Intestinal Helminthes of Cervidae in the Aukštaitija National Park

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Abstract

The aim of this study was to identify helminthes in the alimentary tract of Cervidae. Parasitological study of Moose (*Alces alces*), Red Deer *(Cervus elaphus*) and Roe Deer (*Capreolus capreolus*) has been implemented in the areas of the hunting research base of Vilnius University, the Ignalina and Utena regions, on the area of the Aukštaitija National Park. Additional material for coprological analyses of farmed Red Deer was collected. To examine the faeces, the modified method of McMaster, methods of sedimentation and cultures of larvae were applied.

It has been found that 100% of Cervidae were infected with nematodes of the Strongylidae, Trichostrongylidae, Strongyloidae and Trichuridae families, as well as with the flatworms of Paramphistomatidae and Fasciolidae families. Free ranging Red Deer were infected with seven nematode species, while farmed Red Deer were infected with three of them. Moose were infected with six nematode species and Roe Deer were infected with four. Flatworm *P. cervi* was characteristic of all the examined game animals. *F. hepatica* has been determined in Moose and the farmed Red Deer. It is stated that now the parasitological situation in wild game in the examined district is not very bad (the infection level in most cases was lower than 200 epg).

In order to assess seasonal ability of the infection and the extent of the helminthes invasion in wild game, it is very important to examine more Cervidae during seasons of the year, also, to carry out the coproscopic analysis of animals of the different age ranges, and finally, to determine herb contamination with the nematode larvae.

Key words: Cervidae, *Alces alces*, *Cervus elaphus*, *Capreolus capreolus*, helminthes, nematodes, flatworms

Introduction

Most of helminthes species parasitize both, in domestic and wild animals, causing thus hard diseases. Helminthes of game animals, which affect the density of the host population, make considerable damages of game resources. Cervidae often feed in farmlands where they leave their faeces, spreading thus, helminthes eggs of the alimentary tract. This undoubtedly evokes danger for livestock to be infected with helminthes.

In fact, 7-14 nematode species can parasitize in the alimentary tract of ruminant animals (Šarkūnas 1996 a,b). The development of these parasites in the alimentary tract of ruminant animals is related to the animal‘s age, feeding conditions, the spread of the parasites among domestic and wild animals, as well as to the density of herd, the isolation level of the population and the level of forest cover (Genchi and Rizzoli 1986).

Most 2-5 flatworm species are found in the alimentary tract of ruminant animals (Juknevičius and Jucevičius 1996).

Helminthiasis of the alimentary tract has been very little examined in the wild ruminant animals in Lithuania. The knowledge of parasite species and the epizootic data of development of the invasive larvae could help to reduce the risk of infection of game animals. Same as the relevant preventive measures could minimize damage the helminthes cause to the host (Šarkūnas 1996 a,b).

The aim of this study has been to identify helminthes in the alimentary tract of Cervidae by means of ovoscopic and helminth-larvaescopic analyses. The study goals are the following: to examine the helminthes fauna in the alimentary tract of the Moose (*Alces alces*), the Red deer (*Cervus elaphus*) and the Roe Deer (*Capreolus capreolus*); to compare the helminthes fauna of the alimentary tract in free-ranging and farmed Red Deer.

Material and methods

Parasitological study of Cervidae has been implemented in the areas of the hunting research base of Vilnius University, the Ignalina and Utena regions, on the area of the Aukštaitija National Park. Faeces of Cervidae were collected in 2005, March and December and in 2006, March and April. In total, 38 samples

of faeces were collected, including 10 samples of Moose, 23 of Red Deer (10 of them of farmed Red Deer) and 5 of Roe Deer. The population density of game animals was 2.1 Moose, 22 Red Deer and 23 Roe Deer in 1000 ha in the investigated region. There were farmed 50 Red Deer in 27 ha of forest. Farmed Red Deer have been treated with anthelmintics twice a year.

