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The structure of parasitofauna of European bison (*Bison bonasus*) in various populations in Belarus

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Abstract: The structure of parasitofauna of European bison from various populations in Belarus was estimated on the basis of coproscopic studies and autopsy of culled or naturally dead animals. The largest number of identified helminthes species (37) was at Białowieska Forest followed by Ozeranskaya and Berezina-Borisov populations (15), then Polessky State Radiation Ecological Reserve (14), and the lowest number of species was found in Volozhin population (6). More than 50% of animals in all subpopulations were carriers of parasites.

Key words: European bison, Belarus, micropopulations, helminthes

Introduction

The level of parasite invasion in mammals, in particular the *Bison bonasus,* is one of the biological markers of the state of populations inhabiting various territories. Among parasitic diseases the greatest threat for E. bison pose helminthiases (Goregliad 1971). In period of mass reproduction, helminths at various stages of their development have a negative impact on the health of the host animal through reducing the reproduction, vitality, and sometimes leading to death. Helminthes are a permanent deterrent to the growth of E. bison populations (Kozlo, Bunevich 2011).

Studies on helminthiasis as a factor affecting the condition of E. bison populations is especially important in case of parasites living in pulmonary and digestive tracts. Apart from viral and bacterial pathogens helminthes disturb homeostasis and cause disturbances in the functioning of animal body. Helminthes invasion affecting organs of E. bison, facilitates also penetration of various microorganisms into animals' tissues. Hence, animals not only become more susceptible to infectious diseases, but also have lower toleration to changes of climatic conditions (Krasochko *et al*. 2004). The parasitofauna of E. bison was studied in Belarus by many researchers (Anisimava *et al*. 2008; Kotlerchuk 2008). The best knowledge on helminthes of European bison has been gathered for Białowieska Forest. In both of its parts (Belarus and Poland) more than 40 helminthes species were described (Kochko, Jakubowski 2000; Drożdż *et al*. 1989).

It was found that in 2000 in comparison to 1965 the species composition of helminthes identified in E. bison of Belovezhskaya Forest in Belarus increased from 17 to 23 species, and represented nematodes (18), trematodes (4) and cestode (1) (Kochko, Jakubowski 2000; Krasochko *et al.* 2004). When the high extensity of infection is observed (at least 75%), every animal hosts from 1 to 8 helminthes species. The most common are nematodes, which occurred in 100% of samples. Therefore the study of the structure of the European bison parasitofauna could be helpful in the control and prevention against the helminthes invasion in cattle farms of Belarus.

Material and methods

The study was conducted in years 2006 – 2014 in following European bison populations: in Minsk Region (Volozhin, experimental forestry), Mogilev region (Osipovichi experimental forestry), in Gomel region (Experimental Forest Hunting "Lyaskovichi", National Park "Pripyat", Polesski State Radiation Ecological Reserve), and in Grodno region (Agricultural Production Cooperatives 'Lake'). Those populations live in different landscape and vegetation conditions of Belarus. The study was based on coproscopic analysis, as well as autopsy of culled or naturally dead animals (Yatusevich *et al.* 1999). The obtained results were analyzed using statistical methods: the G-test, t-test, the Czekanowski-Sorensen index (Ics,%) and rank correlation coefficient of Spearman (rs).

Results and discussion

In Ozerskaya population the extensity of invasion equaled to 70.7% of samples, with a predominance of monoinvasion (50.0%). On average, in one sample we found 1.61 ± 0.7 helminthes species. The structure of helminthes was: Trematoda – 5.6%, Cestoda – 11.1%, Nematoda – 100.0%. Identified were representatives of 10 genera. The most common were: *Neoscarus vitulorum* (48.1%) and *Dictyocaulus filaria* (33.3%).

In Berezina – Borisov subpopulation we identified 15 species: *Fasciola hepatica, Dicrocelium lanceatum, Paramphystomum sp., Moniezia sp., Oesophagostomum radiatum, Ostertagia ostertagi, Cooperia oncophora, H. contortus, Nematodirus helvetianus, Neoscarus vitulorum, Dictyocaulus filaria, Trichocephalus globulosa, Capillaria biolata, Paramphistomum sp.* belonging to classes and structure: class Trematoda – 4, –Cestoda – 1 and Nematoda – 10 species (Subbotin *et al.* 2007). The most frequent were Trichostrongylidae (80%). Other helminthes species were found in 1–5% samples. On average, the extensity of helminthes invasion was equal to 78.6%.

