African Swine Fever surveillance in African wild suids

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GF-TADs Meeting, Abidjan 1-3 August 2023

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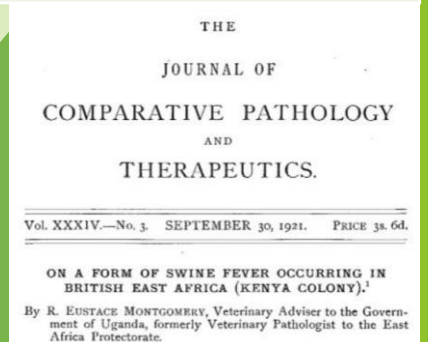
AGRICULTURAL RESEARCH
FOR DEVELOPMENT

Presentation plan

- Overview on knowledge about wild pigs and ASF
- Surveillance of ASF in wild pigs- Feasability and knowledge gaps
- Biosecurity issues –
- Conclusions and perspectives

Scarce Knowledge on the role of African wild pigs

Species	Warthog	Bushpig	Red river hog	Giant forest hog
Scientific name	*Phacochoerus africanus* *P. aethiopicus*	*Potamochoerus larvatus*	*Potamochoerus porcus*	*Hylochoerus meinertzhageni*
Reference	Heuschele & Coggins, 1969	Anderson *et al.,* 1998	Luther *et al.,* 2007	Montgomery, 1921
Available Knowledge (0-5)	4	1,5	0,5	0,5
Prevalence of ASF	80-100%	Unknown	Unknown	Unknown


THE
JOURNAL OF
COMPARATIVE PATHOLOGY
AND
THERAPEUTICS.

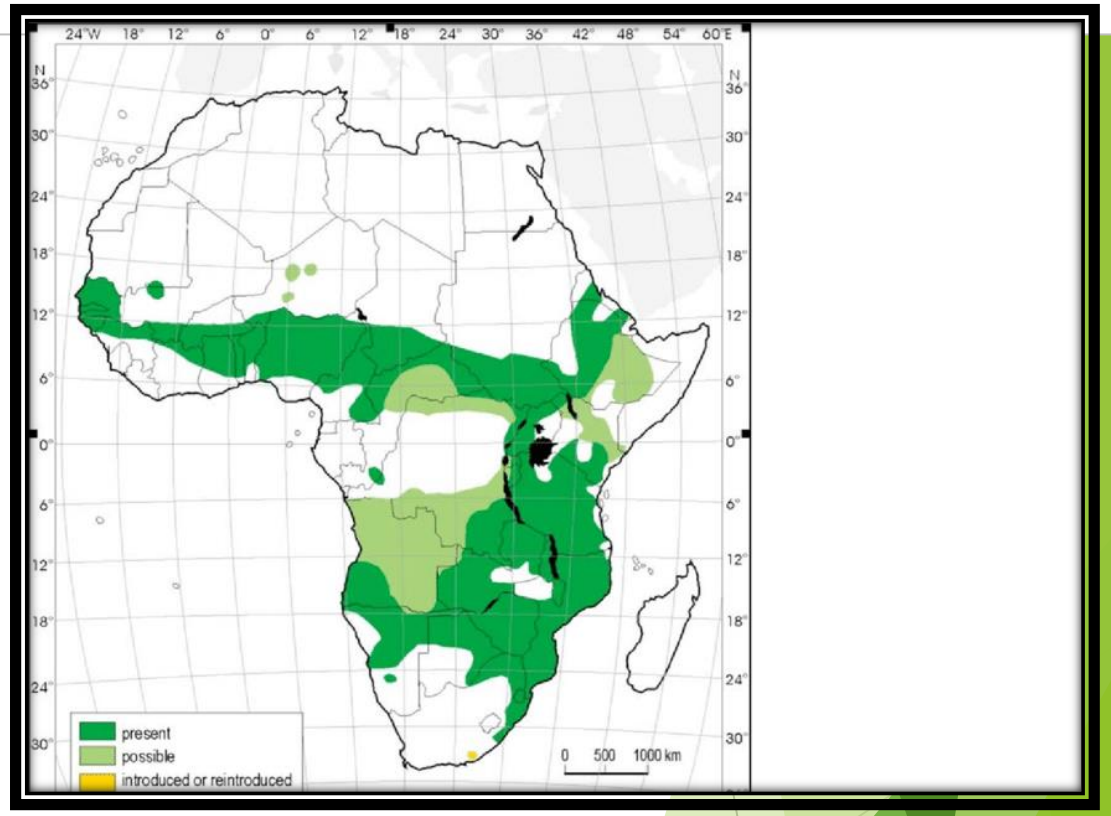
Vol. XXXIV.—No. 3. SEPTEMBER 30, 1921. PRICE 3s. 6d.

