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Study on the European mink *Mustela lutreola* helminthocenoses in connection with the American mink *M. vison* expansion in Belarus: story of the study and review of the results

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Summary

The species diversity of helminths in the European mink population in Belarus is described. The differences of the helminthocenoses of the *Mustela lutreola* between different periods of the naturalization process of the *Mustela vison* in Belarus were revealed.

Key words: helminthocenoses; European mink; American mink; species diversity

Introduction

The work is mainly directed on the helminthocenoses of the European mink *Mustela lutreola.* This predatory species is at risk of being the next extinct mammal in Europe, so absolutely all aspects of its ecology are important for its conservation. Comparatively few data have been published so far on the helminth fauna of the European mink (Petrov, 1941; Lyubashenko and Petrov, 1962; Danilov and Tumanov, 1976; Sidorovich and Bychkova, 1993; Sidorovich *et al.*, 1997). Twenty species were recorded in the world helminth fauna of the *Mustela lutreola*. 12 out of them are specialised, 6- facultative and 1- accidental parasites of Mustelidae (Kontrimavichus, 1969). 18 helminth species of the European mink were registered in the former Soviet Union (Kontrimavichus, 1969). Only two individuals of the *Mustela lutreola* were analysed in the Iberian Peninsula as helminth hosts (Feliu *et al.*, 1992), and only one helminth species was recognised. In Spain, there were two helminth species in the European mink - *Molineus patens* and *Euryhelmis squamula* (Miquel *et al.*, 1992).
In Belarus, the helminth fauna of the European mink has been investigated for a period of 40 years, but the material was not collected during the whole period. In 1963, Shimalov investigated 6 minks and only one individual was infested by the *Skrjabingylus nasicola* specimen (Shimalov, 1963). Later (Shimalov and Shimalov, 1987; Shimalov *et al.*, 1993), 30 minks were dissected and 24 (80 %), of them were infested by totally fifteen helminth species.

Material and Methods

The study was done during 1980 – 2000 in northern Belarus and neighbouring regions of Russia. The main study area was situated in the Lovat upper reaches, NE Belarus, the Loknja medium-sized river basin, the Lovat big river catchment, Russia. For the study we used the European minks captured by the local trappers. Totally 56 European minks were processed by ordinary helminthological methods (Ivashkin *et al.*, 1971). At the same time the seasonal and individual variations of the feeding habits of the European mink and its population dynamics and spatial structure changes in connection with the American mink expansion were investigated in detail (Sidorovich, 2000; Sidorovich and MacDonald, 2001a; Sidorovich *et al.*, 2001b).
All obtained data were shared in the two periods substantially differing by the European mink's population statement in the area. The first period lasting from 1985 to 1990 was characterised by the American mink expansion to the territory. This process had great influence on the European mink's population and resulted in pronounced habitat changes and population decline of this native predator. European mink began to occupy small streams instead of great rivers and glacial lakes. During the second period from 1991 to 2000 the European mink's population was highly reduced and the predator was forced out from the native habitats by the intruder (Sidorovich, 2000).

Results

Helminthological investigation of the 56 mink has showed that 45 (80.4 %) animals were infected with parasitic worms. 18 helminth species were recorded from the European minks. These belonged to the three classes: trematodes (5 species), cestodes (2 species) and nematodes (11 species). Concerning the prevalence, the most common were nematodes (61 %) and trematodes (27.8 %). The greatest species diversity recorded was in nematodes (11 species).

At the beginning of the study period (before 1990) there were 15 helminth species revealed in the European minks; the prevalence was 92 %. Only 8 % of the minks were infected by one helminth species, and 84 % - by two and more helminth species (in average 3.2 ± 1.6 helminth species per infected individual). Amongst trematodes the commonest species revealed was *E. melis* (28 %), amongst cestodes - *S. erinacei* (88 %), and amongst nematodes - *S. nasicola* 32 % and *C. mucronata* 28 % Tab.1.

During the second part of the study period the helminth species diversity changed. In the helminthocenoses of the European mink only 10 helminth species were registered.

