Isolation of Theileria parva (SAO Hill) and Theileria parva (West Kilimanjaro) and their cross-immunity with Theileria parva (Kasoba)

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Deux souches de Theileria parva ont été isolées sur du bétail-témoin pendant des essais d’immunisation sur le terrain contre la theilérioèse à SAO Hill et West Kilimanjaro, dans les parties Sud et Nord de la Tanzanie respectivement. Ces deux souches de parasites ont engendré une affection grave au point de vue clinique qui a nécessité un traitement antitheilérien pour 3 des 5 bovins infectés expérimentalement. Les animaux guéris de cette affection avec les deux souches de T. parva en cause n’ont pas présenté de signes fébriles, et un seul animal sur quatre a présenté une parasitoèse avec de rares schizontes pendant un jour, au cours d’un test d’infection avec Theileria parva (Kasoba) originaire du sud du Malawi. À l’inverse, les deux témoins ont montré des signes de fièvre avec la présence de schizontes, et l’un d’entre eux a dû subir un traitement antitheilérien pour être sauvé.


Introduction

This paper describes the results of attempts to infect experimental animals with Theileria parasites from East Coast fever (ECF) immunization trial sites in Tanzania, the course of their infection and the preliminary observations on cross-protection following challenge with Theileria parva (Kasoba) from northern Malawi.

Materials and Methods

Parasite isolation and challenge (table I)

Theileria parva (SAO Hill)

Laboratory-reared Rhipicephalus appendiculatus nymphal ticks were fed on control cattle suffering from ECF during an ECF field immunization trial in 1990 at SAO Hill.

1. East Coast Fever Vaccine Production, Quality Control and Immunization Project RAF/92/010, C/o FAO Representative, POB 30750, Lilongwe 3, Malawi.
2. Project GGP/URT/098/DEN, P.O. Box 290, Iringa, Tanzania.


TABLE 1 Responses of cattle to T. Parva (Sao Hill), T. Parva (W. Kilimanjaro) and with T. Parva (Kasoba) infections.

<table>
<thead>
<tr>
<th></th>
<th>Primary infection</th>
<th></th>
<th>Challenge infection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Days to and duration of</td>
<td>Piroplasm parasitaemia</td>
<td>Treatment Day 3</td>
</tr>
<tr>
<td></td>
<td>schizont 1</td>
<td>fever 2</td>
<td>1 p. 100</td>
</tr>
<tr>
<td>T. parva stock</td>
<td>cattle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sao Hill</td>
<td>981</td>
<td>14 (16)</td>
<td>7 (1)</td>
</tr>
<tr>
<td>1 259</td>
<td>1 289</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 289</td>
<td>1 259</td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Kilimanjaro</td>
<td>1 301</td>
<td>11 (15)</td>
<td>11 (10)</td>
</tr>
<tr>
<td>1 300</td>
<td>1 302</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kasoba</td>
<td>1 299</td>
<td>6 (8)</td>
<td>8 (6)</td>
</tr>
<tr>
<td>Kasoba</td>
<td>1 300</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ND: Not done.
1 Figures in bracket represent the duration in days of detection of schizonts.
2 Figures in bracket represent the duration in days of detection of fever.
3 Days of the experiment on which cattle considered seriously ill were treated with drug buparvaquone.
4 Received stabilates No. 110 ; T. parva (Sao Hill).
5 Received stabilates No. 121 ; T. parva (West Kilimanjaro).
6 Received stabilates No. 66 ; T. parva (Kasoba).

in southern Tanzania. The adult ticks which moulted from the nymphs were sent to the Central Veterinary Laboratory (CVL), Lilongwe, Malawi where they were applied to animal No. 981 to transmit the parasite. Non-infected laboratory-reared R. appendiculatus nymphs were applied to animal No. 981 to pick up the parasite for subsequent stabilate preparation using the methods of CUNNINGHAM et al. (5).

Theileria parva (West Kilimanjaro)

In a similar field trial in West Kilimanjaro, Tanzania, laboratory-reared R. appendiculatus nymphs were fed on to control cattle with ECF. Adult ticks moulted from the engorged nymphs were sent to the same laboratory for isolation of the field Theileria at the exposure site for eventual stabilate preparation.

The stablates prepared from both isolations were inoculated into cattle and the course of infection was monitored clinically, parasitologically and serologically. On day 29 post infection, the cattle were challenged with Theileria parva (Kasoba) (6,10). Again the clinical, parasitological and serological responses were monitored.

