

# African swine fever – from humble beginnings to pandemic

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WOAH Collaborating Centre for  
Training in Integrated Livestock and  
Wildlife Health and Management

Reference Centre



World Organisation  
for Animal Health  
Founded as OIE

## The first 50 years

- African swine fever (ASF) was first diagnosed on European settlers' pig farms and at the Veterinary Research Centre at Muguga, Kenya
- It was diagnosed by a British veterinary officer stationed in Nairobi, R. Eustace Montgomery



R. Eustace Montgomery



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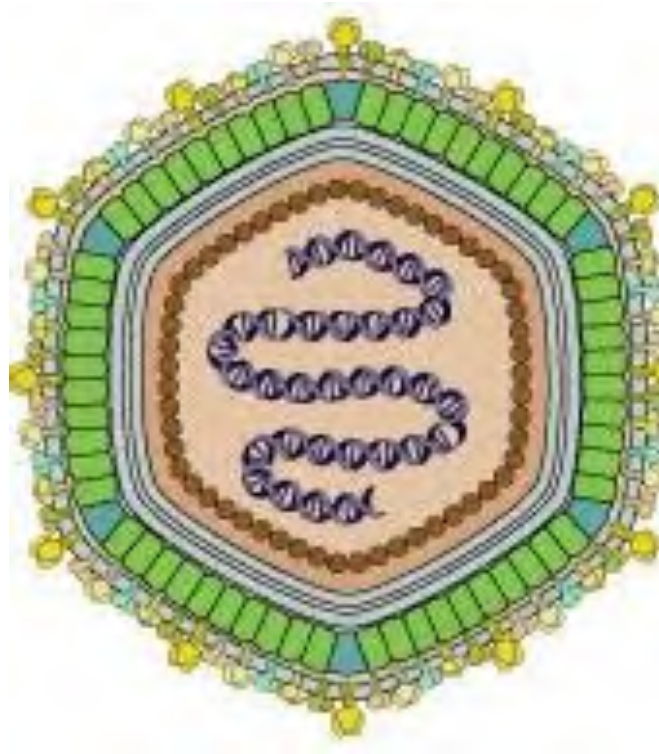
# Laying the foundation – R. Eustace Montgomery

- A comprehensive paper in two parts detailing an 11-year study of ASF outbreaks in Kenya from 1910 was published in 1921 which described the new disease:
  - Caused by a filterable agent
    - Classical swine fever sera from England and Hungary failed to protect pigs from infection with the African virus
  - Presence of warthogs and bushpigs noted around outbreaks
    - No other links between farms that suffered outbreaks
  - Experimental studies provide the basis of what we know about:
    - Course, presentation and duration of virulent, lethal ASF
    - Presentation of infection in warthogs and bushpigs (asymptomatic)
    - Other domestic species (calf, oxen, sheep, dog, rabbit) not susceptible
    - Duration of infectivity of virus in various substrates and conditions
    - Transmission of the virus by various routes – pig lice and fleas were excluded as likely to transmit the virus



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## Key findings from experimental studies



- Duration of infectivity at a wide range of temperatures
  - Virulent ASF virus was inactivated by maintaining at 60°C for 20 minutes, 15 minutes and 10 minutes (p.179)
- Short duration of infectivity in contaminated pig sties (confirmed in South Africa (1932) and Denmark (2018))
- No airborne transmission – only a few metres in enclosed space
- Transmission of virus from experimentally infected warthogs and bushpigs to pigs only occurred by inoculation of blood
- Conventional approaches to vaccinating pigs were not successful

# Early efforts to control the disease

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- Preventing contact with the wild hosts of the virus
  - Confinement of pigs on farms showed that the disease was preventable
  - ASF Controlled Area established in South Africa in 1935 based on outbreaks in pigs and detecting infection in warthogs – requirement for double-fenced farms, the forerunner of ASF-free compartments for pigs
- Vaccinating the pigs
  - Hyperimmune sera – East and South Africa – variable protection limited to homologous virus
  - Killed virus had no effect and viruses of reduced virulence by heating caused chronic disease (Montgomery, 1921)
  - Multiple passages in rabbits reduced virulence but did not protect pigs (Angola in the 1950s)



