

Towards the development of a safe and sustainable vaccine against African Swine Fever

Directorate “Health and Food”
DG Joint Research Centre

Civil Dialogue Group on Animal Production – Focus on Pigmeat
26 April 2023

ASF Virus research review



2022 African Swine Fever Virus Research Review



2022 African Swine Fever Virus Research Review

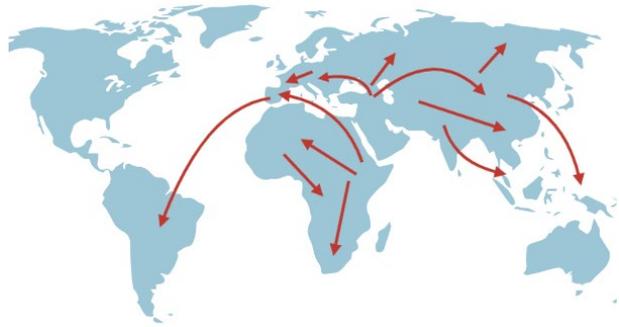
- Progress made since 2015.
- Study commissioned by the STAR-IDAZ International Research Consortium in collaboration with the Agricultural Research Service, United States Department of Agriculture (USDA, ARS), and the Global African Swine Fever Research Alliance (GARA).
- Findings will be used to support detailed gap analyses



The Secretariat for the STAR-IDAZ IRC (SIRCAH) is funded from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727494



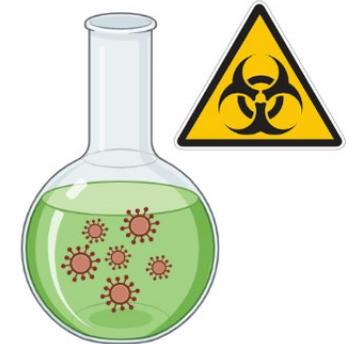
The Problem



Rapid spread worldwide



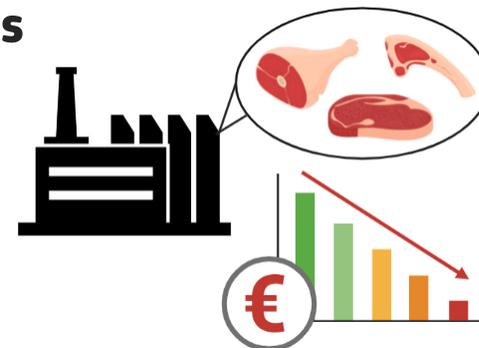
**Biosecurity measures
Culling of infected pigs**



**Candidate to
biological warfare**



**No treatments or
vaccines available**



**Economic impact in
pork industry**

The Problem

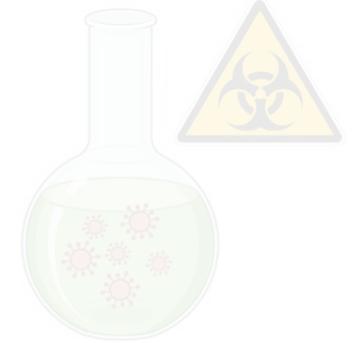
**Urgent need for a safe,
sustainable and efficient vaccine**



