



ASF Outbreaks in Vietnam (2019-2023)- Insights and Lessons Learned ”

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Content

- I. Pig production in Vietnam
- II. General information of ASF
- III. ASF outbreaks in Vietnam during the 2019-2023 period- Insights and Lessons Learned

I. Pig production in Vietnam

❖ Pig population in 2019: Nearly 30 million

- Pork volume: 3.82 million tons
- Pork presents at 70% meals of Vietnamese

❖ Pig-raising households:

About 2.5 million

- 49% of the total pig population
- 40% of the total pork volume

❖ Large big farms:

- 51% of the total pig population
- 60% of the total pork volume

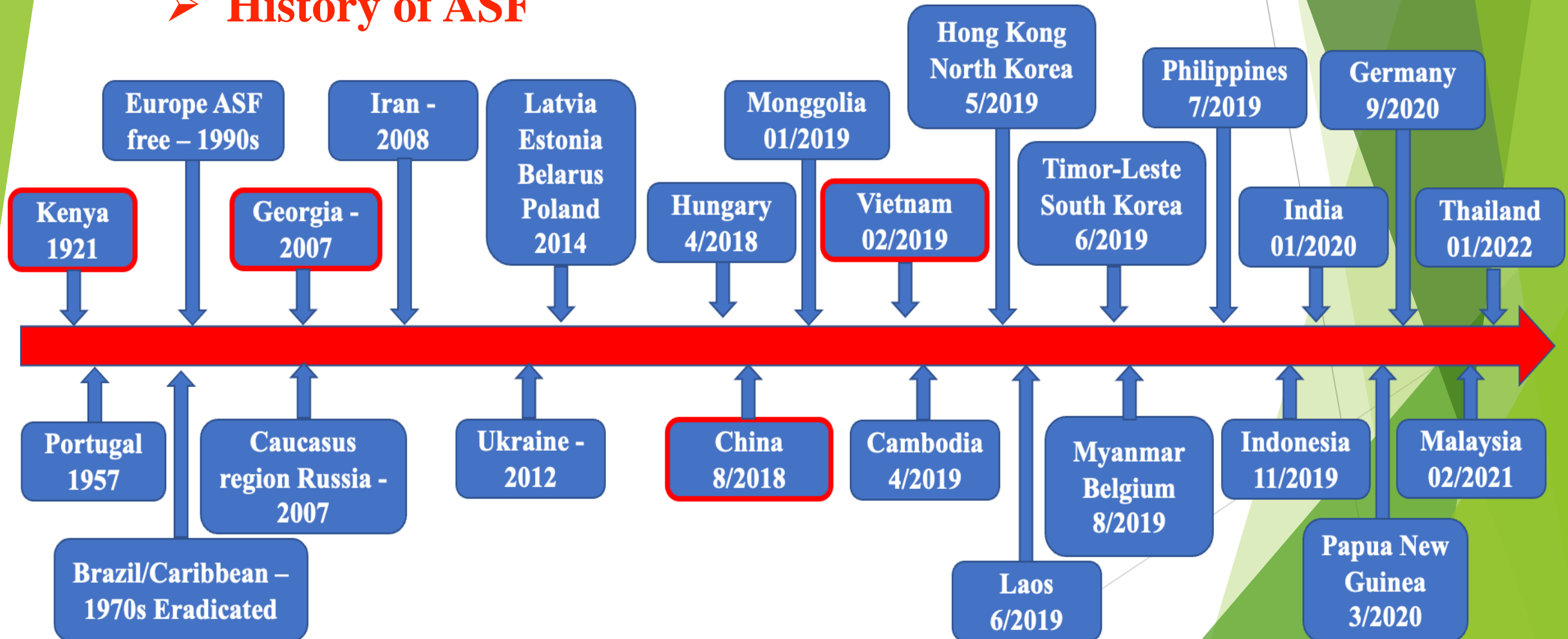
❖ Breeding pigs:

- Sows: About 4.0 million
- Boars: 76,000



II. General information of ASF

➤ History of ASF



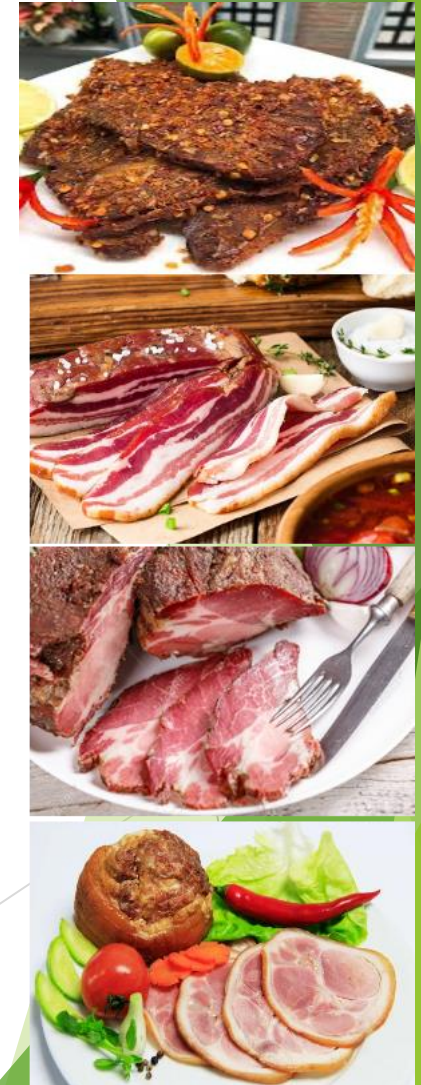
II. General information of ASF

- ❖ Asfarviridae: *Asfivirus*
 - ✓ Large, enveloped DNA virus
- ❖ Caused diseases in all pig species
 - ✓ Mortality (domestic pigs) up to 100%
- ❖ 24 genotypes
 - ✓ Vary in virulence
 - ✓ High virulence: up to 100% mortality
 - ✓ Low virulence: seroconversion
- ❖ Infects monocytes and macrophages



Persistence of ASFV across a variety of environmental conditions

Item.	Survival time
Salted meat	182 days
Dried meat	300 days
Smoked and deboned meat	30 days
Frozen meat	1000 days
Chilled meat	110 days
Offal	105 days
Blood stored at 4 ⁰ C	18 months
Putrefied blood	15 weeks
Contaminated pig pens	1 month
Faeces at room temperature	11 days
Skin/Fat (even dried)	300 days



(<https://www.fao.org/3/i7228e/i7228e.pdf>)

Resistance of ASFV to physical and chemical action

Action	Resistance
Temperature	Highly resistant to low temperatures. Heat inactivated by 56°C/70 min; 60°C/20 min.
pH	Inactivated by pH <3.9 or >11.5 in serum-free medium. Serum increases the resistance of the virus, <i>e.g.</i> , at pH 13.4 , resistance lasts up to 21 h without serum and 7 days with serum.
Chemicals / Disinfectants	Susceptible to Ether and Chloroform. Inactivated by 8/1,000 sodium hydroxide (or NaOH) (30 min); Hypochlorites (ClO) as 2.3% chlorine (or clo) (3 min); 3/1,000 formalin (30 min) ; 3% ortho-phenylphenol (30 min) and iodine compounds.
Survival	Remains viable for long periods in blood, faeces, and tissues , especially infected uncooked or undercooked pork products.

(OIE. *Technical disease card for African swine fever*. 2009)

Journal of Animal Science, 2022, 100, 1–6
<https://doi.org/10.1093/jas/skac248>
 Advance access publication 1 August 2022
 Microbiology and Microbiome

OXFORD
 AMERICAN SOCIETY OF ANIMAL SCIENCE

Inactivation rate of African swine fever virus by a formaldehyde-based product

Van Phan Le,¹ Thi Bich Ngoc Trinh,^{1,a} Van Tam Nguyen,^{1,a} Thi Lan Nguyen,[†] and Suphachai Nuanualsuwan^{†,§,1}

Annals of Agricultural Sciences 67 (2022)



Contents lists available at ScienceDirect

Annals of Agricultural Sciences

journal homepage: www.elsevier.com/locate/aoas



Inactivation rates of African swine fever virus by compound disinfectants

Van Phan Le,^a Tapanut Songkasupa^b, Prakrit Boonpornprasert^b, Thi Lan Nguyen^a, Suphachai Nuanualsuwan^{c,d,*}

frontiers | Frontiers in *Veterinary Science*

Antiviral activity of SAFER[®], a commercial acidifying desiccant powder, against African swine fever virus

Thi Bich Ngoc Trinh^{1†}, Elodie Lazenec^{2†}, Thi Ngoc Ha Lai¹, Maria Matarad-Mann², Luong Tan Phat², Anne Morvan², Anne-Cecile Delahaye², Pi Nyvall Collén², Thi Lan Nguyen¹ and **Van Phan Le^{1*}**

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III. ASF outbreaks in Vietnam during the 2019-2023 period

- First report: **February 1, 2019**, in Hung Yen Province, **Northern Vietnam**
- September 3 (**after 7 months**): ASF outbreaks were reported in **all 63/63 provinces** of Vietnam
- At least **6 million pigs** were culled
- **Caused by a highly virulent ASFV p72 genotype II**



