



Food and Agriculture
Organization of the
United Nations



European Commission for the Control
of Foot-and-Mouth disease

WOAH/FAO
Foot-and-Mouth Disease
Reference Laboratories
Network



FMD

2024

**APR
MAY
JUN**

**Quar
ter
ly**

**Re
port**

2024 Foot-and-mouth disease quarterly report
April-May-June



This report is version 1

All maps within this document were drawn using the United Nations Map (UNMap) v2020, supplied to the authors by FAO. The following disclaimers apply to the maps in this document.

The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Jammu and Kashmir: *Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.*

Sudan and South Sudan: *Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.*

Abyei: *Final status of the Abyei area is not yet determined.*

Falkland Islands (Malvinas): *A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).*

Use of data (including all images) from this document

Copies of all the individual reports cited herein can be obtained from WRLFMD (www.wrlfmd.org) and please seek permission before presentation, publication or other public use of these data.

Contents

1.	Highlights and headlines	1
2.	General overview	2
3.	Summary of FMD outbreaks and intelligence.....	3
3.1.	Overview of reports	3
3.2.	Pool 1 (Southeast Asia/Central Asia/East Asia).....	3
3.3.	Pool 2 (South Asia)	4
3.4.	Pool 3 (West Eurasia and Near East).....	4
3.5.	Pool 4 (North and Eastern Africa)	6
3.6.	Pool 5 (West/Central Africa)	6
3.7.	Pool 6 (Southern Africa)	7
3.8.	Pool 7 (South America).....	7
3.9.	Extent of global surveillance	7
4.	Detailed analysis	10
4.1.	Pool 1 (Southeast Asia/Central Asia/East Asia).....	10
4.2.	Pool 2 (South Asia)	10
4.3.	Pool 3 (West Eurasia and Near East).....	10
4.4.	Pool 4 (North and East Africa).....	11
4.5.	Pool 5 (West/Central Africa)	18
4.6.	Pool 6 (Southern Africa)	18
4.7.	Pool 7 (South America).....	18
4.8.	Vaccine matching	18
Annex 1:	Sample data	22
	Summary of submissions	22
	Clinical samples.....	22
Annex 2:	FMD publications	27
Annex 3:	Vaccine recommendations	30
Annex 4:	Brief round-up of EuFMD and WRLFMD activities.....	31
	Courses	31
	Meetings.....	32
	Proficiency test scheme organised by WRLFMD	32

Abbreviations and acronyms

BVI	Botswana Vaccine Institute
EIDRA	Emerging Infectious Disease Research Association
EuFMD	European Commission for the Control of Foot-and-Mouth Disease
FAST reports	foot-and-mouth and similar transboundary animal diseases reports
FGBI “ARRIAH”	Federal Governmental Budgetary Institution “Federal Centre for Animal Health”
FMD	foot-and-mouth disease
FMDV	foot-and-mouth disease virus
FMDV GD	foot-and-mouth disease virus genome detected
FMDV NGD	foot-and-mouth disease virus genome not detected
GF-TAD	Global Framework for the Progressive Control of Transboundary Animal Diseases
LVRI	Lanzhou Veterinary Research Institute
MEVAC	International Facility for Veterinary Vaccines Production (Egypt)
MNFMDL	Malaysian National Foot-and-Mouth Disease Laboratory
NT	not tested
NVD	no virus detected
PIADC	Plum Island Animal Disease Center
Pusvetma	Pusat Veteriner Farma (Indonesia)
rRT-PCR	real-time reverse transcription polymerase chain reaction
SAARC	South Asian Association for Regional Cooperation
SADC	Southern African Development Community
SAT	Southern African Territories
SEACFMD	South-East Asia and China FMD campaign
SSARRL	Sub-Saharan Africa Regional Reference Laboratory
SVD	swine vesicular disease
VETBIS	Veterinary Information System of Türkiye
VI	virus isolation
WAHIS	World Animal Health Information System (of the WOAHA)
WOAH	World Organisation for Animal Health
WRLFMD	World Reference Laboratory for Foot-and-Mouth Disease

1. Highlights and headlines

Welcome to this FMD Quarterly Report prepared by the WRLFMD, Pirbright and EuFMD. During this period, the WRLFMD has reported test results for samples received from Ethiopia, Jordan, Kenya, Namibia, Nigeria, Malawi and Uganda. There have also been new sequence submissions from Libya (from IZSLER, Italy) and Türkiye (from Şap Enstitüsü, Türkiye). Sequences of the viruses recovered from the Ugandan and Ethiopian samples provide important insights about the prevailing FMD situation in East Africa. As highlighted in previous studies, two different serotype O topotypes O/EA-2 and O/EA-3 are present in Uganda and Ethiopia, respectively, supporting the idea that there are two discrete FMDV ecosystems in East Africa. In this report, we also describe the detection of a new clade within the SAT1/VII topotype. These sequences from Uganda are >10% different to their closest genetic relatives (viruses collected from the region during the 1970s), representing another example of the unexpected re-emergence of a SAT lineage virus from Africa, similar to the patterns observed for the SAT2/V and SAT2/VIX topotypes described in previous reports. During this quarter, we have not been made aware of any further FMD cases due to the emerging SAT2/V topotype in Algeria. However, new SAT2 outbreaks have been reported in Türkiye, and in South Africa, new FMD cases due to serotype SAT2 and SAT3 have been reported to WOA (in Kwazulu Natal and Eastern Cape, respectively). Elsewhere, there have been unconfirmed reports on ProMed of FMD cases in the Znaursky District of South Ossetia, Georgia in April 2024.

The incursions of viruses from the A/EURO-SA and O/EURO-SA topotypes in Egypt during 2022 raised questions about whether the vaccines included in European vaccine banks and those deployed during ongoing outbreaks could be used to control the spread of these exotic strains. In this report, we describe vaccine matching results for 20 representative South American A and O serotype isolates which were kindly provided by PANAFITSA, Brazil. The results provide *in vitro* data to support the use of vaccines from commercial suppliers, but also highlight limitations of only using the r₁ vaccine matching test to select candidate vaccine strains; since for serotype O, the highest heterologous titres were obtained for the O1 Campos vaccine strain, but correspondingly high homologous responses resulted in calculated r₁ values of < 0.3.

The Annual Meeting of the WOA/FAO FMD Laboratory Network (www.foot-and-mouth.org) will be held in at FAO HQ in Rome during 26th-27th September; please contact me if you are interested to join in-person or remotely.

Don King, Pirbright, July 2024

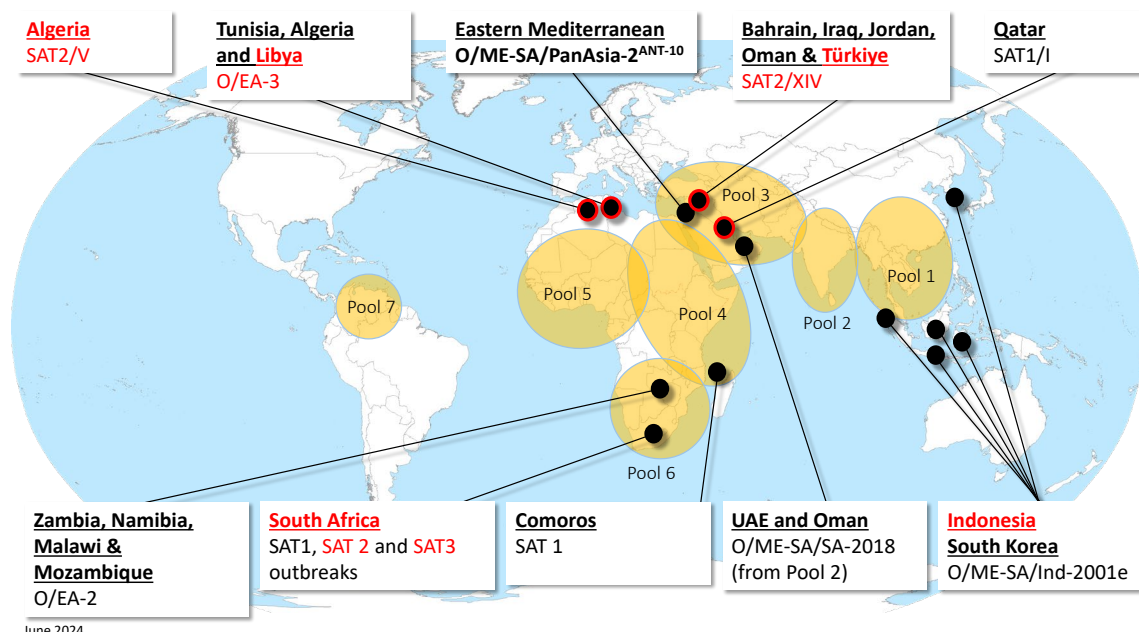


Figure 1: Recent FMD outbreaks with global epidemiological significance.

Note: New headline events reported January to March 2024 are highlighted in red with FMD endemic pools highlighted in orange. Source: WRLFMD. Map conforms to the United Nations World Map, June 2020.

2. General overview

Endemic Pools comprise separate ecosystems that maintain independently circulating and evolving foot-and-mouth disease virus (FMDV) genotypes. In the absence of specific reports, it should be assumed that the serotypes indicated below are continuously circulating in parts of these pools and would be detected if sufficient surveillance was in place.

POOL	REGION/COUNTRIES	SEROTYPES PRESENT
	<u>SOUTHEAST ASIA/CENTRAL ASIA/EAST ASIA</u>	
1	Cambodia, China, China (Hong Kong SAR), Taiwan Province of China, Indonesia, Democratic People's Republic of Korea, Republic of Korea, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Russian Federation, Thailand, Viet Nam	A, Asia1 and O
	<u>SOUTH ASIA</u>	
2	Bangladesh, Bhutan, India, Mauritius ¹ , Nepal, Sri Lanka	A, Asia1 and O
	<u>WEST EURASIA & NEAR EAST</u>	
3	Afghanistan, Armenia, Azerbaijan, Bahrain, Georgia, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Oman, Pakistan, Palestine, Qatar, Saudi Arabia, Syrian Arab Republic, Tajikistan, Türkiye, Turkmenistan, United Arab Emirates, Uzbekistan	A, Asia1 and O (SAT2)
	<u>EASTERN AFRICA</u>	
4	Burundi, Comoros, Djibouti, Egypt ³ , Eritrea, Ethiopia, Kenya, Rwanda, Somalia, South Sudan, Sudan, Uganda, United Republic of Tanzania, Yemen	O, A, SAT1, SAT2 and SAT3
	<u>NORTH AFRICA</u> ²	
	Algeria, Libya, Morocco, Tunisia	A and O
	<u>WEST/CENTRAL AFRICA</u>	
5	Benin, Burkina Faso, Cabo Verde, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Sao Tome and Principe, Senegal, Sierra Leone, Togo	O, A, SAT1 and SAT2
	<u>SOUTHERN AFRICA</u>	
6	Angola, Botswana, Malawi, Mozambique, Namibia, South Africa, Zambia, Zimbabwe	SAT1, SAT2 and SAT3 (O ⁴ , A)
	<u>SOUTH AMERICA</u>	
7	Venezuela (Bolivarian Republic of)	O and A

¹FMD outbreaks in 2016/21 due to O/ME-SA/Ind-2001 demonstrate close epidemiological links between Pool 2 and Mauritius.

²Long-term maintenance of FMDV lineages has not been documented in the Maghreb countries of North Africa and therefore this region does not constitute an Endemic Pool, but data is segregated here since FMD circulation in this region poses a specific risk to FMD-free countries in Southern Europe.

³Egypt represents a crossroads between East African Pool 4 and the Near East (Pool 3). NB: Serotypes SAT1 and SAT3 have not been detected in this country.

⁴Detection of O/EA-2 in southern/western Zambia (2018–2021), Namibia (2021), Malawi (2022) and Mozambique (2022) represent a new incursion into Pool 6.

3. Summary of FMD outbreaks and intelligence

3.1. Overview of reports

The location of information provided in this report can be seen on the map below. More detailed maps and sample data, on a country-by-country basis, can be found in the following sections of this report.

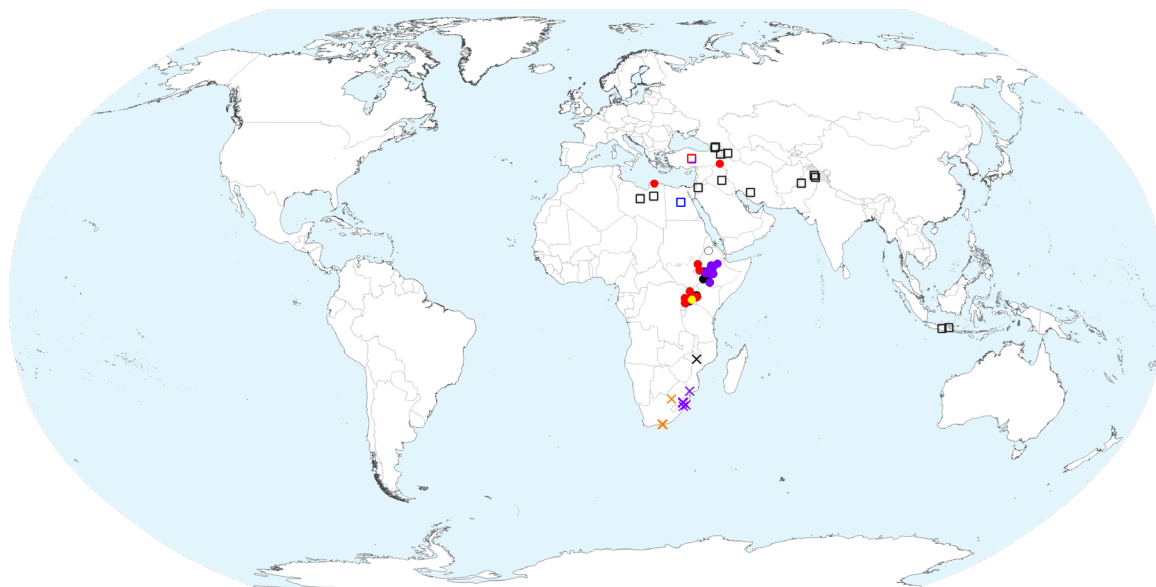


Figure 2: Samples tested by WRLFMD or reported in this quarter. ● indicates samples analysed; × indicates outbreaks reported/updated to the WOAHA this quarter; □ indicates reports of FMD from other sources. Shape colours define the serotype detected ●O; ●A; ●C; ●Asia1, ●SAT1, ●SAT2, ●SAT3, ● serotype undetermined/not given in the report, ○ FMD not detected.

