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RESEARCH COMMUNICATION

FAILURE OF *HAEMATOBIA THIROUXI POTANS* (BEZZI) TO TRANSMIT FOOT-AND-MOUTH DISEASE VIRUS MECHANICALLY BETWEEN VIRAEMIC AND SUSCEPTIBLE CATTLE

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ABSTRACT

THOMSON, G. R., DOUBE, B. M., BRAAK, L. E. O., GAINARU, M. D. & BENGIS, R. G., 1988. Failure of *Haematobia thirouxi potans* (Bezzi) to transmit foot-and-mouth disease virus mechanically between viraemic and susceptible cattle. *Onderstepoort Journal of Veterinary Research*, 55, 121–122 (1988).

In 2 separate experiments the blood-feeding fly *Haematobia thirouxi potans* (Bezzi) failed to transmit foot-and-mouth disease virus when transferred from viraemic (log 2,6–log 4,3 MLD_{50} or $TCID_{50}/m\ell$) to susceptible cattle. Each experiment involved 2 suscetible and 2 viraemic animals housed in separate stables and 2 000 – 4 000 flies of which most had fed on viraemic hosts 120 min prior to transfer. Furthermore, only minimal quantities of virus were isolated from free-living flies captured on experimentally infected buffalo *(Syncerus caffer)* in the acute stages of infection.

Foot-and-mouth disease (FMD) is spread directly by contact between infected and susceptible hosts and indirectly by the airborne route, by contaminated animal products as well as mechanically on people, vehicles, wild animals, birds and fomites (Sellers, 1971).

In southern Africa the only free-living maintenance host for the SAT types of FMD virus so far identified is the buffalo *(Syncerus caffer)* (Hedger, 1976) and it is therefore commonly assumed that they generally provide the primary source of infection in outbreaks involving domestic stock. However, because even acutely infected buffalo apparently do not transmit SAT viruses to cattle unless contact between the 2 species is intimate (Gainaru, Thomson, Bengis, Esterhuysen, Bruce & Pini, 1986) and because buffalo in the field do not usually associate closely with other species, it is not clear how the virus may be transmitted from buffalo to cattle.

Although little evidence has been found to suggest a role for arthropods in general, or biting flies in particular, in the epidemiology of FMD (Greenberg, 1973), there are a number of features of the biology of the African buffalo fly *Haematobia thirouxi potans* (Bezzi) which predispose it to act as a mechanical vector of foot-and-mouth disease virus. Large numbers (up to 1 000 per head) of the fly have been observed on buffalo in the Kruger National Park (unpublished data) and the same species has been recorded on cattle in many regions of southern Africa (Doube, 1986). *Haematobia* flies feed on blood numbers of times per day, transfer between animals within herds, and leave their host to oviposit on dung (Chamberlain, 1981; 1982). After oviposition the fly must find a new host and may travel kilometres to this end (Ferrar, 1969; Tugwell, Burns & Witherspoon, 1966). It is therefore probable that cattle in the regions surrounding the Kruger National Park will occasionally become infested with buffalo flies which have recently fed upon a viraemic buffalo. This, in conjunction with the observation of viraemias up to log 4,8 $MLD_{50}/m\ell$ in acutely infected buffalo (Gainaru *et al.*, 1986), suggested that the African buffalo fly may be involved in the mechanical transmission of SAT virus types between buffalo and cattle and prompted this investigation.

Newly emerged adult flies fed within 1–2 h of release onto cattle but mass gain during the next 4 –5 h was minimal (Fig. 1). However, samples (20 –50 individuals) of newly emerged laboratory-reared adults of the African buffalo fly (Doube, Fay & Ashenborn, 1982), which had been fed for 2 h on cattle viraemic with SAT 1 virus (Table 1), failed to reveal infectivity when suspensions were inoculated into suckling mice. Likewise virus was recovered only once in a trace amount from free-living flies captured on experimentally infected buffalo (Table 2).

