OCCURRENCE AND GEOGRAPHIC DISTRIBUTION OF Q FEVER ANTIBODIES IN ALABAMA DAIRY CATTLE

W. R. Miller, D.V.M., M.S.

Q FEVER has been reported from at least 35 States and is rapidly increasing both in incidence and distribution. The disease is a public health problem in some areas and is being recognized in others which have been considered free of the disease (*1*). As observed by Luoto (*2*), the status of Q fever in the United States should be determined. It is essential to define the infected areas, the extent of the problem, and the potential for spread of the disease.

The capillary-agglutination test (CAT) developed by Luoto (*3*) is widely used as a means of demonstrating Q fever antibody. The sensitivity and specificity of the test on bovine (*3*) and human (*4*) serums and on bovine milk (*5*) has been established. Its use in screening pooled herd milk samples has been reported by several workers (*5–8*).

The occurrence and distribution of Q fever in Alabama has not previously been determined. Shepard, in a nationwide survey in 1948, tested 55 bovine serum samples from Alabama by the complement fixation test with negative results (*9*). In a survey of herds in the Atlanta milkshed, Starr and Henning (*10*) reported two of two pooled herd milk samples from Alabama were positive to the CAT.

To supply the needed information on the status of Q fever in Alabama, a series of epidemiologic studies has been initiated. This paper reports the findings of the first phase, a statewide survey using the CAT, on pooled herd milk samples submitted to the Alabama State Board of Health during a 2-month period.

Dr. Miller is an assistant professor in the department of bacteriology, Auburn University School of Veterinary Medicine, Auburn, Ala. *This paper is adapted from a thesis which has been approved as publication no. 940 of the Auburn University School of Veterinary Medicine.*

Materials and Methods

Antigen. Antigen for this study was furnished by the Communicable Disease Center, Public Health Service, Atlanta, Ga. It was a suspension of stained *Coxiella burnetii*, prepared by Luoto's method.

Milk samples. Milk samples were obtained periodically from the various branch laboratories of the Alabama State Board of Health (see map). They were composite herd milk samples submitted to the branch laboratories for routine bacteriological procedures. They were shipped, usually by mail, and arrived in our laboratory in various physical states ranging from frozen to complete separation into curd and whey.

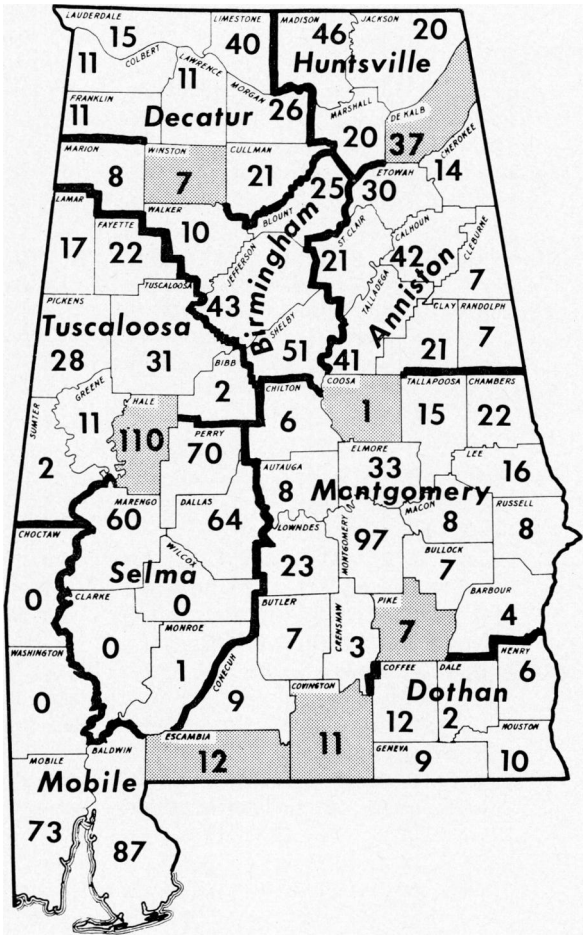
The test procedures were carried out according to the method described by Luoto (*5*). Observations of the tests were made after 2 hours' incubation at 37° C. and again after 24 hours at room temperature. A positive test was considered to be one in which a colored ring, agglomerates, or both were visible at the 2-hour or the 24-hour observation, or both.

Results

The variations encountered in the physical condition of the milk samples as they arrived in our laboratory did not interfere with the performance of the tests. Contrary to the experience of others (*10*), whey was entirely satisfactory for antibody demonstration.

Results of the investigation are summarized

Number of grade A dairies by county and areas served by branch laboratories of the Alabama State Board of Health



NOTE: Shaded areas are served by more than one laboratory.

in the table. Antibodies were demonstrated in a number of milk samples from every laboratory. The average incidence for the entire State was 38.6 percent.

Because of the means used to collect samples, their identification as to county of origin was not practical. For the purposes of this investigation, identification by laboratory name was judged suitable. While there was overlapping of laboratory jurisdiction in some counties, no two laboratories sent samples from the same herd. Also, because of the 2-month time limitation, very few herds are represented by more than one sample from one laboratory.

Included in the samples were a small number from "fringe-area" herds located in areas of States adjacent to Alabama. Thus their samples were tested by the branch laboratories concerned.

Discussion and Conclusion

The results of this investigation serve to demonstrate the presence and statewide distribution of Q fever in Alabama. The high incidence of antibodies found makes it logical to assume that the organism does actually exist in Alabama dairy cattle, for it is unlikely that such a high incidence would result from importation of animals with CAT-positive milk.

