



Dr Livio Heath

OIE Expert for African swine fever (Africa)

Illegal use of ASF Vaccines



Regional training course (Africa)
Import risk analysis for African swine fever
9 November – 14 December 2021



Organisation
Mondiale
de la Santé
Animale

World
Organisation
for Animal
Health

Organización
Mundial
de Sanidad
Animal

The Virus



- ASFV virions have a complex multilayer structure
- More than 50 proteins are included in the virion
- Proteins on surface of virus particle are targets for antibody mediated protection
- Multi-Gene Families are involved in virulence and immune modulation

Genome

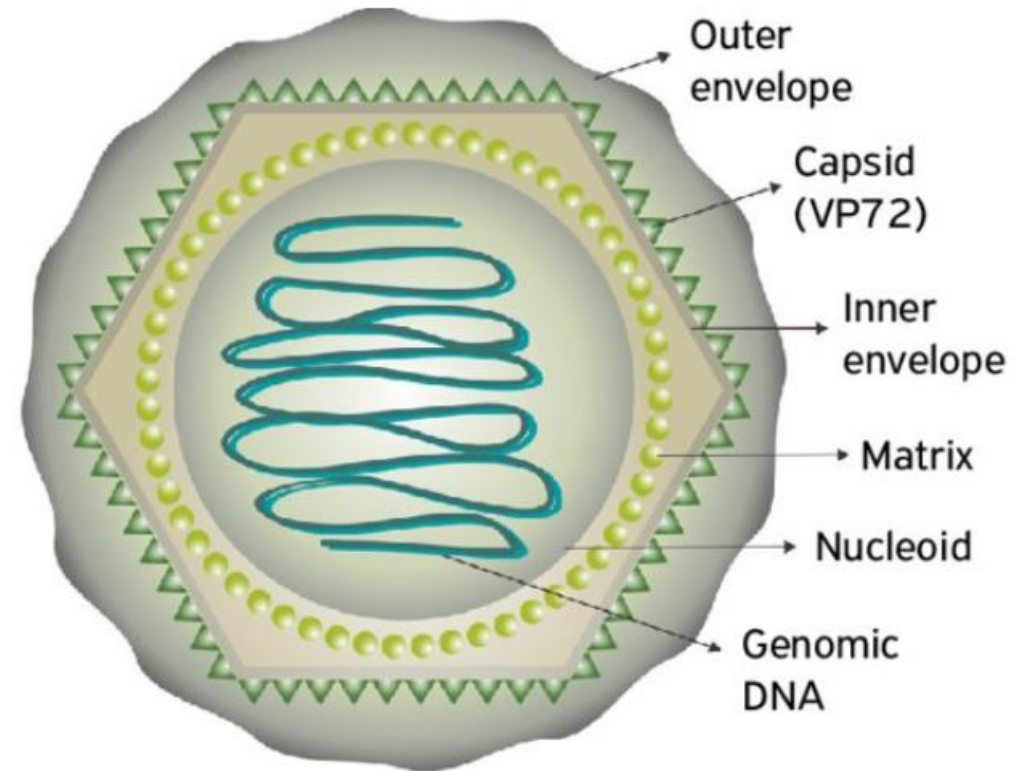
Large double-stranded DNA virus

Genes

Encodes about 151-167 genes

Proteins of interest

P72, P54, P30, CD2V.



Source: Freitas; Tavares 2016

The Virus



- ASFV virions have a complex multilayer structure
- More than 50 proteins are included in the virion
- Proteins on surface of virus particle are targets for antibody mediated protection
- Multi-Gene Families are involved in virulence and immune modulation

