Studies on foot and mouth disease in the eastern region of Abu Dhabi, United Arab Emirates

T. MOUSTAFA * and F. ABD EL-GADIR **

Summary: The present paper describes the status of foot and mouth disease (FMD) in the eastern region of Abu Dhabi, United Arab Emirates, over a three-year period from 1987 to 1989. The disease was prevalent among the various livestock populations in the study area.

Type O appeared to be most prevalent followed by types A and Asia 1 which were recorded at lower incidences. Type C was not recorded during the period of study.

Two isolates of each serotype were tested for antigenic relatedness to each other and to a reference virus. Both type O isolates were closely related but less related to the reference virus O1 BFS (1860). The type A isolates and the reference virus A22 IRQ 24/64 showed a similar degree of close interrelatedness. In contrast, the two Asia 1 field isolates, while being closely related, showed no antigenic relationship with the reference virus Asia 1 PAK 1/54.

The possible implications of these results regarding the current situation of FMD control in the United Arab Emirates and neighbouring countries are discussed.


INTRODUCTION

There is little data available concerning the foot and mouth disease (FMD) virus serotypes prevalent in the United Arab Emirates (UAE).

For the period 1984-1989, the FAO/OIE/WHO Animal Health Yearbook (4, 5, 6, 7, 8) reported either sporadic or low incidence of FMD in the UAE. FMD has been clinically diagnosed in the area of study since 1986 (2).

The current study was conducted in an attempt to obtain knowledge on the FMD status and the virus types prevalent in the eastern region of Abu Dhabi, from 1987 to 1989.
MATERIAL AND METHODS

Area of study

The area of study lies towards the east of the Abu Dhabi Emirate and accommodates approximately 15,000 head of cattle and 400,000 head of sheep and goats. This constitutes one-third of the national animal population (1, 2).

Vaccination

In 1987, 5,000 head of cattle were vaccinated with bivalent FMD vaccine containing antigens against types A and O (no further information is available regarding the serotypes included). No records were available for vaccination of sheep and goat populations.

In 1988, 10,000 head of cattle were vaccinated with multivalent FMD vaccine containing a combination of virus strains: O, Lausanne, O, Manisa, A, Azerbaidjan 1964, A Iran 1987, C, Philippines 1976 and Asia 1 Iran 1973. A total of 92 goats and 96 sheep were similarly vaccinated.

During the first six months of 1989, 5,000 head of cattle were vaccinated using the above FMD vaccine. In the second half of the year, 5,000 head of cattle, 210 goats and 385 sheep were vaccinated with multivalent FMD vaccine containing a different combination of virus strains: O, BFS, O Leb 85, O Manisa, A, Iraq, A Saudi, C, Pando, Asia 1 India and Asia 1 Turkey.

Further details concerning the origin of the vaccines can be obtained from the authors.

Samples

A total of 59 FMD suspected outbreaks were notified during the period of study. Tongue epithelia, vesicular fluid and saliva were collected from 92 infected animals following the method described by Hedger (11). A 10% sample suspension was prepared in Earle's balanced salt solution, treated with chloroform, centrifuged and the supernatant kept frozen at −70°C until serotyping. Samples which did not contain sufficient virus material for immediate use were passaged in two- to three-day-old baby mice as recommended elsewhere (17).

Reference antigens and antisera

Reference vaccine strains and the corresponding guinea-pig hyper-immune antisera (HIS) were kindly supplied by the OIE/FAO World Reference Laboratory for FMD in Pirbright, United Kingdom. FMD virus serotypes O, BFS (1860), A, Iraq 24/64, C, Noville and Asia 1 PAK 1/54 were supplied as 0.05% acetyleneimine-inactivated tissue-culture antigens.

Reference guinea-pig HIS against type A was supplied as an immune serum against a combination of A, A, and A, antigens.

Typing of field isolates

Cross complement fixation tests (CFT) were applied as described elsewhere (19) in a final test volume of 0.5 ml.
Preparation of hyper-immune antisera

Immune sera against some field isolates of cattle origin were prepared in guinea-pigs as described elsewhere (20). Each hind pad was inoculated intradermally with 0.5 ml of each studied isolate. Virus was harvested from inoculated pads after maximal reactions. The inoculated animals were boosted with a 10% preparation of this harvest mixed with 0.75 mg/ml saponin four weeks post-inoculation, and blood samples were taken seven to ten days later. Serum samples were tested individually against the homologous antigen by CFT.

