

World Organisation for Animal Health

Australian Aid

SEACFMD

# SEACFMD Laboratory Network Meeting

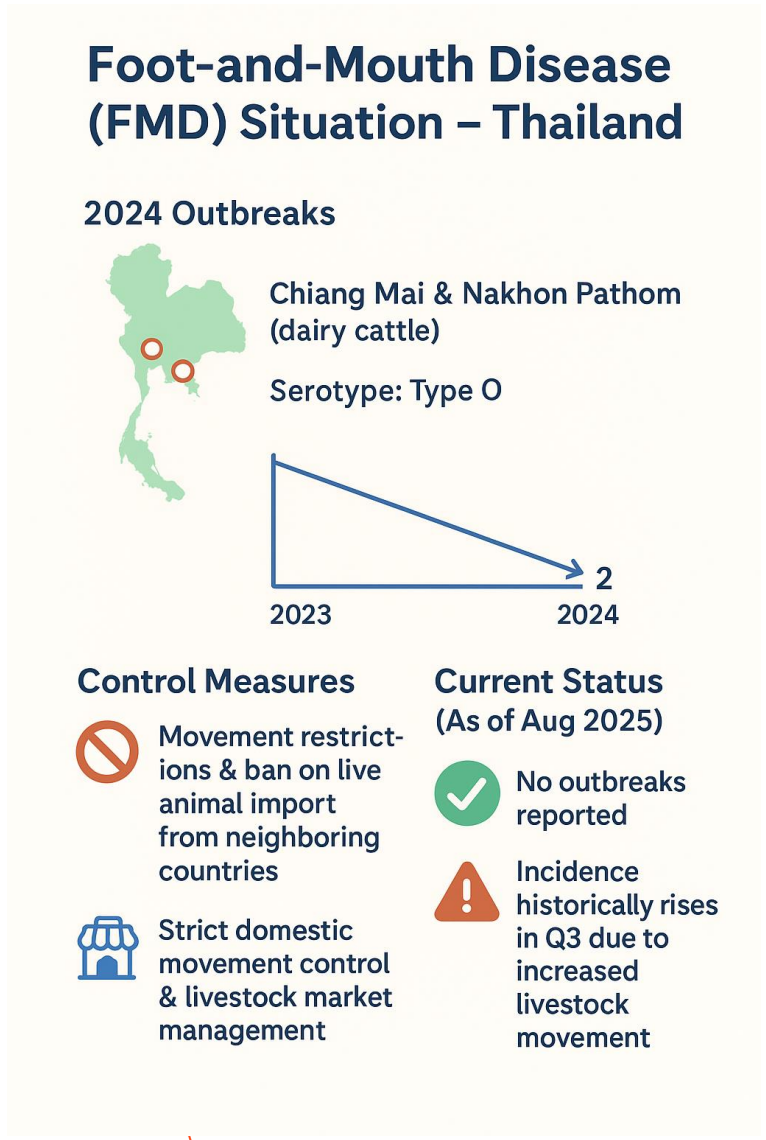
# 2026 Country Report
# THAILAND

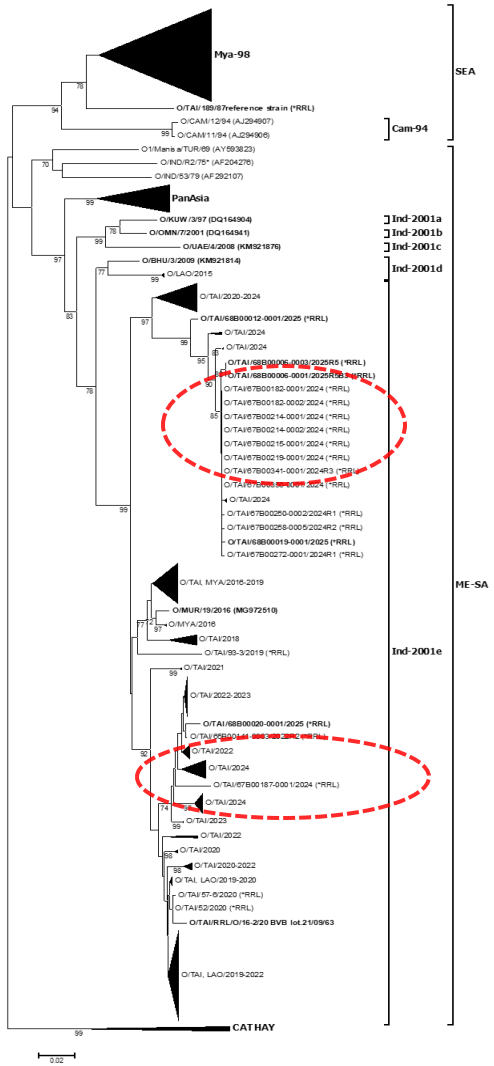
*Dr. Kingkarn Boonsuya Seeyo*
*Director of RRLFMD-Pakchong*

*10-11 November 2026*
*Manila, The Philippines*

# FMD situation in 2024 and 2025

- In 2024, outbreaks of FMD were reported in dairy cattle in Chiang Mai and Nakornpathom province.
- All the cases were serotyping as O.
- **Control and Preventive Measures**:
  - Implement movement restrictions in affected areas to prevent further disease spread.
  - Restrict the importation of live animals from neighboring countries based on disease risk.
  - Strengthen farm biosecurity and livestock management practices.
  - Enforce stringent domestic animal movement controls and improve livestock market surveillance and management.