Cattle and ticks

The cattle used were Friesian-Malawi Zebu crosses obtained from farms where strict tick control is practised in the Southern region of Malawi, where ECF cases have not been reported. All cattle were serologically negative in the indirect immunofluorescent antibody test (IFAT) to T. parva schizont antigen (4). R. appendiculatus (Muguga) ticks maintained in the laboratory using methods described by BAILEY (1), were used for parasite picked up from the control cattle at the trial sites and for stabilate production.

Estimation of parasite infection in ticks

No estimation of infection rates was made for the adult R. appendiculatus ticks collected from Sao Hill because the number was small and this could have prejudiced the success of transmitting the parasite. However, the infection rate for the Sao Hill parasite stock was determined in the subsequent pick-up laboratory ticks and also for the West Kilimanjaro field pick-up ticks by dissecting and staining salivary glands in Feulgen's stain using the method described by BLEWETT and BRANAGAN (2). For each of the parasite stocks, 20 pairs of male and female ticks were dissected after prefeeding on rabbit ears for 4 days.

Results

Thirty-one adult R. appendiculatus ticks from the Sao Hill trial were received at CVL, Lilongwe and were applied to animal No. 981 which developed a Theileria schizont parasitosis in lymphoid cells. Out of the 11,000 nymphs applied to pick up the parasites from animal No. 981, 10,000 adult ticks were harvested; 32.5 % of those were infected and they had an estimated mean Theileria acini infection rate of 26 %. These ticks were used to prepare 500 ml of stablate No. 110. In the case of the West Kilimanjaro stock, 1,200 adult R. appendiculatus ticks were received and prefed on rabbits. One thousand ticks were harvested; 50 % of these were infected and they had a mean Theileria acini infection rate of 70 %. The ticks were used for preparing stablete No. 121.

The responses of cattle to the different parasite stocks are summarized in table I. The West Kilimanjaro parasite stock caused shorter prepatent periods to schizonts and fever than the Sao Hill and Kasoba stocks. For the two Tanzanian parasite stocks, the duration of detection of
The clinical, parasitological and serological responses of cattle to the infection with the *Theileria* parasite stocks isolated from SAO Hill and West Kilimanjaro in Tanzania were indistinguishable from those with a classical *T. parva* stock, *Theileria parva* (Muguga) (3). It is therefore concluded that the two Tanzania *Theileria* isolates are indeed *T. parva* stocks.

The ability of cattle recovering from *T. parva* (SAO Hill) and *T. parva* (West Kilimanjaro) infections to resist a *T. parva* (Kasoba) challenge as evidenced by lack of marked clinical and parasitological responses (table I) indicates a close antigenic relationship between these parasites. The Tanzanian parasite stocks used were isolated during ECF immunization from field sites where significant protection against local ECF challenge was observed (JACOBSEN, unpublished data). It is therefore assumed that a close antigenic relationship also exists between the Tanzanian stocks and the combination of parasite stocks (*Theileria parva* Muguga), *Theileria parva* (Kiambugi) (7) and *Theileria parva* (Serengeti transformed) (12) used in the ECF immunization at SAO Hill and West Kilimanjaro.

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**References**


6. HOVE (T.), MUSISI (F.L.), KANHAI (G.K.), LATIF (A.), MASAKA (S.), MUNAISWA (F.C.), PEGRAM (R.G.), DOLAN (T.T.), KAMWENDO (S.P.), QUIROGA (J.C.). Challenge of *Theileria parva* (Boleni) immunized cattle with selected East African *Theileria* stocks. (Submitted for publication).


10. MUSISI (F.L.), QUIROGA (J.C.), KANHAI (G.K.), KAMWENDO (S.P.), MZOMA (F.J.), NJUGUNA (L.M.). Isolation and cross-immunity studies with *Theileria parva* (Kasoba). (Manuscript prepared for publication).


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Two *Theileria parva* stocks were isolated from control cattle during East Coast fever (ECF) field immunization trials at SAO Hill and West Kilimanjaro in the southern and northern parts of Tanzania respectively. Both parasite stocks caused severe clinical ECF which required antitheilerial treatment for 3 of the 5 experimentally infected cattle. Cattle recovering from infection with the two *T. parva* stocks did not develop a fever and only 1 of 4 animals developed scanty schizont parasitosis for one day during a challenge with *T. parva* (Kasoba) from northern Malawi. In contrast, both control cattle developed fever and schizonts, and one required antitheilerial treatment to survive.

Key words: Cattle - East Coast fever - *Theileria parva* - Immunity - Experimental infection - Tick - *Rhipicephalus appendiculatus* - Tanzania.