Several methods have been applied implementing parasitological analyses of the excrements. A modified McMaster method, based on flotation principle (Henriksen and Aagaard 1976) was applied for qualitative and quantitative testing of the presence of helminthes eggs. The sedimentation method was used seeking to separate hard helminthes eggs from excrements (*Fasciola* spp., *Paramphistomum* spp., *Nematodirus* spp., *Trichuris* spp., *Capillaria* spp.). The obtained eggs of helminthes were counted per gram faeces (epg) and differences were analyzed statistically. The game animals were lightly infected if there were less than 200 eggs of helminthes per gram faeces and the infection was high if there were more than 400 epg. Additionally, the larvae culture method (Henriksen and Korlsholm 1983) has been applied, since some nematode species can be exactly determined only by means of cultivating the invasive larvae from eggs.

Results

We determined that various species of nematodes and flatworms parasitized both in all the free-ranging and farmed game animal alimentary tracts (100% intensity of invasion). The presence of nematodes was more frequent than the presence of flatworms.

The most part of the nematode eggs have been found in the faecal samples of Roe Deer (269.7 epg), the least – in Red Deer (84.6 epg). In comparison to other examined animals, the invasion of flatworms was more considerable in Roe Deer (63.1 epg). Meanwhile, the infection with these helminthes in Red Deer was similar to that in Roe Deer (49.4 epg). The lowest level of infection with flatworm eggs was found in the samples of excrements of Moose (24.6 epg) (Table 1, Fig. 1).

Table 1. The intensity of the helminthes invasion in the examined Cervidae's

Cervine	Number of examples	The average of nematodes eggs per gram faeces	The average of flatworms eggs per gram faeces
A. alces	10	178.5 ± 73.8	24.6 ± 16,7
C. capreolus	5	269.7 ± 43.3	63.1 ± 34.4
C. elaphus	13	84.6 ± 64.3	49.4 ± 25.0
C. elaphus (farmed)	10	52.1 ± 30.6	37.9 ± 1.0

The prevalence of nematode eggs in the faeces of free-ranging animals was twice as big as in the farmed Deer (84.6 and 52.1 epg, respectively) (Fig. 1). Such difference could be revealed by the reason of the regular preventive treatment with anthelmintics carried out for the farmed Red Deer. The prevalence of flatworms in the farmed Red Deer was only slightly lower than in the free-ranging Red Deer (37.9 and 49.4 epg, respectively).

The analysis of helminthes species of alimentary tract of *Cervidae's* has shown that the prevalence of

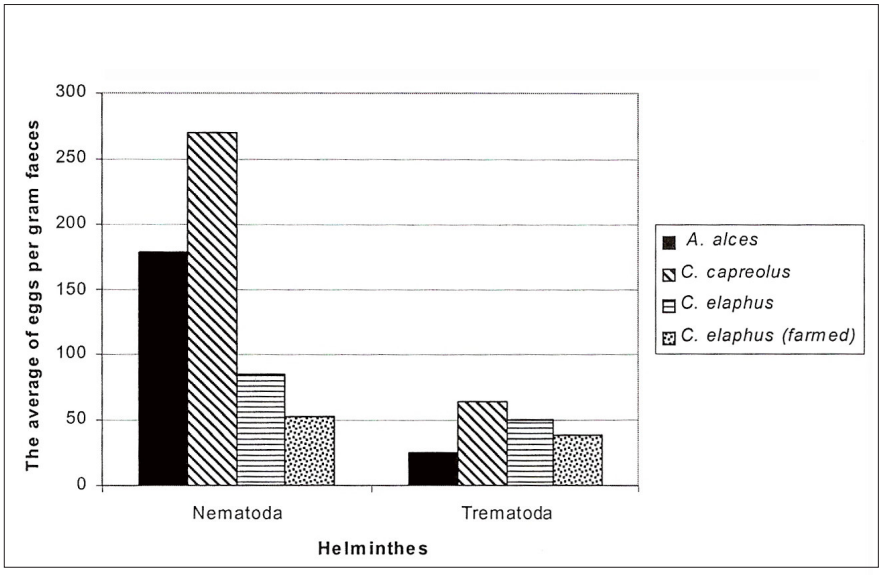

Figure 1. The intensity of the helminthes invasion in the examined Cervidae's

the nematodes of the Strongylidae, Trichostrongylidae, Strongyloidae and Trichuridae families, and of the flatworms of the Paramphistomatidae and Fasciolidae families was identified in all the examined animals (Table 2).

of the free-ranging Red Deer (14.7 and 10.1 epg, respectively).

