Full Length Research Paper

A contribution to the knowledge of endoparasitic helminthes: Fauna of wild and farmed cervidae in Lithuania

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The aim of this study was to identify the eggs of helminths in the faeces of Alces alces, Cervus elaphus and Capreolus capreolus in Lithuania. The modified method of McMaster and the sedimentation technique were applied. 110 samples of faeces were collected including 20 samples of elk, 30 samples of roe deer and 60 of red deer (30 of farmed and 30 of wild red deer) and investigated for the presence of helminth endoparasite eggs. 100% of the samples studied showed nematodes and/or trematodes eggs. The following species were found: Paramphistomum cervi (10% of the Cervidae faeces positive), Dicrocoelium dendriticum (45%), Strongyloides papilosus (60%), Trichuris ovis (5%), Capillaria sp. (19%), Nematodirus sp. (36%) and Strongylidae (25%). P. cervi, D. dendriticum, S. papilosus and Strongylidae were found in all three cervid species. Capillaria sp. was common only in red deer. The presence of T. ovis eggs was found at various distribution rates in elk and roe deer faeces. The eggs of Nematodirus sp. were identified in elk and red deer faeces. The wild and farmed red deer demonstrated the same helminths species. There were maximum numbers of helminths eggs per gram in the samples of farmed red deer faeces.

Key words: Trematoda, nematoda, alces, capreolus, cervus.

INTRODUCTION

Red deer (Cervus elaphus), roe deer (Capreolus capreolus), elk (Alces alces) and wild boar (Sus scrofa) are cloven-hoofed mammals which live in forest ecosystems of Lithuania. These animals can act as hosts for many species of helminths which are dangerous to humans as well as, to farm and domestic animals. Cervidae often feed in farmlands where they leave their faeces, spreading thus, helminthes eggs of the alimentary tract. Helminths of game animals which affect the density of the host population make considerable damages of game resources.

The protection of game from diseases is important for several reasons. Mainly, this is concerned with the health of the animals themselves, which under conditions obtained in Lithuania are at an increasing rate exposed to negative factors arising from the activities of man. Among other factors, exposure to diseases, including those caused by parasitic infections, is on the increase. The development of 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 (Goosens et al., 2005; Letkova et al., 2008).

In order to assess the prevalence of parasitic worms in Cervidae gastrointestinal tract, samples of their faeces were investigated by means of ovoscopic analyses. 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 just as the relevant preventive measures could minimize damage caused by helminthes to the host.

This report is the result of the ovoscopic examination of Cervidae faeces of helminthes eggs, carried out in Aukstaitija National park (Eastern part of Lithuania: Ignalina and Utena regions).

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MATERIALS AND METHODS

Faeces of Cervidae were collected from September, 2010 to March, 2011. In total, 110 samples of faeces were collected, including 20 samples of elk, 30 samples of roe deer and 60 of red deer (30 of farmed and 30 of wild red deer). The population density of game animals was 21 elk, 23 roe deer and 22 red deer in 100 ha in the investigated region. There were 50 Red Deer reared in farm conditions in 27 ha of forest. Farmed red deer was treated with anthelmintics twice a year.

Several methods have been applied implementing parasitological analyses of the excrements. A modified McMaster method (Pereckiene et al., 2007) was applied for qualitative and quantitative testing of the presence of nematodes eggs. The sedimentation technique was used to separate hard trematodes eggs from excrements (Aiello, 1998; http://www.rvc.ac.uk/review/parasitology/FaecalSedimentation/Step2.htm). The obtained eggs of helminthes were counted per gram faeces (EPG). The mean (x ± SE (standard error)) of faecal egg and larvae count was analyzed with the software SPSS statistical package.

RESULTS

When the data obtained during the sampling period were taken into consideration, 100% of the samples studied showed nematodes and/or trematodes eggs. The presence of eggs of flatworm was more frequent than the presence of nematode eggs and oscillated between 6 to 799 EPG while the nematode eggs oscillated between 10 to 160 EPG faeces.

Most part of the flatworm eggs was found in the faecal samples of farmed red deer (the mean being 251.3 ± 61.9) and the least in roe deer were found to be (50.9 ± 11.5) (Figure 1). The invasion of round worms was also more considerable in farmed red deer (Figure 1) (the EPG being 86.9 ± 7.3). Meanwhile, the infection with these helminthes in free red deer was lower to that in farmed and EPG of nematode eggs oscillated between 49.9 ± 6.2 and 86.9 ± 7.3 respectively. The samples of elk and roe deer faeces showed similar amount of nematode eggs per gram faeces (Figure 1), 37.5 ± 5.3 and 27.7 ± 5.5 EPG respectively.

