

Original papers

Parasite infections in red deer *Cervus elaphus* from Krakow area, southern Poland¹

Jerzy Kowal¹, Sławomir Kornaś¹, Paweł Nosal¹, Marek Wajdzik²,
Marta Basiaga¹, Maciej Lesiak³

¹Institute of Animal Science, University of Agriculture in Krakow, al. Mickiewicza 24/28, 30-059 Krakow, Poland

²Institute of Forest Ecology and Silviculture, University of Agriculture in Krakow, al. 29-Listopada 46, 31-425 Krakow, Poland

³Firm “KABAN” Maciej Lesiak, Osiedle Przy Arce 22/24, 31-846, Krakow, Poland

Corresponding author: Jerzy Kowal; e-mail: kowaljerzy@o2.pl

ABSTRACT. The study describes the parasitofauna of red deer *Cervus elaphus* from Kraków area (southern Poland). The study was done in years 2011–2012 and included altogether 6 animals. Five deer originated from the forest areas (hunted) and one came from the urban site (it died in a road accident). In addition to post-mortem examination, coproscopic analyses with sporulation were performed to define *Eimeria* species diversity. The deer were infected with four species of nematodes: *Ashworthius sidemi*, *Spiculoptera spiculoptera*, *Oesophagostomum venulosum* and *O. sika*, and two species of coccidia: *E. elaphi* and *E. austriaca*. The level of parasitic infections was low, but the results indicate the important role of deer as possible transmitter of *A. sidemi* to other ungulates in examined area.

Key words: *Cervus elaphus*, nematodes, coccidia, Poland

Introduction

Red deer (*Cervus elaphus*) is a valuable species for hunters. In Poland there are several ecotypes of this species, associated with the geographical distribution. The species occurs in all large forest complexes, and its population recently is growing up in Poland. This trend, however, can only be kept at a reasonable forms of hunting management.

Among the parasites of ungulates, including red deer, the most important are gastro-intestinal nematodes (Trichostrongylidae) inhabiting the abomasum and small intestine. In Poland, the species composition of these nematodes in deer is well known, however, in recent years, the research have focused on *Ashworthius sidemi* – the invasive species which entered to Europe by the introduction of foreign ungulates and probably spread to Poland through natural migration of deer. Wild and domestic ruminants often use the same pastures –

therefore the way of transmission to domestic ruminants is easy, so this pathogenic species which may have a huge economic aspect.

The aim of the study was to evaluate the species composition of parasites occurring in red deer population living in the area of Krakow.

Materials and Methods

The study was conducted in the Malopolska province in 2011–2012, in the area of Krakow. Digestive systems and internal organs of five red deer (*Cervus elaphus*) originated from the forest habitat and of one from the urban agglomeration, were examined. Necropsies were made on the basis of the method appropriate for this species [1]. Parasites found were preserved in 75% alcohol with 5% glycerol addition, and their species were determined based on morphological features [2–4]. Fecal samples collected from the rectum were

¹Work financed from statutory activity, project no. DS 3247/2014 Institute of Animal Science, University of Agriculture in Krakow

Table 1. The level of nematodes infection based on necropsy

Nematode species	P	I [R]
<i>Ashworthius sidemi</i>	6/6	73 (3-292)
<i>Spiculoptera spiculoptera</i>	2/6	13 (2-23)
<i>Oesophagostomum venulosum</i>	1/6	2
<i>O. sikae</i>	2/6	2 (1-2)
Total	6/6	77 (6 -315)

Table 2. The results of coproscopical examination parasite parameters

Parasite	Parameters	
	P	OPG/EPG
<i>Eimeria</i> spp.	2/6	20
Strongylida	2/6	120

examined by a modified McMaster method with centrifugation [5]. A saturated solution of salt and sugar ($d=1.28$ g/ml) was used as a flotation fluid. In order to identify the species of coccidian, the oocyst sporulation was performed in 2% potassium dichromate solution [6], and the species were determined based on their morphology and size [7].

All the measurements were made using Motic BA210 microscope, in the Motic Image Plus 2.0 program, under 40, 100, 400 and 1000 \times magnification.

Number of animals infected/examined (P), mean intensity (I), intensity range (R), mean abundance (A), and average number of oocysts/eggs per 1 g of feces (OPG/EPG) were determined [8].

Results

The deer were infected with four species of nematodes: *Ashworthius sidemi*, *Spiculoptera spiculoptera*, *Oesophagostomum radiatum* and *O. sikae*. The infection was observed in all animals, but the mean intensity of infection (I) was low (Table 1). The mean parasite density was the highest for *A. sidemi* (Fig. 1).

The results of coproscopical analyses of deers are shown in Table 2. Faecal examination confirmed the presence of Strongylida nematodes in deer, and sporulation revealed two species of *Eimeria*: *E. elaphi* and *E. austriaca*.