ON A FORM OF SWINE FEVER OCCURRING IN BRITISH EAST AFRICA (KENYA COLONY).[1]

By R. EUSTACE MONTGOMERY, Veterinary Adviser to the Government of Uganda, formerly Veterinary Pathologist to the East Africa Protectorate.

Warthog, the main African reservoir

Phacochoerus africanus



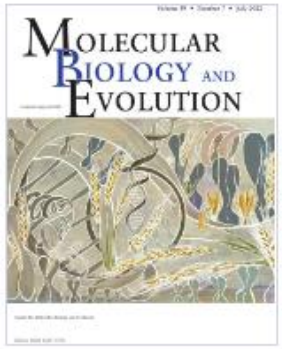
JOURNAL ARTICLE

Warthog Genomes Resolve an Evolutionary Conundrum and Reveal Introgression of Disease Resistance Genes

Genís Garcia-Erill, Christian H F Jørgensen, Vincent B Muwanika, Xi Wang, Malthe S Rasmussen, Yvonne A de Jong, Philippe Gaubert, Ayodeji Olayemi, Jordi Salmona, Thomas M Butynski, Laura D Bertola, Hans R Siegismund, Anders Albrechtsen, Rasmus Heller ✉

Author Notes

Molecular Biology and Evolution, Volume 39, Issue 7, July 2022, msac134,
https://doi.org/10.1093/molbev/msac134
Published: 02 July 2022



Volume 39, Issue 7
July 2022

Forth *et al. BMC Biology* (2020) 18:136
https://doi.org/10.1186/s12915-020-00865-6

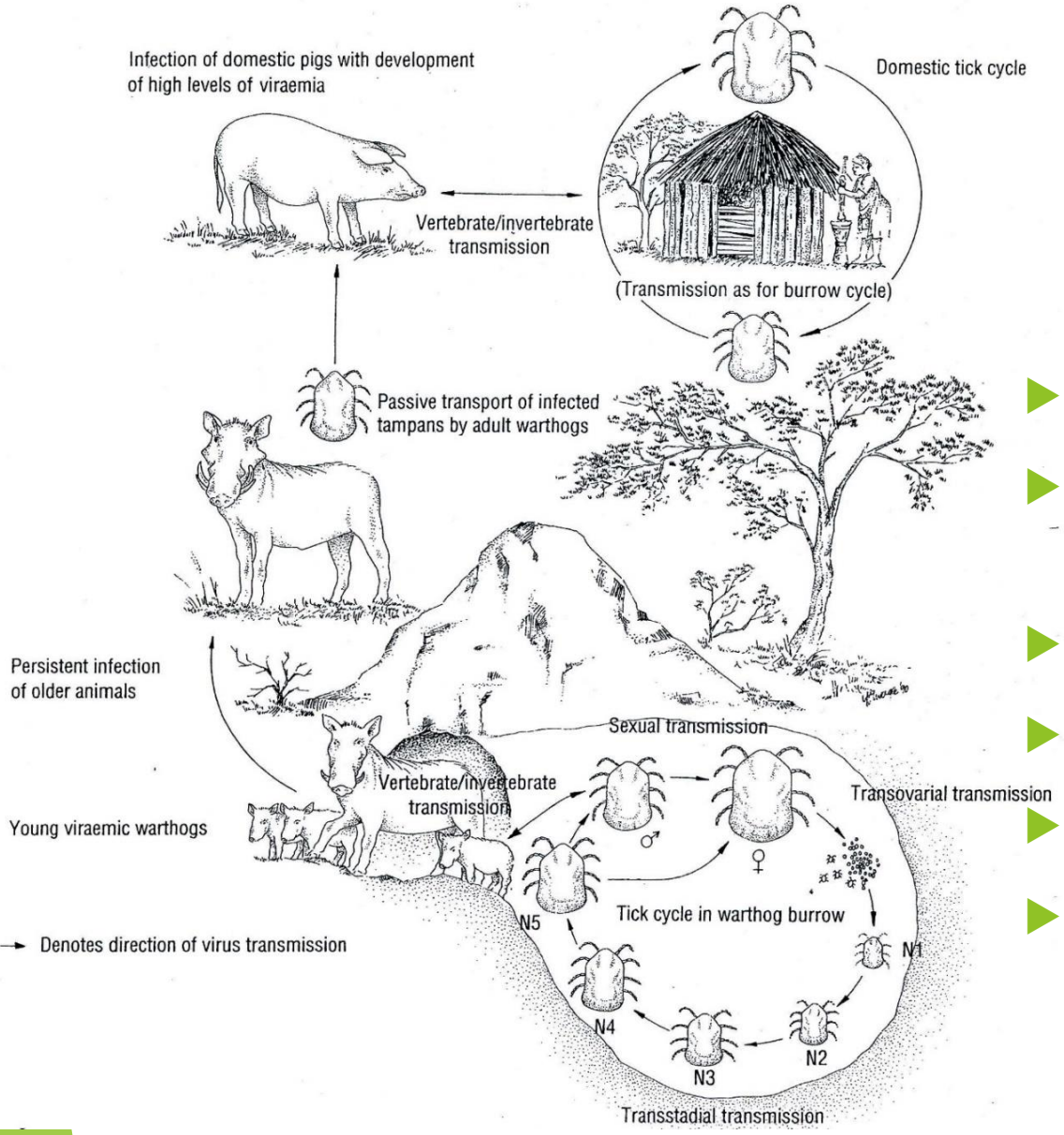
BMC Biology

RESEARCH ARTICLE Open Access

Identification of African swine fever virus-like elements in the soft tick genome provides insights into the virus' evolution

