington, L., Pidgeon, E., Rowlands, G., Sheriff, C., Kulis-Malkowska, K., Sinski, E., Gilbert F.S., Barnard, C.J. (2008a): Temporal and between-site variation in helminth communities of the bank vole (*Myodes glareolus*) from N.E. Poland. 1. Regional fauna and component community levels. *Parasitology*, 135: 985 – 997. DOI: 10.1017/S0031182008004393

Behnke, J.M., Bajer, A., Harris, P.D., Newington, L., Pidgeon, E., Rowlands, G., Sheriff, C., Kulis-Malkowska, K., Sinski, E., Gilbert, F.S., Barnard, C.J. (2008b): Temporal and between-site variation in helminth communities of the bank vole (*Myodes glareolus*) from N.E. Poland. 2. The infracommunity level. *Parasitology*, 135: 999 – 1018. DOI: 10.1017/S0031182008004484

Binkienė, R. (2006): Helminth fauna of shrews (*Sorex* spp.) in Lithuania. *Acta Zool. Litu.*, 16: 241 – 244. DOI:10.1080/13921657.2006.10512738

Bjelić-Čabrilo, O., Popović, E., Šimić, S., Kostić, D. (2009): Nematofauna of bank vole-*Clethrionomys glareolus* (Schreber, 1780)-Mt Fruška gora (Serbia). *Arch. Biol. Sci.*, 61: 555 – 561

Bjelić-Čabrilo, O., Kostić, D., Popović, E., Ćirković, M., Aleksić, N., Lujić, J. (2011): Helminth fauna of the bank vole *Myodes glareolus* (Rodentia, Arvicolinae) on the territory of Fruska Gora Mountain (Serbia) – A potential source of zoonoses. *Bulg. J. Agric. Sci.*, 17 (6): 829 – 836.

Bush, A.O., Lafferty, K.D., Lots, J.M., Shostak, A.W. (1997): Parasitology meets ecology on its own terms: Margolis *et al*. revisited. *J. Parasitol.*, 83 (4): 575 – 583

Choi, W.Y., Kim, B.C., Choi, H.C. (1967): The first case of human infection with tapeworms of the genus *Mesocestoides* in Korea. *Korean J. Parasitol.*, 5: 21 –23

Eom, K. S., Kim, S.H., Rim, H.J. (1992): Second case of human infection with *Mesocestoides lineatus* in Korea. *Korean J. Parasitol.*, 30 (2): 147 – 150

Fan, S.Q. (1988): First case of *Mesocestoides lineatus* infection in China (in Chinese). *Chin. J. Parasitol. Parasitic. Dis.*, 64: 310

Feliu, C., Renaud, F., Catzeflis, F., Hugot, J. P., Durand, P., Morand, S. (1997): A comparative analysis of parasite species richness of Iberian rodents. *Parasitology* 115: 453 – 466. DOI: 10.1017/S0031182097001479

Ferrari, N., Cattadori, I.M., Nespereira J., Rizzoli, A., Hudson, P.J. (2004): The role of host sex in parasite dynamics: field experiments on the yellow-necked mouse *Apodemus flavicollis*. *Ecol. lett.*, 7: 88 – 94. DOI: 10.1046/j.1461-0248.2003.00552.x

Genov, T. (1984): Helminths of insectivorous mammals and rodents in Bulgaria (in Bulgarian). Publishing house of the Bulgarian academy of sciences, Sofia, 348 pp.

Gicik, Y., Kara, M., Sari, B., Kilic, K., Arslan, M.Ö. (2009): Intestinal parasites of red foxes (*Vulpes vulpes*) and their zoonotic importance for human in Kars province. *Kafkas Üniv. Vet. Fak. Derg.*, 15: 135 – 140

Grikienienė, J. (2005): Investigations into endoparasites of small mammals in the environs of Lake Drūkšiai. *Acta Zool. Litu.*, 15 (2): 109 – 114. DOI: 10.1080/13921657.2005.10512384

Habijan-Mikeš, V. (1990): Nematodes of the species *Apodemus flavicollis* Melch. from Fruška gora mountain (in Serbian). Magisterial thesis. University of Novi Sad, Faculty of Sciences, Department of biology and ecology, Novi Sad

Hamrick, H.J., Bowdre, J.H., Church, S.M. (1990): Rat tapeworm: *Hymenolepis diminuta* infection in a child. *Pediatr Infect Dis J* 9: 216 – 219

Hrčkova, G., Miterpáková, M., O'Connor, A., Šnábel, V., Olson, P.D. (2011): Molecular and morphological circumscription of *Mesocestoides* tapeworms from red foxes (*Vulpes vulpes*) in central Europe. *Parasitology* ,138: 638 – 647. DOI: 10.1017/S0031182011000047

Jin, L.G., Yi, S.H., Liu, Z. (1990): The first case of human infection with *Mesocestoides lineatus* (Goeze, 1782) in Jilin Province. *J. Norman Bethune Univ. Med. Sci.*, 4: 360 – 361

Kataranovski, D., Vukićević-Radić, O., Kataranovski, M., Radović, D., Mirkov, I. (2008): Helminth fauna of *Mus musculus* Linnaeus, 1758 from the suburban area of Belgrade, Serbia. *Arch. Biol. Sci.*, 60 (4): 609 – 617. DOI:10.2298/ABS0804609

Kryštufek, B., Vohralík, V., Meinig, H., Zagorodnyuk, I. (2008): *Cricetus cricetus*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on June 20 2012.

