COMPARATIVE INFECTION RATES OF *THEILERIA PARVA LAWRENCEI* IN SALIVARY GLANDS OF *RHIPICEPHALUS APPENDICULATUS* AND *RHIPICEPHALUS ZAMBEZIENSIS*

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ABSTRACT


Three cattle, which had been experimentally infected with *Theileria parva lawrencei* and maintained as carriers of the infection, were each infested simultaneously with clean nymphal *Rhipicephalus appendiculatus* and *Rhipicephalus zambeziensis* in ear bags on separate ears. After moulting, the ensuing adult ticks were fed on rabbits for 4 days and their salivary glands were examined for infective stages of the parasite. Microscopic examination revealed significantly higher infection rates in the salivary glands of *R. zambeziensis* than in *R. appendiculatus* which may indicate an increased vector efficiency of *R. zambeziensis* for *T. p. lawrencei*.

INTRODUCTION

Corridor disease, caused by *Theileria parva lawrencei*, is transmitted from buffalo (*Syncerus caffer*) to cattle by *Rhipicephalus appendiculatus* (Neitz, 1955). In the Republic of South Africa (RSA) it is a controlled disease and is endemic to the Kruger National Park and some of the Zululand game reserves (Potgieter, Stoltzs, Blouin & Roos, 1988). Sporadic outbreaks occur on farms bordering on, or in close proximity to, these endemic areas and have thus far always been associated with the presence of buffalo (Bigalke, De Vas & Barrowman, 1976).

De Vos (1981) indicated that *R. appendiculatus* was still considered to be the only known tick species capable of transmitting Corridor disease. *Rhipe­cephalus zambeziensis* was described by Walker, Norval & Corwin (1981) as a new tick species from eastern and southern Africa, including the RSA, which closely resembled *R. appendiculatus*. *R. zambeziensis* is generally found in hotter, drier areas than *R. appendiculatus* and the 2 species have often been confused in the past (Norval, Walker & Colborne, 1982). In the RSA, the distribution of *R. zambeziensis* has not been extensively surveyed but it has reportedly occurred on game species in the Kruger National Park (Horak, Potgieter, Walker, De Vos & Boomker, 1983). It is likely that this species is more widely distributed than present data indicate.

Lawrence, Norval & Uilenberg (1983) demonstrated that *R. zambeziensis* was an experimental vector of *T. p. lawrencei* and that infection rates in salivary glands were high. They also suggested that in certain parts of Zimbabwe *R. zambeziensis* may be the only vector of *T. p. lawrencei*. In similar trials, a South African strain of *R. zambeziensis* has been successfully used in the transmission of *T. p. lawrencei* between cattle (Potgieter et al., 1988) and infection rates in ticks were also found to be high. Since infection rates in *R. appendiculatus* fed on cattle are generally low (Young & Purnell, 1973), a comparison of the infection rates in the 2 tick species was conducted, using 3 *T. p. lawrencei* carrier cattle. This report presents the results of those trials.

MATERIALS AND METHODS

Three cattle (*Bos taurus* and *Bos indicus* crosses), reared under tick-free conditions at the Veterinary Research Institute, were infected with the Hluhluwe 3 isolate (De Vos, 1982) of *T. p. lawrencei*. Details of the infection of individual animals are given in Table 1.

Ticks were reared and fed according to the methods of Neitz, Boughton & Walters, 1971. Each of the animals was infested with 300 nymphal *R. appendiculatus* (Rietvlei cross) (De Vos & Roos, 1981) on 1 ear and 300 *R. zambeziensis* (Kilikenney) (Potgieter et al., 1988) on the other ear. Engorged nymphae were collected and allowed to moult in an acaridarium at 25°C and 85% relative humidity.

At approximately 6 weeks post-moult ing, 150 of the ensuing adults of each species from each feeding were fed on rabbits. At 4 days post-infestation the ticks were removed. Each tick was placed into a drop of RPMI 1640 medium1 and its dorsal exoskeleton was cut away. The salivary glands of individual ticks were dissected out and teased onto glass slides. The glands were fixed in Carnoy’s fixative, stained with methyl green/pyronin (Irvin, Boarer, Dobbe laere, Mahan, Masake & Ocamá, 1981) and examined with a light microscope for infective stages of *T. p. lawrencei*.

RESULTS

Despite the relatively small numbers of ticks recovered and examined (refer to Table 2), it was clear that significantly higher infection rates were obtained with *R. zambeziensis* ticks which fed as nymphae on Animals 9512–9 and 9418–5 (Table 2). The mean number of infected acini per infected tick was also higher in *R. zambeziensis* than in *R. appendiculatus*. No infective stages could be found in any of the ticks fed as nymphae on Animal 9666–0. This result was not surprising, since piroplasms could not be demonstrated microscopically in blood smears of the animal examined during this period. Subinoculation of blood from Animal 9666–0 to a splenectomized ox did, however, result in a patent parasitemia in the latter animal, thus confirming the carrier status.