Jan H. Forth[1], Leonie F. Forth[1], Samantha Lycett[2], Lesley Bell-Sakyi[3], Günther M. Keil[1*], Sandra Blome[1], Sébastien Calvignac-Spencer[4], Antje Wissgott[5], Johannes Krause[5], Dirk Höper[1], Helge Kampen[1] and Martin Beer[1*]

The natural warthog-tick cycle



Source: Plowright *et al.*,1984

- Close relation with Argasid ticks in burrows
- Warthog infection occurs in individuals younger than months (viraemia)
- At older age, ASFV localized in lymph nodes
- Warthogs -> Asymptomatic ASFV hosts
- Warthog horizontal transmission never demonstrated
- Role of Argasid ticks is essential in the transmission

The main African reservoir

Sylvatic cycle

Phacochoerus africanus

Domestic cycle

Soft tick

Warthog

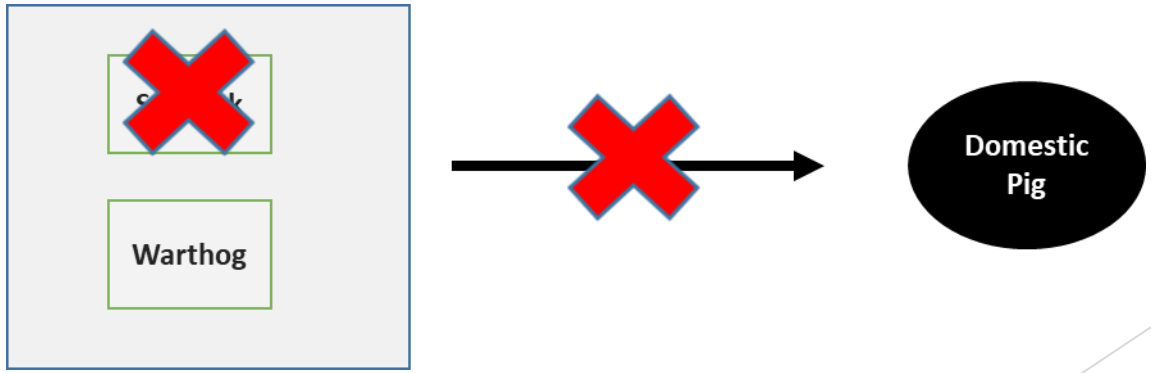
