Comments on Tularemia and Other Tick-Borne Affections of Livestock in Montana

Cornelius B. Philip, *Ph.D., Sc.D.*
California Academy of Sciences
San Francisco, California 94118

This is an account of the infrequent and poorly documented outbreaks of illnesses in sheep and cattle that can cause serious losses to livestock ranchers in Montana and other Rocky Mountain areas that are initiated by unpredictable cyclic peaks in local wood tick populations. Veterinary supervision is recommended to reduce hazards of spread of illness in a heavily tick-infested herd of pastured or range livestock, particularly during springtime lambing or calving.

Cycles of abundance in western U.S. native populations of Rocky Mountain wood ticks and jack rabbits (e.g., Philip, Bell and Larson, 1955) are well-known but episodes and outbreaks of illness in associated local herds of sheep and cattle in Montana have only sporadically been observed since 1925 when natural infection with *Francisella tularensis* of *Dermacentor andersoni* off sheep was reported in 1925 (see Jellison, 1974).

Illnesses in heavily tick-infested sheep occasionally have been observed by practicing veterinarians and others of the Montana Livestock Sanitary Board, as well as by staff of the Public Health Service Rocky Mountain Laboratory in Hamilton, Montana. One such outbreak among sheep and jack rabbits in 1934 near Ringling, central Montana was reported by Philip, Jellison, and Wilkins (1935). That *F. tularensis* was a prime cause of the epizootic was confirmed serologically and by isolation from tissues and from ticks taken from the animal hosts.

Subsequent to the 1934 epizootic in sheep and jack rabbits on the Ringling Ranch reported above, return to the area during the following tick season in 1935 revealed that the epizootic and peak tick occurrence were continuing, but that cattle on the ranch had now become involved as well.

On 3 June it was noted that 12 of 39 three-month-old Hereford calves were sick though none of a large herd of older animals pasturing with them showed unusual signs of illness. A calf lying some distance from the herd got up and walked slowly with a stiff-legged gait. Diarrhea was evident. A second calf with the herd (also in obvious distress) showed similar signs. When caught to obtain blood samples, each was seen to be heavily infested with adult *D. andersoni,* samples of which were also taken.

On a revisit to the ranch 6 days later, the calves had been corralled for branding, and several were still obviously ill, though no deaths were recorded in the meantime. A blood sample was taken from one showing most evident signs. Another younger calf, which had been missed in the roundup, was found lying along the road about a mile from the corral and was in obvious distress. There was nasal discharge and diarrhea. Rectal temperature was 104.5° F and respiration 90. It was also heavily tick infested.

Later agglutination tests against *F. tularensis* were positive for the first 2 calves but negative for the last 2 probably because they were bled near onset. This was further suggested by the fact that the blood clot from one of these two negative sera when injected into a guinea pig subcutaneously, produced typical infection fatal in 11 days. Gross pathology was characteristic of tularemia and a pure culture of *F. tularensis* was recovered which was agglutinated by anti-tularensis serum. Subtransfer to a fresh guinea pig by spleen vaccination of the scarified skin resulted fatally with characteristic lesions evident at necropsy. Similar tests of the blood clot from the other negative serum (the young calf by the roadside) were negative; however, it was 2 days before the unrefrigerated sample could be tested after being drawn.

A pool of 13 triturated ticks off one of the first 2 calves was injected into 2 guinea pigs subcutaneously and intraperitoneally, respectively. Death occurred in 4 and 3 days and each showed characteristic pin-point necrotic foci in the spleen and liver. The first was transferred to a fresh animal by spleen vaccination which was again fatal in 4 days. The inguinal nodes were enlarged and caseous, the spleen was enlarged 3 times and it and the liver showed numerous fine foci, but attempted culture from heart-blood while moribund failed to produce growth. No further passages were made in the belief that characteristic infection had been demonstrated.

Fatalities among the affected calves were not subsequently reported to us by the owners, and it is likely that all recovered though at one time or another according to report and observation, some of these young calves were desperately ill.

Coincident with this affection of calves, tests of tissues from 4 sheep and one jack rabbit with signs of illness, and of ticks off 2 sheep in addition to those taken by flagging, all provided positive results confirmed by culture.

Another year of high tick density in 1964 was reported by Jellison, Jacobson and Flora (1964) as affecting certain stock ranches in central and eastern Montana. Incidental to a recorded outbreak of tick paralysis on a cattle ranch near

Big Sandy, Montana, blood samples from two sick but not paralyzed Hereford calves provided fully virulent isolates of *F. tularensis* in later laboratory studies, as did tests of ticks off both of these calves.

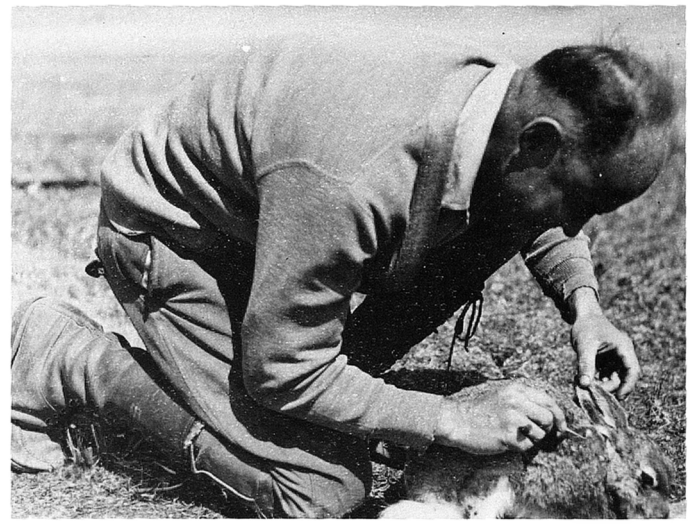
This report is offered to call attention to the fact that at least under conditions of localized tick-borne tularemia epizootic on a stock ranch, it is possible for young cattle to be affected and management with regard to control of tick-infestation may be guided accordingly. Details of tests in laboratory animals are supplied to confirm that the isolates were fully virulent though isolates of low virulence from some other natural sources also have been recognized.

Discussion

While *Francisella tularensis* was the proven cause of illness in Ringling animals and also isolated from their tick parasites, the epizootiological picture was further enhanced by observation of "tick-host anemia" in local black tailed jack rabbits afflicted with overburdens of attached ticks. *Fig. 1* shows a rabbit so weakened by loss of blood from feeding adult ticks, it could not remain on its feet; it was sero-negative vs. *F. tularensis;* haemoglobin count critically low at about 30% as checked in the field with a Tallqvist comparator chart. 152 adult *Dermacentor* tick females were removed in various states of engorgement at one time. Death has been produced in laboratory rabbits infested with as few as 72 paired female ticks (Jellison and Kohls, 1938).

Tick paralysis, another tick-caused affliction in domestic and wild hosts, as well as man, was not diagnosed in the Ringling outbreak but was later reported by Jellison *et al.* in the 1964 episodes on other Montana ranches. Paralysis results from a neurotoxin proliferated by occasional, rapidly engorging female ticks. A single engorging female tick is known to have paralyzed a mature bull in British Columbia.

Figure 1. Weakened jack rabbit examined by the author on the Ringling Ranch (sero-negative vs. the tularemia agent) apparently dying of "tick host anemia" from loss of blood due to massive tick infestation. 152 adult ticks removed, some of which are shown engorging in the neck and shoulder area.



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