In Alabama, dairy cattle are more numerous in the geographic areas served by the Selma, Birmingham, and Montgomery laboratories than in other areas (see chart). This may account for the unusually high occurrence of antibodies in samples from those areas. However, the occurrence of antibodies in the samples from the Mobile laboratory was very close to the average occurrence in samples from the six low areas, yet Mobile and Baldwin Counties have a larger number of dairy cattle than these six areas. Apparently, epidemiologic factors other than density of cattle population are involved.

The results obtained by others (*3–5*, *11*) in comparison studies of the CAT and complement fixation test make possible a valid comparison of the results of this survey with those obtained by Shepard (*9*) in 1948. He tested 1,800 bovine serums from 37 States by the comple-

Results of capillary-agglutination test on milk samples submitted to the branch laboratories of the Alabama State Board of Health

Laboratory	Number samples	Number positive	Percent positive
Anniston	145	49	33. 7
Birmingham	343	152	44. 3
Decatur	89	30	33. 7
Dothan	20	5	25. 0
Huntsville	117	31	26. 4
Mobile	91	27	29. 6
Montgomery	383	157	40. 9
Selma	223	102	45. 7
Tuscaloosa	100	31	31. 0
Total	1, 511	584	[1] 38. 6

[1] Average.

ment fixation test, including 55 samples from Alabama. Of 27 positive samples found, only 2 (from Mississippi) were from the eastern United States, an indication that Q fever may be of comparatively recent origin in Alabama.

The incidence of antibodies found in this survey correlates well with the results obtained by others in surveys using the CAT. Ferris and co-workers (*12*) found a 60 percent occurrence in more than 300 pooled herd milk samples tested in Illinois. Fish and Labzoffsky (*11*) reported a 7 percent occurrence in dairy herds in western Ontario, Canada. Reed and Wentworth (*13*) tested pooled herd milk samples from 2,047 dairy herds in central Ohio and found only 9 positive samples. Starr and Henning (*10*) reported a 12.4 percent occurrence of antibodies in 1,167 samples tested from 85 Georgia counties. An infection rate ranging from 1 to 65 percent in 35 States studied has been reported (*1*).

Luoto (*2*) has demonstrated that 50 percent of serologically positive cows shed *C. burnetii* in their milk and that half of these animals develop chronic udder infections and continue to excrete the organism for up to 2 years. He has also shown that cattle intensively contaminate their environment with the organism at calving time (*14*). These findings indicate that viable rickettsia may be present in a high proportion of dairy herds over the entire State, and thus are a potential source of human infection. Preliminary unpublished results of other studies now in progress, however, reveal no evidence of human infection.

Summary

Antibodies to *Coxiella burnetii* were demonstrated in 584 (38.6 percent) of 1,511 pooled milk samples from Alabama dairy herds. The capillary-tube agglutination test was performed on samples submitted to nine branch laboratories of the State board of health. The test results show that Q fever probably exists among dairy cattle in all sections of the State. With one exception, the areas of greatest dairy cattle density have the highest occurrence of antibodies. The existence of Q fever in Alabama dairy cattle constitutes a potential source of human infection.

REFERENCES

(*1*) Luoto, L.: Report on the nationwide occurrence of Q fever infection in cattle. Public Health Rep 75: 135–140, February 1960.

(*2*) Luoto, L.: The epidemiology of Q fever in the United States. Amer J Public Health 49: 334–338 (1959).

(*3*) Luoto, L.: A capillary agglutination test for bovine Q fever. J Immun 71: 226–231 (1953).

(*4*) Luoto, L.: A capillary-tube test for antibody against *Coxiella burnetii* in human, guinea pig, and sheep sera. J Immun 77: 294–298 (1956).

(*5*) Luoto, L., and Mason, D. M.: An agglutination test for bovine Q fever performed on milk samples. J Immun 74: 221–227 (1955).

(*6*) Stoenner, H. G., et al.: The role of dairy cattle in the epidemiology of Q fever in Idaho. J Infect Dis 109: 90–97 (1961).

(*7*) Tjalma, R. A., and Braun, J. L.: Application of the Luoto capillary agglutination milk test to the study of bovine Q fever. Amer J Public Health 49: 1025–1031 (1959).

(*8*) Weiner, D., Baker, E. F., and Mason, H. C.: Q fever antibodies in dairy cattle and in humans in Washington State. Public Health Rep 76: 257–260, March 1961.

(*9*) Shepard, C. C.: Q fever: A serological survey of bovine serum in the United States. Amer J Trop Med 28: 849–855 (1948).

(*10*) Starr, L. E., and Henning, W. C.: A review of the Q fever problem with particular reference to the present status of the infection in Georgia. *In* Proceedings, 64th annual meeting, U.S. Livestock Sanitary Association, Charleston, W.Va., October 1960, pp. 249–261.

(*11*) Fish, N. A., and Labzoffsky, N. A.: The incidence of Q fever among dairy herds in western Ontario. Canad J Public Health 51: 200–205 (1960).

(*12*) Ferris, D. H., Hanson, L. E., and Brandley, C. A.: Q fever in Illinois—1958–1960. Prevalence of reactors and infections in livestock. J Amer Vet Med Assoc 139: 1111–1115 (1961).

(*13*) Reed, C. F., and Wentworth, B. B.: Q fever studies in Ohio. J Amer Vet Med Assoc 130: 458–461 (1957).

(*14*) Luoto, L., and Huebner, R. J.: Q fever studies in southern California. IX. Isolation of Q fever organisms from parturient placentas of naturally infected dairy cows. Public Health Rep 65: 541–544, Apr. 21, 1950.