Source: WRLFMD. Map conforms to the United Nations World map, June 2020.

3.2. Pool 1 (Southeast Asia/Central Asia/East Asia)

The Republic of Indonesia



FMD has been detected in Klaten Regency, Central Java with 11 cases detected in April 2024. Numbers are lower than in 2023 when there were almost 4000 cases.

ProMED post: [20240501.8716248](https://www.promed.org/post/20240501.8716248)

An inspection in Sidoarjo Regency during early June found that 3 cows belonging to an animal trader had mild symptoms of FMD. The animals were immediately isolated and treated for the disease to aid their recovery.

ProMED post: [20240615.8717053](https://www.promed.org/post/20240615.8717053)

3.3. Pool 2 (South Asia)

The Republic of India



Increasing numbers of FMD cases have been reported in Bandipora District, Jammu and Kashmir, India. In addition to treatment for the affected animals, a vaccination campaign is being planned in the locality to help curb the spread of the disease.

ProMED post: [20240529.8716757](https://www.promed.com/post/20240529.8716757)

FMD is reported to have killed many sheep in Pulwama district, Jammu and Kashmir, India. Officials were dispatched to the area where they vaccinated animals and advised on preventative measures to take.

ProMED post: [20240520.8716616](https://www.promed.com/post/20240520.8716616)

3.4. Pool 3 (West Eurasia and Near East)

Armenia



A quadrivalent FMD vaccine (O, A and Asia 1 serotypes) has been used to vaccinate almost 25,000 animals, while over 850,000 animals have been vaccinated using FMD vaccine that contained antigens for four serotypes (O, A, Asia 1 and SAT 2).

The 2024 seromonitoring survey was started following the spring vaccination campaign with the collection of 4,400 samples. Passive and active surveillance for FMD is also in place in Armenia.

[EuFMD FAST Report](#)

The Republic of Azerbaijan



During the period between March to June, in excess of 1.6 million cattle and 3.8 million small ruminants were vaccinated. Active and passive surveillance is in place to monitor for outbreaks of FMD.

[EuFMD FAST Report](#)

Georgia



Animals with clinical signs suggestive of FMD were discovered in Znaursky District of South Ossetia in April 2024. Subsequent testing confirmed the diagnosis. Measures were immediately put in place to contain and prevent the further spread of the virus.

ProMED post: [20240423.8716107](https://www.promed.com/post/20240423.8716107)

Over 325,000 large and small ruminants have been vaccinated during this quarter. Passive surveillance for FMD is in place, with active surveillance not yet started.

[EuFMD FAST Report](#)

The Islamic Republic of Iran



At the beginning of April it was announced that FMD had been detected in wild goats in Bemo National Park. As a result, visits to the park have been suspended.

ProMED post: [20240408.8715766](https://www.promed.org/post/20240408.8715766)

The Republic of Iraq



A total of 28 outbreaks of FMD affecting cattle and buffalo across 6 governates were reported this quarter. A vaccination campaign is planned to start in August - 5 million doses have been purchased for small ruminants and 2 million doses for cattle and buffalo [cattle will receive 2 doses separated by 6 months).

[EuFMD FAST Report](#)

The Hashemite Kingdom of Jordan



Passive surveillance for FMD is occurring and syndromic surveillance is being established. A vaccination campaign is in progress, with 130,000 large ruminants and more than 26,000 small ruminants vaccinated so far.

[EuFMD FAST Report](#)

The Islamic Republic of Pakistan



Hundreds of animals have died in the South Waziristan district of Khyber Pakhtunkhwa in outbreaks of FMD and Peste des petits ruminants.

ProMED post: [20240405.8715807](https://www.promed.org/post/20240405.8715807)

Türkiye



On 9 May 2024 a single **FMD type O** sequence was received from Şap Enstitüsü. The sample had been taken in April 2024 from the Mamras Border Patrol Cross border to Iraq in Hakkari. Genotyping revealed that it belonged to the O/ME-SA/PanAsia-2^{ANT-10} lineage (see below).

In this quarter, 72 new outbreaks were detected, all due to serotype SAT 2. Additionally serotype O has been identified in illegally imported animals caught at a quarantine point where investigations showed no further spread (see above). Previously established Risk Based Surveillance in the Thrace region and clinical surveillance in the buffer zone along the Southeastern and Eastern borders of Anatolia continue to monitor for FMD outbreaks. Two animal movement checkpoints were set up to monitor animal movements and compliance with regulations. Randomly sampled animals at these points were also sero-tested for FMD by ELISA testing. The Spring vaccination campaign was completed for small ruminants (Thrace only) and large ruminants with a tetravalent vaccine (O, A, Asia 1 and SAT 2 serotypes).

[EuFMD FAST Report](#)

3.5. Pool 4 (North and Eastern Africa)

The Arab Republic of Egypt



A total of 6 outbreaks of FMD were reported this quarter, all of which were type as A/AFICA/G-IV.

Extensive clinical surveillance has been undertaken in villages and animal markets

More than 2.6 million animals have been vaccinated during this period.

[EuFMD FAST Report](#)

The Federal Democratic Republic of Ethiopia



On 20th March 2024, a batch of 112 samples was received to the WRLFMD. The samples had been collected from various locations across Ethiopia between May 2022 and April 2024. They were identified as **FMD SAT 2** (n=43) and FMDV-GD (genome detected) (n=38). *Sequencing subsequently revealed that 5 of these 38 samples were **FMD type O**.* Sequencing characterized the type O viruses as O/EA-3 topotype, while 41 of the SAT 2 viruses were characterised as SAT 2/XIV topotype and the remaining SAT 2 viruses typed as SAT 2/VII/Alx-12 (see below).

The State of Libya



On 12 April 2024, a single FMD type O sequence was received from IZSLER. The sample was collected in February 2024 and genotyping revealed that it belonged to the O/EA-3 topotype (see below).

Passive surveillance for FMD is occurring in Libya

[EuFMD FAST Report](#)

The Republic of Uganda



On 19 March 2024, a batch of 50 samples was received by WRLFMD, they had been collected from various locations across Uganda between October 2023 and February 2024. The samples were identified as **FMD type O** (n=18. *Seven of these were identified as type O by sequencing and were originally reported as FMDV-GD*), **FMD type SAT 1** (n=2), **FMD SAT 1** (n=2) and FMDV-GD (genome detected) (n=9) and remaining samples had no detectable virus. Sequencing results characterised these viruses



as belonging to the O/EA-2 and SAT 1/VII topotypes (see below).

On 28 March 2024 two **FMD type O** VP1 sequences were received from BVI. Both were from samples collected in 2024 with genotyping revealing that they both belonged to O/EA-2 topotype (see below).

3.6. Pool 5 (West/Central Africa)

No new outbreaks of FMD were reported in West or Central Africa.

3.7. Pool 6 (Southern Africa)

The Republic of Mozambique	
	The two FMD outbreaks in Mozambique (one FMD type SAT 2 and the other untyped) were declared resolved in reports released in late April. WOAH World Animal Health Information System (event IDs: 3279 & 4566)
The Republic of South Africa	
	On 2 May 2024, 70 cases of FMD type SAT 3 were reported via WAHIS from Eastern Cape province. By late June the number of cases identified had risen to 127 (with no deaths reported). The on-going SAT 3 event in Free State Province recorded no new outbreaks, though a number of cattle were slaughtered/killed for commercial use. The on-going outbreak of FMD type SAT 2 in Kwazulu-Natal province recorded 80 new cases in reports through this quarter. WOAH World Animal Health Information System (event IDs: 3738, 4368 & 5658)

3.8. Pool 7 (South America)

No new outbreaks of FMD were reported in South America.

3.9. Extent of global surveillance

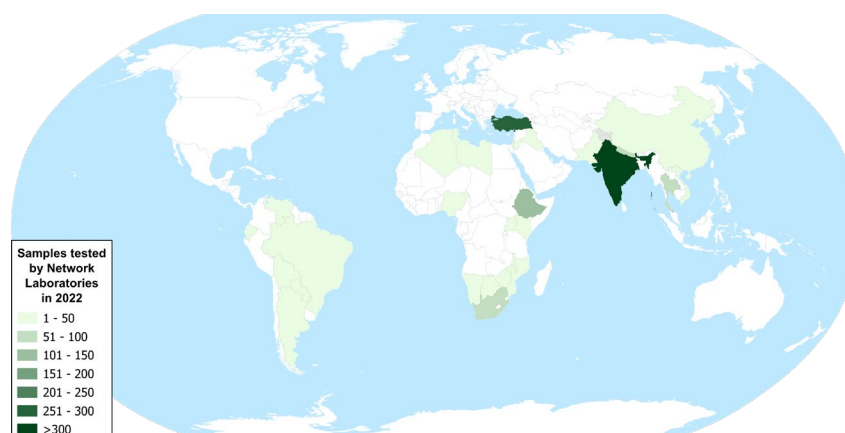


Figure 3: Samples received during 2023 from FMD outbreaks (routine surveillance that is undertaken in countries that are FMD-free without vaccination is not shown). Data (updated where appropriate) from presentations given at the WOA/FAO FMD reference laboratory network annual meeting (<https://www.foot-and-mouth.org/Ref-Lab-Network/Network-Annual-Meeting>).

Source: WRLFMD. Map conforms to the United Nations World map, June 2020.

In regions where FMD is endemic, continuous evolution of the virus generates geographically discrete lineages that are genetically distinct from FMD viruses found elsewhere. This report displays how different FMD lineages circulate in different regions; these analyses accommodate the latest epidemiological intelligence to assess the relative importance of the viral strains circulating within each region (see Table 1, below).

Table 1: Proposed changes to the conjectured relative prevalence of circulating FMD viral lineages in each Pool.

Lineage	Southeast/ Central / East Asia [Pool 1]	South Asia [Pool 2]	West Eurasia & Near East [Pool 3]	North Africa	Eastern Africa [Pool 4]	West / Central Africa [Pool 5]	Southern Africa [Pool 6]	South America [Pool 7]
O ME-SA PanAsia-2			30					
O ME-SA PanAsia	10							
O SEA Mya-98	21.5							
O ME-SA Ind2001	40	76 ¹	5.5 ¹	0				
O EA or O WA			1.5	60	53.5	69	16	
O EURO-SA								90
O CATHAY	10.5							
A ASIA Sea-97	18							
A ASIA Iran-05	0		28					
A ASIA G-VII		20	5					
A AFRICA				30	17	15		
A EURO-SA								10
Asia1	0	4	10					
SAT 1			1	0	15	1	16	
SAT 2			19	10	14	15	52	
SAT 3					0.5		16	
C								

¹ Includes cases due to the emerging O/ME-SA/SA-18 lineage that has been recently detected in Pools 2 and 3.

Note: For each of the regions, data represent the relative importance of each viral lineage (prevalence score estimated as a percentage [percent] of total FMD cases that occur in domesticated hosts). These scores (reviewed at the WOA/FAO FMD reference laboratory network meeting in October 2023) can be used to inform the PRAGMATIST tool (see Annex 3). Recent changes to increase risks are shown in **red**, while a reduction in risk is shown in **green**. NB: In response to the FMD cases due to SAT2/XIV, risks in Pool 3 were reviewed and revised in April 2023.

A number of outbreaks have occurred where samples have not been sent to the WRLFMD or other laboratories in the WOA/FAO FMD Laboratory Network. An up-to-date list and reports of FMD viruses characterised by sequencing can be found at the following website: <http://www.wrlfmd.org/country-reports/country-reports-2024>.

Results from samples or sequences received at WRLFMD (status of samples being tested) are shown in Table 2 and a complete list of clinical sample diagnostics made by the WRLFMD from April - June 2024 is shown in Annex 1: (Summary of submissions). A record of all samples received by WRLFMD is shown in Annex 1: (Clinical samples).

Table 2: Status of sequencing of samples or sequences received by the WRLFMD from April - June 2024.

WRLFMD Batch No.	Date received	Country	Total No. samples	Serotype	No. of samples	No. of sequences	Sequencing status
WRLFMD/2024/000004	19/03/2024	Uganda	50	O	11	11	Finished
				SAT 1	2	2	
				FMDV GD	16	7 (O)	
				NVD	21	0	
WRLFMD/2024/000005	20/03/2024	Ethiopia	112	SAT 2	43	44	Finished
				FMDV GD	38	6(O)	
				NGD	31	31	
Totals			162		162	101	

Table 3: VP1 sequences submitted by other FMD laboratories to the WRLFMD from April - June 2024.

