The role of European bison in the transmission of arthropod-borne zoonotic pathogens in a sylvatic environment

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Environmental changes, particularly those related to climate, have important implications for arthropod activity and thus potentially increase the risk of spreading climate-sensitive diseases. The natural environment is the first to be susceptible to these changes, and free-living animals are important reservoirs for over 70% of known zoonoses. Free-living animals can also be indicators of the spread of many zoonoses, and their monitoring allows for epidemiological analysis to protect animals and humans. The European bison (*Bison bonasus*) was saved from total extinction from the free-ranging state in the early 20th century by the efforts of generations of ranchers, foresters, and veterinarians. In 2022 we will celebrate the 70th anniversary of the reintroduction of the species to the free state in Bialowieza Forest. It is a huge success to reach over 9000 individuals in 2020. However, along with the increase in numbers, the density in free roaming populations is also growing and, consequently, the risk of various types of threats. Understanding the role of the European bison as a possible reservoir of climate-sensitive pathogens to which it is exposed under different climatic, forest and synanthropic scenarios; determining the effects of climate and habitat on the diversity of endoparasites and ectoparasites, as well as arthropod vector-borne pathogens, should be an important part of the species conservation strategy. As our previous studies have shown, European bison are vulnerable to infection by emerging pathogens such as Schmallenberg virus (SBV) transmitted by blood-sucking flies of the genus *Culicoides* spp. The same insect vectors were responsible for the spread of bluetongue virus (BTV), which is new to our latitude (re-emerging). The occurrence of SBV and BTV epizootics has been associated with observed changes in climate and arthropod activity. The intensification of clinical cases of fly-transmitted *Thelazia* spp. infestation in European bison in the Bieszczady and Bialowieza Forest is also related to climate change. Presented studies concern three diseases whose vectors are ticks: *Coxiella burnetii* causing Q fever; *Francisella tularensis* causing tularemia; and tick-borne encephalitis virus (TBEV). Serological studies were conducted in several European bison populations in Poland. Epidemiological analysis was concerned with determining the spread of these pathogens and determining risk factors. Cases of Q fever were reported in bison in the 80s, when also exposure of the staff of the Bialowieza National Park was found. Our study showed that European bison exposure to *C. burnetii* infection was rather accidental and the role of this species as an important source of infection is currently unlikely. Similarly, the risk of *F. tularensis* infection in European bison is very low, despite the fact that they inhabit the same environment with the main reservoirs i.e. rodents, lagomorphs and ticks. Surprisingly high

seroprevalence was obtained for TBEV. Interestingly, the highest TBEV seroprevalence in European bison from north-eastern free-living populations (Białowieza, Borecka, and Knyszynska Pushcha) corresponds to the highest incidence of TBEV in humans in the country. Risk factors for TBEV infection in European bison included age (risk increased with age), gender of European bison (higher risk in females), and population type (significantly higher risk of exposure in free-living populations).