UNSUCCESSFUL ATTEMPTS TO ESTABLISH CATTLE *Babesia* INFECTIONS IN WHITE-TAILED DEER

K. L. KUTTLER*, O. H. GRA'''M**, S. R. JOHNSON*, and J. L. TREVINO**

* Institute of Tropical Veterinary Medicine, Texas A&M University, College Station, Texas 77843.

** Entomology Research Division, A.R.S., U.S.D.A., Kerrville, Texas 78028.

Abstract: Attempts to induce a demonstrable cattle *Babesia* infection by feeding known infected ticks on two white-tailed *(Odocoileus virginianus)* deer were unsuccessful. The injection of known *Babesia* carrier blood into an intact and a splenectomized deer failed to result in evidence of infection.

All deer were checked for possible sub-patent infections by inoculating their blood into splenectomized calves at weekly intervals for 5 weeks following exposure, but no infections were produced in the calves.

Babsia infected ticks having undergone one generation on deer were unable to transmit infection to splenectomized calves on the succeeding generation.

Cattle babesiosis, while no longer occurring in the United States, is a major disease problem in many tropical and sub-tropical areas of the world. This disease is usually associated with one or more ticks of the genus *Boophilus*. The eradication of these ticks from the U.S. was accompanied by the elimination of bovine babesiosis. Both *B. annulatus* and bovine *Babesia* are known to occur in Mexico adjacent to the U.S. border. Because of the proximity of both vector and disease agent to the U.S., intensive surveillance and strict import regulations including the use of acaricides on all animals being moved across the border are mandatory. The regulation of wildlife movement is, however, impractical and at present almost impossible. White-tailed deer are a recognized host for *B. annulatus*.[1] In recent years *B. annulatus* adults have been recovered from white-tailed deer in Texas as much as 64 kilometers north of the Mexican border,* emphasizing the possibilities of tick re-introduction by this means.

Spindler, *et al.*[4] in 1958 reported finding a *Babesia* like organism in blood films of white-tailed deer which was morphologically similar to *B. bigemina*. In 1968 Emerson and Wright[2] reported the isolation of *Babesia cervi* in deer from East Texas. This *Babesia* was morphologically similar to *B. divergens*, but could not be propagated in calves, and appeared host specific for deer.

Callow[3] has reported transmission of *B. bigemina* to sheep and goats by *B. microplus* and the re-infection of B. *microplus* with *B. bigemina* from these non-bovine hosts. This finding suggests the possibility that deer carrying *B. annulatus* and moving across quarantine lines might, in addition to the tick, be carrying a cattle *Babesia*, which could prove highly pathogenic for U.S. cattle,

This research was done at a field laboratory operated by the United States Department of Agriculture in Nuevo Laredo, Tamaulipas, Mexico and was made possible by a grant from the U.S. Agency for International Development to the Institute of Tropical Veterinary Medicine, Texas A&M University.

* Personal Comm.. ications: W. J. Turner, Animal Health Division, Laredo, Texas, O. H. Graham, Entomology Research Division, Kerrville, Texas, and M. A. Price, Texas A&M University, College Station, Texas.

This paper was presented at the Annual Conference of the Wildlife Disease Association, Colorado State University, Fort Collins, Colorado, U.S.A., August 25-27, 1971.

and re-establish both disease and vector in the southern U.S. In addition to the obvious economic considerations for the livestock industry, it is probable that considerable ill will toward the maintenance of wildlife populations in these border areas would ensue.

This study was undertaken to determine the ability of the cattle *Babesia*, occurring in Mexico, to infect deer by placing infected *B. annulatus* larvae on them and allowing them to feed and by needle transfer of infected blood. In addition, trials were conducted to determine the ability of infected ticks to transmit babesiosis to cattle after one generation on deer.

MATERIALS AND METHODS

In trial 1, deer 471 (figure 1) and splenectomized calf 187 were each infested on day 0 with 1 g of *B. annulatus* larvae (1 g = 20,000 eggs) from a common pool that had been obtained from engorged females that had fed on a *Babesia* infected calf native to Mexico. Blood samples were taken from each animal at weekly intervals beginning 2 weeks before tick infestation and continuing for at least 9 weeks after, except where death intervened. On days 7, 14, 21, 28, and 35, 10 ml of blood from deer 471 was collected in 0.5 ml of 12% sodium citrate and injected subcutaneously (s/c) into a susceptible splenectomized calf to check for evidence of a non-apparent latent or transient parasitemia. Blood samples from this calf were examined weekly for evidence of babesiosis. A large number of engorged females were harvested from deer 471 and allowed to oviposit. The resulting larvae were pooled, and 1 g placed on a susceptible splenectomized calf.