Domestic Pig

The main African reservoir but not everywehere in Africa

Sylvatic cycle

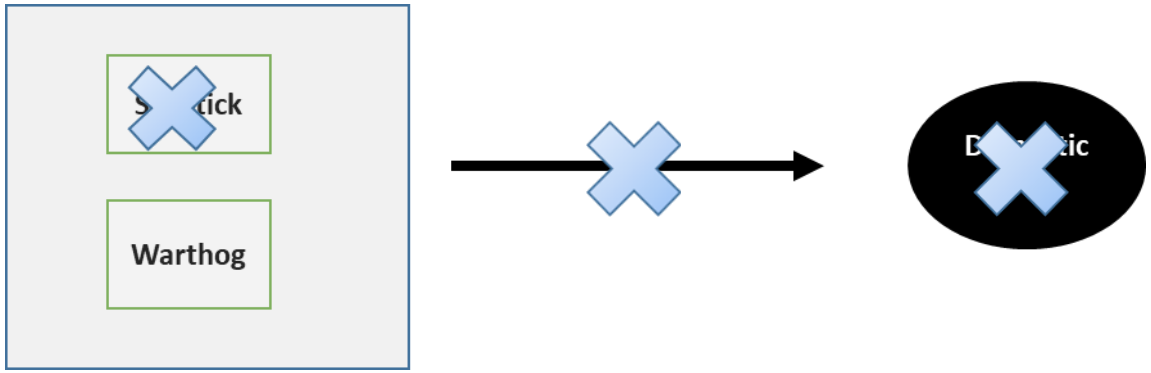
Phacochoerus africanus

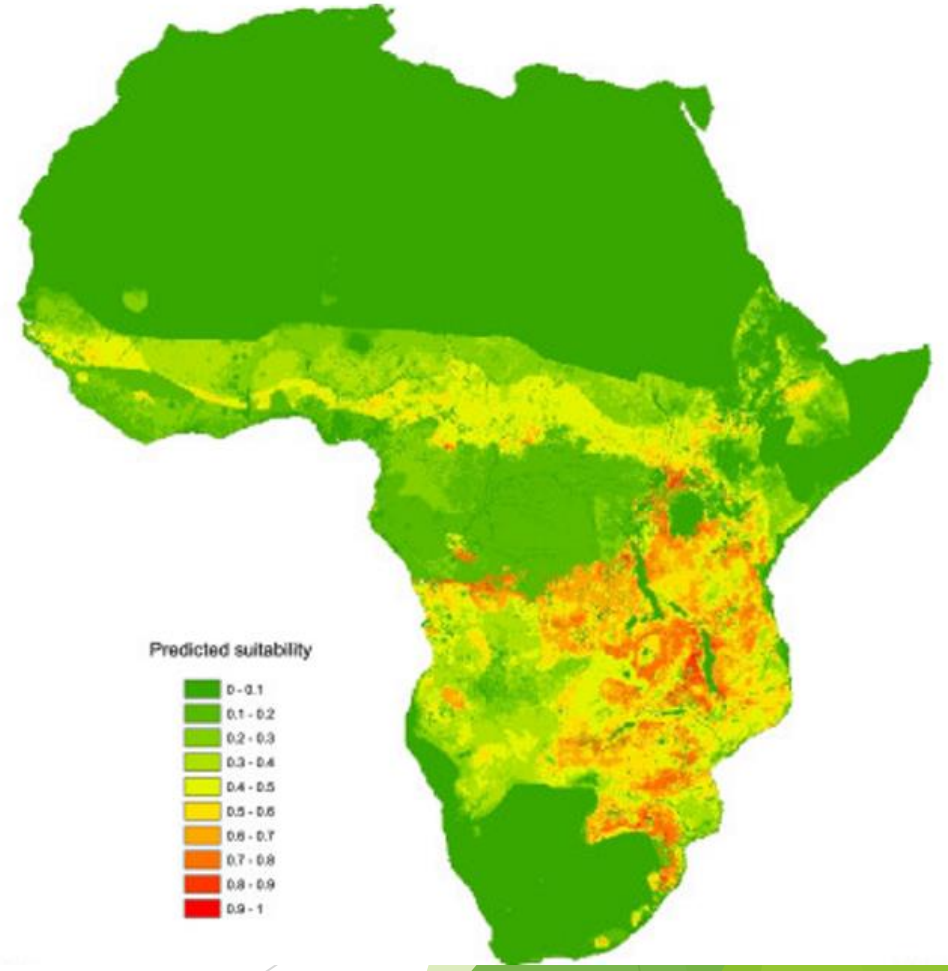
Domestic cycle



Distribution of Ornithodoros ticks in warthog burrows

- ONLY in East & Southern Africa
- NOT in Central and West Africa





Source: De Glanville et al. Spatial multi-criteria decision analysis to predict suitability for African swine fever endemicity in Africa. BMC Vet Res 10, 9 (2014).

The warthog -soft tick reservoir
Main patterns in East & Southern Africa

3 major patterns:

- High infection rates of warthogs (80-100%)
- Fair proportion of burrows infested with soft ticks (44-65%)
- Low Rates of infected ticks range between (0-3%)