Genome

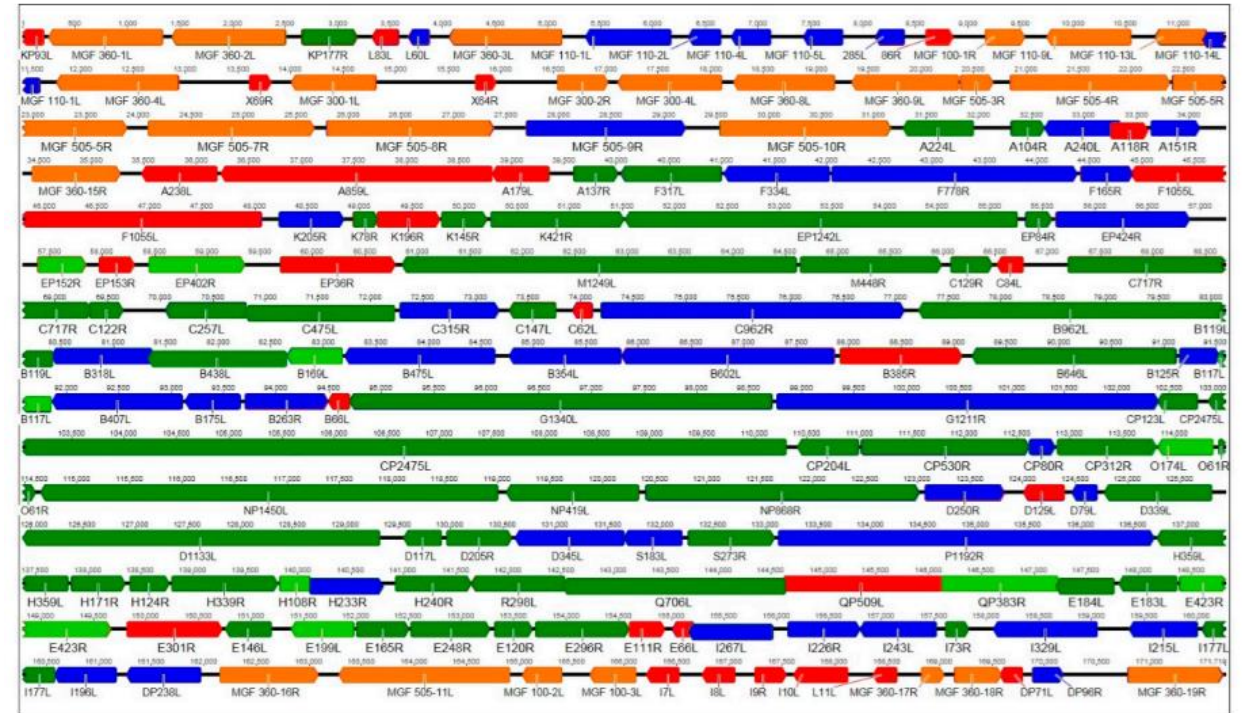
Large double-stranded DNA virus

Genes

Encodes about 151-167 genes

Proteins of interest

P72, P54, P30, CD2V.



Source: Karger et al., 2019

Challenges to ASF vaccine development



- Inactivated ASF virions do not induce protection
- Vaccines developed through serially passaged used in Portugal and Spain in 1960s caused post-vaccination reactions in
- Complexity of virus (~160-175 genes encoded. Virus particles contain > 50 proteins in several concentric layers)
- Neutralising antibodies are not effective
- Genetic diversity complexity.
 - Many virus genotypes (24) have been defined by sequence of the gene encoding the major capsid protein.
 - Lack of cross-protection between genotypes
 - Correlates of protection is not well understood.

Types of Vaccines



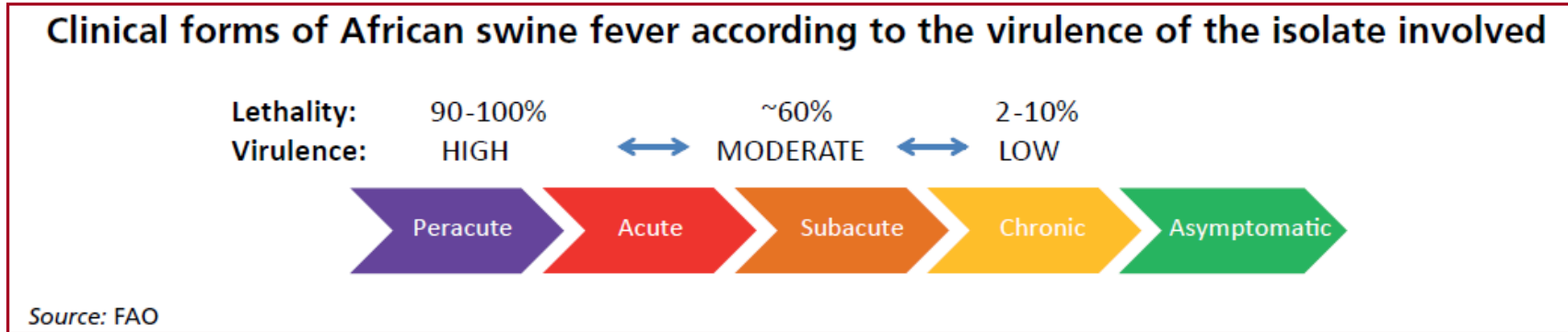
- Live Attenuated Vaccines
 - Inactivation of immuno-modulating gene by recombination
- Recombinant subunit vaccines
 - Production various ASF proteins using viral vectors
- Replication deficient recombinant ASFV vaccine
 - Viral proteins expressed under control of a inducible promoter



