Precipitating antibodies against bluetongue and foot and mouth disease viruses in cattle between the two Niles in Khartoum Province, Sudan

E.M.E. ABU ELZEIN *

Summary: Several animal production schemes are being planned for the area between the two Niles in Khartoum Province, Sudan. Results of a serological survey of cattle in that area are presented. Antibodies against bluetongue were detected in 51.1% of the animals examined, and 18.6% of the animals possessed antibodies against FMD virus. Suggestions for controlling the two diseases are given.

INTRODUCTION

The area between the two Niles in Khartoum Province, Sudan, was chosen because several dairy and fattening schemes for cattle are planned for this area.

The present investigations were undertaken mainly to examine cattle in this area for precipitating antibodies against the foot and mouth disease (FMD) and bluetongue (BT) viruses. These diseases were selected because they are major animal diseases in the Sudan, having a considerable economic impact on animal production, and cattle are not currently immunized against them.

Both diseases are highly endemic in the country. The epidemiology of FMD is well understood and the Sudanese FMD virus serotypes and subtypes have been amply studied and characterized (1, 3, 4, 5, 6). The incidence of the disease, as reflected by the presence of antibodies against FMD virus in serum from different animal species from Sudan has also been studied and the strains to be used in vaccine formulation are also known (2).

Although reports of the occurrence of bluetongue in the Sudan go as far back as 1953, no information is available regarding the virus serotypes existing in the country. Two attempts have been made to isolate the virus, but both were unsuccessful (12, 11). Eisa et al. (9) claimed to have isolated BT virus from a disease outbreak in Darfur province in the mid-seventies, and reported then that serotyping of the virus was underway. However, the result of serotyping that virus has not been published so far.

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Serological surveys for BT precipitating antibodies in animals in the Sudan by Eisa et al. (9), Taylor (13) and Abu Elzein (2) have shown that the disease is widespread.

MATERIALS AND METHODS

Viral antigens and reference sera used in this study were as follows:

1. BT virus type 4 soluble antigen, supplied by the Animal Virus Research Institute, Pirbright, U.K.

2. FMD virus-associated antigen (VIA) prepared from FMD virus type O Sudan (1980) in BHK-21 cells by the method described by Cowan and Graves (8) with some modification.

3. Reference sheep serum against type 4 BT virus, supplied by the Animal Virus Research Institute, Pirbright, U.K.

4. Reference hyperimmune guinea pig antiserum against FMD virus type O was prepared by the method of Brooksby (7).

5. Test serum samples collected from apparently healthy cattle more than 2 years old, from the following localities: Al Samir, Al Bagaire, Putry, Al Gadid, West Soba, Soba Mashrooh, Al Sarhat, Edd Hussein, Al Karama (see Fig. 1).

Double immunodiffusion test.

The slide method was used. Each slide received 3 ml of either 1% Difco agar in 0.02 M tris buffer with the addition of 0.15 M NaCl and 0.1% NaN₃ (for the VIA test) or 3 ml of 1% solution of Litex agarose in borate buffer at pH 9.0 (9 g boric acid + 2 g sodium hydroxide dissolved in a litre of distilled water) for the BT test.

The test pattern consisted of a cluster of 6 wells, each 5 mm diameter, around a central well, with 7 mm separating the middle of the central well from the middle of the peripheral wells. Using Pasteur pipettes, the viral antigen was added to the central well. Test sera were added to alternate wells of the cluster, and reference serum to the remaining wells. Slides were then placed in a humid chamber at room temperature. The appearance of precipitin lines was recorded daily for between 3 and 4 days.

RESULTS

Results of screening bovine serum samples for antibodies against BT virus are shown in Table I, and against FMD virus in Table II. Table III shows the overall results for all samples and both viruses. BT seems to be widespread (51.1% positive) but FMD is less so (18.6% positive).
### Table I

**Results of screening bovine sera for antibodies against BT virus**

<table>
<thead>
<tr>
<th>Locality</th>
<th>Number examined</th>
<th>Number positive</th>
<th>% positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al Bagaire</td>
<td>46</td>
<td>27</td>
<td>58.7</td>
</tr>
<tr>
<td>Al Gadid</td>
<td>17</td>
<td>7</td>
<td>41.2</td>
</tr>
<tr>
<td>Al Samir</td>
<td>14</td>
<td>10</td>
<td>71.4</td>
</tr>
<tr>
<td>Al Sarhat</td>
<td>15</td>
<td>12</td>
<td>80</td>
</tr>
<tr>
<td>Edd Hussein</td>
<td>20</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Putry</td>
<td>23</td>
<td>15</td>
<td>65.2</td>
</tr>
<tr>
<td>Soba Almashrooh</td>
<td>35</td>
<td>14</td>
<td>40</td>
</tr>
<tr>
<td>Soba West</td>
<td>43</td>
<td>23</td>
<td>53.5</td>
</tr>
<tr>
<td>Al Karama</td>
<td>8</td>
<td>2</td>
<td>25</td>
</tr>
</tbody>
</table>

### Table II

**Results of screening bovine sera for antibodies against FMD virus**

<table>
<thead>
<tr>
<th>Locality</th>
<th>Number examined</th>
<th>Number positive</th>
<th>% positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al Bagaire</td>
<td>46</td>
<td>12</td>
<td>26.1</td>
</tr>
<tr>
<td>Al Gadid</td>
<td>17</td>
<td>3</td>
<td>17.6</td>
</tr>
<tr>
<td>Al Samir</td>
<td>14</td>
<td>4</td>
<td>28.6</td>
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<tr>
<td>Al Sarhat</td>
<td>15</td>
<td>5</td>
<td>33.3</td>
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<td>Edd Hussein</td>
<td>20</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>Putry</td>
<td>23</td>
<td>2</td>
<td>8.6</td>
</tr>
<tr>
<td>Soba Almashrooh</td>
<td>35</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Soba West</td>
<td>43</td>
<td>2</td>
<td>4.7</td>
</tr>
<tr>
<td>Al Karama</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Table III