In all, at least two species of trematodes and four species of nematodes were identified. Some like nematode eggs were identified as belonging to Strongylidae and can be determined only by means of cultivating invasive larvae from eggs. Six species of helminthes were found in elk and both free and farmed red deer, and five species in roe deer. The results of helminthes ovsoscopic examination are given in Table 1. 

Table 1. Helminths species and the mean of eggs per gram faeces (± standard error) in the faecal samples of examined Cervidae.

<table>
<thead>
<tr>
<th>Helminths species</th>
<th>Capreolus</th>
<th>Alces</th>
<th>Cervus (wild)</th>
<th>Cervus (farmed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. cervi</td>
<td>84.3 ± 23.1</td>
<td>70.1 ± 35.1</td>
<td>56.5 ± 9.6</td>
<td>54.1 ± 1.4</td>
</tr>
<tr>
<td>D. dendriticum</td>
<td>30.9 ± 4.3</td>
<td>64.8 ± 21.2</td>
<td>83.3 ± 18.9</td>
<td>264.7 ± 122.4</td>
</tr>
<tr>
<td>T. ovis</td>
<td>18.5 ± 4.1</td>
<td>39.8 ± 10.4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cappilaria sp.</td>
<td>-</td>
<td>-</td>
<td>23.9 ± 3.7</td>
<td>23.7 ± 4.6</td>
</tr>
<tr>
<td>S. papillosus</td>
<td>70.3 ± 14.8</td>
<td>16.7 ± 3.3</td>
<td>76.6 ± 18.5</td>
<td>53.1 ± 17.6</td>
</tr>
<tr>
<td>Nematodirus sp.</td>
<td>-</td>
<td>32 ± 4.9</td>
<td>20 ± 16.0</td>
<td>56.3 ± 12.7</td>
</tr>
<tr>
<td>Strongylidae</td>
<td>25.2 ± 5.2</td>
<td>22.2 ± 3.1</td>
<td>16.9 ± 4.0</td>
<td>24.7 ± 4.1</td>
</tr>
</tbody>
</table>

Figure 1. The eggs of parasitic worms per gram faeces (EPG) of examined Cervidae
deer (264.7 ± 122.4 EPG in farmed and 83.3 ± 18.9 EPG in free ranging). The least value of *D. dendriticum* EPG was established in roe deer faeces (the mean being 30.9 ± 4.3 EPG). Although, the highest amount of *P. cervi* eggs (341 EPG in one of the samples) was found in one of the samples of the elk faeces, the mean of *P. cervi* eggs was higher in roe deer (84.3 ± 23.1).

The presence of *Trichuris ovis* eggs was found at various distribution rates in elk and roe deer faeces, whereas *Capillaria* sp. was common only in red deer with very similar prevalences of 18.0% in wild and 20.0% in farmed red deer. *Nematodirus* sp. eggs were identified at various distribution rates in elk and red deer faeces. The most and least average of nematodes eggs showed *S. papilosus*: the most in roe deer faeces with mean being (70.3 ± 1 4.8) and the least in elk faeces (16.7 ± 3.3). The wild and farmed red deer demonstrated the same helminthes species and the mean of eggs was very similar (Table 1).

**DISCUSSION**

All the mentioned species of helminthes from cervids are known to be parasites of humans, domestic animals (cats, dogs) and/or farm animals (rabbits, goats, sheep, cattle and horses). Game helminthoses are involved, and this is often common for domestic as well as, free living animals and refers principally to domestic ruminants that share the grazing with game helminthoses. Lambs and calves are very susceptible to parasites and infection is usually fatal (Mage et al., 2002; Manga-Gonzales et al., 2010).

In view of our data, we can state that all the examined Cervidae species were infected with nematode *S. papilosus* and with trematodes *P. cervi* and *D. dendriticum*. Unfortunately, there are no data related with trematodes invasion in wild or domestic ruminants in Lithuania. On the other hand, *P. cervi* (Kuzmina et al., 2010), *Fasciola hepatica* (Shimalov and Shimalov, 2003; Rehbein and Visser, 2007) and *D. dendriticum* (Rehbein and Visser, 2007) are very common flatworms in wild ruminants in other countries and domestic ruminants often are the hosts of the aforementioned trematodes (Mage et al., 2002; Manga-Gonzales et al., 2010).

