New concepts on limiting factors of Ovine and Caprine Malignant Theileriosis (OCMT) in Iran

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Summary

In spite of presence of the vector ticks and susceptible hosts of Ovine Malignant Theileriosis in all parts of Iran, the endemic areas of the disease are restricted to certain foci in the South and center of the country. Finding the reason of this point, this study was conducted in seven experiments to transmit Theileria lestoquardi from carrier sheep to susceptible host by Hyalomma anatolicum anatolicum. The carrier sheep were collected from three different areas including Fars, Ilam and Tehran provinces and the vector ticks were collected from Fars, Ilam and Urmia. The results showed that the ticks from non-endemic areas could potentially transmit the parasite. Therefore the assumption that the restricted foci of the disease are due to adaptation of the parasite in the endemic areas to the local vector tick is not much valid. It may be concluded that in some areas (non-endemic) the limiting factor is low temperature and in the others, the extreme high temperature that reduce tick ratio per animal. Ovine and Caprine Malignant Theileriosis (OCMT) occurs in certain foci of Iran with a mean annual temperature between 20 - 25°C. The clinical signs and the variation of parasitemia were recorded in the experimentally infected animals.

Key words: Theileria lestoquardi, Sheep, Malignant theileriosis, Iran

Introduction

Malignant theileriosis of sheep and goat caused by the tickborne protozoan parasite, Theileria lestoquardi, (Morel and Uilenberg, 1981) is reported from North Africa, southern Europe, the southern USSR, Asia minor and India (Norman and Levine, 1985) (Salih et al., 2003). This species has been considered in Iran since long time ago as a fatal disease of sheep widespread in south, southwest and sporadically in the East of Iran (Hooshmand Rad, 1974). Despite the wide distribution of the known vector, Hyalomma anatolicum anatolicum and susceptible hosts including sheep and goat in the most part of the country (Anwar, 1974). The infection seems to be limited to particular area of Iran. The main objective of this study is to determine the possible potency of non-endemic tick in transmission of parasite to susceptible hosts in Iran.

Materials and Methods

The engorged female and male ticks were collected from sheep in Fars, Ilam and Urmia and identified following description by Mazlum (1968). The engorged female ticks of Hyalomma anatolicum anatolicum were selected, washed, dried and then were kept into vials at 28°C with relative humidity above 80% (Jones et al., 1988). To avoid fungus contamination, the orthopedic cotton wool was used as caps of vials. The eggs were collected weekly after the incubation period and transferred to tick culture tubes at the same condition until the larvae emerged. New-Zealand white rabbits were used to feed the larval stage by applying the rabbit ear bag for feeding periods. Then, the fed larvae were
separated and returned into the tube at the cultural condition, to moult to nymphal stage. They were placed on ear of each carrier sheep from the different areas in the ear bag. The donor sheep showed parasitemia with a ratio of at least 1:100. Following a suitable time considered for feeding of nymphal stage, the ticks were separated and kept in the optimal condition until moulting was occurred. Equal numbers of both male and female ticks (5/5) were transferred on parasite free recipient sheep of six months age. All infested animals were kept individually during the experimental period, the clinical observation and the rate of parasitemia were checked daily until 40 days post infestation.

Results

From seven experiments carried out in this study, sheep number 671,263 and 273 which were challenged by infected ticks, originally collected from Fars, Ilam (endemic area) and Urmia (non endemic area) respectively, showed acute malignant theileriosis. In these cases the schizonts of theileria were easily showed in liver smears. The fourth animal showed a mild fever and low parasitemia (0.2%) and then recovered from the disease (sheep no.640). In this case the vector ticks were collected from Fars province (endemic area).

In 3 other experiments Sheep number 269, 274 and 266 showed only a mild fever, but no parasitemia. The vector ticks belonged to Tehran, Fars and Tehran provinces, respectively. The clinical signs in the 3 acute infected animals were almost similar and consisted of lethargy, fever up to 42 °C, thoracic pain, respiratory disorder with increase in nasal mucopurulent discharge, hypoxia, hyperaemia of mucusal membranes with subsequent anemia and icter, anorexia and emaciation have been seen at last phase of disease. Death occurred following a reduction in body temperature when animal became recumbent. However prepatent periods and parasitemia were somewhat different in each individual animal (Table 1). Maximum and minimum rates of parasitemia were 9% and 2%, respectively. The mean period to death was 42 days.