EMERGING INFECTIOUS DISEASES

Emerg Infect Dis. 2019 Jul; 25(7): 1433-1435.
doi: 10.3201/eid2507.190303

Outbreak of African Swine Fever, Vietnam, 2019

Van Phan Le¹, Dae Gwin Jeong¹, Sun-Woo Yoon, Hye-Min Kwon, Thi Bich Ngoc Trinh, Thi Lan Nguyen, Thi To Nga Bui, Jinsik Oh, Joon Bae Kim, Kwang Myun Cheong, Nguyen Van Tuyen, Eunhye Bae, Thi Thu Hang Vu, Minjoo Yeom, Woonsung Na, and Daesub Song

frontiers
in Veterinary Science

Clinical and Pathological Study of the First Outbreak Cases of African Swine Fever in Vietnam, 2019

Bui Thi To Nga¹, Bui Tran Anh Dao¹, Lan Nguyen Thi¹, Makoto Osaki², Kenji Kawashima², Daesub Song³, Francisco J. Salguero^{4†} and Van Phan Le^{1†*}

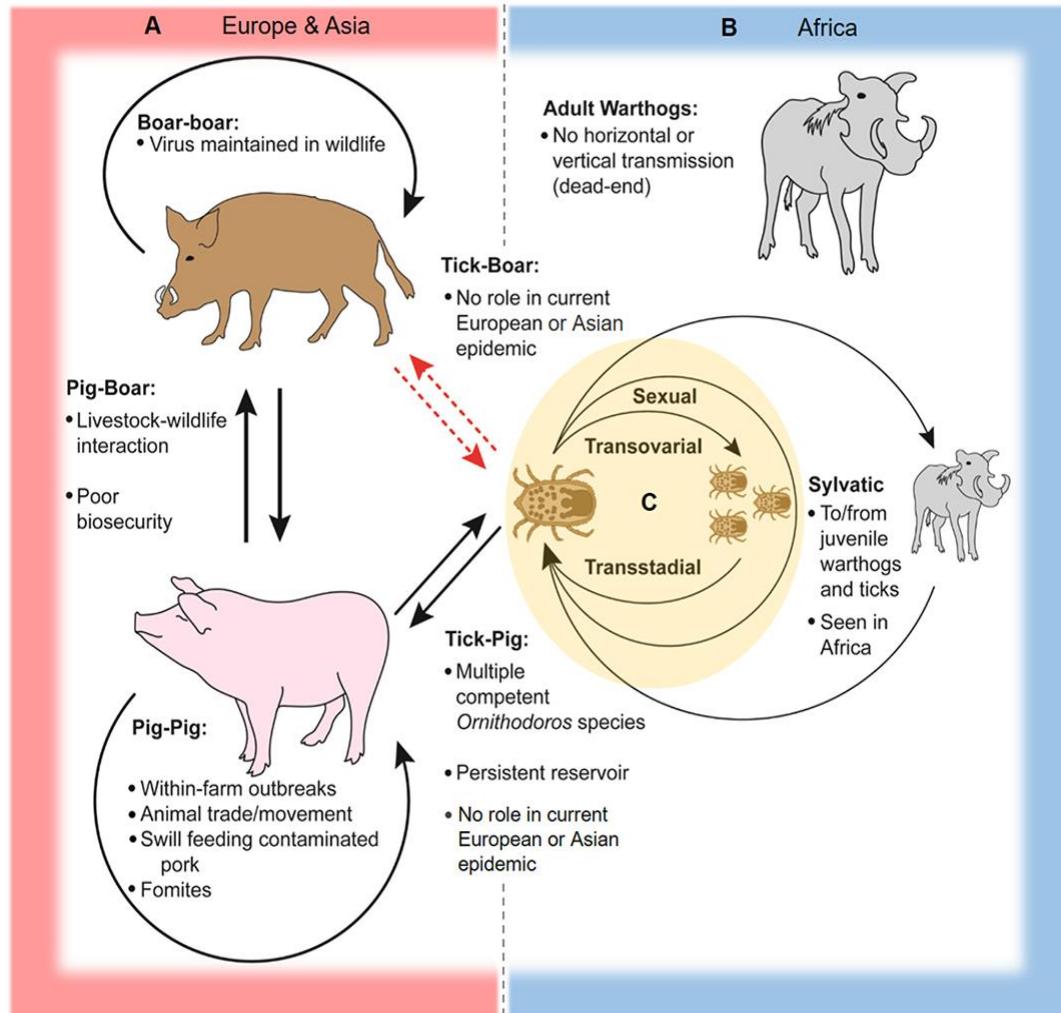
viruses **MDPI**

Article

A Whole-Genome Analysis of the African Swine Fever Virus That Circulated during the First Outbreak in Vietnam in 2019 and Subsequently in 2022

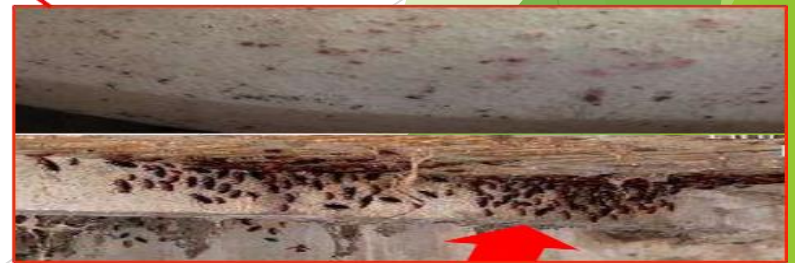
Van Phan Le^{1,†}, Min-Ju Ahn^{2,3,†}, Jun-Seob Kim^{4,†}, Min-Chul Jung^{2,3,†}, Sun-Woo Yoon⁵, Thi Bich Ngoc Trinh¹, Thi Ngoc Le^{2,3}, Hye Kwon Kim⁶, Jung-Ah Kang³, Jong-Woo Lim⁷, Minjoo Yeom⁷, Woonsung Na⁸, Xing Xie⁹, Zhixin Feng⁹, Daesub Song^{7,*} and Dae Gwin Jeong^{2,3,*}

ASF Transmission in Vietnam



(Gaudreault et al., 2020)

ASF Transmission in Vietnam



Local markets are the main source of ASF infection in Vietnam

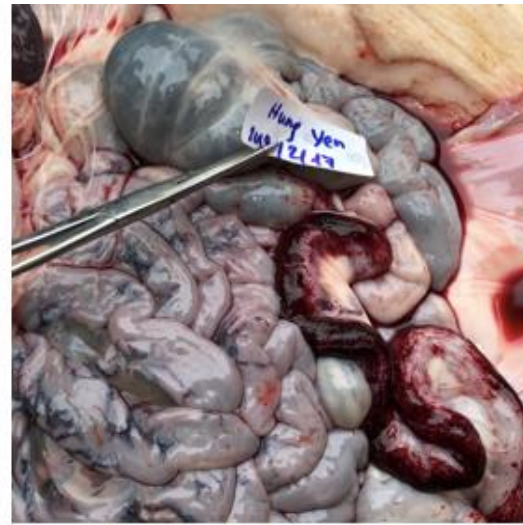
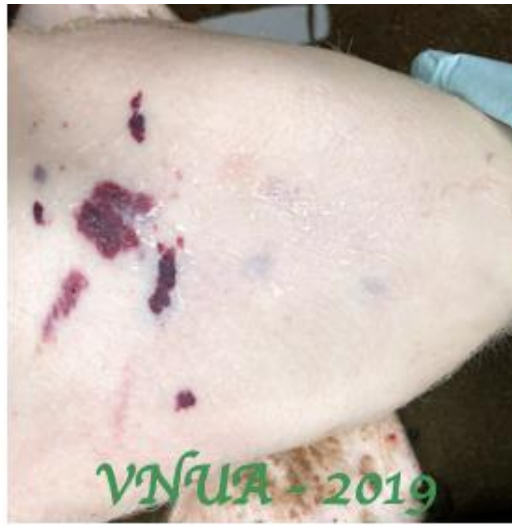


Clinical sign investigation

Clinical signs	Type of pig			
	Boar (%) (n=3)	Sow (%) (n=178)	Fattening (%) (n=212)	Piglet (%) (n=93)
Fever	100	100	100	100
Loss of appetite	100	100	100	100
Vomiting	100	90	10	20
Foaming at mouth	0	40	55	80
Skin hemorrhage	33	40	100	50
Hemorrhagic discharge from nasal/anus	10	10	90	0
Abortion in pregnant sows	-	100	-	-
Leg problem	0	0	0	100



Necropsy lesions of the ASFV- infected pigs



Basic reproduction number (R_0) in sow and fattening pig farms

Table 1. Mean, standard deviation of infected cases per day and R_0 values

Farm	Type of pig	Actual pig population	Mean	Standard Deviation	Basic reproduction number (R_0) (95% C.I)
HY1	Sow	384	4.5	2.78	1.78 (1.35 – 2.35)
	Fattening	1682	13.94	15.98	4.76 (4.18 – 5.38)
HY2	Sow	192	3.3	2.54	1.55 (1.08 – 2.18)
	Fattening	981	14.28	10.25	3.80 (3.33 – 4.28)

Note: C.I: Confident interval,

Front Vet Sci. 2022; 9: 918438.