The whole population infestation has decreased significantly and comprised 71 % ($X^2 = 7.2$; $P < 0.01$). But the infestation of the *M. lutreola* by one helminth species has increased - 19.9 % ($X^2 = 2.7$; $P = 0.1$). 51.6 % of the minks were infected by two and more helminth species, which is significantly lower ($X^2 = 11.6$; $P < 0.01$) than in the first period of the study. In average 2.5 ± 1.1 helminth species were per an infected individual, that is lower than in the beginning of the study period too. The infestation of the European mink by the *E. melis* has remained at the high level ($X^2 = 1.2$; $P = 0.25$) and even has an increased trend (41.9 %). The other trematodes species that were rare in the first period of the study were not registered in the second period of investigations. There was only one cestode species revealed (*S. erinacei)*, the infestation by which, in spite of has significantly decreased ($X^2 = 6.1$; $P < 0.01$), was high enough (58 %). The highest changes were registered for the nematode species structure. The whole nematode infestation in the second study period has decreased and composed 48.4 % ($X^2 = 8.2$; $P < 0.01$). In the both investigation periods 9 species of this helminth class were registered. The *S. nasicola* and *C. mucronata*, dominated in the first period, were common in the second period too. The infestation by these helminth species has weakly decreased ($X^2 = 0.5\text{-}3.0$; $P = 0.5\text{-}0.1$). The helminth species which prevalence were about 20 % in the first period, have decreased their infestation level in the second period like the *C. putorii,* and *C mustelorum*, ($X^2 = 5.5$; $P < 0.025$), or have the same frequency of occurrence like the *F. martis* ($X^2 = 0.6$; $P = 0.5$). The nematodes, infested 4 – 12 % of

Table 1. Helminth infestation of the European mink population in Belarus, 1985 – 2000

Helminth	1985 – 1990 Prevalence % (n)	1990 – 2000 Prevalence % (n)	X^2 (P) L ≤ 0. 05
Euparyphyum melis	28 (25)	41.9 (31)	1.2 (0.25)
Alaria alata	4 (25)	0 (31)	1.0 (0.25)
Metorchis albidus	4 (25)	0 (31)	1.3 (0.25)
Pseudamphistomum truncatum	4 (25)	0 (31)	1.0 (0.25)
Rossicotrema donicum	4 (25)	0 (31)	1.0 (0.25)
Spirometra erinacei	88 (25)	58 (31)	6.1 (0.01)
Taenia mustelae	8 (25)	0 (31)	2.6 (0.1)
Ascaris devosi	8 (25)	0 (31)	2.6 (0.1)
Filaroides martis	24 (25)	16 (31)	0.6 (0.5)
Capillaria mucronata	28 (25)	20 (31)	0.5 (0.5)
Capillaria putorii	20 (25)	6,4 (31)	2.3 (0.1)
Capillaria mustelorum	24 (25)	3,2 (31)	5.5 (0.025)
Molineus patens	12 (25)	0 (31)	3.9 (0.05)
Skrjabingylus nasicola	32 (25)	13 (31)	2.9 (0.1)
Strongyloides martis	4 (25)	0 (31)	1.3 (0.25)
Crenosoma taiga	0 (25)	3,2 (31)	0.8 (0.5)
Capillaria aerophila	0 (25)	3,2 (31)	0.8 (0.5)
Trichinella spiralis	0 (25)	6,4 (31)	1.7 (0.25)

Table 2. Helminth infestation of the European mink in connection with habitat selection in different periods, 1980 – 2000

Periods	Small rivers up to 100km Prevalence		Small streams from 2 to 10 km Prevalence		Streams up to 2 km, glacial lakes Prevalence		Total Prevalence	
	%	Species	%	Species	%	Species	%	Species
1985-1990	92.8	15	80.0	4	100.0	5	92.0	15
1991-2000	72.7	8	68.4	7	50.0	2	71.0	10

the minks in the first period were not registered as parasites of the European mink in the second period. Three nematodes species, that were never registered as parasites of the European mink in Belarus, were revealed. These were *C. taiga, C. aerophila* and *T. spiralis*.
By comparison the helminth infestation rate in the population of the European mink in the different periods (Tab. 2), we can see that the value has decreased in the second period both in the whole and for many structural units of the helminthocenoses. We suggest that it is due to the sharp decrease in the European mink numbers in all its common habitats. As to the helminth species diversity, it has increased in the small rivers only, while in the all other habitats this value has decreased. It is noteworthy that two nematode species (*C. taiga* and *T. spiralis)* firstly registered in the European mink were revealed from the minks inhabited medium sized rivers, and one species (*T. aerophila*) was revealed from the mink captured in a small stream.

