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OCCURRENCE OF GASTRO-INTESTINAL NEMATODES IN CERVIDS (CERVIDAE) OF NORTH- WESTERN POLAND

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ABSTRACT

The study described was aimed at evaluating the extent of gastro-intestinal helminth infestation in the roe deer, fallow deer, and red deer in Western Pomerania; infestation prevalence and intensity as well as the species composition of the helminth fauna were determined. Within March 1999 – July 2000, a total of 199 animals (86 roe deer, 68 red deer, and 25 fallow deer) were examined. The animals were obtained from 9 north-western Poland's forest districts. The following nematode species were found to be present in the alimentary tracts examined: *Spiculoptera boehmi*, *S. mathevossiani*, *Spiculoptera asymmetrica*, *Ostertagia kolchida*, *O. leptospicularis*, *Haemonchus contortus*, *Chabertia ovina*, *Oesophagostomum venulosum*, *Nematodirus* sp., *Trichocephalus ovis*, *Capillaria bovis*, *Trichostrongylus axei*, and *Trichostrongylus* sp. As shown by biopsies, the infestation prevalence amounted to 73.53; 96.51; and 92.0% in red deer, roe deer, and fallow deer, respectively. The parasites occurred at an intensity of 10 to 660 individuals.

Key words: gastro-intestinal nematodes, cervids, invasion prevalence, invasion intensity, north-western Poland.

INTRODUCTION

Disease monitoring in wild animals has recently become a necessary component of game management. Game habitat alterations resulting from human activities substantially affect the animals' immunity and metabolism. The dysfunctions result in intensification of infectious and invasive diseases, the latter having a potential of

causing considerable losses. The presence of parasites in an animal body, particularly in young animals, leads to health deterioration, lowered condition, reduced body weight gains, and reproductive disorders; in addition, the parasites affects the quality of animal products (meat, skin, antlers). As opposed to domestic animals the losses of which are measurable and documentable [16], game losses are difficult to determine with any degree of accuracy due to methodological reasons. As shown by some studies, body weight of the roe deer infested with endoparasites is reduced by about 1.1-6.2 kg [23].

Gastro-intestinal nematodes belong to the most dangerous cervid parasites. So far, their occurrence in cervids in north-western Poland has not been studied. This study can thus be regarded as an additional source of data on cervid alimentary tract parasites in Poland. The research, carried out so far in the eastern part of the country, showed a high gastro-intestinal nematode invasion prevalence that, as in the subfamily *Ostertagiinae*, is frequently as high as 100% [4,5,6,7,8,9,10,11,12,13].

This study was aimed at determining the prevalence and intensity of the helminth invasion as well as at elucidating the species composition of the parasitic fauna in the alimentary tract of roe deer, fallow deer, and red deer in Western Pomerania.

MATERIALS AND METHODS

Animals for the study were obtained from 9 forest districts (Trzebież, Rokita, Goleniów, Połczyn Zdrój, Szczecinek, Mirosławiec, Wałcz, Człopa, Złotów) in north-western Poland. Within March 1999 – January 2000, a total of 179 animals (86 roe deer, 68 red deer, and 25 fallow deer) were biopsied. The alimentary tracts examined were dissected out of the animals killed during hunts. Parasitological examination was conducted following recommendations put forth by Drózd [4]. Gastro-intestinal nematodes found were permanently mounted in polyvinylpyrrolidone (PVP) on slides to facilitate taxonomic identification. Special criteria were applied when identifying nematodes of the subfamily *Ostertagiinae*: the males only were identified and the sex ratio (females:males) was determined.

RESULTS

The study showed all the cervid species examined to harbour gastro-intestinal nematodes. Of the 86 roe deer examined, 83 were infested (invasion prevalence of 96.51%). Of the 68 red deer examined, nematodes were present in 50 (invasion prevalence of 73.53%). Finally, out of the 25 fallow deer examined, 23 carried gastro-intestinal nematodes (invasion prevalence of 92%). The highest prevalence of the gastro-intestinal nematode invasion in the red deer (88%) was recorded in the forest districts of Szczecinek and Połczyn Zdrój; among the roe deer and fallow deer, the invasion was most frequent (98.27 and 92.00%, respectively) in the forest districts of Złotów, Wałcz, Człopa, and Mirosławiec (Table 1). Tables 2 and 3 summarise data on prevalence and intensity of infection with various gastro-intestinal nematodes.

