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New data on the helminths of the muskrat (*Ondatra zibethicus*) in Lithuania

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Abstract. Thirty-four muskrats, hunted in 2006–2007 on Rusnė Island, Lithuania, were examined for helminths. Eight helminth species were found: five trematodes (*Echinostoma* sp., *Plagiorchis elegans*, *Skrjabinoplagiorchis ondatrae*, *Psilotrema spiculigerum*, *Psilotrema simillimum*) and three cestodes (*Hydatigera taeniaeformis*, *Tetratirotaenia polyacantha*, *Echinococcus multilocularis*). All the species found are widely spread or are indigenous to Europe. The helminth fauna in the muskrat consisted of helminths hosted by a wide range of waterfowl and mammals. This was only the second time the cestode *E. multilocularis*, the causative agent of the serious zoonosis alveolar echinococcosis, was found in the muskrat in Lithuania.

Key words: *Ondatra zibethicus*, *Echinococcus multilocularis*, cestodes, trematodes.

INTRODUCTION

The muskrat (*Ondatra zibethicus*) is a semi-aquatic rodent belonging to the order Rodentia and family Cricetidae native to North America, but in the 20th century it was introduced to Europe and Asia from Canada. There were three centres of its spreading: the area of the present-day Czech Republic (from 1905), Finland (from 1916–1919), and France (from 1919) (Sokolov & Lavrov, 1993).

In 1951, 114 muskrats from Arkhangelsk were released into a tributary of the Nemunas River near the Curonian Lagoon (Slavsk District, Kaliningrad Region, Russia) (Lavrov, 1957) (Fig. 1). In 1954, 82 muskrats from Arkhangelsk were introduced into eastern Lithuania, and in 1956, 204 more were introduced from Kazakhstan to eastern and southern Lithuania. Since 1960 muskrats have been found in Šilutė District in the Nemunas delta. In 1964 they were first encountered in Vilkaviškis District (Prūsaitė et al., 1988).

The years 1967–1975 are considered a plentiful period (Prūsaitė et al., 1988); then there were about 40 000 muskrats in Lithuania. By today the number of muskrats has reduced. Now there are only 2000–2500 individuals in Lithuania (our unpublished data), the same number as in 1966 (Prūsaitė et al., 1988). Although muskrats are widespread, the density of these animals is different in various parts

Fig. 1. Site of material collection for helminthological examination (♦; Šilutė District, Rusnė Island) and places of the introduction of the muskrat in Lithuania and Kaliningrad Region ( ) from Arkhangelsk (A) and Kazakhstan (K) with introduction year (numerator) and number of introduced individuals (denominator).

of Lithuania (Balčiauskas et al., 1999). The largest populations are in Utena, Molėtai, Zarasai, Varėna, Vilkaviškis, and Šalčininkai districts. In the north of Lithuania the muskrat is rare.

From the parasitological aspect, the muskrat is an interesting object to study. It is fascinating to follow how its parasite fauna has changed after its acclimatization in Eurasia. During the acclimatization of the muskrat, new parasite species could have been introduced. The question arises what helminth species this mammal acquired in Eurasia. In the former USSR helminths of American origin were detected during parasitological studies of the muskrat (Lavrov, 1957).

In Lithuania the helminth fauna of the muskrat was studied in 1973–1976. A total of 222 muskrats from different localities of Lithuania were examined by the method of total helminthological dissection. Twenty species of trematodes, larvae of one species of cestodes, and one species of nematodes were found (Kiselienė & Mickus, 1976a, b; Kiselienė, 1983).

In later studies of five muskrats hunted in Šilutė District in 2001, six helminth species were detected (Mažeika et al., 2003). In that study the cestode *Echinococcus multilocularis* was found in rodents in Lithuania for the first time. The aim of the current study was to examine helminths of the muskrat from the Nemunas delta (Rusnė Island) in Lithuania.

