

# EXOTIC

## Foot and mouth disease (native wildlife)

### Fact sheet

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#### Introductory statement

Foot and mouth disease (FMD) is a highly contagious viral vesicular disease of cloven hoofed animals. It is a major issue in international trade in livestock and livestock products. **Australia is free of the disease** and it is vital that it remains so. The 2001 outbreak in the United Kingdom resulted in over 10 million cattle and sheep being slaughtered at a cost of over GBP 8 billion in order to eradicate the disease.

This fact sheet summarises what is known about FMD and Australian native wildlife. WHA also manages an fact sheet that briefly summarises information on FMD and feral animals “Foot and Mouth Disease (General Information)”.

#### Aetiology and natural hosts

FMD is caused by an aphthovirus belonging to the family Picornaviridae. It is a single stranded non enveloped 25 nm RNA virus. There are seven serotypes: A, O, C, SAT 1, SAT 2, SAT 3, and Asia 1.

All cloven hoofed animals are considered susceptible. Cases have also been reported in elephants, hedgehogs and some rodents.

#### World distribution and occurrences in Australia

FMD is endemic in Africa, the Middle East, Asia and parts of South America. The disease has almost been eradicated from Europe with the most recent cases occurring in the United Kingdom and Cyprus in 2007.

FMD has **not occurred** in Australia for over 130 years, and then only in livestock. Minor outbreaks occurred in 1801, 1804, 1871 and 1872 (Geering et al 1995). However, a case was reported in an eastern grey kangaroo (*Macropus giganteus*) held in a zoo in India (Bhattacharya et al 2003).

## Epidemiology

FMD is generally transmitted via the respiratory system, orally or through breaks in the skin or mucosa. FMD virus is produced in large quantities by infected animals. Experimental transmission studies in a variety of Australian native animals (housed overseas) by Snowdon (1968) were undertaken to determine susceptibility of Australian mammals to FMD (Appendix 1). These studies demonstrated short periods of virus replication, viraemia and shedding of virus in a high proportion of many of the native species tested. A measurable and significant antibody response was also evident in many animals.

Natural transmission from infected cattle to red kangaroos and wombats did occur, when species were held in close confinement. However, spread from naturally infected red kangaroos to other red kangaroos or cattle did not occur under close confinement (although artificially inoculated kangaroos could transmit FMD to cattle through contact).

The author concluded that native Australian species were unlikely to play an important role in the epidemiology of an FMD outbreak. This is because the risk of transmission within and between native species, from native species to cattle and from domestic species to native species was considered low under normal field conditions, although the author noted that this might occur under adverse conditions such as drought (when many species are in close contact at water sources).

## Clinical signs

The naturally infected eastern grey kangaroo developed lameness and sloughing of the foot pads, while the experimentally infected ones showed no clinical signs. One out of 24 experimentally infected red kangaroos developed irregular circular ulcers on the feet 14 days after inoculation, with no lesions seen prior to this time. The tree kangaroo developed a vesicle on the tongue three days after inoculation, which had healed by day 11. It also developed vesicles on the feet four days after inoculation. Four of five water rats developed white circular tongue lesions, although these did not appear vesicular. Two out of 13 echidnas developed vesicles on the hind feet and ulceration on the posterior third of the tongue. The Bennett's wallabies, wombats, possums, potoroos, bandicoots, and antechinus developed no clinical signs post inoculation (Bhattacharya et al 2003, Snowdon 1968).

## Diagnosis and differential diagnosis

A diagnosis of FMD is based on a combination of clinical signs and laboratory tests. Differential diagnoses include other vesicular diseases such as vesicular stomatitis (antibodies have been found in opossums; *Didelphis virginianus*) (Fletcher et al 1985), traumatic lesions of the mouth or feet or chemical irritants and scalding.

## Pathology

The naturally infected eastern grey kangaroo had areas of myocardial necrosis with an inflammatory cell infiltrate (Bhattacharya et al 2003). Pancreatic lesions were seen in the experimentally infected antechinus and water rats (Snowdon 1968).