Discussion

The presence of coccidia in cervids (Cervidae) was studied before in northern Poland (Pomerania), and the biodiversity of protozoan parasites in deer was greater there, including *E. sordida*, *E. robusta*, *E. cervi* and *E. elaphi* [9–11]. In the most comprehensive and current work on the presence of coccidia in cervids in our country, Demiaszkiewicz and Pyziel [12] have noted two other species *E. asymmetrica* and *E. virginianus* (typical for white-tailed deer *Odocoileus virginianus* occurring in North America). In the present study, coccidia of two species were found only in 33% of examined red deer, which may be associated with a small number of animals examined. According to other authors, the prevalence of coccidian infection in red deer from the north-western Poland reached 75%, or hesitated from less than 1 to 62% [10,13]. In Borecka Forest, 30% of red deer were infected [9] and for the entire country of Poland infection was determined at approximately 23% for this group of parasites [12], which corresponding with our results.

In the present study, three nematode species

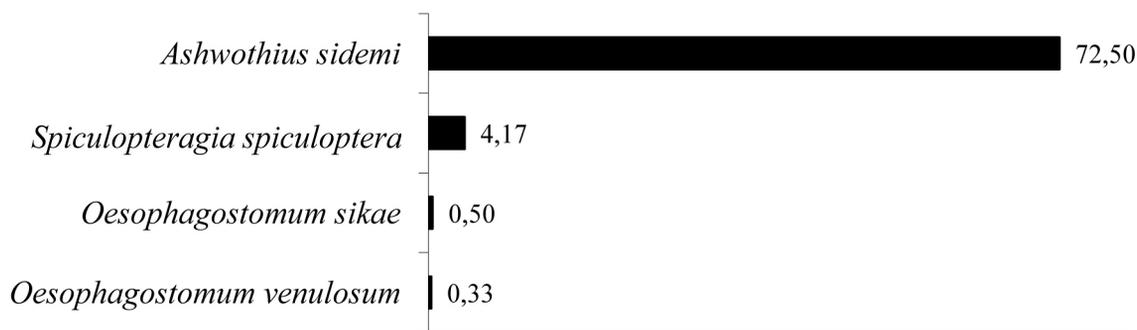


Fig. 1. Relative abundance (A) of species composition in nematodes metapopulation based on necropsy

native to deer [1] in our country were rarely recorded, in contrast to alien invasive species *Ashworthius sidemi*, which was the dominant.

The most dangerous species among the identified parasites was *Ashworthius sidemi* because of its high pathogenicity [14]. This nematode is typical for indian sambar (*Rusa unicolor*) and probably got to Europe and Poland during introduction sika deer (*Cervus nippon*) [14]. The first observation of this parasite in Poland was in bison (*Bison bonasus*), in the Bieszczady Mountains in 1997. As a probable cause of the parasite appearance in Poland, the migration of deers (mostly *Cervus elaphus*) across the border with Ukraine and Slovakia was also listed.

Natural migration of deer certainly helped in the spread of *Ashworthius sidemi* on the territory of our country. In recent years, the range of this parasite was extended to the Bieszczady Mountains and the Białowieża Forest [15,16], and the new hosts have become successively: bison, roe deer and red deer. Recently, the nematode was found in Malopolska (Dulowa Forest near Krakow) in the fallow deer *Dama dama* and then in the moose (*Alces alces*) from Augustów Forest and Biebrza Marshes [17]. The presence of *A. sidemi* in all animals examined in this study indicated red deer as an important transmitter of this parasite. The appearance of *A. sidemi* in the area of Malopolska could occur as a consequences of increasing range of Bieszczady Mountains foci (via the Carpathian ecological corridor). In southern Poland, the transmission may be connected with the fallow deer escaped from breeding farms.

In the present study intensity of *A. sidemi* infection in deer was low, similar to the results obtained by other authors in Poland [16]. The infection of wild ruminants by *A. sidemi* larvae probably takes place in the period from June to late autumn [18]. During the summer, when cervids migration occurs, the infection between roe deer and deer or other cervids can be carried out in forest habitats, where deer are staying for a long time. In the case of *Cervus elaphus*, the changes in population size and high density of animals, are likely to have little impact on the species composition and level of parasitic invasions [19]. However, the spread of *A. sidemi* in the population of cervids may be affected – apart from the migration of these animals – by other factors, such as reproductive period, and the creation of new herds.

So far, despite the high risk, *A. sidemi* was never found in domestic ruminants [17]. However, Moskwa et al. [20] have shown the presence of DNA of this nematode in cattle faeces.

Reducing the scale of the problem of the parasites transmission from other geographical area, ie. natural spread of *A. sidemi* with migrating hosts (roe deer, red deer, moose) is impossible. However, it's important to minimize the introduction of alien species of cervids and animal translocations. Other activities, like use of anthelmintic in free-living animals is difficult and requires further study. Open question – whether drugs should be used in wildlife – in the case that parasites are important factor of natural selection.

