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Monitoring of the state of helminth infections in various populations of European bison (*Bison bonasus*) in Belarus

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Abstract: In this paper are discussed the results of monitoring the level of helminth infections in various populations of European bison in current conditions of the region of Belarus In 2012–2014 the analysis of 398 coproscopy fecal samples of European bison was performed using the precipitation and flotation methods.

Key words: European bison, helminth infection, Belarus

Introduction

At the end of 2014, the territory of Belarus inhabited 1283 free living European bison. This population grows every year. Its growth rate is influenced by various factors, including parasitic diseases. Infection with parasites affects wild animals, by weakening their immune system, reproductive functions, the ability to adapt to the environment and may even cause their death, becoming one of the main factors reducing the population numbers of game animals. This is especially important in case of the parasites localized in such organs like lungs, liver and gastrointestinal tract (Yatusevich *et al.* 1999).

Study of the species composition and dynamics of species diversity of helminths provide a scientific basis for recommendations to prevent the spread of parasitic invasions in hunting grounds (Anisimava *et al.* 2011).

Therefore for further efforts to preserve and develop E. bison population, a knowledge on potential impact of helminth related diseases on the population status of E. bison, a study on species' diversity and trends of dynamics is necessary.

Material and method

The study was carried on the territory of Belovezhskaya Pushcha National Park, Grodno region (herd "Ozery") and Mogilev region (herd "Osipovichi"). On the territory of Belovezhskaya Pushcha the samples were collected in 6 different fore-

stries, Porozovo, Nikorsky, Korolevo-Mostovo, Jasenska, Hvoykinsky and Svisloch. Due to the fact that E. bison is included in the Red Book of Belarus, it is difficult to obtain full data from parasitological necropsy so mainly there are carried out coproscopic studies (both *ovo* and *larvo* scopy) (Polaz *et al.* 2014). During the reporting period (2012–2014) there were examined 398 samples of bison feces. The used methods of fecal samples study were the flotation and precipitation methods. Statistical data processing was performed using the g-test.

Results and Discussion

In 2014, from 141 analyzed fecal samples from E. bison in 73 (extensity of invasion 51,7%) identified were various helminths. One type of helminthes was found in 20 samples (27.4%), two types in 37 (50.6%), three in 13 (17.8%), and four species of helminthes were encountered in 3 samples (4.1%). Flukes were recorded in 26.2% of the investigated samples, cestodes in 5.6%, and nematodes in 47.5%.

In E. bison from the Belovezhskaya Pushcha National Park in general noted was the high incidence of eggs and larvae of worms of the class of nematodes, but the intensity of invasion in 2014 was not high because of the deworming in 2013, after which the extent of invasion decreased by 1.4 times. The general level of parasitic infection in E. bison from Belovezhskaya Pushcha National Park in 2014, amounted to 52.3%

The level of infestation differed among particular forestries, ranging from 38.8% to 58.3% (in Hvoykinsky forestry) (Tabl. 1). Pathogens of fascioliasis were dominating (100% of infected samples). The incidence of nematodes was low. Extensity of invasion in Porozovo forestry was 55%, with high incidence and intensity of infestation by *Fasciola* spp. Only in one of the samples *Moniezia expansa* (Cestoda class) were detected. In Korolevo-Mostovo forestry one type of helminth – *Neoascaris* sp. from the Nematoda class was detected, from the class of trematode, the *Fasciola hepatica* was registered. Extensity of infestation in the Korolevo-Mostovo forestry amounted to 57.1% while in Nikorsky forestry only to 38.8%.

With a low diversification of species composition and low intensity of invasion of nematodes, fascioliasis pathogens dominated. In Jasenska forestry the extent of infestation was 52.6%. Characteristic for this forestry was high incidence and intensity of infection of the *Paramphistomum* sp. Pathogen, and a single occurrence of *Moniezia expansa* (Cestoda class). In Svisloch forestry the extent of invasion was 50%, with predominant *Fasciola* spp. (EI – 43%) and much less frequent nematode (6.25%).