The eggs of two flatworm species – *Paramphistomum cervi* and *Fasciola hepatica* (Table 2) have been identified in the excrements of the examined *Cervidae's*.

Table 2. Helminthes species and the intensity of invasion

Cervine	Helminthes species and the average of eggs per gram faeces						
	Paramphistomum cervi	*Fasciola hepatica*	*fam.Strongylidae*	*Strongyloides spp.*	*Nematodirus spp.*	*Trichuris spp.*	*Capillaria spp.*
A. alces	19.6 ± 12.9	5 ± 3.,8	20.0 ± 12.7	28.0 ± 18.7	13.1 ± 8.9	69.4 ± 33.6	-
C .capreolus	63.0 ± 34.4	-	144.0 ± 89.1	92.0 ± 26.5	-	33.7 ± 27.7	-
C. elaphus	49.4 ± 25.0	-	7.7 ± 4.3	13.9 ± 12.3	22.0 ± 12.7	31.1 ± 29.7	10.0 ± 5.3
C. elaphus (farmed)	22.5 ± 6.6	15.4 ± 4.5	10.0 ± 6.2	16.0 ± 7.8	5.4 ± 3.8	6 ± 3.1	14.7 ± 9.8

The highest invasion of nematodes *Trichuris* spp. (69.4 epg) and the lowest invasion of the *Nematodirus* spp. (13.1 epg) were recorded in the alimentary tract of Moose (Table 2). The greatest prevalence of the nematode eggs of the Strongylidae family (144.0 epg) and the lowest – of *Trichuris* spp. (33.7 epg) was in the alimentary tract of Roe Deer. The highest level of *Trichuris* spp. (31.1 epg) and *Nematodirus* spp. (22.0 epg) and the lowest level of *Capillaria* spp. (10.1 epg) invasion have been recorded in the free-ranging Red Deer. The prevalence of eggs of *Strongyloides* spp. (16.0 epg) and of *Nematodirus* spp. (5.4 epg) was in the farmed Red Deer (Fig. 2).

The results of the helminth-ovoscopic analysis have shown the prevalence of the *Capillaria* spp. nematode in Red Deer only. The invasion of these nematodes in the farmed Red Deer was higher than that

The prevalence of *P. cervi* has been determined in all animals. The highest level of the infection was recorded in Roe Deer and Red Deer (63.1 and 49.4 epg, respectively). No *F. hepatica* eggs were found in the samples of the faeces of Roe Deer and the free-ranging Red Deer. Only slight prevalence of the flatworms was identified in Moose and in the farmed Red Deer (5 and 15.4 epg, respectively) (Table 2, Fig. 3).

Additional helminth-larvaescopic analyses have shown that the examined Cervidae were infected with a few more nematode species (Table 3, Fig. 4). Low prevalence of larvae cultivated in the cultures of excrements could have been influenced by the composition of the excrements. Based on the observations of M. B. Lancaster and S. J. Andrews (1996), the surviving conditions of larvae in the hard excrements are harder than in the faeces of cows.