In population of Volozhin we examined 27 samples, and in 3 (11.1%) of them we found helminthes. Species in 2 samples belonged to the class Trematoda and in 1 to Cestoda.

In the Osipovichy population the results of the survey showed the extensity of invasion at the level of 53.3%. From samples with parasites 62.5% carried only one species, in 31.2% were found two species, and three species in the rest of the samples (6.2%). On average 1.44 ± 0.63 species per sample were identified. The structure of classes was: Cestoda – 6.3%, Nematoda – 93.8%. The most common species were *Dictyocaulus filaria* (30.1%) and *Neoscarus vitulorum* (21.7%), followed by Trichostrongylidae (13.3%). Other species were recorded sporadically. In 2012 we advised the managers of Osipovichy population to introduce complex medical and preventive measures, including deworming. In the study done next year (2013) only in 9.5% of the samples were found eggs or larvae of helminthes class Trematoda (*Paramphistomum* sp.).

In Ozeranskaya population 44 samples were examined, and in 69.2% of them helminthes were registered. In those samples, 66.7% and 33.9% carried one or two species of helmintes respectively. On average in one sample we found 1.3 ± 0.48 helminthes species. The occurrence of classes was as follow: Trematoda – 5.6%, Cestoda – 11.1%, Nematoda – 100%. The most common were *Trichostrongylus sp.* (55.8%) and *Dictyocaulus filaria* (16.2%).

In our previous studies (Kotlerchuk *et al.* 2007) conducted in the National Park "Pripyat" 15 species of parasites were found: *Fasciola hepatica, Dicrocoelium lanceatum, Moniezia sp., Ostertagia ostertagi, Cooperia oncophora, Haemonchus contortus, Neoascaris vitulorum, Trichocephalus globulosa, Oesophagostomum radiatum, Dictyocaulus viviparus, Protostrongylus sp.* It is worth to notice that in the Okski Reserve, from where the ancestors of the Pripyat population came, 17 species of helminthes parasite were recorded (Nazarova 1966).

In excrements of E. bison from Polessky State Radiation Ecological Reserve following extensity of helminthes invasion was found: Trichostrongylidae – 100%, *Fasciola hepatica* – 16.5%, *Paramphistomum cervi* – 17.6%, *Moniezia sp.* – 8.2%, *Dictyocaulus viviparus* – 5.8%, *Neoascaris vitulorum* – 10.6%, *Nematodirus helvetianus* – 11.8%, *Capillaria bovis* – 22.4%, *Trichocephalus globulosa* – 4.3%. The most common were nematodes, and species *Nematodirus* sp. was the most often in young animals (Penkevich 2007). As a result of helminthological autopsy of 14 dead bison following extensity of helminthes invasion was determined: *Fasciola hepatica* – 10.4%, *Paramphistomum* sp. – 19.8%, *Moniezia* sp. – 7.1%, *Nematodirus helvetianus* – 11.8%, *Haemonchus contortus* – 13.4%, *Dictyocaulus viviparus* – 4.9%, *Ostertagia ostertagi* – 15.2%, *Oesophagostomum radiatum* – 22.0%, *Trichocephalus ovis* – 4.3%, *Capillaria bovis* – 22.4%. Those species belong to classes: Nematoda – 78.6%, Trematoda – 12.3% and Cestoda – 7.1%. The most common were *Capillaria bovis, Oesophagostomum radiatum* and fluke *Paramphistomum sp*. The extensity of helminthes invasion in different periods varied from 78.1 to 100%. Only one type of parasites was reported in 24.7% of sampled E. bison. Large part of animals simultaneously carried two (51.8%) and three (11.7%), four (7.1%), five (3.5%) and six (1.2%) helminthes species.

On the base of fecal samples from Białowieska population we stated that the extensity of helminthes was equal to 66.9%. On average we found 1.9 ± 0.12 parasites species per sample. In total 14 species of helminthes from 3 classes (Nematoda, Trematoda, Cestoda) were found. The intensity of invasion in various parts of Białowieska Forest was different. The most widespread and numerous nematodes were Dictyocaulidae (44.1%) and Fasciolidae. The maximal extensity of invasion by *Dictyocaulus viviparus* (76.9%) was observed in animals from Beliansky forestry. Also considerable part of E. bison from the Korolyovo-Mostovskay forestry was infested by *Ostertagia* sp. (30.5%). The largest diversity of species was found for bison living in Yasenskay forestry, where in 4% of the samples we found the presence of Cestoda – *Moniezia expansa*.

