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Serologic Survey for Infectious Pathogens in Free-ranging American Bison

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ABSTRACT: From November 1991 through March 1992, we evaluated 101 free-ranging American bison (*Bison bison*) from Yellowstone National Park, Wyoming (USA) for exposure to infectious organisms that commonly infect cattle. No titers were detected for bluetongue virus, bovine leukemia virus, or *Campylobacter fetus* in these 101 bison. Detectable antibodies occurred against *Anaplasma marginale* (eight of 76, 11%), bovine respiratory syncytial virus (31 of 101, 31%), bovine viral diarrhea (31 of 101, 31%), bovine herpesvirus 1 (29 of 76, 38%), *Leptospira interrogans icterohaemorrhagiae* (four of 101, 4%), *L. interrogans hardjo* (seven of 101, 7%), *L. interrogans autumnalis* (one of 101, 1%), *L. interrogans bratislava* (seven of 101, 7%), *L. interrogans australis* (one of 101, 1%), and parainfluenza 3 virus (27 of 75, 36%). The low antibody titers and the lack of gross lesions are evidence that while previous exposure to infectious organisms may have occurred, none appeared to have active infections.

Key words: Bison, *Bison bison*, Yellowstone National Park, Wyoming, serology, serologic survey, pathogen.

The American bison (*Bison bison*) population within Yellowstone National Park, Wyoming (USA) is the only free-ranging, naturally regulated bison population in the United States. The herd is estimated to consist of approximately 3,000 animals (Breining, 1992). Reports on bison and disease exposure have been limited to relatively small numbers of animals. Our objective was to conduct a serologic survey on 101 free-ranging adult bison for exposure to infectious organisms that commonly infect domestic cattle.

In 1991, the Montana Department of Livestock and Department of Fish, Wildlife and Parks passed Order of Destruction Number B-2 in an effort to decrease the potential threat of disease transmission between domestic livestock and free-ranging bison migrating north from Yellowstone National Park near Gardiner, Montana, USA (45°3′N, 110°53′W). From November 1991 through March 1992, 257 head of American bison were killed by rifle shot to the head after they had exited the northern boundary of the Park.

Carcasses were examined and tissues collected for several concurrent research projects. Whole blood was collected from adult bison from lanced jugular veins into glass serum tubes and ethylenediaminetetraacetic acid (EDTA) tubes (Becton Dickinson Vacutainer Systems, Franklin Lakes, New Jersey, USA) within 10 min of death. All samples were placed in a cooler and sent chilled via over-night delivery to the University of Idaho, Caine Veterinary Teaching and Research Center, Caldwell, Idaho (USA).

After arrival at the laboratory, blood samples for serology were centrifuged at 500 × *G* for 10 min, and the serum was decanted into individual, sterile plastic vials. Sera were delivered to the Idaho Bureau of Animal Health Lab, Boise, Idaho for serologic testing. Sera were tested using protocols established by the National Veterinary Services Laboratory (Ames, Iowa USA) as follows: *Anaplasma marginale* by complement fixation, bluetongue virus by agar gel immunodiffusion, bovine leukemia virus by agar gel immunodiffusion, bovine respiratory syncytial virus by serum neutralization, bovine viral diarrhea by serum neutralization, *Campylobacter fetus* by micro-agglutination, infectious bo-

TABLE 1. Serologic test results from free-ranging American bison (*Bison bison*) from Yellowstone National Park, 1991 to 1992.

Organism	Lowest titer conducted	Number of bison at each titer level
Anaplasma marginale	5	68 had no titer
		5 had titer of 1:5
		3 had titer of 1:20
Bluetongue virus	1+	101 had no titer
Bovine herpes virus 1	4	47 had no titer
		21 had titer of 1:8
		8 had titer of 1:16
Bovine leukemia virus	1+	101 had no titer
Bovine respiratory syncytial virus	4	70 had no titer
		22 had titer of 1:8
		9 had titer of 1:16
Bovine viral diarrhea	4	55 had no titer
		22 had titer of 1:8
		3 had titer of 1:16
Campylobacter fetus	4	101 had no titer
Leptospira interrogans serovars	50	85 had no titer
L. interrogans icterohaemorrhagiae		4 had titer of 1:50
L. interrogans hardjo		7 had titer of 1:50
L. interrogans autumnalis		1 had titer of 1:50
L. interrogans bratislava		7 had titer of 1:50
L. interrogans australis		1 had titer of 1:50
Parainfluenza 3 virus	5	48 had no titer
		17 had titer of 1:5
		7 had titer of 1:10
		3 had titer of 1:20

vine rhinotracheitis by serum neutralization, *Leptospira interrogans* serovars (*icterohaemorrhagiae, hardjo, autumnalis, bratislava,* and *australis*) by micro-agglutination, and parainfluenza 3 virus by serum neutralization (Animal and Plant Health Inspection Service, 1991; Pearson and Jochim, 1991; Snyder et al., 1991).