MATERIAL AND METHODS

The material for the investigation was collected on Rusnė Island, Šilutė District, Lithuania (Fig. 1). Thirty-four muskrats, hunted in 2006–2007, were examined using the method of total helminthological dissection of individual organs. The intestines, stomach, and liver were examined. The content of the intestines and of the stomach was studied by the method of consistent flushing (Ivashkin et al., 1971). The helminths found were picked out and fixed in 70% ethanol. The helminths were coloured with acetic carmine and mounted in Canada balsam on slides or temporary water–glycerine preparations were made.

Helminthological terms were used according to the recommendations of Bush et al. (1997). The 95% confidence intervals for prevalence were calculated as described by Rojtman & Lobanov (1985). To estimate the parasite aggregation we used the simplest and most commonly used aggregation index: the ratio of the variance to the mean abundance (S^2/A) (Poulin, 1998).

RESULTS

Of the 34 muskrats hunted in 2006–2007 21 or 61.8% were infected with helminths. In total eight helminth species were found (Table 1); four of them were found both in 2006 and 2007. In 2006 six helminth species were found: five trematode species, *Plagiorchis elegans* (Rudolphi, 1802), *Skrjabinoplagiorchis ondatrae* (Andrejko, 1965), *Psilotrema spiculigerum* (Mühling, 1898), *Psilotrema simillimum* (Mühling, 1898), *Echinostoma* sp., and larvae of one cestode species, *Hydatigera taeniaeformis* (Batsch, 1786).

Table 1. Infection with helminths in the muskrat on Rusnė Island, Lithuania, in 2006-2007 (N – number of autopsies, N_I – number of infected muskrats, A – mean abundance of helminths, P,% – infection prevalence (95% confidence interval), I_{min}–I_{max} – infection intensity, S^2 – variance of helminths)

Helminth species	Year	N	N_I	A	P,%	I_{min}–I_{max}	S^2
Plagiorchis elegans	2006	12	3	14.33	25.0 (5.4–52.7)	8–84	1004.97
Skrjabinoplagiorchis ondatrae			1	0.67	8.3 (0.0–30.2)	8	5.33
Echinostoma sp.			4	1.42	33.3 (10.3–61.8)	2–6	5.17
Psilotrema spiculigerum			2	0.58	16.7 (1.7–42.4)	2–5	2.26
Psilotrema simillimum			3	2.92	25.0 (5.4–52.7)	1–17	43.36
Hydatigera taeniaeformis, larvae			1	0.08	8.3 (0.0–30.2)	1	0.08
Plagiorchis elegans	2007	22	7	23.72	31.8 (14.2–52.7)	2–369	6269.06
Echinostoma sp.			10	7.09	45.5 (25.3–66.5)	1–69	341.23
Psilotrema spiculigerum			4	1.14	18.2 (5.1–37.0)	1–12	9.36
Psilotrema simillimum			2	0.59	9.1 (0.9–24.6)	2–11	5.59
Tetratirotaenia polyacantha, larvae			1	0.09	4.5 (0.0–17.2)	2	0.18
Echinococcus multilocularis, larvae			2	–	9.1 (0.9–24.6)	–	–

– Cannot be determined.

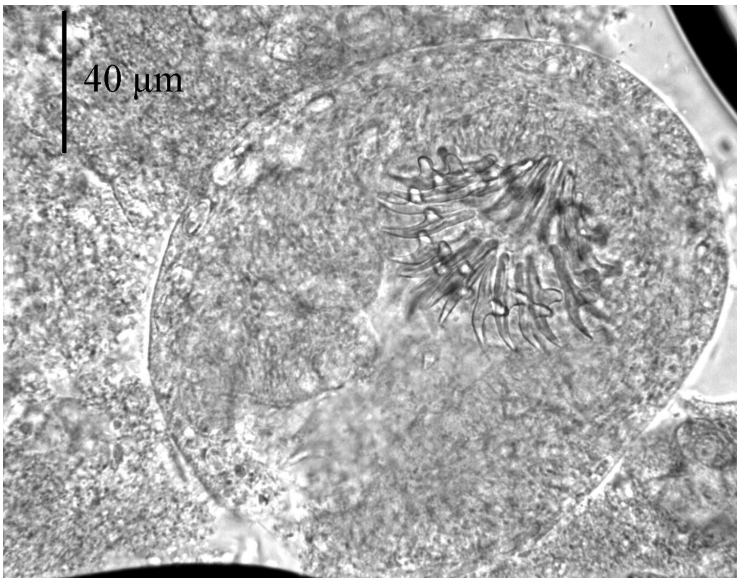

Fig. 2. Protoscolex of *Echinococcus multilocularis* from the muskrat.

