Epidemiol. Infect. (1993), **111**, 559–563

The role of wild animals, other than buffalo, in the current epidemiology of foot-and-mouth disease in Zimbabwe

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(*Accepted 29 June 1993*)

SUMMARY

Between 1989 and 1992, 7970 wild ungulates, comprising 14 different species, were tested for antibodies to types SAT 1, SAT 2 and SAT 3 foot-and-mouth disease (FMD) virus. Of these 1·2% were found to be positive and these included impala (*Aepyceros melampus*), eland (*Taurotragus oryx*), waterbuck (*Kobus ellipsiprymnus*) and sable (*Hippotragus niger*). All the positive animals were either from the wildlife areas where buffalo (*Syncerus caffer*) occur or from ranches where clinical FMD had occurred in cattle. The role of these animal species in the current epidemiology of FMD in Zimbabwe is discussed.

INTRODUCTION

Foot-and-mouth disease (FMD) is endemic in the wild buffalo (*Syncerus caffer*) populations of Zimbabwe. Following an eradication policy carried out in the early 1980s they are now confined to the wildlife areas of the Zambesi valley, the Hwange National Park and adjacent safari areas in the north of the country, and to the Gona-re-zhou National Park and two adjoining game ranches in the south-east lowveld.

The objective in eradicating the buffalo from the farming areas of Zimbabwe was to remove what was then thought to be the only source of FMD infection and so pave the way for the establishment of a FMD-free zone within the country to allow exports of beef to Europe.

For FMD control purposes the country was divided into five zones (Fig. 1): a wildlife zone ('W'), a vaccination zone adjacent to the wildlife zone ('red' zone) in which all cattle are vaccinated every 6 months, a non-vaccinated buffer zone ('green' zone) from which all susceptible animals must be tested serologically negative before they can be moved to the 'clear' zone. Cattle are not, however, generally moved into the 'clear' zone. The 'clear' zone is divided into two regions, 'C' and 'E', with exports taking place from zone 'E' only. Cattle and wild ungulates from the wildlife and vaccinated zone cannot be moved to the other zones without a negative antibody test following a quarantine period of 3 weeks. As a result of an increasing interest in the utilization of wildlife for the establishment of small game parks as tourist attractions large numbers of wild

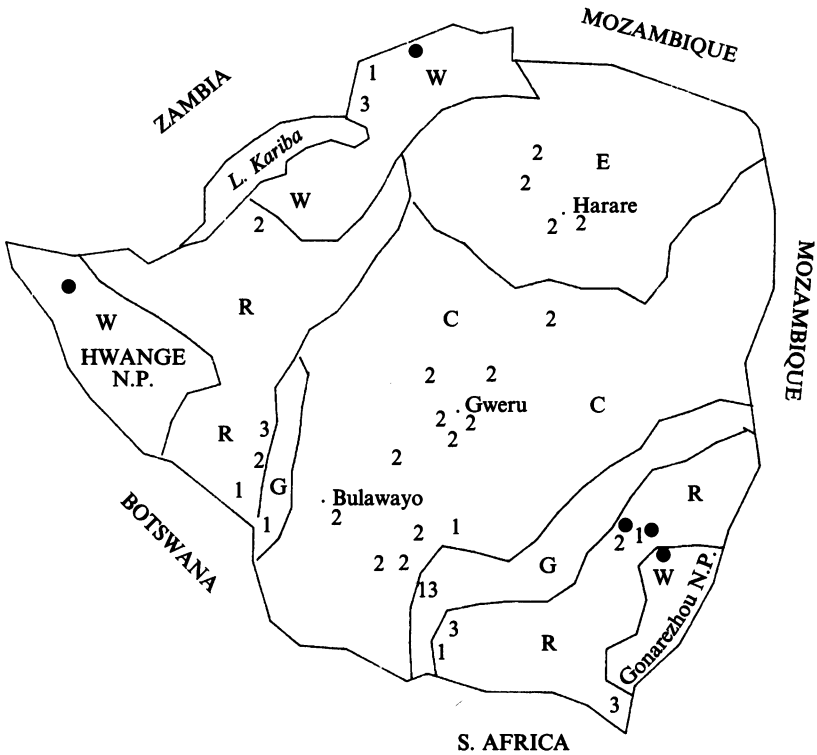

Fig. 1. Outbreaks of foot and mouth disease in Zimbabwe between 1980 and 1992. W, wildlife zone; R, vaccinated zone; G, non-vaccinated buffer zone; C, FMD free zone; E, FMD free zone from which exports take place; 1, type SAT 1; 2, type SAT 2; 3, type SAT 3; O, places where seropositive animals have been found.

animals have been captured and translocated within the country over the past 3 years to restock commercial farms. Most of the wild animals occur in the 'wildlife' and 'red' zones of the country and this has necessitated testing them for FMD antibodies.

This paper records the results of these tests and discusses the likely significance of these species in the current epidemiology of the disease.

METHODS

Blood samples were collected following either chemical immobilization or physical restraint. Between 1989–91 animals in the 'wildlife' and 'red' zones were sampled twice, at the beginning and completion of a 3-week quarantine period in an approved quarantine holding facility. In the light of the results obtained, samples were only collected at the completion of the quarantine during 1992 in order to minimize the trauma and stress that results from the handling of the animals.

All sera were tested for antibodies to the three endemic serotypes, SAT 1, SAT 2 and SAT 3 using a blocking ELISA [1] employing inactivated antigens obtained from the Botswana Vaccine Institute.