Published online 2022 Sep 29. doi: [10.3389/fvets.2022.918438](https://doi.org/10.3389/fvets.2022.918438)

PMCID: PMC9556723

PMID: [36246317](https://pubmed.ncbi.nlm.nih.gov/36246317/)

Estimation of basic reproduction number (R_0) of African swine fever (ASF) in mid-size commercial pig farms in Vietnam

[Nguyen Tuan Anh Mai](#)^{1,†}, [Thi Bich Ngoc Trinh](#)^{1,†}, [Van Tam Nguyen](#)¹, [Thi Ngoc Ha Lai](#)¹, [Nam Phuong Le](#)¹, [Thi Thu Huyen Nguyen](#)^{1,2}, [Thi Lan Nguyen](#)¹, [Aruna Ambagala](#)³, [Duc Luc Do](#)^{3,4,*} and [Van Phan Le](#)^{1,*}

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animals



Article

Estimation of a Within-Herd Transmission Rate for African Swine Fever in Vietnam

[Van Phan Le](#)¹, [Nguyen Thi Lan](#)¹, [Jose Tobias Canevari](#)², [Juan Pablo Villanueva-Cabezas](#)^{3,4,*}, [Pawin Padungtod](#)⁵, [Thi Bich Ngoc Trinh](#)⁶, [Van Tam Nguyen](#)⁶, [Caitlin N. Pfeiffer](#)², [Madalene V. Oberin](#)², [Simon M. Firestone](#)² and [Mark A. Stevenson](#)²

Genetic Characterization of ASF Viruses Circulating in Vietnam during the 2019-2023 period

- **319** ASFV-positive samples were collected for the study.
- From **Feb 2019 to Dec 2023**
- In **32 provinces**
- **p72** (B646L), full-length **p54** (E1803L), **CD2v** (EP402R), the central variable region (**CVR**) of pB602L, and the intergenic region (**IGR**) between the I73R and I329L genes of ASFV were used for genetic characterization.



Genetic Characterization of ASF Viruses Circulating in Vietnam during the 2019-2023 period (continued)

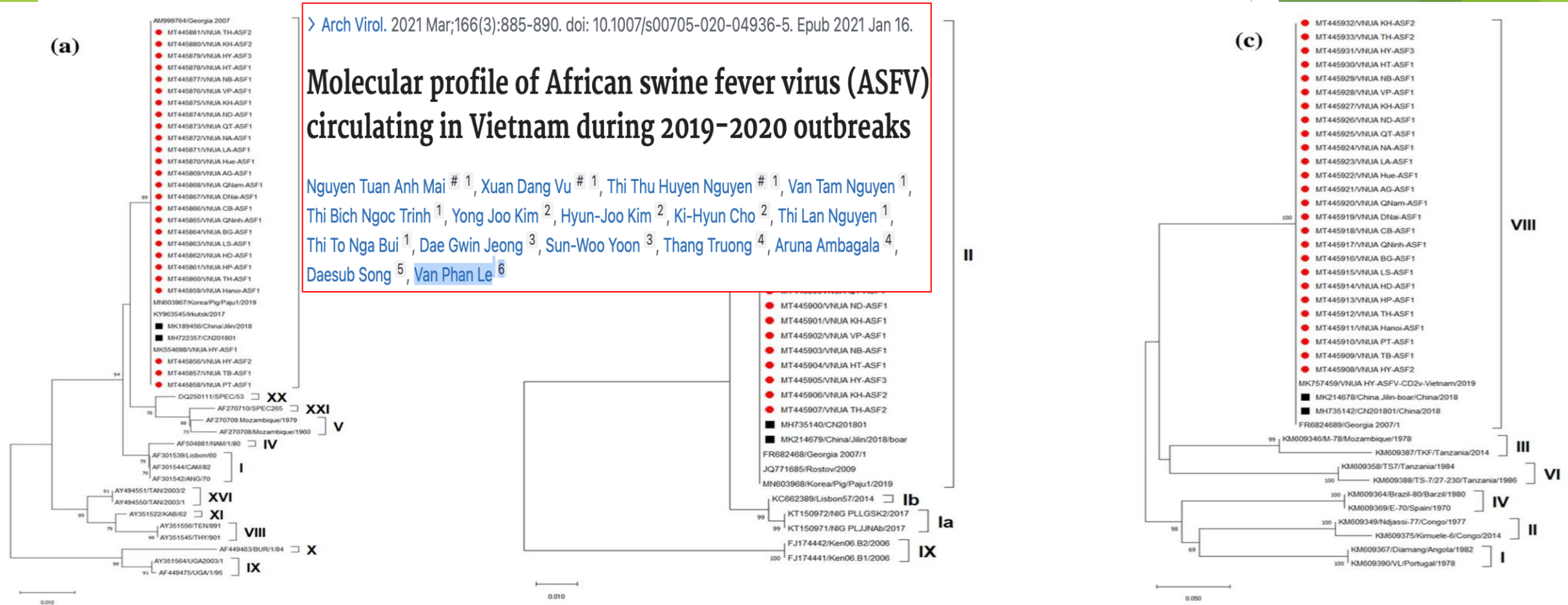


Fig. 2 P72-P54-CD2v phylogenetic trees based on nucleotide sequences. (A) P72 (neighbor-joining method); (B) P54 (neighbor-joining method); (C) CD2v (Kimura 2-parameter method). Bootstrap

analysis was performed with 1000 replicates. Only bootstrap values > 70% are shown.

Genetic Characterization of ASF Viruses Circulating in Vietnam during the 2019-2023 period (*continued*)

> Arch Virol. 2022 Apr;167(4):1137-1140. doi: 10.1007/s00705-022-05363-4. Epub 2022 Feb 21.

Multiple variants of African swine fever virus circulating in Vietnam

Van Tam Nguyen # ¹, Ki-Hyun Cho # ², Nguyen Tuan Anh Mai ¹, Jee-Yong Park ², Thi Bich Ngoc Trinh ¹, Min-Kyung Jang ², Thi Thu Huyen Nguyen ^{1 3}, Xuan Dang Vu ¹, Thi Lan Nguyen ¹, Van Diep Nguyen ¹, Aruna Ambagala ⁴, Yong-Joo Kim ⁵, Van Phan Le ⁶

Veterinary Research Communications
<https://doi.org/10.1007/s11259-022-10068-9>

BRIEF REPORT

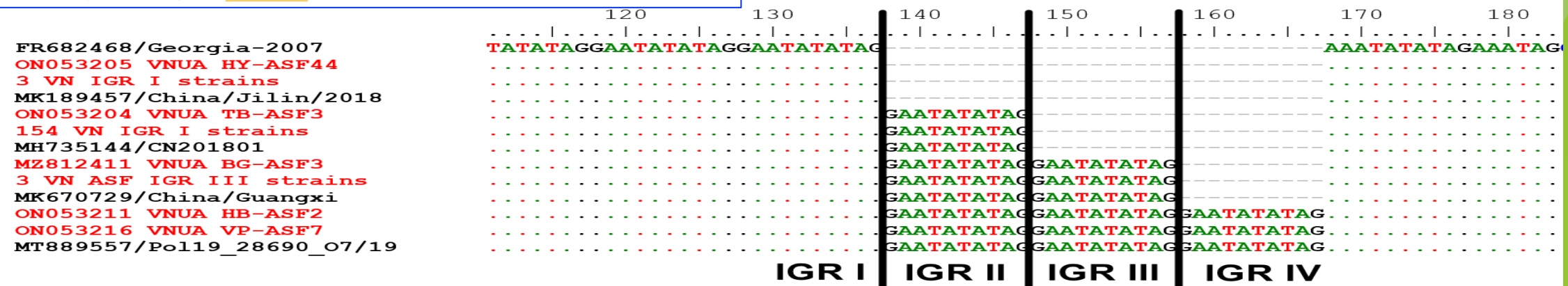


Emergence of a novel intergenic region (IGR) IV variant of african swine fever virus genotype II in domestic pigs in Vietnam

Nguyen Tuan Anh Mai¹ · Van Phai Dam¹ · Ki-Hyun Cho² · Van Tam Nguyen³ · Nguyen Van Tuyen⁴ · Thi Lan Nguyen¹ · Aruna Ambagala⁵ · Jee-Yong Park² · Van Phan Le^{1,3}

