THE EXPERIMENTAL TRANSMISSION OF THEILERIA OVIS
BY RHIPICEPHALUS EVERTSI MIMETICUS AND R. BURSA

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ABSTRACT


The successful transmission of Theileria ovis Rodhain, 1916 to splenectomized sheep by Rhipicephalus evertsi mimeticus Donitz and R. bursa Canestrini & Fanzago is recorded. The protozoon is acquired by the immature stages of these two ticks and transmitted by the ensuing adults. The course of the disease is accompanied by pyrexia and a transitory appearance of schizonts in films prepared from swollen lymph nodes while endoglobular parasites are demonstrable during the reaction and for long periods after recovery.

INTRODUCTION

Benign ovine and caprine theileriosis, which is caused by Theileria ovis Rodhain, 1916 (syn. Theileria recondita Lestquard, 1929) is widely distributed in Africa, Asia and Europe. Countries in which the disease has been established are recorded by Neitz (1957) and in the FAO-WHO-OIE Animal Health Yearbook (1970). Investigations on the biological transmission are limited to those conducted in the Russian Federation Socialist Republic and South Africa (Table 1).

The object of this paper is to record that Rhipicephalus bursa from the northern hemisphere is capable of transmitting the South African T. ovis strain and that R. evertsi mimeticus from South West Africa can serve as a vector of this protozoon.

MATERIALS AND METHODS

1. Origin of the ticks

Larvae, the progeny of two R. bursa females, were supplied by Dr. C. R. Lambert of the Ciba-Geigy Research Laboratory, Domaine de la Barque, Switzerland.

Table 1 Biological transmission of T. ovis

<table>
<thead>
<tr>
<th>Vector</th>
<th>Country</th>
<th>No. of hosts</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhipicephalus bursa Canestrini &amp; Fanzago</td>
<td>Transcaucasia (USSR)</td>
<td>2</td>
<td>X---X---</td>
</tr>
<tr>
<td></td>
<td>+ South Africa</td>
<td>2</td>
<td>X---X---</td>
</tr>
<tr>
<td>Rhipicephalus evertsi evertsi Neum.</td>
<td>South Africa</td>
<td>3</td>
<td>X---X---</td>
</tr>
<tr>
<td>Rhipicephalus evertsi mimeticus Donitz &amp; Walters (1971)</td>
<td>Transcaucasia</td>
<td>2</td>
<td>X---X---</td>
</tr>
<tr>
<td>Dermanyssus marginatus Oleniev</td>
<td>Transcaucasia</td>
<td>3</td>
<td>X---X---</td>
</tr>
<tr>
<td>Dermaon Desert Smith</td>
<td>Transcaucasia</td>
<td>2</td>
<td>X---X---</td>
</tr>
<tr>
<td>H. phlebotomus sulcata Canestrini &amp; Fanzago</td>
<td>Transcaucasia</td>
<td>3</td>
<td>X---X---</td>
</tr>
<tr>
<td>Ornithodorus labruneus Neum.</td>
<td>Transcaucasia</td>
<td>3</td>
<td>X---X---</td>
</tr>
<tr>
<td></td>
<td>Kazakhstan (USSR)</td>
<td>3</td>
<td>X---X---</td>
</tr>
<tr>
<td></td>
<td>Kazakhstan</td>
<td>3</td>
<td>X---X---</td>
</tr>
</tbody>
</table>

Legend: X = Stage in which infection is acquired
L = Larva; N = Nympha; I = Imago
* = See remarks in text
† = Investigations with ticks from Giba-Geigy, Switzerland
‡ = Investigations with ticks from South West Africa

Table 2 Attempts to infect rhipicephalid ticks with T. ovis

<table>
<thead>
<tr>
<th>No. of splenectomized T. ovis carrier</th>
<th>Infected with immature stages of</th>
<th>Batch No.</th>
<th>Fed for days</th>
<th>No. of engorged nymphae collected</th>
<th>Premoulting period in days</th>
<th>Prefeeding period in days</th>
<th>Ensuing adults fed on sheep No. (Table 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S 15535</td>
<td>R. bursa</td>
<td>3317 Ba</td>
<td>15-20</td>
<td>59</td>
<td>19</td>
<td>123</td>
<td>2476</td>
</tr>
<tr>
<td>S 15535</td>
<td>R. (e.) mimeticus</td>
<td>3340 As</td>
<td>13-28</td>
<td>119</td>
<td>39</td>
<td>29</td>
<td>2191</td>
</tr>
<tr>
<td>S 2476</td>
<td>R. (e.) mimeticus</td>
<td>3340 Ca</td>
<td>14-24</td>
<td>30</td>
<td>38</td>
<td>29</td>
<td>2212</td>
</tr>
</tbody>
</table>

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## Table 3 Biological transmission of T. ovis by R. bursa and R. e. mimeticus