Serological relationship

The potential relationship (R%) between selected serotype pairs of field isolates of cattle origin (two isolates each of serotypes A, O and Asia 1) and the serotype-matched reference strains available were studied using CFT in a checkerboard titration following the method described by Forman (9). Each virus-serum titration was applied by means of progressive dilutions of each serum sample against various antigen dilutions. The end-point was taken as the reciprocal logarithm of the highest serum dilution which gave 50% haemolysis against the optimum antigen dilution. Each titre was recorded as the average of eight replicates, as recommended elsewhere (12).

\[ R\% = \frac{100 \sqrt{r_1 \times r_2}}{2} \]

The R% data were interpreted as recommended (18, 10). R% values of more than 25% indicated that the two antigens were related but not identical (10).

RESULTS

The computed data for the applied vaccination campaigns revealed low levels of vaccination coverage.

The number of suspected FMD outbreaks involved in the current study was 59. Field isolates were recovered and successfully typed as FMD virus in 32 incidents. The annual distribution of the recovered field isolates among the different livestock populations is shown in Table I. Over the three-year period, FMD virus type O was recovered in twenty-four incidents whereas type A and type Asia 1 field isolates were both recovered in four incidents. FMD virus type C was not recorded in the present study (Table I).

The R% values for different bilateral comparisons between the selected field isolates and the matched reference strains are listed in Table II. With respect to the type O field isolates studied, the R% value indicating the relatedness between a field isolate recovered in January 1988 (O Jan. 1988) and a field isolate recovered in January 1989 (O Jan. 1989) was 65%. Between these isolates and the reference O1 BFS (1860) virus, values of 36% and 37%, respectively, were obtained. Bilateral comparisons between type A field isolates recovered in March 1988 (A March 1988) and November 1989 (A Nov. 1989), as well as with the reference A25 IRQ 24/64, gave R% values of >55%.
### Table I

**Number of foot and mouth disease outbreaks and patterns of recovered field isolates reported between 1987 and 1989**

<table>
<thead>
<tr>
<th>Year</th>
<th>Source</th>
<th>No. of outbreaks</th>
<th>No. of isolates</th>
<th>Type O</th>
<th>Type A</th>
<th>Type C</th>
<th>Type Asia 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>Sheep and goats</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Cattle</td>
<td>10</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1988</td>
<td>Sheep and goats</td>
<td>12</td>
<td>10</td>
<td>6</td>
<td>2</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Cattle</td>
<td>10</td>
<td>7</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1989</td>
<td>Sheep and goats</td>
<td>12</td>
<td>9</td>
<td>7</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Cattle</td>
<td>4</td>
<td>4</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>59</strong></td>
<td><strong>32</strong></td>
<td><strong>24</strong></td>
<td><strong>4</strong></td>
<td><strong>0</strong></td>
<td><strong>4</strong></td>
</tr>
</tbody>
</table>

Results from the comparison between the Asia 1 field isolates recovered in December 1988 (Asia 1 Dec. 1988) and those recovered in September 1989 (Asia 1 Sept. 1989) gave values of almost 50%. In contrast, the reference Asia 1 PAK 1/54 strain gave R% values of only 14% and 22%, respectively.

### DISCUSSION

The annual number of recognised and non-identified FMD outbreaks among different livestock populations might indicate the relative prevalence of FMD in the Al-Ain region of Abu Dhabi. This might also reflect the general picture of the disease in

### Table II

**Serological relationships between selected foot and mouth disease field isolates of cattle origin and the serotype-matched reference strains**

<table>
<thead>
<tr>
<th>Source of comparison</th>
<th>$r_1$</th>
<th>$r_2$</th>
<th>R%</th>
</tr>
</thead>
<tbody>
<tr>
<td>O Jan.1988 x O Jan. 1989</td>
<td>1.80</td>
<td>1.62</td>
<td>64.6%</td>
</tr>
<tr>
<td>O1 BFS (1860) x O Jan. 1988</td>
<td>1.44</td>
<td>1.70</td>
<td>37.2%</td>
</tr>
<tr>
<td>O1 BFS (1860) x O Jan. 1989</td>
<td>1.32</td>
<td>1.80</td>
<td>36.3%</td>
</tr>
<tr>
<td>A March 1988 x A Nov. 1989</td>
<td>1.82</td>
<td>1.71</td>
<td>58.2%</td>
</tr>
<tr>
<td>A22 IRQ 24/64 x A March 1988</td>
<td>1.67</td>
<td>1.81</td>
<td>55.0%</td>
</tr>
<tr>
<td>A22 IRQ 24/64 x A Nov. 1989</td>
<td>1.80</td>
<td>1.83</td>
<td>65.3%</td>
</tr>
<tr>
<td>Asia 1 Dec. 1988 x Asia 1 Sept. 1989</td>
<td>1.62</td>
<td>1.77</td>
<td>49.5%</td>
</tr>
<tr>
<td>Asia 1 PAK 1/54 x Asia 1 Dec. 1988</td>
<td>1.32</td>
<td>1.35</td>
<td>21.6%</td>
</tr>
<tr>
<td>Asia 1 PAK 1/54 x Asia 1 Sept. 1989</td>
<td>0.92</td>
<td>1.35</td>
<td>14.0%</td>
</tr>
</tbody>
</table>
the UAE, since the area of study accommodates approximately one-third of the national animal population. Reporting of FMD as a disease of exceptional occurrence in cattle and only suspected in sheep and goats in the UAE (6, 7, 8) could be attributed to a lack of diagnostic capabilities as well as the reticence of local breeders to report disease.