Rapid spread



Equity, safety & security
Culling of infected pigs



Candidate to
biological warfare



No treatments or
vaccines available



Economic impact in
pork industry

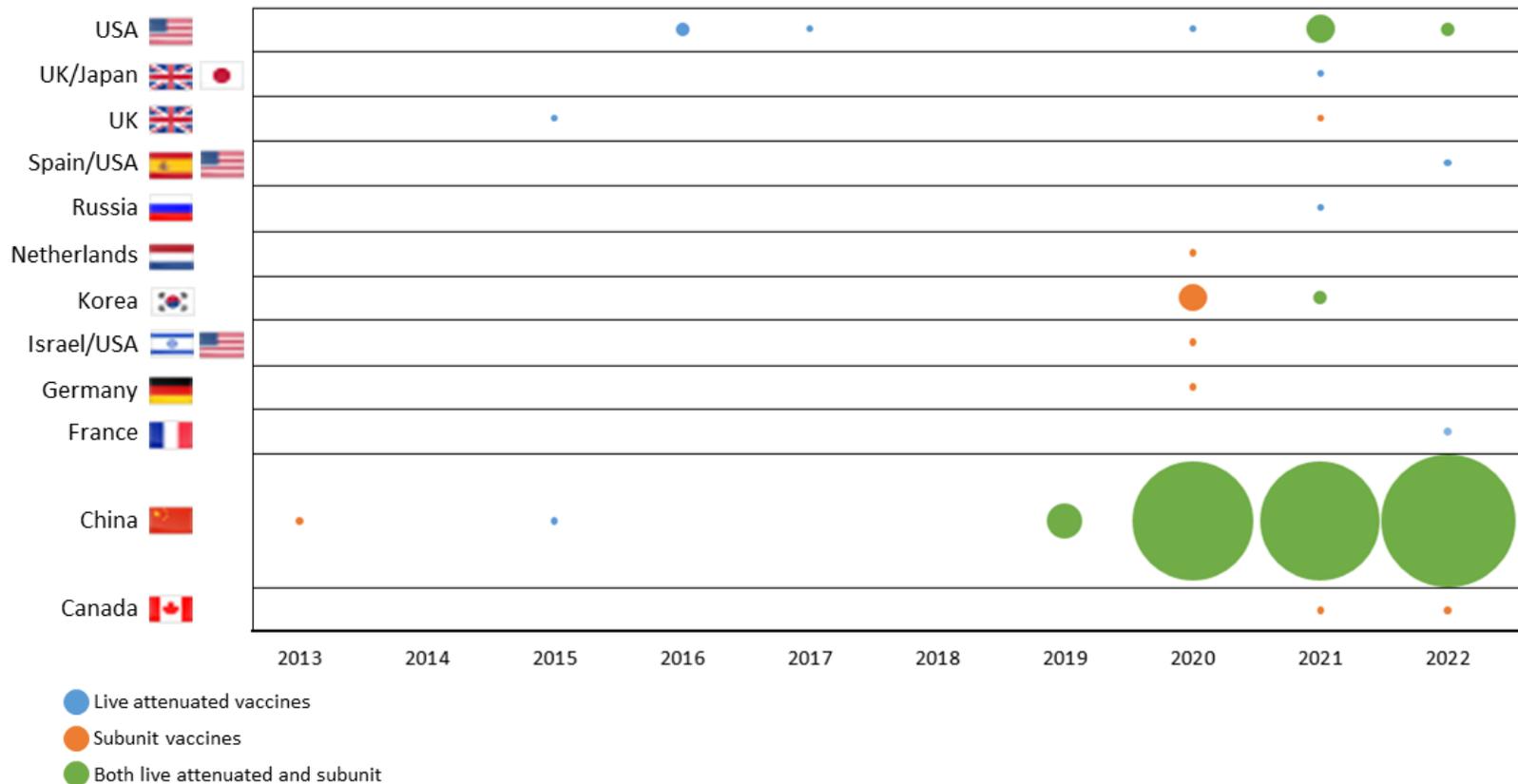
Vaccine efforts: some considerations

- The search for an ASF vaccine is not comparable to the development of a covid19 vaccine; compare it rather to searching for a vaccine against acquired immune deficiency syndrome.
- Although the virus is extremely complex, much progress has been made to have vaccine candidates; often of different type (live attenuated or other).
- In [November 2021](#), Russia's deputy prime minister Victoria Abramchenko instructed the Russian Science and Education Ministry to start using the Russian ASF vaccine by 2024.

Strong commitment from Commission services to better coordinate efforts at European level

ASF vaccines - Where are we now?