Table 1: The observation of seven experiments

<table>
<thead>
<tr>
<th>Sheep No.</th>
<th>Incubation period till fever (Days)</th>
<th>Prepatent period till parasitemia (Days)</th>
<th>Putting infected ticks to death (Days)</th>
<th>Max. Temp. °C</th>
<th>Max. Parasitemia %</th>
<th>Fever period (Days)</th>
<th>Source of parasite</th>
<th>Source of Vector</th>
</tr>
</thead>
<tbody>
<tr>
<td>671</td>
<td>16</td>
<td>21</td>
<td>32</td>
<td>41.5</td>
<td>2</td>
<td>16</td>
<td>Fars (H.E.)</td>
<td>Fars (H.E.)</td>
</tr>
<tr>
<td>263</td>
<td>10</td>
<td>13</td>
<td>39</td>
<td>41.6</td>
<td>9</td>
<td>5</td>
<td>Fars (H.E.)</td>
<td>Ilam (E.)</td>
</tr>
<tr>
<td>273</td>
<td>7</td>
<td>20</td>
<td>55</td>
<td>42</td>
<td>3</td>
<td>19</td>
<td>Fars (H.E.)</td>
<td>Urmia (N.E.)</td>
</tr>
<tr>
<td>460</td>
<td>24</td>
<td>26</td>
<td>-</td>
<td>40</td>
<td>0.2</td>
<td>3</td>
<td>Saveh(N.E.)</td>
<td>Fars (H.E.)</td>
</tr>
<tr>
<td>269</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>40.3</td>
<td>-</td>
<td>5</td>
<td>Saveh(N.E.)</td>
<td>Nazarabad(N.E.)</td>
</tr>
<tr>
<td>274</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>39.8</td>
<td>-</td>
<td>5</td>
<td>Ilam (E.)</td>
<td>Fars (H.E.)</td>
</tr>
<tr>
<td>266</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>40.2</td>
<td>-</td>
<td>4</td>
<td>Fars (H.E.)</td>
<td>Nazarabad(N.E.)</td>
</tr>
</tbody>
</table>

(H.E.) Highly Endemic. (E.) Endemic. (N.E.) Non Endemic
Discussion

Malignant Ovine and Caprine Theileriosis, caused by *T. lestoquardi*, has been considered in Iran since long time ago as a fatal disease of sheep widespread in the South, Southwest and sporadically in the East of Iran. In the present study, in addition to previously reported foci in provinces of Fars, Tehran, Khoozestan (Mazlum, 1970), new foci of disease has been recognized; Zarande Saveh (Kale sorkh) and Shahrood. Moreover, blood smears from pyretic sheep of these areas showed the piroplasm of *T. lestoquardi*. *Rhipicephalus bursa* had been recognized as the vector of *T. lestoquardi* in Serbia (Dschunkovsky and Urodoschevich, 1924), but this species, so far has not been reported from south of Iran, where Ovine and Caprine Malignant Theileriosis is most prevalent. Hooshmand Rad and Hawa (1973) demonstrated *H. anatolicum anatolicum*, to be the vector of the parasite in Iraq. This tick has been assumed to be the potential vector in Fars province in Iran. All experiments to produce theileriosis were carried out using *H. anatolicum anatolicum* which had been collected as vector tick samples from endemic and non endemic areas in the present study. In these experiments, three cases ended in acute and four in a mild form of the disease or fever. Malignant Ovine and Caprine Theileriosis, differs from tropical theileriosis in one more respect. While local breeds are relatively resistant to tropical theileriosis, indigenous sheep is highly susceptible to *T. lestoquardi* infection. With regard to percentage of red blood cells invaded by the piroplasm form of the parasite, the result obtained in the present study differed with what recorded by Nuttall and Hindle (1913) which up to 95% of red blood cells of sheep were infected with parasite. In our study, the red blood cells infected with the parasite did not exceed more than 9%. Contrary to tropical theileriosis, which is prevalent wherever the vector tick is present, Malignant Ovine and Caprine Theileriosis is limited to certain pockets even though the vector is widespread in Iran. In East Coast Fever not with standing the prevalence of the disease that corresponds to the vector distribution, in a tiny areas such as the West of Zambia and coast of South Africa where *Rhipicephalus apendiculatus* prevail the disease does not exist (ILRAD report, 1992).

If foci of Malignant Ovine and Caprine Theileriosis are contemplated on map, one can infer that these places have relatively similar climatic conditions. Most areas in the South of Iran where *T.lestoquardi* infection occurs are situated in places with a mean annual temperature between 20-25°C; one can easily see ambient temperature plays a decisive role in the epidemiology of disease. Lewis and Footingham (1941) and Lewis, (1950) showed that infected larvae and nymph moulting at 35-36°C, respectively, could no longer transmit the parasite. Furthermore, Nuttall and Hindle (1913) pointed that the temperature of 8-10 °C has harmful effect on *T.amnulata* in the vector ticks. On the other hand, Gill et al., (1977) in their research found that there was a relationship between the number of infected ticks on a host and outcome of the disease; the more number of ticks on the host, the more severe would be the consequential disease. In the present study, out of 7 attempts to transmit the parasite only three resulted in severe reaction. One of them was the transmission of parasite by tick which originated from non-endemic area (Ureemia), where the mean tick ratio per sheep was recorded five (Rahbari, 1995). According to what has been mentioned, Fars province with mean annual temperature of 20-25°C is the most suitable area for development of *Ixodid* ticks and naturally, with a higher ratio of tick. Therefore, it may be concluded that *T. lestoquardi* is temperature dependent instead of depending on the strain of the vector. In fact, in the Northern parts, the limiting factor is low temperature while in some other places, the extreme high temperature can be the limiting factor.

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References