The profile of recovered FMD virus types indicates a prevalence, in descending order of incidence, of FMD virus types O, A and Asia 1; there was no evidence for the presence of type C. The virus serotypes involved and animal species affected were similar to findings in the neighbouring Sultanate of Oman and Saudi Arabia with respect to the prevalence of type O (8). FMD virus type A was recorded in Saudi Arabia in 1986 (14) and 1987 (15), while type Asia 1 has recently been identified in the Sultanate of Oman (8). No data are available concerning the incidence of type C in the surrounding Gulf States.

The potential antigenic relationship between serotype pairs of field isolates of cattle origin (two isolates each of serotypes A, O and Asia 1) and the available reference strains was interpreted as described by Forman (10) and Stellmann and colleagues (18). The results obtained showed that both type O field isolates tested were antigenically closely related to each other, but more distantly related to the reference virus O1 BFS (1860). In contrast, the type A field isolates were related antigenically, both to each other and to the reference virus A22 IRQ 24/64. The type Asia 1 field isolates were antigenically related to each other, but showed no relationship with the Asia 1 PAK 1/54 reference strain.

The present results, in conjunction with those reported for field isolates of types O and A from the neighbouring Gulf States (13, 15, 16) and Asia 1 field isolates (3), would suggest that further studies on vaccinated animals challenged with the various local field isolates might prove informative. Such analyses are necessary in order to achieve a proper evaluation of the efficiency of FMD vaccines to be used in the United Arab Emirates and in neighbouring countries.

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ÉTUDES SUR LA FIÈVRE APHTEUSE DANS L'EST D'ABOU DHABI, ÉMIRATS ARABES UNIS. – T. Moustafa et F. Abd El-Gadir.

Résumé : L'article décrit l'évolution de la fièvre aphteuse sur une période de trois ans, de 1987 à 1989, dans l'est d'Abou Dhabi (Émirats arabes unis), zone où la maladie sévissait dans différents élevages.

Le type O du virus de la fièvre aphteuse semblait être le plus répandu, suivi par les types A et Asia 1. Le type C n'a pas été signalé pendant la durée de l'étude.

Deux isolats de chaque sérotype ont été étudiés quant à leurs relations antigéniques respectives et vis-à-vis d'un virus de référence. Les deux isolats de type O étaient étroitement apparentés entre eux, mais ils l'étaient moins vis-à-vis du virus de référence O1 BFS (1860). Les isolats de type A et le virus de référence A22 IRQ 24/64 présentaient le même type d'étroite parenté. En revanche, les deux isolats de terrain Asia 1, très proches l'un de l'autre, ne
présentaient aucune relation antigénique vis-à-vis du virus de référence Asia 1 PAK 1/54.

Les conséquences possibles de ces résultats sur la lutte contre la fièvre aphteuse, actuellement en cours dans les Emirats arabes unis et les pays voisins, font l'objet de la discussion.


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ESTUDIOS SOBRE LA FIEBRE AFTOSA AL ESTE DE ABU DHABI, EMIRATOS Árabes Unidos. – T. Moustafa y F. Abd El-Gadir.

Resumen: El artículo describe la evolución de la fiebre afrósa en un período de tres años, entre 1987 y 1989, al este de Abu Dhabi (Emiratos Árabes Unidos), región en que esta enfermedad atacaba diferentes ganados.

El tipo O mostró ser el más difundido, seguido por los tipos A y Asia 1. El tipo C no fue observado en el período en cuestión.

Se investigaron dos aislados de cada serotipo para comprobar sus relaciones antigénicas respectivas y ante un virus de referencia. Los dos aislados de tipo O estaban estrechamente emparentados entre sí, pero bastante menos en relación con el virus de referencia O1 BFS (1860). Los aislados de tipo A y el virus de referencia A22 IRQ 24/64 presentaban el mismo tipo de relación estrecha. En cambio, los dos aislados de campo Asia 1, estrechamente emparentados entre sí, no mostraron ninguna relación antigénica respecto del virus de referencia Asia 1 PAK 1/54.

Los autores se refieren, por último, a las consecuencias que estos resultados podrían tener en el control de la fiebre afrósa en los Emiratos Árabes Unidos y países vecinos.


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REFERENCES