Although, we have only found the invasion of *Capillaria* sp. in red deer, this nematode is a common parasite not only of red deer (Goosens et al., 2005; Pilarczyk et al., 2005), but of other Cervidae such as roe deer (Pilarczyk et al., 2005), fallow deer (Vengust and Bidovec, 2003) and elk (Goosens et al., 2005) which can also act as hosts for these worms. According to our studied data, red deer in Aukstaitija National Park of Lithuania was infected with several more nematode species, namely, *S. papilosus*, *Nematodirus* sp. and Strongyloidae. The nematodes of the later species are often found in red deer (Goosens et al., 2005; Pilarczyk et al., 2005), fallow deer (Vengust and Bidovec, 2003), sika deer (Rehbein and Visser, 2007) and reindeer (Hrabok et al., 2006) not only in Lithuania, but in the other European countries as well.

Despite the fact that our farmed red deer were treated for helminthes twice a year, they still were infected with the same parasitic worm species as the wild ones. In view of our data, the bigger density of farmed red deer population, maybe, higher contamination of herbage with infective nematode larvae in the farm could reveal the higher value of parasitic nematode eggs in the faeces of farmed red deer as compared to other examined Cervidae. The water pool in the pen should be investigated according to the prevailing composition of mollusc species in order to obtain data about the intermediate host of trematodes.

Sarkunas (1996) stated that roe deer hunted in the Central Part of Lithuania were infected with the nematodes of *Chabertia ovina*, *Bunostomum trigonocepalum*, *Strongyloides papilosus*, *Oesophagostomum venulosum* and *Ostertagia circumcincta*. Based on our study data, we can state that roe deer in the Eastern part of Lithuania may have been infected with the same nematode species as those in the study regions of the aforementioned author. We do not raise Strongyloidae eggs in larvae culture and this group has been left not qualified. But additionally, we detected three more helminthes species namely, *T. ovis, P. cervi* and *D. dendriticum* in the faeces of roe deer. It should be

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**Figure 2.** Prevalence of helminthes in examined Cervidae faeces.
mentioned that the prevalence of Trichuris sp. and Strongyliidae are recorded in the alimentary tract of roe deer in Belarus (Shimalov and Shimalov, 2003), in Ukraine (Kuzmina et al., 2010) and in Poland (Pilarczyk et al., 2005). However, our results do not coincide with the report obtained by Pilarczyk et al. (2005) and Kuzmina et al. (2010), who stated that roe deer are infected with several more nematode species.

Based on our data, the elk was infected with four nematode species in the investigated area of Lithuania. The most dominant species of roundworms T. ovis was found in 85% of faecal samples of elk. The present result partly coincide with those of Goosens et al. (2005) who detected more nematode species in the gastrointestinal tract of elk and do not coincide with those given by Borgsteede (1982) who raised the infective larvae of Ostertagia, Spiculopteragia and Skrjabinagia spp. respectively from the faeces of elk.

However, our results do not coincide with those obtained by several authors, who had stated that Cervidae can be infected with several more parasite species such as, Spiculopteragia sp., Aschworthius sp., Marshallagia sp., Taenia sp., Setaria sp., Echinococcus granulosus and many others (Shimalov and Shimalov, 2003; Manfredi et al., 2007; Letkova et al., 2008; Kuzmina et al., 2010). We did not record some parasite eggs in faeces, because these worms or their larvae can be found by helminthological examination (dissection and organ compression). Some of them such as E. granulosus are of great medical and veterinary importance in Lithuania. This species of helminthes have been registered by the Lithuanian medical services in humans. Lithuanian veterinary statistics report cases of cattle, sheep, pigs, dogs and foxes infected with E. granulosus.

It is very important to examine more Cervidae during seasons of the year, and also to carry out not only the coproscopical analysis but helminthological examination of animals of the different age ranges. This will help to assess season ability of the infection and the extent of the helminthes invasion in wild game. Finally, it is also important to determine herb contamination with the nematode larvae and to find natural infections of ants and snails (the intermediate host of flatworms) with trematode larvae, which will help to control parasitic infections of wild game.

**Conclusion**

S. papillosus, P. cervi, D. dendriticum and Strongylidae were found in all three cervid species. S. papillosus was the most frequently detected parasite with prevalence of 60.0%. Additionally, T. ovis was identified in roe deer, T. ovis and Nematodirus sp. in elk, and Capilaria sp. in red deer. The wild and farmed red deer demonstrated the same helminthes species and the mean of eggs was very similar.

**REFERENCES**


http://www.rvc.ac.uk/review/parasitology/FaecalSedimentation/Step2.ht m.