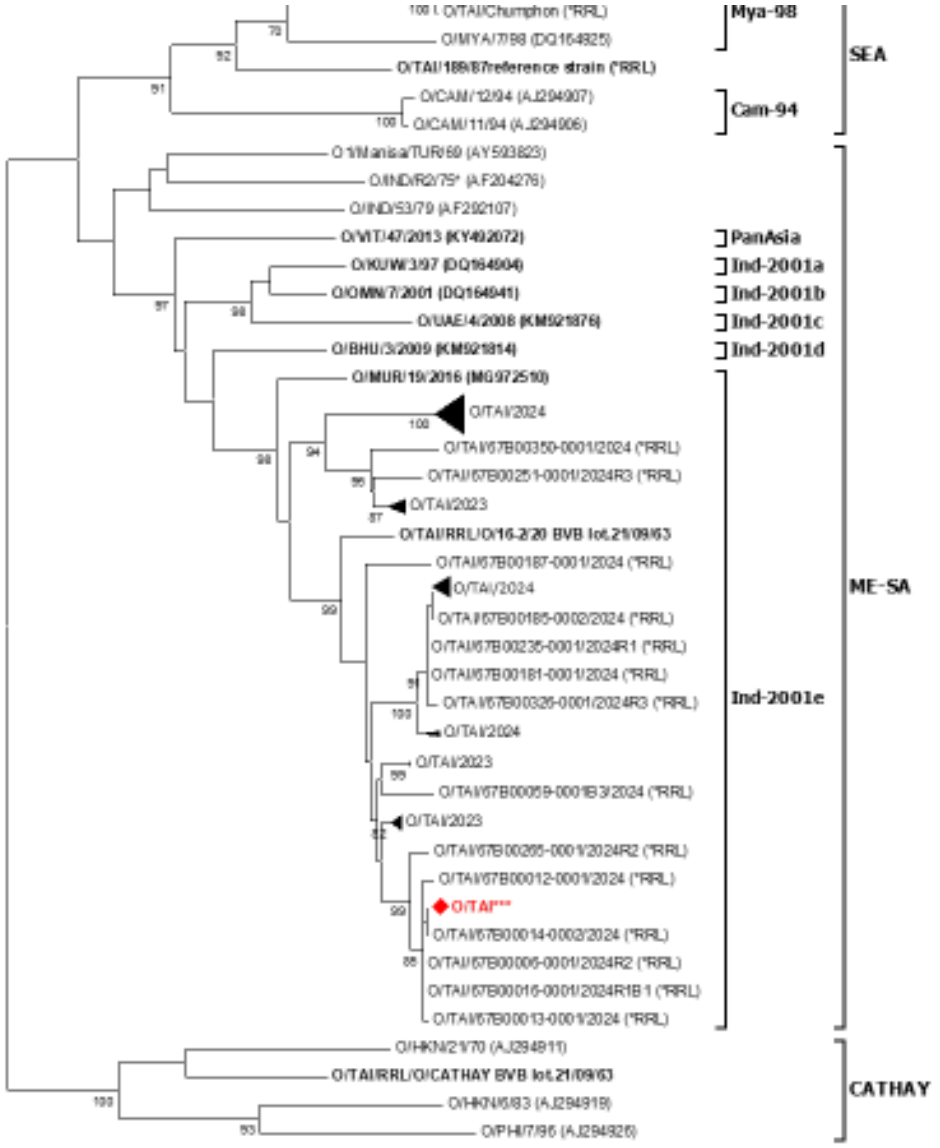


## ❑ 2025: Probang samples related 2024 samples

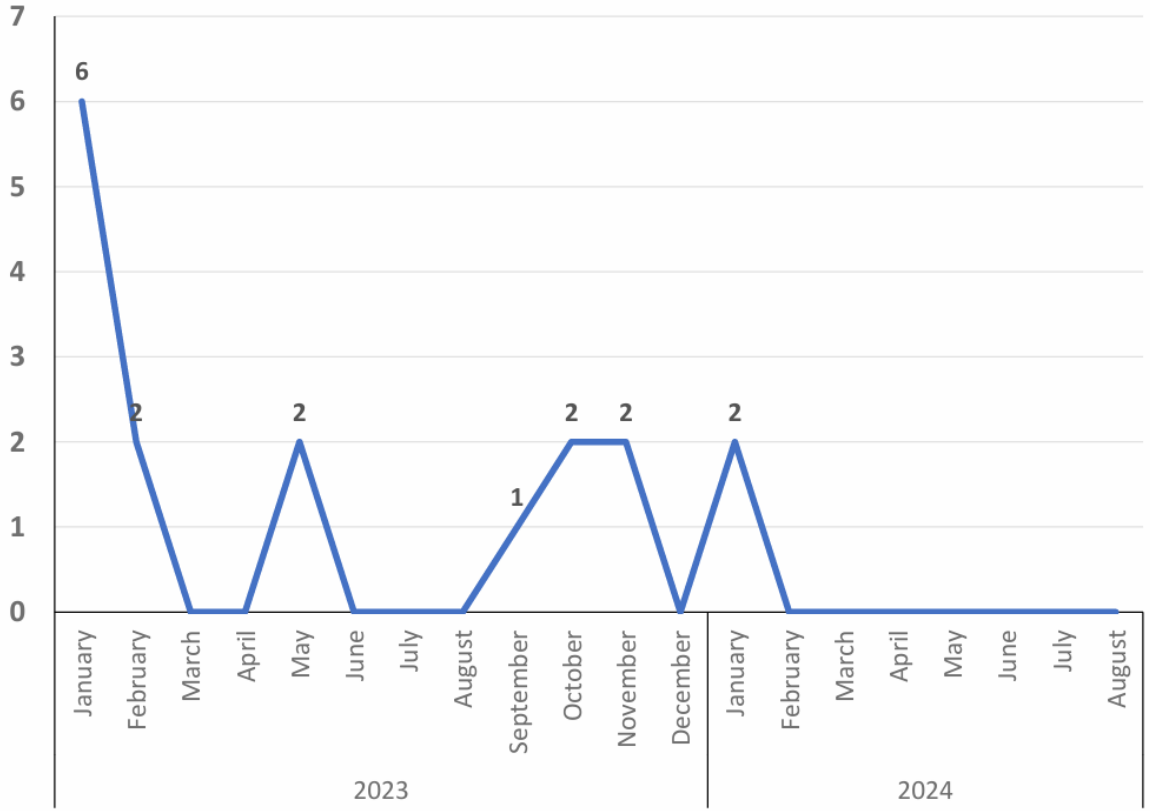
- ❑ Probang samples collected in 2025 have been identified as serotype O.
- ❑ It is hypothesized that this serotype represents a persistent strain that has remained endemic in the area,

- ❑ The clustering patterns suggest close genetic links to viruses previously reported in the region, indicating either local persistence or regional virus movement.



# Surveillance

## Temporal distribution of FMD reported in Thailand in 2023-2024




The ***Notification of FMDV serotype A***, lineage A/ASIA/SEA-97 in SEA region, has previously been detected in Southeast Asia and may continue to circulate in the region. Strengthened surveillance, VP1 sequencing, and vaccine matching studies are essential to monitor its distribution and potential spread.