Table 1. The results of post- mortem examination of game in North-West Poland

Forest region	Roe deer			Red deer			Fallow deer		
	number of		Prevalance E.I (%)	number of		Prevalance E.I (%)	number of		Prevalance E.I (%)
	examined animals	infected animals		examined animals	infected animals		examined animals	infected animals	
Złotów Wałcz Człopa Mirosławiec	58	57	98.27	32	25	78.12	25	23	92.00
Szczecinek Połczyn Zdrój	19	18	94.74	25	22	88.00	-	-	-
Trzebież Goleniów Rokita	9	8	88.88	11	3	27.27	-	-	-
Total:	86	83	96.51	68	50	73.53	25	23	92.00

Table 2. The prevalence of particular species of gastro-intestinal nematodes in game in North-West Poland

Species of gastro-intestinal nematodes	Roe deer		Red deer		Fallow deer	
	number of infected animals	prevalence E.I.(%)	number of infected animals	prevalence E.I.(%)	number of infected animals	prevalence E.I.(%)
<i>Spiculoptera</i> <i>boehmi</i>	25	29.10	18	26.47	8	32.60
<i>S.mathevossiani</i>	4	4.65	1	1.47	1	4.04
<i>S.asymmetrica</i>	2	2.33	0	0	4	16.00
<i>Ostertagia kolchida</i>	6	6.98	4	5.88	1	4.00
<i>O.leptospicularis</i>	20	23.26	9	13.24	1	4.00
<i>Haemonchus contortus</i>	8	9.30	7	10.29	1	4.00
<i>Chabertia ovina</i>	8	9.30	5	7.35	2	8.00
<i>Oesophagostomum venulosum</i>	9	10.47	7	10.29	11	44.00
<i>Nematodirus</i> sp.	6	6.98	3	4.41	2	8.00
<i>Trichocephalus ovis</i>	7	8.14	3	4.41	2	8.00
<i>Capillaria bovis</i>	6	6.98	1	1.47	1	4.00
<i>Trichostrongylus axei</i>	1	1.16	0	0	1	4.00
<i>Trichostrongylus</i> sp.	1	1.16	0	0	0	0

Nematodes of the family *Trychostrongylidae* were most frequently encountered in the alimentary tracts examined, representatives of the subfamily *Ostertagiinae* being most abundantly represented. They were present in stomachs of all three cervid species examined. *Spiculoptera boehmi* and *Ostertagia leptospicularis* were dominants in the roe and red deer, while *Oesophagostomum venulosum* was the most frequent nematode in fallow deer (Table 2).

Table 3. The intensity of gastro-intestinal nematodes in examined animals in North-West Poland

Species of gastro-intestinal nematodes	Roe deer	Red deer	Fallow deer
	range of intensity	range of intensity	range of intensity
<i>Spiculoptera boehmi</i>	10-150	10-50	10-190
<i>S. mathevossiani</i>	10	20	20
<i>S. asymmetrica</i>	10-40	0	10-20
<i>Ostertagia kolchida</i>	10-20	10-20	10
<i>O. leptospicularis</i>	20-80	10-60	20
<i>Haemonchus contortus</i>	20-320	10-500	40
<i>Chabertia ovina</i>	20-660	10-190	10
<i>Oesophagostomum venulosum</i>	10-20	10-20	10-200
<i>Nematodirus</i> sp.	10-130	10-20	10-40
<i>Trichocephalus ovis</i>	10-50	10-20	10-60
<i>Capillaria bovis</i>	20-50	10-40	10
<i>Trichostrongylus axei</i>	30	0	10
<i>Trichostrongylus</i> sp.	10	0	0

Invasion intensity varied from 10 to 660 individuals (Table 3). *Chabertia ovina* (20-660 individuals) and *Spiculoptera boehmi* (10-150) were the nematodes occurring at the highest intensity in the roe deer. In the red deer, the heaviest infections were produced by *Haemonchus contortus* (10-500 individuals) and *Chabertia ovina* (10-190), while *Oesophagostomum venulosum* (10-200 individuals) and *Spiculoptera boehmi* (10-190) were responsible for the heaviest invasion in fallow deer.