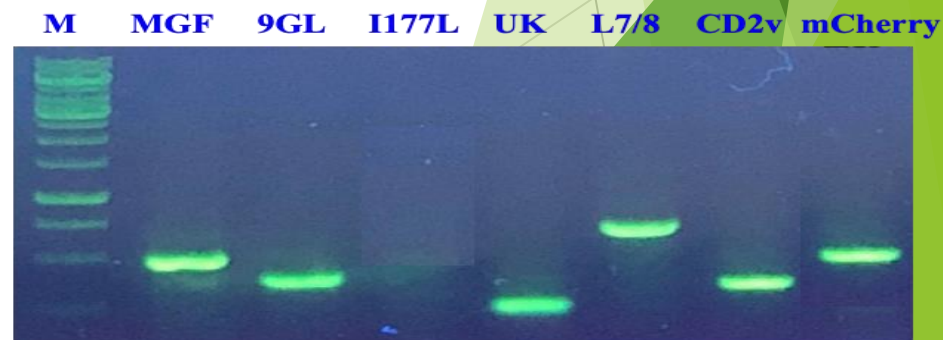
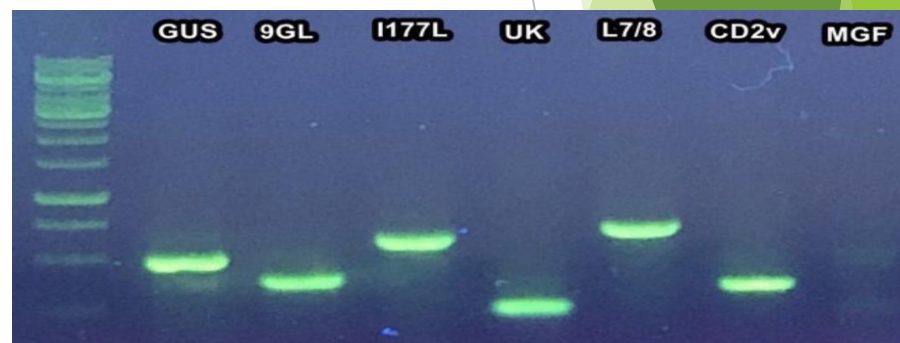
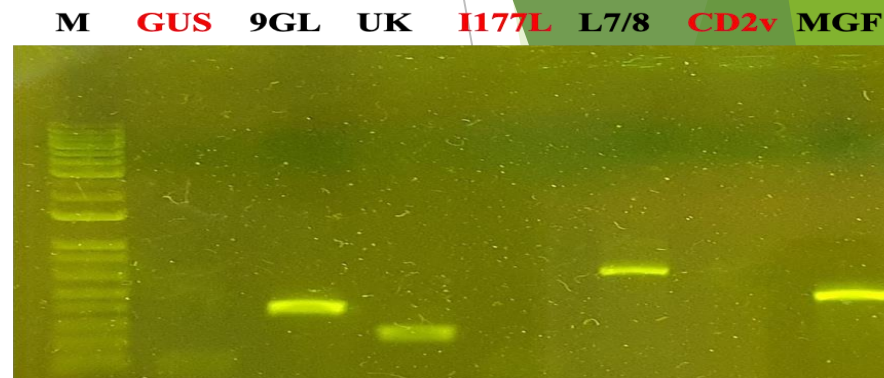
Based on the **IGR gene region** (Intergenic region) between the I73R and I329L genes

Year	IGR			
	I	II	III	IV
2019	1	75		
2020		87	3	
2021	3	28	1	2
2022	50	67	2	
Tổng	54	257	6	2
Rate (%)	16.9%	80.5%	1.9%	0.7%



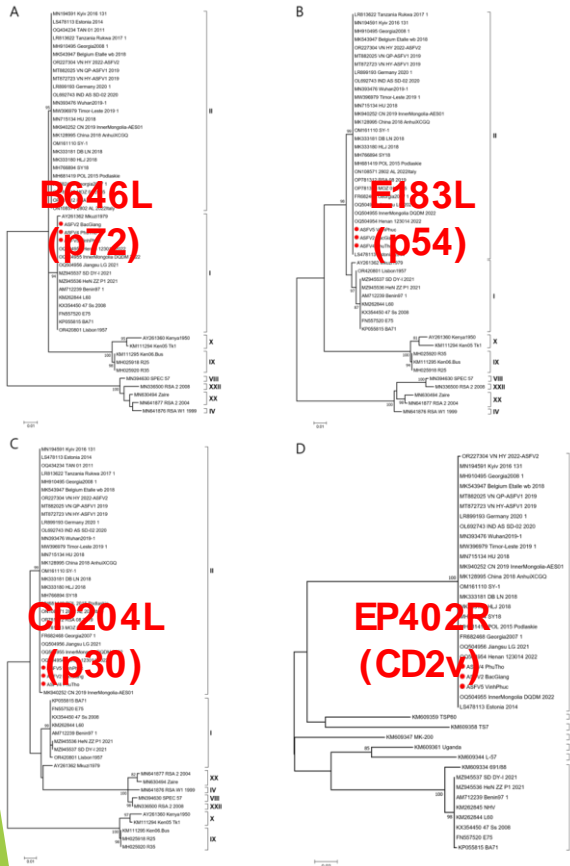
Detection of Gene-Deleting ASFV Strains- Vaccine - Like Strains

No.	Genes	Functions	Length (bp)
1	Beta-GUS	Marker	471
2	mCherry	Marker	508
3	9GL (B119L)	Genes related to the virulence of ASF virus	360
4	I177L		534
5	UK (DP96R)		291
6	L7L – L11L		834
7	CD2v (EP402R)		1,083
8	MGF Gene		8,605
9	DP71L		213
10	I73R		219
11	I267L		804



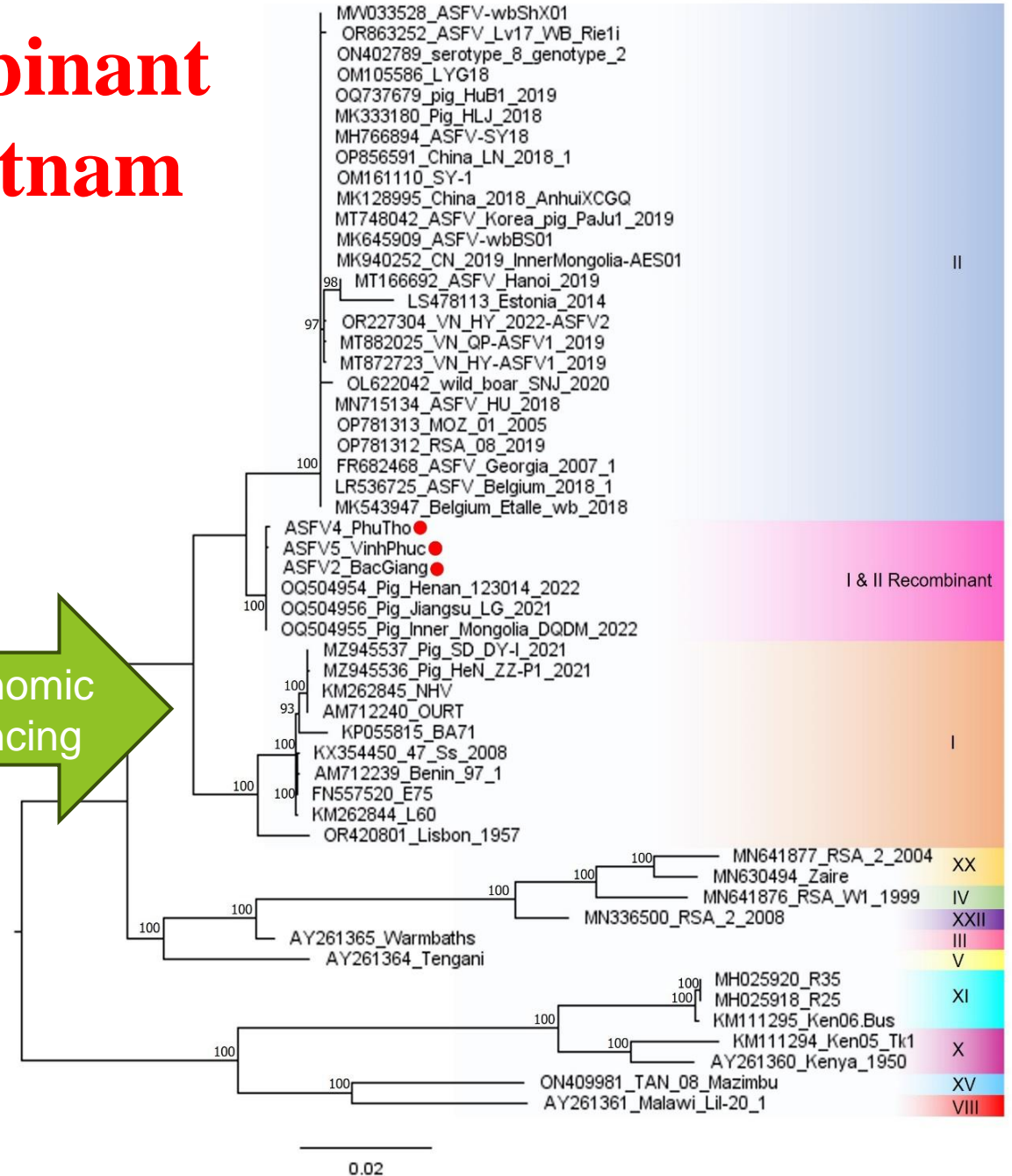
Detection of Recombinant ASFV Strains in Vietnam

Genotypic Profiling of ASFV-Positive Samples




Genotype / Serogroup	r ASFV
p72 (B646L)	I
p54 (E183L)	II
p30 (CP204L)	II
CD2v (EP402R)	VIII

Full genomic sequencing



EID Journal > Volume 30 > Early Release > Main Article

Detection of Recombinant African Swine Fever Virus Strains of p72 Genotypes I and II in Domestic Pigs, Vietnam, 2023

Van Phan Le , Van Tam Nguyen, Tran Bac Le, Nguyen Tuan Anh Mai, Viet Dung Nguyen, Thi Tam Than, Thi Ngoc Ha Lai, Ki Hyun Cho, Seong-Keun Hong, Yeon Hee Kim, Tran Anh Dao Bui, Thi Lan Nguyen, Daesub Song, and Aruna Ambagala

On This Page

[The Study](#)

> [Emerg Microbes Infect.](#) 2024 Sep 11:2404156. doi: 10.1080/22221751.2024.2404156.
Online ahead of print.