In trial 2, deer 124 (figure 2) and splenectomized calf 237 were each infested on day 0 with 2 g of *B. annulatus* larvae collected from a common pool, having been recovered from engorged females that had fed on a *Babesia* infected calf native to Mexico. Blood samples were taken at weekly intervals as described for trial 1. On days 7, 14, 21, 28, 35, and 42, 10 ml of blood from deer 124 was injected s/c into a susceptible splenectomized calf to check for evidence of latent *Babesia* infection. Weekly blood samples, from this calf, were examined for evidence of *Babesia*. A large number of engorged females were harvested from deer 124 and allowed to oviposit. The resulting larvae were pooled and when ready to feed, 2 g were placed on a susceptible splenectomized calf.

In trial 3, deer 475 and splenectomized calf 177 were each inoculated s/c on day 0 with 10 ml whole blood collected from a *Babesia* carrier calf. On days 7, 14, 21, 28, and 35, 10 ml of blood from deer 475 was injected into a *Babesia* susceptible splenectomized calf. On day 58, deer 475 was splenectomized.

In trial 4, 28 days after splenectomy, deer 475 and splenectomized calf 179 were each inoculated s/c with 10 ml whole blood collected from a *Babesia* carrier calf. On days 7, 14, 21, 28, 10 ml of blood from deer 475 was injected into a *Babesia* susceptible, splenectomized calf.

During all experiments blood samples were collected at weekly intervals, and daily observations made for signs of illness. Packed cell volume (PCV) determinations and Giemsa-stained blood smears were examined for evidence of *Babesia* infection. Rectal temperatures were taken of all calves exhibiting signs of clinical illness.

Babesiosis, as indicated in the results, was diagnosed on the basis of a *Babesia* parasitemia associated with a temperature rise, anemia, and hemoglobinuria. The babesiosis encountered in Mexican cattle used in these experiments appeared to be a mixed infection of *B. bigemina* and *B. argentina*.

RESULTS

Calf 187 (figure 1) died of acute babesiosis 16 days after being exposed to *B. annulatus* larvae. Larvae from the same source failed to produce evidence of *Babesia* infection in deer 471. A susceptible splenectomized calf failed to show evidence of *Babesia* infection after having

been inoculated with blood from deer 471; 7, 14, 21, 28, and 35 days after tick release. A second generation of larvae from deer 471 attached and readily fed on a splenectomized calf but failed to transmit a *Babesia* infection.

Calf 237 (figure 2) died of acute babesiosis 13 days after being exposed to 2 g of *B. annulatus* larvae. Larvae from the same source failed to produce evidence of *Babesia* infection in deer 124. A splenectomized calf failed to show