However, ongoing circulation in specific countries in 2026 requires confirmation through recent surveillance data.

## Highlights of FMD prevention and control activities

-The vaccination campaign was strengthened with a focus on administering FMD booster  to young animals.

-Conduction FMD stability test and other quality control test for DLD FMD vaccine.

-Surveillance on FMD exotic serotype: SAT 1 and 2 (2026-2027)

## Any recent changes in FMD control policies

-100% vaccination for all susceptible

## Progression to next FMD-PCP Stage

-Ongoing support activities for the Region 2 free zone include revising relevant legislation and regulations, such as strengthening import criteria for live animals and related products to comply with the updated WOAH Terrestrial Code

-The active laboratory surveillance plan has been revised to align with the current epidemiological situation.

# Current Projects and Programmes Supporting Laboratory Capacity Building

| Project / Programme | Implementation Period | Main Focus Areas | Donor / Supporting Organisation | Laboratory Capacity-Building Activities / Outputs |
|---|---|---|---|---|
| **1. FMD Laboratory Surveillance and Diagnostic Capacity Strengthening** | Every year | FMD diagnosis, surveillance, molecular characterization | DLD, Thailand; FAO; WOAH; WRLFMD (technical support) | Strengthening laboratory-based surveillance; improving FMDV detection, serotyping, VP1 sequencing and molecular epidemiology; monitoring circulating strains; supporting outbreak investigations |
| **2. Regional FMD Laboratory Network Capacity Building** | Every year | Regional laboratory collaboration, diagnostic harmonization, technical training | WOAH/FAO, DLD, WRLFMD, Partner | Providing technical training to ASEAN laboratories; harmonizing diagnostic methods; distributing reference reagents; strengthening regional laboratory surveillance and information sharing |
| **3. SATREPS Collaborative Research Programme** | 2020–2025 | Advanced FMD diagnostics, molecular research, rapid detection technologies | JST/JICA, Japan; Japanese research partners; DLD | Development and evaluation of ddPCR, portable PCR, monoclonal antibodies and immunochromatographic diagnostic assays; technology transfer; scientific collaboration |
| **4. FMD Laboratory Proficiency Testing Programme** | Every Year | Laboratory quality assurance, proficiency testing, diagnostic performance | DLD/WOAH/FAO; RRLFMD Pakchong; regional laboratory partners | Organizing PT for antigen detection, RT-qPCR and serological assays; evaluating laboratory performance; identifying technical gaps; recommending corrective actions.<br>Participating with WRL |

# Current Projects and Programmes Supporting Laboratory Capacity Building

| Project / Programme | Implementation Period | Main Focus Areas | Donor / Supporting Organisation | Laboratory Capacity-Building Activities / Outputs |
|---|---|---|---|---|
| 1. FMD Laboratory Surveillance and Diagnostic Capacity Strengthening | Every year | FMD diagnosis, surveillance, molecular characterization | DLD, Thailand; FAO; WOAH; WRLFMD (technical support) | Strengthening laboratory-based surveillance; improving FMDV detection, serotyping, VP1 sequencing and molecular epidemiology; monitoring circulating strains; supporting outbreak investigations |
| **2. Regional FMD Laboratory Network Capacity Building** | Every year | Regional laboratory collaboration, diagnostic harmonization, technical training | FAO, WOAH, DLD, WRLFMD | Providing technical training to ASEAN laboratories; harmonizing diagnostic methods; distributing reference reagents; strengthening regional laboratory surveillance and information sharing |
| 3. SATREPS Collaborative Research Programme | 2020–2025 | Advanced FMD diagnostics, molecular research, rapid detection technologies | JST/JICA, Japan; Japanese research partners; DLD | Development and evaluation of ddPCR, portable PCR, monoclonal antibodies and immunochromatographic diagnostic assays; technology transfer; scientific collaboration |
| 4. FMD Laboratory Proficiency Testing Programme | Every Year | Laboratory quality assurance, proficiency testing, diagnostic performance | DLD/WOAH/FAO; RRLFMD Pakchong; regional laboratory partners | Organizing PT for antigen detection, RT-qPCR and serological assays; evaluating laboratory performance; identifying technical gaps; recommending corrective actions.<br>Participating with WRL |

# Current Projects and Programmes Supporting Laboratory Capacity Building

| Project / Programme | Implementation Period | Main Focus Areas | Donor / Supporting Organisation | Laboratory Capacity-Building Activities / Outputs |
|---|---|---|---|---|
| **1. FMD Laboratory Surveillance and Diagnostic Capacity Strengthening** | Every year | FMD diagnosis, surveillance, molecular characterization | DLD, Thailand; FAO; WOAH; WRLFMD (technical support) | Strengthening laboratory-based surveillance; improving FMDV detection, serotyping, VP1 sequencing and molecular epidemiology; monitoring circulating strains; supporting outbreak investigations |
| **2. Regional FMD Laboratory Network Capacity Building** | Every year | Regional laboratory collaboration, diagnostic harmonization, technical training | FAO, WOAH, DLD, WRLFMD | Providing technical training to ASEAN laboratories; harmonizing diagnostic methods; distributing reference reagents; strengthening regional laboratory surveillance and information sharing |
| **3. SATREPS Collaborative Research Programme** | 2020–2025 | Advanced FMD diagnostics, molecular research, rapid detection technologies | JST/JICA, Japan; Japanese research partners; DLD | Development and evaluation of ddPCR, portable PCR, monoclonal antibodies and immunochromatographic diagnostic assays; technology transfer; scientific collaboration |
| **4. FMD Laboratory Proficiency Testing Programme** | Every Year | Laboratory quality assurance, proficiency testing, diagnostic performance | DLD/WOAH/FAO; RRLFMD Pakchong; regional laboratory partners | Organizing PT for antigen detection, RT-qPCR and serological assays; evaluating laboratory performance; identifying technical gaps; recommending corrective actions.<br>Participating with WRL |