As already mentioned, the *Ostertagiinae* females were not identified to species. However, the sex ratio (females:males) was determined to amount to 1:2.1.

DISCUSSION

Roe deer parasitic fauna

The roe deer have been examined for the presence of helminths both in Poland and abroad [3,5,6,7,8,9,13,14,22,24].

The roe deer living near Poznań were found to carry 13 alimentary tract nematode species. Invasion prevalence was observed to reach 100%. *Spiculoptera boehmi* and *Ostertagia leptospicularis* were the most frequent species, occurring at intensities of 1-287 and 1-539 individuals. The rarest species was *Trichostrongylus capricola* the invasion intensity of which ranging within 1-64 individuals [6].

Zaleska-Schönthaler and Szczupakiewicz [24] examined 4 roe deer in the Romnicka Forest and found *Chabertia ovina*, *Spiculoptera dagestanica*, and *Trichocephalus* sp. to be present in 2 deer.

In their study conducted in the Białowieża Primeval Forest, Drózdź et al. [7] identified 8 gastro-intestinal nematode species. All the roe deer examined in that study were infested with *Spiculoptera boehmi*, *Ostertagia leptospicularis*, and *Ostertagia kolchida* that occurred at intensities ranging from 1 to 184 individuals. On the other hand, few roe deer only were infested with *Bunostomum trigonocephalum*, *Spiculoptera mathevossiani*, *Spiculoptera dagestanica*, and *Nematodirus europaeus*.

When working in the Borecka Forest, Drózdź et al. [8] found 100% of the roe deer to be infested with gastro-intestinal nematodes. *Spiculoptera boehmi*, *Ostertagia leptospicularis*, *Ostertagia kolchida*, and *Ostertagia antipini* were the most frequent species which occurred at intensities of 1-2333 individuals. On the other hand, *Oesophagostomum sikae* and *Ostertagia lyrata* were present sporadically only.

In Rogowo, Drózdź and Dudziński [9] found gastro-intestinal nematodes in 100% of the roe deer examined. The most frequent species included *Spiculoptera boehmi*, *Spiculoptera mathevossiani*, *Ostertagia leptospicularis*, and *Ostertagia kolchida* which occurred at intensities 1-321 individuals. Relatively rare in the Rogowo materials was *Haemonchus contortus*, but its invasion intensity was very high and reached 4771 individuals.

Drózdź et al. [13] and Drózdź [5] found *Ashworthius sidemi* to occur in the roe deer in the Bieszczady Mountains.

Gastrointestinal nematodes were reported from the roe deer in other European countries as well. In the former Czechoslovakia, Dyk and Chroust [14] found *Spiculoptera boehmi*, *Ostertagia kolchida*, and *Chabertia ovina* to be the most frequent nematodes. They occurred at an intensity reaching 684 individuals. In Italy, Rossi et al. [22] reported *Spiculoptera boehmi*, *Spiculoptera mathevossiani*, *Ostertagia leptospicularis* as the most frequent species which occurred at an average intensity of 407 individuals. In the Netherlands, Borgsteede et al. [3] showed 1-79% of the roe deer to be infested. The most frequent nematodes were *Spiculoptera boehmi* and *Ostertagia leptospicularis*. The authors quoted reported also sporadic occurrence of *Teladorsagia circumcincta* (1%) as well as *Chabertia ovina* and *Bunostomum trigonocephalum* (2%).

