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SEROLOGICAL STUDIES ON SYMPATRIC BARBARY SHEEP AND MULE DEER FROM PALO DURO CANYON, TEXAS [1]

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Abstract: Sera were collected from 12 Barbary sheep *(Ammotragus lervia)* and 11 mule deer *(Odocoileus hemionus)* occupying sympatric ranges in Palo Duro Canyon, Texas. These were tested for leptospirosis, brucellosis, bovine virus diarrhea, anaplasmosis, vesicular stomatitis, bluetongue (BT), epizootic hemorrhagic disease (EHD), infectious bovine rhinotracheitis (IBR), and coccidioidomycosis. Serologic reactors were found to IBR in 3 Barbary sheep, BT in 6 Barbary sheep and 6 mule deer and EHD in 3 Barbary sheep and 4 mule deer. Possible ramifications of evidence for these diseases in wild herbivore populations in this area are discussed.

INTRODUCTION

Mule deer, *Odocoileus hemionus,* and Barbary sheep, *Ammotragus lervia,* occupy sympatric ranges within the Palo Duro Canyon of the Texas Panhandle. The Texas Parks and Wildlife Department released 268 mule deer in the canyon from 1949 through 1951 to augment a small remnant population[4] and this population is now estimated at about 6,000 animals. Forty-four Barbary sheep, an exotic species native to the North African mountains, were introduced into the canyon in 1957-58.[16] This population is now estimated at 1,200 to 1,600 animals. Other ruminants in the area are predominantly range cattle, with a few small herds of white-tailed deer, *Odocoileus virginianus.* Few domestic sheep or goats are in the area.

Palo Duro Canyon is a deep eroded gorge characterized by precipitous cliffs and mesas. The canyon is about 90 km long and varies to a maximum width of 30 km, in the otherwise flat topography of the Texas Panhandle. It is well-defined by a caprock escarpment, the walls of which rise to 240 m above the canyon floor. The vegetation reflects the topographic diversity with a mixing of eastern and western species. Good brouse affords suitable habitat for increasing wild herbivore populations in the estimated 200,000 ha area of the Palo Duro.

The canyon is almost entirely privately owned and is used primarily for cattle production. Cattle graze the interior and less demanding slopes within mule deer and Barbary sheep ranges as well as the High Plains adjacent to the canyon. The objectives of this study were to access domestic-wild herbivore disease relationships and to investigate possible mortality factors of Barbary sheep and mule deer in this area.

MATERIALS AND METHODS

The study area is located on the northern canyon rim 40 km southeast of Amarillo, Armstrong Co., Texas. Blood samples were collected from 12 and 15

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Barbary sheep and mule deer, respectively, post mortem after shooting during the 1977 hunting season (5 November to 5 December). Three samples from deer were discarded because of contamination. Serum was removed as soon as practicable from each sample and stored at -4 C until tested. The tests included were (1) Rapid Plate Agglutination test using Fort Dodge Antigen for leptospirosis *(Leptospira pomona, L. icterohemorrhagiae, L. canicola, L. hardjo* and *L. grippotyphosa)* in which titers of 40 (without crossreaction) or below were considered insignificant,[12] (2) Card test (official test antigen supplied by USDA) for *Brucella abortus,* (3) Modified Direct Compliment Fixation test for infectious bovine rhinotracheitis (IBR) in which titers above 1:16 indicate a recent infection,[5] (4) Modified Direct Compliment Fixation test for bovine virus diarrhea (BVD) in which titers above 1:16 indicate a recent infection,[5] (5) Official Compliment Fixation test (USDA) for anaplasmosis (blood films also examined for *Anaplasma marginale),* (6) Official Modified Compliment Fixation test for bluetongue (BT) in which antibody titers below 1:5 are considered negative, from 1:5 to 1:10 suspicious, and above 1:10 considered positive,[1] (7) Compliment Fixation test for epizootic hemorrhagic disease (EHD) in which antibody titers of 1:5 and 1:10 are considered suspicious of recent exposure and titers of 1:20 or greater are indicative of recent infection,[9] (8) Serum Neutralization test for vesicular stomatitis (VSV) where titers less than 1:8 are considered insignificant,[6] and (9) Agar Gell Diffusion test for coccidioidomycosis.[8] Serological tests were performed by the Texas Veterinary Medical Diagnostic Laboratory, College Station, Texas and the National Veterinary Services Laboratory, Ames, Iowa.

