ABSTRACT


The potential of the ixodid tick, Rhipicephalus zambeziensis, was investigated as a vector in the transstadial transmission of the foot-and-mouth disease virus by feeding nymphae on viraemic (log_{10}1-4 TCID_{50}/mL) cattle. Suspensions were prepared, at various intervals after detachment, from pools of engorged nymphae—some of which were allowed to moult first. Suspensions were inoculated into sucking mice, cell cultures and, in some cases, cattle to detect the FMD virus. Newly moulted adult ticks, derived from nymphae which had fed on viraemic cattle, were also allowed to feed on susceptible cattle. The pattern of virus detection indicated that the FMD virus was capable of surviving at least 3 d in engorged nymphae, but less than 7 d following repletion. It was concluded that R. zambeziensis is unlikely to transmit the FMD virus.

A rich variety and abundance of arthropods occur in the Kruger National Park (KNP) in South Africa where foot-and-mouth disease (FMD) is enzootic, but there is little evidence to suggest that arthropods are important in the epidemiology of the disease (Bachrach 1968; Greenberg 1973; Thomson, Doube, Braack, Gainaru & Bengis 1988). Nevertheless, the FMD virus is able to persist up to 48 h in infected arthropods and there are reports of transmission of the virus, amongst others, by Rhipicephalus and Hyalomma spp., so the possibility of tick-borne transmission of the FMD virus remains (Hyslop 1970).

African buffalo, Syncerus caffer, the only known free-living maintenance hosts for the SAT types of FMD virus (Hedger, 1976; Thomson & Bengis 1990, unpublished observations), have been shown to be important hosts of ixodid ticks and at least 5 sp. of Rhipicephalus have been identified on buffalo (Horak, Potgieter, Walker, De Vos & Boomker 1983). Experimental infection of buffalo with SAT-1 or SAT-2 virus resulted in the development of viraemias which persisted up to 4 d and reached levels of 10^{5.2} MLD_{50}/mL. These levels and duration of viraemia are very similar to those obtained in cattle inoculated with the same virus strains (Gainaru, Thomson, Bengis, Esterhuysen, Bruce & Pini 1986).

In order to investigate the possible role of ixodid ticks in the epidemiology of FMD in the KNP and to develop a strategy for conducting biologically safe research on Theileria parva lawrencei (the causative agent of Corridor disease, obtained from R. zambeziensis collected in the KNP) an experiment was devised to establish the duration that the FMD virus, ingested by these ticks, survives in ticks and whether transstadial transmission is possible.

Ticks infected with FMD virus were obtained as follows. Three healthy steers, housed in a high...
Transmission of foot-and-mouth disease virus

TABLE 1  Virus recovery from R. zambezieni s nymphae and adults fed on viraemic cattle

<table>
<thead>
<tr>
<th>Animal No.</th>
<th>Detection system</th>
<th>Days after virus inoculation</th>
<th>Number of days after tick infestation</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
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<td></td>
<td>CC</td>
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<tr>
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<td></td>
<td>CC</td>
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<td>6</td>
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<tr>
<td></td>
<td>CC</td>
<td>3.2</td>
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</tbody>
</table>

**Detection system**

- **M** — sucking mice
- **CC** — cell culture (IB-RS-2)

**Log titre (log MLD_{50} or TCID_{50} per tick)**

**NT** — number of ticks tested

**NA** — not applicable

**ND** — not done

+ — virus recovered but not titrated

Day 6 and a further 10 ml of the suspension administered intramuscularly in each animal in divided doses. Typical FMD lesions were observed in both animals 48 h later and the SAT-1 virus was recovered from lesion material collected from both cattle.

A suspension was prepared from 50 engorged nymphae 7 d after infestation and titrated in sucking mice and IB-RS-2 cells. Virus titres of 10^{1.7} MLD_{50} and 10^{1.0} TCID_{50} were obtained. This procedure was repeated on Days 11 and 13 after infestation, but no virus could be detected in either group of ticks (Table 2).

A pool of engorged nymphae was maintained in the acaridium for a period of 30 d, during which time they moulted. Two hundred of these newly moulted adults ticks were used to prepare at 10% suspension as previously described. Two cattle were inoculated intradermally in 2 sites with 0.2 ml of this suspension with an additional 10 ml injected subcutaneously into each animal. Daily clinical examination of the cattle over a 2-week period showed no evidence of FMD infection, nor could a serological response to SAT-1 virus be detected 3 weeks later.

Finally, newly moulted adult ticks were assessed for their ability to transmit FMD to cattle 30 d after detachment by placing 100 newly moulted individuals into each of 2 ear bags which were attached to the ears of 2 cattle. Most of these adult ticks had fed

**FIG. 1** Flow diagram depicting the sequence of events in this investigation.

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when they were examined 1 week later. Daily clinical examination for 14 d revealed no evidence of FMD infection and no serological response was detected by virus neutralization tests conducted 3 weeks after attaching the ear bags to the cattle.

Results from this experiment indicated that FMD virus survived for at least 3 d, but less than 7 d in *R. zambeziensis* nymphae. Although the epidemiology of FMD in southern Africa has not yet been completely elucidated, we conclude that it is unlikely that *R. zambeziensis* is able to transmit FMD virus.

**REFERENCES**