## Laboratory diagnostic specimens and laboratory procedures

Vesicular fluid, epithelial flaps and blood in EDTA or heparin should be collected. A necropsy should be performed and a complete set of tissues collected fresh and in formalin. It is important to include sections of soft palate and pharynx, as these seem to contain the highest concentrations of virus in marsupials (Geering et al 1995, Snowdon 1968). Diagnosis can be made by ELISA, PCR and viral culture.

## Treatment, prevention and control

Treatment is not an option as the disease is exotic to Australia. Australia has stringent quarantine measures in place to prevent the introduction of FMD, so the risk of Australian native mammals contracting the disease is extremely low.

## Surveillance and management

Australia's approach to managing an incursion of FMD is described in the AUSVETPLAN foot-and-mouth disease strategy, version 3.4, 2014. Wildlife considerations as part of response are addressed in the WARS AUSVETPLAN. Both can be found at: [www.animalhealthaustralia.com.au/our-publications/ausvetplan-manuals-and-documents/](http://www.animalhealthaustralia.com.au/our-publications/ausvetplan-manuals-and-documents/)

The role of native species in an FMD outbreak is likely to be minor as it is very unlikely that they will become infected and transmit the disease under normal field conditions. However, in the event of an outbreak of FMD it may be valuable to conduct some surveillance in native species. It may also be necessary to demonstrate to trading partners that there is no persistence of FMD in native species. This type of surveillance would be conducted as part of proving freedom, and would be targeted to previously-infected areas where native and domestic animals are in high concentrations and contact was likely to have occurred.

## Statistics

Wildlife disease surveillance in Australia is coordinated by Wildlife Health Australia. The National Wildlife Health Information System (eWHIS) captures information from a variety of sources including Australian government agencies, zoo and wildlife parks, wildlife carers, universities and members of the public. Coordinators in each of Australia's States and Territories report monthly on significant wildlife cases identified in their jurisdictions. NOTE: access to information contained within the National Wildlife Health Information System dataset is by application. Please contact [admin@wildlifehealthaustralia.com.au](mailto:admin@wildlifehealthaustralia.com.au).

No cases of FMD have been reported from native Australian wildlife in Australia.

## Human health implications

Although human infections have been reported, they are very rare. Symptoms, if they occur, include fever and vesicles on the hands or feet or in the mouth. People can mechanically transfer the infection, and may harbour the virus in the nasopharynx for more than 24 hours (Geering et al 1995).

## Conclusions

While Australian native mammals can be infected with FMD virus, they would appear to pose minimal risk to livestock during an epidemic. The virus may persist in the blood for up to four days in species tested, but clinical disease is rare. In experimental studies, while kangaroos could contract the disease from infected cattle in close contact, they were not able to transmit it to uninfected cattle or other kangaroos, making persistence of the virus in Australian native animals extremely unlikely. Echidnas represent a greater potential threat because of their more prolonged viraemia but their preference for open forest or scrub would bring them into only limited contact with livestock. Feral wildlife have been assessed as a much more significant risk to the epidemiology of FMD in Australia than native wildlife (Murray and Snowdon 1976).

## References and other information

- Bhattacharya S, Banerjee R, Ghosh R, Biswas A and Chatterjee A. Identification of foot-and-mouth disease from a captive kangaroo in a zoological garden in India. *Veterinary Record* 2003; 153: 504-505.
- Fletcher WO, Stallknecht DE and Jenney EW. Serologic surveillance for vesicular stomatitis virus on Ossabaw Island, Georgia. *Journal of Wildlife Diseases* 1985; 21: 100-104.
- Geering WA, Forman AJ and Nunn MJ. Foot-and-mouth disease. In: *Exotic Diseases of Animals*. Australian Government Publishing Service, Canberra. 1995; 112-131.
- Murray, M.D., Snowdon, W.D. (1976) The role of wild animals in the spread of exotic diseases in Australia. *Australian Veterinary Journal*. 1976; 52: 547-554.
- Snowdon WA. The susceptibility of some Australian fauna to infection with foot and mouth disease virus. *Australian Journal of Experimental Biology and Medical Science*. 1968; 46: 667-687.