In 2007 also six helminth species were found, but the community structure was somewhat different. The trematode *S. ondatrae* and the cestode *H. taeniaeformis* were not detected but cestodes of two other species – *Tetratirotaenia polyacantha* (Leuckart, 1856) and *Echinococcus multilocularis* Leuckart, 1863 – were present. Alveolar cysts filled with protoscolices (Fig. 2) of *E. multilocularis* were observed in the livers of two muskrats.

In 2006 the distribution of the helminths among hosts was aggregated ($S^2/A > 1$), except that of the cestode *H. taeniaeformis* ($S^2/A = 1$). The highest value of the aggregation index was found for *P. elegans* ($S^2/A = 70.13$). In 2007 the highest aggregation index was found also for *P. elegans* ($S^2/A = 264.29$). A relatively high index was found for *Echinostoma* sp. ($S^2/A = 48.13$).

DISCUSSION

Some remarks should be made on the trematodes of the genus *Echinostoma*. They correspond to the description of *Echinostoma revolutum* (Key..., 1978), but according to Kanev (1994), the adults of *E. revolutum* cannot be identified using morphological criteria and it is proposed that worms with 37 collar spines belonging to the genus *Echinostoma* and occurring in naturally infected birds in Europe and Asia be referred to as an '*E. revolutum* group'. Other researchers, for example Kostadinova et al. (2000) have found morphological differences between trematodes of the '*E. revolutum* group' (e.g. between *E. revolutum* and *E. miyagawai*). Genetic studies of echinostomatids (e.g. Kostadinova et al., 2003),

have not solved the taxonomic problems of the '*E. revolutum* group' yet, which raises the question about the number of species present in Europe. Because of these problems we could not identify the '*E. revolutum* group' to species level.

In Lithuania the helminth fauna of the muskrat was studied in 1973–1976 and 22 species of helminths were found (Kiselienė & Mickus, 1976a, b; Kiselienė, 1983). In the authors' opinion, there were four helminth species of American origin among them: *Quinqueserialis quinqueserialis*, *Echinostoma armigerum*, *Echinostoma coalitum*, and *Stichorchis subtriquetrus*. However, *S. subtriquetrus* is a parasite characteristically found in beavers in North America and Europe, and the validity of the species of the genus *Echinostoma* is questionable. Thus the only species of American origin without doubt is *Q. quinqueserialis*.

We found eight helminth species in 34 muskrats studied helminthologically. All the species found are widely spread or are indigenous to Europe. No species of American origin were detected. Such results could be due to the relatively small number of dissected muskrats. After dissecting 160 muskrats Kiselienė & Mickus (1976a) found that the prevalence of *Q. quinqueserialis* was 3.4%. We think it is too early to assert that the species is extinct.

The trematode species we identified in the muskrats are parasites characteristically found in waterfowl. The question arises, why are muskrats infected by these parasites? It can be explained by taking into account the feeding mode of muskrats and the life cycles of these trematodes. Muskrats are omnivores; they feed on plants and small animals (Prūsaitė et al., 1988). The first intermediate hosts of trematodes of the genus *Echinostoma* are molluscs (in the case of *E. revolutum*, molluscs of the family Limneidae). The second intermediate hosts, in which metacercariae form, are the same molluscs or frog tadpoles (Key..., 1978). Muskrats are infected with *Echinostoma* by feeding on the second intermediate host. The first intermediate host of the fluke *P. elegans* is snails of the genus *Limnea* (e.g. *Limnea stagnalis*); the second intermediate host is insects, crustaceans, and molluscs (Key..., 1978; Krasnolobova, 1987). Muskrats are infected with the fluke *P. elegans* also when feeding on the second intermediate host. The intermediate host of *P. spiculigerum* is molluscs *Bythinia tentaculata*; and its metacercariae are formed on water plants (Key..., 1978). Definitive hosts (including muskrats) are infected when they swallow metacercariae together with plants they eat. The life cycles and modes of infection of *P. simillimum* and *P. spiculigerum* have to be similar.

