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**The State of Research on the Helminthofauna
of the European Bison**

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[With 1 Table]

After reviewing foreign and Polish literature the author finds that the problem of helminthofauna of the European bison in Poland has been sufficiently elaborated. A large amount of data has been accumulated on the epizootiology of helminthiases in European bison in different reserves, the occurrence of intermediate hosts and the ways in which such invasions are spread. In relation to the majority of helminthiases occurring in the European bison in Poland these data may be considered as sufficient, but the research on liver fluke disease should be continued. In conclusion the author emphasises the necessity for undertaking attempts at limiting the progressive invasion of liver fluke in bison reserves in Poland.

Foreign literature on the parasites of the European bison is unusually poor and in principle limited to typically faunistic studies, listing the parasites invading this host. A review of these studies shows that the majority are fragmentary and usually based on small amounts of coproscopic material (Wetzel & Enigk, 1936; Bohn, 1937), or on material originating from single (1—7) dissections (Ruchljadev, 1939; Zabłocki, 1951; Bielaieva, 1957; Nazarova, 1965a, 1965b; Mathevossian, 1964; Tschertkova, & Kospuko, 1964). The only more extensive study in foreign literature in this field is that by Koffman (1942) based on material collected during dissection of 13 bison which had died from various causes in Sweden during the period from 1939—1941. The parasites described in this study are not, however, given accurate descriptions, the biometric data are insufficient and are illustrated only by microphotographs which are not always legible which, combined with the numerous taxonomic errors, leads to Koffman's study giving rise to many doubts.

A knowledge of the parasites of the bison based on the above studies is therefore confined to faunistic data only, recording a total of 37 species from the following systematic groups: *Protozoa* — 1, *Trematoda* — 4, *Cestoda* — 2, *Nematoda* — 30.

A far better knowledge has been obtained of the parasites and the diseases they cause in European bison living in Poland. The first information on this subject was published over 100 years ago, when fairly large numbers of European bison were still living free in the Białowieża Primaeval Forest. Attention was drawn at that time to the periodically occurring mortality among European bison during the spring. This disease was termed »liver rotting«. It was at first held that the disease was caused by the animals eating *Cicuta virosa* L. (Dolmatov, 1848, cited by Büchner, 1900; Gliński, 1885), which grew luxuriantly in the marshy parts of the forest, and only later was it considered to be due to parasites. Büchner (1900) wrote on this subject: ...»in my opinion it is not the species of grass which is harmful and causes the disease, but the parasites clinging to plants in marshy parts. These swallowed together with the fodder are often the cause of this liver disease«... Auer (1893—1894) considered that this disease is caused by *Fasciola hepatica*, Büchner (1900) on the other hand is more inclined to suspect *Dicrocoelium dendriticum* (Rudolphi, 1819).

Auer (l.c.), in analysing in his study the causes of mortality among European bison in the Białowieża Forest, includes detailed lists of the deaths of these animals between 1873—1892, which show that 65 bison died from liver fluke disease during this period. The scrupulous records kept by Auer make it possible to trace the dynamics of mortality among the bison. It turns out that deaths due to liver fluke disease occurred among bison over the whole year, but most occurred in the spring and summer period.

Wróblewski (1927), who carried out investigations in the Białowieża Forest from 1906—1918, set himself the task of elaborating as comprehensively as possible problems which might be connected with the deaths of the European bison and as a result devoted considerable space in his study to invasive diseases. He dissected 81 European bison which had died or been shot in the Białowieża Primaeval Forest, and listed 10 species of parasitic helminths, and described (Wróblewski, 1908) a new species of *Protozoa*, of the genus *Trypanosoma* (which has not so far been found again). He considered the liver fluke, which he found to have invaded 78 of the dissected animals, as the most dangerous parasite of European bison. The three specimens free from liver fluke were calves which had probably not as yet had time to be invaded. The intensity of invasion by the liver fluke in European bison during this period was also very considerable. It is sufficient to state that the above author counted 668 specimens of adult parasites in $\frac{1}{3}$ of the liver of one adult bison. Out of the total number of 81 animals dissected by Wróblewski (l.c.) 13 had died from liver fluke disease. The deaths of bison caused by this disease occurred most often in spring, that is, during the period in which free-living European bison suffered the greatest hunger and were in the weakest condition. Under such circumstances even relatively slight invasion caused the animal's death. During the summer and autumn period when there was abundant food in the Białowieża Forest the condition of the European bison was good despite the invasion of the liver fluke. Wróblewski (l.c.) expresses the opinion that

if the European bison were well fed during the spring they would overcome invasion.

The next study on parasites of European bison is the publication by Szwejkowski (1954) reporting the finding for the first time in the heart of an European bison the gyri of *Sarcocystis fusiformis* (*S. blanchardi*). Out of the 18 bison examined 15 (83.3%) had these parasites, although no distinct reaction on the part of the host was found.

The final Polish publication in this field is the study by Drózdź (1961), forming the result of many years of investigations (1953—1959) made in all of the European bison reserves in Poland.

