1940

Tularemia in Iowa Cottontail Rabbits (Sylvilagus floridanus mearnsi) and in a Dog

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Recommended Citation
Waller, E. F. (1940) "Tularemia in Iowa Cottontail Rabbits (Sylvilagus floridanus mearnsi) and in a Dog," Iowa State University Veterinarian: Vol. 2 : Iss. 2 , Article 5.
Available at: https://lib.dr.iastate.edu/iowastate_veterinarian/vol2/iss2/5

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DURING the past several years numerous studies on population fluctuations for various game animals and birds have been made. The causes of many of these fluctuations are still unknown. During the past four months we have been able to observe a rapid decrease as it occurred in the Iowa cottontail (*Sylvilagus floridanus mearnsi*) and to determine the cause of the same. This work was made possible by the cooperation of G. O. Hendrickson, Ph. D., Assistant Professor in the Zoology Department of Iowa State College. For the past four years Dr. Hendrickson has been engaged in making census studies at regular intervals of the cottontail rabbit in various parts of Iowa. One of these areas under observation was in central southern Iowa. When this area was visited on October 7 and 8, 1939, Dr. Hendrickson observed a number of sick rabbits and a few dead ones. The total number of rabbits observed on this trip to certain areas in Decatur, Wayne, Appanoose and Davis counties showed only a slight decrease over that previously noted. No sick or dead animals were collected on this trip.

On October 21, 1939, the writer accompanied Dr. Hendrickson on his visit to these same areas. At this time approximately as many dead as living rabbits were encountered. Only one sick rabbit was observed and it escaped. All of the dead rabbits found were young ones close to maturity. Live cottontails appeared plentiful on most of the plots but only about 50 per cent as many were encountered as had been found two weeks before. One dead rabbit was collected in Wayne county and two in Davis county. The temperature at 3 p.m., October 22, 1939, was 80°F, and most of the carcasses found were badly decomposed and wholly unfit for laboratory examination. In the Davis county area we found eleven dead and nine live, apparently normal rabbits. No sick ones were observed. This particular area was readily accessible and since more complete records were available on it than on some of the others, we returned there on November 4 and 5 for further observations. This time in walking over the same area we found eight dead and four live rabbits. Only one of these eight dead rabbits had been present the two weeks before. Two of the four live rabbits were sick; one of them was captured and the other escaped. Two of the eight dead rabbits, together with the sick one, were brought to the laboratory.

The specimens collected on these two trips were brought to the laboratory for necropsy. All six of them presented gross lesions in the various internal organs identical to those described by Lillie and Francis, 1936, as being typical of tularemia in the cottontail. Numerous cultures were made from the livers and spleens on cystine agar enriched with two per cent horse serum and one per cent dextrose. After approximately 5 days of incubation some of the cultures began to show isolated colonies growing near the base of the slant. Smears made from these cultures...
revealed an organism having the staining and morphological characteristics of *Pasteurella tularensis*. This organism was agglutinated by the serum of a goat immunized against *P. tularensis*. It was also capable of killing a guinea pig within 72 hours after injection. Such guinea pigs presented areas of focal necrosis in the livers and usually enlarged spleens. This organism was isolated from all three rabbits collected on the second trip. The rabbit from which the organism could not be isolated had been dead for quite some time and decomposition was marked. The sick rabbit was found to be infested with the common rabbit tick (*Haemaphysalis leporis-palustris*) and the rabbit flea (*Cediopsylla simplex*). Six of these ticks and two of the fleas were ground in a mortar, then suspended in sterile broth which was injected into a guinea pig. This guinea pig sickened on the second day and died on the third day following inoculation. Upon necropsy the liver and spleen presented lesions grossly typical to tularemia.

On November 7, 1939, a young male cocker spaniel was entered in the Veterinary Clinic of Iowa State College for treatment. This dog had been sick for about eighteen hours. He was depressed and had a temperature of 105.5°F. On November 5 he had caught a young cottontail and had eaten part of the carcass. The remainder of the carcass was brought to the laboratory at the same time the dog was submitted to the clinic. The dog was given 20 c.c. of anti-canine distemper serum and placed in isolation. The liver of the rabbit showed numerous areas of focal necrosis. The spleen was enlarged. A portion of the liver was ground in sterile physiological saline solution and injected into a guinea pig. Blood was drawn from the dog about six hours after it was entered at the clinic. Two c.c. of this was injected intraperitoneally into each of two guinea pigs. One was found dead a few hours later and the other died the night of the ninth day following the injection. This second guinea pig had a markedly enlarged spleen and numerous areas of focal necrosis in the liver. The guinea pig inoculated with the rabbit liver and spleen died after about sixty hours and *P. tularensis* was isolated from its swollen liver and spleen. Some of the dog’s blood was used in making a microscopic agglutination test with a live antigen prepared from 48 hour old cultures of *P. tularensis*. The reaction was negative. The dog was discharged from the hospital November 13 after having made an uneventful recovery. At the time it was discharged another sample of blood was collected and when it was subjected to the microscopic agglutination test was found to be positive. The same sample was then tested by the tube method and after 48 hours was positive in a dilution of 1/100. Blood drawn from another apparently normal dog of about the same age and of the same breed was negative at the same time against both antigens. Serum from these two dogs gave negative results to a tube agglutination test with Brucella antigen.

In a paper entitled “Sources of Infection and Seasonal Incidence of Tularemia in Man,” Francis, 1937, makes the following statement in regard to the cottontail rabbit, jack rabbit and snowshoe hare: “These animals are the direct cause of over 90 per cent of human cases in the United States. It is estimated that about one per cent of them are naturally infected. The disease is a bacteremia among them and is spread from rabbit to rabbit principally by the rabbit tick, *Haemaphysalis leporis-palustris*, but also by other blood sucking arthropods—ticks, lice and fleas.”

Matheson, 1932, states that the entire life cycle of *Haemaphysalis leporis-palustris* can be completed in less than three months and that all stages of the tick are found on the rabbit throughout the year. In the period beginning November 1, 1938, and ending May 1, 1939, Morgan and Waller examined 210 Iowa cottontails and did not encounter this tick until April, 1939. They did, however, collect three species of Siphonaptera; *Cediopsylla simplex*, *Hoplopsyllus affinis* and *Ctenocephalides canis* throughout the period.

(Continued on Page 73)
TULAREMIA—
(Continued from Page 55)

Francis states that the rabbit tick, the rabbit louse and the rabbit flea do not bite man. However, Riley and Johannsen, 1932, in their text book "Medical Entomology" list the fleas belonging to the genera Hoplopsyllus and Ctenocephalides as fleas noxious to man. Fleas belonging to these two genera may prove capable of transmitting tularemia to man from infected cottontails.

I wish to acknowledge the assistance of Irving Fox, Ph. D., of the Zoology Department of Iowa State College for identifying the fleas encountered and the assistance of Allen Packer in conducting the agglutination tests.

SUMMARY

1. A definite rapid decrease in the cottontail rabbit population in sections of central southern Iowa has been observed.
2. This decrease has been shown to have been caused by tularemia.
3. Pasteurella tularensis was isolated from a dog following natural infection.
4. Pasteurella tularensis was recovered from ticks (Haemaphysalis leporis-palustris) and fleas (Cediopsylla simplex) collected from a sick rabbit.
5. Other species of fleas (Hoplopsyllus affinis) and (Ctenocephalides canis) capable of attacking man have been collected from Iowa cottontails.

Bibliography