The roe deer examined in this study were found to be infested by 13 gastro-intestinal species (Tables 2 and 3). The most frequent nematodes were *Spiculoptera boehmi* (29.10%) and *Ostertagia leptospicularis* (23.26%) the invasion intensity of which ranged within 10-150 and 10-80 individuals, respectively. Sporadic records were obtained of *Trichostrongylus axei* and *Trichostrongylus* sp. (1.16%) which occurred at an intensity of 10-30 individuals. Noteworthy is the fact that the roe deer parasites dominant in north-western Poland were identical to those reported by other authors from the remaining regions of the country [6,7,8,9,].

Parasitic fauna of the red deer

Studies conducted on gastro-intestinal nematodes occurring in the red deer in Poland have demonstrated a high prevalence of infestation.

In the Białowieża Primeval Forest, Drózdź et al. [7] found *Spiculoptera boehmi* to be most prevalent (100%), its invasion intensity ranging from 30 to 1095 individuals; *Ostertagia leptospicularis* was very frequent (78%) as well and occurred at an intensity of 5-60 individuals. The fewest records were those of *Cooperia pectinata* and *Capillaria bilobata*.

Drózdź et al. [10, 11] found 4-100% of the red deer in the Słowiński National Park to be infested. The most frequent nematode was *Spiculoptera boehmi* (100%) occurring at an intensity of 5-2120 individuals; Somewhat less frequent (92%) was *Ostertagia leptospicularis* the invasion intensity of which ranged within 10-805 individuals. The rarest nematode, *Spiculoptera dagestanica* (9%) occurred at an intensity of 5-25 individuals.

In addition, Drózdź et al. [13] and Drózdź [5] found a centre of *Ashworthius sidemi* in the red deer of the Bieszczady Mountains, the nematode being present in 100% of the red deer examined.

Similarly to the findings in Poland, the prevalence of gastro-intestinal nematode infestation in other European countries was high. In the former Czechoslovakia, Rezac [20] found those nematodes in 6.7-90% of the red deer, while Ferte et al. [15] reported *Ashworthius sidemi* from 90% of the red deer in France.

The red deer examined in this study were found to be infested by 10 gastro-intestinal nematodes (Tables 2 and 3). Individual species occurred in 1.47-26.47% of the red deer. The most frequent nematodes were *Spiculopteragia boehmi* (26.47%) and *Ostertagia leptospicularis* (13.24%) which occurred at intensities of 10-50 and 10-60 individuals, respectively. On the other hand, *Spiculopteragia mathevossiani* and *Capillaria bovis* were present in as few as 1.47% of the roe deer examined, the invasion intensity amounting to 10-40 individuals. The invasion prevalence values recorded were lower than those reported by the authors quoted above.

Parasitic fauna of the fallow deer

Research on the fallow deer parasitic fauna, carried out so far in Poland and elsewhere in Europe, has revealed a heavy infestation of alimentary tracts with gastro-intestinal nematodes.

Drózdź [4] recorded the presence of 14 gastro-intestinal nematode species in the fallow deer, the prevalence of individual species ranging within 7-100%. Those most frequent nematodes included *Spiculopteragia asymmetrica* (100%), *S. spiculoptera* (86%), and *S. quadrispiculata* (86%).

In their study on the fallow deer faeces in the Wielkopolska region, Kozakiewicz et al. [17] found 81.8-100% of the fallow deer to be infested.

When working at a breeding centre in Kosewo Górne, Drózdź et al. [12] found nematode invasions to affect 12-100% of the fallow deer. The most frequent nematode there was *Spiculopteragia asymmetrica* (100%) the intensity of invasion of which reached 300 individuals. Somewhat less frequent were *Oesophagostomum venulosum* and *O. radiatum* (87%) which occurred at intensities of 17 and 24 individuals, respectively. The least frequent nematodes were *Trichostrongylus axei*, *T. askivali*, *Spiculopteragia quadrispiculata*, and *Cooperia pectinata* which affected 12% of the fallow deer.

In the former Czechoslovakia, Kotrlá and Kotrlý [18] recorded 21 gastro-intestinal nematode species in the fallow deer, the prevalence of infestation amounting to 0.5-60.9%. The most frequent nematodes were *Oesophagostomum venulosum* and *Spiculopteragia asymmetrica*.