The basis for elaboration of the helminthofauna of the European bison was material obtained by helminthological dissection of 25 animals which had either died or been shot, originating from different reserves and zoological gardens. The material elaborated consisted of: 3 species of *Trematoda*, 2 of *Cestoda* and 16 of *Nematoda*. In all, therefore, 21 species of helminths parasitising the European bison in Poland were found. European bison proved to be a new host for six of the species of parasites, and four species were simultaneously found for the first time in Poland. The author gives original drawings and descriptions of the less known parasites and revises the new species described by Koffman (1942). As a result three of Koffman's species (*l.c.*) were recognised as synonyms of forms previously described.

Of the 21 species of parasites found in the European bison in Poland the great majority was formed by parasites of cattle and sheep. An exception to this was *Spiculopteria spiculoptera* (Guschanskaja, 1931) — a specific parasite of *Cervidae* hitherto found in *Bovinae*.

The somewhat random material dissected coming from bison dead of different diseases did not permit of ascertaining the intensivity of invasion by parasites in European bison in the different breeding reserves. Coproscopic and habitat examinations aimed at elucidating the current invasiological relations in different reserves and enclosures were therefore undertaken. Examinations of the excrement of 104 bison established that the most frequently occurring parasites of the European bison in Poland include: nematodes of the *Trichostrongylidae* family — 98%, *Fasciola hepatica* — 53.8%, *Paramphistomum* — 45.1% and *Dictyocaulus viviparus* — 30.7%.

The small number of eggs of the stomach and intestinal nematodes found in excrement and the slight invasion of enclosures by their larvae indicates that the intensivity of these helminthiasis in European bison is not great. It appears that the activities of coprophagous beetles may play a part in reducing the spread of gastro-intestinal helminthiasis in the European bison, these being primarily representatives of the genus *Geotrupes*, which bury excrement together with the eggs and invasive larvae of nematodes.

The most dangerous parasite of the European bison is *Fasciola hepatica* which occurs in Poland in 53.8% of these animals. Its intermediate host, *Galba truncatula*, occurs in the reserves at Białowieża and Borki. It was also found that invasive forms of *F. hepatica* were quite possibly carried into the bison reserves from outside, by the forest streams at Białowieża or together with hay at Pszczyna and Smardzewice.

Invasion by *Paramphistomum cervi* was found in 45.1% of the bisons examined. This parasite occurred most often in the Białowieża Forest — 100%, in the enclosures at Białowieża — 69.6% and at Borki — 55.5%.

Pulmonary helminthiasis in European bison is caused by *Dictyocaulus viviparus*. As in the case of cattle a certain degree of resistance is acquired after the animal has had pulmonary helminthiasis.

Dicrocoelium dendriticum was found only in the European bison at Białowieża. The examinations made showed that all the links in the development cycle of *D. dendriticum* are present in this reserve.

The last problem dealt with was the contacts between European bison and domestic and free-living animals. The possibility of exchange of parasites between *Cervinae* and European bison was shown.

In the light of the studies discussed it appears that the question of the helminthofauna of the European bison in Poland has been sufficiently elaborated, as is shown by the unusually large amount of dissection material forming the basis of this research and also the list of 26 species of parasitic helminths forming the sum total of these parasites found in Polish European bison.

There are also abundant data on the helminthic epizootiology of European bison in different reserves, the occurrence of intermediate hosts and the ways in which these invasions are spread. These data may be considered as sufficient in relation to the majority of the helminthiasis occurring in European bison in Poland, but research on liver fluke disease should be continued.

Confinement of European bison in limited enclosed areas settled by the already infected intermediate host favours the accumulation of liver flukes in the bison's organism. It must be assumed that the intensity of this invasion will increase every year and similarly increasingly great infection of the habitat will occur. Under such circumstances even well-fed animals will not be protected from clinical disease and death. A foretaste of these gloomy prognoses is formed by the events which took place over recent years. Thus up to 1959 the bison reserve at Borki was free of liver fluke, despite the numerous occurrence of the intermediate host, but now a considerable percentage of the bison are invaded by this parasite (unpublished data).

The studies by Büchner (1900), Auer (1893—1894) and Wróblewski (1927) discussed above show that very numerous cases of death due to liver fluke disease were recorded among the European bison than living in freedom in the Białowieża Forest. After the first world war, which completely liquidated the Białowieża population, there were none of these animals in the Białowieża Forest for 10 years. It was not until 1929 that action was taken to reconstitute this species in enclosed reserves. This restitution of the European bison probably contributed to reducing the intensity of invasion by the liver fluke, as is evidenced by the fact that up to 1959 no deaths due to this disease were recorded. The death of an European bison at Białowieża as the result of mass invasion of the liver fluke, which took place in recent years, is an alarm signal. The bison in question lived in enclosure 3 in reserve I, in which the invasiological situation in 1959 looked very unfavourable. Numerous

occurrence of the intermediate host and also 100% extensiveness of invasion by the liver fluke in European bison living in the enclosure were found at that time.

Bearing the above data in mind, attention must be drawn to the necessity for undertaking steps to limit the progressive invasion of the liver fluke in reserves.

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STAN BADAŃ NAD HELMINTOFAUNĄ ŻUBRA

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