The tapeworms we found in muskrats are widely distributed. *Hydatigera taeniaeformis* is a widespread cestode found in all continents. Its adult form parasitizes predatory mammals, most often cats. It is found in humans too. Major intermediate hosts are rodents. The strobilocercus, surrounded by a round or oval cyst, is usually located in the liver and sometimes in the abdominal or breast cavity (Kozlov, 1977; Key..., 1978). Sexually mature cestodes *T. polyacantha* parasitize intestines of canids. Their intermediate hosts are rodents, usually small ones. Larvae are located in the abdominal and breast cavity (Key..., 1978).

Echinococcus multilocularis is a cestode species restricted to the northern hemisphere where it is the causative agent of the most serious zoonosis – alveolar echinococcosis (Muller, 2001; Jenkins et al., 2005). There are two hosts in the life

cycle of *E. multilocularis*. The definitive hosts of the cestode are predatory mammals, most often members of the dog family. The intermediate hosts are rodents, especially voles, and other small mammals (Muller, 2001; Jenkins et al., 2005).

In central Europe, the common vole (*Microtus arvalis*), the water vole (*Arvicola terrestris*), and the muskrat (*O. zibethicus*) are regarded as important intermediate hosts of *E. multilocularis*, but also some other rodent species have been found to be infected (Eckert et al., 2001). In west-central Europe, the main definitive hosts of the parasite are red foxes (*Vulpes vulpes*). In the tundra zone, the definitive hosts are the arctic foxes (*Alopex logopus*) (Jenkins et al., 2005). While domestic dogs and cats are also sporadically infected, they appear to be of secondary importance for the life cycle of the cestode. They may, however, play a key role in the transmission of the parasite to humans (Jenkins et al., 2005).

The eggs of *E. multilocularis* are sensitive to environmental factors: elevated temperature and desiccation can effectively reduce oncosphere infectivity (Veit et al., 1995). Humid soil conditions may be favourable for the persistence of the parasite's life cycle in a habitat. Such habitats are preferred by muskrats, which are a susceptible intermediate host species. The parasite was found in muskrats in many localities (e.g. Shuteev, 1977; Eastman & Worley, 1979; Borgsteede et al., 2003; Miterpáková et al., 2006). High prevalences at the local level may be associated with the longer life span of the muskrat when compared with small microtine life expectancy. However, the importance of muskrats as a food item for foxes (as the basis for an infection risk) is doubtful. Rather muskrats appear to be bioindicators for a local infection risk for intermediate hosts (Staubach et al., 2001).

The cestode *E. multilocularis* is found in many European countries, e.g. Ukraine (Kharchenko et al., 2008), Slovakia (Miterpáková et al., 2006), Poland (Malczewski et al., 2008), the Netherlands (Giessen et al., 1999; Borgsteede et al., 2003), Germany (Friedland et al., 1985), France (Houin et al., 1982), Switzerland (Hofer et al., 2000; Stieger et al., 2002), Belarus (Merkusheva & Bobkova, 1981; Shimalov & Shimalov, 2003), Russia (Key..., 1978), Estonia (Moks et al., 2005). Whether the range of *E. multilocularis*, as recognized today, is the result of an expansion or more intensive investigations is not known because of the lack of historical data. However, there is mounting evidence of an increase of the parasite density (increase of prevalence) in many areas. In central Europe, there is a correlation between the increase in the fox population (as a result of the successful immunization of foxes against rabies since the early 1990s) and the increasing prevalence of *E. multilocularis* (Jenkins et al., 2005). In 2003, alveolar echinococcosis was added to the list of zoonoses to be monitored in the member states of the European Union according to Directive 2003/99/EC.