## Appendix 1: Additional information on transmission of FMD in Australian native wildlife

Experimental transmission studies to a variety of Australian mammals (red kangaroos (*Macropus rufus*), a Matschie's tree kangaroo (*Dendrolagus matschiei*), eastern grey kangaroos, Bennett's wallabies (*M. rufogriseus*), common wombats (*Vombatus ursinus*), brush-tailed possums (*Trichosurus vulpecula*), long-nosed bandicoots (*Perameles nasuta*), long-nosed potoroos (*Potorous tridactylus*), water rats (*Hydromys chrysogaster*), echidnas (*Tachyglossus aculeatus*), and brown antechinus (*Antechinus stuartii*), resulted in viraemias for varying periods of time (Snowdon 1968), as shown in the table below.

Species	Days post infection										
	1	2	3	4	5	6	7	10	14	21	35
Red Kangaroo	21/31*	26/37	16/33	5/25	1/14	0/2	0/8				
EG Kangaroo	1/4	1/6	0/6	0/6	0/2		0/2				
Tree kangaroo	1/1	1/1	1/1	1/1	1/1						
Bennett's wallaby	1/6	6/10	2/10	3/10	0/4		1/6				
Wombat	4/8	9/14	8/14	8/11	0/3	0/3	¼				
Possum			3/6				0/6				
Potoroo			1/5				0/5				
Bandicoot			0/5				¼				
Water rat			2/8				0/8				
Antechinus			2/4								
Echidna			11/13				8/12	4/11	1/6	0/6	0/6
Rabbit	1/16	10/16	3/16	0/16	0/10						

\* Number of animals viraemic over number of animals tested.

Virus was generally recoverable from oral and cloacal swabs in viraemic animals, but it was also recovered from one oral swab in a grey kangaroo, one oral swab in a wallaby, two cloacal swabs in grey kangaroos and four cloacal swabs in wallabies that were not viraemic.

Antibody titres in inoculated red kangaroos, the tree kangaroo and wombats peaked 14 days after inoculation and then gradually declined. Antibodies developed in only one out of four wombats despite all four becoming viraemic. Inoculated echidnas had no detectable antibody titres 21 days after inoculation but had considerable titres when tested at day 35.

When four red kangaroos and four wombats were held in contact with an infected steer three kangaroos and all wombats developed a low grade viraemia. Three of the kangaroos and none of the wombats seroconverted. When seven red kangaroos were inoculated with the virus and placed in contact with six steers one steer developed FMD seven days after contact and one developed it 15 days after contact. When three inoculated kangaroos were placed in contact with other kangaroos none of the contact kangaroos became viraemic.

Four inoculated steers developed FMD and were placed in contact with 13 kangaroos. After 48 hours seven of the kangaroos were placed in contact with six cattle and six kangaroos were placed in contact with six kangaroos. Viraemia was not detected in any of the in contact kangaroos and none of the cattle developed FMD. None of the contact cattle or kangaroos seroconverted.

Four red kangaroos and three wombats were inoculated with the virus. All kangaroos became viraemic with one animal developing clinical lesions in the hind feet. Only one wombat became viraemic and none

developed clinical signs. Two red kangaroos, one grey kangaroo and two wombats were held in contact with the inoculated animals. None of the contact animals seroconverted or developed clinical signs of FMD.

A red kangaroo was inoculated with virus and blood was collected while it was viraemic. This blood was inoculated into another kangaroo. No clinical signs developed and virus could not be recovered from this kangaroo.

The mode of transmission to the kangaroo infected in the Indian zoo is unknown but infection was speculated to have come from muntjac (*Muntiacus muntjac*) within the zoo that were showing clinical signs at the time (Bhattacharya et al 2003).

## Acknowledgements

We are extremely grateful to the many people who had input into this fact sheet. Without their ongoing support production of these fact sheets would not be possible.

Updated: Aug 2018

## To provide feedback on this fact sheet

Wildlife Health Australia would be very grateful for any feedback on this fact sheet. Please provide detailed comments or suggestions to [admin@wildlifehealthaustralia.com.au](mailto:admin@wildlifehealthaustralia.com.au). We would also like to hear from you if you have a particular area of expertise and would like to produce a fact sheet (or sheets) for the network (or update current sheets). A small amount of funding is available to facilitate this.

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or call +61 2 9960 6333