We found high extensity of parasitic invasion in calves from Belovezhskaya population, but its intensity was low. Results obtained in this study confirm the necessity for monitoring the strength and types of parasitological invasions in all home ranges of E. bison populations.

Table 1. The index of similarity of helminth invasion in studied populations (Ics [%]).

Subpopulation	Ozeranskaya	Volozhin	Białowieska	Osipovichy
Ozerskaya	0.19	0.25	0.13	0.62
Ozeranskaya	–	0.12	0.36	0.48
Volozhin	–	–	0.05	0.17
Belovezhskaya	–	–	–	0.08

The results of comparison the composition of helminthes species in analyzed subpopulations proved large similarity between Ozerskaya and Osipovichy subpopulations (Ics=0.62) as well as between Ozeranskaya, Białowieska and Osipovichy (Ics = 0.48 and 0.36 respectively) (Tabl. 1). Rather low similarity was observed between Ozerskaya and Ozeranskaya populations (0.19), however they had the same species of nematodes and cestodes, and between Ozeranskaya and Volozhin (0.12), where we found one common cestodes.

Table 2. The rank correlation coefficients between the structure of helminthes in different species of ungulates.

View	Deer	Elk	Bison	Goat	Small cattle	Cattle
Deer	1.00	0.16	0.15	0.33	0.15	0.14
Elk	–	1.00	0.37	0.19	0.18	0.23
Bison	–	–	1.00	0.08	0.40	0.46
Goat	–	–	–	1.00	0.17	0.27
Small cattle	–	–	–	–	1.00	0.51
Cattle	–	–	–	–	–	1.00

The largest number of helminthes species was recorded in the Białowieska population (37). In Ozeranskaya and Berezina-Borisov populations was noted equal number of species (15), in Polessky State Radiation Ecological Reserve (14), and the lowest number of species was found in Volozhin population – only 6.

In many studies was noted significant variability of parasitic fauna as well as considerable dynamics of extensity of its invasion. Proved were changes of intensity and presence of some parasitic species in time (Krasochko *et al*. 2004). E. bison can be a reservoir of some parasites since the parasitic fauna is not very much specialist to host species. As a consequence, some species of wild and domestic ruminants living within the same area and using the same food resources may be threatened by those parasites. This could be proved on the basis of the rank correlations between species composition of helminthes within wild ungulates (deer, elk, goat) and domestic ones (cattle and small cattle) (Tabl. 2). The highest similarity was found between E. bison and domestic cattle (0.40 and 0.46), and between E. bison and elk (0.37).

Conclusion

In our studies on helminthes species conducted on various populations of European bison we proved the rich species composition and high extensity of parasites' invasion. More than 50% of animals in all subpopulations were carriers of parasites: Ozeranskaya – 69.2%, Osipovichskaya – 53.3%, Białowieska – 66.9%, Polesskaya – from 78.1 to 100%. In the majority of animals one (50.0 – 66.7%) or two (25.0 – 38.0%) of helminthes species were found. A larger numbers of helminthes species are rare. In all studied populations the parasitofauna was dominated by nematodes, which occurrence was 6 times higher than other classes ($G=39.8$; $p<0.01$). We also proved that bison revealed not only high extensity of invasion, but also common with other local ungulates helminthes species composition.

Many new E. bison populations in Belarus are at the first stage of parasitic invasion and the mutual structure of parasites' species is not in balance yet. When the acclimatization process of E. bison introduced to new environment is finished, the fauna of parasites may change because E. bison may receive local helminthes from other native ungulates. In new habitats, formation process of parasites depends primarily on the environment, physiological status of the animals, quality of feeding and the implementation of regular treatment and preventive measures.

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Struktura parazytofauny żubra (*Bison bonasus*) w populacjach bytujących na Białorusi

Streszczenie: W pracy omawiane są wyniki badań parazytologicznych w kilku populacjach żubra bytujących na Białorusi. Największa liczba gatunków pasożytów stwierdzana jest w populacji w Puszczy Białowieskiej, w pozostałych badanych stadach jest znacznie mniejsza. Porównano również skład gatunkowy pasożytów w różnych stadach i stwierdzono znaczne podobieństwo pomiędzy niektórymi populacjami.