Figure 1
Deer 471

Attempted Tick Transmission Of Babesia

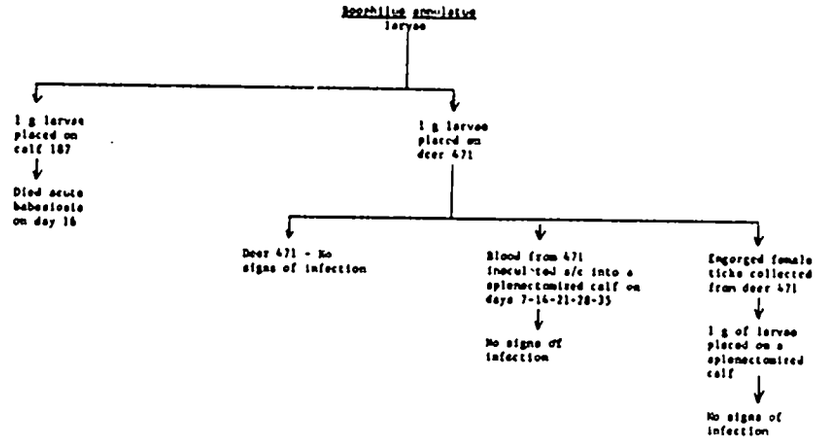
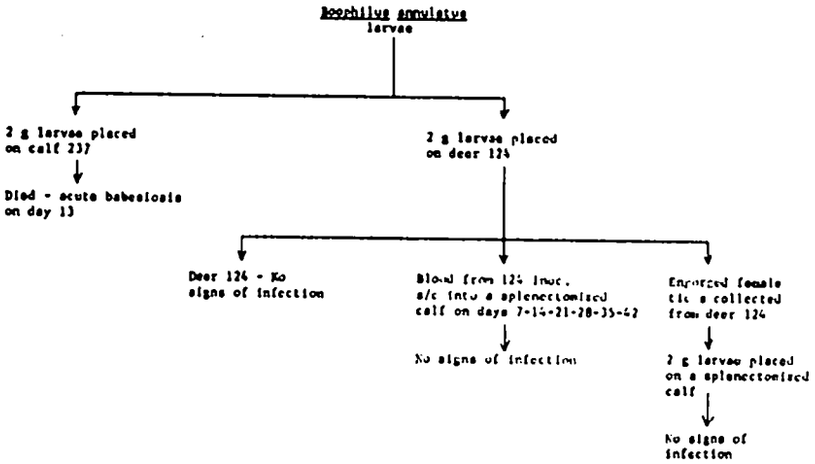


Figure 2
Deer 124

Attempted Tick Transmission of Babesia



evidence of *Babesia* infection after having been inoculated with blood from deer 124; 7, 14, 21, 28, 35, and 42 days after tick release. A second generation of larvae from deer 124 attached and readily fed on a splenectomized calf but failed to transmit *Babesia* infection.

Calf 177 died of acute babesiosis on day 9 after having been injected s/c with 10 ml of blood from a carrier calf. Deer 475 after receiving a similar exposure failed to develop signs of *Babesia* infection. Attemps to recover *Babesia* from deer 475 by sub-inoculations into a splenectomized calf on days 7, 14, 21, 28, and 35 were negative. There was no evidence of a developing infection after the splenectomy of deer 475.

Calf 179 died of acute babesiosis on day 12 after having been injected s/c with 10 ml of blood from a carrier calf. Splenectomized deer 475 after receiving a similar exposure failed to develop signs of *Babesia* infection. Attempts to recover *Babesia* from deer 475 by sub-inoculations into a splenectomized calf on days 7, 14, 21, and 28 were negative.

DISCUSSION AND CONCLUSIONS

It would be premature to state that white-tailed deer cannot be infected with cattle *Babesia*, but these experiments clearly indicate that deer do not develop a persistent detectable, parasitemia following exposure to known infected ticks or by the inoculation of known infected blood from sources available to us. Ticks carrying *Babesia* were in both instances unable to transmit *Babesia* infection after having undergone a life cycle on white-tailed deer.

If the pattern of *Babesia* transmission observed in these experiments also occurs under natural conditions, it can be expected that ticks dropping off white-tailed deer are no longer capable of transmitting babesiosis. This does not mean that tick infested deer crossing the border are not capable of re-introducing *B. annulatus* into the border areas, but perhaps in so doing they do not re-introduce babesiosis. Subsequent tick generations in contact with *Babesia* carrier cattle, whether in the U.S. or Mexico, could be expected to become infected and hence transmit the disease.

LITERATURE CITED

1. ANON. 1965. Manual on Livestock Ticks for Animal Disease Eradication Division Personnel, U.S. Dept. of Ag., ARS 91-49.
2. CALLOW, L. L. 1965. *Babesia bigemina* in ticks grown on non-bovine hosts and its transmission to these hosts. Parasit. 55: 375-381.
3. EMERSON, H. R., and W. T. WRIGHT. 1968. The isolation of a *Babesia* in white-tailed deer. Bull. Wildlife Disease Assoc. 4: 142-143.
4. SPINDLER, L. A., R. W. ALLEN, L. S. DIAMOND, and J. C. LOTZE. 1958. *Babesia* in a white-tailed deer. J. of Prot. 5 Supp.: 8.

Received for publication September 7, 1971