Food and Agriculture Organization of the United Nations

eufmd
european commission for the control of foot-and-mouth disease

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

Foot-and-Mouth Disease

April-June 2021
Quarterly report

FAST Reports
Foot-and-mouth And Similar Transboundary animal diseases

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

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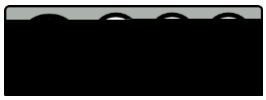


Contents

1. Highlights and headlines 1
2. General overview 2
3. Summary of FMD outbreaks and intelligence 3
   3.1. Global overview of samples received and tested 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 Middle 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) 6
   3.8. Pool 7 (South America) 7
   3.9. Extent of global surveillance 8
4. Detailed analysis 11
   4.1. Pool 1 (Southeast Asia/Central Asia/East Asia) 11
   4.2. Vaccine matching 13

Annex 1: Sample data 16
   Summary of submissions 16
   Clinical samples 16

Annex 2: FMD publications 17

Annex 3: Vaccine recommendations 22

Annex 4: Brief round-up of EuFMD and WRLFMD activities 23
   Courses 23
   Other resources 23
   Meetings 24
   Proficiency test scheme organised by WRLFMD 24

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	The National Reference Laboratory for FMD, The Lanzhou Veterinary Research Institute, Chinese Academy of Agricultural Sciences
MEVAC	International Facility for Veterinary Vaccines Production (Egypt)
NT	Not tested
NVD	No virus detected
OIE	World Organisation for Animal Health
PIADC	Plum Island Animal Disease Center
rRT-PCR	Real-time reverse transcription polymerase chain reaction
SAARC	South Asian Association for Regional Cooperation
SADC	Southern Africa in collaboration with the 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 Turkey
VI	Virus Isolation
WAHIS	World Animal Health Information System (of the OIE)
WRLFMD	World Reference Laboratory for Foot-and-Mouth Disease

1. Highlights and headlines

Welcome to this latest issue of the FMD Quarterly report that summarises testing that has been undertaken by the WRLFMD and highlights recent epidemiological events relating to FMD. For those who are interested, a static "dashboard" for FMD information can be found at https://foot-and-mouth.org/ including headline events described in previous reports and individual reports for samples tested are posted on the WRLFMD website (http://www.wrlfmd.org/).

During this quarter, reports have been prepared for samples submitted from Bahrain, Cambodia, Israel, Laos, Thailand and Vietnam. In addition, phylogenetic analyses have been undertaken for FMDV sequences submitted from Malaysia. As I have highlighted in previous updates, submissions to the WRLFMD have been severely curtailed during the past twelve months due to COVID-19 restrictions, although new submissions received recently at Pirbright from DRC, Iran, Kenya, Zambia (results to be reported next quarter) provide early indication that these transboundary surveillance activities may be slowly recovering. Elsewhere, data from other partner and affiliate laboratories of the OIE/FAO FMD Laboratory Network (shown in Figure 4 in this report) indicates that while there was an overall decrease in samples submissions during 2020, the impacts of COVID-19 have not been equally felt across the different FMD endemic pools. In contrast to the reduction in samples tested for Pools 2, 3, 4 (where the greatest relative reduction in numbers was in Pool 4), sample reports increased in the remaining 4 pools during this twelve-month period.

Sequence data from Malaysia and for Vietnamese samples provides further evidence that the O/ME-SA/Ind-2001e viral lineage is now well established as an endemic lineage in southeast Asia. Elsewhere, during this quarter, FMD outbreaks comprising SAT 1, SAT 2 and SAT 3 have been reported to the OIE. Other FMD outbreaks in southern Africa have been reported in Namibia (historical cases of SAT 2 in 2020) and Malawi (not typed).

Don King, Pirbright July 2021

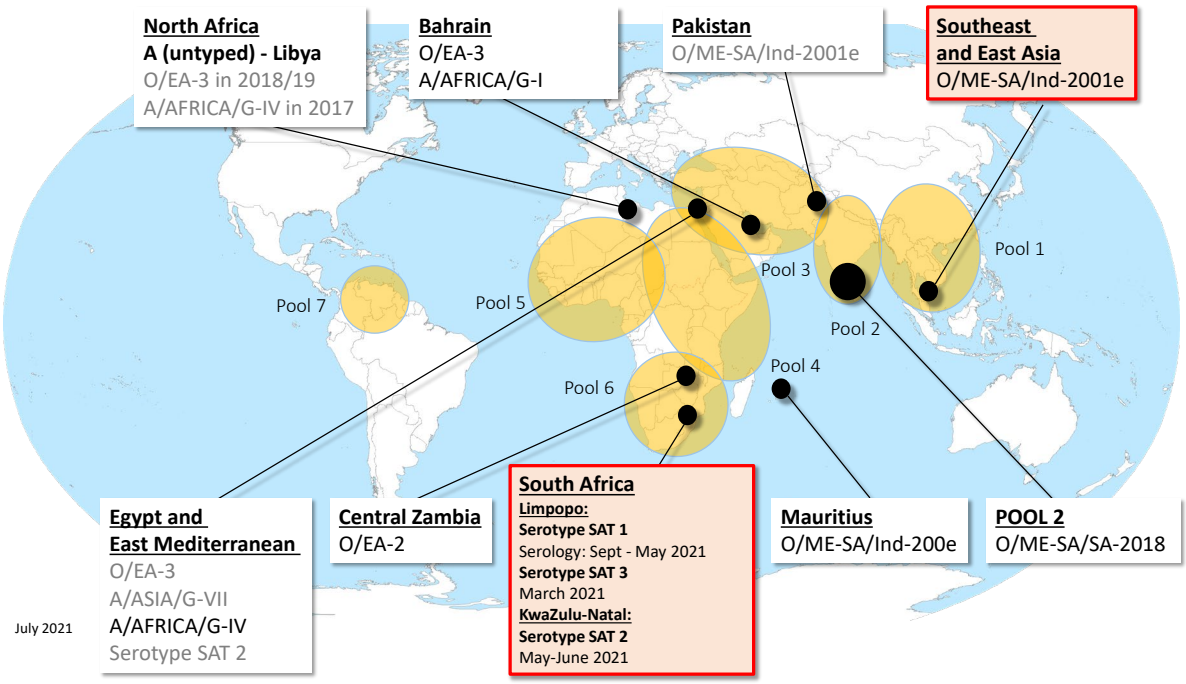


Figure 1: Recent FMD global outbreaks (new headline events reported April to June 2021 are highlighted) with endemic pools highlighted in orange. Source: WRLFMD. Map conforms to the United Nations World Map, June 2020.

