World Organisation for Animal Health

To Be Decided - - KOREA_(REP_OF)

WOAH Reference Laboratory Reports Activities 2025

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LABORATORY INFORMATION

***Name of disease (or topic) for which you are a designated WOAH Reference Laboratory:**	Foot and mouth disease
***Address of laboratory:**	Animal and Plant Quarantine Agency, Republic of Korea(South Korea)
***Tel:**	+82549120774
***E-mail address:**	beliefsk@korea.kr
Website:	
***Name (including Title) of Head of Laboratory (Responsible Official):**	Jung-Rok Choi, Commissioner of APQA
***Name (including Title and Position) of WOAH Reference Expert:**	Su-Mi Kim, DVM, PhD
***Which of the following defines your laboratory? Check all that apply:**	Governmental

TOR1: DIAGNOSTIC METHODS

1. Did your laboratory perform diagnostic tests for the specified disease/topic for purposes such as disease diagnosis, screening of animals for export, surveillance, etc.? (Not for quality control, proficiency testing or staff training)

Yes

Diagnostic Test	Indicated in WOAH Manual (Yes/No)	Total number of test performed last year	
Indirect diagnostic tests		Nationally	Internationally
ELISA (SP Antibody)	Yes	633019	0
ELISA (NSP Antibody)	Yes	498798	51
Direct diagnostic tests		Nationally	Internationally
Virus isolation	Yes	1	36
Realtime RT-PCR	Yes	6477	101
VP1 gene sequencing	Yes	85	62

TOR2: REFERENCE MATERIAL

2. Did your laboratory produce or supply imported standard reference reagents officially recognised by WOAH?

No

3. Did your laboratory supply standard reference reagents (nonWOAH-approved) and/or other diagnostic reagents to WOAH Members?

Yes

Type of reagent available	Related diagnostic test	Produced/ provide	Amount supplied nationally (ml, mg)	Amount supplied internationally (ml, mg)	No. of recipient WOAH Member Countries	Country of recipients
VDRD FMDV 3Diff/PAN Rapid kit	FMDV Rapid test	Median Diagnositcs/APQA	1240 tests	120 tests	3	KOREA (REP. OF), LAOS, SRI LANKA,

FMDV PAN-3Type Dx/DDx direct qRT-PCR	Direct rRT-PCR	OPTOLANE/APQA	0	256 tests	2	BANGLADESH, MONGOLIA,
PowerChek FMDV Multiplex Real-Time PCR Kit(3D IRES)	rRT-PCR	Kogenebiotech/APQA	31624 tests	600 tests	1	KOREA (REP. OF), LAOS,
Bionote FMD NSP Ab ELISA	NSP ELISA	Bionote/APQA	792 kits	0	1	KOREA (REP. OF),
VDpro® FMDV NSP AB ELISA	NSP ELISA	Median/APQA	329 kits	0	1	KOREA (REP. OF),
PrioCHECHKTM FMDV NS Ab Strip kit	NSP ELISA	ThermoFisher/APQA	66 kits	0	1	KOREA (REP. OF),
VDpro® FMDV Type O Ab b-ELISA	Type O ELISA	Median/APQA	332 kits	0	1	KOREA (REP. OF),
Bionote FMD Type O Ab ELISA	Type O ELISA	Bionote/APQA	724 kits	0	1	KOREA (REP. OF),
PrioCHECK FMDVTM Type O Ab Strip Kit	Type O ELISA	ThermoFisher/APQA	48 kits	0	1	KOREA (REP. OF),

4. Did your laboratory produce vaccines?

No

5. Did your laboratory supply vaccines to WOAH Members?

TOR3: NEW PROCEDURES

6. Did your laboratory develop new diagnostic methods for the designated pathogen or disease?

Yes

7. Did your laboratory validate diagnostic methods according to WOAH Standards for the designated pathogen or disease?

Yes

Name of the new test or diagnostic method developed	Description and References (Publication, website, etc.)
FMDV PAN-3Type Dx/DDx direct qRT-PCR	On-site Molecular Test for Foot-and-Mouth Disease Detection, Serotyping, and Foot-and-Mouth Disease-like Vesicular Diseases Test for Foot-and-Mouth Disease Detection, Serotyping, and other Vesicular Diseases (SVV, SVD) *Publication: https://doi.org/10.1016/j.bios.2025.117345

