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APPARENT FAILURE OF *BOOPHILUS ANNULATUS* TO TRANSMIT ANAPLASMOSIS TO WHITE-TAILED DEER (*ODOCOILEUS VIRGINIANUS*)

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ABSTRACT: Transovarial transmission of anaplasmosis occurred when two splenectomized calves were infested with unfed larvae of *Boophilus annulatus* but no evidence of infection was detected in 2 intact white-tailed deer after they were infested with other larvae of common origin. All attempts to isolate *Anaplasma marginale* from the 2 deer by transfer of blood into splenectomized calves were unsuccessful.

Boophilus annulatus (Say), at the beginning of the century, was widely distributed throughout the southern United States and was of tremendous economic importance because of its role in the transmission of bovine babesiosis. This tick, now essentially eradicated from the United States, is occasionally observed in areas adjacent to the Mexican border. It is suspected that these infestations are the result of introduction on clandestine or stray cattle and other livestock from Mexico where *B. annulatus* is still abundant (Anon., 1965). In addition, other recognized hosts for *B. annulatus* such as white-tailed deer could become a source of tick introduction if they moved into the U. S. from Mexico (Anon., 1965).

Along with other species of *Boophilus*, *B. annulatus* is recognized as a vector of bovine babesiosis, but in addition it has been reported to transmit anaplasmosis (Rees, 1950). The possibility of *Boophilus* transmitting anaplasmosis to deer, which in turn could serve as a reservoir of infection to cattle, is a subject of concern, especially since both vector and disease occur in Texas adjacent to the Rio Grande River.

MATERIALS AND METHODS

A partially engorged *B. annulatus* female was recovered 12 December, 1968 from a deer in Dimmit County, Texas, and was used to establish a laboratory strain designated SpD_2. Unfed F_1 larvae were placed on an intact calf (414) of Mexican origin and 31 engorged female ticks were recovered. The eggs were pooled and 500 mg were placed in each of several cotton-stoppered glass vials.

Two splenectomized, male Holstein calves, identified as 480 and 185, were each infested with approximately 20,000 F_2 larvae on day 0. Calves were approximately 3 months of age when splenectomized and were observed for a minimum of 4 weeks after splenectomy and before tick infestation. During this time no evidence of infection with *Anaplasma marginale* was detected in either calf. Four *A. marginale*-susceptible, splenectomized male Holstein calves were housed in adjacent stalls and were observed for the duration of the experiment for evidence of accidental transmission of anaplasmosis.

Each of 2 white-tailed deer (*Odocoileus virginianus*) of Mexican origin, 471 and 475, approximately 1 year of age, were also infested on day 0 with approximately 20,000 larvae of comparable age from the same pool that was used to infest calves. No evidence of *A. marginale* infection was detected in either deer prior to tick infestation, as determined by the CF test, stained blood smears, and by blood inoculation into susceptible splenectomized calves.

Weekly blood samples were taken from all animals at least 4 weeks prior to and 4 months after tick infestation, except where death intervened. Giemsa-stained blood smears, packed cell volume (PCV), and the complement-fixation test (Anon., 1958) (CF) for anaplasmosis were performed on all blood samples.

After tick infestation deer 475 and 471 were periodically checked for an *A. marginale* parasitemia. A subcutaneous injection of 10 ml citrated blood from deer (475) was made into a splenectomized calf of Texas origin 7, 14, 21, 42, 70, and 161 days after release of the larvae. The same procedure was used on deer 471 with blood transfers being made 7, 14, 21, 42, 70, 84, and 98 days after release.

These 2 splenectomized calves were observed at weekly intervals for a minimum of 3 months following the last inoculation of deer blood for evidence of anaplasmosis infection. Giemsa-stained blood smears, PCV, and CF test were completed on all samples.