# Current Projects and Programmes Supporting Laboratory Capacity Building

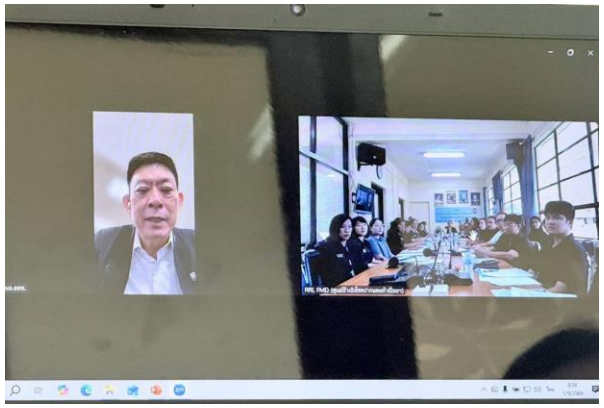
| Project / Programme | Implementation Period | Main Focus Areas | Donor / Supporting Organisation | Laboratory Capacity-Building Activities / Outputs |
|---|---|---|---|---|
| **1. FMD Laboratory Surveillance and Diagnostic Capacity Strengthening** | Every year | FMD diagnosis, surveillance, molecular characterization | DLD, Thailand; FAO; WOAH; WRLFMD (technical support) | Strengthening laboratory-based surveillance; improving FMDV detection, serotyping, VP1 sequencing and molecular epidemiology; monitoring circulating strains; supporting outbreak investigations |
| **2. Regional FMD Laboratory Network Capacity Building** | Every year | Regional laboratory collaboration, diagnostic harmonization, technical training | FAO, WOAH, DLD, WRLFMD | Providing technical training to ASEAN laboratories; harmonizing diagnostic methods; distributing reference reagents; strengthening regional laboratory surveillance and information sharing |
| **3. SATREPS Collaborative Research Programme** | 2020–2025 | Advanced FMD diagnostics, molecular research, rapid detection technologies | JST/JICA, Japan; Japanese research partners; DLD | Development and evaluation of ddPCR, portable PCR, monoclonal antibodies and immunochromatographic diagnostic assays; technology transfer; scientific collaboration |
| **4. FMD Laboratory Proficiency Testing Programme** | Every Year | Laboratory quality assurance, proficiency testing, diagnostic performance | DLD/WOAH/FAO; RRLFMD Pakchong; regional laboratory partners | Organizing PT for antigen detection, RT-qPCR and serological assays; evaluating laboratory performance; identifying technical gaps; recommending corrective actions.<br>Participating with WRL |

| Project / Programme | Implementation Period | Main Focus Areas | Donor / Supporting Organisation | Laboratory Capacity-Building Activities / Outputs |
|---|---|---|---|---|
| **5. BSL-3 Laboratory Infrastructure and Biorisk Management Strengthening** | 2019-2025 | Biosafety, biosecurity, laboratory infrastructure, facility commissioning | Government of Thailand; DLD; technical partners | Upgrading BSL-3 facilities; establishing biosafety and biosecurity procedures; personnel competency development; equipment validation, facility commissioning and certification preparation |
| **6. FMD Laboratory Quality Management System Strengthening** | Every year | ISO/IEC 17025:2017, method validation, quality assurance | DLD; NIAH; technical partners | Strengthening QMS; validating and verifying diagnostic methods; conducting internal audits; improving laboratory documentation, competency assessment and quality control |
| **7. FMDV SAT1 Preparedness and Regional Diagnostic Support** | 2026–2027 | Emerging FMD serotypes, SAT1 surveillance, laboratory preparedness | WOAH/FAO; WRLFMD; DLD | Supporting and sharing SAT1 molecular diagnostic capacity; distributing primers, probes and reference materials; providing regional technical training; supporting early detection and molecular characterization |
| **8. FMD Vaccine Matching and Antigenic Characterization** | Every year | Vaccine matching, antigenic relationships, circulating FMDV strains | DLD; WRLFMD, ACDP, Japanese research partners | Strengthening virus neutralization testing and vaccine matching; monitoring antigenic variation; generating evidence to support vaccine strain selection |
| **9. FMD Epidemiological Surveillance and Carrier-State Research** | Every year | FMD epidemiology, persistent infection, molecular surveillance | DLD/NIAH Japan; research collaborators | Conducting field surveillance and longitudinal studies; investigating carrier status; applying RT-qPCR, ddPCR and sequencing; improving epidemiological interpretation |
| **10. Regional Training and Knowledge Transfer Programme** | Every year | Laboratory workforce development, diagnostic techniques, biosafety and quality management | FAO; WOAH; DLD; WRLFMD; international partners | Organizing workshops and hands-on training; strengthening staff technical competency; sharing SOPs and good laboratory practices; promoting sustainable regional laboratory capacity |

| Project / Programme | Implementation Period | Main Focus Areas | Donor / Supporting Organisation | Laboratory Capacity-Building Activities / Outputs |
|---|---|---|---|---|
| **5. BSL-3 Laboratory Infrastructure and Biorisk Management Strengthening** | 2019-2025 | Biosafety, biosecurity, laboratory infrastructure, facility commissioning | Government of Thailand; DLD; technical partners | Upgrading BSL-3 facilities; establishing biosafety and biosecurity procedures; personnel competency development; equipment validation, facility commissioning and certification preparation |
| **6. FMD Laboratory Quality Management System Strengthening** | Every year | ISO/IEC 17025:2017, method validation, quality assurance | DLD; NIAH; technical partners | Strengthening QMS; validating and verifying diagnostic methods; conducting internal audits; improving laboratory documentation, competency assessment and quality control |
| **7. FMDV SAT1 Preparedness and Regional Diagnostic Support** | 2026–2027 | Emerging FMD serotypes, SAT1 surveillance, laboratory preparedness | WOAH/FAO; WRLFMD; DLD | Supporting and sharing SAT1 molecular diagnostic capacity; distributing primers, probes and reference materials; providing regional technical training; supporting early detection and molecular characterization |
| **8. FMD Vaccine Matching and Antigenic Characterization** | Every year | Vaccine matching, antigenic relationships, circulating FMDV strains | DLD; WRLFMD, ACDP, Japanese research partners | Strengthening virus neutralization testing and vaccine matching; monitoring antigenic variation; generating evidence to support vaccine strain selection |
| **9. FMD Epidemiological Surveillance and Carrier-State Research** | Every year | FMD epidemiology, persistent infection, molecular surveillance | DLD/NIAH Japan; research collaborators | Conducting field surveillance and longitudinal studies; investigating carrier status; applying RT-qPCR, ddPCR and sequencing; improving epidemiological interpretation |
| **10. Regional Training and Knowledge Transfer Programme** | Every year | Laboratory workforce development, diagnostic techniques, biosafety and quality management | FAO; WOAH; DLD; WRLFMD; international partners | Organizing workshops and hands-on training; strengthening staff technical competency; sharing SOPs and good laboratory practices; promoting sustainable regional laboratory capacity |

