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Authors: Vestweber, J. G., Merrill, G. L., Staats, J. J., and Veatch, J.

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Serologic Survey for Selected Microbial Pathogens in Bison from Kansas

J. G. Vestweber,[1] G. L. Merrill,[2] J. J. Staats,[1] and J. Veatch,[3] [1] Department of Clinical Sciences, Kansas State University, Manhattan, Kansas 66506, USA; [2] Division of Biology, Kansas State University, Manhattan, Kansas 66506, USA; [3] Department of Veterinary Diagnosis, Kansas State University, Manhattan, Kansas 66506, USA

ABSTRACT: A serologic survey was conducted on an American bison (*Bison bison*) herd in Kansas for antibodies against *Brucella* spp., *Leptospira interrogans* serovar *canicola, pomona, grippotyphosa, icterohaemorrhagiae*, and *hardjo, Anaplasma* spp., bluetongue virus, infectious bovine rhinotracheitis virus and bovine viral diarrhea virus. There was an increase in prevalence of bluetongue antibodies from 38% in 1987 to 100% in 1989 in animals ≥24-mo-old. Prevalences of antibodies against the other livestock pathogens were either negative or at levels associated with previous vaccination.

Key words: American bison, *Bison bison*, epizootiology, serosurvey, microbial pathogens.

Recent increase in the numbers of American bison (*Bison bison*) in wild and private herds has heightened concern about their susceptibility to bovine infectious diseases and the potential for bison to be carriers of these pathogens. Information is minimal on the infectious diseases of bison that also are found commonly in the cattle.

The importance of bison as reservoirs of *Brucella abortus* has been inferred because of detection of antibodies to the organism in serologic surveys and also because of the isolation of *B. abortus* (Davis et al., 1990). If bison are a significant reservoir of *B. abortus*, brucellosis eradication programs should consider the role of bison in the epizootiology of the disease (McCorquodale and DiGiacomo, 1985).

A review of anaplasmosis summarized the history and epizootiology of this disease in both wild and domestic hosts (Kuttler, 1984) and reported that there is little or no evidence that American bison were suspectable to *Anaplasma* sp. infections. Later, Zaugg and Kuttler (1985) reported that one splenectomized and one spleen-intact bison calf inoculated with *A. marginale* became infected and were able to transmit the disease to splenectomized cattle.

Information on the occurrence in bison of other infectious diseases commonly found in cattle is minimal. The objective of this study was to determine the serologic prevalence of brucellosis, leptospirosis, anaplasmosis, bluetongue, infectious bovine rhinotracheitis, and bovine viral diarrhea in a captive bison herd.

The study herd of 22 American bison was established in 1987 from a herd at Fort Riley, Kansas, that had been separated from other ruminants. It consisted of two males and three females that were <6-mo-old; one male and one female in the age range of 7- to 23-mo-old; and two males and 13 females that were >24-mo-old. All bison >7-mo-old had been vaccinated in 1986 with *Leptospira interrogans* serovar *canicola, poma, grippotyphosa, icterohaemorrhagiae*, and *hardjo* bacterin. Three females born in 1975, 1978, and 1979 had also been vaccinated with the previously mentioned leptospirosis bacterin and a modified live infectious bovine rhinotracheitis virus and bovine viral diarrhea virus vaccine in 1983 and 1984.

In 1989, the herd had grown to 45 by the addition of three animals from Maxwell Game Preserve at Canton, Kansas, four animals from a private bison herd owner at Longford, Kansas, and 16 bison that were born on site. None of these additional bison received any vaccines. The herd was divided into three age groups: two males and six females that were <6-mo-old; six males and seven females with an age range of 7- to 23-mo-old; and six males and eighteen females that were >24-mo-old. Bison were maintained on 469-ha of native tallgrass prairie, part of the 3,487 ha Konza

Prairie Research Natural Area, located in the northern Flint Hills (96°32′ to 96°37′W, 39°03′ to 39°07′N), in Riley and Geary counties, Kansas (USA). Bison are allowed to graze freely on good quality range, with minimum management and continuous access to pond water. They were located at least 1,000 m from domestic livestock and no other wild ruminants were raised on the same range. The area had a moderate deer population.

In this study, bison were either blood tested on 15 October 1987 or 30 October 1989. The animals were attracted to a corral by a 12-hr period of supplemental feeding with a 14% protein pellet. They were kept in the corral for 24 hr prior to blood sampling with brome hay and water continuously available during this period. All bison were randomly handled over a 5 hr period in a circular corral leading to a restraint chute. We collected blood by venipuncture of the external jugular and coccygeal veins into serum tubes. The serum was removed from the clots and the sera were refrigerated or frozen until tested. Sera were tested for antibodies to *Brucella abortus* by means of the card test (Alton et al., 1975), infectious bovine rhinotracheitis and bovine viral diarrhea viruses by the serum neutralization test (Carbrey et al., 1971), *Anaplasma* spp. by the card test (Amerault and Roby, 1968), and bluetongue virus by the immunodiffusion test (Pearson and Jochim, 1979). Antibodies against *Leptospira interrogans* serovar *canicola*, *pomona*, *grippotyphosa*, *icterohaemorrhagiae*, and *hardjo* were detected by the microscopic agglutination test (Cole et al., 1973). For the card and immunodiffusion tests, specimens were considered either positive or negative whereas for other tests, minimum titers were established based upon natural or experimental infection of the bovine species. Any antibody titers that were 1:4 or greater for infectious bovine rhinotracheitis (Carbrey et al., 1971), 1:16 or greater for bovine viral diarrhea (Kelling et al., 1990) and 1:100 or greater for *Leptospira interrogans* serovar *canicola*, *pomona*, *grippotyphosa*, *icterohaemorrhagiae*, and *hardjo* (Ellis and Thiermann, 1986) were considered to provide evidence of past exposure to the infectious agent or vaccine in question.