Due to constraints related to the control operation, not all animals had all samples taken and some samples were inadequate in quantity to perform all tests. No serologic evidence of exposure to bluetongue virus bovine leukemia virus, or *C. fetus* was detected in the 101 Yellowstone bison we tested (Table 1). Vestweber et al. (1991) reported serologic evidence of bluetongue virus exposure in bison but no clinical disease. Zarnke (1993) found two (<1%) of 362 bison with serologic evidence of exposure to either bluetongue or epizootic hemorrhagic disease, or an unknown related virus. We could locate no previous reports where bison had been tested for evidence of exposure to bovine leukemia virus or *C. fetus*.

This is the first report of free-ranging American bison with serologic evidence of exposure to an *Anaplasma* spp. American bison were thought to be resistant to anaplasmosis when investigators were unable to isolate it from 132 animals raised in an enzootic area of Oregon (USA) (Peterson and Roby, 1975). However, Zaugg (1986) experimentally infected both splenectomized and spleen intact American bison with *A. marginale* and found they remained carriers for at least 496 days. Eight (11%) of 76 Yellowstone bison had low positive titers, however; differential blood cell counts conducted in a separate but concurrent study were found to be within normal limits on all the animals tested (Zaugg et al., 1993). Therefore, the low titers re-

ported here maybe indicative of bison being carriers of this organism or of cross reactivity from another organism.

The Yellowstone bison had low titers to bovine respiratory syncytial virus, bovine virus diarrhea, bovine herpesvirus 1, parainfluenza 3 virus, and *Leptospira interrogans* serovars (Table 1), Williams et al. (1993) reported seven (44%) of 16 bison positive with titers that ranged from 1 : 32 to greater than 1 : 8,192 for bovine respiratory syncytial virus. Williams et al. (1993) reported 12 of 16 bison had antibodies against bovine virus diarrhea with titers ranging from 1 : 32 to greater than 1 : 8,192 and Zarnke (1993) found five (2%) of 275 bison in Alaska to have titers of an unreported range. In Alaska, one of 327 bison was seropositive to bovine herpesvirus 1 while 14 (6%) of 229 unvaccinated bison had titers >1 : 100 to *L. interrogans* (Zarnke, 1983). Zarnke (1983) reported the first parainfluenza 3 virus seropositive (14 of 21) American bison and later reported additional seropositive animals (Zarnke and Erickson, 1990; Zarnke, 1993). Williams et al. (1993) reported 16 of 16 bison seropositive with titers ranging from 1 : 512 to 1 : 8,192. However, the low titers and lack of clinical disease or gross lesions were evidence that the Yellowstone bison were most likely not undergoing active clinical infection. The low titer reactions to *Leptospira interrogans* serovars, are probably better designated suspect than positive.

Serology can be an important tool in understanding the epizootiology of disease. In theory, the presence of a detectable antibody level is evidence that the animal has been exposed to that particular antigen at some point in its life and responded by producing antibody, but does not necessarily mean that active infection and clinical disease is occurring. In addition, cross reactions do occur on many serologic tests.

The Yellowstone bison included in this survey had never been vaccinated and thus we did not have to consider a humoral immune response from vaccination. All bison were determined to be in good body condition and without any detectable clinical abnormalities. In concurrent studies, we found *Pasteurella* spp. present in the nasal and pharyngeal swab samples (Taylor et al., 1996). Hematologic, serologic values, histopathologic, and fecal evaluations were also performed (Zaugg et al., 1993).

From a herd health viewpoint, these free-ranging bison were relatively free from the typical infectious organisms that often infect cattle and are commonly found in area cattle. Because of our large sample size, we would have expected that if these diseases were clinically active within the herd that titers would have been increased or gross lesions would have been observed. Thus the Yellowstone bison may not be frequently in close enough contact with area cattle to allow for much transmission of these organisms from the cattle to the bison.

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