| Project / Programme | Implementation Period | Main Focus Areas | Donor / Supporting Organisation | Laboratory Capacity-Building Activities / Outputs |
|---|---|---|---|---|
| **5. BSL-3 Laboratory Infrastructure and Biorisk Management Strengthening** | 2019-2025 | Biosafety, biosecurity, laboratory infrastructure, facility commissioning | Government of Thailand; DLD; technical partners | Upgrading BSL-3 facilities; establishing biosafety and biosecurity procedures; personnel competency development; equipment validation, facility commissioning and certification preparation |
| **6. FMD Laboratory Quality Management System Strengthening** | Every year | ISO/IEC 17025:2017, method validation, quality assurance | DLD; NIAH; technical partners | Strengthening QMS; validating and verifying diagnostic methods; conducting internal audits; improving laboratory documentation, competency assessment and quality control |
| **7. FMDV SAT1 Preparedness and Regional Diagnostic Support** | 2026–2027 | Emerging FMD serotypes, SAT1 surveillance, laboratory preparedness | WOAH/FAO; WRLFMD; DLD | Supporting and sharing SAT1 molecular diagnostic capacity; distributing primers, probes and reference materials; providing regional technical training; supporting early detection and molecular characterization |
| **8. FMD Vaccine Matching and Antigenic Characterization** | Every year | Vaccine matching, antigenic relationships, circulating FMDV strains | DLD; WRLFMD, ACDP, Japanese research partners | Strengthening virus neutralization testing and vaccine matching; monitoring antigenic variation; generating evidence to support vaccine strain selection |
| **9. FMD Epidemiological Surveillance and Carrier-State Research** | Every year | FMD epidemiology, persistent infection, molecular surveillance | DLD/NIAH Japan; research collaborators | Conducting field surveillance and longitudinal studies; investigating carrier status; applying RT-qPCR, ddPCR and sequencing; improving epidemiological interpretation |
| **10. Regional Training and Knowledge Transfer Programme** | Every year | Laboratory workforce development, diagnostic techniques, biosafety and quality management | FAO; WOAH; DLD; WRLFMD; international partners | Organizing workshops and hands-on training; strengthening staff technical competency; sharing SOPs and good laboratory practices; promoting sustainable regional laboratory capacity |








แผนเผชิญเหตุ

โรคปากและเท้าเปื่อย
ซีโรไทป์ SAT 1

สำนักควบคุม ป้องกันและบำบัดโรคสัตว์ กรมปศุสัตว์

# Workshop on FMDV SAT1 Preparedness Activities at RRLFMD-Pakchong

# Workshop on FMDV SAT1 Preparedness Activities at RRLFMD-Pakchong













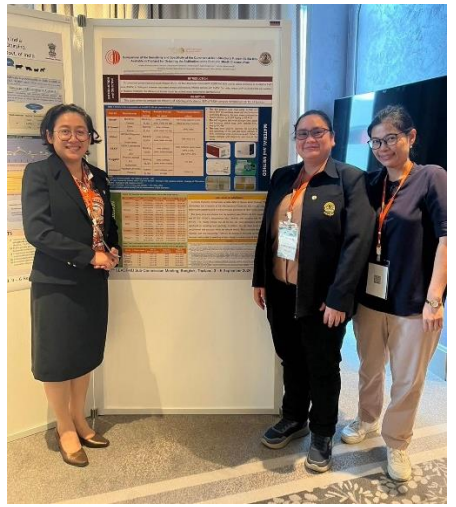
| Project / Programme | Implementation Period | Main Focus Areas | Donor / Supporting Organisation | Laboratory Capacity-Building Activities / Outputs |
|---|---|---|---|---|
| **5. BSL-3 Laboratory Infrastructure and Biorisk Management Strengthening** | 2019-2025 | Biosafety, biosecurity, laboratory infrastructure, facility commissioning | Government of Thailand; DLD; technical partners | Upgrading BSL-3 facilities; establishing biosafety and biosecurity procedures; personnel competency development; equipment validation, facility commissioning and certification preparation |
| **6. FMD Laboratory Quality Management System Strengthening** | Every year | ISO/IEC 17025:2017, method validation, quality assurance | DLD; NIAH; technical partners | Strengthening QMS; validating and verifying diagnostic methods; conducting internal audits; improving laboratory documentation, competency assessment and quality control |
| **7. FMDV SAT1 Preparedness and Regional Diagnostic Support** | 2026–2027 | Emerging FMD serotypes, SAT1 surveillance, laboratory preparedness | WOAH/FAO; WRLFMD; DLD | Supporting and sharing SAT1 molecular diagnostic capacity; distributing primers, probes and reference materials; providing regional technical training; supporting early detection and molecular characterization |
| **8. FMD Vaccine Matching and Antigenic Characterization** | Every year | Vaccine matching, antigenic relationships, circulating FMDV strains | DLD; WRLFMD, ACDP, Japanese research partners | Strengthening virus neutralization testing and vaccine matching; monitoring antigenic variation; generating evidence to support vaccine strain selection |
| **9. FMD Epidemiological Surveillance and Carrier-State Research** | Every year | FMD epidemiology, persistent infection, molecular surveillance | DLD/NIAH Japan; research collaborators | Conducting field surveillance and longitudinal studies; investigating carrier status; applying RT-qPCR, ddPCR and sequencing; improving epidemiological interpretation |
| **10. Regional Training and Knowledge Transfer Programme** | Every year | Laboratory workforce development, diagnostic techniques, biosafety and quality management | FAO; WOAH; DLD; WRLFMD; international partners | Organizing workshops and hands-on training; strengthening staff technical competency; sharing SOPs and good laboratory practices; promoting sustainable regional laboratory capacity |

