

The first detection of nematodes *Ashworthius sidemi* in elk *Alces alces* (L.) in Poland and remarks of ashworthiosis foci limitations

Aleksander W. Demiaszkiewicz*, Izabela Kuligowska, Jacek Lachowicz,
Anna M. Pyziel and Bożena Moskwa

W. Stefański Institute of Parasitology PAS, 51/55 Twarda street, 00-818 Warszawa, Poland

Abstract

Ashworthius sidemi, a nematode belonging to the family of Trichostrongylidae, is a primary parasite of the Asian deer, mainly sika deer (*Cervus nippon*), with which it was introduced to Ukraine, as well as Slovakia, the Czech Republic and France. Migrating red deer carried this parasite from neighboring countries to Polish territory. Until now, in Poland, this parasite has been recorded in European bison, red deer, roe deer and fallow deer. As a result of post-mortem examinations of 10 elk, 2 of them from the Augustów Forest and Biebrza Marshes, *A. sidemi* were found in abomasa for the first time in Poland. The intensity of the invasions was 120 and 7 specimens, respectively. This finding of *Ashworthius sidemi* in elk indicates a further expansion of the focus of ashworthiosis in Białowieża towards the north into the Biebrza Marshes and the Augustowska Forest. The growth of the elk population and their tendency for long distance migrations can contribute to the spread of the parasitosis in much greater distances than deer. On the basis of our own research and data from the literature, the current spread of ashworthiosis in Poland is discussed.

Keywords

Key words *Ashworthius sidemi*, *Alces alces*, new host, ashworthiosis

Introduction

Ashworthius sidemi, a nematode belonging to the family of Trichostrongylidae, is a primary parasite of Asiatic cervides, mostly sika deer (*Cervus nippon*), with which it has been introduced to Ukraine, as well as Slovakia, the Czech Republic and France (Ferte and Durette-Deset 1989; Kotrla and Kotrly 1973, 1977; Ovcharenko 1968). Migrating red deer carried this parasite to neighboring countries as well as to Polish territory, namely the Bieszczady Mountains. In the years 1997–1999, 100% of wild ruminants (European bison, red deer and roe deer) were found to be infected in the Bieszczady Mountain region (Drózd 2001; Drózd *et al.* 1998, 2000, 2003). Then, in 1999, single specimens of this worm were detected in one bison in the Belarusian part of the Białowieża Forest (Kochko, 2003), and in 2000, an invasion of several specimens was found in one bison in the Polish part of the Forest. The infection of ashworthiosis in bison has gradually in-

creased over the years and in 2004, it reached 100% extensiveness and a maximum intensity of 11,900 specimens of nematodes. In subsequent years, the intensity of the invasion continued to increase and in 2007 it reached the maximum value of 44,300 specimens of nematodes (Demiaszkiewicz and Lachowicz, 2007) and 77,600 nematodes in 2011 (own data, unpublished). There were also *A. sidemi* nematodes found in the Białowieża Forest in red deer and roe deer. The maximum intensity of infection in these animals was lower and amounted 165 and 3,127 specimens of nematodes, respectively (Demiaszkiewicz *et al.* 2009). So far there have been two main foci of ashworthiosis registered in Poland. The finding of *A. sidemi* in European bison, red deer and roe deer suggests that the blood-sucking nematode can also occur in other wildlife ruminants. The aim of this study was to answer the question whether *A. sidemi* occurs in elk, to determine the intensity of infection in these animals, and to assess the territorial extent of ashworthiosis foci in Poland.

*Corresponding author: aldem@twarda.pan.pl



Fig. 1. Posterior end of male *Ashworthius sidemi* – bursa copulatrix (magnification 250x)



Fig. 2. Vulvar region of female of *A. sidemi* (magnification 250x) Short title: *Ashworthius sidemi* in elk

Materials and Methods

Parasitological examinations were done on 10 digestive tracts from elk hunted in November 2010 under the authorization of the Minister of Environment for scientific purposes in the Augustowska Forest and the Biebrza Marshes. The content of the abomasum and duodenum was subjected to repeated decantation, after which it was conserved in 2% formalin. It was then placed in small portions into Petri dishes and examined using a stereomicroscope. All nematodes found in gastric contents were selected by preparative needle, and transported in alcohol with glycerol. The species was determined on the basis of morphometric characters of the bursa copulatrix of males (Fig. 1) and cuticular lobe around the vulva of females (Fig. 2).

Results and Discussion

Since 2001, a moratorium for hunting elk has been imposed in Poland, so obtaining the materials for parasitological studies from these animals proved to be very difficult. However, an authorization from the Minister of Environment for elk hunting provided us with a possibility for parasitological examination of the digestive tract of this species.