WRLFMD Batch No.	Date received	Country	Serotype	Date Collected	No. of sequences	Submitting laboratory
WRLMEG/2024/000004	28/03/2024	Uganda	O	2024	1	BVI
WRLMEG/2024/000005	28/03/2024	Uganda	O	2024	1	BVI
WRLMEG/2024/000006	12/04/2024	Libya	O	2024	1	IZSLER
WRLMEG/2024/000007	09/05/2024	Türkiye	O	2024	1	Şap Enstitüsü
Total					4	

4. Detailed analysis

4.1. Pool 1 (Southeast Asia/Central Asia/East Asia)

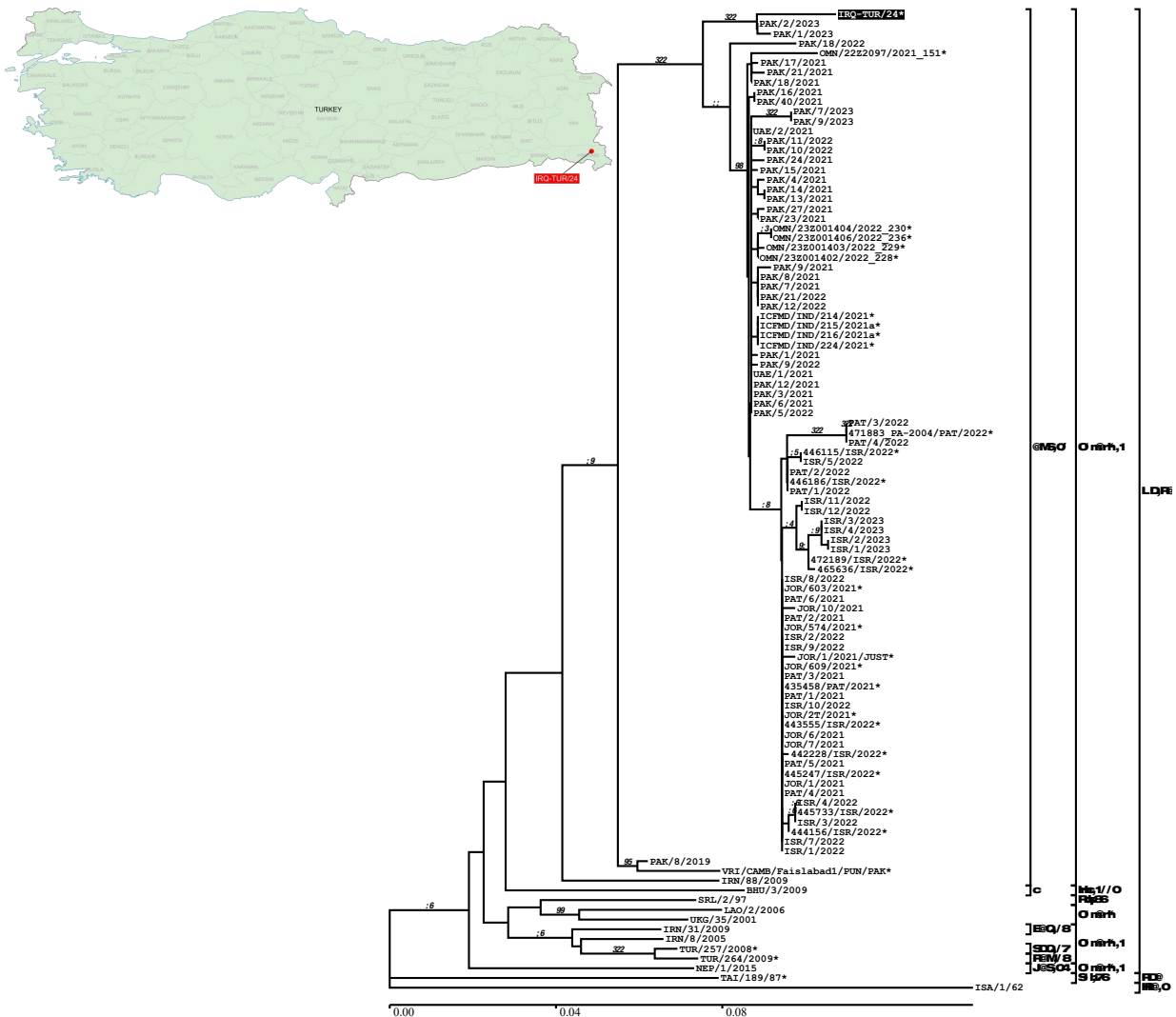
No samples/sequences received.

4.2. Pool 2 (South Asia)

No samples/sequences received.

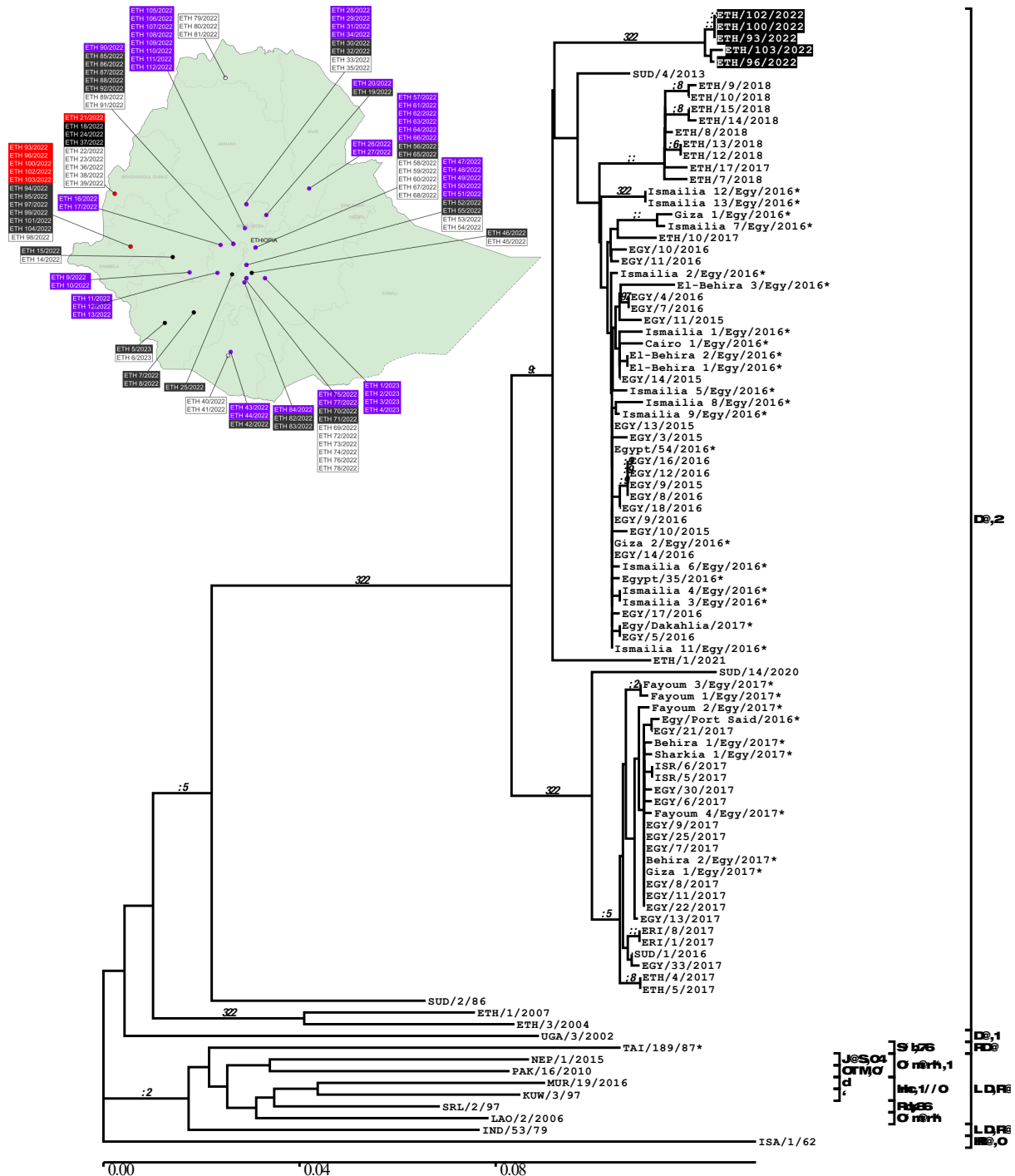
4.3. Pool 3 (West Eurasia and Near East)

The Republic of Türkiye	
Batch:	WRLMEG/2024/000007
Samples/sequences provided by:	Şap Enstitüsü
Date Received:	9 May 2024
Number Of Samples:	1
O (O/ME-SA/PanAsia-2)	1



4.4. Pool 4 (North and East Africa)

The Federal Democratic Republic of Ethiopia	
Batch:	WRLFMD/2024/000005
Samples/sequences provided by:	AHI
Date Received:	20 March 2024
Number Of Samples:	112
O (O/EA-3)	6



The Federal Democratic Republic of Ethiopia

Batch: WRLFMD/2024/000005

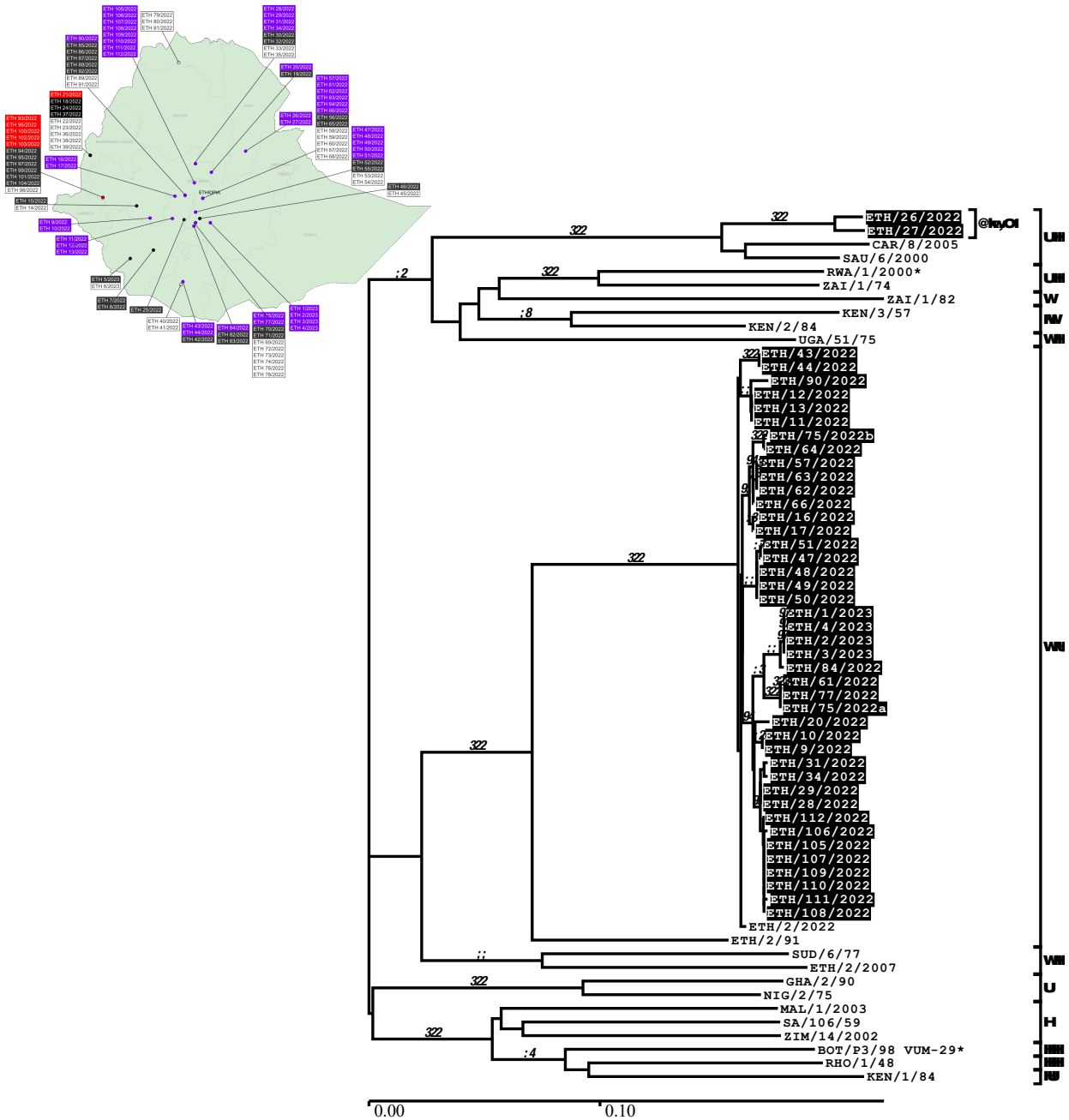
Samples/sequences provided by: AHI

Date Received: 20 March 2024

Number Of Samples: 112

SAT2 (SAT 2/VII) 2

SAT2 (SAT 2/XIV^{Alx-12}) 42



The State of Libya

Batch:

WRLMEG/2024/000006

Samples/sequences provided by:

IZSLER

Date Received:

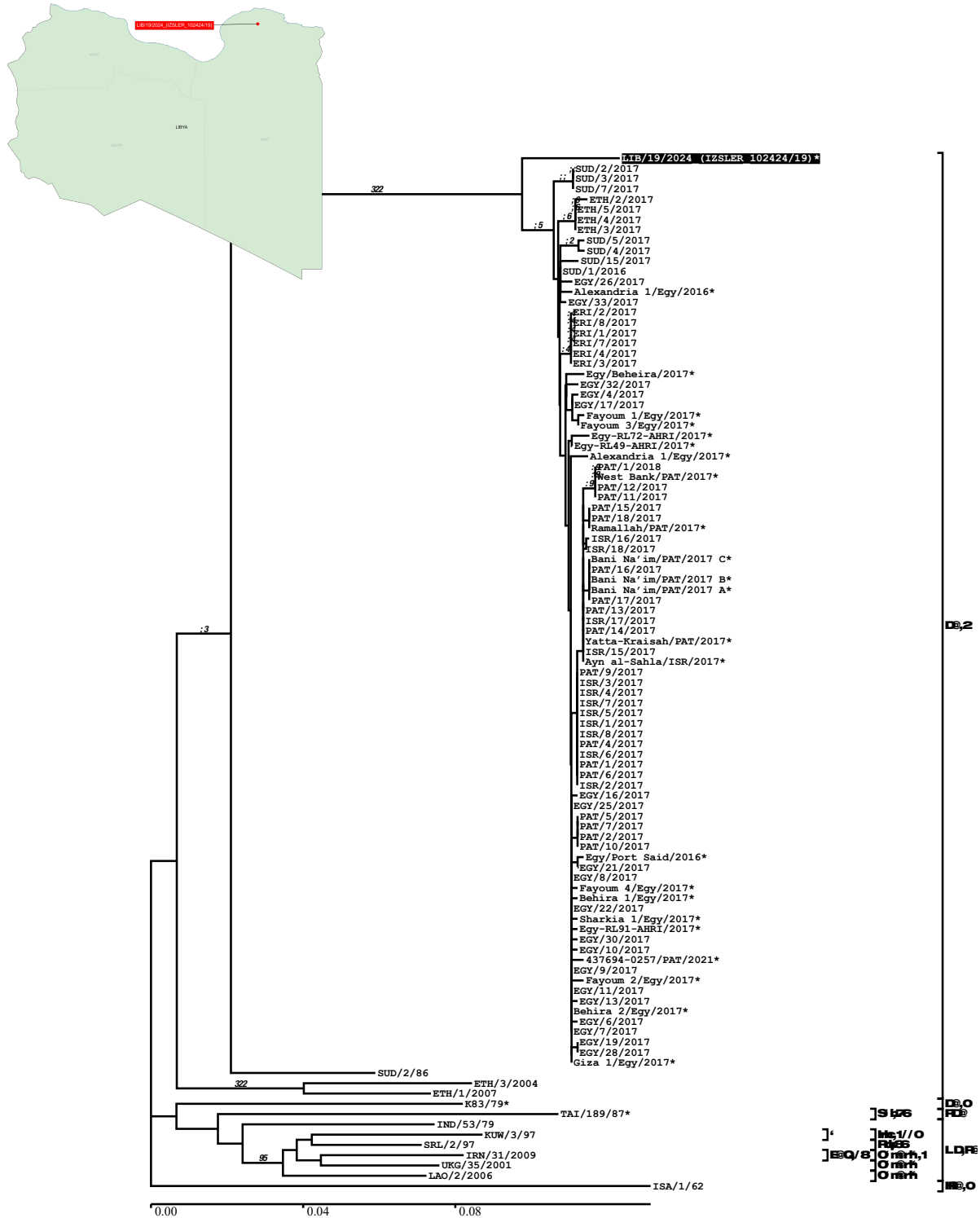
12 April 2024

Number Of Samples:

1

O (O/EA-3)

1



The Republic of Uganda

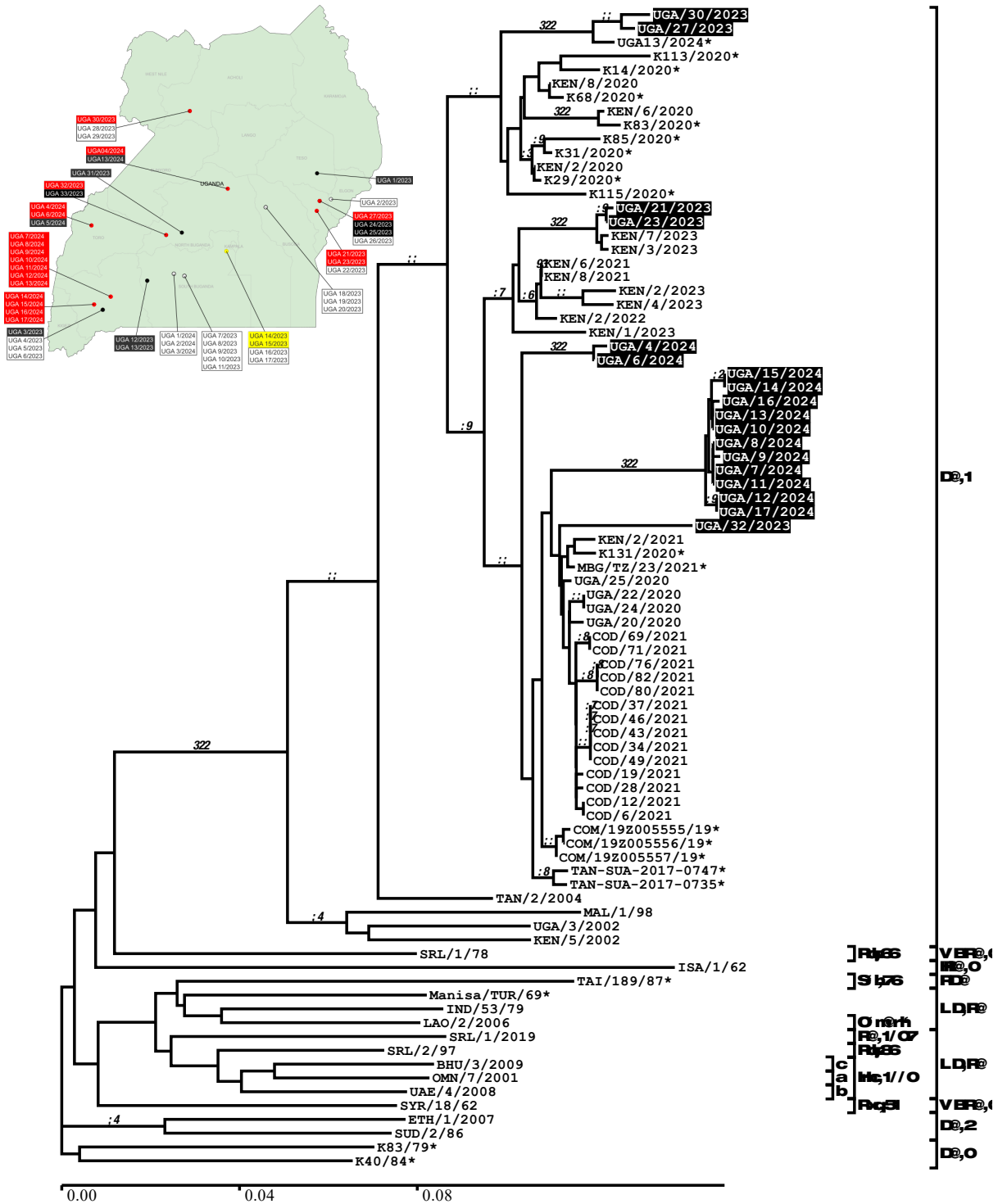
Batch: WRLFMD/2024/000004

Samples Provided by: NADDEC

Date Received: 19 March 2024

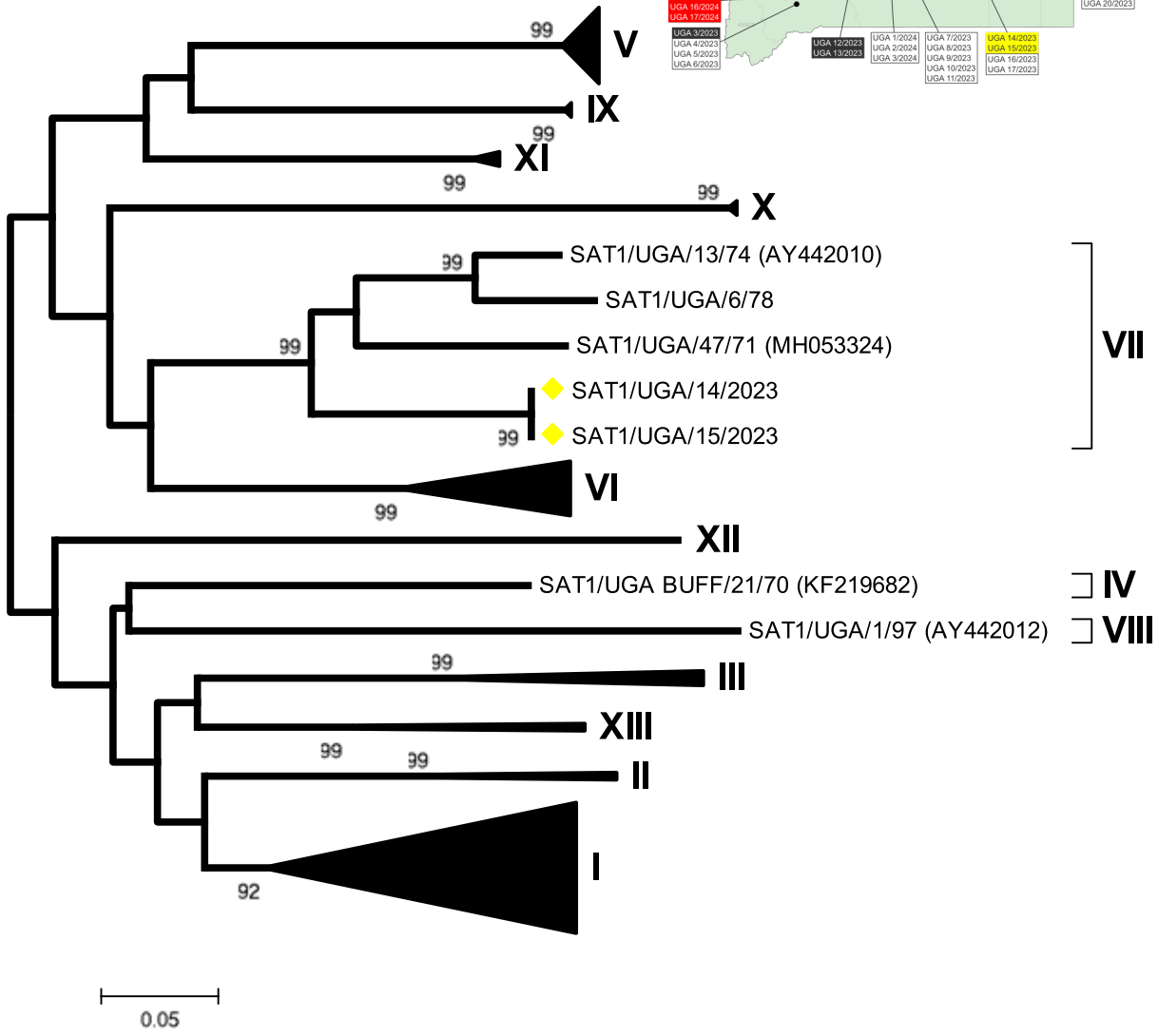
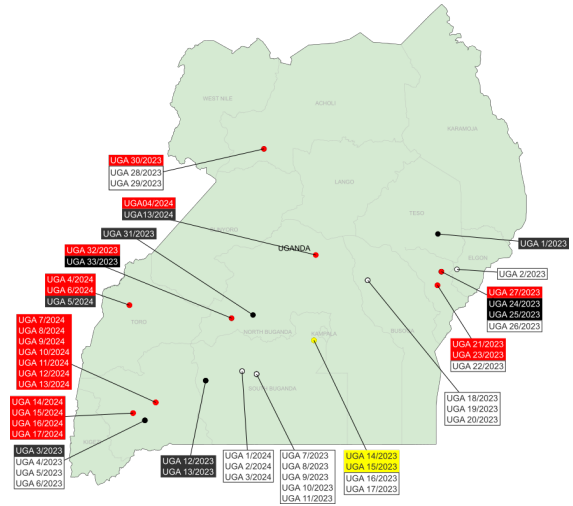
Number Of Samples: 50

O (O/EA-2) 18



The Republic of Uganda

Batch:	WRLFMD/2024/000004
Samples Provided by:	NADDEC
Date Received:	19 March 2024
Number Of Samples:	50
SAT 1 (SAT 1/VII)	2



The Republic of Uganda

Batch:

WRLMEG/2024/000004

Samples Provided by:

BVI

Date Received:

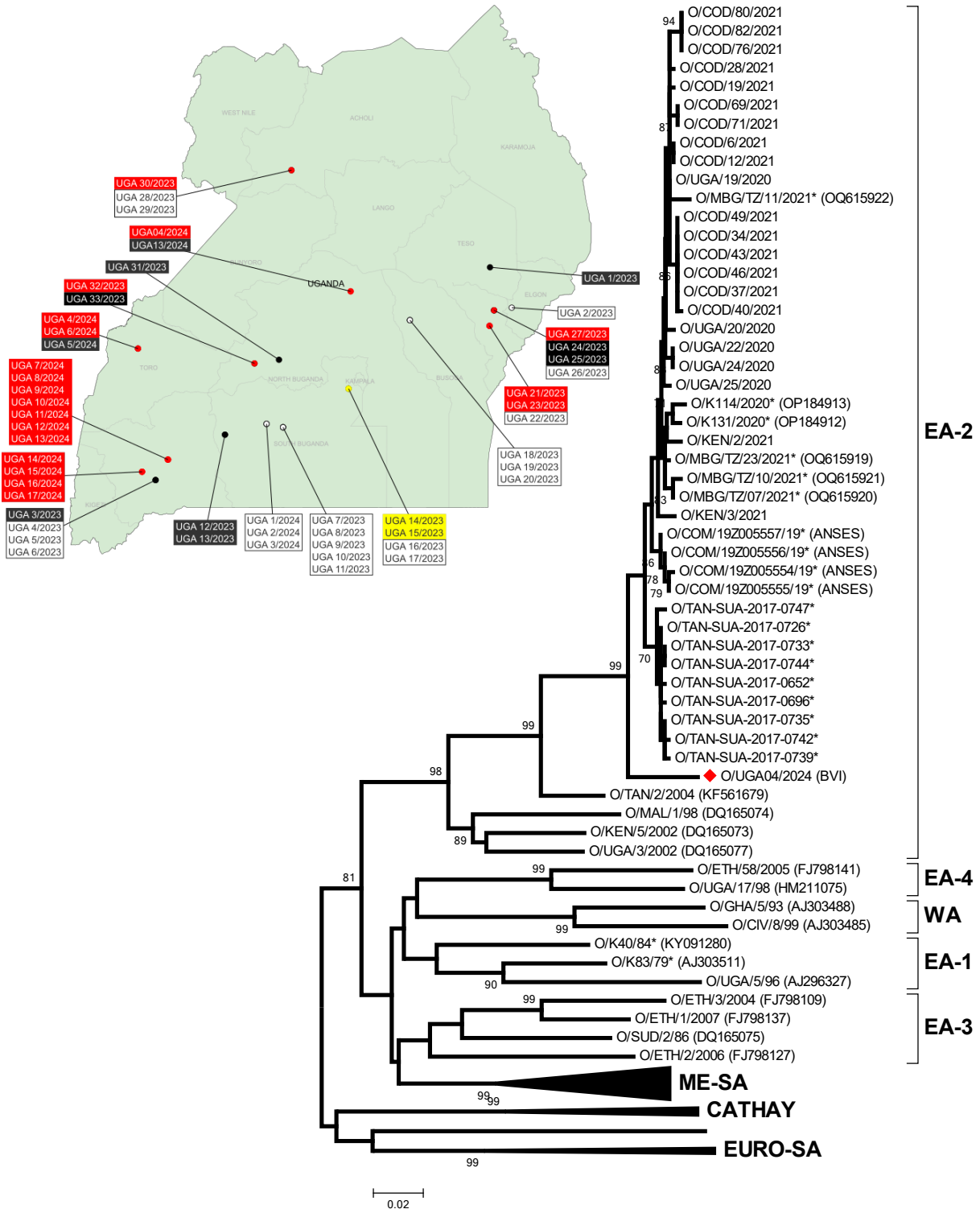
19 March 2024

Number Of Samples:

1

O (O/EA-2)

1



The Republic of Uganda

Batch:

WRLMEG/2024/000005

Samples Provided by:

BVI

Date Received:

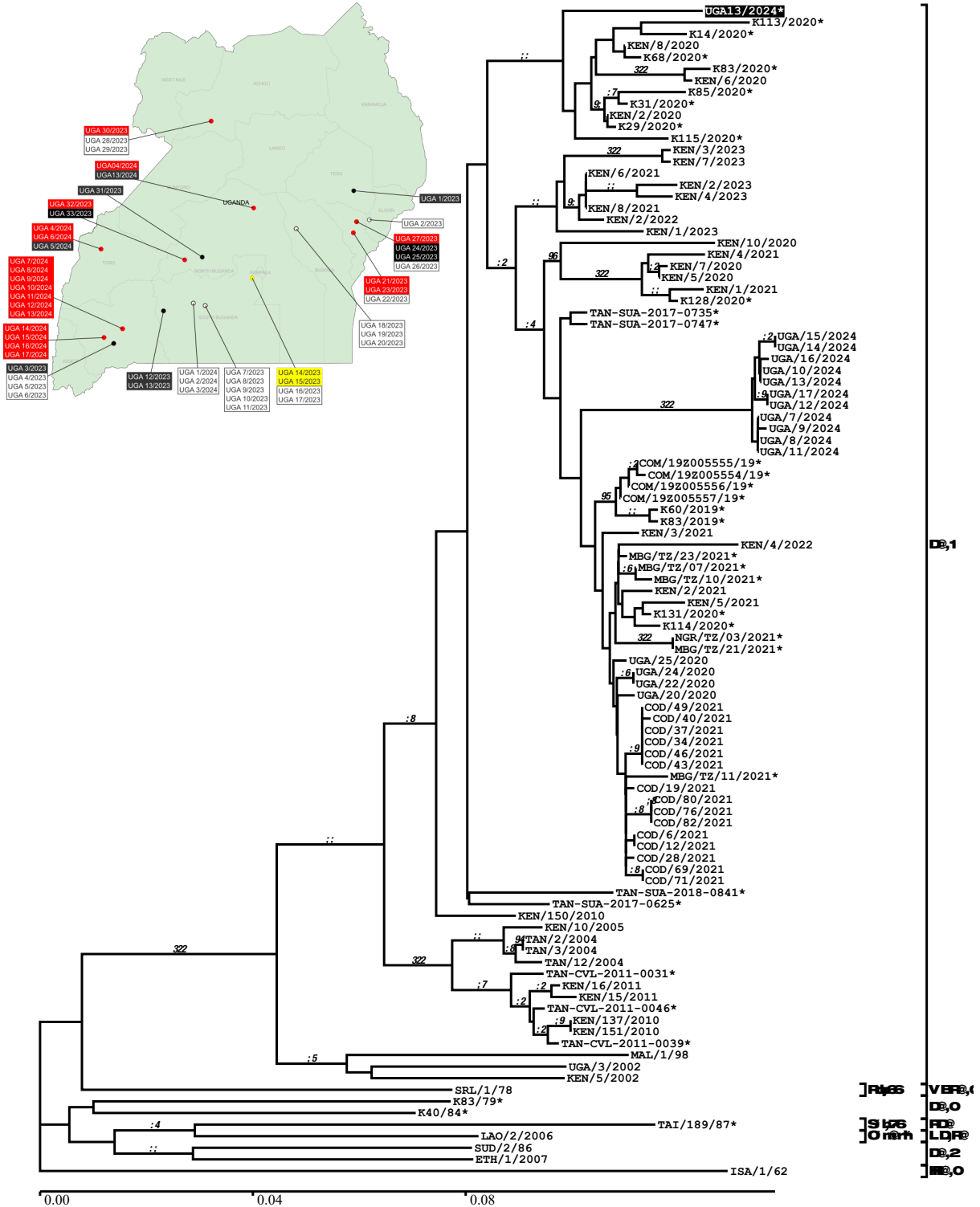
28 March 2024

Number Of Samples:

1

O (O/EA-2)

1



4.5. Pool 5 (West/Central Africa)

No samples/sequences received.

4.6. Pool 6 (Southern Africa)

No samples/sequences received.

4.7. Pool 7 (South America)

No samples/sequences received.

4.8. Vaccine matching

Antigenic characterisation of FMD field isolates by matching with vaccine strains by 2dmVNT from April - June 2024.

NOTES:

1. Vaccine efficacy is influenced by vaccine potency, antigenic match and vaccination regime. Therefore, it is possible that a less than perfect antigenic match of a particular antigen may be compensated by using a high potency vaccine and by administering more than one vaccine dose at suitable intervals. Thus, a vaccine with a weak antigenic match to a field isolate, as determined by serology, may nevertheless afford some protection if it is of sufficiently high potency and is administered under a regime to maximise host antibody responses (Brehm, 2008).
2. Vaccine matching data generated in this report only considers antibody responses in cattle after a single vaccination (typically 21 days after vaccination). The long-term performance of FMD vaccines after a second or multiple doses of vaccine should be monitored using post-vaccination serological testing.

Table 4: Summary of samples tested by vaccine matching.

Serotype	O	A	C	Asia 1	SAT 1	SAT 2	SAT 3
Argentina *	1	3					
Bolivia (Plurinational State of) *	1	1					
Brazil *		1					
Colombia *	4	1					
Ecuador *	1						
Kenya	2	2			1	2	
Malawi	2						
Namibia						2	
Nigeria	2						
Paraguay *	2						

Serotype	O	A	C	Asia 1	SAT 1	SAT 2	SAT 3
Uganda	2				2		
Uruguay *		2					
Venezuela (Bolivarian Republic of) *		2					
Total	17	12	0	0	3	4	0

* Note: the samples received from South American countries are from historical, and not current, outbreaks.

Abbreviations used in tables

For each field isolate the r_1 value is shown followed by the heterologous neutralisation titre (r_1 -value / titre). The r_1 values shown below, represent the one-way serological match between vaccine strain and field isolate, calculated from the comparative reactivity of antisera raised against the vaccine in question. Heterologous neutralisation titres for vaccine sera with the field isolates are included as an indicator of cross-protection.

M	<p>Vaccine Match</p> <p>$r_1 = \geq 0.3$ - suggests that there is a close antigenic relationship between field isolate and vaccine strain. A potent vaccine containing the vaccine strain is likely to confer protection.</p>
N	<p>No Vaccine Match</p> <p>$r_1 = < 0.3$ - suggest that the field isolate is antigenically different to the vaccine strain. Where there is no alternative, the use of this vaccine should carefully consider vaccine potency, the possibility to use additional booster doses and monitoring of vaccinated animals for heterologous responses.</p>
NT	<p>Not tested against this vaccine</p>

NOTE: A "0" in the neutralisation columns indicates that for that particular field virus no neutralisation was observed at a virus dose of a 100 TCID₅₀.

NOTE: This report includes the source of the vaccine virus and bovine vaccinal serum. Vaccines from different manufactures may perform differently and caution should be taken when comparing the data.

Table 5: Vaccine matching studies for O FMDV

Serotype O			O 3039 Boehringer Ingelheim		O Campos Boehringer Ingelheim		O ₁ Campos Biogénesis Bagó		O Manisa Boehringer Ingelheim		PanAsia 2 Boehringer Ingelheim		O/TUR/5/09 MSD	
Isolate	Topotype	Lineage	r ₁	titre	r ₁	titre	r ₁	titre	r ₁	titre	r ₁	titre	r ₁	titre
MAL 1/2022	EA-2	-	0.82	2.01	0.50	2.17	0.66	2.75	0.66	2.24	0.54	2.20	1.00	2.26
MAL 2/2022	EA-2	-	0.58	1.85	0.43	2.11	0.71	2.78	0.53	2.15	0.38	2.05	0.95	2.21
KEN 5/2023	EA-2	-	0.88	1.95	0.44	2.10	0.57	2.65	0.65	2.20	0.78	2.32	0.98	2.22
KEN 7/2023	EA-2	-	0.79	1.90	0.33	1.97	0.31	2.38	0.49	2.08	0.42	2.05	0.77	2.12
UGA 8/2024	EA-2	-	0.70	1.88	0.24	1.87	0.42	2.35	0.48	2.24	0.26	1.99	0.82	2.12
UGA 14/2024	EA-2	-	0.70	1.88	0.24	1.87	0.45	2.38	0.80	2.46	0.28	2.02	0.83	2.12
NIG 2/2023	EA-3	-	0.33	1.74	0.34	1.91	0.58	2.46	0.36	1.93	0.34	1.89	0.70	2.09
NIG 7/2023	EA-3	-	0.44	1.86	0.32	1.88	0.53	2.42	0.36	1.93	0.48	2.05	0.65	2.06
ARG 4/2000	EURO-SA	-	0.80	1.90	0.22	1.94	0.18	2.14	0.63	2.30	0.18	1.79	0.78	2.25
BOL 1/1997	EURO-SA	-	0.20	1.43	0.20	1.90	0.12	1.96	0.18	1.75	0.10	1.51	0.40	1.96
COL 1/1983	EURO-SA	-	0.99	2.00	0.38	2.17	0.62	2.55	0.70	2.35	0.31	2.03	0.74	2.23
COL 1/1997	EURO-SA	-	0.76	1.88	0.25	1.99	0.50	2.36	0.42	2.13	0.24	1.92	0.63	2.16
COL 1/2017	EURO-SA	-	0.89	1.95	0.37	2.16	0.26	2.30	0.58	2.26	0.45	2.13	0.64	2.16
COL 1/2018	EURO-SA	-	0.63	1.80	0.26	2.01	0.14	2.06	0.41	2.11	0.22	1.82	0.57	2.11
ECU 1/1996	EURO-SA	-	0.55	1.74	0.17	1.81	0.26	2.29	0.31	1.99	0.17	1.70	0.34	1.88
PAR 3/2002	EURO-SA	-	0.63	1.80	0.22	1.94	0.20	2.19	0.37	2.07	0.15	1.71	0.52	2.08
PAR 4/2002	EURO-SA	-	0.71	1.85	0.24	1.97	0.25	2.28	0.48	2.18	0.25	1.92	0.60	2.13
URU 2/2000	EURO-SA	-	1.00	2.04	0.46	2.25	0.26	2.29	1.00	2.45	0.40	2.07	1.00	2.42

Table 6: Vaccine matching studies for A FMDV

Serotype A			A Eritrea 98, Boehringer Ingelheim		A GVII 2015, Boehringer Ingelheim		A Iran 05, Boehringer Ingelheim		A Malaysia 97, Boehringer Ingelheim		A Saudi 95, Boehringer Ingelheim		A/TUR/20/06, MSD Animal Health		A22 Iraq, Boehringer Ingelheim	
Isolate	Topotype	Lineage	r ₁	titre	r ₁	titre	r ₁	titre	r ₁	titre	r ₁	titre	r ₁	titre	r ₁	titre
KEN 15/2021	AFRICA	G-I	0.30	2.10	0.47	1.62	0.14	1.75	NT	-	0.22	1.83	0.12	1.47	0.25	1.84
KEN 6/2023	AFRICA	G-I	0.08	1.54	0.36	1.50	0.16	1.80	NT	-	0.08	1.41	0.06	1.15	0.33	1.96
ARG 5/2000	EURO-SA	-	0.09	1.51	0.00	0.00	0.05	1.15	0.11	1.46	0.13	1.35	0.07	1.16	0.05	1.00
ARG 8/2001	EURO-SA	-	0.27	1.97	0.43	1.57	0.05	1.35	0.22	1.84	0.00	0.00	0.00	0.00	0.07	1.39
ARG 9/2001	EURO-SA	-	0.12	1.69	0.30	1.45	0.05	1.27	0.24	1.80	0.00	0.00	0.11	1.48	0.07	1.35
BOL 2/1997	EURO-SA	-	0.16	1.77	0.23	1.08	0.10	1.50	0.24	1.84	0.17	1.48	0.17	1.57	0.08	1.24
BRA 1/1997	EURO-SA	-	0.24	2.18	0.92	1.94	0.11	1.78	0.22	1.81	0.10	1.64	0.18	1.91	0.08	1.39
COL 1/1996	EURO-SA	-	0.15	1.97	0.43	1.60	0.61	2.42	0.15	1.65	0.25	2.04	0.10	1.67	0.71	2.30
URU 2/2001	EURO-SA	-	0.14	1.70	0.45	1.57	0.04	1.29	0.17	1.73	0.12	1.48	0.21	1.64	0.05	1.28
URU 3/2001	EURO-SA	-	0.09	1.56	0.39	1.57	0.05	1.19	0.21	1.79	0.00	0.00	0.18	1.67	0.04	1.11
VEN 1/2013	EURO-SA	-	0.31	1.98	0.00	0.00	0.10	1.36	0.16	1.67	0.00	0.00	0.04	1.18	0.08	1.50
VEN 2/2013	EURO-SA	-	0.39	2.05	0.37	1.58	0.12	1.59	0.12	1.59	0.11	1.37	0.12	1.52	0.15	1.76

