

Original papers

Parasites of wild animals as a potential source of hazard to humans

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ABSTRACT. The decline in wild animal habitats and the uncontrolled growth of their population make these animals come closer to human settlements. The aim of the study was to identify parasitic infections in wild animals in the selected area, and to specify the hazards they create for humans. In more than 66% of the analysed faecal samples from wild boar, hares, roe deer, deer and fallow deer various developmental forms of parasites were found. These included parasites dangerous for humans: *Toxocara canis*, *Capillaria hepatica*, *Capillaria bovis*, *Trichuris suis*, *Trichuris ovis*, *Trichuris globulosus*, *Eimeria* spp., and *Trichostongylus* spp. It is necessary to monitor parasitic diseases in wild animals as they can lead to the spread of parasites creating a hazard to humans, pets and livestock.

Key words: wild animals, parasites, monitoring

Introduction

In Poland forests cover approximately 9 164 Kha, which accounts for 29.3% of the country's total area. Forests border directly with many ecosystems exploited by humans, such as cities, towns, villages, farmlands or pastures. They create a habitat for many wild animals. It has been estimated that the populations of wild boar, foxes and deer have increased by over 150% in the last decade. The increase in the population size of these animals is associated with agricultural damage. Statistics from the Polish Hunting Association for 2009–2013 indicate that the populations of the most important wild animals in Poland continue to grow (Fig. 1) [1]. During the inventory of game animals in the Wielkopolska region in the years 2012/2013 was found one of the largest populations of wild boars in Poland with over 25 thousand specimens. Hare population was estimated at more than 53 thousand specimens and the cervids of over 106 thousand specimens. Moreover, the development of urban areas in Poland reduces the size and biodiversity of forest ecosystems, thus bringing wild animals closer to human settlements. Similar consequences are produced by pro-environmental educational attitudes promoting close contact between man and nature, as well as popular leisure activities offering direct contact with different animal species in agritourism farms.

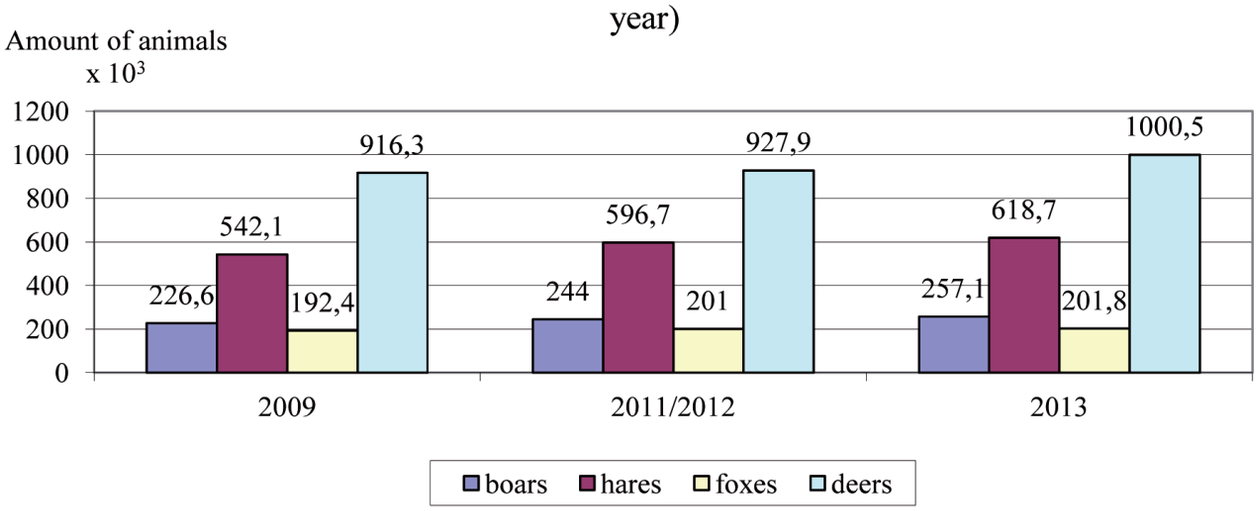
Parasitic diseases in wild animals may be latent and uncontrolled, but they also have a significantly delayed onset, depending on the life cycle of the parasite. The monitoring of health in wild animals is practically impossible. Therefore, these animals may create a hazard to humans, pets and livestock, yet Poland has no relevant monitoring system.