Two out of 10 examined elk were infected with the *Ashworthius sidemi* nematodes, giving an invasion extensiveness of this nematode 20%. In the abomasum of the first adult bull deriving from the Augustowska Forest, 120 specimens of these nematodes (60 males and 60 females) were found. In the abomasum of the second, calf weighing 70 kg from Biebrza Marshes, 7 nematodes (4 males and 3 females) were found. On the Polish territory, nematodes *A. sidemi* in elk have not yet been reported, marking this finding as the first registration of this parasite within this host species in Poland.

Until now ashworthiosis has been registered in elk in Russia near Moscow in the National Park „Elk Island,, (‘‘Losinyj ostrov’’). As a result of necropsies of 10 elk in that region, the invasion of *A. sidemi* in elk were also found in two animals in the intensity of 150 and 200 specimens of nematodes (Samojlovska 2010). These results are similar to those observed in the presented study.

In the earlier studies on the scale of distribution of ashworthiosis conducted in 2009, one bison was necropsied in the Knyszyńska Forest. It was a cow aged about 12 years in which 467 juvenile *A. sidemi* nematodes were found in the abomasum. Taking into account the low intensity of invasion of the nematode, it can be assumed that *A. sidemi* penetrated into the area of this Forest only about 2–3 years ago. In February 2005, two young bison heifers from the Białowieża Forest were relocated to Knyszyńska Forest. During this period, all examined bison in the Białowieża Forest were infected with *A. sidemi*. Thus, this invasion could have been transferred there with the relocated bison. However, the possibility of migrating cervides cannot be excluded as a reason for the parasite transferal. The registration of ashworthiosis in Kny-

żyńska Forest is an extension of the north Białowieża focus of ashworthiosis (Demiaszkiewicz *et al.* 2009). Also, the statement mentioning nematodes in elk represents a further spreading of this focus in the same direction in the area of Biebrza Marshes and Augustowska Forest. The growth of the elk population and their tendency for long migrations can cause the spread of the foci of this parasitosis in much greater distances than deer.

The second focus of ashworthiosis was detected in the Bieszczady Mountains in 1997, and initially concerned the Lutowska Forest District, where in four necropsied bison a total number of 629 adult specimens of nematodes *A. sidemi* were found (Drózd *et al.* 1998). In the subsequent years the focus spread to other Forest Districts in Bieszczady: Stuposiany, Brzegi Dolne, Baligród and Komańcza, where *A. sidemi* was noticed in all examined 40 wild ruminants (18 red deer, 9 roe deer and 13 European bison). The maximum intensity of infection in roe deer was 656 nematodes, 570 specimens in red deer and 4,000 in bison (Drózd *et al.* 2003). In the subsequent examinations, 10 roe deer and 5 red deer from Komańcza and Cisna Districts were found to be infected with nematodes *A. sidemi*. The intensity of infection of roe deer ranged from 42 to 416 specimens of the nematodes and the medium intensity reached 161. The intensity of infection of red deer in these Districts ranged from 18 to 296 nematodes with a mean of 148. There were also four red deer examined from the Lutowska Forest District, all of which were infected with ashworthiosis. The intensity of invasion ranged from 4 to 291 nematodes, with an average of 148. However, out of the 10 red deer from the District Baligród, only one was not infected. The extensiveness of invasion of red deer in this Forest District was therefore 90%. The intensity of invasion ranged from 27 to 209 specimens of *A. sidemi* and the average intensity was 103 nematodes. In the abomasum of the one red deer deriving from the Forest District Krasiczyn located on Przemyśl Foothills, only three specimens of *A. sidemi* were found (Demiaszkiewicz *et al.* 2008). It is also an extension of the north Bieszczady focus of ashworthiosis.

In 2011, *A. sidemi* was found in Małopolska within a new host – a fallow deer maintained in a farm homestead in the Dulowska Forest. The source of infection could be a fallow deer imported from Hungary in 1998–1999 to the farm as a breeding animal. Taking into account the fact that nematodes *A. sidemi* were also found in roe deer and red deer in the wild of the nearby hunting ground, the Dulowska Forest should be considered to be a third focus of this parasitosis in Poland (Kowal *et al.* 2012). However, finding the ashworthiosis in roe deer in Krynica region may be due to enlargement of the Bieszczady focus of ashworthiosis along the Carpathian ecological corridor (Kowal 2013).

A. sidemi is a typical parasite of cervides. The invasion occurs in not more than a few hundred nematodes, and seems not to be pathogenic in this case. However, in bison, which are the new hosts of this parasite, the invasion reaches the maximum intensity of tens of thousands of specimens. Such a

high intensity of invasion of this blood-sucking nematode can cause an inflammation of the gastrointestinal tract and chronic diarrhea, which, especially in young animals may lead to cachexia, or even falls (Osińska *et al.* 2010).