<table>
<thead>
<tr>
<th>No.</th>
<th>Sex</th>
<th>Age</th>
<th>History</th>
<th>Batch No.</th>
<th>Infestation with adult ticks</th>
<th>Clinical signs and microscopical examination of the left parotid lymph node (L1) and blood films</th>
</tr>
</thead>
<tbody>
<tr>
<td>2476</td>
<td>♂</td>
<td>204 days</td>
<td>Splenectomized; fully susceptible</td>
<td>3317 Ba1</td>
<td>R. bursa LL and NN fed on T. ovis carrier (Table 2)</td>
<td>Fed for days 7-9; IP in days 13; Days after infest. 12; Temp. °C 39.4; L1 degree of enlargement -; Koch bodies 0; T. ovis e-forms -; Remarks (Table 2)</td>
</tr>
<tr>
<td>2191</td>
<td>♂</td>
<td>415 days</td>
<td>Splenectomized; fully susceptible</td>
<td>3349 Aa1</td>
<td>R. e. mimeticus LL and NN fed on T. ovis carrier (Table 2)</td>
<td>Fed for days 7-9; IP in days 13; Days after infest. 12; Temp. °C 39.4; L1 degree of enlargement -; Koch bodies 0; T. ovis e-forms -; Remarks (Table 2)</td>
</tr>
<tr>
<td>2212</td>
<td>♂</td>
<td>404 days</td>
<td>Splenectomized; fully susceptible</td>
<td>3349 Ca1</td>
<td>R. e. mimeticus LL and NN fed on T. ovis carrier (Table 2)</td>
<td>Fed for days 8-9; IP in days 14; Days after infest. 12; Temp. °C 39.4; L1 degree of enlargement -; Koch bodies 0; T. ovis e-forms -; Remarks (Table 2)</td>
</tr>
</tbody>
</table>

### Legend
- LL = Larvae; NN = Nymphae
- IP = Incubation period
- e. forms = Endoglobular forms
- + = Moderate enlargement
- ++ = Fairly marked enlargement
- +++ = Marked enlargement
- 0 = Absent
- = Not examined
- PCV = Packed cell volume

### Remarks
- Mild anaemia - anisocytosis, basophilia and polychromasia seen on Day 11 after first appearance of T. ovis and persisted until Day 34; PCV of 30% on Day 1 decreased to 21% on Day 20 and rose to 29% on Day 64
- Mild anaemia - anisocytosis, basophilia and polychromasia seen on Day 11 after first appearance of T. ovis and persisted until Day 26; PCV of 30% on Day 1 decreased to 24% on Day 19 and rose to 29% on Day 33
- Mild anaemia - anisocytosis, basophilia and polychromasia on Day 11 after first appearance of T. ovis and persisted until Day 26; PCV of 30% on Day 1 decreased to 18% on Day 20 and rose to 26% on Day 37
were opened daily for the collection of detached ticks. After detachment of the females the males were removed and the left lymph nodes were then palpated daily to determine the degree of enlargement. Smears were prepared from the swollen nodes during the febrile reaction as shown in Table 3. Blood smears were prepared daily during and after the reaction period. The films were stained with Giemsa stain and examined for the presence of Koch bodies and endoglobular parasites.

**RESULTS**

Table 2 gives the duration of the feeding periods of the immature stages, the number of nymphs that fed to repletion on the *T. avis* carriers and the duration of the nymphal premouling and imaginal prefeeding periods.

The feeding of the ensuing adults of both species on three fully susceptible splenectomized sheep and their response to the infestation are recorded in Table 3. All the sheep developed a febrile reaction which commenced 13 to 15 days after tick attachment and persisted for 4 to 5 days. The parotid lymph nodes showed a distinct swelling for periods varying from 7 to 11 days. Smears prepared from them showed an increased lymphocytic and histiocytic activity and very few Koch bodies on Days 15 to 17 after the *R. bursa* infestation of Sheep 2476 and on Day 15 after the *R. e. mimeticus* attachment on Sheep 2191 and 2212. The endoglobular *T. avis* parasites were seen 3 days after the appearance of schizonts in the lymph node films. The infection of the erythrocytes was never more than 1.5%. A variable degree of anaemia developed in all the sheep and persisted for several weeks as recorded in Table 3.

**DISCUSSION AND CONCLUSIONS**

Although larvac of both species readily attached on the ears of the three *T. avis* carriers, the nymphal harvests were poor in two of them. The reason for this is attributed to the inclination of larvae to attach in peripheral blood circulation. In constrast Jansen & Neitz (1956) and the current investigations have established that the prepatent period of the endoglobular *T. avis* parasites following the infestation with three *Rhipicephalus* spp. varied from 17 to 20 days. Consideration of these divergent results suggests that the entire sheep, employed by Rastegaieff (1934), harboured a latent *T. avis* infection and that the infestation by an extremely large number of *R. bursa* adults resulted in a relapse.

**SUMMARY**

1. The known vectors of *T. avis* and the countries, where the transmission by ticks has been conducted, are presented in tabular form.
2. Observations on the current transmission experiments are listed in two tables.
3. *T. avis* is acquired by the larvac and nymphae of *R. e. mimeticus* and *R. bursa* and transmitted by the ensuing adults.
4. The reaction in all the sheep was accompanied by an increased lymphocytic and histiocytic production in the parotid lymph nodes, a fever and a relatively mild anaemia.
5. Schizonts appeared in smears prepared from lymph nodes and endoglobular forms in blood smears.

**ACKNOWLEDGMENTS**

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**REFERENCES**