Molecular Characterization of Emerging Recombinant African Swine Fever Virus of Genotype I and II in Vietnam, 2023

Kyungmoon Lee ¹, Thi Thu Hang Vu ², Minjoo Yeom ¹, Viet Dung Nguyen ³, Thi Tam Than ³, Van Tam Nguyen ², Dae Gwin Jeong ⁴, Aruna Ambagala ⁵, Van Phan Le ³, Daesub Song ¹

What ASFV strains are circulating in Vietnam



CHINA

VIETNAM

Transboundary and Emerging Diseases **8/2018**
 OUTBREAK ALERTS
Emergence of African Swine Fever in China, 2018

Genotype II – High pathogenic strains- Caused acute diseases

Detected
>>> Caused acute disease

Emerging Microbes & Infections **3/2021**
 Volume 10, 2021 - Issue 1
 3,927 views
 0 CrossRef citations to date
 17 Altmetrics
Genotype I African swine fever viruses emerged in domestic pigs in China and caused chronic infection
 Encheng Sun, Lianyu Huang, Xianfeng Zhang, Jiwen Zhang, Dongdong Shen, Zhenjiang Zhang, ...show all
 Pages 2183-2193 | Received 04 Aug 2021; Accepted 26 Oct 2021; Accepted author version posted online 28 Oct 2021; Published online 22 Nov 2021

Genotype I – Low pathogenic strains >> Caused chronic diseases

Not yet detected

nature communications **12/2021**
 Article
<https://doi.org/10.1038/s41467-023-38868-w>
Highly lethal genotype I and II recombinant African swine fever viruses detected in pigs

Recombinant genotype I + II >>> Caused acute diseases

Detected
>>> Caused acute disease

Front Vet Sci. 2022; 9: 912224. **01/2019 – 12/2020**
 Published online 2022 Jun 15. doi: 10.3389/fvets.2022.912224
Molecular Characterization of African Swine Fever Virus From 2019-2020 Outbreaks in Guangxi Province, Southern China

> Gene deleted ASFV strains - Low pathogenic strains >> Caused chronic diseases

Detected
>>> Caused chronic disease

pathogens **7/2019**
 Article
Genetic Characterization and Variation of African Swine Fever Virus China/GD/2019 Strain in Domestic Pigs

> Detected

Imported vaccine strains

> Detected

Diagnosis of ASF in Vietnam

❖ Clinical diagnosis ???

- Clinical symptoms are very diverse, depending on the virus strains

❖ Laboratory diagnosis

- Realtime PCR:

Samples: Whole blood or Serum, lymph node, spleen...

- ✓ High pathogenic strains: Ct = 16-25
- ✓ Low pathogenic strains: Ct = 29-35
- Serology assays: Elisa is used for disease detection (**antibody detection**)

Vet Med Sci. 2021 Nov; 7(6): 2268–2272. PMID: PMC8604108
Published online 2021 Aug 13. doi: [10.1002/vms3.605](https://doi.org/10.1002/vms3.605) PMID: [34388311](https://pubmed.ncbi.nlm.nih.gov/34388311/)

Development of a novel real-time PCR assay targeting p54 gene for rapid detection of African swine fever virus (ASFV) strains circulating in Vietnam

Thi Bich Ngoc Trinh¹ | Thang Truong² | Van Tam Nguyen¹ | Xuan Dang Vu¹ | Le Anh Dao¹ | Thi Lan Nguyen¹ | Aruna Ambagala³ | Shawn Babiuk³ | Jinsik Oh⁴ | Daesub Song⁵ | **Van Phan Le¹**

Transboundary and Emerging Diseases

Direct colorimetric LAMP assay for rapid detection of African swine fever virus: A validation study during an outbreak in Vietnam

Diem Hong Tran¹ | Hau Thi Tran¹ | Uyen Phuong Le¹ | Xuan Dang Vu² | Thi Bich Ngoc Trinh² | Hoang Dang Khoa Do¹ | Van Thai Than^{3,4} | Le Minh Bui¹ | Van Van Vu¹ | Thi Lan Nguyen² | Huong Thi Thu Phung¹ | **Van Phan Le²**



microorganisms



Article

A Robust Quadruple Protein-Based Indirect ELISA for Detection of Antibodies to African Swine Fever Virus in Pigs

Min-Chul Jung^{1,2,†}, **Van Phan Le^{3,†}**, Sun-Woo Yoon^{4,†}, Thi Ngoc Le^{1,2,†}, Thi Bich Ngoc Trinh³, Hye Kwon Kim⁵, Jung-Ah Kang¹, Jong-Woo Lim⁶, Minjoo Yeom⁶, Woonsung Na⁷, Jin-Ju Nah⁸, Ji-Da Choi⁸, Hae-Eun Kang⁸, Daesub Song^{6,*} and Dae Gwin Jeong^{1,2,*}



Contents lists available at ScienceDirect

Journal of Virological Methods

journal homepage: www.elsevier.com/locate/jviromet



Establishment of a p30-based lateral flow assay for African swine fever virus detection

Thi Thu Hang Vu^{a,1}, **Van Phan Le^{b,1}**, Dae Gwin Jeong^{c,f,1}, Minjoo Yeom^c, Jinsik Oh^d, BoKyu Kang^d, Song-Kyu Park^a, Daesub Song^{c,*}





STAGES OF ASF DIAGNOSIS IN VIETNAM

qPCR + / ELISA -
<12 days

qPCR + / ELISA +
>12 days

qPCR + - / ELISA +
>24 days

Acute

Subacute

Chronic

High pathogenic ASFV strains
qPCR Ct = 16-25

Low pathogenic ASFV strains
qPCR Ct = 29-35

qPCR (DNA detection) + ELISA (Antibody detection)

ASFV distribution at different organ samples of pigs using Realtime PCR (Ct value)

Samples	Fattening pig 75	Fattening pig 79
Whole blood > 10 ⁸ HAD50/ml	19.2	15.56
Urine	31.43	25.89
Spleen	15.29	11.88
Kidney	22.86	17.11
Lung	20.28	14.56
Liver	18.86	14.48
Submandibular lymph nodes	16.91	13.61
Inguinal Lymph node	18.8	16.57
Mesenteric lymph node	19.54	15.86



Front Vet Sci. 2020; 7: 392.

Published online 2020 Jul 8. doi: [10.3389/fvets.2020.00392](https://doi.org/10.3389/fvets.2020.00392)

PMCID: PMC73

PMID: 327

Clinical and Pathological Study of the First Outbreak Cases of African Swine Fever in Vietnam, 2019

Bui Thi To Nga,¹ Bui Tran Anh Dao,¹ Lan Nguyen Thi,¹ Makoto Osaki,² Kenji Kawashima,² Daesub Song,³ Francisco J. Salguero,^{4,†} and Van Phan Le^{1,*†}

Suggestion for sampling



> [Viruses](#). 2022 Jan 4;14(1):83. doi: 10.3390/v14010083.

Superficial Inguinal Lymph Nodes for Screening Dead Pigs for African Swine Fever

Kalhari Bandara Goonewardene ¹, Chukwunonso Onyilagha ¹, Melissa Goolia ¹, [Van Phan Le](#) ², Sandra Blome ³, Aruna Ambagala ^{1 4}



Pathological Characteristics of ASFV Strains Isolated in Vietnam





Pathological characteristics of the ASFV strain that caused the first reported ASF outbreaks in Vietnam

Experiments	1	2	3	4
Number of pigs	5	5	5	10
Age (Week)	6	6	6	6
Virus strain	VNUA/HY-ASF1			
Dose (HAD50)	10²	10³	10⁴	10³
Infection route	IM	IM	IM	Oral
The study period	21	21	21	28

Pathological characteristics of the ASFV strain that caused the first reported ASF outbreaks in Vietnam (*continued*)

Experiment	Pig No.	Date of clinical symptom onset						Dead	Viremia
		Loss of appetite	Inactivity	Diarrhea	Cough	Fever	Hemorrhagic Skin		
10²HAD₅₀/pig (IM)	1	4	4	-	-	5	-	8	3
	2	4	5	-	5	4	-	8	3
	3	4	5	-	-	4	-	12	3
	4	4	4	10	5	3	-	13	3
	5	5	2	-	5	3	-	11	3
Mean		4.2±0.45	4.0±1.22		5	3.8±0.84		10.4±2.3	3

Note: (-): no clinical sign

Pathological characteristics of the ASFV strain that caused the first reported ASF outbreaks in Vietnam (*continued*)

Experiment	Pig No.	Date of clinical symptom onset						Dead	Viremia
		Loss of appetite	Inactivity	Diarrhea	Cough	Fever	Hemorrhagic Skin		
10³HAD₅₀/pig (IM)	1	5	6	-	-	3	-	7	2
	2	5	6	-	-	2	-	8	3
	3	5	5	-	-	2	-	7	3
	4	7	7	-	-	5	-	9	3
	5	5	5	-	-	2	-	6	3
Mean		5.4±0.89	5.8±0.84			2.8±1.3		7.4±1.14	2.8±0.45

Note: (-): no clinical sign

Pathological characteristics of the ASFV strain that caused the first reported ASF outbreaks in Vietnam (continued)

Experiment	Pig No.	Date of clinical symptom onset						Dead	Viremia
		Loss of appetite	Inactivity	Diarrhea	Cough	Fever	Hemorrhagic Skin		
10⁴HAD₅₀/pig (IM)	1	5	6	-	-	3	-	7	2
	2	4	4	-	-	4	-	5	3
	3	4	6	-	-	3	-	7	3
	4	5	6	-	-	5	-	9	3
	5	4	4	-	4	3	-	6	3
Mean		4.4±0.56	5.2±1.1		4	3.6±0.89		6.8±1.48	2.8±0.45