Naturally Attenuated Viruses



- Acute cases of ASF can result in 100% Mortality
- Acutely infected animals often die before developing antibodies
- Some pigs develop subacute or chronic forms of the disease
- Surviving pigs are immune to re-infection



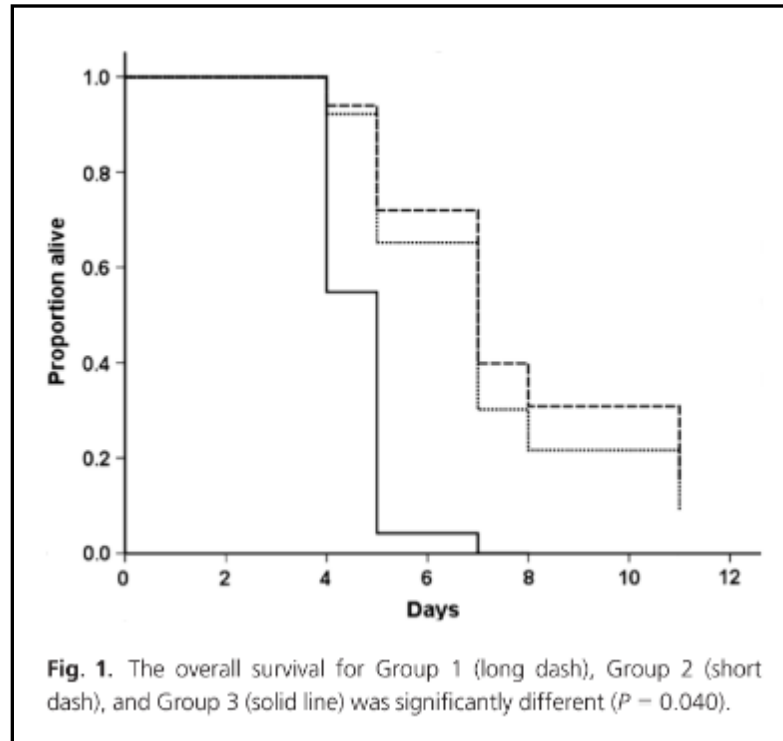
Strain	Days post infection				
	Clinical Signs	Viraemia	Sero-conversion		Death
OURT 3/88	ND	ND	7 [∅]	14 ^{∅∅}	-----
MKUZE /78	7	18	7 [∅]	14 ^{∅∅}	18*
BENIN 1/97	2	3	7 [∅]	-----	7
MOZ 1/98	2	3	-----	-----	6

ND not detected; * Animals euthanized; ∅ one animal was positive; ∅∅ all pigs are sero-positive; samples collected

Naturally Attenuated Viruses



- Surviving pigs are immune to re-infection with the same virus
- Pigs challenged with a different virus are not always protected against re-infection
- Vaccination does delay the onset of disease



Source: Souto *et al.* 2014

Table 2. Characteristics of disease in pigs vaccinated with a live attenuated strain (OURT 3/88) and challenged with virulent MOZ 1/98

Groups	No. of pigs	Days post-challenge (dpc)			End point
		Fever	Clinical Signs	Viraemia*	
Group 1 (vaccinated twice)	6	2	3	3	5–9
Group 2 (vaccinated once)	6	1–4	3–4	3	5–11
Group 3 (control group)	3	2	3	3	4–5