Discussion

The studies reported above demonstrate the differences of mink infestation between two periods of our investigation and previous studies. According to Shimalov (1963) there was low-level infested European mink population in Belarus at the beginning of the sixties. The same results were obtained in other areas (Machulsky, 1953; Andrejko and Pinchyk, 1964). The data were obtained in the period after 10 years of the American mink expansion when its density was not high and its helminthocenoses was not established.
Infestation rates of the European mink considerably increased later, especially in 1985 – 1995 (Shimalov and Shimalov, 1987; Sidorovich *et al.*, 1997). These alterations are connected with the increase in the American mink numbers, the population density, which has become much higher. The infestation rate of both the American and European minks was the highest in that period, which may be explained by the ecological causes such as high mink population densities in river bank ecotones, which were the main habitats of these semiaquatic mustelids. There were often intensive contacts of the two mink species with helminth eggs, due to the marking places, resting sites as well as feeding and rolling places were closely located. In addition the helminth eggs were locally concentrated in river valleys due to the minks foraging on the preys mostly inhabiting the water ecosystems. Most of the preys are intermediate, paratenic and other hosts of helminth. This is important in the helminth cycling and resulted in heavy mustelids infestations. It was exactly the period when species diversity of the European mink's helminth has become wider. More frequent contacts with infection material have lead to the helminth species of other mustelids, which appeared in the European mink. Some of them, such as *M. albidus, C. mustelorum, A. devosi*, have arrived with the American mink from its native area (northern America); and other helminths such as *Rossicotrema donicum,* have their origin from the farm-raised American minks. The third group of the helminth species - *Taenia mustelae, Capillaria aerophilus, Crenosoma taiga* originated from other native mustelid species - *Martes martes, Mustela erminea, M. nivalis, M. putorius.*
The obtained results show that the introduction and the following expansion of the American mink had a great influence on the helminthofauna of the European mink. The differences in the helminth abundance and rates of infestation in the European mink in the latest period can be explained by the influence of the American mink. Interference is the main component of the competition between the two mink species (Sidorovich, 1997). Both minks feed on nearly the same food and the dietary differences observed in the large-scale food samples were due to the differences in the habitat selection (Maran *et al.*, 1998; Sidorovich, 2000). The American mink is physically stronger (Danilov and Tumanov, 1976; Sidorovich, 1993, Sidorovich *et al.*, 1997b) and more aggressive (Maran *et al.*, 1989). The density of the European mink in small rivers decreased about 6.6-folds, whereas in small streams its density decreased on average by 1.8-folds (Sidorovich *et al.*, 1997b). Mainly, small streams were the last accessible habitats for the European mink.
Totally, we have recorded 18 helminth species from the European mink (*M. lutreola*) in Belarus. Most of them are common helminth species in mustelids. Three species were recorded in the European mink first time.
Since 1992 the American mink population in Belarus was at a high level. In the conditions of competitive expansion in water habitats, occupied by the European mink, the reproductive strategy of the American mink has changed to intensify the reproductive rate in order to accelerate the ecological carrying capacity occupation (Sidorovich *et al.*, 1997b). Today, the European mink is completely supplanted from its common habitats. Some helminth species (*Strongyloides martis, Opistorchis felineus, Corynosoma strumosum*), which were not numerous before, have disappeared from the decreased European mink population in new habitual places.
Circulation of helminth in biocenosis is provided by biological peculiarities of helminth themselves, their intermediate and final hosts, as well as a number of other components of biocenosis, which are not directly involved in the parasitic life cycles. European mink has been excluded from the life cycle of some helminth species and has brought a part of the infection material to new places, of course.
So, the introduced American mink have a great influence on the European mink helminthocenoses in Belarus e.g. level of infestation and diversity of its helminth species.