Table 1. *The total number of animals tested for antibody to types SAT 1, SAT 2 and SAT 3 and their distribution*

	Control zone*					
Species	E	C	G	R	W	Total
Giraffe	3	3	56	419	5	486
Eland	13	32	219	992	1	1257
Impala	—	782	374	2189	490	3835
Tsessebe	5	631	—	8	—	644
Kudu	—	40	45	24	1	110
Waterbuck	—	4	14	135	124	277
Sable	34	82	—	277	90	483
Bushbuck	—	27	—	31	—	58
Nyala	—	—	—	25	—	25
Warthog	—	54	31	—	1	86
Bushpig	—	2	—	—	2	4
Reedbuck	—	19	—	—	—	19
Wildebeest	10	21	162	270	223	686
Total	65	1697	901	4370	937	7970

* E, beef export FMD-free zone; C, non-export FMD-free zone; G, unvaccinated buffer zone; R, FMD vaccinated zone; W, wildlife FMD endemic zone.

Table 2. *Places where seropositive animals were found and the proportion (%) positive at that sampling*

				Percent positive (titre $\log_{10}$)		
Place	Zone	Species	Number	SAT 1	SAT 2	SAT 3
Hippo Valley	W	Impala	92	27 (2·0–3·1)	8·7 (2·0–3·1)	nil
		Eland	48	12·5 (1·5–2·5)	nil	nil
Matetsi	W	Waterbuck	41	2·4 (3·1)	nil	nil
nr Hwange		Sable	17	16 (2·2–3·1)	nil	nil
Buffalo Range	R	Sable	6	100 (1·7–2·6)	nil	nil
Eaglemont nr	R	Eland	11	27 (1·8–2·4)	nil	nil
Buffalo Range		Impala	41	7·3 (1·8–2·4)	nil	nil
Mana Pools	W	Impala	308	nil	7·8 (1·7–2·4)	3·6 (1·7–2·8)

RESULTS

Table 1 lists the number of each of 14 species sampled between September 1989 and December 1992 according to the zone in which they occurred. A total of 7970 samples were tested with the majority coming from animals in the 'red' zones.

A total of only 103 (1·2%) animals were found with antibody, mainly to type SAT 1 (Table 2). All these animals were in the 'red' or 'wildlife' zones. All those found in the 'red' zone were in the south-east and were positive for SAT 1 antibody and were from ranches which had either experienced a SAT 1 outbreak in cattle within the previous 12 months or were adjacent to such ranches. Those found positive for SAT 2 and SAT 3 were all from the wildlife zones of the Zambezi valley or Hippo Valley Estates where buffalo occur. No positives were found in the 'green' or 'clear' zones. No evidence was found for any involvement of wildlife in

the 1989 SAT 2 epidemic that began in the 'clear' zone (C) in the Midlands and Matebeleland North Province and spread to Mashonaland (E).

Throat scrapings from all the seropositive animals, with the exception of those from Mana Pools in the Zambezi valley, taken either at the time of blood sampling or while they were still being held in quarantine after being found positive, were negative for FMD virus.

DISCUSSION

A serological survey [2] of wildlife carried out in Zimbabwe in the late 1960s identified 14 species, apart from buffalo, in which antibody to FMD virus was found. These animals came from all the major wildlife areas of the country where a constant source of infection was provided by the buffalo. In this study most, but not all, of the samples came from areas where buffalo are no longer found. Figure 1 shows the distribution of the outbreaks of clinical FMD that occurred in cattle between 1980 and 1992. In this study the majority of wildlife sampled came from the 'red' zone in the south-east where outbreaks caused by all three serotypes have occurred. Outbreaks due to SAT 1 occurred during 1987 and 1989 and cattle on some of the ranches from which the wild animals were sampled were known to have been infected e.g. Buffalo Range. Studies on persistent infection in impala [3, 4] wildebeest [4], eland and sable [5, 6; Anderson, unpublished results] have shown that none of these species become consistent carriers of FMD virus following experimental infection unlike cattle and buffalo.

The results of the survey reported here showed only four species to have been infected in recent years, namely impala, sable, eland and waterbuck although this may simply be because other species were not exposed to infection.

There were no buffalo on Buffalo Range ranch where the outbreak in cattle occurred but they were present on the adjoining game ranch, Hippo Valley Estates. Although the exact source of infection for the cattle was not determined it is known that the virus isolated from the cattle was closely related to a strain isolated from buffalo on Hippo Valley Estates in 1990 (2·4% nucleotide differences in the hypervariable region of the 1D gene; N. Knowles and colleagues, results to be published). Whether antelope acted as intermediaries in the chain of infection is not known. Impala were frequently infected in the Kruger National Park [7] where transmission between impala readily occurred. The initial infection there was presumed to be from buffalo and comparisons of the nucleotide sequences of the same region of the 1D gene showed that some isolates from impala were related to buffalo isolates but others were more divergent [8].

The seropositive animals detected in the wildlife zones must have been infected by contact with buffalo as there were no cattle in these areas.

No seropositive wild animals were detected in the Midlands where the SAT 2 epidemic occurred in 1989. However, it is uncertain how much contact there was between the wildlife and the infected cattle.

The conclusion that can be drawn from these results is that while wild ungulates, other than buffalo, do become infected with FMD virus and could act as intemediaries in the transmission of infection to cattle this would not be a common event and has yet to be demonstrated conclusively. They have not played a significant role in the transmission of FMD in Zimbabwe in recent years.

ACKNOWLEDGEMENTS

The assistance of Jane Rogers and Leslie Rowe is gratefully acknowledged. This paper is published with the permission of the Director of Veterinary Services, Zimbabwe.

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