However, in previous studies, the infection of nematodes *A. sidemi* has never been detected in domestic ruminants. It should be taken into account that there is a possibility of infection of these animals grazing on pastures that are shared with wild ruminants. Therefore, regular monitoring of the status of parasitic invasions of the wild and domestic animals in the vicinity of the previously identified foci of ashworthiosis is necessary.

Acknowledgements. This research was partially supported by the National Science Centre, Grant No NN308 585740.

References

- Demiaszkiewicz A. W., Lachowicz J. 2007. Wzrost zarażenia żubrów helmintami w Puszczy Białowieskiej. W: Rola hodowli *ex situ* w procesie restytucji żubra. (Red: W. Olech). Lasy Państwowe. Gołuchów. 12–16.
- 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.
- Demiaszkiewicz A. W., Lachowicz J., Osińska B. 2009. *Ashworthius sidemi* (Nematoda, Trichostrongylidae) in wild ruminants in Białowieża Forest. *Polish Journal of Veterinary Sciences*, 12, 385–388.
- Demiaszkiewicz A. W., Pyziel A. M., Lachowicz J., Kuligowska I. 2009. Nowe ognisko aswortiozy żubrów w Puszczy Knyszyńskiej. Streszczenia referatów Międzynarodowej Konferencji „80 lat restytucji żubra w Puszczy Białowieskiej”, Białowieża. 28–29.09.2009 r. 12–13.
- Dróżdż J. 2001. Ognisko aswortiozy dzikich przeżuwaczy w Bieszczadach. *Magazyn Weterynaryjny*, 10, 66–68.
- Dróżdż J., Demiaszkiewicz A. W., Lachowicz J. 1998. *Ashworthius sidemi* (Nematoda, Trichostrongylidae) a new parasite of the European bison *Bison bonasus* (L.) and the question of independence of *A. gagarini*. *Acta Parasitologica*, 43, 75–80.
- Dróżdż J., Demiaszkiewicz A. W., Lachowicz J. 2000. Aswortioza – nowa parazytoza dzikich przeżuwaczy. *Medycyna Weterynaryjna*, 56, 32–35.
- Dróżdż J., Demiaszkiewicz A. W., Lachowicz J. 2003. Expansion of the Asiatic parasite *Ashworthius sidemi* (Nematoda, Trichostrongylidae) in wild ruminants in Polish territory. *Parasitology Research*, 89, 94–97.
- Ferte H., Durette-Deset M. C. 1989. Redescription d' *Ashworthius sidemi* Schulz, 1933 et d' *A. gagarini* Kostyaev, 1996, (Nematoda, Trichostrongylidae) parasites de Cervidae. *Bulletin Museum National d' Histoire Naturelle Sect. A*, 11, 69–77.
- Kochko Y. P. 2003. Podsumowanie aktualnej sytuacji helmintologicznej żubrów w Puszczy Białowieskiej. Materiały konferencji „Znaczenie badań naukowych dla ochrony żubra w Polsce”, SGGW, Warszawa, 13.06.2003 r. 17–19.
- Kotrla B., Kotrly A. 1973. The first finding of the nematode *Ashworthius sidemi* Schulz, 1933 in *Sika nippon* from Czechoslovakia. *Folia Parasitologica*, 20, 377–378.
- Kotrla B., Kotrly A. 1977. Helminths of wild ruminants introduced in Czechoslovakia *Folia Parasitologica*, 24, 35–40.
- Kowal J. 2013. Parazytofauna wybranych gatunków dzikich i udomowionych zwierząt parzystokopytnych (Artiodactyla) z obszaru Małopolski. Praca doktorska. Uniwersytet Rolniczy, Kraków.
- Kowal J., Nosal P., Bonczar Z., Wajdzik M. 2012. Parasites of captive fallow deer (*Dama dama* L.) from southern Poland with special emphasis on *Ashworthius sidemi*. *Annals of Parasitology*, 58, 23–26.
- Osińska B., Demiaszkiewicz A. W., Lachowicz J. 2010. Pathological lesions in European bison (*Bison bonasus*) with infestation by *Ashworthius sidemi* (Nematoda, Trichostrongylidae). *Polish Journal of Veterinary Sciences*, 13, 63–67.
- Ovcharenko D. A. 1968. Seasonal dynamics and development of *Ashworthius sidemi* (Trichostrongylidae), *Oesophagostomum radiatum*, and *O. venulosum* (Strongylidae) of *Cervus nippon hortulorum*, (in Russian). *Parazitologija*, 2, 470–474.
- Samojlovska N. A. 2010. Ekologo-epizootologiceskij analiz parazitarnych boleznij dikich zvacznyh v Nacionalnom Parke „Losinyj Ostrov”. Avtoreferat dissertacii na soiskanie uczenoj stepeni kandidata biologiceskich nauk, Moskva, 1–22 (in Russian).