2. General overview

Endemic Pools represent independently circulating and evolving foot-and-mouth disease virus (FMDV) genotypes; within the pools, cycles of emergence and spread occur that usually affect multiple countries in the region. In the absence of specific reports, it should be assumed that the serotypes indicated below are continuously circulating in parts of the pool area and would be detected if sufficient surveillance was in place.

POOL	REGION/COUNTRIES	SEROTYPES PRESENT
1	**SOUTHEAST ASIA/CENTRAL ASIA/EAST ASIA** Cambodia, China, China (Hong Kong SAR), Taiwan Province of China, Democratic People's Republic of Korea, Republic of Korea, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Russian Federation, Thailand, Viet Nam	A, Asia 1 and O
2	**SOUTH ASIA** Bangladesh, Bhutan, India, Mauritius, Nepal, Sri Lanka	A, Asia 1 and O
3	**WEST EURASIA & MIDDLE EAST** 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, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan	A, Asia 1 and O (SAT 2)
4	**NORTH AFRICA** Algeria, Egypt, Libya, Morocco, Tunisia	A, O and SAT 2
	EASTERN AFRICA Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, South Sudan, Sudan, Uganda, United Republic of Tanzania, Yemen	O, A, SAT 1, SAT 2 and SAT 3
5	**WEST/CENTRAL AFRICA** 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, SAT 1 and SAT 2
6	**SOUTHERN AFRICA** Angola, Botswana, Malawi, Mozambique, Namibia, South Africa, Zambia, Zimbabwe	SAT 1, SAT 2 and SAT 3 (O, A)[†]
7	**SOUTH AMERICA** Colombia, Venezuela (Bolivarian Republic of)	O and A

[†] *only in Angola and north Zambia as spill-over from pool 4*

3. Summary of FMD outbreaks and intelligence

3.1. Global overview of samples received and tested

The location of all samples detailed 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.

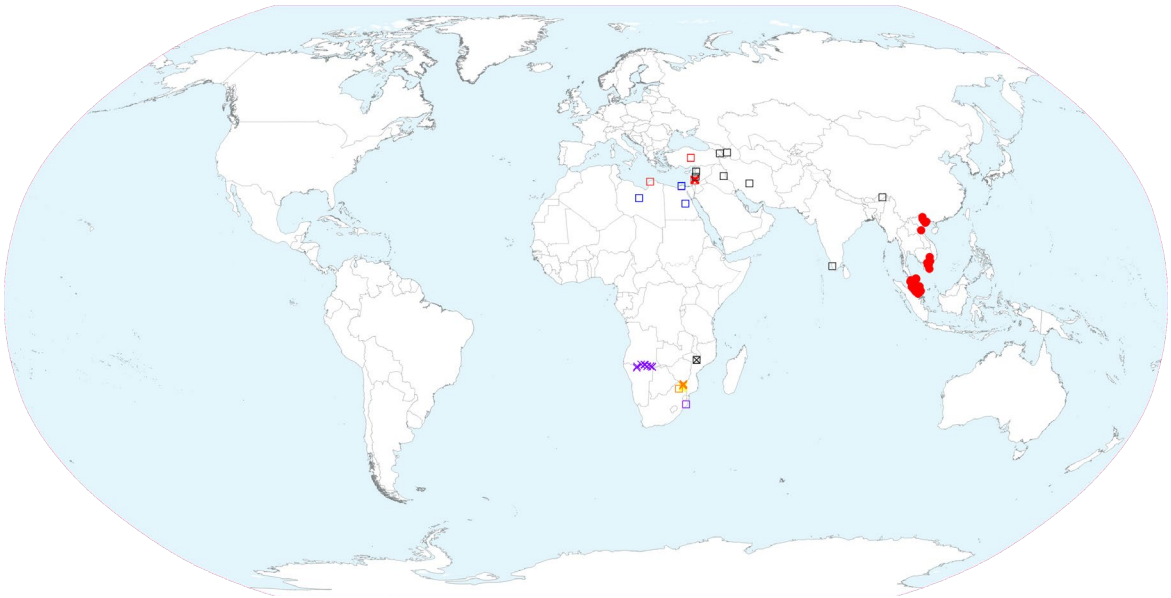
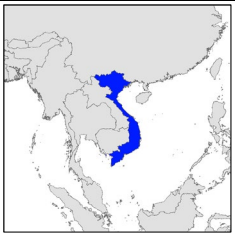


Figure 2: Samples tested by WRLFMD or reported in this quarter. ● indicates samples analysed; × indicates new outbreaks reported to the OIE, but where results to define the genotype have not been reported; □ indicates reports of FMD from other sources. Shape colours define the serotype detected ●O; ●A;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

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

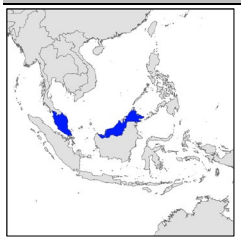
3.2. Pool 1 (Southeast Asia/Central Asia/East Asia)

The Socialist Republic of Viet Nam



On 9 June 2021, a batch of 16 samples were received. The samples were collected from various species (cattle, water buffalo and pigs) between November 2018 and January 2021. FMD type O was isolated from all the samples and genotyping revealed that one belonged to the SEA/Mya-98 lineage while 15 belonged to the ME-SA/Ind-2001e sublineage (see below).

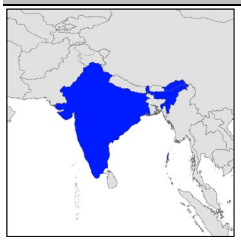
Malaysia



On the 10 May 2021, 33 **FMD type O** VP1 sequences were received from the National FMD Laboratory. The samples from which the sequences originated had been collected from cattle in various parts of the country between January 2020 and April 2021. Genotyping revealed they all belonged to the ME-SA topotype and 32/33 belonged to the Ind-2001e sublineage and one to the PanAsia lineage (see below).

3.3. Pool 2 (South Asia)

The Republic of India



FMD was reported to be affecting Mithun in the Siang belt area of Arunachal Pradesh

ProMED post: 20210413.8305677

Vaccination and other measures were taken to check the spread of FMD in the Indian state of Kerala in June.