**Summary of the overall results for BT and FMD**

<table>
<thead>
<tr>
<th>Total number examined</th>
<th>BT results</th>
<th>FMD results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number positive</td>
<td>% positive</td>
</tr>
<tr>
<td>221</td>
<td>113</td>
<td>51.1</td>
</tr>
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</table>
FIG. 1
Map showing the area between the Blue and White Nile in Khartoum Province, Sudan.
DISCUSSION

The results show that 51.1% of the animals examined had antibodies against BT virus, while 18.6% had antibodies against FMD virus-infection-associated antigen (VIA).

Detection of antibodies against VIA in the absence of vaccination suggests that the animals have undergone infection with FMD virus (10). Since no vaccination against FMD is practised in the Sudan, the results obtained in this survey indicate that 18.6% of the animals have been exposed at some time to FMD virus infection. Our previous studies on FMD have shown that Khartoum province is the least affected by FMD in the Sudan (5, 6, 4, 1), and that most outbreaks occurring in that province primarily involved trade cattle in quarantine, from which the disease often spread to local dairy and fattening farms.

BT seems to be highly endemic in Khartoum province. The presence of the midges responsible for its transmission, together with the favourable conditions for their breeding throughout the year, and the absence of vaccination of animals against BT, have led to the present epidemicity of the disease. Personal experience (unpublished) has shown that serologically negative animals may give a positive result when the serum sample is tested for the presence of BT virus, with high titres of virus. Consequently animals in the viraemic stage are usually missed in serological surveys in endemic areas. BT is evidently more widespread in Khartoum province than once thought.

The lack of reports of overt BT virus infection in cattle in the Sudan may be due to a natural resistance of cattle to BT virus infection, subclinical or inapparent infection or failure to recognize the disease, confusing it with other diseases having a similar clinical picture.

Natural resistance can be excluded, because even if we assume that indigenous cattle are resistant to the disease, several hundred cattle have been imported from other countries over the years. As no vaccination has been practised to date these cattle would have been exposed to BT infection, and this could have been overlooked or misdiagnosed because no virological research on BT virus was done in the Sudan until the mid-seventies.

Suggestions for control:

1. **FMD:**

   Since the epidemiological situation for FMD is well elucidated, the next step is the formulation of a potent quadrivalent vaccine to be used in conjunction with other restrictive sanitary measures, and the control of animal and human movements.

2. **BT:**

   Until the epidemiology of the disease in the country has been adequately studied, and unless we stop speculations which are not based on experimental
evidence, no vaccination or other control measure will meet with success. For example, there has been frequent speculation that the disease is inapparent or subclinical in cattle in the Sudan, whereas not a single experiment has been performed to attempt to transmit the disease either naturally, by infected midges, or by subinoculation of BT virus of known virulence to see how Sudanese or imported cattle react to it.

Proposals for the control and eradication of BT are:

1. A scientific approach to the BT problem in the Sudan, to provide a firm base, supported by experimental evidence, for its future control and eradication.

2. Serotyping the viruses already isolated in the country, and providing encouragement for further isolations and serotyping of the virus from natural outbreaks, from apparently healthy domestic and wild animals and from the insect vectors, so as to pin-point the reservoir of the virus in the country.

3. Study of potential insect vectors for the virus, and to find out the best methods for their control.

4. Formulation of a vaccine containing the virus serotypes prevailing in the country, and its use in the animal species susceptible to BT infection.

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ACKNOWLEDGEMENTS

I would like to thank Mrs. B.J. Newman, of the Animal Virus Research Institute, Pirbright, England, for preparing VIA antigen.

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Résumé : Des programmes de développement de la production animale sont à l’étude pour la zone située entre le Nil Blanc et le Nil Bleu, dans la province de Khartoum, au Soudan. Une enquête sérologique portant sur les bovins présents dans cette zone a donné les résultats suivants : des anticorps contre le virus de la fièvre catarrhale ont été trouvés chez 51,1 % des animaux examinés, tandis que 18,6 % d’entre eux possédaient des anticorps contre le virus aphteux. L’auteur fait des suggestions sur les méthodes à employer pour combattre ces deux maladies.

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ANTICUERPOS QUE PRECIPITAN EL VIRUS DE LA LENGUA AZUL Y EL VIRUS AFTOSO EN LOS VACUNOS DEL ÁREA ENTRE EL NILO BLANCO Y EL NILO AZUL EN LA PROVINCIA DE JARTUM, EN SUDÁN. — E.M.E. Abu Elzein.

Resumen: Se están estudiando programas de desarrollo de producción pecuaria para el área situada entre el Nilo Blanco y el Nilo Azul, en la provincia de Jartum, en Sudán. La encuesta serológica efectuada en los bovinos presentes en el área dio los siguientes resultados: se encontraron anticuerpos contra el virus de la lengua azul en el 51,1% de los animales examinados, mientras que el 18,6% de los mismos poseía anticuerpos contra el virus aftoso. Presenta el autor sugerencias sobre los métodos que se han de emplear para combate ambas enfermedades.

REFERENCES