# First changes in pattern – long distance spread

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- Until 1950s ASF was confined to East, Southern and Central Africa, causing sporadic outbreaks in domestic pigs
- In 1957 and again in 1960 ASF reached Portugal, probably ex Angola, with spread in western Europe, Caribbean and Brazil
- From about 1959 ASF was established in Senegal, Guinea-Bissau and Cape Verde in the westernmost part of West Africa
- The most likely source of infection in distant areas was infected pork in galley waste from airplanes or ships disposed of where scavenging pigs or pig owners could access it



# Advances in research 1960s-1980s

Major breakthrough – finding the biological vector

*Ornithoros erraticus* ticks shown to maintain and transmit ASFV in Spain (1963) – this led to investigation in East Africa

*Ornithodoros moubata* complex ticks from warthog burrows in Tanzania shown to be competent biological vectors (1969)

Maintenance of ASFV in warthog-tick cycle (1983)

Neonatal warthogs develop sufficient level of viraemia to infect *Ornithodoros* ticks in burrows

Discovery of the pig-tick cycle in Malawi – *Ornithodoros* ticks in pig shelters

Genetic characterization of ASFV through RFLP (restriction fragment length polymorphism) studies – enabled more accurate tracking of outbreaks

ASFV inactivated by long dry-curing process in Parma ham, Serrano ham and other dry-cured pork products





# The ASF history in Africa that we do not know

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- Determining the history of domestic pigs in Africa is still a work in progress
- It is certain that indigenous populations in Africa were keeping pigs long before the advent of colonists
- The pigs were likely free-ranging, as a great many still are today
- Those pigs kept in areas with the sylvatic cycle would have been victims of ASF
- In Angola, outbreaks in pigs belonging to Portuguese farmers occurred when they introduced local pigs
- In hyper-endemic areas in eastern and southern Africa, we have local breed domestic pigs that resist the pathogenic effects of ASF



# Africa's resistant pig populations

- In hyperendemic areas, up to 50% or more pigs may be impervious to the pathogenic effects of highly virulent ASF viruses that cause the remaining pigs to die of acute, severe ASF (Penrith et al., 2004)
  - Seroconversion usually provides the only evidence of infection
  - The innate resistance applies to infection with multiple unrelated ASF viruses
  - These pigs are not 'tolerant' or 'chronically infected' and they eliminate the virus within a short time post infection and do not infect in-contact pigs (Penrith et al., 2004; Valadão, 1969)
  - An experimental study on pigs from a hyperendemic area in Mozambique indicated that the resistance is not simply inherited
- Pig populations with a high survival rate have been reported in Mchinji district of Malawi (Haresnape et al., 1985, 1987) and western Kenya (Mujibi et al., 2018; Thomas et al., 2018) and probably exist elsewhere in long-time endemic areas
- Studies on ASF pathogenesis and immune response of such pigs to ASF similar to the bushpig study by Oura et al (1998) could provide valuable information that might be helpful in developing vaccines that could protect against multiple strains of ASF virus and breeding pigs that would be assets in endemic areas



# African swine fever in Africa today

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- Until around the 1980s, Africa hosted only 2,5% of the world's pigs
- In the 1990s the pig population had doubled to 5% of the world's pigs
- There was a concomitant increase in the number and extent of ASF outbreaks
- New countries were infected in West Africa, as well as the island of Madagascar in the Indian Ocean
- The sylvatic cycle was absent, but the virus was maintained by circulation in pigs and pork
- This cycle also prevailed in countries with the sylvatic cycle but with many subsistence pig farmers





## African domestic pigs

- Commercial intensive pig production occurs in most African countries
- Most farms are small by international standards
- Biosecurity levels vary from inadequate to highly secure state-approved and registered compartments
- Most are considered relatively safe from ASF but if there are breaches in biosecurity, they are not invincible
- An ASF break in a compartment results in all the pigs being culled

# African domestic pigs

- ASF is strongly linked to pig production systems and value chains
- More than 70% of pigs are kept in traditional and smallholder systems with low or no biosecurity and little or no investment
- Risk assessments in several countries have identified several risky practices in both production systems and value chains in several African countries
- Anthropogenic drivers of ASF are sometimes mentioned as something different from pig husbandry, but there can be no doubt that human activities are the most important driver of ASF even where wildlife is involved (who lets the pigs run free or brings in infected fomites?)