In Lithuania the cestode *E. multilocularis* was found for the first time in rodents in the muskrats hunted in 2001 (Mažeika et al., 2003). Infection of definitive hosts, foxes, with *E. multilocularis* and information concerning alveolar echinococcosis in humans in Lithuania is given in Marcinkutė et al. (2005) and Bružinskaitė et al. (2007). Of the 206 dissected red foxes *E. multilocularis* was detected in 57.3%

(Bružinskaitė et al., 2007). From 1997 to July 2006, 80 cases of alveolar echinococcosis were diagnosed. Most alveolar echinococcosis patients lived in the northwestern and northeastern parts of Lithuania, but cases were recorded from many parts of the country, which suggests that the whole territory of Lithuania should be considered as an endemic area of alveolar echinococcosis (Bružinskaitė et al., 2007).

CONCLUSIONS

In the muskrats studied helminthologically in 2006–2007 eight helminth species were found: five trematodes (*Echinostoma* sp., *Plagiorchis elegans*, *Skrjabinoplagiorchis ondatrae*, *Psilotrema spiculigerum*, *P. simillimum*) and three cestodes (*Hydatigera taeniaeformis*, *Tetratirotaenia polyacantha*, *Echinococcus multilocularis*). All these helminth species are widely spread or are indigenous to Europe. The helminth fauna in the muskrat consisted of helminths hosted by a wide range of waterfowl and mammals. This was only the second time that the cestode *E. multilocularis*, the causative agent of the serious zoonosis alveolar echinococcosis, was found in the muskrat in Lithuania.

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REFERENCES

Balčiauskas, L., Trakimas, G., Juškaitis, R., Ulevičius, A. & Balčiauskienė, L. 1999. *Atlas of Lithuanian Mammals, Amphibians and Reptiles*. 2nd edn. (revised). Akstis Publishers, Vilnius (in Lithuanian with English summary).

Borgsteede, F. H. M., Tibben, J. H. & Giessen, J. W. B. 2003. The musk rat (*Ondatra zibethicus*) as intermediate host of cestodes in the Netherlands. *Vet. Parasitol.*, **117**, 29–36.

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

Bružinskaitė, R., Marcinkutė, A., Strupas, K., Sokolovas, V., Deplazes, P., Mathis, A., Eddi, C. & Šarkūnas, M. 2007. Alveolar echinococcosis, Lithuania. *Emerg. Infect. Dis.*, **13**, 1618–1619.

Eastman, K. L. & Worley, D. E. 1979. The muskrat as an intermediate host of *Echinococcus multilocularis* in Montana. *J. Parasitol.*, **65**, 64–72.

Eckert, J., Schantz, P. M., Gasser, R. B., Torgerson, P. R., Bessonov, A. S., Movsessian, S. O., Thakur, A., Grimm, F. & Nikogossian, M. A. 2001. Geographic distribution and prevalence. In *WHO/OIE Manual on Echinococcosis in Humans and Animals: A Public Health Problem of Global Concern* (Eckert, J., Gemmell, M. A., Meslin, F.-X. & Pawlowski, Z. S., eds), pp. 101–143. World Health Organisation for Animal Health, Paris.

Friedland, T., Steiner, B. & Böckeler, W. 1985. Prävalenz der Cysticercose bei Bisams (*Ondatra zibethica* L.) in Schleswig-Holstein. *Z. Jagdwiss.*, **31**, 134–139.

Giessen, J. W. B., Rombout, Y. B., Franchimont, J. H., Limper, L. P. & Homan, W. L. 1999. Detection of *Echinococcus multilocularis* in foxes in The Netherlands. *Vet. Parasitol.*, **82**, 49–57.

Hofer, S., Gloor, S., Müller, U., Mathis, A., Heqqlin, D. & Deplazes, R. 2000. High prevalence of *Echinococcus multilocularis* in urban red foxes (*Vulpes vulpes*) and voles (*Arvicola terrestris*) in the city of Zürich, Switzerland. *Parasitology*, **120**, 135–142.