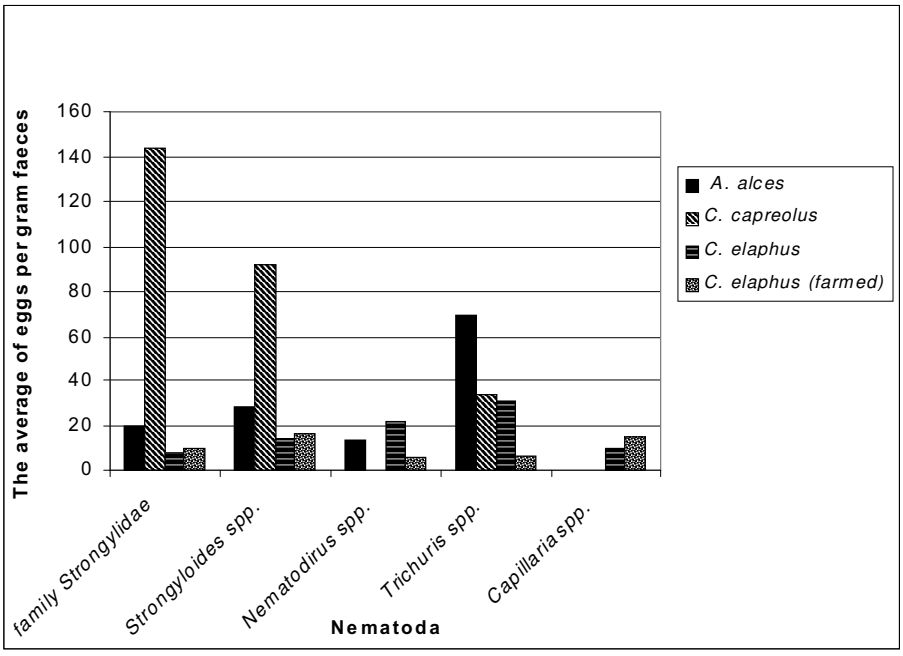

Figure 2. The intensity of the nematode invasion

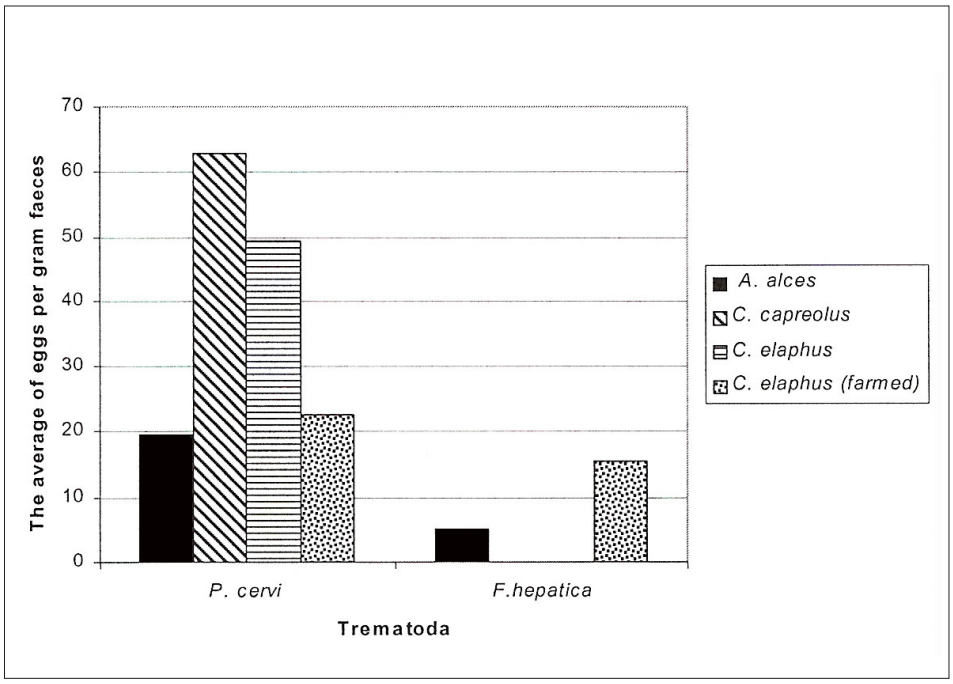

Figure 3. The intensity of the flatworm invasion

Table 3. The species composition of nematode larvae raised in the cultures of faeces