ProMED post: 20210617.8456180

3.4. Pool 3 (West Eurasia and Middle East)

The Republic of Armenia

456,578 large ruminants and 393 small ruminants were vaccinated in March-May, 2021 in all regions.

The Republic of Azerbaijan

2,211,930 cattle and 4,873,747 small ruminants were vaccinated in January-June. Vaccine coverage is 89.7% for cattle and 64% for small ruminants. Azerbaijan plans to conduct a post-vaccination serological survey for large and small ruminants after the autumn vaccination campaign.

The Islamic Republic of Iran

52 outbreaks in small ruminants, and 84 outbreaks in large ruminants in this were recorded in this quarter. Increased number of cases reporded in the West Azerbaijan province in April 2021.

The predominant sub-lineages were O/ME-SA/PanAsia-2^{ANT-10} and A/ASIA/Iran-05^{Far-11}. Serotype Asia 1 has not been detected in this quarter.

According to the Iran Veterinary Organization (IVO) 1,040,188 large ruminants and 15,034,436 small ruminants were vaccinated against FMD between 1st March and 1st June 2021 with trivalent vaccines (O, A, Asia1) which were either locally produced or imported.

The vaccination of nomadic animals was done free of charge.

The Republic of Iraq

An outbreak of FMD has been reported by buffalo breeders in Diyala governorate, with a high number of deaths reported.

A vaccination campaign of buffalo herds has been launched that to last 4 weeks, starting from 1 Jun 2021.

ProMED post: 20210612.8443121

State of Israel

FMD was reported to the OIE as resolved in June (OIE event ID: 37437).

OIE World Animal Health Information System

Between January and June 2021, outbreaks of **FMD type O** were reported in cattle, sheep, and goats (n=15) in the northern part of the country (HaZafon). The virus was also found in two locations in wildlife [mountain gazelle (*Gazella gazella*) and fallow deer (*Dama dama*)] within the region.

An outbreak of FMD (O/ME-SA/PanAsia-2) has been reported in Israel's northern district (Yodfat, Lower Galilee). As of the 2nd June, no further clinical cases have been observed and therefore a 30 day countdown began, in which no animals from the affected herds may exit the declared zone.

ProMed post: 20210611.8441061:

The Lebanese Republic

A FMD mass vaccination campaign, for dairy cattle, sheep and goats was launched in June, 2021 and is ongoing. The FMD vaccines were provided as a donation from the French Embassy.

The Syrian Arab Republic

There was a suspected FMD outbreak in goat herds in Ma'areen village, Latakia/Lattakiya (Al Ladhiqiyah) Governorate in northwest Syria.

Vaccination of the entire livestock population in the affected and surrounding villages was performed. Many animals were from unknown sources (e.g. imported from local markets or close neighboring governorates) and therefore their vaccination history was unknown.

ProMED post: 20210422.8320257

The Republic of Turkey

Nine outbreaks (3 in small ruminants, 6 in cattle; O/ME-SA/PanAsia-2^{QOM-15}) were reported in Anatolia in the second quarter of 2021. Clinical active surveillance was conducted in 8 provinces bordering with Georgia, Armenia, Azerbaijan and Iran, where no FMD outbreaks were detected .

Spring preventive vaccinations were finalized on 15th May. The campaign targets only large ruminants in Anatolia and both, large and small ruminants in Thrace, including a booster vaccination for primo-vaccinates. Min. 6PD$_{50}$ potency vaccines are used for preventive and 10PD$_{50}$ for emergency vaccination in the surveillance zone for all susceptible species.

3.5. Pool 4 (North and Eastern Africa)

The Arab Republic of Egypt

Four confirmed notifications of outbreaks (A/AFRICA/G-IV) – 2 in Dakhalia Governorate in Jan and Feb 2021 , one in Sohag Governorate in Feb 2021 and one in Kafrelshikh Governorate in April 2021.

The State of Libya

Seven outbreaks (serotype A) occurred in western (two) and eastern (five) Libya, at end of 2020 and beginning 2021 (reported in the October-December 2020 report EuFMD FAST report).

45 serum samples were received from Almarj City (Eastern Libya) from suspected cases in cattle. These samples were tested in the Veterinary Central Lab in Tripoli, and 19 of 45 samples were FMD seropositive for serotype O.

3.6. Pool 5 (West/Central Africa)

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

3.7. Pool 6 (Southern Africa)

The Republic of Malawi

Between April and June 2021, three outbreaks of **FMD** (diagnosis by NSP ELISA) were detected in cattle at Msiyamphanje village (near to Lengwe National Park, Chikwawa). The origin was suspected to be African buffalo. [OIE event ID: evt_3655]

OIE World Animal Health Information System

ProMED post: 20210414.8307678

The Republic of Namibia

During September 2020, FMD type SAT 2 was detected in cattle in 10 villages along the northern border of the country. [OIE event ID: 36008]

OIE World Animal Health Information System

The Republic of South Africa

Between September 2020 and May 2021, 16 further outbreaks of **FMD SAT 1** occurred in cattle at Mopani, Limpopo.

Between May and June 2021, 17 outbreaks **FMD type SAT 2** occurred in cattle in KwaZulu-Natal.

In March 2021, 9 outbreaks due to **FMD SAT 3** were reported in cattle in Thulamela, Vhembe, Limpopo, close to the Kruger National Park.

[OIE event IDs: 36933, evt_3738 and evt_3758]

OIE World Animal Health Information System

ProMED Post: 20210528.8399717 and 20210621.8464993

The Republic of Zambia

On 8 June 2021, a batch of 97 samples was received. The results of serotyping and genotyping are pending.

[samples not plotted on Figure 2]

3.8. Pool 7 (South America)

No new outbreaks of FMD were reported in South America.