Transboundary and Emerging Diseases

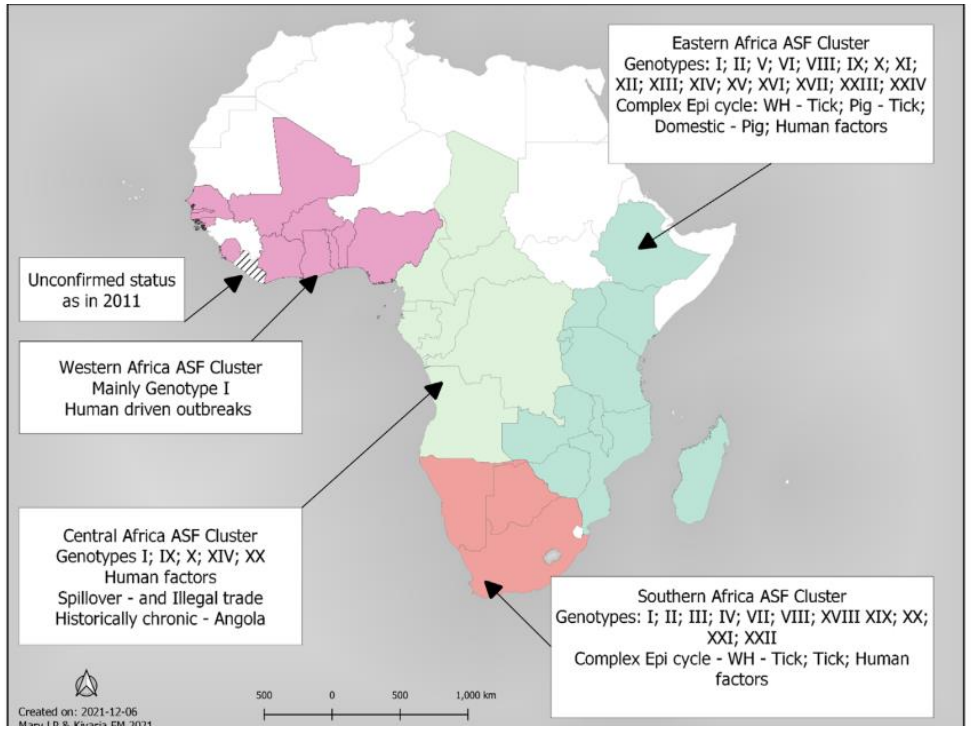
Transboundary and Emerging Diseases

ORIGINAL ARTICLE

Investigation into the Epidemiology of African Swine Fever Virus at the Wildlife – Domestic Interface of the Gorongosa National Park, Central Mozambique

C. J. Quembo[1,2,3], F. Jori[4,5,6], L. Heath[1], R. Pérez-Sánchez[7] and W. Vosloo[1,2,8]

Impact on ASF viral diversity



Source:Penrith & Kivaria, 2021

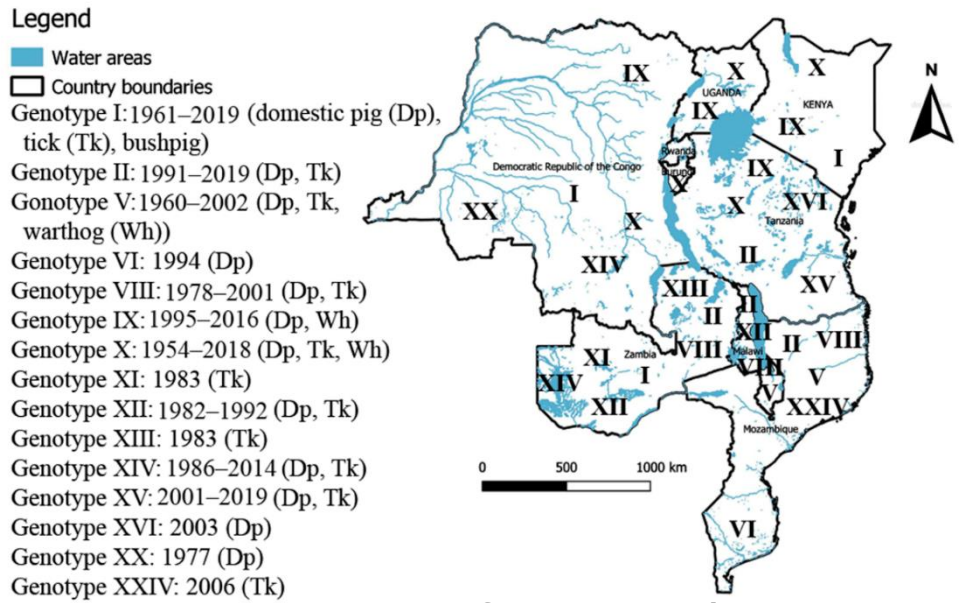
Received: 14 March 2017
DOI: 10.1111/tbed.12700

ORIGINAL ARTICLE

WILEY Transboundary and Emerging Diseases

Genetic characterization of African swine fever virus isolates from soft ticks at the wildlife/domestic interface in Mozambique and identification of a novel genotype

C. J. Quembo[1,2,3] | F. Jori[4,5] | W. Vosloo[1,2,6] | L. Heath[1]



Source: Hakizimana et al., 2021

Figure 2. Distribution of the ASFV p72 genotypes circulating between Tanzania and its eight neighboring countries by October 2020. The map was developed using QGIS version 3.4.4 (https://www.qgis.org/en/site/about/index.html).

Some exceptions to these patterns

Location	ASF prevalence in wild warthogs (% positive)	Frequency of infested burrows (ASFV rates in burrow ticks)
RSA North Transvaal	4	0
RSA (Mkuzi)	4	33 (0,060)
RSA (Umfolozi / Hluhluwe)	0	0 (0)
Kenya (Lolldaiga)	**75**	**0**

- Some **variations between** geographically close regions:
  - **High infection** rates of **warthogs** in the **absence of tick** infested burrows
  - **Low infection** rates of warthogs **despite presence of ticks** in burrows

- The sylvatic cycle is a environmental process exposed to major changes
  - Climatic drift, habitat transformation, pollution, etc..
  - Its drivers and their impact in tick and virus are currently unknown

Are wild suids important for the control of African swine fever?