Note: (-): no clinical sign

Pathological characteristics of the ASFV strain that caused the first reported ASF outbreaks in Vietnam (*continued*)

Experiment	Pig No.	Date of clinical symptom onset						Dead	Viremia
		Loss of appetite	Inactivity	Diarrhea	Cough	Fever	Hemorrhagic Skin		
10³HAD₅₀/pig (Oral)	1	14	15	14	11	4	15	18	8
	2	14	16	--	-	5	-	21	12
	3	16	19	18	11	9	-	20	16
	4	22	23	-	-	19	-	25	16
	5	9	-	-	5	5	8	10	8
	6	18	19	-	-	15	20	22	12
	7	22	23	-	-	10	25	27	16
	8	15	-	-	7	8	16	18	8
	9	16	19	19	-	15	-	20	8
	10	14	15	-	15	11	15	17	12
Mean		16.0±3.92	18.63±3.2	17.0±2.65	9.8±3.9	10.1±4.9	16.5±5.68	19.8±4.7	11.6±3.5

Note: (-): no clinical sign



Article

Pathological Characteristics of Domestic Pigs Orally Infected with the Virus Strain Causing the First Reported African Swine Fever Outbreaks in Vietnam

Thi Thu Huyen Nguyen ^{1,2}, Van Tam Nguyen ³, Phuong Nam Le ³, Nguyen Tuan Anh Mai ³ , Van Hieu Dong ¹,
Tran Anh Dao Bui ¹, Thi Lan Nguyen ¹, Aruna Ambagala ⁴  and **Van Phan Le** ^{1,3,*} 

¹ College of Veterinary Medicine, Vietnam National University of Agriculture, Hanoi 100000, Vietnam

² Faculty of Animal Science and Veterinary Medicine, Bac Giang Agriculture and Forestry University, Bac Giang 230000, Vietnam

³ Institute of Veterinary Science and Technology (IVST), Hanoi 100000, Vietnam

⁴ National Centre for Foreign Animal Disease, Canadian Food Inspection Agency, Winnipeg, MB R3E 3M4, Canada