ASF vaccine patents distribution per year and country



Source: Patent search on PatentSight® on January 2023

- First patent registered in 2013
- 2020 and onwards: number of patents increases substantially
- Patents published by entities in 12 different countries
- China is the country with more registered patents (69%)
- Most patents correspond to **LAVs** and **subunit vaccines**

Overview on ASF vaccine types

Promising ASF vaccines - LAVs

Ref	Deleted genes/proteins	Parental strain	Challenge strain	Results
Borca M.V., et al. 2021	I177L	Georgia2007/1	Georgia2007/1	100% (5/5 and 5/5) pigs survived
Borca M.V., et al. 2020	I177L	Georgia2007/1	Georgia2007/1	100% (5/5) pigs survived
Tran X.H., et al. 2021	I177L	Georgia2007/1	TTKN/ASFV/DN/2019	100% (5/5) pigs survived
Gladue D.P., et al. 2021	A137R	Georgia2007/1	Georgia2007/1	100% (5/5) pigs survived
Zhang Y., et al. 2021	I226R	SY18	SY18	100% (5/5) pigs survived
Zhang Y., et al. 2021 (2)	L7L-L11L	SY18	SY18	100% (6/6) and 83% (5/6) pigs survived
Chen W., et al. 2020	MGF360(12-14L) + MGF505-(1-3R) MGF360(12-14L) + MGF505-(1-3R) + CD2v	HLJ/18	HLJ/18	100% (4/4) pigs survived 100% (4/4) pigs survived
Monteagudo P.L., et al. 2017	EP402R	Ba71V	Ba71V, E75, Georgia2007/1	100% (12/12, 12/12 and 18/18) pigs survived
O'Donnell V., et al. 2017	B119L, DP96R	Georgia2010	Georgia2010	100% (9/9, 10/10 and 15/15) pigs survived
O'Donnell V., et al. 2015	B119L	Georgia2010	Georgia2010	100% (10/10) and 70% (7/10) pigs survived higher dose = more protection
O'Donnell V., et al. 2015 (2)	MGF360(6), MGF505	Georgia2010	Georgia2010	100% (10/10 and 10/10) pigs survived

Overview on ASF vaccine types

Promising ASF vaccines – Subunit vaccines

Ref	Target proteins	Parental strain	Challenge strain	Results
Lacasta A., et al. 2014	80 ORFs fragments fused with Ub	Ba71V	E75	60% (3/5) and 50% (4/8) pigs survived
Argilaguët J.M., et al. 2013	SHA, p54, p30	E75	E75	67% (4/6) pigs survived
Argilaguët J.M., et al. 2012	Ub/sHA/p54/p30 fusion	E75	E75	33% (2/6) and 17% (1/6) pigs survived Lower number of doses = more protection
Barderas M.J., et al. 2001	P54, p30	E75	E75	100% (2/2) pigs survived
Gomez-Puertas P., et al. 1998	p54 + p30	E75	E75	50% (3/6) pigs survived
Ruiz-Gonzalvo F., et al. 1996	CDv2	E75	E75	100% (3/3) pigs survived

Approved vaccines in Vietnam. Success?

1. NAVET-ASFVAC vaccine, US-Vietnam partnership (USDA-ARS, NAVETCO)

- 24 August 2022:
“Vietnam has temporarily suspended the use of its first home-grown African swine fever vaccine after dozens of pigs inoculated with the shots died this month”. (Reuters)
- 27 September 2022:
“According to information received from MARD, it was determined that the deaths were caused by vaccination processes that were out of compliance with ministry guidelines,”
- 24 April 2023 (GARA LinkedIn)
“The USDA ASFV-G-dl177L vaccine platform is safe and effective. The vaccine is moving to Phase II deployment in Vietnam”

Stricter control of the vaccination process !!



Approved vaccines in Vietnam. Success?

2. AVAC vaccine, Vietnam

- 1 February 2023:
“The efficacy rate of the AVAC vaccine, administered to pigs between the ages of 8 and 10 weeks, has been shown to reach 95%

“Vietnam expects to begin nationwide distribution of the vaccine this month”