3.9. Extent of global surveillance

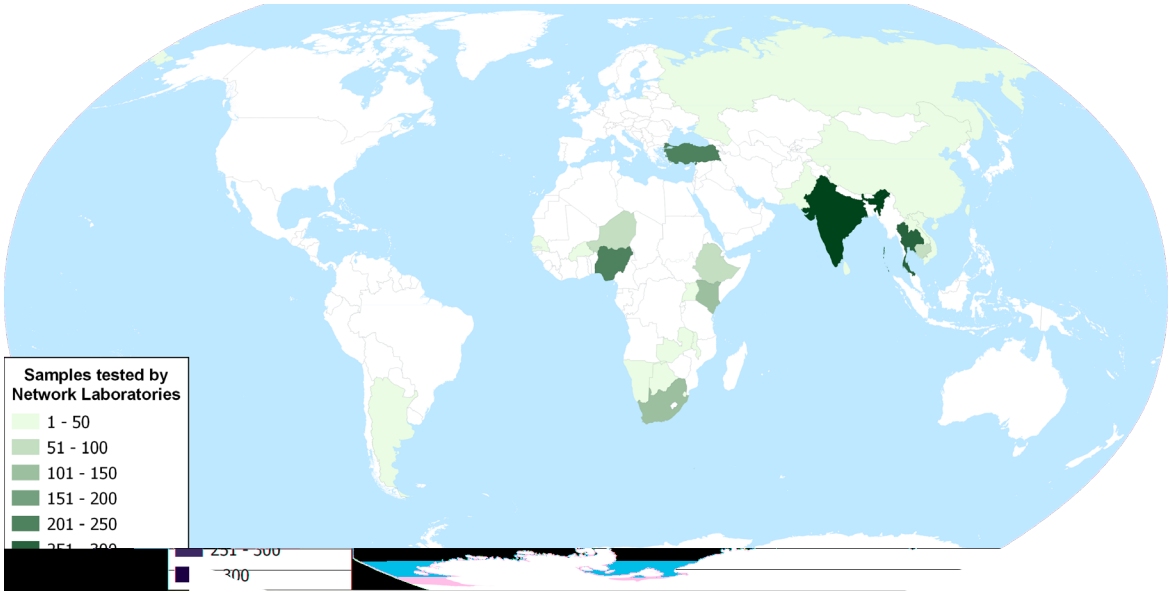


Figure 3: Samples received during 2020 from FMD outbreaks (routine surveillance that is undertaken in countries that are FMD-free without vaccination is not shown). Data from presentations given at the OIE/FAO Reference laboratory Network annual meeting (https://www.foot-and-mouth.org/Ref-Lab-Network/Network-Annual-Meeting) Source: WRLFMD. Map conforms to the United Nations World map, June 2020.

During 2020, results for 1590 samples were recorded by the partner and affiliate laboratories of the OIE/FAO FMD Laboratory Network (draft data).

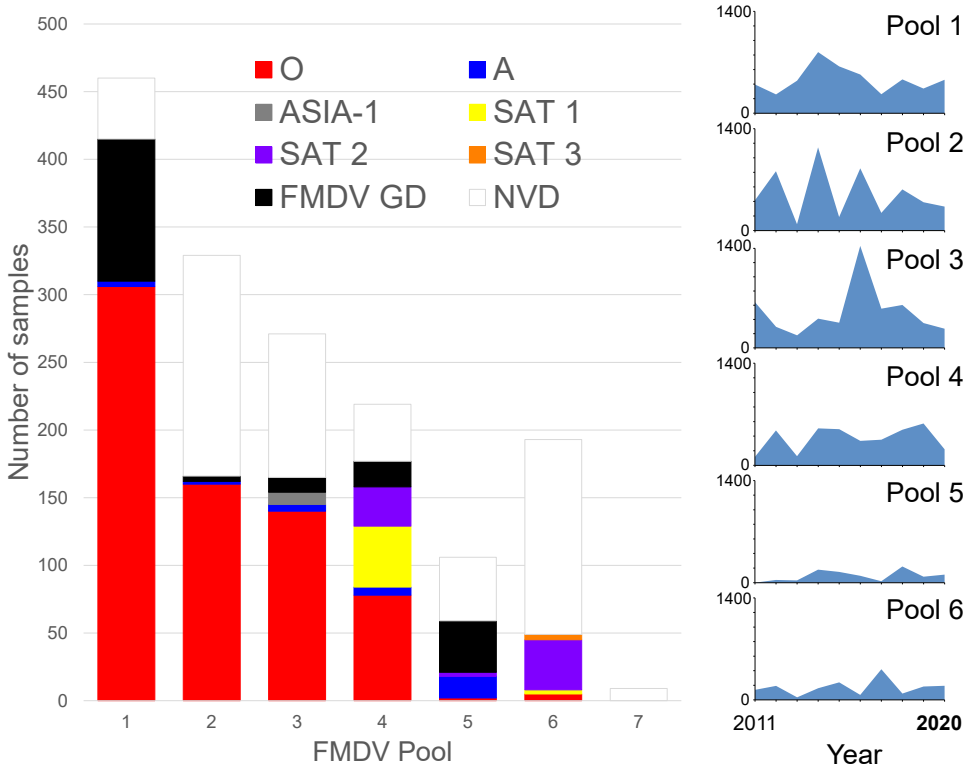


Figure 4: Representation of different FMDV serotypes detected in samples tested from the FMD endemic pools by the OIE/FAO FMD Laboratory Network during 2020 (NB: Figure 1 shows the geographical coverage of each pool; NVD = no virus detected; GD = genome detected by RT-PCR). Right-hand panels display historical trends for each of the pools (since 2011). NB; submission from Pool 7 are low and these data are not shown.

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: Conjectured relative prevalence of circulating FMD viral lineages in each Pool. For each of the regions, data represent the relative importance of each viral lineage [prevalence score estimated as a percentage (%) of total FMD cases that occur in domesticated hosts]. These scores (reviewed at the OIE/FAO FMD Laboratory Network meeting in December 2020) 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.

Lineage	Southeast / Central / East Asia [Pool 1]	South Asia [Pool 2]	West Eurasia & Middle 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			35					
O ME-SA PanAsia	10							
O SEA Mya-98	33							
O ME-SA Ind2001	20	80	7	10				
O EA or O WA			3	55	55	70		
O EURO-SA								80
O CATHAY	10.5							
A ASIA Sea-97	26							
A ASIA Iran-05	0		27					
A ASIA G-VII		16	15					
A AFRICA				25	22	15		
A EURO-SA								20
Asia-1	0.5	4	12.5					
SAT 1				0	8	5	27	
SAT 2			0.5	10	14	10	57	
SAT 3					1		16	
C								

A number of outbreaks have occurred where samples have not been sent to the WRLFMD or other laboratories in the OIE/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-2021.