Table 7: Vaccine matching studies for SAT 1 FMDV

Isolate	Serotype O		SAT1 Rho 78, Boehringer Ingelheim	
	Topotype	Lineage	r ₁	titre
KEN 3/2022	I (NWZ)	-	0.30	1.72
UGA 14/2023	VII (EA-2)	-	0.33	1.78
UGA 15/2023	VII (EA-2)	-	0.33	1.77

Table 8: Vaccine matching studies for SAT 2 FMDV

Isolate	Serotype SAT 2		Eritrea 98 <i>Boehringer Ingelheim</i>		SAT2 Zim 83 <i>Boehringer Ingelheim</i>	
	Topotype	Lineage	r_1	<i>titre</i>	r_1	<i>titre</i>
NMB 1/2022	III	-	0.14	1.22	0.12	1.65
NMB 2/2022	III	-	0.12	1.16	0.11	1.63
KEN 11/2021	IV	-	0.20	1.18	0.07	1.48
KEN 6/2022	IV	-	0.24	1.26	0.18	1.91

Annex 1: Sample data

Summary of submissions

Table 9: Summary of samples collected and received to WRLFMD April - June 2024

Country	N ^o of samples	Virus isolation in cell culture/ELISA								RT-PCR for FMD	
		FMD virus serotypes							No Virus	Positive	Negative
		O	A	C	SAT 1	SAT 2	SAT 3	ASIA1			
Ethiopia	112	0	0	0	0	43	0	0	55	81	31
Uganda	50	11	0	0	2	0	0	0	37	29	21
TOTAL	162	11	0	0	2	43	0	0	92	110	52

Clinical samples

Table 10: Clinical sample diagnostics made by the WRLFMD April - June 2024

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	VI/ELISA	Results	
	Received	Reported					RT-PCR	Final report
Uganda	19 Mar 2024	01 May 2024	UGA 1/2023	Bovine	10 Nov 2023	NVD	FMDV GD	FMDV GD
			UGA 2/2023	Bovine	10 Nov 2023	NVD	NGD	NVD
			UGA 3/2023	Bovine	11 Jan 2023	NVD	FMDV GD	FMDV GD
			UGA 4/2023	Bovine	11 Jan 2023	NVD	NGD	NVD
			UGA 5/2023	Bovine	11 Jan 2023	NVD	NGD	NVD
			UGA 6/2023	Bovine	11 Jan 2023	NVD	NGD	NVD
			UGA 7/2023	Unknown	11 Jan 2023	NVD	NGD	NVD
			UGA 8/2023	Unknown	11 Jan 2023	NVD	NGD	NVD
			UGA 9/2023	Unknown	11 Jan 2023	NVD	NGD	NVD
			UGA 10/2023	Unknown	11 Jan 2023	NVD	NGD	NVD
			UGA 11/2023	Unknown	11 Jan 2023	NVD	NGD	NVD
			UGA 12/2023	Bovine	11 Feb 2023	NVD	FMDV GD	FMDV GD
			UGA 13/2023	Bovine	11 Feb 2023	NVD	FMDV GD	FMDV GD
			UGA 14/2023	Bovine	11 Mar 2023	SAT1	FMDV GD	SAT 1
			UGA 15/2023	Bovine	11 Mar 2023	SAT1	FMDV GD	SAT 1
			UGA 16/2023	Bovine	11 Mar 2023	NVD	NGD	NVD
			UGA 17/2023	Bovine	11 Mar 2023	NVD	NGD	NVD
			UGA 18/2023	Bovine	11 Mar 2023	NVD	NGD	NVD
			UGA 19/2023	Bovine	11 Mar 2023	NVD	NGD	NVD
			UGA 20/2023	Bovine	11 Mar 2023	NVD	NGD	NVD
			UGA 21/2023	Bovine	11 Oct 2023	NVD	FMDV GD	FMDV GD

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	Results		
	Received	Reported				VI/ELISA	RT-PCR	Final report
			UGA 22/2023	Bovine	11 Oct 2023	NVD	NGD	NVD
			UGA 23/2023	Bovine	11 Oct 2023	NVD	FMDV GD	FMDV GD
			UGA 24/2023	Bovine	11 Oct 2023	NVD	FMDV GD	FMDV GD
			UGA 25/2023	Bovine	11 Oct 2023	NVD	FMDV GD	FMDV GD
			UGA 26/2023	Bovine	11 Oct 2023	NVD	NGD	NVD
			UGA 27/2023	Bovine	11 Oct 2023	NVD	FMDV GD	FMDV GD
			UGA 28/2023	Bovine	11 Oct 2023	NVD	NGD	NVD
			UGA 29/2023	Bovine	11 Oct 2023	NVD	NGD	NVD
			UGA 30/2023	Bovine	11 Oct 2023	NVD	FMDV GD	FMDV GD
			UGA 31/2023	Unknown	12 Jul 2023	NVD	FMDV GD	FMDV GD
			UGA 32/2023	Bovine	12 Oct 2023	NVD	FMDV GD	FMDV GD
			UGA 33/2023	Bovine	12 Oct 2023	NVD	FMDV GD	FMDV GD
			UGA 1/2024	Bovine	01 Sep 2024	NVD	NGD	NVD
			UGA 2/2024	Bovine	01 Sep 2024	NVD	NGD	NVD
			UGA 3/2024	Bovine	01 Sep 2024	NVD	NGD	NVD
			UGA 4/2024	Bovine	17 Jan 2024	NVD	FMDV GD	FMDV GD
			UGA 5/2024	Bovine	17 Jan 2024	NVD	FMDV GD	FMDV GD
			UGA 6/2024	Bovine	17 Jan 2024	NVD	FMDV GD	FMDV GD
			UGA 7/2024	Unknown	14 Feb 2024	O	FMDV GD	O
			UGA 8/2024	Unknown	14 Feb 2024	O	FMDV GD	O
			UGA 9/2024	Unknown	14 Feb 2024	O	FMDV GD	O
			UGA 10/2024	Unknown	14 Feb 2024	O	FMDV GD	O
			UGA 11/2024	Unknown	14 Feb 2024	O	FMDV GD	O
			UGA 12/2024	Unknown	14 Feb 2024	O	FMDV GD	O
			UGA 13/2024	Unknown	14 Feb 2024	O	FMDV GD	O
			UGA 14/2024	Unknown	16 Feb 2024	O	FMDV GD	O
			UGA 15/2024	Unknown	16 Feb 2024	O	FMDV GD	O
			UGA 16/2024	Unknown	16 Feb 2024	O	FMDV GD	O
			UGA 17/2024	Unknown	16 Feb 2024	O	FMDV GD	O
			ETH 7/2022	Cattle	17 May 2022	NVD	FMDV GD	FMDV GD
			ETH 8/2022	Cattle	17 May 2022	NVD	FMDV GD	FMDV GD
			ETH 9/2022	Cattle	28 May 2022	SAT2	FMDV GD	SAT 2
			ETH 10/2022	Cattle	28 May 2022	SAT2	FMDV GD	SAT 2
			ETH 11/2022	Cattle	31 May 2022	SAT2	FMDV GD	SAT 2
			ETH 12/2022	Cattle	31 May 2022	SAT2	FMDV GD	SAT 2
			ETH 13/2022	Cattle	31 May 2022	SAT2	FMDV GD	SAT 2
			ETH 14/2022	Cattle	31 May 2022	NVD	NGD	NVD
			ETH 15/2022	Cattle	31 May 2022	NVD	FMDV GD	FMDV GD
			ETH 16/2022	Cattle	31 May 2022	SAT2	FMDV GD	SAT 2
			ETH 17/2022	Cattle	31 May 2022	SAT2	FMDV GD	SAT 2
Ethiopia	20 Mar 2024	29 May 2024						

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	Results		
	Received	Reported				VI/ELISA	RT-PCR	Final report
			ETH 18/2022	Cattle	23 Jun 2022	NVD	FMDV GD	FMDV GD
			ETH 19/2022	Cattle	07 May 2022	NVD	FMDV GD	FMDV GD
			ETH 20/2022	Cattle	07 May 2022	SAT2	FMDV GD	SAT 2
			ETH 21/2022	Cattle	07 May 2022	NVD	FMDV GD	FMDV GD
			ETH 22/2022	Cattle	16 Jul 2022	NVD	NGD	NVD
			ETH 23/2022	Cattle	17 Jul 2022	NVD	NGD	NVD
			ETH 24/2022	Cattle	17 Jul 2022	NVD	FMDV GD	FMDV GD
			ETH 25/2022	Cattle	09 May 2022	NVD	FMDV GD	FMDV GD
			ETH 26/2022	Cattle	09 Sep 2022	SAT2	FMDV GD	SAT 2
			ETH 27/2022	Cattle	09 Sep 2022	SAT2	FMDV GD	SAT 2
			ETH 28/2022	Cattle	14 Sep 2022	SAT2	FMDV GD	SAT 2
			ETH 29/2022	Cattle	14 Sep 2022	SAT2	FMDV GD	SAT 2
			ETH 30/2022	Cattle	14 Sep 2022	NVD	FMDV GD	FMDV GD
			ETH 31/2022	Cattle	14 Sep 2022	SAT2	FMDV GD	SAT 2
			ETH 32/2022	Cattle	14 Sep 2022	NVD	FMDV GD	FMDV GD
			ETH 33/2022	Cattle	14 Sep 2022	NVD	NGD	NVD
			ETH 34/2022	Cattle	14 Sep 2022	SAT2	FMDV GD	SAT 2
			ETH 35/2022	Cattle	14 Sep 2022	NVD	NGD	NVD
			ETH 36/2022	Cattle	20 Sep 2022	NVD	NGD	NVD
			ETH 37/2022	Cattle	20 Sep 2022	NVD	FMDV GD	FMDV GD
			ETH 38/2022	Cattle	20 Sep 2022	NVD	NGD	NVD
			ETH 39/2022	Cattle	20 Sep 2022	NVD	NGD	NVD
			ETH 40/2022	Cattle	10 May 2022	NVD	NGD	NVD
			ETH 41/2022	Cattle	10 May 2022	NVD	NGD	NVD
			ETH 42/2022	Cattle	10 May 2022	NVD	FMDV GD	FMDV GD
			ETH 43/2022	Cattle	10 May 2022	SAT2	FMDV GD	SAT 2
			ETH 44/2022	Cattle	10 May 2022	SAT2	FMDV GD	SAT 2
			ETH 45/2022	Cattle	15 Oct 2022	NVD	NGD	NVD
			ETH 46/2022	Cattle	15 Oct 2022	NVD	FMDV GD	FMDV GD
			ETH 47/2022	Cattle	22 Oct 2022	SAT2	FMDV GD	SAT 2
			ETH 48/2022	Cattle	22 Oct 2022	SAT2	FMDV GD	SAT 2
			ETH 49/2022	Cattle	22 Oct 2022	SAT2	FMDV GD	SAT 2
			ETH 50/2022	Cattle	22 Oct 2022	SAT2	FMDV GD	SAT 2
			ETH 51/2022	Cattle	22 Oct 2022	SAT2	FMDV GD	SAT 2
			ETH 52/2022	Cattle	22 Oct 2022	NVD	FMDV GD	FMDV GD
			ETH 53/2022	Cattle	22 Oct 2022	NVD	NGD	NVD
			ETH 54/2022	Cattle	22 Oct 2022	NVD	NGD	NVD
			ETH 55/2022	Cattle	22 Oct 2022	NVD	FMDV GD	FMDV GD
			ETH 56/2022	Cattle	22 Oct 2022	-	FMDV GD	FMDV GD
			ETH 57/2022	Cattle	22 Oct 2022	SAT2	FMDV GD	SAT 2