RESULTS

No detectable and/or significant titers were found using test systems or sera for leptospirosis, brucellosis, BVD, anaplasmosis, VSV or coccidioidomycosis (Table 1). Clinical signs of disease were not evident in any of the animals handled. Material for bacterial or viral isolation procedures was not collected. Serologic reactors were found to IBR, BT, and EHD in Barbary sheep and to BT and EHD in mule deer (Table 1).

Titers to IBR in 3 reactor Barbary sheep were 1:4, 1:8, and 1:16, respectively. Titers to BT were 1:10 or less for 4 suspect animals and 1:20 or greater were considered positive for 2 Barbary sheep. All 6 animals were positive reactors by the BT Agar Gel Immunodiffusion test. Two Barbary sheep had titers of 1:20 for EHD by compliment fixation. One animal had a titer of 1:10 indicative of recent exposure to the virus.

In mule deer, 4 animals were suspected of being exposed to BT (titers of 1:10 or less) and 4 deer presented evidence of recent infection (titers of 1:20 or greater). Similarly, in EHD 2 mule deer had titers of 1:10 indicating exposure while 3 remaining reactors had titers of 1:20, 1:40, and 1:80, respectively, indicating recent infection.

All animals collected were mature adults. There were no significant differences in rates of infection between sexes.

DISCUSSION

Of the three diseases detected serologically from wild ruminants in this study, IBR and BT are potential problems for domestic livestock. Of particular interest are the three positive reactor Barbary sheep to IBR. This is apparently the first record of serologic evidence of exposure to IBR in this species. Although mule deer[3] and white-tailed deer[7] have been incriminated as potential infectious reservoirs of IBR, CF antibodies were not detected from mule deer in the present study. Clinical signs of IBR develop after experimental infec-

TABLE 1. Serologic tests on Barbary sheep and mule deer sera from Palo Duro Canyon, Texas.

	Mule Deer				Barbary sheep			
Disease	Neg.	Pos.	Susp.	AC.	Neg.	Pos.	Susp.	AC.
Leptospirosis								
L. pomona	11	0	0	-	12	0	0	-
L. icterohemorrhagiae	11	0	0	-	12	0	0	-
L. canicola	11	0	0	-	12	0	0	-
L. hardjo	11	0	0	-	12	0	0	-
L. grippotyphosa	11	0	0	-	12	0	0	-
Brucellosis	11	0	0	-	12	0	0	-
IBR	5	0	0	6	3	3[3]	0	6
BVD	6	0	0	5	6	0	0	6
Anaplasmosis	11	0	0	0	11	0	0	1
BT	0	3	3	5	1	1	5	5
Coccidioidomycosis	11	0	0	0	12	0	0	0
EHD	1	2[2]	2[1]	6	0	2[4]	1[1]	9
VS	11	0	0	-	12	0	0	-

[1]Titers of 1:10
[2]Titers of 1:20
[3]Titers of 1:4, 1:8 and 1:16, respectively
[4]Titers of 1:10, 1:20 and 1:20, respectively

tions in mule deer,[3] but the effects of this disease in Barbary sheep are unknown.

Serologic evidence of BT has been previously documented from Barbary sheep in New Mexico and mule deer in New Mexico and Wyoming.[14] It has not been previously reported from these hosts in West Texas, but BT is apparently enzootic in white-tailed deer in East Texas.[14] Although BT is pathogenic in white-tailed deer[11,15] and bighorn sheep[10] the clinical manifestations of this disease in Barbary sheep and mule deer are poorly understood.

Of particular interest was the high prevalence of serologic reactors to EHD in both mule deer and Barbary sheep. This is the first record of evidence for antibody titers to EHD in the latter host. Although mule deer occasionally are involved in major outbreaks involving white-tailed deer[2,13] the clinical effects of this disease in other wild ruminants such as the Barbary sheep are poorly known. That the virus can be pathogenic to other wild ruminants aside from deer was evidenced in the Alberta epizootic of 1962 where a small number of pronghorn antelope, *Antilocapra americana,* also succumbed.[2]

Although our sample sizes are small, this study indicates exposure and/or evidence of recent infection with EHD and BT in both mule deer and Barbary sheep from the Palo Duro Canyon in the Texas Panhandle. This suggests a strong possibility of past and probable future epizootics occurring in these populations. Also, the high prevalence of antibody titers to these diseases in both mule deer and Barbary sheep and IBR in Barbary sheep indicate a good potential source of infection for domestic livestock in the area.

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