Houin, R., Deniau, M., Liance, M. & Puel, F. 1982. *Arvicola terrestris* an intermediate host of *Echinococcus multilocularis* in France: epidemiological consequences. *Int. J. Parasitol.*, **12**, 593–600.

Ivashkin, V. M., Kontrimavičius, V. L. & Nazarova, N. S. 1971. *Methods of Collecting and Studying Helminths of Terrestrial Mammals*. Nauka, Moscow (in Russian).

Jenkins, D. J., Romig, T. & Thompson, R. C. A. 2005. Emergence/re-emergence of *Echinococcus* spp. – a global update. *Int. J. Parasitol.*, **35**, 1205–1219.

Kanev, I. 1994. Life-cycle, delimitation and redescription of *Echinostoma revolutum* (Froelich, 1802) (Trematoda: Echinostomatidae). *Syst. Parasitol.*, **28**, 125–144.

Key to Helminths of Rodents of the Fauna of the USSR: Cestodes and Trematodes. 1978. Nauka, Moscow (in Russian).

Kharchenko, V. A., Kornyushin, V. V., Varodi, E. I. & Malega, O. M. 2008. Occurrence of *Echinococcus multilocularis* (Cestoda, Taeniidae) in red foxes (*Vulpes vulpes*) from Western Ukraine. *Acta Parasitol.*, **53**, 36–40.

Kiselienė, V. 1983. Echinostomatides of muskrats in Lithuania and some peculiarities of their development. *Acta Parasitol. Lituan.*, **20**, 77–88 (in Russian).

Kiselienė, V. & Mickus, A. 1976a. On the question of the helminth fauna of the muskrat of Lithuania. *Acta Parasitol. Lituan.*, **14**, 43–45 (in Russian).

Kiselienė, V. & Mickus, A. 1976b. Peculiarities of the helminth fauna of muskrats in the Lithuanian SSR. In *Biological Foundations of the Development Reconstruction and Preservation of the Fauna of Belarus*, pp. 236–237. Minsk (in Russian).

Kostadinova, A., Gibson, D. I., Biserkov, V. & Ivanova, R. 2000. A quantitative approach to the evaluation of the morphological variability of two echinostomes, *Echinostoma miyagawai* Ishii, 1932 and *E. revolutum* (Frölich, 1802), from Europe. *Syst. Parasitol.*, **45**, 1–15.

Kostadinova, A., Herniou, E. A., Barrett, J. & Littlewood, D. T. J. 2003. Phylogenetic relationships of *Echinostoma* Rudolphi, 1809 (Digenea: Echinostomatidae) and related genera re-assessed via DNA and morphological analyses. *Syst. Parasitol.*, **54**, 159–176.

Kozlov, D. P. 1977. *Key to Helminths of Carnivorous Mammals of the USSR*. Nauka, Moscow (in Russian).

Krasnolobova, T. A. 1987. *Trematodes of the Fauna of the USSR: Genus* Plagiorchis. Nauka, Moscow (in Russian).

Lavrov, N. P. 1957. *Acclimatization of Muskrat in the USSR*. Centrosoyuz, Moscow (in Russian).

Malczewski, A., Gawor, J. & Malczewska, M. 2008. Infection of red foxes (*Vulpes vulpes*) with *Echinococcus multilocularis* during the years 2001–2004 in Poland. *Parasitol. Res.*, 103, 501–505.

Marcinkutė, A., Virbalienė, R., Žiliukienė, J., Barakauskienė, A., Valantinas, J., Strupas, K., Sokolovas, V., & Brimas, G. 2005. Some aspects of *Echinococcus multilocularis* infection in humans in Lithuania. *Bull. Scand. Balt. Soc. Parasitol.*, 14, 102–103.

Mažeika, V., Paulauskas, A. & Balčiauskas, L. 2003. New data on the helminth fauna of rodents of Lithuania. *Acta Zool. Lituan.*, **13**, 41–47.