The aim of the study was to identify parasite species infected wild animals in the selected forest area of Wielkopolska province, and to specify parasites that may create hazard to humans.

Materials and Methods

The study was carried out in winter 2013/2014 in Konin county, Wielkopolska province, where forests cover 25.26 K ha (16% of the total area). The largest forests are located in the municipalities of Grodziec, Kazimierz Biskupi, Stare Miasto, and in the eastern part of the Ślesin municipality. Smaller forests surround towns (e.g. Las Rudzicki), or have been established on wasteland of the former brown

Fig. 1. Amount of wild animals in Poland (data from PZŁ 2009-2013 year)



coal mine.

In total, 186 faecal samples (46 from wild boar, 36 from hare, 105 from roe deer, deer and fallow deer) were collected randomly into plastic containers. Animal species were identified based on the characteristically shaped faeces [2,3]. In the laboratory, the faeces in the containers was stirred with a glass rod, 3 samples, 1 g each, were weighed, and then analysed using the Fülleborn flotation technique after adding Darling fluid (composition: 50% saturated NaCl and 50% glycerol). Samples were centrifuged at 3500× g for 10 min. Each centrifuged sample was used to prepare 3 specimens for the analysis under a light microscope at ×200 magnification. Parasitic species were identified with reference to an atlas and oocysts were observed measured and indentified under a light microscope connected to a digital camera and computer with Olympus image analysis software. The measurements were performed using computer program for acquisition and visualization of the image [4,5]. Quantitative analysis of eggs/oocysts was carried out using the McMaster chamber [6]. Analytical results were recorded as a mean from 3 replicates (Table 1).

Results and Discussion

In total, 124 (66.67%) out of 186 (100%) faecal samples from wild animals contained developmental forms of parasites. All faecal samples from wild boar contained oocysts of *Eimeria* spp., mainly *E. debliecki*, *E. suis*, *E. scabra*, and *E. perminuta*. On average, each sample contained 575.5 oocysts/g. Eggs of *Trichuris suis* were found in 10 (21.28%) out of 46 samples (mean 1705 eggs/g), and *Monocystis* spp. was identified in 7 (15.22%) samples (mean 250 oocysts/g).

All faecal samples from hare also contained oocysts of *Eimeria* spp. (*E. exigua*, *E. piriformis, E. stiedae*, *E. magna*). On average, each sample contained 4240 oocysts/g of faeces. Nematode eggs were identified in 20 (53%) samples. These included *Trichuris leporis* in 10 (21.28%) samples (mean 1561 eggs/g of feaces), *Capillaria hepatica* in 6 (17.65%) samples (mean 1100 eggs/g), and

Table 1. Amount and percentage of positive samples and medial number of oocysts or eggs in 1g of stool

Animal species	Parasites					
	Eimeria spp.	*Capillaria* spp.	*Trichuris* spp.	*Toxocara* spp.	*Trichostrongylus* spp.	*Monocystis* spp.
Boars n=46	46 (100%) 575.5 oocysts	–	10 (21.28%) 1705 eggs	–	–	7 (15.22%) 250 oocysts
Hares n=36	36 (100%) 4240 oocysts	6 (17.65%) 1100 eggs	10 (29.41%) 1561 eggs	4 (11.76%) 11582 eggs	–	–
Deers n=105	11 (10.48%) 954 oocysts	13 (12.38%) 900 eggs	11 (10.48%) 1854 eggs	–	18 (17.14%) 752 eggs	–

Toxocara canis in 4 (11.76%) samples (mean 11582 eggs/g).

