Opportunities and constraints posed by wildlife in the diagnosis and epidemiology of foot-and-mouth disease virus infection

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WHY IT IS IMPORTANT TO CONSIDER WILDLIFE IN THE EPIDEMIOLOGY OF FOOT-AND-MOUTH DISEASE (FMD)

This presentation will address wildlife and also feral populations of animals such as swine and swamp buffaloes.

The overall FMD ‘picture’ is the result of complex interactions between sedentary farmed livestock, migratory/transhumant livestock, wildlife/feral animal populations and their migrations, trade in animal products and zoo-sanitary provisions.

1. Wildlife can suffer clinical disease – they can become infected from domesticated animals and can also pass infection to domesticated animals – it is a two-way dynamic exchange

2. Some wild populations can harbour FMD and are intimately involved in the epidemiology of FMD – there is still much more to learn

3. For a full knowledge of FMD viruses and their constant evolution we need to know the situation in wildlife

4. For accreditation of FMD freedom we need to include wildlife
THE AFRICAN WILDLIFE RESERVOIR

The pivotal role played by the African buffalo (*Syncerus caffer*) in acting as a reservoir of infection to maintain and propagate infection is well known.

Ecological groupings of FMD viruses

![Map of African wildlife reservoir](image)

Area where wildlife are important in FMD maintenance and transmission

THE AFRICAN WILDLIFE RESERVOIR

Evolving understanding of the role of wildlife in harbouring and propogating FMD

After all the years of study of wildlife in southern Africa and their role in generating cattle FMD, two interesting insights have recently emerged:

(1) Impala (*Aepyceros melampus*) are important independently of buffaloes (*Syncerus caffer*) in maintaining and propogating FMD; there is a much more complex relationship than was suspected: sub-clinical, seasonally modulated infection occurs commonly in some populations of impala.

(2) There is ample evidence that FMD viruses spread repeatedly from buffaloes to cattle, but it has been difficult to reproduce this experimentally. There is now evidence that venereal transmission from bull buffaloes to domesticated cows could be one mechanism not recognised before.

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POTENTIAL FOR WILD/FERAL SPECIES TO PLAY A ROLE IN FMD MAINTENANCE AND TRANSMISSION OUTSIDE AFRICA

ASIA

South Asia: feral swine/wild boar are abundant

Unknown role in FMD epidemiology
POTENTIAL FOR WILD/FERAL SPECIES TO PLAY A ROLE IN FMD MAINTENANCE AND TRANSMISSION OUTSIDE AFRICA

ASIA

Mongolia/China antelopes: transfrontier migration

Mongolian gazelle or zeren (Procapra gutturosa)
A POSSIBLE MEKONG RIVER FOCUS

ASIA

Type A viruses of an eastern South-East Asian topotype have been detected repeatedly in SE Asia and have recently been described in China.

The Mekong River System

FMD Type A
Gizhou and Shandong ...
China May-June 2009
Thursday 25th June 2009

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China

Serological evidence of Type A FMD

Feral swamp buffaloes

wild pigs

China

Serological evidence of Type A FMD

Feral swamp buffaloes

wild pigs
Wild bactrian camel (*Camelus bactrianus*)

Bactrian camels develop frank clinical disease\(^1\) but wild populations are too small to be of importance

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POTENTIAL FOR WILD/FERAL SPECIES TO PLAY A ROLE IN FMD MAINTENANCE AND TRANSMISSION OUTSIDE AFRICA

ASIA

Sri Lanka

Wilpattu National Park

FMD Type O

Bubalus bubalis

wild boar
Sus scrofa

Sri Lanka
POTENTIAL FOR WILD/FERAL SPECIES TO PLAY A ROLE IN FMD MAINTENANCE AND TRANSMISSION OUTSIDE AFRICA

MIDDLE EAST

Israel/Palestine

Mountain gazelle (Gazella gazella)

Indicators of infection in small ruminants - sentinels
POTENTIAL FOR WILD/FERAL SPECIES TO PLAY A ROLE IN FMD MAINTENANCE AND TRANSMISSION OUTSIDE AFRICA

EUROPE: Caucasus/Transcaucasus

Involved in African swine fever

Wild boar (Sus scrofa)

Probably not important in FMD maintenance and propagation
POTENTIAL FOR WILD/FERAL SPECIES TO PLAY A ROLE IN FMD MAINTENANCE AND TRANSMISSION OUTSIDE AFRICA

SOUTH AMERICA

Camelids

Although the camelids can be infected with FMD virus by direct contact, they are not very susceptible and do not pose a risk of transmitting FMD to susceptible animal species ¹.

They do not become FMDV carriers.

Populations too small to sustain infection.

A DIVERSE ECOLOGY

Amazonian rain forest

Pantanal
All susceptible to FMD infection

AN ENIGMA – TYPE C FMD IN BRAZIL 2004

“One of the most critical and as yet unsolved epidemiological problems in foot-and-mouth disease is the survival of the virus in the field during interepidemic intervals.”

Has this been resolved?

AN ENIGMA – TYPE C FMD IN BRAZIL 2004

- A novel virus within C₃ group
- No closely related viruses known

WHAT WAS ITS ORIGIN?
WHERE DID IT COME FROM?

Courtesy of Dr N.J. Knowles, Institute for Animal Health, Pirbright Laboratory, UK
OPPORTUNITIES AFFORDED BY WILDLIFE IN THE STUDY OF FMD

• Trade: Geography-based *versus* commodity-based risk limitation \(^1,^2\)

  ➢ Monitoring wildlife infection will remain essential even if commodity-based certification gains greater acceptance

  ➢ Wildlife is important in its own right – trade in meat from wild animals; to inform risk analysis.

    Trade in meat from wildlife could become more important in future – The Transfrontier Conservation Area initiative in Africa promotes livelihood generation from sustainable harvesting of wild species

• Wildlife surveillance is an under-utilised tool:

  ➢ Sentinels for undetected virus circulation in small ruminants
  ➢ Sentinels for virus circulation in vaccinated cattle populations
  ➢ Demonstrating freedom from infection
  ➢ Monitor virus evolution: vaccine design/matching

• Combine with surveillance for other diseases

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\(^1\) Devising import health measures for animal commodities [http://www.oie.int/eng/normes/guides/EN_commodity-based_approach.pdf](http://www.oie.int/eng/normes/guides/EN_commodity-based_approach.pdf)


Thomson, G.R., Leyland T.J. And Donaldson, A.I. (2009) De-boned beef – an example of a commodity for which specific standards could be developed to ensure an appropriate level of protection for international trade. Transboundary and Emerging Diseases 56, 9-17
THE CONSTRAINTS

1. ACCESS
   - Capture and immobilisation of wild animals: cost
   - Surveillance systems deficient in detecting disease in wildlife
   - Insufficient use of opportunistic sampling – could be systematic and incorporated in hunting licensing
   - Need more animal health personnel skilled in wildlife and disease management

2. SAMPLING TOOLS
   - Need simpler means of sampling animals and virus detection
     - Current system of probang sampling with need for instant cryo-preservation of samples is logistically difficult, expensive and inefficient
     - Pharyngeal brush swab sampling has potential

3. TEST SYSTEMS
   - Sensitive cell lines for culture from carrier animals
   - Antibody assays fully validated for wildlife species and all serotypes of FMD virus e.g. SAT serotypes and NSP antibody assays
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Gracias por su atención
Merci de votre attention
Thank you for your attention