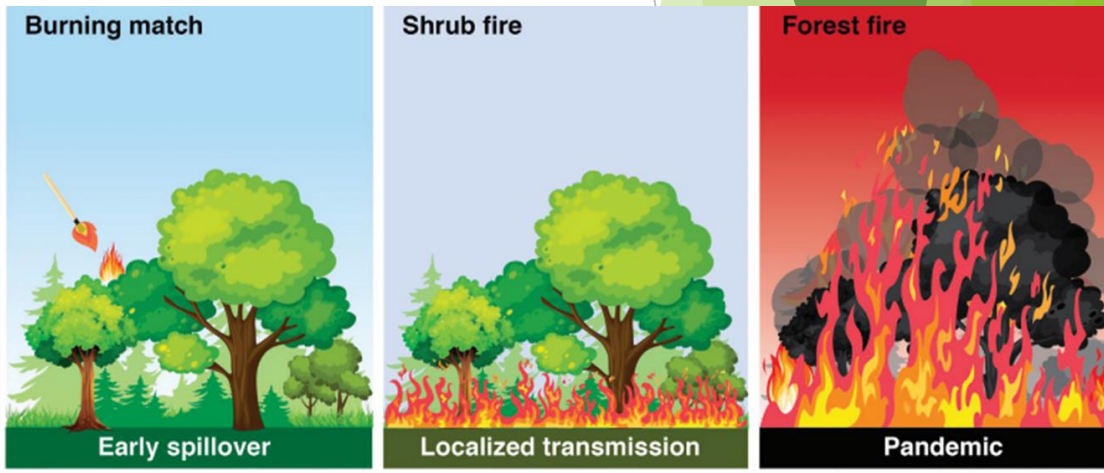
REVIEW

WILEY Transboundary and Emerging Diseases

Epidemiology of African swine fever in Africa today: Sylvatic cycle versus socio-economic imperatives

Mary-Louise Penrith[1] | Armanda Duarte Bastos[2] | Eric M. C. Etter[3,4,5] | Daniel Beltrán-Alcrudo[6]

- Minor role compared to the domestic cycle
- However importance as a source of early spillover
- Importance as a source of new strains
  - No cross reactivity with new strains
  - New introduction: new crisis !!!
- Contacts between wild and domestic pigs will increase in the next decades in Africa



Is surveillance in wild pigs feasible?

Species	*Phacochoerus africanus* *P. aethiopicus*	*Potamochoerus larvatus*	*Potamochoerus porcus*	*Hylochoerus meinertzhageni*
Antibody detection	+++	+/-	?	?
Virus detection (PCR)	+++	++	+/-	+/-

How?

Transboundary and Emerging Diseases

Review Article

African Swine Fever Diagnosis Adapted to Tropical Conditions by the Use of Dried-blood Filter Papers

T. Randriamparany, K. V. Kouakou, V. Michaud, J. Fernández-Pinero, C. Gallardo, M.-F. Le Potier, R. Rabenarivahiny, E. Couacy-Hymann, M. Raherimandimby, E. Albina

- Hunting samples can be collected with filter papers
- Can be tested
  - for detection of antibodies (ELISA test)
  - By PCR
- Surveillance data could be easily produced to generate country based information

Methods to test the presence/absence of a sylvatic cycle

- Direct Methods
  - Manual Collection
  - CO2 traps
- Indirect Methods
  - Detection of ASFV Antibodies in Warthogs and Pigs
  - Historical Records of Previous ASF Outbreaks in Domestic Pigs
  - Sentinel animals

ASF surveillance in warthogs

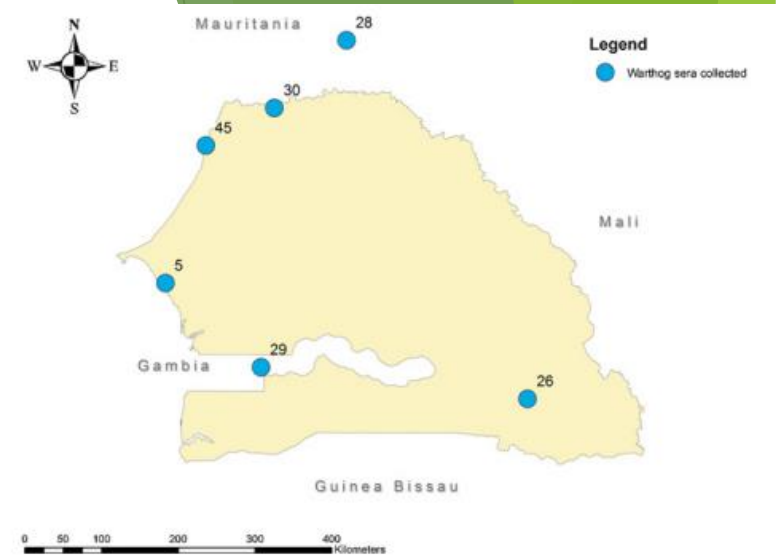


Fig. 7. Sampling spots of warthog populations in Senegal and neighboring countries (Gambia and Southern Mauritania). Figures of the number of animals samples are indicated.