Vietnam to begin nationwide distribution of ASF vaccine



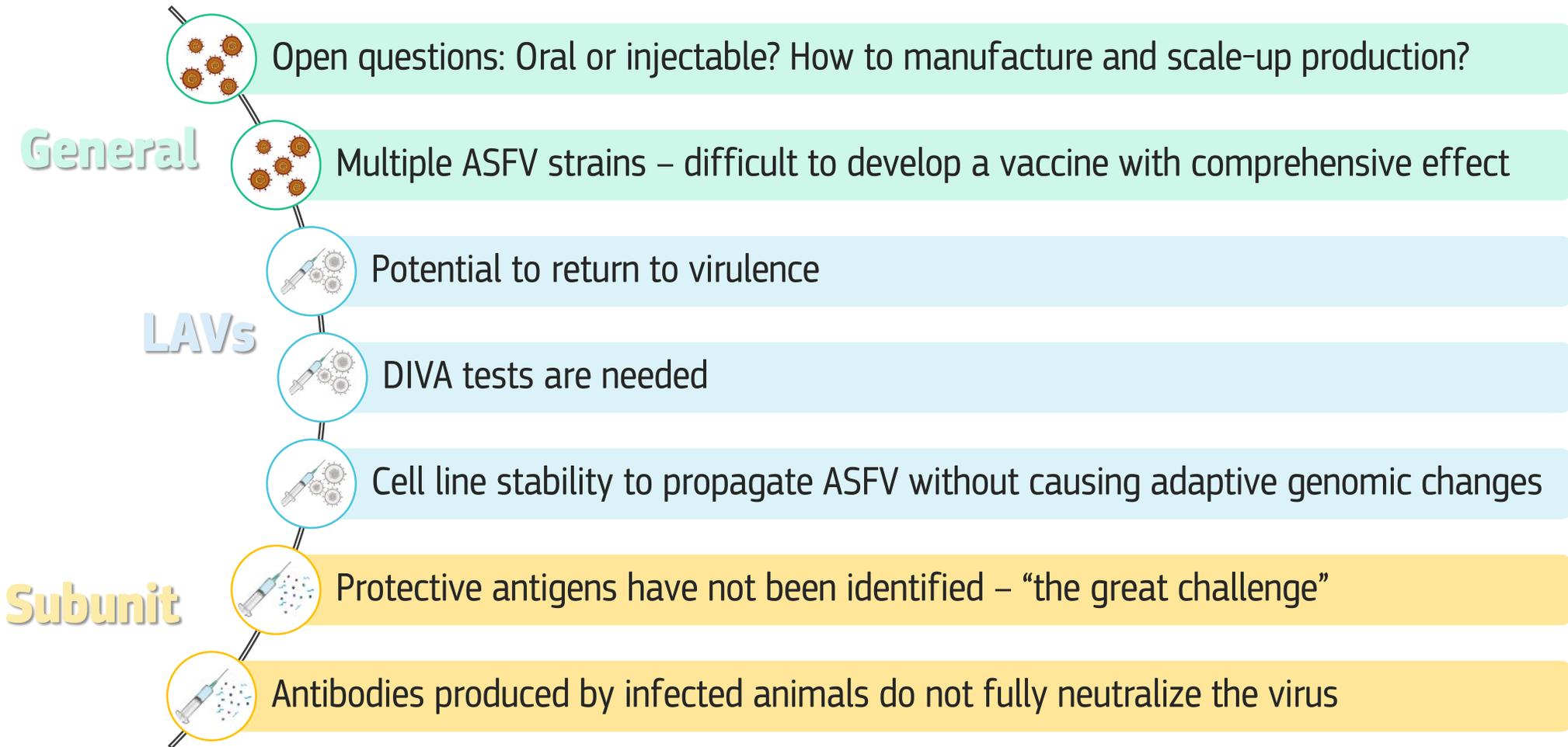
By Ann Reus | February 1, 2023



dusanpetkovic | iStock.com

Efficacy rate of AVAC Vietnam vaccine for African swine fever has been shown to reach 95%

ASF vaccines – Technical Challenges



Requires a standardised pipeline for vaccine evaluation or side-by-side comparison.