8. Did your laboratory develop new vaccines for the designated pathogen or disease?

9. Did your laboratory validate vaccines according to WOAH Standards for the designated pathogen or disease?

TOR4: DIAGNOSTIC TESTING FACILITIES

10. Did your laboratory carry out diagnostic testing for other WOAH Members?

Yes

Name of WOAH Member Country seeking assistance	Date	Which diagnostic test used	No. samples received for provision of diagnostic support	No. samples received for provision of confirmatory diagnoses
CAMBODIA	2025-01-02	Virus isolation, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis	0	8
MONGOLIA	2025-08-19	Virus isolation, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis	0	25
LAOS	2025-02-10	Virus isolation, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis	0	8
LAOS	2025-07-05	Virus isolation, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis	0	19

BANGLADESH	2025-12-05	Virus isolation, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis	0	45

11. Did your laboratory provide expert advice in technical consultancies on the request of an WOAH Member?

No

TOR5: COLLABORATIVE SCIENTIFIC AND TECHNICAL STUDIES

12. Did your laboratory participate in international scientific studies in collaboration with WOAH Members other than the own?

Yes

Title of the study	Duration	Purpose of the study	Partners (Institutions)	WOAH Member Countries involved other than your country
Collection and genetic characterization of FMDV and AI circulating in SEA	2023-2027	Studies on genetic characterization of foot and mouth disease viruses and avian influenza virus in Cambodia	NAHPRI (National Animal Health and Production Research Institute)	CAMBODIA
Collection and genetic characterization of FMDV and AI circulating in SEA	2023-2027	Studies on genetic characterization of foot and mouth disease viruses and avian influenza virus in Cambodia	NAHL (National Animal Health Laboratory)	LAOS
Resource celloection and genetic characterization of FMD in Pool2	2025~2029	Studies on genetic characterization of foot and mouth disease viruses in Bangladesh	CDIL(Central Disease Investigation Laboratory)	BANGLADESH
Collection and genetic characterization of FMDV circulating in Mongolia	2024~2028	Studies on genetic characterization of foot and mouth disease viruses in Mongolia	SCVL(State Central Veterinary Laboratory)	MONGOLIA

13. In exercising your activities, have you identified any regulatory research needs* relevant for WOAH?

No

TOR6: EPIZOOLOGICAL DATA

14. Did your Laboratory collect epidemiological data relevant to international disease control?

Yes

If the answer is yes, please provide details of the data collected:
Epizootiological data(sampling time, location and species) relating to the samples received for scientific research (see ToR5) was collected

15. Did your laboratory disseminate epidemiological data that had been processed and analysed?

No

16. What method of dissemination of information is most often used by your laboratory? (Indicate in the appropriate box the number by category and list the details in the box)

a) Articles published in peer-reviewed journals:

3

1. Development of a complementary metal-oxide-semiconductor-based biosensor system enabling in situ real-time PCR on chip for onsite detection, serotyping, and differentiation of FMD. Ryoo S, Seo SM, Kang H, Lim DR, Hong HJ, Lee MH, Lee Y, Eom TY, Cho E, Kim JM, Cho IH, Kim JW, Lee DY, Cha SH. Biosensor and Bioelectronics 282 (2025) 117345. doi:10.1016/j.bios.2025.117345

2. Molecular characterisation of FMDV collected from Bangladesh during 2021-2023: evidence for trans-pool spread of exotic viral lineages. Kang H, Ryoo S, Lim DR, Eom TY, Kim JM, Kim J, Badhy SC, Sadekuzzaman M, Akter S, Di Nardo A, King DP, Chowdgury MGA, Cha SH Veterinary Research (2026) 57:1. doi: 10.1186/s13567-025-01655-0

3. Immunostimulatory effects of multiple short-hairpin RNAs enhance foot-and-mouth disease vaccine-induced humoral immunity. Kim A, Hwang JH, Lee G, Park JH, Lee MJ, Kim SM. Antiviral Research 240 (2025) 106202. doi: 10.1016/j.antiviral.2025.106202

b) International conferences:

5
1. Validation of a Portable Direct rRT-PCR CMOS Biosensor for Rapid On-Site Detection and Serotyping of Foot-and-Mouth Disease Virus in Clinical Samples, Ryoo S et al., GFRA 2025
2. Phylogenetic Analysis of O/ME-SA/Ind-2001e lineage Foot-and-Mouth Disease Virus in the 2025 Outbreak in Republic of Korea, Ryoo S et al., GFRA 2025
3. First case of Foot-and-Mouth Disease virus (FMDV) in an Elephant from Cambodia, Ryoo S et al., GFRA 2025
4. Foot-and-Mouth Disease Vaccination and Post-Vaccination Monitoring in Korea, Noh J et al., GFRA 2025
5. Operation of a Foot-and-Mouth Disease Serum Bank and Analysis of Stored Sera to Standardize Serological Diagnosis of Foot-and-Mouth Disease in South Korea, Seo HJ et al., GFRA 2025

c) National conferences:

19
1. Phylogenetic analysis of Foot-and-mouth disease virus outbreaks recently in Bangladesh, 2024. Jeon JH et al., The Korean Society of Veterinary Science 2025
2. Evaluation of Foot-and-Mouth Disease Virus SP-O Antibody Levels in Cattle Breeding Farms in South Korea, 2023–2024, Kim TE et al., The Korean Society of Veterinary Science 2025
3. Characterization of Foot-and-Mouth Disease Virus from the Korean Outbreak in 2025, Kang H et al., The Korean Society of Veterinary Science 2025
4. Genetic characterization of foot-and-mouth disease virus isolated in Laos in 2024, Lee H et al., The Korean Society of Veterinary Science 2025
5. Genetic Characterization of Foot-and-Mouth Disease Virus from Mongolia in 2025, Park S et al., The Korean Society of Veterinary Science 2025
6. Cytokine Profile Induced by Infection with Foot-and-Mouth Disease Virus in SPF pigs, Jo E et al., The Korean Society of Veterinary Science 2025
7. Application of Nanopore sequencing for Foot-and-Mouth Disease Outbreaks in Korea, 2025, Jeon JH et al., The Korean Society of Veterinary Science 2025
8. The Detection of Foot-and-Mouth Disease Specific Antibody in Wildlife in Republic of Korea, Jung MK et al., The Korean Society of Veterinary Science 2025
9. First case of Foot-and-Mouth Disease virus (FMDV) in an Elephant from Cambodia, Hwang HW et al., The Korean Society of Veterinary Science 2025

10. Nationwide FMD serosurveillance of pigs in Korea, 2024, Noh J et al., The Korea Society of Preventive Veterinary Medicin, 2025
11. National Serosurveillance of Vaccine-Induced Immunity Against Foot-and-Mouth Disease in Cattle in Korea, 2024. Kim K et al., The Korea Society of Preventive Veterinary Medicine

12. Evaluation of the effectiveness of the FMD vaccination program through post-vaccination monitoring in South Korea. Kim I et al., The Korea Society of Preventive Veterinary Medicine 2025

13. Evaluation of Serological Responses Against O/SKR/BE/2017 of Commercial Foot-and-Mouth Disease Vaccines in Pigs. Lee GM et al., The Korea Society of Preventive Veterinary Medicine 2025

14. Operation of a Serum Bank and Analysis of Stored Sera for the Standardization of Serological Diagnosis of Foot-and-Mouth Disease. Kang E et al., The Korea Society of Preventive Veterinary Medicine 2025

15. Surveillance of Foot-and-Mouth Disease Virus in Wild Animals Collected in South Korea from 2022 to 2024. Kim TE et al., The Korea Society of Preventive Veterinary Medicine 2025

16. Serosurveillance of food-and-mouth disease on cattle breeding farms in South Korea, 2023-2024. Moon KH et al., The Korea Society of Preventive Veterinary Medicine 2025
17. Comparative evaluation of ELISA developed for the detection of antibodies against structural protein of serotype Asia 1 foot-and-mouth disease virus, Lee GM et al., The Korea Society of Preventive Veterinary Medicine
18. Sero-surveillance of food and mouth disease antibodies in wild animals collected in Republic of Korea in 2023, Kim TE et al., The Korea Society of Preventive Veterinary Medicine
19. Emergency vaccinations monitoring for evaluation of food-and-mouth disease herd Immunity level in Republic of Korea in 2023, Moon KH et al., The Korea Society of Preventive Veterinary Medicine

d) Other (Provide website address or link to appropriate information):

1
Monthly National sero-surveillance results for overall population immunity and prevalence of infection surveillance (in Korean, www.qia.go.kr)