- Several countries in East & Southern Africa have occasionally implement surveys in warthogs :South Africa,Tanzania, Kenya, Zambia, Uganda

- Not systematically

- Information from West and Central Africa is anecdotical or unexistant.

ASF surveillance in buhspigs (P. larvatus)

- Uganda, Lake Mburo National Park, 11 animals screened
  - One PCR positive and 2 seropositives (Bjornheden,2011; Stahl et al.2014)

- Madagascar, almost 200 samples screened
  - Ravaomanana et al. 2011 -> 27 samples
  - Ramy-Ratiarison, 2014 -> 26 samples
  - Rakotoarovony, et al. 2023 (in prep) ->144 samples

All negative

Source : Karl Stahl

Biosecurity issues at the interface

- Wild pigs from different species can get close to human setttlements
- They are attracted by crops, sources of water and human garbage
- Current trends of population growth, agricultural expansion, habitat transformation, climate change are facilitating interactions with domestic pigs.

Knowledge on the interface in Uganda

frontiers in Veterinary Science

ORIGINAL RESEARCH
published: 14 April 2016
doi: 10.3389/fvets.2016.00031

Wild and Domestic Pig Interactions at the Wildlife–Livestock Interface of Murchison Falls National Park, Uganda, and the Potential Association with African Swine Fever Outbreaks

Esther A. Kukielka[1], Ferran Jori[2,3], Beatriz Martínez-López[1], Erika Chenais[4,5], Charles Masembe[6], David Chavernac[7] and Karl Ståhl[4,5]*

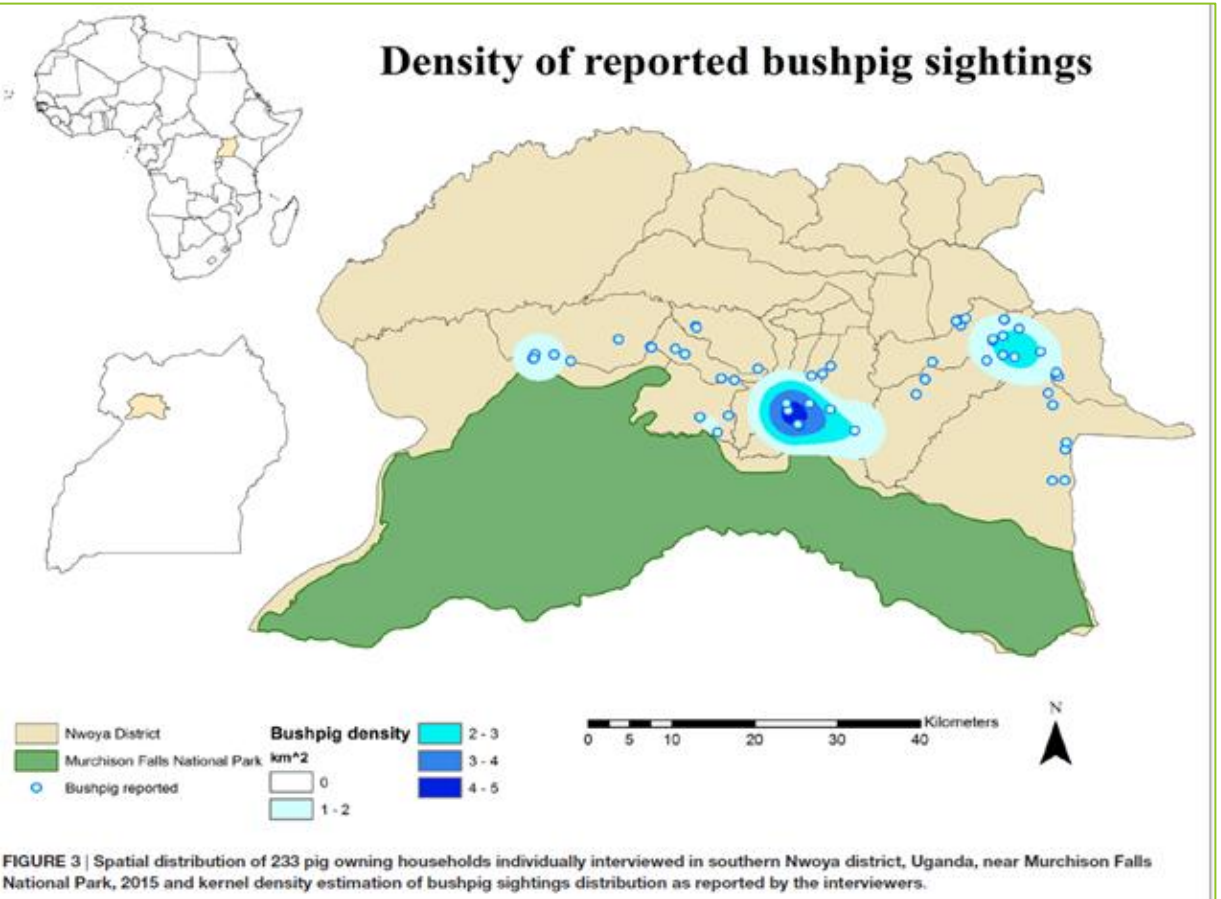


FIGURE 3 | Spatial distribution of 233 pig owning households individually interviewed in southern Nwoya district, Uganda, near Murchison Falls National Park, 2015 and kernel density estimation of bushpig sightings distribution as reported by the interviewers.