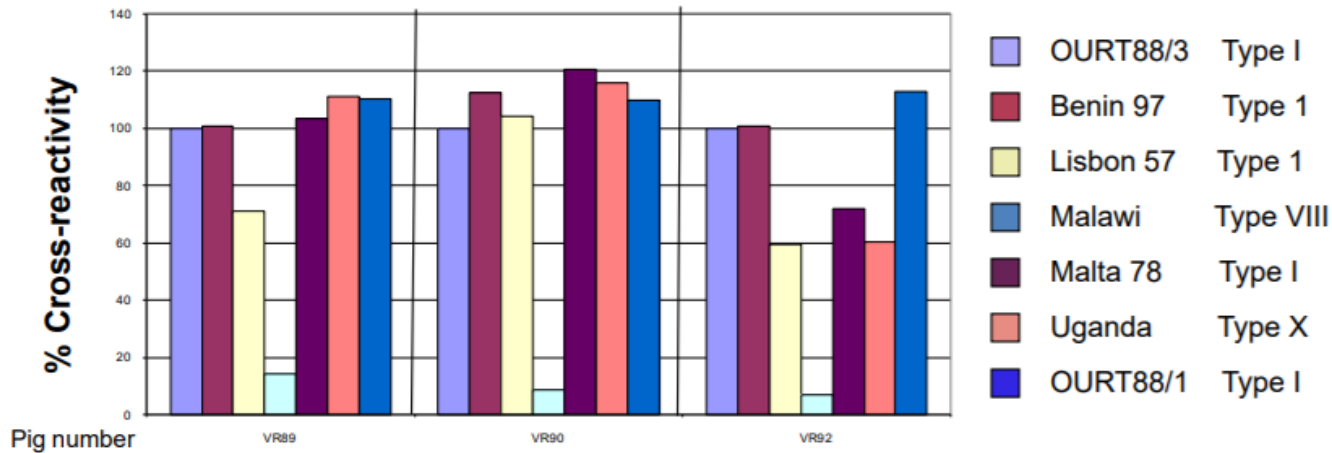
*Virus DNA detected in the blood.

Live Attenuated Vaccines

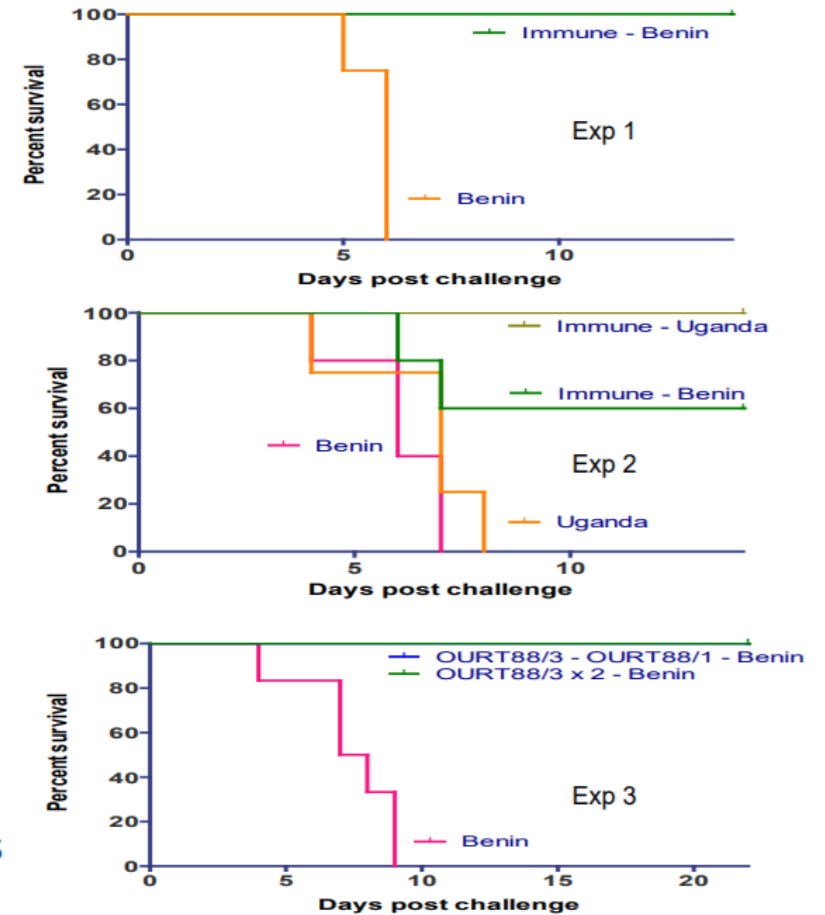


- LAV are developed by deleting one or more immune modulating genes
- Pigs challenged with a different virus are not always protected against re-infection