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 to June 2021 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 to June 2021 (* indicates a batch carried over from the previous quarter).

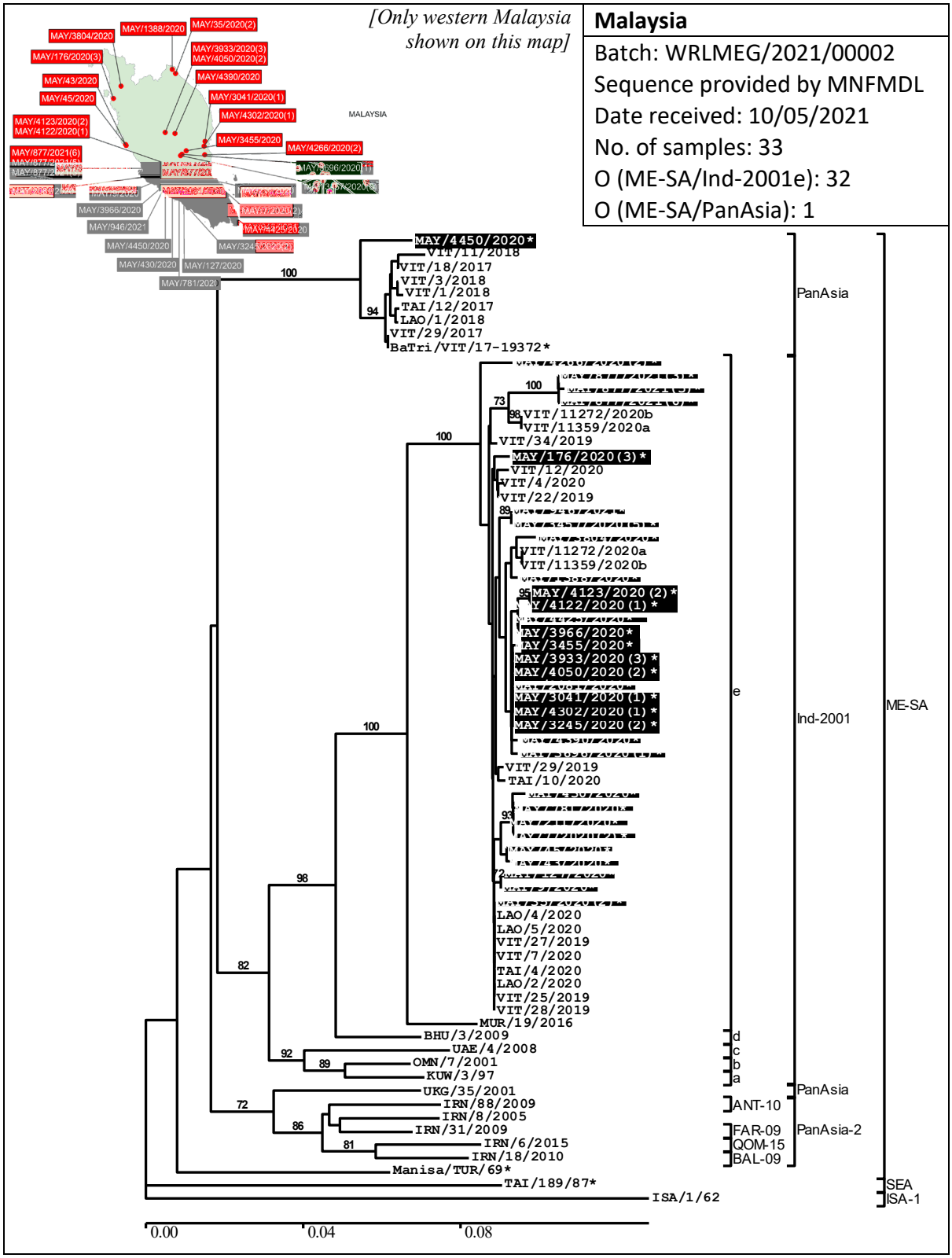
WRLFMD Batch No.	Date received	Country	Serotype	No. of samples	No. of sequences	Sequencing status
WRLFMD/2020/00007	09-Jun-21	Vietnam	O	16	16	Finished
WRLFMD/2020/00008	08-Jun-21	Zambia	Pending	97	-	Pending
			Total	**16**	**0**	

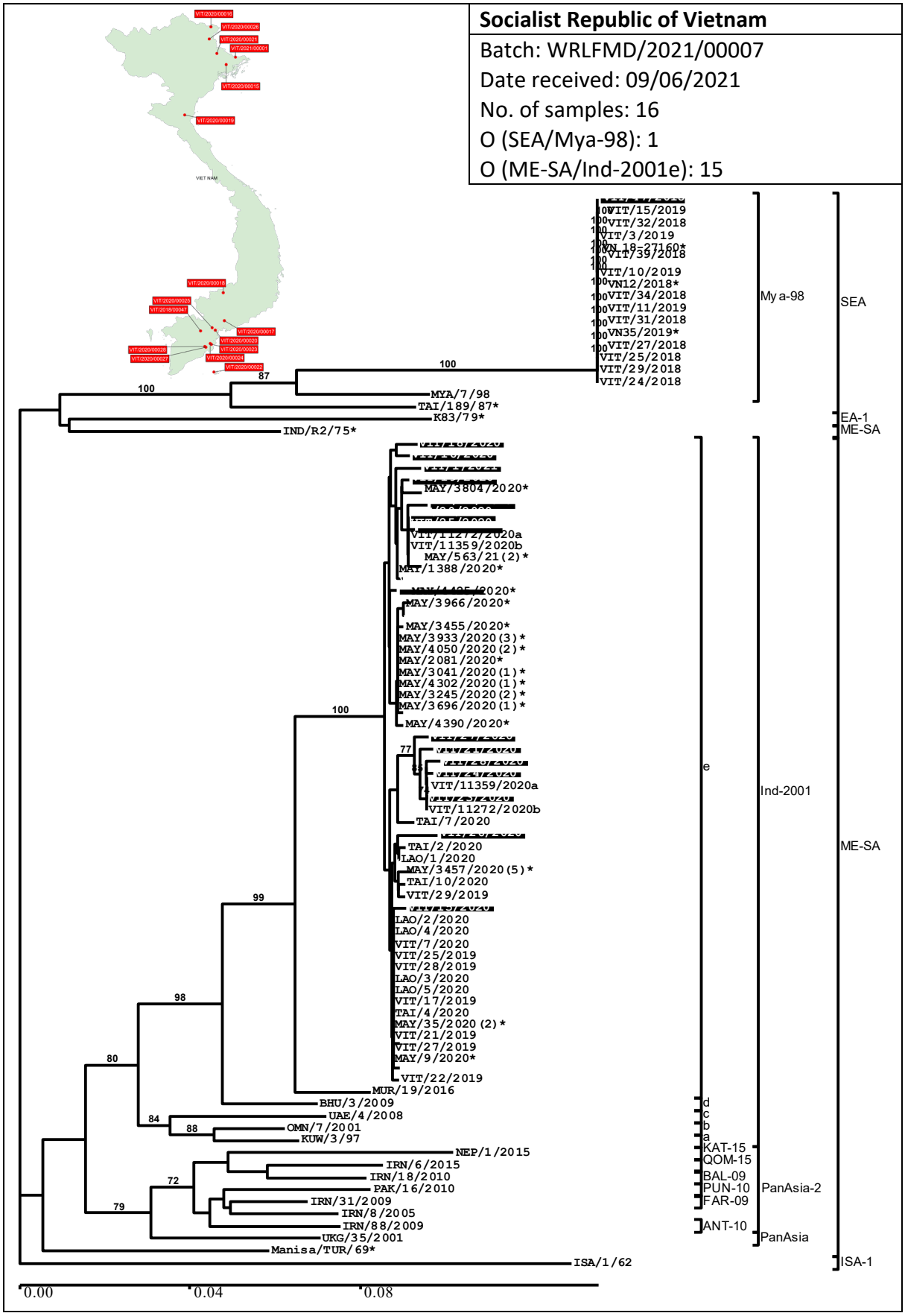
Table 3: VP1 sequences submitted by other FMD Network laboratories to the WRLFMD from April to June 2021.