| Project / Programme | Implementation Period | Main Focus Areas | Donor / Supporting Organisation | Laboratory Capacity-Building Activities / Outputs |
|---|---|---|---|---|
| **5. BSL-3 Laboratory Infrastructure and Biorisk Management Strengthening** | 2019-2025 | Biosafety, biosecurity, laboratory infrastructure, facility commissioning | Government of Thailand; DLD; technical partners | Upgrading BSL-3 facilities; establishing biosafety and biosecurity procedures; personnel competency development; equipment validation, facility commissioning and certification preparation |
| **6. FMD Laboratory Quality Management System Strengthening** | Every year | ISO/IEC 17025:2017, method validation, quality assurance | DLD; NIAH; technical partners | Strengthening QMS; validating and verifying diagnostic methods; conducting internal audits; improving laboratory documentation, competency assessment and quality control |
| **7. FMDV SAT1 Preparedness and Regional Diagnostic Support** | 2026–2027 | Emerging FMD serotypes, SAT1 surveillance, laboratory preparedness | WOAH/FAO; WRLFMD; DLD | Supporting and sharing SAT1 molecular diagnostic capacity; distributing primers, probes and reference materials; providing regional technical training; supporting early detection and molecular characterization |
| **8. FMD Vaccine Matching and Antigenic Characterization** | Every year | Vaccine matching, antigenic relationships, circulating FMDV strains | DLD; WRLFMD, ACDP, Japanese research partners | Strengthening virus neutralization testing and vaccine matching; monitoring antigenic variation; generating evidence to support vaccine strain selection |
| **9. FMD Epidemiological Surveillance and Carrier-State Research** | Every year | FMD epidemiology, persistent infection, molecular surveillance | DLD/NIAH Japan; research collaborators | Conducting field surveillance and longitudinal studies; investigating carrier status; applying RT-qPCR, ddPCR and sequencing; improving epidemiological interpretation |
| **10. Regional Training and Knowledge Transfer Programme** | Every year | Laboratory workforce development, diagnostic techniques, biosafety and quality management | FAO; WOAH; DLD; WRLFMD; international partners | Organizing workshops and hands-on training; strengthening staff technical competency; sharing SOPs and good laboratory practices; promoting sustainable regional laboratory capacity |

| Project / Programme | Implementation Period | Main Focus Areas | Donor / Supporting Organisation | Laboratory Capacity-Building Activities / Outputs |
|---|---|---|---|---|
| **5. BSL-3 Laboratory Infrastructure and Biorisk Management Strengthening** | 2019-2025 | Biosafety, biosecurity, laboratory infrastructure, facility commissioning | Government of Thailand; DLD; technical partners | Upgrading BSL-3 facilities; establishing biosafety and biosecurity procedures; personnel competency development; equipment validation, facility commissioning and certification preparation |
| **6. FMD Laboratory Quality Management System Strengthening** | Every year | ISO/IEC 17025:2017, method validation, quality assurance | DLD; NIAH; technical partners | Strengthening QMS; validating and verifying diagnostic methods; conducting internal audits; improving laboratory documentation, competency assessment and quality control |
| **7. FMDV SAT1 Preparedness and Regional Diagnostic Support** | 2026–2027 | Emerging FMD serotypes, SAT1 surveillance, laboratory preparedness | WOAH/FAO; WRLFMD; DLD | Supporting and sharing SAT1 molecular diagnostic capacity; distributing primers, probes and reference materials; providing regional technical training; supporting early detection and molecular characterization |
| **8. FMD Vaccine Matching and Antigenic Characterization** | Every year | Vaccine matching, antigenic relationships, circulating FMDV strains | DLD; WRLFMD, ACDP, Japanese research partners | Strengthening virus neutralization testing and vaccine matching; monitoring antigenic variation; generating evidence to support vaccine strain selection |
| **9. FMD Epidemiological Surveillance and Carrier-State Research** | Every year | FMD epidemiology, persistent infection, molecular surveillance | DLD/NIAH Japan; research collaborators | Conducting field surveillance and longitudinal studies; investigating carrier status; applying RT-qPCR, ddPCR and sequencing; improving epidemiological interpretation |
| **10. Regional Training and Knowledge Transfer Programme** | Every year | Laboratory workforce development, diagnostic techniques, biosafety and quality management | FAO; WOAH; DLD; WRLFMD; international partners | Organizing workshops and hands-on training; strengthening staff technical competency; sharing SOPs and good laboratory practices; promoting sustainable regional laboratory capacity |

# Knowledge management

- Scientific meeting and Conference
- Research publication
- Collaboration study




www.nature.com/scientificreports

scientific reports

OPEN

Evaluation and comparison of performances of six commercial NSP ELISA assays for foot and mouth disease virus in Thailand

Kingkarn Boonsuya Seeyo[1], Amonrat Choonnasard[1], Jeeranant Chottikamporn[1], Sopha Singkleebut[1], Parichart Ngamsomsak[1], Karnrawee Suanpat[2], Nagendrakumar Singanallur Balasubramanian[3], Wilna Vosloo[3] & Katsuhiko Fukai[4]

ELISA kits that detect antibodies to the non-structural protein (NSP) of the foot-and-mouth disease virus (FMDV), commonly referred to as NSP-ELISA, can distinguish between vaccinated and naturally infected animals. They can play an essential role in demonstrating '*proof-of-freedom*' during the control of FMD. Although various NSP-ELISA kits are available in Thailand, information regarding their performance is lacking. To select the most appropriate NSP-ELISA kit for our specific purpose, we must compare their performance using carefully characterized sera. This will ensure that we maximize the benefits of our testing. In this study, six NSP-ELISA kits sold in Thailand—Biovet, ID Screen, VDPro, IDEXX, PrioCHECK, and KUcheck-F—were evaluated and compared. A total of 800 serum samples were examined, including samples from 357 cattle and 29 buffaloes in outbreak areas, as well as 14 swine serum samples from the Vaccine Quality Control Unit of the Bureau of Veterinary Biologics, Ministry of Agriculture and Cooperation, Thailand. Four hundred samples were confirmed to originate from animals infected with FMDV through ELISA typing ($n = 11$, tested as representative samples in each farm) and/or RT-PCR ($n = 400$, all samples), serving as positive control sera. Additionally, 400 negative control sera were obtained from Japan (97 cattle and 300 pigs) and Australia (3 goats), certified by the World Organisation for Animal Health as '*free of FMD*'. The sensitivity and specificity of the six tests were determined based on the results obtained from two-by-two tables. Cohen's kappa statistics were calculated for the six tests to assess their concordance, and the diagnostic accuracy of the assays was also determined. For all six NSP-ELISA kits, the sensitivity ranged from 97.75 to 99.50%, and the specificity ranged from 97.25 to 100%. Cohen's kappa statistics ranged from 0.96 to 1.00, and diagnostic accuracy ranged from 98.13 to 99.75%. The study results indicated that the test kits have statistically similar sensitivity, specificity, concordance, and diagnostic accuracy, suggesting they can be used interchangeably. However, ID Screen demonstrated the highest sensitivity and specificity among all kits tested. Therefore, if a single kit were to be selected from the six evaluated, ID Screen would be the most appropriate choice. These findings can aid in selecting the most suitable test kit. Therefore, it is recommended to consider purchasing a diverse range of effective test kits. Furthermore, these findings can provide guidance for expanding the use of test kits, particularly with the growing availability of NSP-ELISA kits in the market.