Merkusheva, I. V. & Bobkova, A. F. 1981. *Helminths of Domestic and Wild Animals of Byelorussia. Catalogue.* Nauka i tekhnika, Minsk (in Russian).

Miterpáková, M., Antolová, D., Ševčíková, Z., Stanko, M., Dinkel, A., Gašpar, V. & Dubinský, P. 2006. *Echinococcus multilocularis* in musk rat (*Ondatra zibethicus*): the first finding of the parasite in naturally infected rodent in the Slovak Republic. *Helminthologia*, **43**, 76–80.

Moks, E., Saarma, U. & Valdmann, H. 2005. *Echinococcus multilocularis* in Estonia. *Emerg. Infect. Dis.*, **11**, 1973–1974.

Muller, R. 2001. *Worms and Human Disease*. Cabi Publishing. UK.

Poulin, R. 1998. *Evolutionary Ecology of Parasites – From Individuals to Communities*. Chapman & Hall, London.

Prūsaitė, J., Mažeikytė, R., Pauža, D., Paužienė, N., Baleišis, R., Juškaitis, R., Mickus, A., Grušas, A., Skeiveris, R., Bluzma, P., Bielova, O., Baranauskas, K., Mačionis, A., Balčiauskas, L. & Janulaitis, Z. 1988. *Fauna of Lithuania. Mammals*. Mokslas Publishers, Vilnius (in Lithuanian).

Rojtman, V. A. & Lobanov, A. L. 1985. Method of estimation of parasite hemipopulation abundance in host population. In *Research on Morphology, Taxonomy and Biology of Bird Helminths. Proceedings of Helminthology Laboratory. Vol. XXXIII* (Sonin, M. D., ed.), pp. 102–123. Nauka, Moscow (in Russian).

Shimalov, V. V. & Shimalov, V. T. 2003. Helminth fauna of red fox (*Vulpes vulpes* Linnaeus, 1758) in southern Belarus. *Parasitol. Res.*, **89**, 77–78.

Shuteev, M. M. 1977. Parasite fauna of the muskrat of the Verkhneobskyj Bor. *Parasitologiya*, **6**, 538–540 (in Russian).

Sokolov, V. E. & Lavrov, N. P. (eds). 1993. *The Muskrat. Morphology, Systematics, Ecology*. Nauka, Moscow (in Russian).

Staubach, C., Thulke, H.-H., Tackmann, K., Hugh-Jones, M. & Conraths, F. J. 2001. Geographic information system-aided analysis of factors associated with the spatial distribution of *Echinococcus multilocularis* infections of foxes. *Am. J. Trop. Med. Hyg.*, **65**, 943–948.

Stieger, C., Hegglin, D., Schwarzenbach, G., Mathis, A. & Deplazes, P. 2002. Spatial and temporal aspects of urban transmission of *Echinococcus multilocularis*. *Parasitology*, **124**, 631–640.

Veit, P., Bilger, B., Schad, V., Schafer, J., Frank, W. & Lucius, R. 1995. Influence of environmental factors on the infectivity of *Echinococcus multilocularis* eggs. *Parasitology*, **110**, 79–86.

Uued andmed ondatra (*Ondatra zibethicus*) helmintidest Leedus

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On uuritud helminte Rusnė saarel (Leedu) püütud 34 ondatral. Kokku leiti kaheksa liiki: viis imiussi (*Echinostoma* sp., *Plagiorchis elegans*, *Skrjabinoplagiorchis ondatrae*, *Psilotrema spiculigerum*, *Psilotrema simillimum*) ja kolm paelussi (*Hydatigera taeniaeformis*, *Tetratirotaenia polyacantha*, *Echinococcus multilocularis*). Kõik nad on Euroopas esinevad laialt levinud liigid, kes parasiteerivad ka paljudel teistel imetajatel ja veelindudel. Ameerika päritolu helminte ei leitud. Teist korda on Leedu ondatratel tuvastatud paeluss *E. multilocularis*, mis põhjustab rasket zoonootilist haigust alveolaarset ehhinokokoosi.