References

- [1] Drózdź J. 1966. Studies on helminths and helminthiases in Cervidae. II. The helminth fauna in Cervidae in Poland. *Acta Parasitologica Polonica* 14: 1-13.
- [2] Schulz R.E. 1933. *Ashworthius sidemi* n. sp. (Nematoda, Trichostrongylidae) aus einem Hirsch (*Pseudaxis hortulorum*) des fernen Ostens. *Zeitschrift für Parasitenkunde* 5: 735-739.
- [3] Stefański W. 1963. Parazytologia weterynaryjna. Tom 1. Protozoologia i helmintologia. PWRiL, Warszawa.
- [4] Drózdź J. 1965. Studies on helminths and helminthiasis in Cervidae. I. Revision of the subfamily Ostertagiinae Sarwar, 1956 and an attempt to explain the phylogenesis of its representatives. *Acta Parasitologica Polonica* 13: 445-481.
- [5] MAFF. 1986. Manual of veterinary parasitological laboratory techniques. HMSO, London.
- [6] Gundlach J.L., Sadzikowski A.B. 1992. Diagnostyka i zwalczanie inwazji pasożytów u zwierząt. Wydawnictwo AR, Lublin
- [7] Levine N.D., Ivens V. 1970. The coccidian parasites (Protozoa, Sporozoa) of ruminants. University of Illinois Press, Urbana, Chicago and London.
- [8] Bush A.O., Lafferty K.D., Lotz J.M., Shostak A.W. 1997. Parasitology meets ecology on its own terms: Margolis et al. revisited. *Journal of Parasitology* 83: 575-583.
- [9] Demiaszkiewicz A.W., Lachowicz J. 1990. Występowanie oocyst z rodzaju *Eimeria* u saren i jeleni w Puszczy Boreckiej. *Medycyna Weterynaryjna* 46: 473-474.
- [10] Balicka-Ramisz A., Ramisz A., Pilarczyk B., Cisek A. 2000. Występowanie pierwotniaków z rodzaju *Eimeria* u zwierząt wolno żyjących. *Medycyna Weterynaryjna* 56: 723-724.
- [11] Pilarczyk B., Balicka-Ramisz A., Ramisz A., Lachowska S. 2005. Występowanie pasożytów

- przewodu pokarmowego u saren i jeleni na terenie województwa zachodniopomorskiego. *Wiadomości Parazytologiczne* 51: 307-310.
- [12] Pyziel A.M., Demiaszkiewicz A.W. 2012. Badania nad kokcydiami z rodzaju *Eimeria* występującymi u dzikich przeżuwaczy. In: Book of Abstracts of XX Wrocławska Konferencja Parazytologiczna „Specyficzność pasożytów a środowisko”, 21-23.06.2012, Wrocław-Karpacz: 34.
- [13] Burliński P., Janiszewski P., Kroll A., Gonkowski S. 2011. Parasitofauna in the gastrointestinal tract of the cervids (Cervidae) in Northern Poland. *Acta Veterinaria Beograd* 61: 269-282.
- [14] Drózdź J. 2000. Wpływ introdukcji i wędrówek zwierząt na kształtowanie się ich parazytfauny. *Medycyna Weterynaryjna* 56: 154-157.
- [15] Demiaszkiewicz A.W., Lachowicz J., Osińska B. 2008. Ustalenie zasięgu ognisk aswortiozy dzikich i domowych przeżuwaczy we wschodniej i południowej Polsce. *Wiadomości Parazytologiczne* 54: 217-219.
- [16] Demiaszkiewicz A.W., Lachowicz J., Osinska B. 2009. *Ashworthius sidemi* (Nematoda, Trichostrongylidae) in wild ruminants in Białowicza Forest. *Polish Journal of Veterinary Sciences* 12: 385-388.
- [17] Demiaszkiewicz A.W., Kuligowska I., Lachowicz J., Pyziel A., Moskwa B. 2013. The first detection of nematodes *Ashworthius sidemi* in elk *Alces alces* (L.) in Poland and remarks of ashworthiosis foci limitations. *Acta Parasitologica* 58: 515-518.
- [18] Drózdź J., Namżył G. 1973. On Trichostrongylidae (Nematoda) of cervid ruminants in Mongolia, with reference to some more concerning the historical formation of the helminth of this host group. *Acta Parasitologica Polonica* 21: 475-479.
- [19] 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 Parasitologica* 39: 92-94.
- [20] Moskwa B., Bień J., Cybulska A., Kornacka A., Goździk K., Cabaj 2014. The blood-sucking nematode *Ashworthius sidemi*: transmission from wildlife animals to cows. In: Book of Abstracts of V4 Parasitological Meeting “Parasites in the Heart of Europe”, 25-30.05.2014: 1-2.

Received 5 February 2015

Accepted 3 March 2015