Cervine	*Trichostrongylus spp.*	*Ostertagia spp.*	*Nematodirus spp.*	*Cooperia spp.*	*Strongyloides spp.*
A. alces	12.0 ± 11.5	7.4 ± 4.9	2.7 ± 2.7	0.8 ± 0.7	19.0 ± 12.7
C. capreolus	1.8 ± 1.8	2.6 ± 1.9	-	-	3.1 ± 3.1
C. elaphus	1.1 ± 1.1	0.9 ± 0.5	5 ± 4.3	6.4 ± 6.0	13.4 ± 7.3
C. elaphus (farmed)	8.2 ± 8.0	3.5 ± 3.3	-	-	0.1 ± 0.1

The prevalence of *Strongyloides* spp. larvae has been determined in the cultures of excrements of Moose and Roe Deer (19.1 larvae and 3.1 larvae per gram faeces, respectively). Besides, even though the larvae of *Nematodirus* spp. and of *Cooperia* spp. have been identified in the cultures of excrements of Moose and Red Deer, the larvae of these nematodes have not been raised in the cultures of excrements of Roe Deer (Fig. 4). According to the data of other authors (Šarkūnas 1996 a), the nematodes of these species were not found in the intestines of Roe Deer either. The invasive lar-

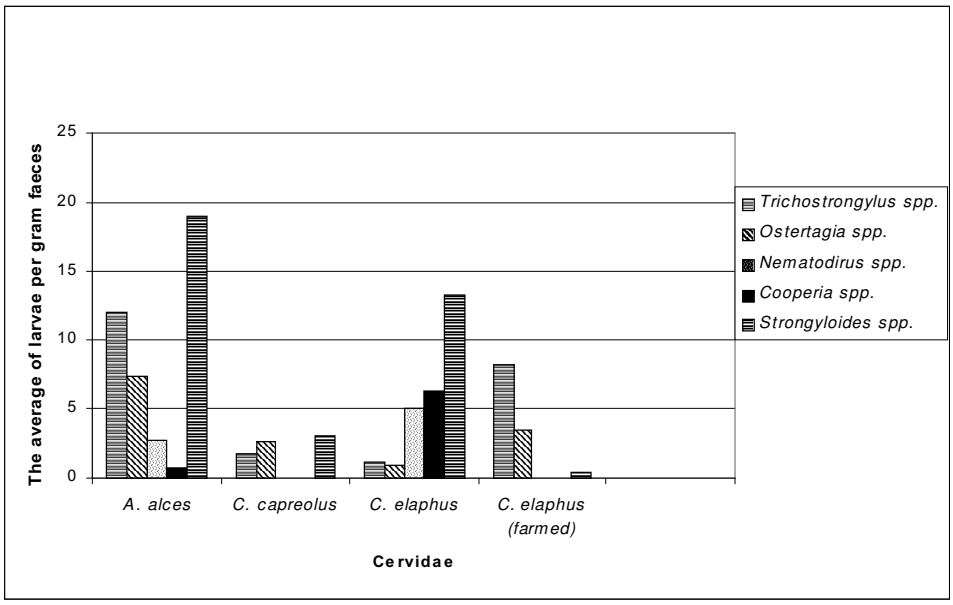

Figure 4. The species composition of nematode larvae raised in the cultures of faeces

vae of *Trichostrongylus* spp. and of *Ostertagia* spp. have been raised up in the samples of excrements of all the examined animals, whereas *Cooperia* spp. larvae has only been identified in the cultures of excrements of Moose and the free-ranging Red Deer (0.8 larvae and 0.4 larvae per gram faeces, respectively).

The results of helminth-larvaescopic analyses have shown that difference in the helminth fauna of the free-ranging and farmed Red Deer is very insignificant, whereas quantitative indicators of the raised up larvae are very diverse (Table 3). The prevalence of the nematode *Trichostrongylus* spp. larvae (8.2) and *Ostertagia* spp. larvae (3.5) was recorded in the cultures of excrements of the farmed Red Deer. While that of *Strongyloides* spp. was very small (0.1), and *Nematodirus* spp. and *Cooperia* spp. larvae have not been found at all (Fig. 4).