Cross-reactivity of vaccinated pigs



Source: L Dixon *et al.*, 2012





Recombinant protein vaccines

- Induced antibodies responses
- Partial protection achieved with recombinant proteins expressed in baculovirus:
 - a mixture of proteins p30 and p54 does not fully protect vaccinated pigs
 - CD2-like protein (or haemmagglutinin)
- Delay in onset of disease signs and viraemia, some pigs recover from infection and clear virus

Viral vector vaccines

- Viral vectors expressing selected ASF proteins *in vivo*
- Induces CTL-responses
- Protects vaccinated pigs from challenges.
- Reduced safety concerns.



- Surveillance of 22 ASFVs revealed two non-HAD isolates with lower virulence
- Both viruses were highly transmissible
- Infections resulted in non-lethal chronic disease, and persistence

Low-virulent Genotype II

Research Paper | Published: 26 February 2021

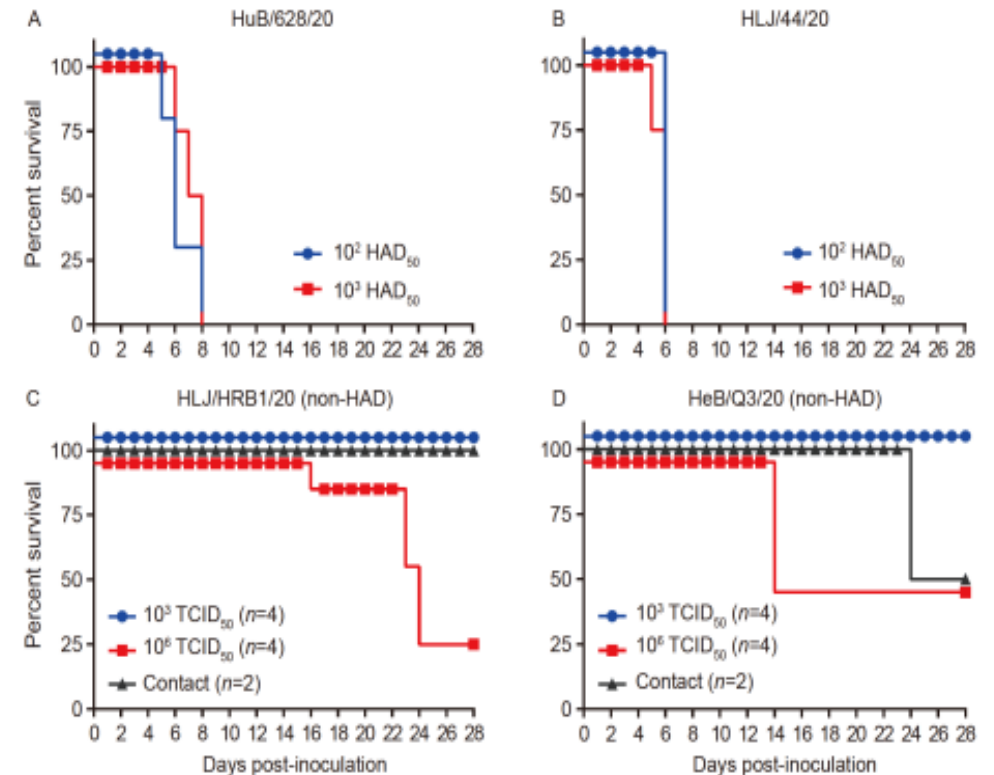
Emergence and prevalence of naturally occurring lower virulent African swine fever viruses in domestic pigs in China in 2020

[Encheng Sun](#), [Zhenjiang Zhang](#), [Zilong Wang](#), [Xijun He](#), [Xianfeng Zhang](#), [Lulu Wang](#), [Wenqing Wang](#), [Lianyu Huang](#), [Fei Xi](#), [Haoyue Huangfu](#), [Ghebremedhin Tsegay](#), [Hong Huo](#), [Jianhong Sun](#), [Zhijun Tian](#), [Wei Xia](#), [Xuewu Yu](#), [Fang Li](#), [Renqiang Liu](#), [Yuntao Guan](#), [Dongming Zhao](#) & [Zhigao Bu](#)