TOR7: SCIENTIFIC AND TECHNICAL TRAINING

17. Did your laboratory provide scientific and technical training to laboratory personnel from other WOAH Members?

Yes

a) Technical visit : 0

b) Seminars : 12

c) Hands-on training courses: 12

d) Internships (>1 month) 0

Type of technical training provided (a, b, c or d)	Country of origin of the expert(s) provided with training	No. participants from the corresponding country
B	LAOS	2
C	LAOS	2
B	BANGLADESH	1
C	BANGLADESH	1
B	MALAYSIA	1
C	MALAYSIA	1
B	MYANMAR	2
C	MYANMAR	2
B	SINGAPORE	2
C	SINGAPORE	2
B	SRI LANKA	2
C	SRI LANKA	2

TOR8: QUALITY ASSURANCE

18. Does your laboratory have a Quality Management System?

Yes

Quality management system adopted	Certificate scan (PDF, JPG, PNG format)	
KS Q ISO/IEC 17025	KT372_Animal_and_Plant_Quarantine_Agency_PM_Eng)_20241121.pdf	KT372_Animal_and_Plant_Quarantine_Agency_PM_Eng_20241121.pdf

19. Is your quality management system accredited?

Yes

Test for which your laboratory is accredited	Accreditation body
Antigen detection(Realtime RT-PCR, RT-PCR, Antigen ELISA)	KOLAS(Korean Laboratory Accrediation)
Antibody detection(SP ELISA , NSP ELISA)	KOLAS(Korean Laboratory Accrediation)

20. Does your laboratory maintain a “biorisk management system” for the pathogen and the disease concerned?

Yes

All work with FMDV is undertaken in high-containment facilities licensed by the KDCA

TOR9: SCIENTIFIC MEETINGS

21. Did your laboratory organise scientific meetings related to the pathogen in question on behalf of WOAH?

No

22. Did your laboratory participate in scientific meetings related to the pathogen in question on behalf of WOAH?

Yes

Title of event	Date	location	Role (speaker, presenting poster, short communications)	Title of the work presented
WOAH/FAO Reference Laboratory Network Annual Meeting	2025-10-22	Istanbul, Turkey	Speaker	FMD-related activities in 2025 of Animal and Plant Quarantine Agency

TOR10: NETWORK WITH WOAH REFERENCE LABORATORIES

23. Did your laboratory exchange information with other WOAH Reference Laboratories designated for the same pathogen or disease?

Yes

24. Are you a member of a network of WOAH Reference Laboratories designated for the same pathogen?

Yes

NETWORK/DISEASE	ROLE OF YOUR LABORATORY (PARTICIPANT, ORGANISER, ETC)	NO. PARTICIPANTS	PARTICIPATING WOAH REF. LABS
Foot-and-mouth disease	Participant	22	NCFAD, Canada, APHIS, USA , PANAFTOSA , Brazil, SENASA , Argentina, OVI, South Africa, BVI, Botswana, APQA , South Korea, LVRI, China, ARRIAH, Russia, ANSES, France, Sciensano, Belgium, IZSLER, Italy, Pirbright, UK

25. Did you organise or participate in inter-laboratory proficiency tests with WOAH Reference Laboratories designated for the same pathogen during the past 2 years?

Yes

Purpose of the proficiency test:	Role of your Reference Laboratory (organiser/ participant)	No. participating Laboratories	Participating WOAH Ref. Labs/ organising WOAH Ref Lab
FMD Diagnosis	Participant	-	The Pirbright Institute, UK

26. Did your laboratory collaborate with other WOAH Reference Laboratories for the same disease on scientific research projects for the diagnosis or control of the pathogen of interest?

Yes

Title of the project or contract	Scope	Name(s) of relevant WOAH Reference Laboratories
Study to develop advanced tools for genetic analysis and assess transmission risks for FMD	Development of advanced molecular diagnostics, improvement of sequence analysis systems, and evaluation of transmission risk in preparation for FMD introduction	The Pirbright Institute, UK

TOR11: OTHER INTERLABORATORY PROFICIENCY TESTING

27. Did your laboratory organise or participate in inter-laboratory proficiency tests with laboratories other than WOAH Reference Laboratories for the same pathogen during the past 2 years?

Yes

Purpose for inter-laboratory test comparisons1	Role of your reference laboratory (organizer/participant)	No. participating laboratories	Name of the test	WOAH Member Countries
National Proficiency test for Diagnosis of FMD	Organizer	46	Proficiency test for Diagnosis of FMD	KOREA (REP. OF),

TOR12: EXPERT CONSULTANTS

28. Did your laboratory place expert consultants at the disposal of WOAH?

No

29. Additional comments regarding your report:

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No