Fifty-three (40.95%) faecal samples from deer contained parasites. Of these 11 (10.48%) contained *Eimeria* spp., mainly *E. bovis* and *E. zuernii*, 18 (17.14%) contained *Trichostrongylus* spp. (mean 752 eggs/g of faeces), 13 (12.38%) contained *Capillaria bovis* (mean 900 eggs/g faeces), and 11 (10.48%) contained *Trichuris ovis* and *T. globulosa* (mean 752 eggs/g faeces).

Similar findings were reported from Slovakia, where 91.89% of faecal samples from hare were infected with coccidia, and 54.5% of samples were infected with nematodes [7]. Research in the Czech Republic revealed that 90.5% of faecal samples from hare contained oocysts of *Eimeria* spp. [8]. In Estonia, 100% of the samples from wild boar bred in captivity contained oocysts of *Eimeria* spp., and *Trichuris suis* was found in 21% of samples [9]. In the sika deer, oocysts of *Eimeria* spp. were identified in 14.8% of samples from Austria and in 8.6% samples from the Czech Republic [10,11].

Pilarczyk et al. [12,13] examined stool samples from wild boars West Pomerania province and reported high prevalence of *Eimeria* spp. amounting 58,5% (*E. debliecki*, *E. suis*, *E. scabra*, *E. perminuta).* In roe deers nematode infection was even higher (100%) and in 47.82% stool samples from red deer nematode eggs were discovered.

The analysis of species composition and developmental forms of parasites in the studied faecal samples revealed the presence of species hazardous to humans and domesticated animals: *Toxocara canis*, *Capillaria hepatica*, *Capillaria bovis*, *Trichuris suis*, *Trichuris ovis*, *Trichuris globulosus*, *Eimeria* spp., and *Trichostongylus* spp.

Hare is a non-specific host for *Toxocara canis.* The parasite encapsulates in host muscles and may be a source of infection in carnivorous animals and humans. Daily it produces 20–50,000 eggs, which are extremely resistant to environmental factors and can survive in the environment for several years [14].

Capillaria hepatica is a nematode that can infect humans and pets, e.g. hunting dogs. Its presence in the body leads to serious liver disorders, including hepatitis and cirrhosis. It can also cause the formation of ascites and bile duct stones [15,16].

Trichuris suis is a parasite found in wild boar. Humans are non-specific hosts to the parasite (no sexual reproduction). Infection with whipworms leads to anaemia, severe weight loss, and toxin-induced inflammatory bowel disease [17].

Eimeria spp. are protozoa commonly found in the environment and may cause gastrointestinal disorders such as diarrhoea with an admixture of mucus or blood, vomiting and, consequently, a significant loss in body weight. The parasite spreads in water and contaminated feed, and juvenile animals are particularly prone to infestation [18,19].

Trichostrongylus spp. is mainly found in cattle, sheep, goats and wild ruminants. The parasite can cause a significant contamination of the environment with its eggs. Humans are non-specific hosts to the parasite, and infection is manifested by bloating, dizziness, abdominal pain, nausea and diarrhoea. In ruminants the parasite causes weakness, wasting and death, especially in young animals [20,21].

Capillaria bovis is a parasite found in cattle, and is particularly harmful to calves. In animals the parasite causes anaemia, hepatitis, jaundice, nephritis and pneumonia, significantly reduces weight gain, and may increase mortality in calves [22].

Wild animals are the reservoir of parasites creating a hazard to humans, pets and livestock. The approach of wild animals to human settlements and the establishment of livestock farms in the immediate proximity of residential areas increases the risk of spreading parasites from one host to another. Uncontrolled migrations of wild animals into urban areas also create an additional hazard, including the risk of contamination of water, food and soil with parasite eggs/oocysts.

This can create a serious problem in protecting public health and maintaining the welfare of farm animals. All parasites detected in our study have a zoonotic potential and can reduce the productivity of livestock, and can even cause death. Deworming wild animals is difficult, and therefore periodic monitoring of forests adjacent to residential areas is necessary in order to foresee potential hazards.

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