WRLFMD Batch No.	Date received	Country	Serotype	Date Collected	No. of sequences	Submitting laboratory
WRLMEG/2021/00009	10/05/2021	Malaysia	O	2020 & 2021	33	MNFMDL
				Total	**33**	

4. Detailed analysis

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




Socialist Republic of Vietnam
Batch: WRLFMD/2021/00007
Date received: 09/06/2021
No. of samples: 16
O (SEA/Mya-98): 1
O (ME-SA/Ind-2001e): 15
VIT/15/2019
VIT/32/2018
VIT/3/2019
VIT/39/2018
VIT/10/2019
VN12/2018*
VIT/34/2018
VIT/11/2019
VIT/31/2018
VN35/2019*
VIT/27/2018
VIT/25/2018
VIT/29/2018
VIT/24/2018
MYA/7/98
TAI/189/87*
K83/79*
IND/R2/75*
MAY/3804/2020*
VIT/11272/2020a
VIT/11359/2020b
MAY/563/21(2)*
MAY/1388/2020*
MAY/3966/2020*
MAY/3455/2020*
MAY/3933/2020(3)*
MAY/4050/2020(2)*
MAY/2081/2020*
MAY/3041/2020(1)*
MAY/4302/2020(1)*
MAY/3245/2020(2)*
MAY/3696/2020(1)*
MAY/4390/2020*
VIT/11359/2020a
VIT/11272/2020b
TAI/7/2020
TAI/2/2020
LAO/1/2020
MAY/3457/2020(5)*
TAI/10/2020
VIT/29/2019
LAO/2/2020
LAO/4/2020
VIT/7/2020
VIT/25/2019
VIT/28/2019
LAO/3/2020
LAO/5/2020
VIT/17/2019
TAI/4/2020
MAY/35/2020(2)*
VIT/21/2019
VIT/27/2019
MAY/9/2020*
VIT/22/2019
MUR/19/2016
BHU/3/2009
UAE/4/2008
OMN/7/2001
KUW/3/97
NEP/1/2015
IRN/6/2015
IRN/18/2010
PAK/16/2010
IRN/31/2009
IRN/8/2005
IRN/88/2009
UKG/35/2001
Manisa/TUR/69*
ISA/1/62
100
87
100
100
77
99
98
80
84
88
72
79
0.00
0.04
0.08
Mya-98
SEA
EA-1
ME-SA
e
Ind-2001
ME-SA
d
c
b
a
KAT-15
QOM-15
BAL-09
PUN-10
FAR-09
PanAsia-2
ANT-10
PanAsia
ISA-1

4.2. Vaccine matching

Antigenic characterisation of FMD field isolates by matching with vaccine strains by 2dmVNT from April to June 2021.

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
Bahrain	2	1	-	-	-	-	-
Cambodia	2	-	-	-	-	-	-
Israel	2	-	-	-	-	-	-
Lao PDR	2	-	-	-	-	-	-
Nigeria	-	-	-	-	-	2	-
Nigeria*	-	3	-	-	-	-	-
Thailand	2	2	-	-	-	-	-
Total	**10**	**6**	**0**	**0**	**0**	**2**	**0**

* Supplementary vaccine matching reports including A Eritrea 98 from Boehringer Ingelheim

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	**Vaccine Match** *r_1 = ≥ 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.*
N	**No Vaccine Match** *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.
NT	**Not tested against this vaccine**

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 $TCID_{50}$.