# Understanding the human element in the epidemiology of ASF

- Pigs and pork transmit ASF virus efficiently and prevention depends on basic biosecurity measures to prevent transmission
- Recent research has focused on why these measures are not implemented and human behaviour as a driver of ASF:
  - Lack of awareness of the disease in uninfected areas
  - Awareness of ASF and understanding importance of biosecurity is important but not necessarily protective
  - Poverty prevents investment in pigs – low local prices dictate that improving husbandry is unprofitable
  - Greed may drive value chain actors to profit from sick or dead pigs available at low prices
  - Cultural practices may make confinement of pigs unacceptable if it limits access to property
  - Careless disposal of carcasses of pigs that die of ASF may be due to discarding of food or burial of animals being forbidden
  - Lack of investment in disposal of port and airport waste is responsible for introductions to new countries and continents
  - Are we teaching the coming generations to do it differently?



# How do we manage outbreaks of ASF?

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- Traditionally “stamping out” is applied, sometimes in a defined area, where all the pigs, healthy and infected are destroyed
- Owners are compensated for healthy pigs culled
- This approach has many negatives – trauma to all involved, potential for environmental pollution, and loss of livelihoods to name a few
- In low- and even middle-income countries, compensation at anything like market value is usually not available
- This discourages reporting, encourages illegal activities, and can result in increased spread of ASF



# Are there alternatives?

- Recognizing the negative aspects of massive culling, alternatives such as modified culling (culling only sick pigs or infected pens) have been proposed
- Although ASF is often described as “highly contagious”, recent research has shown that it normally spreads relatively slowly compared with diseases like foot and mouth disease and classical swine fever
- This can enable most of the pigs to be protected from exposure by early separation and removal of sick pigs and close observation of the rest.; studies in China and Vietnam suggest that this does not significantly shorten the time to achieve freedom from infection
- This approach was used with success in the island of Mauritius in 2007 when ASF was introduced for the first time, with the last outbreak registered 8 months after the first ones and subsequent serological surveys confirming that all the pigs were negative for antibodies to ASF
- Smallholder pig keepers are often deeply attached to their pigs and have described culling as being like ‘killing their children’
- A further disadvantage of massive culling over a defined areas means that biosecure farms within that radius will also be destroyed, which discourages prevention in future



# A strategy for managing ASF in Africa

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- A strategy for managing ASF in Africa developed by a working group under the auspices of FAO, AU-IBAR & ILRI was published in 2017 after validation by representatives of the sub-Saharan African countries at a workshop in Ouagadougou in October 2015
- The strategy has been reviewed because ASF is a dynamic disease that needs a dynamic strategy document, currently being validated by AU-IBAR
- Key to the strategy are:
  - a shift from an authoritarian approach to producer-based approach through a consultative process with stakeholders;
  - flexibility to accommodate different production systems and circumstances;
  - support to resource constrained producers through public-private partnerships;
  - risk mitigation along value chains;
  - improving basic on-farm biosecurity through inclusive community consultation;
  - outbreak management that minimises business disruption and maximises reporting of ASF;
  - a holistic approach to managing pig health and production to improve welfare, market access and profitability to the greatest extent possible.