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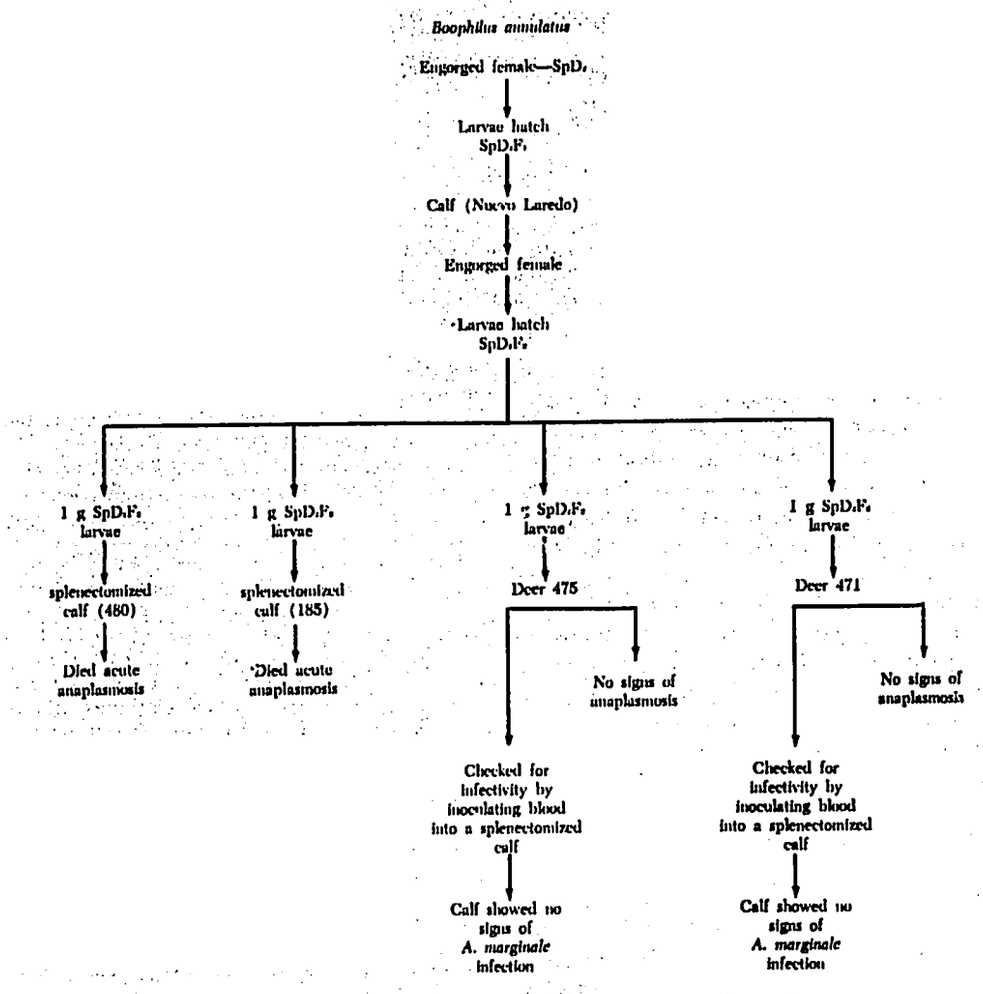

FIGURE 1. Schematic diagram of tick infestation and host response. See text.

RESULTS

A schematic diagram of tick infestation and host response is presented in Figure 1. Calves 480 and 185 died of acute anaplasmosis 65 days after *B. annulatus* larvae were released. Calf 480 developed a positive CF response on day 56, an *A. marginale* parasitemia of 64% on day 63 with PCV of 13%, and died on day 65. Calf 185 had a positive CF response on day 61, at the same time showing a 49% *A. marginale* parasitemia and a PCV of 24%. Death occurred 4 days later. The four splenectomized control calves not infested with ticks did not develop evidence of anaplasmosis during the course of these experiments, as measured by the CF test, parasitemia, and PCV.

Deer 471 and 475 were exposed to the same number of larvae from the same source but failed to show evidence of anaplasmosis in either blood smears or CF tests. Deer 471 was confined in a small wire enclosure during the feeding period and a large number of engorged females were recovered. Deer 475 would not submit to restraint and no engorged females were recovered. Engorged nymphs and a few small adults were observed on deer 475 so it is known that the ticks fed on this animal for 15 to 20 days before being dislodged.

Splenectomized calves receiving blood from deer 471 and 475 failed to show evidence of *A. marginale* infection.

DISCUSSION AND CONCLUSIONS

Much of the research on anaplasmosis in deer has been done using the Colombian black-tailed deer (*Odocoileus hemionus columbianus*) (Boynton and Woods, 1933; Christensen et al., 1958, 1960; Osebold et al., 1962). The susceptibility of this species to anaplasmosis is well documented; in addition the black-tailed deer has been incriminated as a carrier and reservoir of infection that can be transmitted to cattle by naturally occurring vectors (Osebold et al., 1962). The occurrence of anaplasmosis in white-tailed deer has been reported (Roberts and Landcaster, 1963) but less frequently. Kuttler et al. (1967, 1968) induced anaplasmosis infections in both intact and splenectomized white-tailed deer. Moderate parasitemias, CF response, and drops in PCV were described in splenectomized deer, but infections in intact deer were very mild.

In these trials two intact white-tailed deer failed to develop evidence of anaplasmosis after exposure to *B. annulatus* larvae, known to be harboring *A. marginale*, and were apparently free of subclinical infection as determined by blood inoculation into splenectomized calves. Although not conclusive, these results suggest that white-tailed deer, even though they can be infected by blood passage, have sufficient natural resistance to prevent infection by infective *B. annulatus* larvae. These tests indicate that it is unlikely that white-tailed deer would serve as important reservoirs of *A. marginale* in areas in which *B. annulatus* was the only vector.

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