frontiers in Veterinary Science

ORIGINAL RESEARCH
published: 23 September 2021
doi: 10.3389/fvets.2021.689377

Spatial-Temporal Movements of Free Ranging Pigs at the Wildlife-Livestock Interface of Murchison Falls National Park, Uganda: Potential of Disease Control at a Local Scale

Ariane Payne[1]†, Peter Ogweng[1], Karl Ståhl[2], Charles Masembe[1] and Ferran Jori[3,4,5]*

- Wild pig sightings were reported up to 25 km from park boundaries in Murchinson NP (Kukielka et al., 2016)
- Free ranging pigs can move up several km from homesteads (Thomas et al., 2013, Payne et al., 2021).

Attraction points

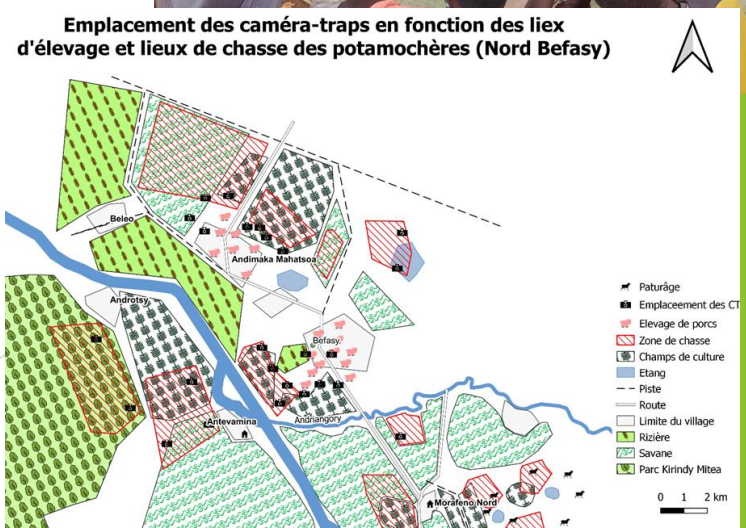
- Bushpigs are a major crop riders (but not the first one..)
- Domestic pigs were also visiting the crops
- Visits by warthogs were much more limited

Species	N° Visits
Domestic goats	32
Domestic pigs	19
Bushpig	16
Dik dik	15
Duiker (*C. nigrifrons*)	10
Buhsbuck (T. sylvaticus)	9
Kobus kob	8
Warthogs	0

Species	Visits (proportion)
Domestic goat	92% (26/28)
Bushpig	75% (21/28)
Elephant	57% (16/28)
Non-human primates	39% (11/28)
Domestic pig	32% (9/28)
Warthogs	10% (3/28)

Preliminary results in Madagascar

- Direct interactions are reported although on rare occasions (10% of the questionnaires among 627 interviews)
- Camera traps and questionnaires seem to confirm the predominance of indirect interactions
- Animals share the same habitat and the minimum time elapsed (1hour) allows transmission of certain pathogens.
- Hybridization is reported



Transmission pathways

- No horizontal transmission to pigs from warthogs (Thomson,1983;1985)
- Transmission from infected buhspigs to domestic pigs was demonstrated once experimentally (Anderson et al., 1998)
- It is potentially possible if the animals are vireamic
- Knowledge on the potential transmission of wild meat is poor

Conclusions on surveillance in wild pigs

- Data of ASF exposure / infection in wild pigs is scarce, patchy and irregular for a large majority of countries in Africa
- National or regional strategies should be built on reliable risk based decision supported by local knowledge including wildlife
- Technical constraints are limited
- implementing more wild pig surveillance programs is feasible
- International organisations should raise awareness on this aspect
- Collaboration between countries could be promoted and examples provided

Conclusions Biosecurity

- Interactions betwen wild and domestic pigs are common and likely to increase in Africa
- Biosecurity measures should be encouraged in those areas where wild and domestic pigs cohabitate (segregation and boiling food items).
- More research should be encouraged on some potential infections routes for ASF transmission
- Useful for other diseases that can be shared at the wild domestic pig interface (cysticercosis, trichinellosis, tuberculosis, toxoplasmosis, Hepatitis E)

Merci beaucoup pour votre attention!

Thank you very much for your attention!

GF-TADs

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