TABLE 1. Percent serum antibody prevalence[a] of six microbial disease agents in American bison (*Bison bison*) from Konza Prairie Research Area, Kansas (1987 and 1989).

Disease	Group 1[b]	Group 2[c]	Group 3[d]
Bluetongue			
1987	ND[e]	ND	38
1989	57	100	100
Anaplasmosis			
1987	ND	ND	0
1989	0	0	0
Brucellosis			
1987	ND	ND	0
1989	0	0	0
Infectious bovine rhinotracheitis			
1987	ND	ND	19
1989	0	0	0
Bovine viral diarrhea			
1987	ND	ND	19
1989	0	0	9
Leptospira interrogans serovar			
canicola			
1987	ND	ND	13
1989	0	0	9
pomona			
1987	ND	ND	13
1989	0	0	9
grippotyphosa			
1987	ND	ND	0
1989	0	0	0
icterohaemorrhagiae			
1987	ND	ND	13
1989	0	0	0
hardjo			
1987	ND	ND	0
1989	0	0	13
Sample size			
1987	ND	ND	16
1989	7	10	23

[a] Prevalence is number positive divided by number tested.
[b] Group 1 are bison ≥6-mo-old.
[c] Group 2 are bison 7- to 23-mo-old of age.
[d] Group 3 are bison ≥24-mo-old.
[e] Specimen not available.

Results of the serologic tests are presented in Table 1. The prevalence of antibodies to bluetongue virus increased in the group ≥24 mo from 38% in 1987 to 100% in 1989; 57% of bison <6 mo of age and 100% of bison 7- to 23-mo-old were seropositive in 1989. The immunodiffusion test used to detect bluetongue virus antibodies is also recognized to detect epizootic hemorrhagic disease viruses because both diseases share group-specific antigens (Della-Porta et al., 1985). A previous serologic study (Zarnke, 1983) in Alaska found no evidence of bluetongue antibodies in 21 bison. Bluetongue is apparently endemic in Kansas cattle (Metcalf et al., 1981) and we assume that the virus was brought into the herd by carrier animals when it was established in 1987. The significance of bluetongue virus in this herd has not been determined. We have not recognized clinical signs in bison that are suggestive of bluetongue as it has been described in cattle and sheep (Jochim, 1986). However, a high percentage of cattle develop serum antibodies to bluetongue virus without exhibiting clinical signs (Bowne et al., 1968).

Anaplasmosis is caused by an intraerythrocytic rickettsial agent of the genus *Anaplasma*, and is characterized in severe acute cases by anemia, icterus and death. Recent studies have demonstrated that bison are susceptible to *Anaplasma marginale* (Zaugg and Kuttler, 1985), but they are apparently resistant to *Anaplasma ovis* infection (Zaugg, 1986). We found no serologic evidence of anaplasmosis in the Konza herd even though the disease is common in cattle in Kansas.

Brucella abortus is an important cause of abortion in cattle (Thimm, 1982) and there are some infected cattle herds still present in Kansas. Brucellosis is also quite prevalent in some bison herds (McCorquodale and DiGiacomo, 1985) and these infected herds are capable of transmitting the disease to susceptible cattle (Davis et al., 1990). The Konza bison were all serologically negative to *B. abortus*.

There are no previous reports of infectious bovine rhinotracheitis virus or bovine viral diarrhea virus exposure in bison even though these viruses are prevalent in the cattle population (Kahrs, 1981). Antibody titers of 1:4 or greater for infectious bovine rhinotracheits virus were present in 19% of the bison in 1987, but <1:4 in all animals in 1989. Antibody titers of ≥1:16 for bovine viral diarrhea virus were present in 19% of the bison in 1987 while there was 9% in 1989. All bison which had titers of ≥1:4 for infectious bovine rhinotracheitis virus and ≥1:16 for bovine viral diarrhea virus were bison which had been vaccinated with a modified live infectious bovine rhinotracheitis and bovine viral diarrhea virus vaccine in 1983 and 1984. The serologic titers for these two viruses had also decreased between 1987 and 1989. None of the remaining animals had serological titers suggestive of present or past active natural infection.

Numerous serologic surveys of wildlife for leptospirosis have been conducted (Reilly et al., 1970) but information on the disease in bison is minimal. The disease is common in cattle and some serovars are capable of causing hemolytic anemia, hemoglobinuria, abortion, stillbirth, and agalactia (Songer and Thiermann, 1988). Serologic findings in cattle aborting from this disease reveal that *Leptospira interrogans* serovar *hardjo* is the primary cause (Ellis et al., 1982). Animals may develop a chronic renal infection with urinary shedding of the organism which may persist for years (Thiermann, 1982). All the bison in our study which had serological titers ≥1:100 had been vaccinated at least once in either 1983, 1984 or 1986. Bison that had been vaccinated at least twice had serological titers of ≥1:200 for *Leptospira interrogans* serovar *canicola, pomona, icterohaemorrhagiae*, and *hardjo*. Most of the serological titers decreased between 1987 and 1989, but a few were negative in 1987 and ≥1:100 in 1989. None of the unvaccinated bison had a serological titer

to leptospirosis and thus we do not believe it is a problem in the herd.

In the future we will be monitoring the herd closely for evidence of disease associated with the bluetongue virus. Unless it is indicated by clinical disease or increased serological titers, vaccines for the prevention of brucellosis, leptospirosis, anaplasmosis, bluetongue virus, infectious bovine rhinotracheitis virus or bovine viral diarrhea virus will not be given.

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