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	Results		
	Received	Reported				VI/ELISA	RT-PCR	Final report
			ETH 58/2022	Cattle	22 Oct 2022	-	NGD	NGD
			ETH 59/2022	Cattle	22 Oct 2022	-	NGD	NGD
			ETH 60/2022	Cattle	22 Oct 2022	-	NGD	NGD
			ETH 61/2022	Cattle	22 Oct 2022	SAT2	FMDV GD	SAT 2
			ETH 62/2022	Cattle	22 Oct 2022	SAT2	FMDV GD	SAT 2
			ETH 63/2022	Cattle	22 Oct 2022	SAT2	FMDV GD	SAT 2
			ETH 64/2022	Cattle	22 Oct 2022	SAT2	FMDV GD	SAT 2
			ETH 65/2022	Cattle	22 Oct 2022	NVD	FMDV GD	FMDV GD
			ETH 66/2022	Cattle	22 Oct 2022	SAT2	FMDV GD	SAT 2
			ETH 67/2022	Cattle	22 Oct 2022	-	NGD	NGD
			ETH 68/2022	Cattle	22 Oct 2022	-	NGD	NGD
			ETH 69/2022	Cattle	22 Oct 2022	-	NGD	NGD
			ETH 70/2022	Cattle	22 Oct 2022	NVD	FMDV GD	FMDV GD
			ETH 71/2022	Cattle	22 Oct 2022	-	FMDV GD	FMDV GD
			ETH 72/2022	Cattle	24 Oct 2022	-	NGD	NGD
			ETH 73/2022	Cattle	24 Oct 2022	-	NGD	NGD
			ETH 74/2022	Cattle	24 Oct 2022	NVD	NGD	NVD
			ETH 75/2022	Cattle	24 Oct 2022	SAT2	FMDV GD	SAT 2
			ETH 76/2022	Cattle	24 Oct 2022	NVD	NGD	NVD
			ETH 77/2022	Cattle	24 Oct 2022	SAT2	FMDV GD	SAT 2
			ETH 78/2022	Cattle	24 Oct 2022	-	NGD	NGD
			ETH 79/2022	Cattle	11 Jun 2022	NVD	NGD	NVD
			ETH 80/2022	Cattle	11 Jun 2022	NVD	NGD	NVD
			ETH 81/2022	Cattle	11 Jun 2022	NVD	NGD	NVD
			ETH 82/2022	Cattle	11 Jun 2022	NVD	FMDV GD	FMDV GD
			ETH 83/2022	Cattle	11 Jun 2022	NVD	FMDV GD	FMDV GD
			ETH 84/2022	Cattle	11 Jun 2022	SAT2	FMDV GD	SAT 2
			ETH 85/2022	Cattle	14 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 86/2022	Cattle	14 Nov 2022	-	FMDV GD	FMDV GD
			ETH 87/2022	Cattle	14 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 88/2022	Cattle	14 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 89/2022	Cattle	14 Nov 2022	NVD	NGD	NVD
			ETH 90/2022	Cattle	14 Nov 2022	SAT2	FMDV GD	SAT 2
			ETH 91/2022	Cattle	14 Nov 2022	-	NGD	NGD
			ETH 92/2022	Cattle	14 Nov 2022	-	FMDV GD	FMDV GD
			ETH 93/2022	Cattle	30 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 94/2022	Cattle	30 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 95/2022	Cattle	30 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 96/2022	Cattle	30 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 97/2022	Cattle	30 Nov 2022	NVD	FMDV GD	FMDV GD

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	Results		
	Received	Reported				VI/ELISA	RT-PCR	Final report
			ETH 98/2022	Cattle	30 Nov 2022	NVD	NGD	NGD
			ETH 99/2022	Cattle	30 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 100/2022	Cattle	30 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 101/2022	Cattle	30 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 102/2022	Cattle	30 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 103/2022	Cattle	30 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 104/2022	Cattle	30 Nov 2022	NVD	FMDV GD	FMDV GD
			ETH 105/2022	Cattle	12 Aug 2022	SAT2	FMDV GD	SAT 2
			ETH 106/2022	Cattle	12 Aug 2022	SAT2	FMDV GD	SAT 2
			ETH 107/2022	Cattle	12 Aug 2022	SAT2	FMDV GD	SAT 2
			ETH 108/2022	Cattle	12 Aug 2022	SAT2	FMDV GD	SAT 2
			ETH 109/2022	Cattle	12 Aug 2022	SAT2	FMDV GD	SAT 2
			ETH 110/2022	Cattle	12 Aug 2022	SAT2	FMDV GD	SAT 2
			ETH 111/2022	Cattle	12 Aug 2022	SAT2	FMDV GD	SAT 2
			ETH 112/2022	Cattle	12 Aug 2022	SAT2	FMDV GD	SAT 2
			ETH 1/2023	Cattle	01 Jan 2023	SAT2	FMDV GD	SAT 2
			ETH 2/2023	Cattle	01 Jan 2023	SAT2	FMDV GD	SAT 2
			ETH 3/2023	Cattle	01 Jan 2023	SAT2	FMDV GD	SAT 2
			ETH 4/2023	Cattle	01 Jan 2023	SAT2	FMDV GD	SAT 2
			ETH 5/2023	Cattle	22 Nov 2023	NVD	FMDV GD	FMDV GD
			ETH 6/2023	Cattle	22 Nov 2023	NVD	NGD	NGD
TOTAL			162					

Annex 2: FMD publications

Recent FMD Publications April - June 2024 cited by Web of Science.

1. Afroz, A., A.K. Verma, A. Kumar, S. Upadhyay, and A. Singh (2024). Detection of antibodies against structural proteins of *Foot-and-mouth disease virus* in bovines of western Uttar India. *Veterinary Research Forum*, **15**(5): 5. DOI: [10.30466/vrf.2024.2014839.4057](https://doi.org/10.30466/vrf.2024.2014839.4057).
2. Anjume, H., K.A. Hossain, A. Hossain, M.A. Hossain, and M. Sultana (2024). Complete genome characterization of *Foot-and-mouth disease virus* My-466 belonging to the novel lineage O/ME-SA/SA-2018. *Heliyon*, **10**(5): 12. DOI: [10.1016/j.heliyon.2024.e26716](https://doi.org/10.1016/j.heliyon.2024.e26716).
3. Arzt, J., M.W. Sanderson, and C. Stenfeldt (2024). Foot-and-mouth disease. *Veterinary Clinics of North America-Food Animal Practice*, **40**(2): 191-203. DOI: [10.1016/j.cvfa.2024.01.001](https://doi.org/10.1016/j.cvfa.2024.01.001).
4. Attreed, S.E., C. Silva, M. Rodriguez-Calzada, A. Mogulothu, S. Abbott, P. Azzinaro, P. Canning, L. Skidmore, J. Nelson, N. Knudsen, G.N. Medina, T. de los Santos, and F.D.S. Segundo (2024). Prophylactic treatment with PEGylated bovine IFN λ 3 effectively bridges the gap in vaccine-induced immunity against FMD in cattle. *Frontiers in Microbiology*, **15**: 15. DOI: [10.3389/fmicb.2024.1360397](https://doi.org/10.3389/fmicb.2024.1360397).
5. Bandaw, T., H.F. Gebremeskel, A. Muluneh, T.S. Mengistu, and I.A. Kebede (2024). Seroprevalence and molecular detection of *Foot-and-mouth disease virus* in cattle in selected districts of Wolaita Zone, Southern Ethiopia. *Scientific Reports*, **14**(1): 12. DOI: [10.1038/s41598-024-57404-4](https://doi.org/10.1038/s41598-024-57404-4).
6. Calderón, L.C.L., G.S. Cabanne, A. Marcos, S.G. Novo, C. Torres, A.M. Perez, O.G. Pybus, and G.A. König (2024). Phylodynamic analysis of *Foot-and-mouth disease virus* evolution in Mar Chiquita, Argentina. *Archives of Virology*, **169**(5): 10. DOI: [10.1007/s00705-024-06028-0](https://doi.org/10.1007/s00705-024-06028-0).
7. Deka, P., S. Das, R. Hazarika, R. Kayaga, B. Dutta, A. Deka, U. Barman, R. Ahmed, N. Islam, M. Sarma, I. Deka, M. Rout, K. Sharma, and R.K. Sharma (2024). Foot-and-mouth disease-associated myocarditis is age dependent in suckling calves. *Scientific Reports*, **14**(1): 7. DOI: [10.1038/s41598-024-59324-9](https://doi.org/10.1038/s41598-024-59324-9).
8. Dung, T.T.N., N.T.Y. Chi, D.V. Quang, N.T. Cong, T.N.H. Lai, and V.P. Le (2024). Effective *Foot-and-mouth disease virus* control using silver nanoparticles. *Chemistryselect*, **9**(20): 7. DOI: [10.1002/slct.202400143](https://doi.org/10.1002/slct.202400143).
9. Guessoum, M., M. Adnane, R. Baazizi, and M.S. Derguini (2024). Spatial and temporal distribution of foot-and-mouth disease outbreaks in Algeria from 2014 to 2022. *Veterinary World*, **17**(3): 509-517. DOI: [10.14202/vetworld.2024.509-517](https://doi.org/10.14202/vetworld.2024.509-517).
10. Humphries, B. and M. Ward (2024). Critically appraised topic: the use of vaccination to control the spread of foot-and-mouth disease in Australian livestock in the event of an incursion. *Australian Veterinary Journal*: 9. DOI: [10.1111/avj.13340](https://doi.org/10.1111/avj.13340).
11. Jiao, J. and P. Wu (2024). A meta-analysis on the potency of foot-and-mouth disease vaccines in different animal models. *Scientific Reports*, **14**(1): 7. DOI: [10.1038/s41598-024-59755-4](https://doi.org/10.1038/s41598-024-59755-4).
12. Jin, J.S., G. Lee, J.Y. Kim, S.H. Lee, J.H. Park, S.Y. Park, and Y.J. Ko (2024). Calcium chloride as a novel stabilizer for *Foot-and-mouth disease virus* and its application in the vaccine formulation. *Vaccines*, **12**(4): 11. DOI: [10.3390/vaccines12040367](https://doi.org/10.3390/vaccines12040367).
13. Kabir, A., A.A. Kamboh, M. Abubakar, A.M. Matar, and K. Kumar (2024). Foot-and-mouth disease seroprevalence is higher in young female crossbred sheep and goats compared to their counterparts in the border area between Pakistan and Afghanistan. *American Journal of Veterinary Research*, **85**(6): 9. DOI: [10.2460/ajvr.23.12.0279](https://doi.org/10.2460/ajvr.23.12.0279).
14. Kim, J., D. Kim, H. Noh, L.G. Hong, E. Chun, E. Kim, Y. Ro, and W. Choi (2024). Analysis of acute phase response using acute phase proteins following simultaneous vaccination of lumpy skin disease and foot-and-mouth disease. *Vaccines*, **12**(5): 8. DOI: [10.3390/vaccines12050556](https://doi.org/10.3390/vaccines12050556).

15. Kim, S.W., S.H. Lee, H. Kim, S.H. Shin, S.H. Park, J.H. Park, J. Kim, and C.K. Park (2024). Evaluation of swine protection with three commercial foot-and-mouth disease vaccines against heterologous challenge with type A ASIA/G-VII lineage viruses. *Vaccines*, **12**(5): 13. DOI: [10.3390/vaccines12050476](https://doi.org/10.3390/vaccines12050476).
16. Lee, G., A. Kim, H.R. Kang, J.H. Hwang, J.H. Park, M.J. Lee, B. Kim, and S.M. Kim (2024). Porcine interferon- α linked to the porcine IgG-Fc induces prolonged and broad-spectrum antiviral effects against *Foot-and-mouth disease virus*. *Antiviral Research*, **223**: 11. DOI: [10.1016/j.antiviral.2024.105836](https://doi.org/10.1016/j.antiviral.2024.105836).
17. Li, Q., X.S. Ma, Y.E. Shen, J.F. Dai, X.F. Nian, X.F. Shang, J. Chen, A.K. Wubshet, J. Zhang, and H.X. Zheng (2024). Chimeric porcine parvovirus VP2 virus-like particles with epitopes of South African serotype 2 *Foot-and-mouth disease virus* elicits specific humoral and cellular responses in mice. *Viruses-Basel*, **16**(4): 18. DOI: [10.3390/v16040621](https://doi.org/10.3390/v16040621).
18. Li, Y.X., R. Yang, F. Yin, H.S. Zhang, G.Y. Zhai, S.Q. Sun, B. Tian, and Q.Y. Zeng (2024). Correlation between 146S antigen content in foot-and-mouth disease inactivated vaccines and immunogenicity level and vaccine potency alternative test methods. *Veterinary Sciences*, **11**(4): 14. DOI: [10.3390/vetsci11040168](https://doi.org/10.3390/vetsci11040168).
19. Litz, B., J. Sehl-Ewert, A. Breithaupt, A. Landmesser, F. Pfaff, A. Romey, S. Blaise-Boisseau, M. Beer, and M. Eschbaumer (2024). Leaderless *Foot-and-mouth disease virus* serotype O did not cause clinical disease and failed to establish a persistent infection in cattle. *Emerging Microbes & Infections*, **13**(1): 13. DOI: [10.1080/22221751.2024.2348526](https://doi.org/10.1080/22221751.2024.2348526).
20. Mushtaq, H., S.S. Shah, Y. Zarlashat, M. Iqbal, and W. Abbas (2024). Cell culture adaptive amino acid substitutions in FMDV structural proteins: a key mechanism for altered receptor tropism. *Viruses-Basel*, **16**(4): 17. DOI: [10.3390/v16040512](https://doi.org/10.3390/v16040512).
21. Robi, D.T., A. Bogale, S. Temteme, M. Aleme, and B. Urge (2024). Adoption of veterinary vaccines, determining factors, and barriers in Southwest Ethiopia: Implications for livestock health and disease management strategies. *Preventive Veterinary Medicine*, **225**: 11. DOI: [10.1016/j.prevetmed.2024.106143](https://doi.org/10.1016/j.prevetmed.2024.106143).
22. Romli, H.F., A. Suryanto, and I. Darti (2023). Dynamics of foot-and-mouth disease spread model for cattle with carrier, vaccination, and environmental transmission. *Communications in Mathematical Biology and Neuroscience*: 17. DOI: [10.28919/cmbn/8207](https://doi.org/10.28919/cmbn/8207).
23. Ryoo, S., H.Y.J. Kang, D. Lim, J.M. Kim, Y. Won, J.Y. Kim, D.P. King, A. Di Nardo, and S.H. Cha (2024). Re-emergence of foot-and-mouth disease in the Republic of Korea caused by the O/ME-SA/Ind-2001e lineage. *Frontiers in Veterinary Science*, **11**: 8. DOI: [10.3389/fvets.2024.1378769](https://doi.org/10.3389/fvets.2024.1378769).
24. Sayee, R.H., M. Hosamani, N. Krishnaswamy, S. Shanmuganathan, M.S.S. Charan, G. Sheshagiri, V. Gairola, S.H. Basagoudanavar, B.P. Sreenivasa, and V. Bhanuprakash (2024). Monoclonal antibody based solid phase competition ELISA to detect FMDV serotype A specific antibodies. *Journal of Virological Methods*, **328**: 8. DOI: [10.1016/j.jviromet.2024.114959](https://doi.org/10.1016/j.jviromet.2024.114959).
25. Shao, J.J., W. Liu, S.D. Gao, H.Y. Chang, and H.C. Guo (2024). A recombinant multi-epitope trivalent vaccine for *Foot-and-mouth disease virus* serotype O in pigs. *Virology*, **596**: 9. DOI: [10.1016/j.virol.2024.110103](https://doi.org/10.1016/j.virol.2024.110103).
26. Sirdar, M.M., G.T. Fosgate, B. Blignaut, L. Heath, D.D. Lazarus, R.L. Mampane, O.B. Rikhotso, B. Du Plessis, and B. Gummow (2024). A comparison of risk factor investigation and experts' opinion elicitation analysis for identifying foot-and-mouth disease (FMD) high-risk areas within the FMD zone of South Africa (2007-2016). *Preventive Veterinary Medicine*, **226**: 14. DOI: [10.1016/j.prevetmed.2024.106192](https://doi.org/10.1016/j.prevetmed.2024.106192).
27. Sulistyaningrum, E., H. Wibawa, and M.H. Wibowo (2024). Identification and molecular characterization of *Foot-and-mouth disease virus* based on VP1 gene fragments in Madura cattle and Ongole Grade cattle. *Tropical Animal Science Journal*, **47**(2): 170-179. DOI: [10.5398/tasj.2024.47.2.170](https://doi.org/10.5398/tasj.2024.47.2.170).

