Experiences with ASF and African wild pigs

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Introducing African Wild Pigs

• Five indigenous species of wild pigs in sub-Saharan Africa – all immune to the pathogenic effects of ASF
  • Warthogs
    – Common warthog (*Phacochoerus africanus*)
    – Desert warthog (*Phacochoerus aethiopicus*)
  • Bushpigs
    – Red river hog (*Potamochoerus porcus*)
    – Bushpig (*Potamochoerus larvatus*)
  • Giant forest hog (*Hylochoerus meinertzhageni*)
• One introduced wild pig species – European wild boar (*Sus scrofa*) – no immunity to ASF
• Only the common warthog has a proven role in ASF
African Wild Pigs

- Common Warthog
- Red River Hog
- Giant Forest Hog
- Bushpig
Common Warthog

Common warthog
Distribution: Savannah areas in West, Central, East and Southern Africa
Habitat: Open savannah with grassland and thorn trees; needs access to water
Habits: Diurnal; shelter and nest in burrows, often in old termite mounds and may use burrows of other species e.g. ant bears, as well as road culverts and hollow baobab trees

Desert warthog (recently recognised as a separate species)
Distribution: Horn of Africa (N Kenya, Ethiopia, Somalia, Djibouti)
Classic Sylvatic Cycle in Eastern & Southern Africa

- Co-evolution of virus with African wild pigs; ancient sylvatic cycle in common warthogs and argasid ticks (eyeless tampans, *Ornithodoros moubata* complex) that live in their burrows.
Transmission of ASFV in Sylvatic Cycle

- No direct contact transmission from warthogs to pigs has ever been demonstrated (warthogs have no/low viraemia)
- Contact transmission from pigs to warthogs has been demonstrated
- Infection by feeding of infected warthog tissues to pigs has been demonstrated experimentally: used minced tissues including lymph nodes from acutely experimentally infected warthogs – unlikely to happen naturally (levels too low in naturally infected older warthogs)
- Transmission relies on *Ornithodoros moubata* complex ticks – biological vector (transovarial, trans-stadial, sexual transmission)
  - Transmit virus to pigs very effectively
  - Cycle of maintenance between neonatal warthogs (viraemia $>10^3$HAD$_{50}$/ml) and ticks has been well demonstrated and reported
  - Large numbers of nymphs can travel on warthogs (428 counted on 32 warthogs in Kruger National Park, 107 on one warthog)
Sylvatic cycle

ASF CONTROL AREA, RSA
History and Evidence for Warthog Cycle

• Association between ASF and wild pigs suspected in Kenya from the beginning (1921)
  – Experimental infection of warthogs and bushpigs
  – Domestic pigs only infected by inoculation of blood or tissues from infected wild pigs
  – Natural infection in warthogs in East Africa ranged from <50% (Uganda) to >80% (Kenya, Tanzania)
  – Natural infection in warthogs subsequently found in Botswana, Mozambique, Namibia, South Africa and Zimbabwe

• ASFV confirmed in *Ornithodoros* from warthog burrows by 1969 in Tanzania and later in Kenya, Uganda, South Africa, Namibia and Zambia, and most recently in Mozambique

• Cycle of maintenance between neonatal warthogs (4-6 weeks) and *Ornithodoros* published in 1983

• All 22 known genotypes of ASFV occur in E/S Africa, several only isolated from warthogs or ticks
• **Red river hog**
  – Distribution range is West and Central Africa
  – High and montane forest and thick bush
• **Bushpig**
  – Distribution range is East, Central and Southern Africa; Madagascar population was probably introduced
  – Habitat is forest and dense bush
• Both species are secretive and mainly nocturnal
• Both species hide in dense vegetation and make large grass nests and therefore any permanent relationship with *Ornithodoros* is excluded
• Rumours and anecdotes of successful cross-breeding between bushpigs and domestic pigs/wild boars are highly improbable due to large genetic differences between the species; none of the reports are well supported with scientific evidence
Bushpigs and ASF (1)