DISCUSSION

Chemotherapeutic treatment of cattle involved in Corridor disease outbreaks is not recommended, as this may result in the creation of carrier animals.

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COMPARATIVE INFECTION RATES OF THEILERIA PARVA LAWRENCEI IN SALIVARY GLANDS

TABLE 1 History of the infection of experimental cattle with Theileria parva lawrencei prior to tick feeding

<table>
<thead>
<tr>
<th>Animal No.</th>
<th>Method of infection</th>
<th>Chemotherapy</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>9512-9 (S)</td>
<td>Transmission with adult R. appendiculatus</td>
<td>Parvaquone¹ 10 mg/kg IM on days 11. 13, 26, 28 and 30 p.t.</td>
<td>Patent piroplasm parasitaemia 130 days p.t. 1/1000 rbc**</td>
</tr>
<tr>
<td>9660-0</td>
<td>Transmission with adult R. appendiculatus</td>
<td>Parvaquone¹ 5 mg/kg IM at 24 months p.t.* (5 treatments at days 0, 2, 4, 7 and 10)</td>
<td>Temporary disappearance of patent parasitaemia. Piroplasms reappeared 150 days p.t. &lt; 1/1000 rbc**</td>
</tr>
<tr>
<td>9418-5 (S)</td>
<td>Subinoculation of blood from a carrier ox*</td>
<td>No treatment required</td>
<td>Piroplasm parasitaemia 1/3000 rbc***</td>
</tr>
</tbody>
</table>

¹ Clexon, Coopers Animal Health Ltd, England
² BW 720C, Coopers Animal Health Ltd, England

TABLE 2 Comparative infection rates of Theileria parva lawrencei in the salivary glands of Rhipicephalus appendiculatus and Rhipicephalus zambeziensis fed on carrier cattle

<table>
<thead>
<tr>
<th>Tick species</th>
<th>Animal No.</th>
<th>Adult ticks fed on rabbits</th>
<th>Mean No. of infected acini per infected tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. appendiculatus</td>
<td>9512-9</td>
<td>0/35</td>
<td>—</td>
</tr>
<tr>
<td>R. appendiculatus</td>
<td>9512-9*</td>
<td>0/25</td>
<td>—</td>
</tr>
<tr>
<td>R. appendiculatus</td>
<td>9418-5</td>
<td>4/72</td>
<td>5</td>
</tr>
<tr>
<td>R. appendiculatus</td>
<td>9666-0</td>
<td>0/60</td>
<td>—</td>
</tr>
<tr>
<td>R. zambeziensis</td>
<td>9512-9</td>
<td>31/62</td>
<td>17/8</td>
</tr>
<tr>
<td>R. zambeziensis</td>
<td>9512-9*</td>
<td>3/28</td>
<td>7</td>
</tr>
<tr>
<td>R. zambeziensis</td>
<td>9418-5</td>
<td>40/43</td>
<td>93</td>
</tr>
<tr>
<td>R. zambeziensis</td>
<td>9666-0</td>
<td>0/57</td>
<td>—</td>
</tr>
</tbody>
</table>

* Second tick feeding 4 months after treatment with buparvaquone

(Potgieter, Roos & De Vos, 1985). When such methods are used to establish experimental T. p. lawrencei infections in cattle, piroplasm parasitaemias are usually very low. Infection rates in R. appendiculatus fed on these carriers are also low. The initial results presented here suggest that R. zambeziensis may be more efficient in picking up low level infections of at least certain isolates of T. p. lawrencei than R. appendiculatus. Higher yields of tick-derived parasite material for serological and immunological studies have thus been obtained by feeding R. zambeziensis on experimental carrier animals, but only when using animals with microscopically detectable parasitaemias.

The role that R. zambeziensis plays in the epidemiology of Corridor disease in the RSA can only be evaluated after further information on its distribution and abundance is obtained. It has been noted in Zimbabwe that, in the absence of tick control, R. zambeziensis appears to maintain lower levels of abundance than R. appendiculatus (Norval et al., 1982). The primary concern is that a more efficient vector might enhance the transmission of T. p. lawrencei between cattle and increase the possibility of the parasite changing its behaviour to that of T. p. parva as reported by Barnett & Brocklesy (1966) and Young & Purnell (1973). This phenomenon has thus far not been observed in the RSA in field or laboratory observations despite the fact that R. zambeziensis has probably existed in endemic areas for many years.

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REFERENCES


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