[Science China Life Sciences](#) **64**, 752–765 (2021) | [Cite this article](#)

660 Accesses | 11 Citations | 15 Altmetric | [Metrics](#)

- The viruses contained natural mutations or deletion in the EP402R gene
- Similar approaches have been used to generate LAVs



Source: Sun et al. (2021)



Farm Journal's **PORK** News Markets Weather Opinion Topics Events Video

HOG PRODUCTION

New China African Swine Fever Strains Point to Unlicensed Vaccines

WH Group: Illegal ASF vaccines killing pigs in China

By Ann Reus | April 1, 2021

[f](#) [t](#) [in](#) [whatsapp](#) [email](#)

Animal Health

Use of Illegal ASF Vaccines in China Causing Worldwide Concern

February 11, 2021

[f](#) [t](#) [p](#) [whatsapp](#) [in](#) [reddit](#) [email](#) [print](#) [t](#) [whatsapp](#) [rss](#) [vk](#) [digg](#)

SHIC Swine Health Information Center

VACDIVA

ABOUT VACDIVA WORK PACKAGES NEWS VACDIVA ACTIVITIES OUR TEAM ASF

Animal's Health Interview

"Illegal vaccines endanger the eradication of African swine fever in Asia"

DATE: March 3rd, 2021

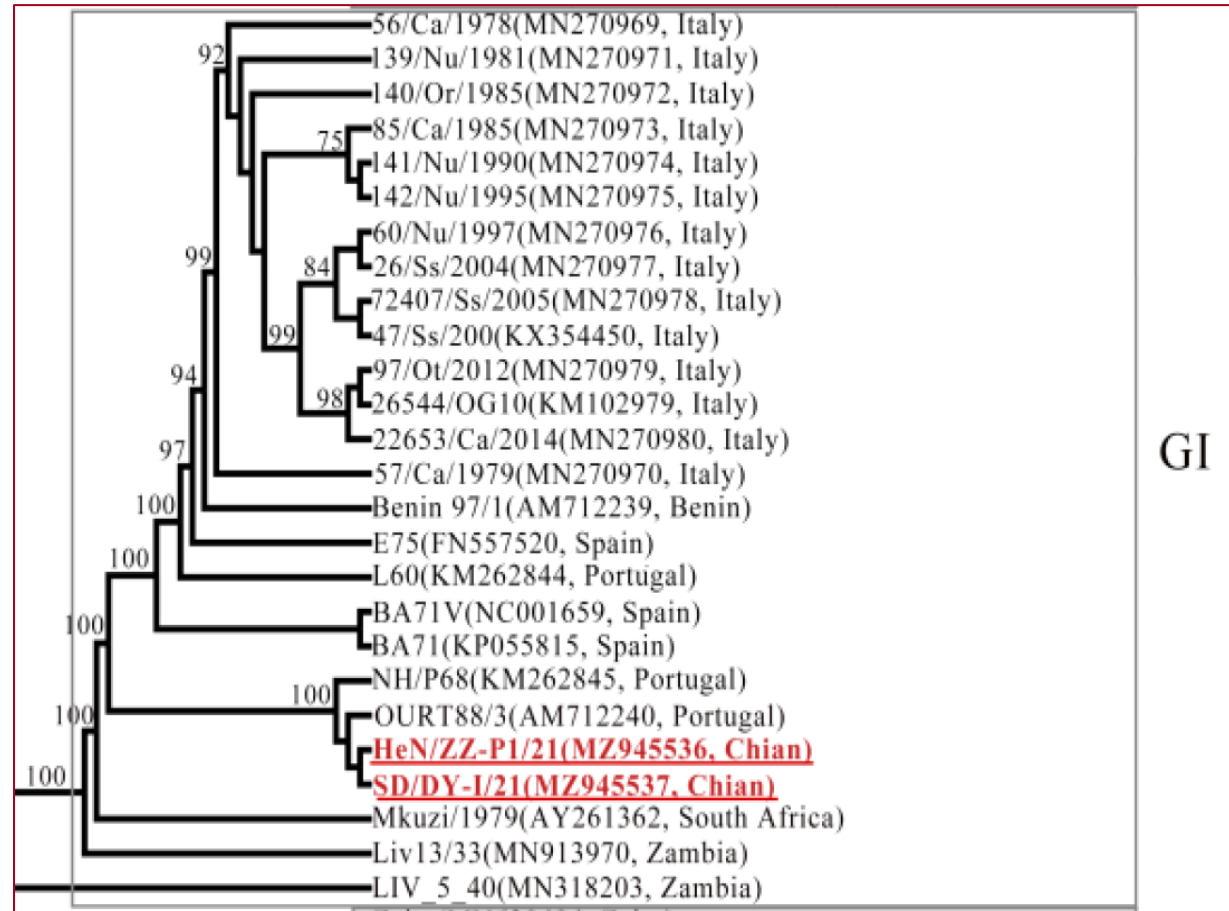
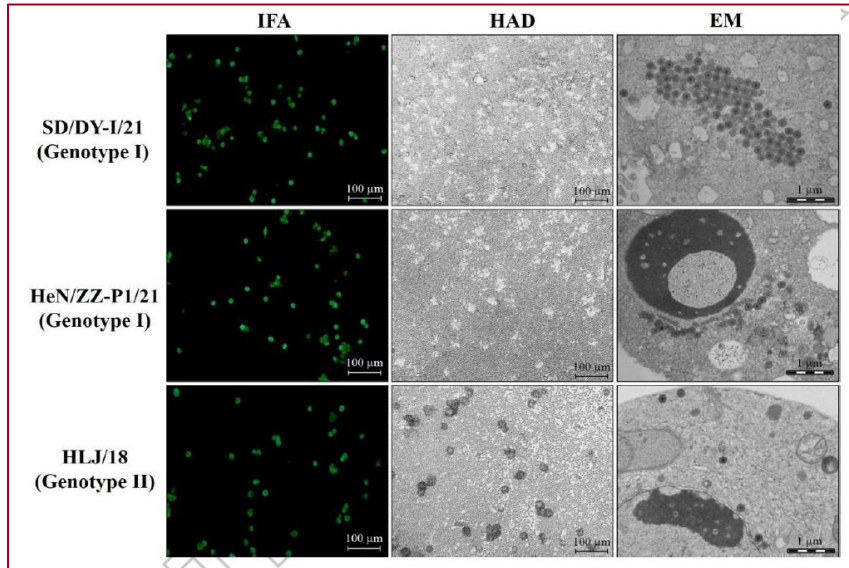
CATEGORY