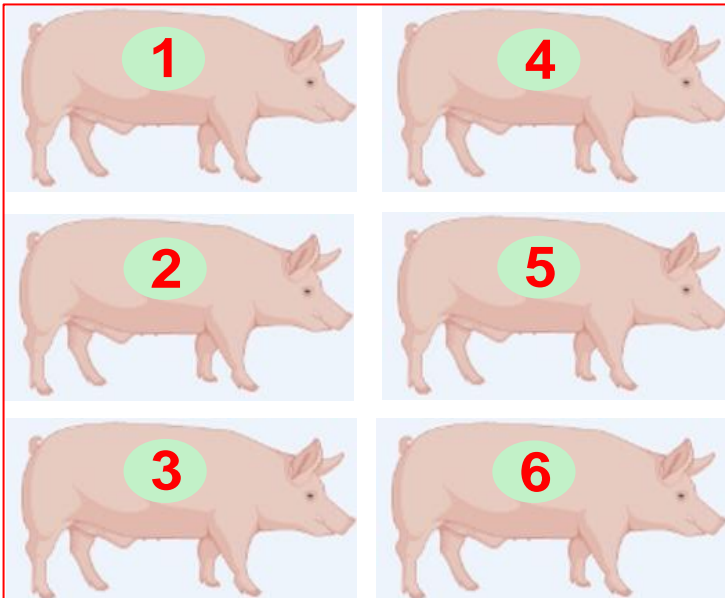
* Correspondence: vanphanle@ivst.vn

Pathological characteristics of a gene-deleting ASFV strain isolated in Vietnam

- **Experimental designs: Using 6-week-old pigs**

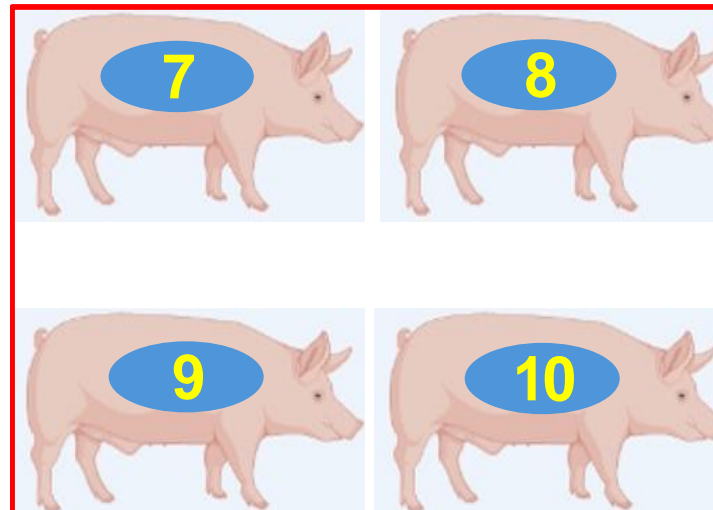
Experiment 1

Pigs were inoculated **ORO-NASALLY** with 2×10^5 TCID₅₀/pig

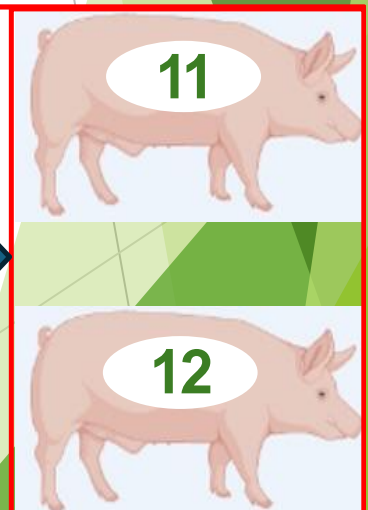


Experiment 2

Pigs were inoculated **INTRAMUSCULARLY** with 2×10^3 TCID₅₀/pig

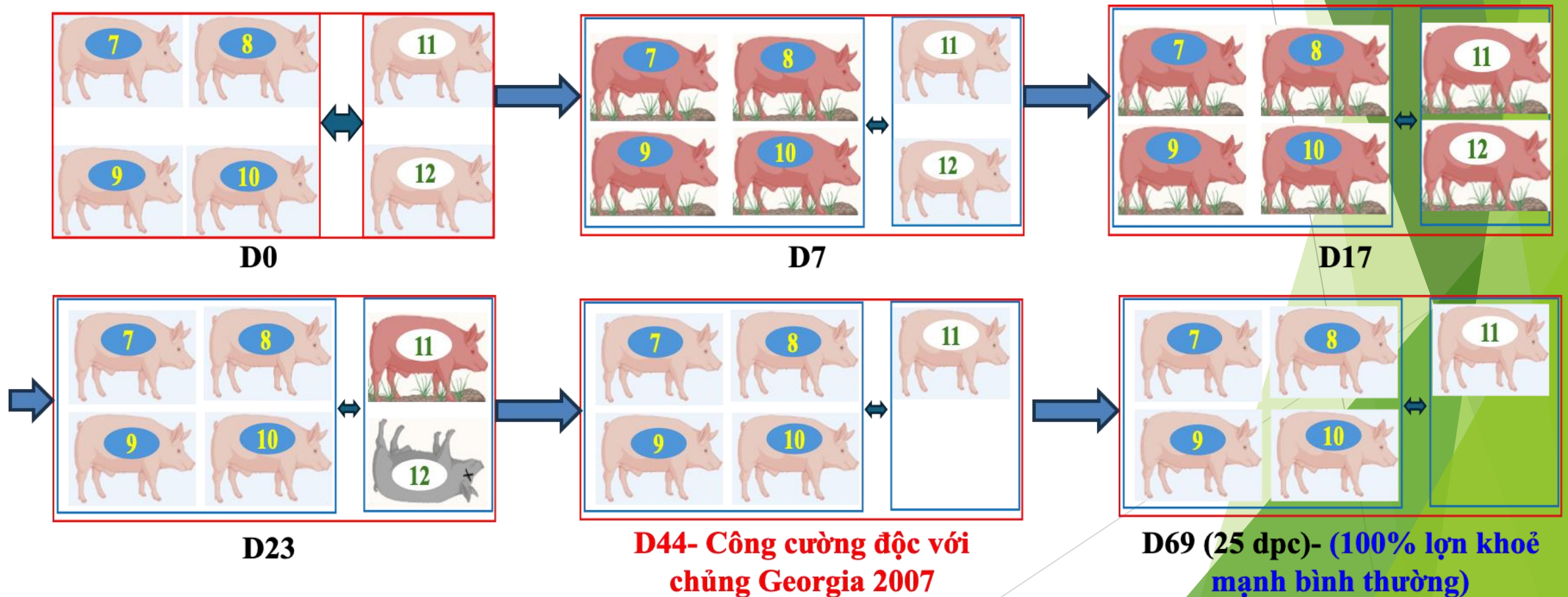


Uninoculated pigs



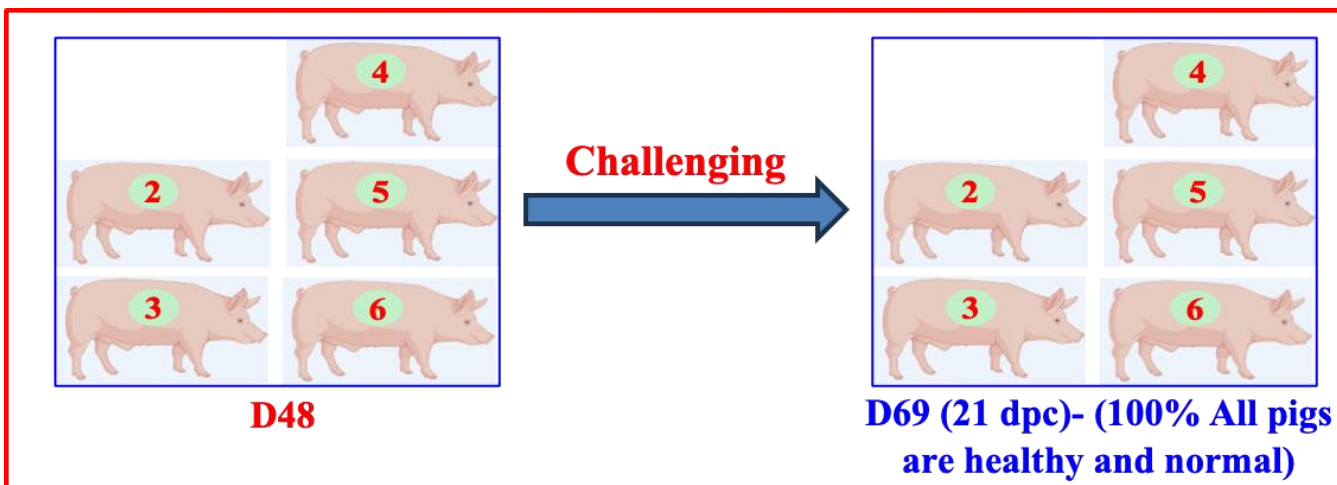
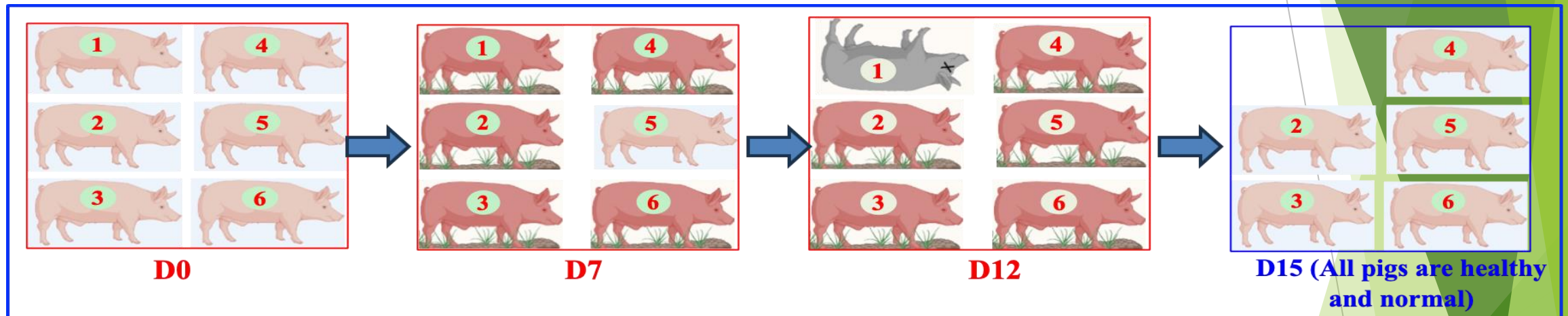
Pathological characteristics of a gene-deleting ASFV strain isolated in Vietnam (*continued*)

➤ Pigs were inoculated INTRAMUSCULARLY with 2×10^3 TCID₅₀/pig



Pathological characteristics of a gene-deleting ASFV strain isolated in Vietnam (*continued*)

➤ Pigs were inoculated ORO-NASALLY with 2×10^5 TCID₅₀/pig

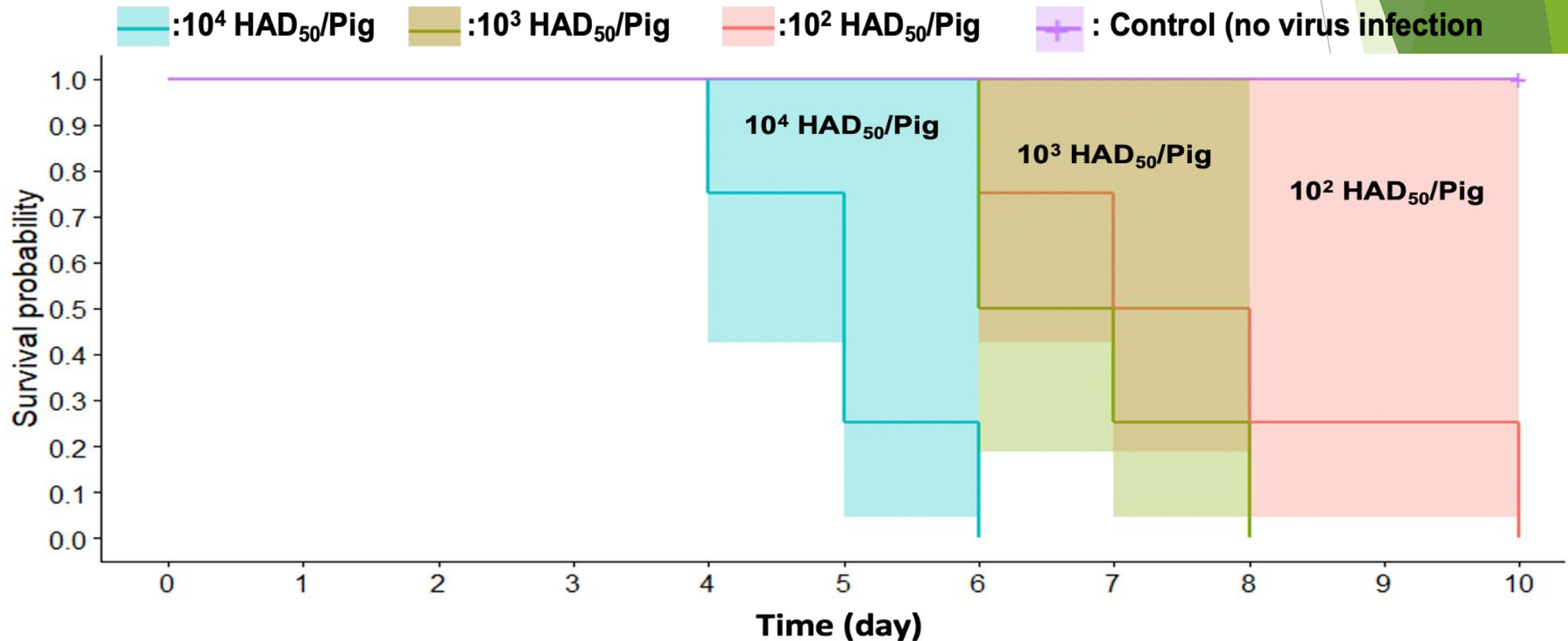


Article

Characterization of an African Swine Fever Virus Field Isolate from Vietnam with Deletions in the Left Variable Multigene Family Region

Aruna Ambagala ^{1,2,3,*}, Kalhari Goonewardene ¹, Ian El Kanoa ¹, Thi Tam Than ⁴, Van Tam Nguyen ⁵, Thi Ngoc Ha Lai ⁴, Thi Lan Nguyen ⁴, Cassidy N. G. Erdelyan ¹, Erin Robert ^{1,2}, Nikesh Tailor ¹, Chukwunonso Onyilagha ¹, Lindsey Lamboo ¹, Katherine Handel ¹, Michelle Nebroski ¹, Oksana Vernygora ¹, Oliver Lung ¹ and Van Phan Le ^{4,*}

Pathological characteristics of a recombinant ASFV strain of p72 genotypes I and II isolated from domestic pigs in Vietnam





Article

Genotype II Live-Attenuated ASFV Vaccine Strains Unable to Completely Protect Pigs against the Emerging Recombinant ASFV Genotype I/II Strain in Vietnam

Nguyen Van Diep ¹, Nguyen Van Duc ¹, Nguyen Thi Ngoc ¹, Vu Xuan Dang ¹, Tran Ngoc Tiep ¹, Viet Dung Nguyen ², Thi Tam Than ³, Dustin Maydaniuk ⁴, Kalhari Goonewardene ⁴, Aruna Ambagala ^{4,*} and Van Phan Le ^{3,5,*}

¹ AVAC Vietnam Joint Stock Company, Ngoc Lich Village, Trung Trac Commune, Van Lam District, Hung Yen 160000, Vietnam; diep.ngv@gmail.com (N.V.D.); ducnv@avac.com.vn (N.V.D.); ngocnt@avac.com.vn (N.T.N.); vxdang.vet@gmail.com (V.X.D.); tieptn@avac.com.vn (T.N.T.)