In each of 2 separate experiments, 5 000 –7 000 newly emerged laboratory-reared adults were released in the vicinity of 2 cattle which were viraemic with SAT 1 virus and housed in a high security stable (Table 1). After 2 h the majority of the flies were recaptured and re-released within minutes in a separate stable which contained 2 susceptible cattle (Table 1). In experiment 1, the flies were briefly anaesthetized with CO_2 during transfer to the virus-free stable: in experiment 2 the flies were not anaesthetized. The transferred flies were left in the stable housing the susceptible cattle for 48 h. In both experiments a large proportion of the flies were seen to begin feeding on the susceptible cattle immediately after release into the "clean" stable. The susceptible cattle failed to develop pyrexia or typical FMD lesions in the 10 days following introduction of the flies and had not developed neutralizing antibody when tested 3 weeks after exposure to the flies, thereby indicating that FMD transmission had not occurred. The large numbers of flies used in this investigation, together with the relatively high viraemias of the infected cattle (Table 1; Gainaru *et al.*, 1986), indicate that *H. thirouxi potans* is, at most, an inefficient mechanical transmitter of SAT viruses.

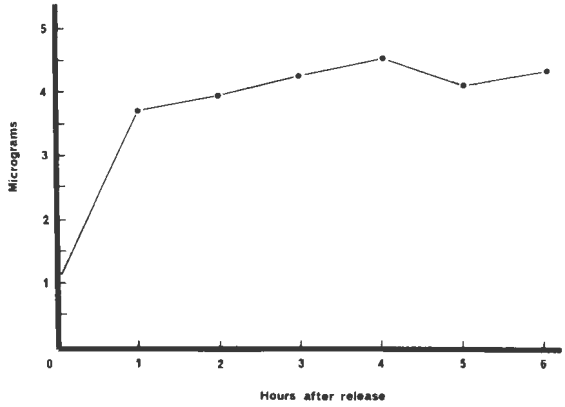

FIG. 1 The change in mass of newly emerged *H. thirouxi potans* following release in a stable housing a steer. Each point represents the mean mass of a sample of 50 flies

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TABLE 1 Details of 2 experiments designed to test mechanical transmission of SAT viruses by *H. thirouxi potans*

Experiment No.	Virus strain used	Animal No.	Level of viraemia	No. of flies fed on viraemic cattle	% which had fed within 2 h (No. dissected)	No. of flies transferred to "clean" stable
1	SAR 17/80	1	2,6[1]	≃5 000	90 (60)	≥2 000
		2	4,3[1]			
2	SAR 4/74	3	4,2[2]	≃7 000	ND	≥3 000
		4	3,2[2]			

[1] Mouse lethal $doses_{50}/m\ell$ (log_{10})
[2] Tissue culture infective $doses_{50}/m\ell$ (log_{10})
ND Not determined

TABLE 2 The recovery of virus from *H. thirouxi potans* captured on pairs of FMD-infected (SAR 17/86) buffalo at Skukuza, Kruger National Park. The buffalo were naturally infested with flies which had bred locally

Estimated No. days after infection[1]	No. of flies captured	Viraemias of the 2 buffalo sampled	Virus recovery from the captured flies (+ or −)
2	206	4,4 & 2,1*	+
3	16	1,0 & negative	−
4	103	1,4 & negative	−
5	6	Both negative	−
8	142	Both negative	−
11	29	Both negative	−
16	75	Both negative	−
18	22	Both negative	−
23	29	Both negative	−
25	112	Both negative	−

[1] The sampled animals were infected by exposure to 2 buffalo infected by needle inoculation
* Log_{10} $MLD_{50}/m\ell$
\+ Virus level was so low that it could not be titrated

There are 3 possible explanations for this inefficiency: the flies' feeding mechanism is such that the ingested virus is not exposed to tissues of the bovine host during subsequent feeding by the flies, the virus ingested is inactivated by exposure to secretions in the gastro-intestinal tract of the fly, and the quantities of virus contaminating the mouth parts or regurgitated during feeding are below the infection threshold. It is not possible to differentiate between these possibilities on the basis of this study.

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