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

Isolate	Serotype O		O 3039 Boehringer Ingelheim		**O Campos** Boehringer Ingelheim		**O Manisa** Boehringer Ingelheim		**O/TUR/5/09** MSD		**O_1 Campos** Biogénesis Bagó	
	Topotype	*Lineage*	*r1*	*Titre*	*r1*	*Titre*	*r1*	*Titre*	*r1*	*Titre*	*r1*	*Titre*
BAR/18/2021	EA-3	-	0.54	1.78	NT	NT	0.49	2.15	0.65	2.31	0.54	2.52
BAR/20/2021	EA-3	-	0.62	1.84	NT	NT	0.50	2.16	0.56	2.25	0.63	2.59
CAM/1/2018	ME-SA	PanAsia	0.33	1.63	0.25	1.91	0.29	1.91	0.46	2.01	0.43	2.37
CAM/6/2018	ME-SA	PanAsia	0.40	1.71	0.32	2.05	0.33	1.97	0.59	2.12	0.49	2.43
ISR/1/2021	ME-SA	Ind-2001	0.35	1.63	NT	NT	0.36	1.92	0.85	2.21	0.52	2.57
ISR/5/2021	ME-SA	Ind-2001	0.48	1.77	NT	NT	0.46	2.02	1.00	2.34	0.76	2.73
LAO/1/2020	ME-SA	Ind-2001	0.65	1.92	0.28	1.81	0.47	2.10	0.50	2.07	0.48	2.48
LAO/5/2020	ME-SA	Ind-2001	0.39	1.70	0.32	1.87	0.62	2.22	0.76	2.25	0.55	2.54
TAI/9/2020	ME-SA	Ind-2001	0.58	1.83	0.34	1.90	0.51	2.15	0.60	2.17	0.65	2.57
TAI/12/2020	ME-SA	Ind-2001	0.47	1.74	0.26	1.79	0.32	1.94	0.54	2.12	0.40	2.32

Table 6: Vaccine matching studies for A FMDV

Isolate	Serotype A		**A GVII 2015** Boehringer Ingelheim		**A/TUR/20/06** MSD Animal Health		**A Malaysia 97** Boehringer Ingelheim		**A22 Iraq** Boehringer Ingelheim		**A Eritrea 98** Boehringer Ingelheim		**A Iran 2005** Boehringer Ingelheim		**A Saudi 95** Boehringer Ingelheim	
	Topotype	*Lineage*	r_1	*Titre*	r_1	*Titre*	r_1	*Titre*	r_1	*Titre*	r_1	*Titre*	r_1	*Titre*	r_1	*Titre*
BAR/21/2021	Africa	G-I	0.39	1.58	0.00	0.00	NT	NT	0.31	1.94	0.12	1.69	0.00	0.00	0.35	1.98
NIG/1/2017	Africa	G-IV	NT	NT	NT	NT	NT	NT	NT	NT	0.17	1.86	NT	NT	NT	NT
NIG/3/2017	Africa	G-IV	NT	NT	NT	NT	NT	NT	NT	NT	0.15	1.82	NT	NT	NT	NT
NIG/5/2015	Africa	G-IV	NT	NT	NT	NT	NT	NT	NT	NT	0.21	1.95	NT	NT	NT	NT
TAI/10/2019	Asia	Sea-97	0.20	1.13	0.00	0.00	0.14	1.42	0.50	2.19	NT	NT	NT	NT	NT	NT
TAI/11/2019	Asia	Sea-97	0.62	1.62	0.13	1.01	0.39	1.87	0.25	1.89	NT	NT	NT	NT	NT	NT

Table 7: Vaccine matching studies for SAT 2 FMDV

Isolate	Serotype SAT 2		**SAT 2 Eritrea 98** Boehringer Ingelheim		**SAT 2 Zim 83** Boehringer Ingelheim	
	Topotype	*Lineage*	r_1	*Titre*	r_1	*Titre*
NIG/1/2020	VII	Lib-12	0.76	1.70	0.23	1.96
NIG/6/2020	VII	Lib-12	0.95	1.80	0.27	1.98

Annex 1: Sample data

Summary of submissions

Table 8: Summary of samples collected and received to WRLFMD (April to June 2021)

Country	Nº of samples	Virus isolation in cell culture/ELISA								RT-PCR for FMD	
		FMD virus serotypes							No Virus Detected		
		O	*A*	*C*	*SAT 1*	*SAT 2*	*SAT 3*	*ASIA-1*		*Positive*	*Negative*
Vietnam	16	16	0	0	0	0	0	0	0	16	0
TOTAL	**16**	**16**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**16**	**0**

Clinical samples

Table 9: Clinical sample diagnostics made by the WRLFMD® April to June 2021

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	Results		
	Received	Reported				VI/ELISA	RT-PCR	Final report
Vietnam	09-Jun-21	29-Jun-21	VIT 47/2018	PIG	22-Nov-18	O	POS	O
			VIT 15/2020	CATTLE	03-Feb-20	O	POS	O
			VIT 16/2020	BUFFALO	15-Jul-20	O	POS	O
			VIT 17/2020	CATTLE	07-Aug-20	O	POS	O
			VIT 18/2020	CATTLE	15-Sep-20	O	POS	O
			VIT 19/2020	CATTLE	06-Oct-20	O	POS	O
			VIT 20/2020	PIG	27-Oct-20	O	POS	O
			VIT 21/2020	BUFFALO	29-Oct-20	O	POS	O
			VIT 22/2020	PIG	02-Nov-20	O	POS	O
			VIT 23/2020	CATTLE	05-Nov-20	O	POS	O
			VIT 24/2020	CATTLE	05-Nov-20	O	POS	O
			VIT 25/2020	CATTLE	06-Nov-20	O	POS	O
			VIT 26/2020	BUFFALO	21-Nov-20	O	POS	O
			VIT 27/2020	CATTLE	15-Dec-20	O	POS	O
			VIT 28/2020	CATTLE	26-Dec-20	O	POS	O
			VIT 1/2021	CATTLE	07-Jan-21	O	POS	O
TOTAL					**16**			

Annex 2: FMD publications

Recent FMD Publications (April to June 2021) cited by Web of Science.