Roadmap & next steps

OBJ. Validate the protective efficacy of the most promising vaccines against ASFV in a double blind trial and advance those that achieve established performance criteria

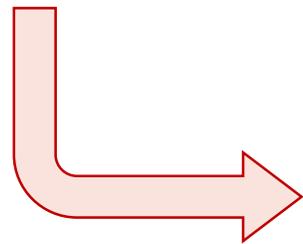
- Step 1. Agree on a safety framework and establish minimal acceptance criteria for candidate vaccines (WOAH)
- Step 2. Agree on a number of performance criteria (efficacy, safety & sustainability) and launch a call for candidate vaccines for testing in a double blind study
(BSL3 facilities; EC – US partnership)
- Step 3. Select the most promising for commercialization based on cut-off criteria (safe, practical and useful)
- Step 4. Plan for scale-up production, including IPR aspects

Possible partners (non-exhaustive)

- USDA – Agricultural Research Service
- US DHS Office of Health Security
- WOA
- EC: DG-SANTE, DG-AGRI, DG-JRC, EMA, EFSA
- Scientific Experts: Global African Swine Fever Research Alliance, EU projects (VACDIVA), EURL for ASF, national ref labs, EU Research Institutes
- plus private sector: COPA-COGECA

Medium term: Promote unfinished promising cutting-edge approaches that are high risk, low success, and high impact research

- Several EU laboratories report they have promising vaccines in the pipeline that are broader in scope than those described above.
- Evaluate whether a promising vaccine (according to the performance criteria described above) can be produced within a short time frame



DG-AGRI call under HE
HORIZON-CL6-2023-FARM2FORK-01-5:
Advancing vaccine development for African swine fever
12 M€

Longer term: Promote cutting-edge approaches that are high risk, low success, and high impact research.

- Focus on new synthetic biology and computational biology techniques aiming for rational vaccine development of epitope-based vaccines.
- Given the risk of integration into the host genome associated with DNA vaccines, the potential of mRNA-based vaccine approach should be exploited.
- Use CRISPR/Cas technology to establish ASF-resistant pigs (legal constraints).

Concluding remarks

- Strong commitment from the EC to tackle ASF
- Roadmap > Validate the protective efficacy of the most promising vaccines against ASFV in a double blind trial and advance those that achieve established performance criteria
- Test guidelines specific for ASF are necessary
- LAVs confer the best level of protection so far.
- LAVs are the first generation vaccines but subunit vaccines or next generation vaccines, e.g. mRNA therapeutics, are a better option in the long term

Thank you

For any question, suggestion: guy.van-den-eede@ec.europa.eu



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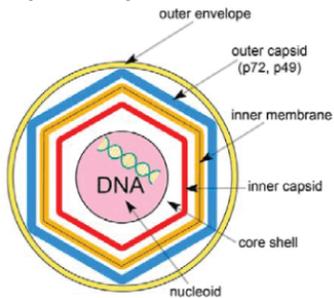
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The Problem

Pathogen

- **African Swine Fever Virus**
- Double stranded DNA
- *Asfarviridae* family
- Complex multiple-layer structure
- Immune escape genes
- Not completely characterized



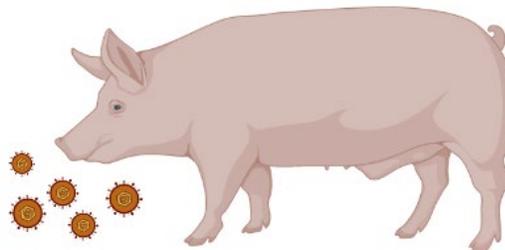
Source: Khanna, K. American Society for Microbiology (2022)

Hosts

- **Domestic pigs**
- **Wild boar**

Reservoirs/Vectors:

- Warthogs
- Bushpigs
- Giant forest hogs
- Soft ticks



Impact

- Rapid spreading
- Highly contagious
- High Mortality – up to 100%
- No vaccine
- No treatment

Available countermeasures:

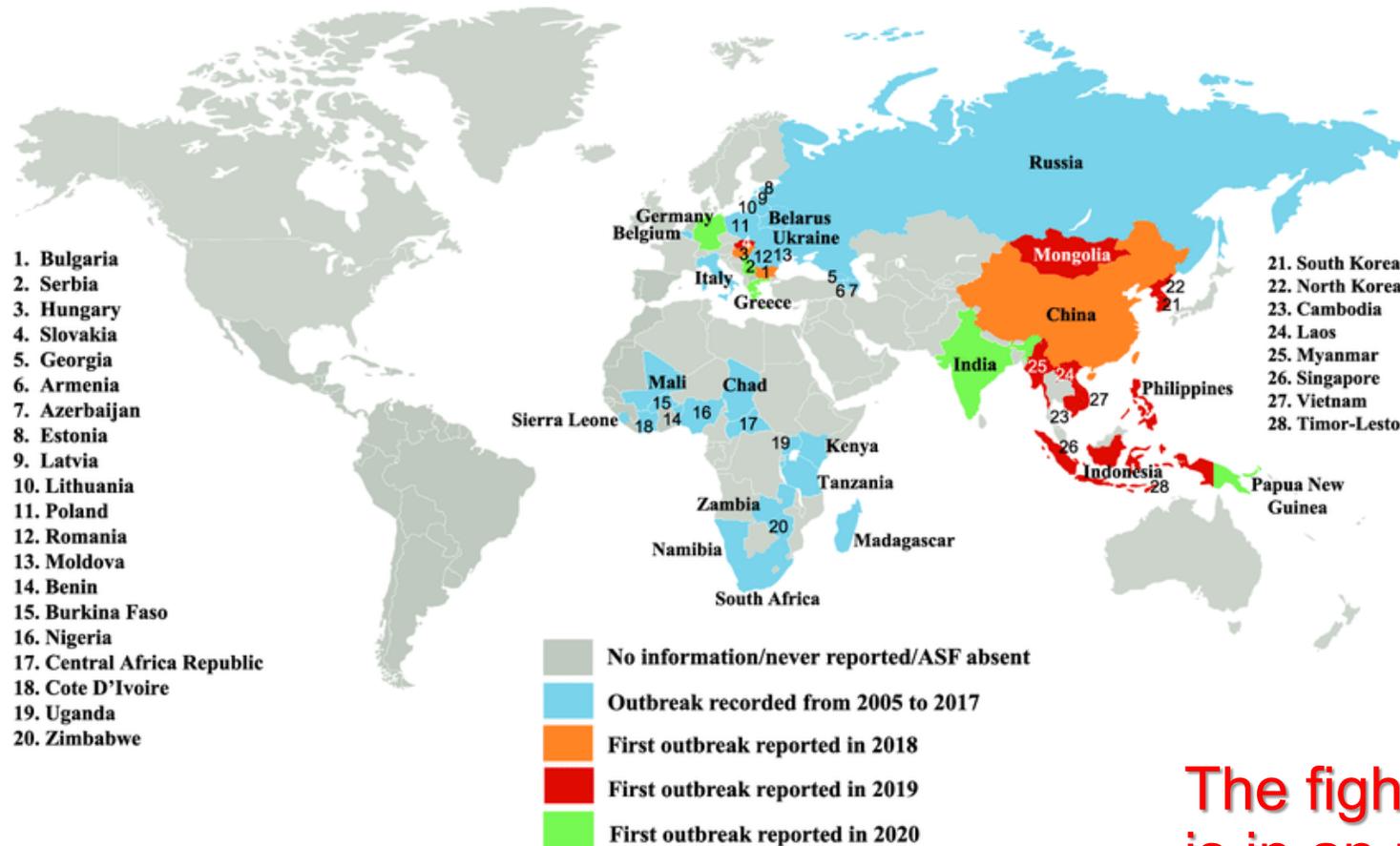
- Improved biosecurity levels
- Culling of infected pigs



**Strong economic impact
for pork industry**

The Problem – ASF spread

ASF distribution 2005-2020



Source: Shi, J., et al. Anim Front (2021)

• 1st round of transmission:

- Started in Kenya, 1921
- Genotype I
- Spread across Africa, Europe and South America
- Eradicated in Europe in the 1990s

• 2nd round of transmission:

- Started in Georgia, 2007
- Genotype II
- Spread across Eastern/Central Europe and Asia
- 2020 to 2022: outbreaks in 35 different countries

The fight against ASF is in an urgent phase

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