² Faculty of Animal Science and Veterinary Medicine, Bac Giang Agriculture and Forestry University, Bac Giang 230000, Vietnam; nguyendungdhnl@gmail.com

³ College of Veterinary Medicine, Vietnam National University of Agriculture, Hanoi 100000, Vietnam; thantam207@gmail.com

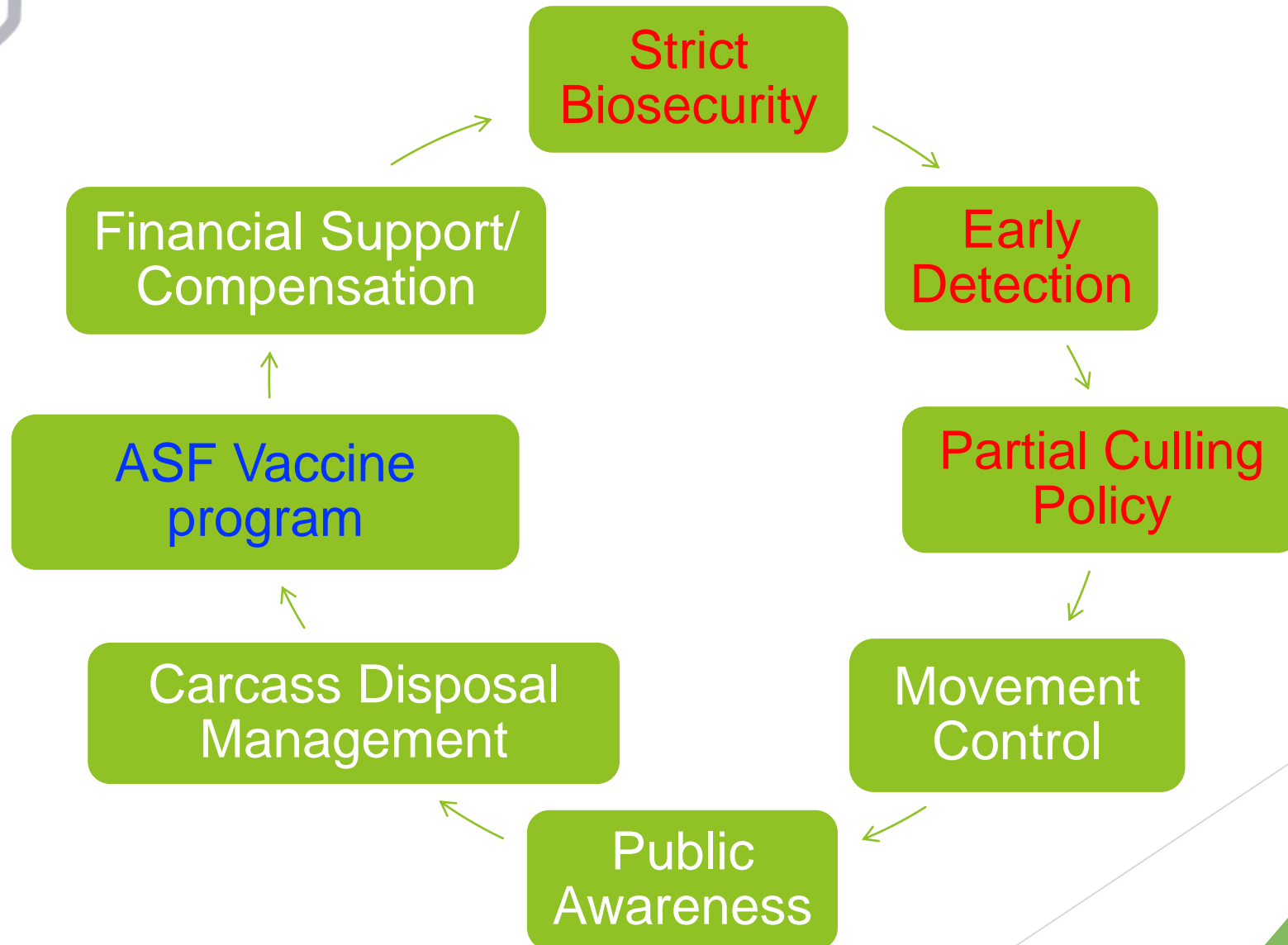
⁴ Canadian Food Inspection Agency, National Centre for Foreign Animal Disease, Winnipeg, MB R3E 3R2,

Potential risk factors for ASF in Vietnam

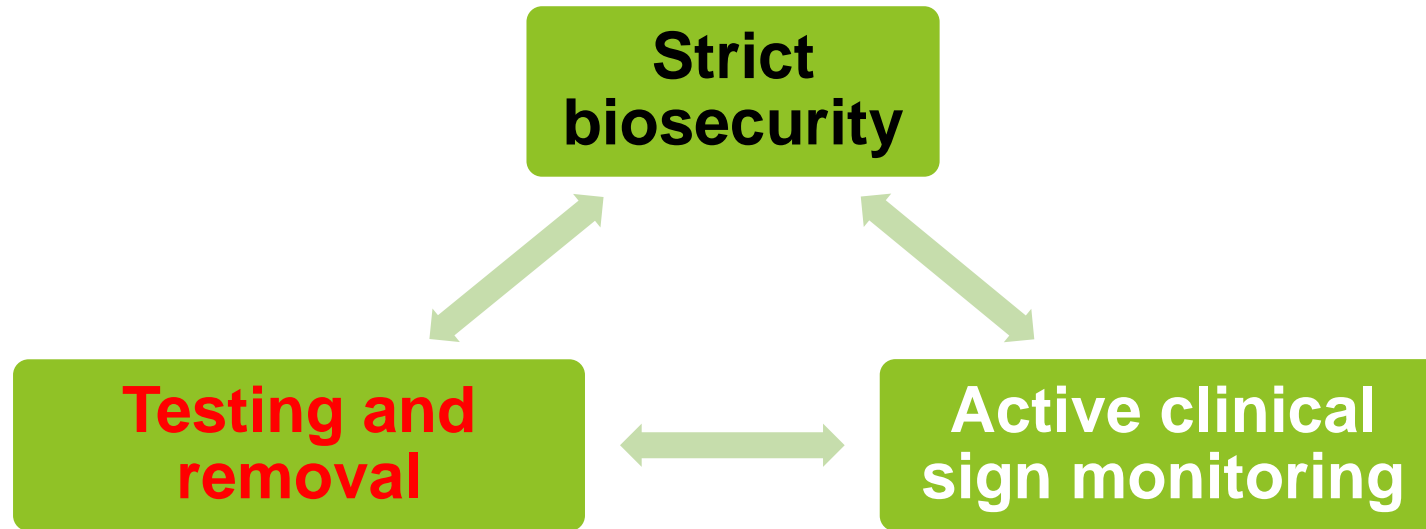
- The proportion of households raising pigs on family farms remains high, making disease control difficult.
- Illegal movement/trade of animals and animal products across long national borders and within the country.
- Most farms are old (approximately 10 years) and maintain a low level of biosecurity.
- The illegal and urgent sale of pigs during outbreaks, especially around the Tet holiday season, poses a significant challenge.



Prevention and control measures of ASF at **GOVERNMENT LEVEL** in Vietnam



Prevention and control measures of ASF at **FARM LEVEL** in Vietnam



- External biosecurity is a key factor in protecting pig farms from ASF infection.
- Early detection and internal biosecurity are the most critical elements in preventing the spread of ASF on farms and ensuring success in testing and removal

What lessons were learned from ASF outbreaks

Suggestion for outbreak investigation



- **Multiple ASFV strains** are circulating in Vietnam, and clinical symptoms are very diverse, depending on the virus strains causing the disease.
 - ✓ **ASFV GENOTYPE II strain:** Highly virulent, causes acute diseases with a mortality rate of up to 100 %.
 - ✓ **Recombinant ASFV GENOTYPE I and II strains:** High virulent, causes acute diseases with a mortality rate of up to 100 %.
 - ✓ **Gene-deleting ASFV strains:** Low virulent, causes chronic diseases.
- Clinical signs were first observed in sows and then in fattening pigs and piglets
- Clinical disease (**fever**) = Viremia, No clinical disease (**no fever**) = No viremia
- The current 2 licensed ASF vaccines do not provide protection against rASFV strains.
- **Early detection and removal**, along with **strict biosecurity measures**, are key to preventing the spread of ASF.

Acknowledgments



Agence canadienne d'inspection des aliments

<https://inspection.canada.ca/ncfad-winnipeg> > eng

National Centre for Foreign Animal Disease (NCFAD) Winnipeg



농림축산검역본부

<https://www.qia.go.kr/indexqiaEngNoticeWebAction>

Animal and Plant Quarantine Agency



서울대학교

<https://www.snu.ac.kr>

Seoul National University



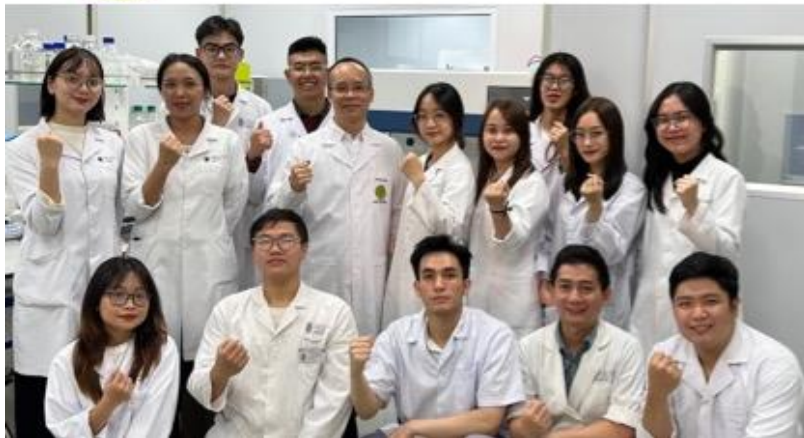
Swine Health Information Center

<https://www.swinehealth.org>

Swine Health Information Center



HỌC VIỆN NÔNG NGHIỆP VIỆT NAM
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What are the opportunities for our collaboration?



Thanks for your attention