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References

ANDREJKO, O. F., PINCHUK, L. M. (1964): Helminthes of mustelids and felids in Moldavia. In *Proc. VOG Conf.*, 1: 15 – 20

ANISIMOVA, E. I., ODINTSOVA, T. M. (2000): Sparganozes and its distribution in Polesse. In *Reports Republ. Sci. Pract. Conf. Ecol. Educ. in post Chernobl period.* Mozar: 229 – 232

DANILOV, P. I., TUMANOV, I. L. (1976): *Mustelids of the north-west of the USSR*. Publ. House AN, Leningrad

FELIU, C., TORRES, J., CASANOVA, J. C., MIQUEL, J., RUIZ-OLMO, J., PALAZON, J. (1992): On the helminthfaunas of semiaquatic carnivores in the Iberian peninsula. Semiaquatische Saugetiere, *Wiss. Beitr. Univ. Halle*: 353 – 356

IVASHKIN, V. M., KONTRIMAVICHUS, V. L., NAZAROVA, N. S. (1971): *Methods of collecting and study of terrestrial mammal helminth*. Publ. House Nauka, Moscow

KONTRIMAVICHUS, V. L. (1969): *Helminthofauna of mustelids and the ways of its formation*. Publ. House Nauka, Moscow

LYUBASHENKO, S. Y., PETROV, A. M. (1962): *Diseases of fur animals*. Selkhozizdat, Moscow

MACHULSKY, S. N. (1953): Helminthes of mustelids in Buryat-Mongolskaja ASSR. In *Helminthologic studies*. ASci. USSR, Moscow: 398 – 406

MARAN, T., KRUUK, H., MACDONALD, W., POLMA, M. (1998): The continuing decline of the European mink *Mustela lutreola*: evidence for the intra-guild aggression hypothesis. *Symp. Zool. Sol, Lond*., 71: 297 – 323

MIQUEL, J., TORRES, J., FELIU, C., CASANOVA, J.C., RUIZ-OLMO, J. (1992): On the helminthfaunas of carnivores in Montseny massif (Catalonia, Spain). 1. Parasites of Viverridae and Mustelidae. *Vie Milieu*, 42: 321 – 325

PETROV, A. M. (1941): *Helminthic diseases of fur animals*. Mezhd. kniga, Moscow

SHIMALOV, V. T. (1963): Skrjabingiloses infestation of the furbearing mustelid species in Belarus. *Publ. Belarus. Acad. Sci., ser. Biol. Sci*., 4: 132 – 133

SHIMALOV, V. T., SHIMALOV, V. V. (1987): *Helminthocenoses in minks of Byelorussia*. Rep. 2nd Rep. Sci. Pract. Conf. parasitocenoses of domestic and wild animals, Minsk: 112 – 115

SHIMALOV, V. T., SISOROVICH, V. E., SHIMALOV, V. V. (1993): Helminths in mustelid inhabiting banks of water-bodies in Belarus. *Publ. Belarus.Acad. Sci., ser. Biol. Sci.*, 4: 96 – 101

SIDOROVICH, V. (1993): Reproductive plasticity of the American mink (*Mustela vison*) in Belarus. *Acta Theriol.*, 38: 175 – 183

SIDOEROVICH, V. E. (2000): Seasonal variation in the feeding habits of riparian mustelids in river valleys of NE Belarus. *Acta Theriol*., 45: 233 – 242

SIDOROVICH, V. E., ANISIMOVA, E. I., BYCHKOVA, E. I., SHIMALOV, V. T., LAUZHEL, G. O. (1997a): Comparative analysis of the semiaquatic mustelid helminthocenosis. In SIDOROVICH, V. E. (Ed.): *Mustelids in Belarus*. Zolotoy uley publisher, Minsk: 194 – 199

SIDOROVICH, V. E., BYCHKOVA, E. I. (1993): Heminth infestation in a declining population of European mink (*Mustela lutreola*) in Belarus. *J. Smal. Carn. Cons*., 9: 16 – 17

SIDOROVICH, V. E., KRUUK, H., MACDONALD, D. W. (1997b): Diet overlaps and resourse competition in the riparian mustelid guild. In SIDOROVICH, V. E. (Ed.): *Mustelids in Belarus*. Zolotoy uley publisher, Minsk: 107 – 114

SIDOROVICH, V. E., MACDONALD, D. W (2001a): Density dynamics and changes in habitat use by the European mink and other native mustelids in connection with the American mink expansion in Belarus. Netherlands *J. Zool*., 5: 107 – 126

SIDOROVICH, V. E., MACDONALD, D. W, PIKULIK, M, KRUUK, H. (2001b): Individual feeding specialization in the European mink, *Mustela lutreola* and American mink, *Mustela vison* in north-eastern Belarus. *Folia Zool.*, 50: 27 – 42

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