**Keywords** Antibody, ELISA, Foot-and-mouth disease virus, Non-structural protein, Thailand


9/11/69 11:02 Development and validation of a one-step RT-ddPCR assay for sensitive and absolute quantification of foot-and-mouth disease vir...

ScienceDirect

Journal of Virological Methods

Date: July 2026

Show more

Research article Get rights and content

Protocols

Development and validation of a one-step RT-ddPCR assay for sensitive and absolute quantification of foot-and-mouth disease virus RNA in probang fluid

Kingkarn Boonsuya Seeyo, Kasuke Natsu, Nalinee Hangchumpon, Jeeranant Chottikamporn, Yuto Matsui, Jonyo Samonti, Alongkorn Pantumart, Parichat Ngamsomsak, Mari Hirokawa, Kentaro Yamada, Landchai Chindapitaksakul, Hiroaki Misawa

Show more

Cite Add to Mendeley Share | 10.1016/j.jviromet.2026.115411

Access through your organi... Purchase PDF Patient Access

Article preview Recommended articles Metrics

Highlights

- One-step RT-ddPCR assay developed for detection of FMDV RNA.
- Enables absolute quantification without need for standard curves.
- Analytical sensitivity comparable to WOAH-recommended RT-qPCR.
- High intra-assay repeatability and acceptable inter-assay reproducibility.
- Detects low-level FMDV RNA in probang samples up to 10–11 months.

Article preview

Abstract

Introduction

Section snippets

References (23)

Abstract

Foot-and-mouth disease (FMD) is a highly contagious viral disease of cloven-hoofed animals caused by foot-and-mouth disease virus (FMDV). FMDV can persist at low levels in probang fluid samples collected from clinically recovered cattle, posing challenges for sensitive detection and quantification. In this study, we developed and validated a one-step reverse transcription droplet digital PCR (RT-ddPCR) assay for the detection and absolute quantification of FMDV RNA. The analytical performance of RT-ddPCR was evaluated in comparison with the WOAH-recommended RT-qPCR assay. The RT-ddPCR assay demonstrated high analytical sensitivity, clear separation of positive and negative droplets, and strong quantitative agreement with RT-qPCR (Pearson's $r = 0.997$, $p < 0.05$). RT-ddPCR demonstrated analytical sensitivity equivalent to RT-qPCR, detecting FMDV RNA down to $1 \times 10^{0}$ $TCID_{50}$/mL. Intra-assay repeatability showed low variability within runs, and inter-assay reproducibility across independent runs was comparable between RT-ddPCR and RT-qPCR. Application of the RT-ddPCR assay to probang fluid samples collected 6 and 10–11 months after FMD outbreaks revealed detectable levels of FMDV RNA in a subset of clinically recovered cattle. These findings indicate that one-step RT-ddPCR provides sensitive detection and absolute quantification of low-level FMDV RNA and represents a valuable complementary tool for investigating viral persistence and subclinical shedding in cattle.

https://www.sciencedirect.com/science/article/abs/pii/S0166093426000765 1/7


Article

Development of a mu3ABC-Based Lateral Flow Immunochromatographic Strip for Rapid DIVA-Compatible Detection of Antibodies Specific to Foot-and-Mouth Disease Virus

Wantanee Tonmeurd, Vijittra Naithong, Jullada Chootip, Kingkarn Boonsuya Seeyo and Pornlipa Lekcharoensuk

Simple Summary

Foot-and-mouth disease is a highly contagious viral illness that threatens livestock such as cattle, pigs, and goats. To control outbreaks effectively, authorities need a fast, on-site tool to distinguish between infected animals and those that have been vaccinated. To address this, we developed a rapid, easy-to-use paper test strip that detects specific proteins produced during an active infection. We evaluated this new test using 566 field animal serum samples and 200 reference samples, comparing its performance against a standard laboratory method. The results showed that our test strip is highly accurate, achieving a diagnostic sensitivity of 88.18% and a diagnostic specificity of 92.56% in field samples, while also performing reliably against reference samples. In conclusion, this newly developed test strip is an effective tool that can be used directly on farms alongside routine surveillance. By enabling rapid identification of infected livestock, this test helps farmers and veterinarians control disease outbreaks quickly, ultimately protecting animal welfare, securing food supplies, and supporting the livelihoods of farming communities directly.

Abstract

Foot-and-mouth disease (FMD) is one of the most infectious viral diseases of cloven-hoofed animals. The crucial strategy for FMD control is the combination of animal quarantine and rapid onsite diagnostic assay capable of differential infected from vaccinated animals (DIVA). Herein, we have developed a lateral flow immunoassay to detect specific antibodies against FMDV non-structural protein (NSP), based on recombinant mu3ABC produced by *E. coli* as an antibody detector, so called mu3ABC strip test. Performance of mu3ABC strip test was examined using 566 field serum samples from cattle, pigs, and goats and compared with the commercial ELISA kit, resulting in the diagnostic sensitivity (DSn) and specificity (DSp) of 88.18% and 92.56%, respectively. Additionally, efficacies of the mu3ABC strip test and commercial ELISA were determined using 200 reference bovine sera (100 positives, 100 negatives) classified by the Regional Reference Laboratory for Foot and Mouth Disease













# Important changes since 2023 SEACFMD LabNet meeting



# Best Practices and Experiences to Share: For examples…




**Strengthening Regional Laboratory Collaboration and Technical Support**

**Lesson learned**: Sustainable laboratory networking requires continuous engagement, mutual trust, timely communication, and technical support tailored to the needs and capacities of individual countries.