Low-virulent Genotype I

Genotype I African swine fever viruses emerged in domestic pigs in China and caused chronic infection

Emergence of genotype I ASFVs in China.

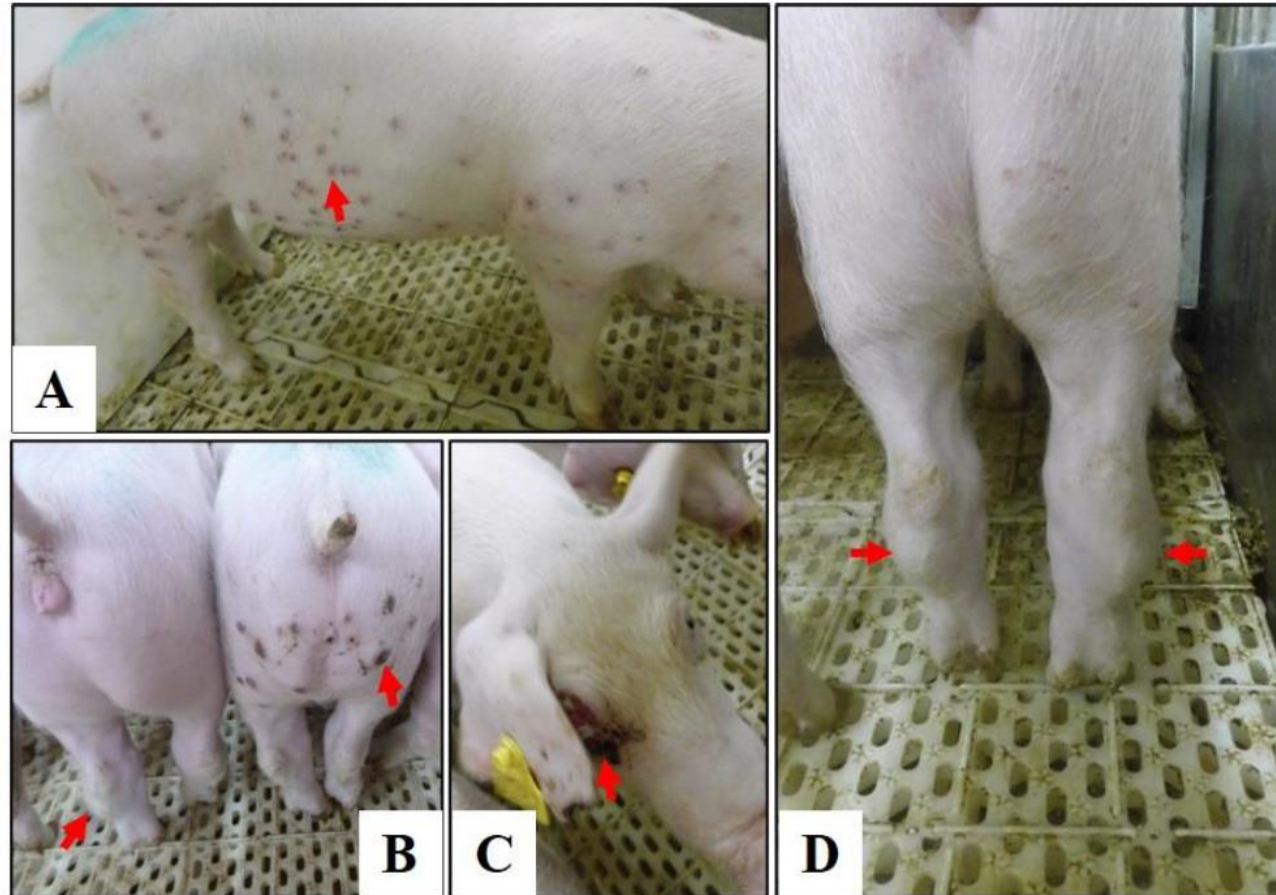


Source: Sun et al. (2021b)

Chronic African swine fever



- Disease signs in pigs infected with the genotype I isolate SD/DY-I/21
- Clinical signs include papules on the flank and rear
- Cutaneous necrosis
- Arthroncus of hind legs



Source: Sun *et al.* (2021b)

Monitoring African Swine Fever Variant Strains



- Triple fluorescent PCR method targeting p72/CD2v/MGF
- A protocol for an I177L gene-specific real time PCR should be included to address potential LAV-derived isolates that may be transmitted and circulate

- EDTA blood or nasal swabs to be collected from live pig.
- Samples should be tested using real-time PCR protocols to detect LAVs
- PCR tests should be confirmed by conventional or Whole Genome Sequencing

Comprehensive decision result	Test results		
	P72-FAM	CD2v-VIC	MGF-Cy5
ASFV epidemic strain positive	+	+	+
ASFV CD2v gene deletion strain positive	+	-	+
ASFV MGF gene deletion strain positive	+	+	-
ASFV CD2v and MGF gene double deletion strain positive	+	-	-
ASFV negative	-	-	-

Source: Dr Zhiliang Wang



Food and Agriculture Organization

- Laboratory diagnosis and surveillance of African swine fever virus: addressing novel emergent variants

World Organisation for Animal Health

- OIE Reference Laboratory Network for African swine fever
- Open Access Information Sharing Platform for the dissemination African swine fever epidemiological and Genomic information
- Technical support by OIE Reference Laboratories

Dr Livio Heath

Onderstepoort Veterinary Institute
Agricultural Research Council
Onderstepoort 0110
South Africa

Tel: +27-12 529 95.01 Fax: +27-12 529 95.95

Email: HeathL@arc.agric.za



GF-TADs

GLOBAL FRAMEWORK FOR THE
PROGRESSIVE CONTROL OF
TRANSBOUNDARY ANIMAL DISEASES



Food and Agriculture
Organization of the
United Nations

Oie

WORLD ORGANISATION
FOR ANIMAL HEALTH

Thank you for your attention!



www.oie.int

Oie

Organisation
Mondiale
de la Santé
Animale

World
Organisation
for Animal
Health

Organización
Mundial
de Sanidad
Animal