- Experimental infection
  - Successful in Kenya (1921)
  - Study in Zimbabwe (1998)
    - Resulted in viraemia lasting up to 91 days, levels sufficient to infect *Ornithodoros*, able to infect in-contact domestic pigs with one of two viruses but not the other
    - Bushpigs were not infected by contact with acutely infected domestic pigs
  - Pathogenesis studies indicated reduced viral replication and minimal apoptosis in lymphoid tissues in bushpigs (1998)
Bushpigs and ASF (2)

Natural infection

• Virus isolated from tissues of several free-living bushpigs in Kenya but 46 free-living bushpigs had no antibodies to ASFV (1963)
• Virus found 10 times more frequently in warthogs than bushpigs in the ASF Control Area in South Africa (1963)
• No evidence of ASF infection in lymph nodes of 3 bushpigs and spleen and sera of 11 bushpigs in Malawi in area with frequent outbreaks in domestic pigs (1985)
• No antibodies found in 10 free-ranging bushpigs in Zimbabwe (1998)
• ASFV DNA found in a Red river hog in Nigeria in area where there were outbreaks in domestic pigs (2007)
• To date no evidence of antibodies to ASFV or tick salivary antigens has been found in bushpigs in Madagascar (2000, 2011)
• Two out of four free-ranging bushpigs in Uganda had antibodies to ASFV (2011)
• Balance of evidence suggests that bushpigs do not play a leading role in transmission of ASFV to domestic pigs but investigations are ongoing
Giant forest hog (*Hylochoerus meinertzhageni*)

- Discontinuous distribution from coastal West Africa through Central to East Africa mainly in forested areas, often in mountains, with excursions into savannah; habits nocturnal except where protected
- Single record of natural infection with ASFV in Kenya
- Habitat and habits make contact with domestic pigs relatively unlikely
Wild Pigs and ASF in West Africa

- *Ornithodoros moubata* complex ticks are reported not to occur in West Africa (old record of *O. porcinus* from a warthog burrow in Liberia)
- Limited sampling of warthogs and bushpigs in Nigeria (1977), warthogs in Senegal (1990) and Benin (1998) revealed no evidence of infection (virus or antibodies)
- One bushpig and one warthog found positive in Nigeria during domestic pig outbreaks (2007) – considered to be spill over from domestic pigs, probably due to careless disposal of infected material
- More intensive surveys of *Ornithodoros sonrai* and warthogs in Senegal revealed no relationship between them and warthog sera were negative for both antibodies to ASFV and to salivary antigens of *Ornithodoros* (2007, 2011)
- There is therefore no evidence to date that a sylvatic cycle involving warthogs or bushpigs exists in West Africa
Experience with ASF in Wild Boars in South Africa

• Brief and tragic
• Wild boar and wild boar-domestic pig crosses farmed for meat in Limpopo and Mpumalanga provinces
  – Some of the crosses were acquired as ‘bushpig/pig’ hybrids
  – Challenged with ASFV at OVI
  – All those challenged died of acute ASF
• Wild boars introduced into hunting concession in ASF Control Area in Limpopo
  – Released into the concession inhabited by warthogs
  – All died of acute ASF
Experience of ASF with Feral Pigs in Mauritius

- Feral pigs descended from domestic pigs introduced into Mauritius by Dutch sailors >400 years ago
- Mainly on hunting concessions and feedlots
- ASF outbreaks in 2007 and 2008 – heavy losses in farmed pigs
- Sampling in 2009 revealed no antibodies to ASF or tick salivary antigen (Ornithodoros has not been recorded in Mauritius)
- The discontinuous populations and high mortality rate when infected with ASF were unfavourable for sustained circulation of the virus
In Conclusion

- The sylvatic cycle between common warthogs and *Ornithodoros moubata* complex ticks is well understood and confinement of pigs in pig-proof premises prevents transmission of ASFV.
- The role of other African wild pigs, principally bushpigs, if any, is not clear but is probably at most incidental.
- More than 90% of outbreaks that occur in Africa are likely due to movement of infected domestic pigs and their products.
- The most important factor in ASF outbreaks in Africa (and undoubtedly elsewhere) is Human Behaviour.
- Adequate biosecurity will eliminate any role that wild pigs have/may have in transmission of ASFV to domestic pigs.
Merci – Thank you – Gracias