**Proactive Preparedness for Emerging FMDV Serotypes**

**Lesson learned:** Early preparedness, access to validated diagnostic methods and reference materials, and coordinated regional surveillance can improve readiness and support timely responses to emerging FMD threats.

**Using Proficiency Testing as a Tool for Continuous Improvement**

**Lesson learned:** Proficiency testing should be viewed not only as a performance assessment but also as an opportunity for technical learning, corrective action, and capacity development.

# Collaboration and network needs

| No. | Priority Area | Collaboration / Technical Support Needed |
|---|---|---|
| 1 | FMD Laboratory diagnostic, surveillance,.. | **Strengthen coordinated** surveillance, molecular characterization, VP1 sequencing, and monitoring of emerging FMDV serotypes and lineages, including SAT1 and A/ASIA/SEA-97. |
| 2 | Data and Information Sharing | **Establish timely mechanisms** for sharing laboratory findings, sequence data, and epidemiological information while respecting national policies and regulations. |
| 3 | Diagnostic Harmonization and Quality Assurance | **Expand QA; proficiency testing**, interlaboratory comparisons, method validation, SOP harmonization, and ISO/IEC 17025 quality management support. |
| 4 | Technical Training and Knowledge Transfer | **Organize hands-on training, expert exchanges, and workshops** on molecular diagnostics, sequencing, bioinformatics, serology, and vaccine matching. |
| 5 | Preparedness for Emerging FMDV Serotypes | **Strengthen SAT1 preparedness** through diagnostic assay support, reference reagents, positive controls, technical guidance, and contingency planning. |

# Collaboration and network needs (Cont.)

| No. | Priority Area | Collaboration / Technical Support Needed |
|---|---|---|
| 6 | **Vaccine Matching and Antigenic Characterization** | Strengthen collaboration with international reference laboratories on virus neutralization testing, antigenic characterization, and vaccine matching. |
| 7 | **Biosafety, Biosecurity, and Laboratory Sustainability** | Share technical expertise on biorisk management, BSL-3 commissioning, certification, equipment maintenance, and personnel competency. |
| 8 | **Access to Reference Materials and Laboratory Resources** | Improve coordination for reference reagent distribution, biological material transfer, import permits, and international sample shipment. |
| 9 | **Joint Research and Technology Transfer** | Promote collaborative research on advanced diagnostic technologies, digital PCR, portable PCR, and novel diagnostic assays study. |
| 10 | **Sustainable Regional Laboratory Networking** | Strengthen regular technical meetings, laboratory focal-point communication, mentoring, and coordinated support from FAO, WOAH, WRLFMD, and other partners. |

# Proposed Priority Actions for Strengthening SEACFMD Laboratory Networking and Regional Collaboration (2026–2028)



| Priority Action | Expected Result |
|---|---|
| 1. Strengthen FMD surveillance and molecular characterization. | Improved early detection and Active monitoring of emerging FMDV strains, including SAT1 and A/ASIA/SEA-97. |
| 2. Enhance diagnostic harmonization and quality assurance. | Improved diagnostic accuracy and laboratory competency. |
| 3. Strengthen preparedness for emerging FMDV threats. | Improved laboratory readiness and rapid response capacity. |
| 4. Expand technical training and collaborative research. | Enhanced technical expertise and sustainable laboratory capacity. |
| 5. Improve regional laboratory networking and information sharing. | Stronger regional coordination and timely information exchange. |

## ❖ Proposed Priorities for Roadmap 2026–2030 (DLD, THAILAND)

- Achieve PCP-FMD Stage 4 for at least 1 zone
- Institutionalize emergency preparedness and simulation exercises
- Expand Public–Private Partnership (PPP) for sustainable vaccination
- Develop digital movement permit system with real-time tracking
- Regional harmonization on outbreak response and surveillance
- Strengthen M&E integration into routine operations

# THANK YOU


เตือนภัย! โรคปากและเท้าเปื่อย
ซีโรไทป์ SAT 1
โรคปากและเท้าเปื่อย ซีโรไทป์ SAT 1
เป็นโรคอุบัติใหม่ที่มีความรุนแรง
หากสัตว์ติดเชื้อ จะมีอัตราการป่วยสูง
แพร่กระจายได้รวดเร็ว
ในโค กระบือ สุกร แพะแกะ
อาการ
1 มีไข้
2 น้ำลายไหล
มีตุ่มใส แผลในปาก
ลิ้น จมูก
3 มีแผลที่ซอกกีบ
เดินกะเผลก
4 มีแผลที่เต้านม
น้ำนมลด
ผลกระทบหากมีการระบาด
ในประเทศไทย
สัตว์ในประเทศไม่มีภูมิคุ้มกันต่อซีโรไทป์นี้
ภูมิคุ้มกันที่เกิดจากการฉีดวัคซีนตามรอบระยะเวลา
ไม่สามารถป้องกันการติดเชื้อข้ามซีโรไทป์ได้
ส่งผลกระทบต่ออุตสาหกรรมการเลี้ยงสัตว์กีบคู่
ในประเทศเป็นวงกว้าง ทั้งด้านเศรษฐกิจ
การส่งออก และความมั่นคงทางอาหาร
หากพบสัตว์ที่แสดงอาการสงสัย
โรคปากและเท้าเปื่อย
ให้แจ้งเจ้าหน้าที่ปศุสัตว์ในพื้นที่เพื่อตรวจสอบทันที
หรือ
สายด่วนกรมปศุสัตว์
063-225-6888
DLD
ทำความสะอาด อุปกรณ์
โรงเรือนด้วยน้ำยาฆ่าเชื้อ
ห้ามนำเข้าสัตว์ ซากสัตว์
และผลิตภัณฑ์จากสัตว์
จากพื้นที่เสี่ยง
เน้นย้ำให้สังเกตอาการ
และแจ้งโรคทันที