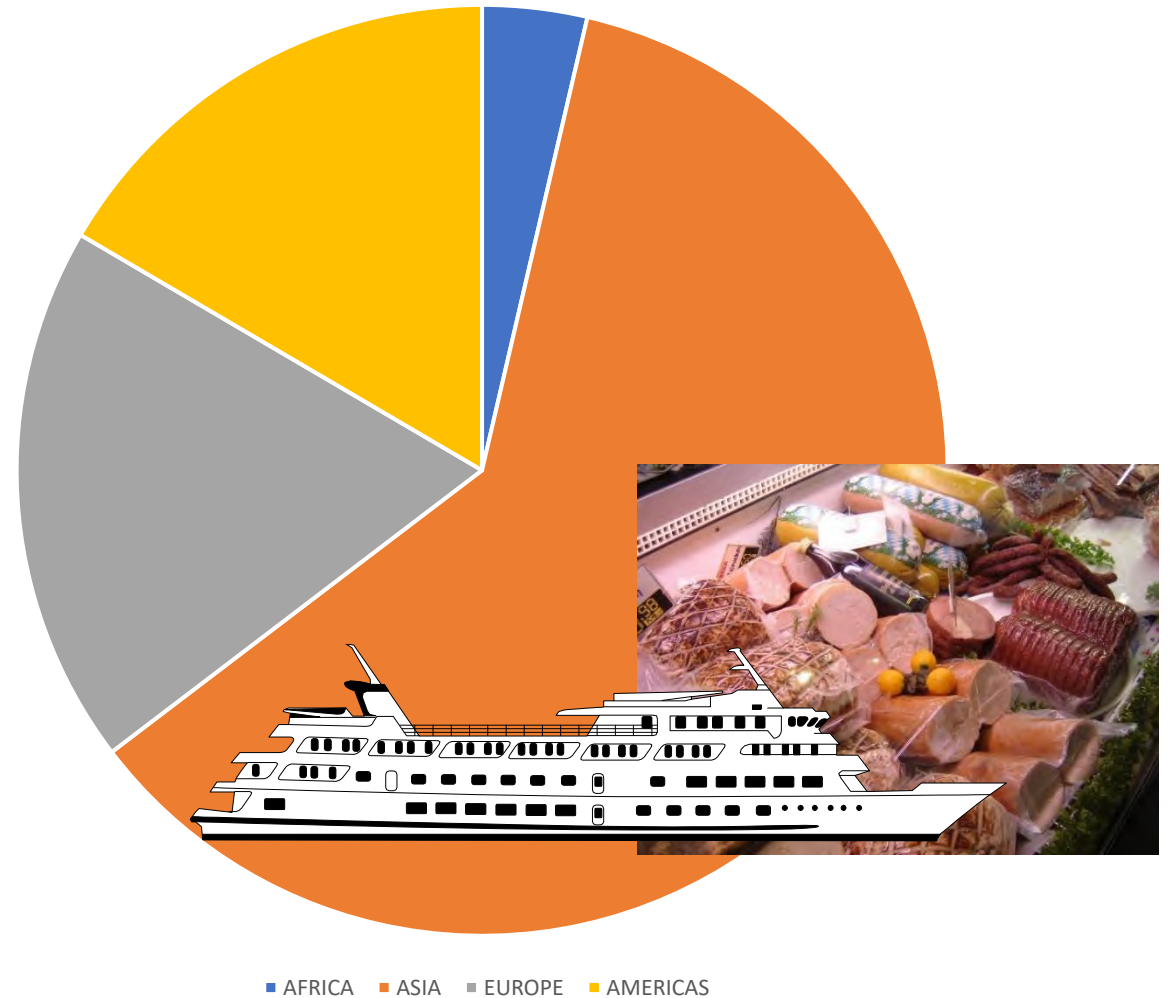


Changing patterns of ASF in Africa – does the principle that ASF is preventable still hold? Yes, but we need more transdisciplinary research and new participatory approaches to management!

# How did a pandemic happen?

- The initial genotype II infection certainly came from Africa – phylogenetic analysis indicates Mozambique
- Africa only has 5% of the world's pigs
- Exports from Africa to countries outside Africa are minimal
- Provisioning of ships/planes most likely source
  - Traditional uncooked Portuguese meat products are manufactured in Angola and Mozambique
- After reaching the Transcaucasus, ASFV developed a life of its own with no further involvement of Africa

REGIONAL DISTRIBUTION  
OF PIGS



## One success story in Africa

- Very few countries that have experienced ASF have lost their entire pig industry
- In Côte d'Ivoire, the ASF experience in 1996 has led to modernisation of pig farming in and around the capital, Abidjan, through a strong Pig Farmers' Association
- Formerly itinerant pig butchers, the women now sell pork obtained on contract from commercial farms via the abattoirs in a modern and hygienic market, while some commercial farmers also have retail outlets providing pork products that were formerly imported from Europe





Thank you  
and bon  
appetit!