In Germany, Barth and Matzke [2] showed the fallow deer they examined to be affected by 16 gastro-intestinal nematode species the prevalence of which ranging from 2 to 94%. The most frequent species was *Oesophagostomum radiatum* (94%). A study described by Kutzer [19] revealed the presence of 24 nematode species, the most frequent of them being *Spiculopteragia asymmetrica* and *Bunostomum trigonocephalum* (more than 50%). Ribbeck and Haust [21] who worked in Germany as well, examined the fallow deer both in the wild and in restricted breeding centres. Nematode invasions in the latter were more intensive and more variable (*Trichostrongylidae*). The dominant species was also *Spiculopteragia asymmetrica*.

Ambrosi et al. [1] found the fallow deer bred in Italy and Austria to be infected by 5 gastro-intestinal nematodes. The most frequent species were *Spiculopteragia asymmetrica* (96.6%) and *Ostertagia drozdzi*, *O. arctica*, and *S. quadrispiculata* (79.3-93.1%). On the other hand, *Trichostrongylus axei* produced sporadic records only (3.4%). This study showed the fallow deer to be infested by 12 gastro-intestinal nematode species (Tables 2 and 3), the invasions affecting from 4 to 44% of the fallow deer. The most frequent species was *Oesophagostomum venulosum* (44%) the invasion intensity of which varied from 10 to 200 individuals. *Spiculopteragia boehmi* and *S. asymmetrica* occurred in 32.60 and 16% of the fallow deer, respectively, at intensities of 10-190 and 10-20 individuals, respectively.

SUMMING UP

The study presented allows to conclude that cervids inhabiting north-western Poland are substantially affected by gastro-intestinal parasites. In most cases, a single host carries a number of co-occurring parasitic species. It seems purposeful to develop a parasitologic prophylaxis programme in the area and to coproscopically monitor the invasions. It would be also desirable to pursue a line of research focusing on economic consequences of the gastro-intestinal nematode invasions in cervids.