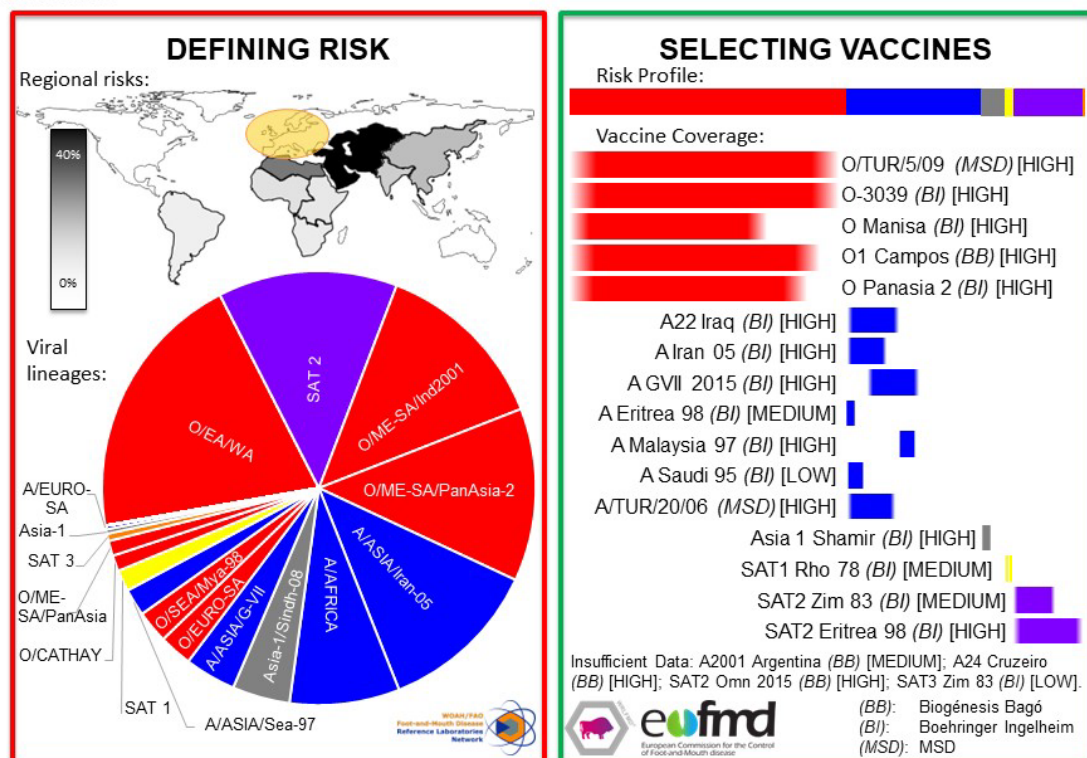
28. Tobing, T.M., F.A. Rantam, T.V. Widiyatno, M.R. Tacharina, J. Rahmahani, N. Triakoso, S. Kuncorojakti, H. Puspitasari, H. Susilowati, D. Diyantoro, F. Azzahra, Y. Kurniawan, A. Aswin, and E.B. Susila (2024). Inactivation of an Indonesian isolate of *Foot-and-mouth disease virus* using formaldehyde. *Veterinary World*, **17**(6): 1190-1195. DOI: [10.14202/vetworld.2024.1190-1195](https://doi.org/10.14202/vetworld.2024.1190-1195).
29. Tuncer-Göktuna, P., B.A. Fontes, C. Çokçaliskan, E. Asar, and M. Karakaya (2024). Implementing an organizational culture of biosafety and biosecurity in the ŞAP Institute. *Health Security*: 10. DOI: [10.1089/hs.2023.0044](https://doi.org/10.1089/hs.2023.0044).
30. Wang, K.L., X.W. Wang, G.X. Wang, T.B. Afera, S.T. Hou, K.S. Yao, J. Zhang, S.S. Wang, and Y.F. Sun (2024). Ssc-miR-7139-3p suppresses *Foot-and-mouth disease virus* replication by promoting degradation of 3C^{pro} through targeting apoptosis-negative regulatory gene Bcl-2. *Virology*, **595**: 12. DOI: [10.1016/j.virol.2024.110070](https://doi.org/10.1016/j.virol.2024.110070).
31. Wubshet, A.K., G.M. Werid, T. Teklue, L.Y. Zhou, C. Bayasgalan, A. Tserendorj, J.J. Liu, L. Heath, Y.F. Sun, Y.Z. Ding, W.X. Wang, A.D. Zaberezhny, Y.S. Liu, and J. Zhang (2024). Foot-and-mouth disease vaccine efficacy in Africa: a systematic review and meta-analysis. *Frontiers in Veterinary Science*, **11**: 10. DOI: [10.3389/fvets.2024.1360256](https://doi.org/10.3389/fvets.2024.1360256).

Annex 3: Vaccine recommendations

This report provides recommendations of FMDV vaccines to be included in antigen banks. These outputs are generated with a tool (called PRAGMATIST) that has been developed in partnership between WRLFMD and EuFMD (<http://www.fao.org/3/cb1799en/cb1799en.pdf>). These analyses accommodate the latest epidemiological data collected by the WOA/FAO FMD reference laboratory network regarding FMDV lineages that are present in different *source regions* (see Table 1 in Section 3.9, above), as well as available *in vitro*, *in vivo* and field data to score the ability of vaccines to protect against these FMDV lineages

Vaccine Antigen Prioritisation: Europe

June 2024



NB: Analyses uses best available data, however there are gaps in surveillance and vaccine coverage data

www.pirbright.ac.uk

Please contact WRLFMD or EuFMD for assistance to tailor these outputs to other geographical regions. NB: Vaccine-coverage data presented is based on available data and may under-represent the true performance of individual vaccines.

Further information about the PRAGMATIST system has been published in *Frontiers in Veterinary Science* - see: <https://doi.org/10.3389/fvets.2022.1029075>.

Annex 4: Brief round-up of EuFMD and WRLFMD activities

Courses

- The [EuFMD's open-access Courses](#) provide convenient self-paced training which you may study anytime, anywhere, free of charge:
 - [Introduction to Foot-and-Mouth Disease](#) (*also available in French*); Provides an overview of foot-and-mouth disease (FMD), recognize or suspect the disease in the field, identify the correct samples to collect and the relevant control measures.
 - [Introduction to the socioeconomics of foot-and-mouth and similar transboundary animal diseases](#); the socioeconomics of foot-and-mouth and similar transboundary (FAST) animal diseases.
 - [Introduction to sheep pox and goat pox](#); Provides an overview of sheep pox and goat pox, recognise or suspect the disease in the field, identify the correct samples to collect and the relevant control measures.
 - [Introduction to Lumpy Skin Disease](#); This online module has been made available to support animal health practitioners in countries that are currently affected by, or at risk of lumpy skin disease (LSD).
 - [Introduction to Rift Valley Fever](#) (*also available in French*); Build your understanding of Rift Valley fever diagnosis, surveillance, prevention and control. This course is intended to be of interest to veterinarians and veterinary para-professionals working in countries that are at risk of Rift Valley Fever epizootics.
 - [Introduction to Animal Health Surveillance](#); Provides an overview of the importance and key activities of surveillance within the overall context of animal health. It also forms the basis for further, in-depth courses on passive surveillance.
 - [What is the Progressive Control Pathway?](#) (*also available in Arabic*); Provides an overview of the Progressive Control Pathway for Foot-and-Mouth Disease (PCP-FMD). This introduction will be interesting for anyone who is new to the PCP-FMD, and who would like a rapid guide to its key features.
 - [Introduction to the Risk Assessment Plan](#) (*also available in French*); The course consists of five self-directed online modules. These modules describe the purpose of the Risk Assessment Plan, give guidance on how to develop a risk assessment plan and explain they key content that should be included within each chapter of the Risk Assessment Plan document.
 - [Introduction to the Risk-Based Strategic Plan](#); The course consists of six self-directed online modules. These modules describe the purpose of the Risk-Based Strategic Plan, give guidance on how to develop a risk-based control strategy and explain they key content that should be included within each chapter of the Risk-Based Strategic Plan document.
 - [Introduction to the Official Control Programme](#); he course consists of six self-directed online modules. These modules describe the purpose of the OCP, give guidance on how to develop an OCP and explain they key content that should be included within each chapter of the OCP document.

- [Introduction to the FMD Minimum Biorisk Management Standards](#); Provides an overview of the Minimum Biorisk Management Standards for foot-and-mouth disease laboratories (MBRMS), explaining the scope and the risks associated with the standards.
- [RTC4 - Real-Time training](#) from 8 to 11 July 2024 in Nakuru, Kenya.
- [Progressive Control Pathway for foot-and-mouth disease \(PCP-FMD\) workshop](#) from 12 to 13 July 2024 in Naivasha, Kenya.
- [RTC35 - Real-Time training](#) from 26 to 29 November 2024 in Nakuru, Kenya.

Podcasts

EuFMD has a constantly updated series of short podcasts relating to the FAST world (<http://www.fao.org/eufmd/resources/podcasts/en/>).

- A series of videos on foot-and-mouth disease (<https://www.fao.org/eufmd/en/>).
- Leaflets on FMD in Arabic, Bosnian, Bulgarian, English, Greek and Montenegrin for the Thrace region (<https://www.fao.org/publications/card/en/c/CB4903EN>).
- Join the EUFMD Telegram channel to receive EuFMD updates (<https://t.me/eufmd>).

Meetings

- [Joint Eastern and Southern Africa FMD Roadmap meeting - GF-TADs](#) from 10 to 13 September 2024 in Tanzania.
- [104th Executive Committee of the EuFMD](#) - 26 September 2024
- [Open Session of the Standing Technical Committee of the EuFMD - OS24 in Madrid, Spain](#) - 29 to 31 October 2024
- [105th Executive Committee of the EuFMD](#) - 12 March 2025
- [46th General Session of the EuFMD](#) - 6 to 7 May 2025

Proficiency test scheme organised by WRLFMD

Results for the FMD PTS (Phase XXXV, supported with funding from EuFMD and UK Defra) are currently being analysed. Participating laboratories should have received feedback letters and we hope to circulate a final report for this scheme shortly. Any laboratories interested in participating in future exercises should contact the WRLFMD for further information. The progress of this PTS will be described in future quarterly reports.



FAO four betters. Better life, better environment, better nutrition, better production.

EuFMD's programme, tools and initiatives

FAST

Foot-and-mouth And Similar Transboundary animal diseases

Dt

EuFMD digital transformation

Tom

EuFMD training management system

Microlearning

EuFMD micro learning

Vlearning

EuFMD virtual learning

SimExOn

Simulation exercises online

Get prepared

Emergency preparedness toolbox

Risk Comms

EuFMD risk communications

RMT-FAST

Risk monitoring tool for foot-and-mouth and similar transboundary animal diseases

Pragmatist

Prioritization of antigen management with international surveillance tool

EuFMDiS

European foot-and-mouth disease spread model

Vademos

FMD vaccine demand estimation model

GVS

Global vaccine security

PQv

Vaccine prequalification

PCP

Progressive control pathway

PSO

Pcp practitioner officers

PPP

Public private partnership

PROTECT RESPOND CONTROL

MOVE FAST

FAST, Foot-and-mouth
And Similar Transboundary
animal diseases.



EuFMD structure

Secretariat, Executive Committee, Standing Technical Committee (STC), Special Committee on Risk Monitoring, Integrated Surveillance and Applied Research (SCRISAR), Special Committee on Biorisk Management (SCBRM), Regional Groups for FAST Coordination, Standing Committee on Prequalification of Vaccines against FAST diseases (SCPQv), Steering Committee TOM (SCTOM).

EuFMD Secretariat

Animal Production and Health Division,
(NSA) / European Commission for the
Control of Foot-and-Mouth Disease
(EuFMD)

eufmd@fao.org

fao.eufmd.org

eufmdlearning.works

eufmd-tom.com

Food and Agriculture Organization
of the United Nations
Rome, Italy



Thinking of the
environmental
footprint

Together against
wasting resources,
think twice before printing



**SUSTAINABLE
DEVELOPMENT
GOALS**



Department
for Environment
Food & Rural Affairs



Biotechnology and
Biological Sciences
Research Council