The prevalence of the *Strongyloides* spp. (13.4), *Cooperia* spp. (6.4) and *Nematodirus* spp. (5.0) larvae was identified in the cultures of faeces of the free-ranging Red Deer (Fig. 4). The invasion of nematodes *Trichostrongylus* spp. and *Ostertagia* spp. in the free-ranging Red Deer was lower than in the farmed Red Deer (1.1 and 0.9 larvae per gram faeces, respectively). Moreover, the prevalence of the nematode *Trichostrongylus* spp. larvae (8.2) and *Ostertagia* spp. larvae (3.5) was observed in the faeces of the farmed Red Deer, and very little of *Strongyloides* spp. larvae (0.1), and just like in Roe Deer, the larvae of *Nematodirus* spp. and *Cooperia* spp. have not been found.

Discussion

Summarizing the obtained data, we can state that the prevalence of the nematodes *Strongyloides* spp., *Trichuris* spp., *Trichostrongylus* spp., *Ostertagia* spp. and representatives of Strongylidae family and the invasion of the trematode *P. cervi* has been identified in all the examined Cervidae species. The invasion of *Nematodirus* spp., *Cooperia* spp. and *F. hepatica* was identified only in Moose and Red Deer. The invasion of *Capillaria* spp. has only been found in Red Deer. The invasion of *Strongyloides* spp., *Trichuris* spp., *Nematodirus* spp., *Capillaria* spp., *Trichostrongylus* spp., *Ostertagia* spp. and *Cooperia* spp. was identified in the free ranging Red Deer while only three of them were characteristic to farmed Red Deer (*Strongyloides* spp., *Trichostrongylus* spp., *Ostertagia* spp.). Two trematode species were found only in the farmed Red Deer. Moreover, the eggs of *F. hepatica* were not identified in the faeces of the free-ranging Red Deer.

The analyses carried out by M. Šarkūnas (1996 a) showed that Roe Deer hunted in the Kaunas and Kėdainiai regions were infected with the nematodes of *Chabertia ovina, Bunostomum trigonocephalum, Strongyloides papilosus, Oesophagostomum venulosum* and *Ostertagia circumcincta*. Based on our study data, we can state that Roe Deer in the Aukštaitija National Park have been infected with the nematode species of the same families as those in the study regions of the above-mentioned author. However, our study data show the prevalence of the eggs of *Trichuris* spp. in the faeces of Roe Deer. It should be mentioned that the prevalence of this nematode species is often recorded in the alimentary tract of sheep. A 100% invasion of *Chabertia* spp., *Cooperia* spp., *Haemonchus* spp., *Nematodirus* spp., *Oesophagostomum* spp., *Ostertagia* spp., *Trichostrongylus* spp. and *Trichuris* spp. was identified in the alimentary tract of sheep in Spain in 2001–2002 (Pedreira *et al* 2002). Accordingly, since Cervidae's often feed in cultural pastures, they can easily get infected with the helminthes of the domestic ruminant animals. On the other hand, the infected wild game may be considered as a potential source of helminthes infection for humans.

According to our study data, Red Deer and Moose in Aukštaitija National Park were infected with several nematode species, namely, *Strongyloides* spp., *Nematodirus* spp., *Trichuris* spp., *Trichostrongylus* spp., *Ostertagia* spp., *Cooperia* spp., as well as with the nematodes of the Strongylidae family. The nematodes of the latter species are often found in Red Deer (Šarkūnas 1996 b, Rehbein *et al* 2002), Sika Deer (Veličkaitė 2002), Fallow Deer (Vengu 2000), Moose (Borgsteede 1982) and Reindeer (Borgsteede 1982; Hrabok *et al* 2006) not only in Lithuania, but in other European countries as well.