REFERENCES

1. Ambrosi M., Manfredi M.T., Lanfranchi P., 1993. Pattern of abomasal helminths in fallow deer farming in Umbria (central Italy). *Vet. Parasitol.* 47 (1-2), 81-86.
2. Barth D., Matzke P., 1984. Gastro-intestinal nematodes of fallow deer (*Dama dama* L.) in Germany. *Vet. Parasitol.* 16, 173-176.
3. Borgsteede F.H.M., Jansen J., Nispen-Tot-Panmerden H.P.M., Burg W.P.J., Noorman N., Pooutsman J., 1990. A study of the endoparasitic helminth fauna of roe deer (*Capreolus capreolus* L.) in the Netherlands. *Z. Jagdwiss.* 36 (2), 104-109.
4. Drózdź J., 1966. Studies on helminths and helminthiasis in Cervidae II. The helminth fauna in Cervidae in Poland. *Acta Parasitol. Pol.* 14, 1-13.
5. Drózdź J., 2001. Ognisko aswortiozy dzikich przeżuwaczy w Bieszczadach [The aswortiosis focus of wild-living ruminants in Bieszczady Mountains]. *Mag. Weter.* 54 (10), 66-68 [in Polish]
6. Drózdź J., Lachowicz J., Demiaszkiewicz A.W., Sulgostowska T., 1987. Abomasum nematodes in field and forest roe deer *Capreolus capreolus* (L.) over the yearly cycle. *Acta Parasitol. Pol.* 32 (4), 339-348.
7. Drózdź J., Demiaszkiewicz A.W., Lachowicz J., 1989. Kształtowanie się helmintofauny żubrów (*Bison bonasus* L.) i jeleniowatych (*Cervidae*) w Puszczy Białowieskiej [The formation of helminth fauna of European bison (L) and *Cervidae* in Białowieska Forest]. *Wiad. Parazytol.* 35 (6), 571-575 [in Polish]
8. Drózdź J., Demiaszkiewicz A.W., Lachowicz J., 1992. The helminth fauna of the roe deer *Capreolus capreolus* (L.) in a hunting area inhabited by red deer, elk and European bison (Borecka Forest, Poland) over the yearly cycle. *Acta Parasitol.* 37 (2), 83-88.
9. Drózdź J., Dudziński W., 1993. Changes in the intensity of infection of the roe deer, *Capreolus capreolus* (L.), with abomasum nematodes in relation to host density in a hunting ground. *Acta Parasitol.* 38 (1), 29-32.
10. Drózdź J., Demiaszkiewicz A.W., Lachowicz J., 1993. Seasonal changes in the helminth fauna of *Cervus elaphus* (L.) from Słowiński National Park (Poland). *Acta Parasitol.* 38 (2), 85-87.
11. Drózdź J., Demiaszkiewicz A.W., Lachowicz J., 1994. The effect of culling red deer, *Cervus elaphus* (L.) on their helminth fauna in the Słowiński National Park (Poland). *Acta Parasitol.* 39 (2), 92-94.
12. Drózdź J., Malczewski A., Demiaszkiewicz A., Lachowicz J., 1998. Odrobaczenie danieli fenbensenem w hodowli fermowej [The anthelmintic treatment with fenbendan in fallow deer kept in the fences]. *Wiad. Parazytol.* 44 (4), 723-727 [in Polish].
13. Drózdź J., Demiaszkiewicz A.W., Lachowicz J., 2000. Aswortioza - nowa parazytoza dzikich przeżuwaczy [The aswortiosis - new parasitosis of wild-living ruminants]. *Med. Weter.* 56 (1), 32-35 [in Polish].
14. Dyk V., Chroust K., 1974. Helminths and coccidia of roe deer in two neighbouring ecologically different regions. *Acta Vet.* 43, 65-77.
15. Ferte H., Cleve D., Depaquit J., Gobert S., Leger N., 2000. Status and origin of Haemonchinae (Nematoda: Trichostrongylidae) in deer: a survey conducted in France from 1985 to 1998. *Parasitol. Res.* 86, 582-587.
16. Fox M.T., 2000. Pathophysiology of gastro-intestinal nematode parasitism in ruminants - an update. *Acta Parasitol.* 45 (3), 243.
17. Kozakiewicz B., Maszewska I., Wiśniewski B., 1983. Parazytofauna danieli (*Dama dama*) w warunkach hodowli w ośrodkach łowieckich w Wielkopolsce. *Med. Weter.* 39 (4), 228-230.
18. Kotrlá B., Kotrlá A., 1980. Zur Verbreitung von Helminthen durch eingeführtes Wild. *Agnew. Parasitol.* 21 (2), 70-78.
19. Kutzer E., 1988. Bedeutung parasitärer Wechselinfektionen bei Haus- und Wild- und wiederkäuern. *Mh. Vet.-Med.* 43, 577-580
20. Rezac P., 1990. Endoparaziti jeleni zvířet v podmínkách farmového chovu. *Veterinarství* 40 (2), 69-71.
21. Ribbeck R., Haust W., 1989. Untersuchungen zum Lungen- und Magen-Darm-Nematoden-Befall bei der nutziertigen Haltung von Damwild. *Mh. Vet.-Med. Jena.* 44, 469-471.
22. Rossi L., Eckel B., Ferroglio E., 1997. A summary of the gastro-intestinal nematodes of roe deer (*Capreolus capreolus*) in a mountain habitat. *Symposia of the VII European multicolloquium of parasitology, Parma Italy 2-6 September 1996, Parassitologia-Roma* 39, 4, 303-312.
23. Tropiło J., Kiszczak L., Kryński A., 1999. Łowiectwo, weterynaria, higiena [The hunting, veterinary and hygiene]. *Łow. Pol.* [in Polish].
24. Zalewska-Schönthaler N., Szpakiewicz W., 1987. Helmintofauna przewodu pokarmowego łosi i sarn w Puszczy Romnickiej [The helminth fauna of alimentary tracts of elks and roe deer in Romnicka Forest]. *Wiad. Parazytol.* 33 (1), 63-65 [in Polish].

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