Levi, M.H., Raucher, B.G., Teicher, E., Sheehan, D.J., McKitrick, J.C. (1987): *Hymenolepis diminuta*: one of three pathogens isolated from a child. *Diagn. Microbiol. Infect. Dis.*, 7: 255 – 259

Lewis, J.W. (1987): Helminth parasites of British rodents and insectivores. *Mammal Rev.*, 17 (2/3): 81 – 93. DOI: 10.1111/j.1365-2907.1987.tb00052.x

Literák, I., Tenora, F., Letková, V., Goldová, M., Torres, J., Olson, P.D. (2006): *Mesocestoides litteratus* (Batsch, 1786) (Cestoda: Cyclophyllidea: Mesocestoididae) from the red fox: morphological and 18S rDNA characterization of European isolates. *Helminthologia*, 43, 191 – 195. DOI: 10.2478/s11687-006-0036-7

Marangi, M., Zechini, B., Fileti, A., Quaranta, G., Aceti, A. (2003): *Hymenolepis diminuta* infection in a child living in the urban area of Rome, Italy. *J Clin Microbiol.*, 41 (8): 3994 – 3995. DOI: 10.1128/JCM.41.8.3994-3995.2003

Mészáros, F. (1977): The parasitic nematodes of the hamster (*Cricetus cricetus* L.) in Hungary. *Acta Zool. Academ. Sci. Hung.*, 23: 133 – 138

Mészáros, F. (2001): Data of the worm fauna of Somogy county at the end of 20th century. *Natura Somogyensis*, 1: 11 – 15 (In Hungarian)

Mészáros, F., Habijan, V., Mikes, M. (1983): Parasitic nematodes of rodents in Vojvodina (Yugoslavia). *Parasit. Hung.*, 16: 103 – 110

Morisita, T., Nagase, K., Moriyama, K., Matsumoto, Y. (1975): The 11th case of human infection with *Mesocestoides lineatus* in Japan. *Jpn. J. Parasitol.*, 24: 353 – 356

Murai, E. (1970): The hamster (*Cricetus cricetus*), a hew host of *Paranoplocephala omphalodes* (Hermann, 1783) Luhe, 1910 (Cestoda, Anoplocephalidae). *Parasit. Hung.*, 3: 43 – 50

Nagase, K., Kani, A., Totani, T., Hamamoto, T., Torikai, K. (1983): Report of a human case of *Mesocestoides lineatus* and preliminary investigation into infective sources. *Jpn. J. Parasitol.*, 32 (Suppl): 18

Nechay, G. (2000): Status of hamsters: *Cricetus cricetus*, *Cricetus migratorius*, *Mesocricetus newtoni* and other hamster species in Europe. Nature and Environment series 106. Council of Europe Publishing, Strasbourg

Ohtomo, H., Hioki, A., Ito, A., Kajita, K., Ishizuka, T., Okuyama, M., Miura, K., Kagei, N., Hayashi, S. (1983): Therapeutic effect of paromomycin sulfate on the 13th case of *Mesocestoides lineatus* infection found in Japan (in Japanese). *Jpn. J. Antibiot.*, 36: 632 – 637

Ondrikova, J., Miklisova, D., Ribas, A., Stanko, M. (2010): The helminth parasites of two sympatric species of the genus *Apodemus* (Rodentia, Muridae) from south-eastern Slovakia. *Acta Parasitol.*, 55 (4): 369 – 378. DOI: 10.2478/s11686-010-0043-1

Ribas, A., Milazzo, C., Foronda, P., Casanova, J.C. (2004): New data on helminths of stone marten, *Martes foina* (Carnivora, Mustelidae) in Italy. *Helminthologia*, 41 (1): 59 – 61

Ryzhikov, K.M., Gvozdev, E.V., Tokobaev, M.M., Shaldybin, L.S., Matsaberidze, G.V., Merkusheva, I.V., Nadtochiy, E.V., Khokhlova, I.G., Sharpilo, L.D. (1978): Key to helminths of rodents of the fauna of the USSR: tapeworms and flukes. Nauka, Moscow (In Russian)

Ryzhikov, K.M., Gvozdev, E.V., Tokobaev, M.M., Shaldybin, L.S., Matsaberidze, G.V., Merkusheva, I.V., Nadtochiy, E.V., Khokhlova, I.G., Sharpilo, L.D. (1979): Key to helminths of rodents of the fauna of the USSR: nematodes and acanthocephalans. Nauka, Moscow (In Russian)

Shimalov, V.V. (2002): Helminth fauna of the striped field mouse (*Apodemus agrarius* Pallas, 1778) in ecosystems of Belorussian Polesie transformed as a result of reclamation. *Parasitol. Res.*, 88: 1009 – 1010. DOI: 10.1007/s004360100416

Tena, D., Pérez Simón, M., Gimeno, C., Pérez Pomata, M.T., Illescas, S., Amondarain, I., González, A., Domínguez, J., Bisquert, J. (1998): Human infection with *Hymenolepis diminuta*: case report from Spain. *J. Clin. Microbiol.*, 36 (8): 2375 – 2376

Varghese, S.L., Sudha, P., Padmaja, P., Jaiswal, P.K., Kuruvilla, T. (1998): *Hymenolepis diminuta* infestation in a child. *J. Commun. Dis.*, 30: 201 – 203.

Vukićević-Radić, O., Kataranovski, D., Kataranovski, M. (2007): First record of *Mastophorus muris* (Gmelin, 1790) (Nematoda: Spiruroidea) in *Mus musculus* from the suburban area of Belgrade, Serbia. *Arch. Biol. Sci.*, 59 (1), 1P – 2P. DOI: 10.2298/ABS0701001V

Yokohata, Y., Abe, H., Jiang, Y.P., Kamiza, M. (1989): Gastrointestinal helminth fauna of Japanese moles. *Jpn. J. Vet. Res.*, 37 (1): 1 – 13