1. Abas, O., A. Abd-Elrahman, A. Saleh, and M. Bessat (2021). Prevalence of tick-borne haemoparasites and their perceived co-occurrences with viral outbreaks of FMD and LSD and their associated factors. *Heliyon*, **7**(3): 7. DOI: 10.1016/j.heliyon.2021.e06479.
2. Bazid, A.H.I., H.A. El-Alfy, G. El-Didamony, W.K. Elfeil, M.M. El-Sayed, and M. Fawzy. Adjuvant effect of saponin in an oil-based monovalent (serotype O) *Foot-and-mouth disease virus* vaccine on the antibody response in guinea pigs and cattle. *Archives of Virology*: 8. DOI: 10.1007/s00705-021-05043-9.
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5. Brown, E., G. Freimanis, A.E. Shaw, D.L. Horton, S. Gubbins, and D. King (2021). Characterising *Foot-and-mouth disease virus* in clinical samples using nanopore sequencing. *Frontiers in Veterinary Science*, **8**: 10. DOI: 10.3389/fvets.2021.656256.
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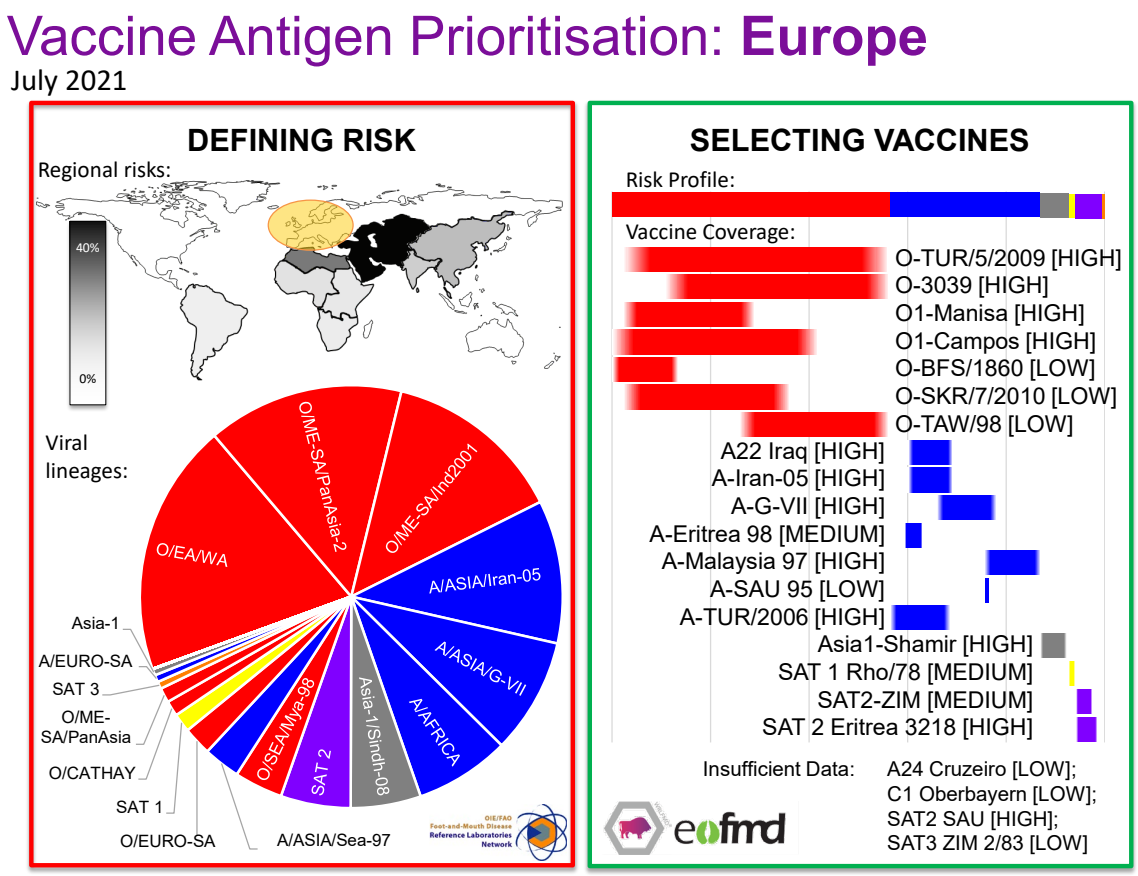
Annex 3: Vaccine recommendations

This report provides recommendations of FMDV vaccines to be included in antigen banks. These outputs are generated with a new 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 OIE FAO FMD 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.



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

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.

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

Courses

- The EuFMD Virtual Learning platform provides convenient self-paced training which you may study anytime, anywhere, free of charge. Open access courses currently offered are:
  - Introduction to Rift Valley Fever
  - Simulation Exercises for Animal Disease Emergencies aiming at building your understanding of simulation exercises and their value as part of the emergency preparedness cycle.
  - Introduction to the Risk-Based Strategic Plan introducing the Risk-Based Strategic Plan (RBSP).
  - What is the Progressive Control Pathway providing an overview of the Progressive Control Pathway for Foot-and-Mouth Disease (PCP-FMD), the tool used to FMD control under the GF-TADs Global Strategy.
  - For anyone who is new to the PCP-FMD, a short e-learning module is also available in Arabic.
  - Introduction to FMD course, available in English and French, introducing foot-and-mouth disease (FMD), its importance, diagnosis, outbreak investigation and the control measure that might apply in a previously free country experiencing an outbreak.
  - Introduction to Lumpy Skin Disease , a short open-access module made available to support countries in Asia and the Pacific face this rapidly emerging threat.
  - Public Private Partnerships in the Veterinary Domain course, developed in partnership with the World Organisation for Animal Health OIE, applying public-private partnerships to the control of FMD and similar transboundary animal diseases.
- The WRLFMD residential training course on FMD diagnostic methods (https://www.pirbright.ac.uk/instructor-led-training/diagnosis-foot-and-mouth-disease) scheduled for 2021 has been postponed.

Other resources

We have a constantly updated series of short **podcasts** relating to the FAST world, available here: http://www.fao.org/eufmd/resources/podcasts/en/

- A series of videos on foot-and-mouth disease in English, Bulgarian, Greek and Turkish
- Leaflets on FMD in English, Turkish, Bulgarian and Greek, for the Thrace region
- Join our Telegram channel to receive EuFMD updates https://t.me/eufmd
- Find out who TOM is and why you need him

Emergency Preparedness Network http://www.fao.org/eufmd/network/en/

The Emergency Preparedness Network is a forum for emergency preparedness experts to share information and experience. You will regularly receive the latest information on topics

related to prevention and control of foot-and-mouth and other similar transboundary animal diseases (“FAST" diseases).

Meetings

- A Meeting of Laboratory and Epidemiology Networks for the West Eurasia Region is planned for August 2021 (virtual) (postponed from June 2021)

Proficiency test scheme organised by WRLFMD

All results for the Phase XXXII exercise have been received and the feedback has been sent out (see table below for a summary of the current status of the exercise). The report summarising this exercise will be circulated shortly.

Status	Number of Labs
Invitations	75*
Declined to take part	21
PTS shipped	37
Destroyed in transit	1
Results returned	37
Feedback returned	37

** This table includes self-funded countries.*

Invitations to join the next PT (Phase XXXIII) will be sent to laboratories before September 2021.