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Bovine Leptospirosis in Iowa: A Serological Survey

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Bovine leptospirosis is one of the major cattle diseases in the United States causing significant economic losses to the cattle industry. This disease in cattle has been associated with abortion, repeat breeding, still-births, fetal deaths, weak calves, and reduced milk production. In the United States, the disease is caused by infection with one or more of 6 known pathogenic leptospiral serovars: pomona, hardjo, grippotyphosa, canicola, icterohaemorrhagiae, and swajizak.

The purpose of the present report is to summarize the serological data on bovine leptospirosis in Iowa from January 1, 1977, to December 31, 1977, obtained from the Veterinary Diagnostic Laboratory (VDL) at Iowa State University.

Materials and Methods
Source of Serum—Serum samples were obtained from Iowa cattle in herds where leptospirosis was suspected and from animals destined for export to foreign countries. Sera were submitted by veterinarians to VDL most often because an abortion problem of unknown etiology was occurring in cattle on their clients’ farms. Only serum from positive accessions were evaluated in this study. Each accession represented one or more serum from a single herd. An accession was considered positive if at least one serum had a microscopic agglutination (MA) titer of at least 1:100.

Antigens—Five Leptospira interrogans serovars (pomona Pomona, copenhageni M-

20. canicola Hond Utrecht IV, hardjo Hardjoprajitno, and grippotyphosa Andaman) were used to examine the cattle serum. Cultures of each serovar were maintained in bovine albumin polysorbate 80 medium.¹

Serotest Methods—The procedures for conducting the MA test were those described by Cole et al.² The MA titer was expressed as the reciprocal of the highest serum dilution in which at least 50% of the leptospires were agglutinated.

Interpretation of Serologic Results—Only titers ≥ 1:400 were considered to be diagnostically significant and to represent exposure of the animal, vaccinated or nonvaccinated, with one or more of the pathogenic leptospires.

Results
Leptospiral agglutinins at a titer of ≥ 1:400 were detected in 263 (22.5%) of the 1,118 serums from cattle in Iowa. In the herd survey, 53.7% of the herds had one or more animals with agglutinins to at least one of the 5 serovars. One hundred twenty serums (10.7%) from beef cattle had titers of ≥ 1:400 to one or more serovars, while 94 (8.4%) serums from dairy cattle were positive.

Agglutinins to all 5 serovar antigens were found. Agglutinins to hardjo were present in 18.2% of the serums, to canicola in 2.4%, to pomona in 1.5%, to grippotyphosa in 1.3%, and to copenhageni in 0.5% of the serums. Agglutinins to hardjo were present in 25.3% of the serums from beef cattle and 12.5% of the serums from dairy cattle. Sixty (43.2%) beef herds had agglutinins to hardjo while 46 (33.1%) dairy herds had agglutinins to this antigen.

¹Representative serovar for icterohaemorrhagiae serogroup.

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Of the 1,118 serums, 13 (1.2%) had agglutinins at a titer of $\geq 1:400$ to more than one serovar. Ten of the 13 serums were from dairy cattle. Agglutinins to both canicola and copenhageni were the most often observed combination. Sixty-two of the 99 counties had herds with agglutinins ($\geq 1:400$) to the leptospiral serovars. The five counties with the greatest number of herds with diagnostically significant agglutinin titers in descending order were: Allamakee, Clayton, Davis, Delaware, and Jones. Northeastern Iowa had the greatest number of herds with leptospiral agglutinins. Agglutinins to serovar hardjo were predominant. Dairy herds with agglutinins to hardjo were located mainly in eastern Iowa, while beef herds with agglutinins to hardjo were located mainly in the southern two-thirds of the state. Herds with agglutinins to pomona and grippotyphosa were scattered throughout the state, while herds with agglutinins to canicola and copenhageni were restricted to mainly northeastern Iowa.

Discussion

Interpretation of leptospirosis serological test results is difficult and caution should be exercised in drawing conclusions. The widespread use of multi-serovar leptospiral bacterins leads to problems in distinguishing an immune response following vaccination from infection. Serological reactions which are due to cross-reactions by serovars belonging to the same or different serogroups adds to the confusion. Since titers induced by bacterin administration are almost always well below a titer of 1:400, this agglutinin level was useful in the evaluation of the serological data. An agglutinin titer of $\geq 1:400$ was also useful as a means of determining those serological reactions that were probably not due to cross-reactions of serovars belonging to different serogroups (only 13 out of 1,118 serums had titers of $\geq 1:400$ to 2 or more serovars). Establishing a diagnostically significant titer was critical in estimating the number of cattle which had been exposed to the pathogenic leptospires.

The serologic data in our study suggests that bovine leptospirosis may be widespread among the cattle population in Iowa. The lower prevalence of leptospirosis in the northwestern part of the state is probably not real but reflects serums being submitted to another diagnostic laboratory. A moderate number of bovine serums are submitted to the Diagnostic Laboratory, South Dakota State University, by veterinarians in northwestern Iowa.

The high incidence of agglutinins to hardjo observed in this study suggests that infection by the Hebdomadis serogroup (hardjo is a member of this serogroup) is the most significant leptospiral infection of cattle in Iowa. However, the MA test can only provide clues as to the identity of the serovar involved. Determination of the infecting serovar can only be established by isolation and identification of the organism. The limitations and dangers involved when serologic data alone are used to diagnose leptospirosis have been reported. The observation of abortions in Hebdomadis infected herds is consistent with the findings of investigators in other areas of the United States, Canada, Australia, and Scotland.

Transmission of hardjo has been thought to occur primarily by direct contact, as a reservoir in the wildlife population was unknown. However, recently hardjo has been isolated in Argentina from the armadillo which inhabits the grasslands used for raising cattle. The question whether hardjo is present in the wildlife of North America remains open.

For many years, the principal serovar of bovine leptospirosis in the United States was pomona. However, vaccination with pomona bacterins has proven effective in reducing the losses due to serovar pomona. Immunity to renal leptospirosis has been demonstrated experimentally in cattle vaccinated with pomona bacterins. As the present serological study has shown, Iowa cattle are being exposed predominantly to hardjo or other members of the Hebdomadis serogroup. A need exists to demonstrate the efficacy of hardjo bacterins in preventing the subtle but damaging effects of this organism in cattle.

The public health significance of leptospirosis should not be overlooked. Dairy cattle in New Zealand appear to be the chief source of leptospirosis for dairy farmers, especially those working in herringbone milking sheds. Hardjo has also been isolated

from dairy workers in Israel and epidemiological evidence suggested infection was due to contact with cattle. Veterinarians should inform the farmer whose cattle are infected with leptospires of the potential health risks.

References