In the helmithological study of Osipovichskaya E. bison population in 2014, 3 species of nematodes (*Oesophagostomum* sp., *Ostertagia* sp.,*Trichostrongulus* sp.) and two species of trematodes (*Paramphistomum* sp. and *Fasciola hepatica*) were revealed (Table 2). In 2012, the Osipovichi Experimental Forestry conducted the deworming

Table 1 The frequency of occurrence of helminths infecting European bison in various forest districts of Belovezhskaya Pushcha National Park

Genus/species of helminths	Forestry					
	Hvoykinsky	**Porozovo**	**Korolevo--Mostovo**	**Nikorsky**	**Jasenska**	**Svisloch**
Nematoda						
Dictyocaulus spp.	5,2	10	–	5,5	–	6,25
Oesophagostomum spp.,	10,5	10	–	–	5,2	6,25
Nematodirus sp.	5,2	–	–	–	–	–
Trichostrongylus spp.	5,2	–	–	–	–	–
Neoascaris sp.	–	5	14,2	–	15,7	–
Ostertagia sp.	–	–	–	11,1	–	6,25
Trichocephalus spp.	–	10	–	–	10,5	–
Trematoda						
Paramphistomum spp.	–	10	–		21	–
Fasciola hepatica	58,3	30	57,1	33,3	10,5	43,7
Cestoda						
Moniezia expansa	–	5	–	–	5,2	–

Table 2 Helminthofauna of European bison inhabiting Osipovichi Experimental Forestry in 2014 [%]

Genus/species of helminths	**Quantity in analyzed samples**	**Intensiveness of invasion (in sight) min-max** (X)	**Extensity of invasion [%]**
Nematoda			
Ostertagia sp.	3	1–3	11,5
Oesophagostomum sp.	5	1–2	19,2
Trichostrongylus sp.	3	2–3	11,5
Trematoda			
Paramphistomum sp.	4	2–9 (5)	15,3
Fasciola hepatica	3	1–6	11,5

of bison, after which extensity and intensity of parasitic invasion was lowered by 8 times ($G \geq 57,7$ $p < 0,01$), Nematoda that so far were prevailing in species composition, were replaced by Trematoda class. The extensity of invasion one year after deworming increased by 4.5 times and amounted to 50% ($G = 30,23$ $p < 0,01$).

In the study on E. bison from the area of agricultural production cooperative "Ozera", eggs and larvae of worms of two classes (Nematoda and Cestoda) were found. Extensity of invasion there in 2014 amounted to 61.9%. There were found Cestodes – *Moniezia* sp. and 6 species / genera of Nematodes – *Neoascaris vitulorum, Trichostrongylus sp, Trichocephalus* sp., *Nematodirus* sp., *Strongyloides papillosus, Ostertagia* sp. (Tabl. 3). Nematodes of gastrointestinal tract dominated , but the *Monieza* sp. invasion was also often registered (18%).

Table 3 Helminths identified in European bison from agricultural production cooperative "Ozery" in 2014

Genus/species of helminths	**Quantity in analyzed samples**	**Intensiveness of invasion (in sight) min-max** (X)	**Extensity of invasion [%]**
Nematoda			
Neoascaris vitulorum	4	1–3	11,7
Trichocephalus sp.	11	4–16 (7)	32,4
Nematodirus sp.	6	1–2	17,6
Ostertagia sp.	5	1–2	14,7
Strongyloides papillosus	11	1–4	32,4
Trichostrongylus sp.	6	1–7	17,6
Cestoda			
Moniezia sp.	6	1–9	17,6

Analysis of parasitic infestation and species diversity in E. bison shows, that there are no worms that are specific for this species. We found worms in E. bison originating from bovids (Bovidae) and partly from cervids (Cervidae), who live in the same habitats. Particularly favourable conditions for active passing the helminthological diseases are permanent winter feeding sites for E. bison.

At the Figure 1, presented are the dynamics of infection in three populations of E. bison in the period from 2012 to 2014. In two of them in the Białowieża (in 2013) and Osipovichskaya (in 2012) performed was deworming, which led to a significant reduction in the level of infestation. Ozerskaya population shows a gradual reduction of parasitic infestation level that may be associated with effect of providing E. bison there with vitamin and mineral complex that helps to strengthen the immune system of animals.