We identified the invasion of flatworms in all the examined Cervidae. Moreover, a 100% infection with *F. hepatica* was identified in Fallow Deer examined in Slovenia (Vengu 2000).

The comparison of the results of our study with these of other authors shows that the most common parasitic nematodes identified in the alimentary tract of the game animals in the territory of the Aukštaitija National Park, just like in other countries, belong to the Strongylidae, Trichostrongylidae, Strongyloidae and Trichuridae families, and the most common flatworms are *F. hepatica* and *P. cervi*.

We can state now that parasitological situation in wild game in the examined district is not very bad (the infection level in most cases was lower than 200 epg). But how parasites influence the wild game population during several years need to be observed. Equally, in order to asses season ability of the infection and the extent of the helminthes invasion in wild game, it is very important to examine more Cervidae's

during seasons of the year, also, to carry out the coproscopic analysis of animals of the different age ranges, and finally, to determine herb contamination with the nematode larvae.

Conclusions

All the examined Cervidae were infected with the nematodes of the Strongylidae, Trichostrongylidae, Strongyloidae and Trichuridae families, and the flatworms of the Paramphistomatidae and Fasciolidae families in the Aukštaitija National Park.

It is determined that the free ranging Red Deer were infected with seven nematode species, while the farmed Red Deer were infected with three of them. Moose were infected with six nematode species and Roe Deer were infected with four. Flatworm *P. cervi* was characteristic of all the examined game animals. *F. hepatica* has been determined in Moose and the farmed Red Deer.

It is stated that now the parasitological situation in wild game in the examined district is not very bad (the infection level in most cases was lower than 200 epg). The prevalence of the nematode invasion has been determined in Roe Deer and Moose (269.7 and 178.5 epg, respectively) and that of flatworms – in the species of Roe Deer and Red Deer (63.1 and 49.4 epg, respectively).

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ГЕЛЬМИНТЫ ПИЩЕВАРИТЕЛЬНОГО ТРАКТА ОЛЕНЬИХ ЗВЕРЕЙ В НАЦИОНАЛЬНОМ ПАРКЕ АУКШТАЙТИЯ

Р. Аукштикальнене, Е. Букельскис и Е. Кашетайте

Резюме

Целью этой работы было установить гельминты пищеварительного тракта оленьих зверей. Исследования проводились на базе охотоведения Вильнюсского университета в районах Игналины и Утяны, в национальном парке Аукштайтия. Экскременты были собраны в 2005–2006 г.г. Всего собрано 38 образцов, из них лося (*Alces alces*)– 10, благородного оленя (*Cervus elaphus*) – 23, косули (*Capreolus capreolus*) –5.

Исследования проводились по модифицированному методу МС Мастера и методом седиментации и выращивания личинок. Установлено, что в исследованной территории все оленьи звери были заражены нематодами семейств: Strongylidae, Trichostrongylidae, Strongyloidae и Trichuridae, а также трематодами из семейства Paramphistomatidae и Fasciolidae.

Нематодами *Strongyloides* spp., *Trichuris* spp., *Trichostrongylus* spp., *Ostertagia* spp., некоторыми из семейства Strongylidae и трематодами *Paramphistomum cervi* установлена инвазия у всех оленьих зверей. *Nematodirus* spp., *Cooperia* spp. и *Fasciola hepatica* найдена только у лосей и выращиваемых в загонах оленей, а *Capilaria* spp. – только у благородных оленей.

Звери, живущие в природе и выращиваемые в загонах, заражены теми же самыми нематодами, а два вида трематодов установлены только у благородных оленей, живущих в загоне. Найболее интенсивная инвазия нематод установлена у косуль и лосей (соответственно 270 и 179 яичек в 1 г экскрементов), а трематод - у косуль и благородных оленей (63 и 49 яичек в 1 г экскрементов).

Ключевые слова: оленьи звери, *Alces alces*, *Cervus elaphus*, *Capreolus capreolus*, гельминты, нематоды, трематоды