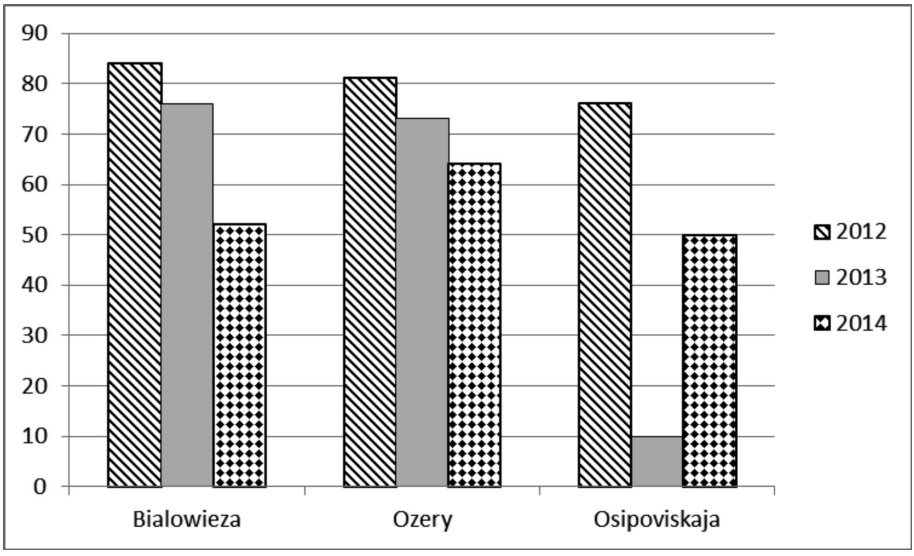

Figure 1 Dynamics of parasitic infestationin E. bison from 3 different populations in the period from 2012–2014.

Currently, study on parasitic problems of E. bison is focused on determining the species composition and intensity of helminth infection. Particular attention is drawn to those animals which are temporarily kept in enclosures (Evtushevsky and Mamenko 2013).

Conclusions

In 2014, E. bison infestation by helminths in all analysed forestries ranged from 38.8% to 61.9%. The average extensity of invasion in 2014 was 51.7%. In studied samples we found 10 genera of helminths (3 classes: Nematoda, Cestoda and Trematoda) were recorded. Of these, seven genera of the Nematoda class (*Nematodirus* sp., *Dictyocaulus* sp., *Neoascaris* sp., *Trichocephalus* sp., *Oesophagostomum* sp., *Ostertagia* sp., *Trichostrongulus* sp.), two trematodes (*Paramphistomum* sp. and *Fasciola hepatica*), and one species from Cestoda class – *Moniezia expansa*.

The level of infestation in various forestries (Porozovo, Hvoyninsky, Svisloch, Jasenska and Korolevo-Mostovo) was not significantly different ($G \leq 0{,}5$ $p \geq 0{,}25$). The lowest it was in the Nikorsky forestry. Intensiveness of invasion also was different. The level of infestation of E. bison on the territory of the Białowieża Forest is high. Regarding species composition dominate there nematodes, but the highest occurrence was by trematodes, particularly fascioliosis fluke (100% of the infected). In case of almost all types of worms that infest the E. bison, the development of invasive larvae is associated with the soil, pasture plants or aquatic environment. In

all studied areas area inhabited by E. bison also occupied by other species of hoofed animals are present, which provides high possibility for the exchange of helminthofauna between particular species of ungulates.

Home ranges of E. bison consist of a mosaic of habitats including mixed forest, forest clearings and farmland. A number of open areas of floodplain meadows there, is a favorable environment for the presence of invasive parasites.

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Monitorowanie stanu zakażenia pasożytami jelitowymi żubra (*Bison bonasus*) w różnych populacjach na Białorusi

Streszczenie: Przedstawiono wyniki parazytologicznych studiów różnych populacji żubrów na Białorusi. Największa różnorodność gatunkowa pasożytów została zarejestrowana w Puszczy Białowieskiej. Natomiast poziom infestacji był podobny w poszczególnych leśnictwach. W składzie gatunkowym dominowały Nematoda, natomiast najczęściej rejestrowana *była Fasciola hepatica*. Odrobaczanie skutkowało spadkiem zapasożycenia w kolejnym roku.