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

2021

Quarterly report

July-September

Funded by the European Union

EuFMD's programme, tools and initiatives

FAST
Foot-and-mputh And Similar Transboudary animal diseases

Pillars
eufmd activities

Dt
eufmd digital transformation

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vlearning
eufmd virtual learning centre

microLearning
eufmd virtual learning

vlc EA
virtual learning centre for East Africa

Tom
eufmd training management system

SimExOn
simulation exercises online

KnowBank
eufmd knowledge bank

GetPrepared
emergency preparedness toolbox

RiskComms
risk communications

SQRA
a method for spatial qualitative risk analysis applied to fmd.

Pragmatist
prioritization of antigen management with international surveillance tool

EuFMDiS
european foot-and-mouth disease spread model

Impact
impact calculator

Vademos
fmd vaccine demand estimation model

GVS
global vaccine security

PQv
vaccine prequalification

PCP
progressive control pathway

PSO
pcp practicioner officers

VPP
veterinary paraprofessionals

PPP
public private partnership

Sustainable development goals, UN-SDGs. EuFMD's programme has a focus on

Together agains wasting resources, think twice before printing.

Thinking of the environmental footprint

Foot-and-Mouth Disease
Quarterly report
July-September 2021

Food and Agriculture Organization of the United Nations

Rome, 2021

Required citation:
FAO. 2021. *Foot-and-mouth disease. Quarterly report, July–September 2021.*Rome. https://doi.org/10.4060/cb7379en

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ISBN 978-92-5-135377-6

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Contents

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

Thank you for taking time to read this quarterly report from WRLFMD and EuFMD that reviews the latest global FMD events and provides details of samples tested by the WRLFMD from Democratic Republic of the Congo, Islamic Republic of Iran, Kenya, Mongolia, Viet Nam and Zambia. Further details about these laboratory results can be retrieved from our website (http://www.wrlfmd.org/).

The circulation of O/ME-SA/Ind-2001e continues to be closely monitored in Asian countries where a new paper documents the retrospective detection of this lineage in Cambodia in 2019 (https://www.frontiersin.org/articles/10.3389/fvets.2021.749966/abstract). Data presented at the SEACFMD national coordinators meetings (https://rr-asia.oie.int/en/events/24th-seacfmd-national-coordinators-meeting/) highlighted the increasing dominance of this lineage across Southeast Asia, and results for samples collected in Mongolia reported here provide further evidence that O/ME-SA/Ind-2001e is becoming established in East Asia.

Elsewhere in Asia, Islamic Republic of Iran has reported a new genetic clade of A/ASIA/Iran-05^{FAR-11} (see sections 4.2 in this report) which appears to be poorly matched against FMD vaccines that are used in the region (reported at the recent West EurAsia Roadmap meeting by the ŞAP FMD Institute, Turkey: https://rr-europe.oie.int/en/our-missions/animal-diseases/foot-and-mouth-disease/west-eurasia-fmd-roadmaps/). Vaccine matching for representative viruses is underway at the WRLFMD and results will be reported shortly.

Sequence data has also been submitted for phylogenetic analyses from Namibia and Malawi (via the OIE Reference Laboratory in Botswana) to demonstrate that FMD outbreaks reported in Namibia (during July 2021) are due to the O/EA-2 topotype sharing closest genetic relationship to viruses recovered from Zambia (99.5% nucleotide identity: see Section 4.4 of this report). The FMD cases in Namibia represent the first occurrence of serotype O anywhere in Southern Africa since 2000, when viruses of Asian origin (O/ME-SA/PanAsia) caused outbreaks in South Africa. This situation will need close monitoring since serotype O vaccines are not so widely used in Namibia, or in neighbouring countries such as Botswana or Zimbabwe.

Don King, Pirbright, October 2021

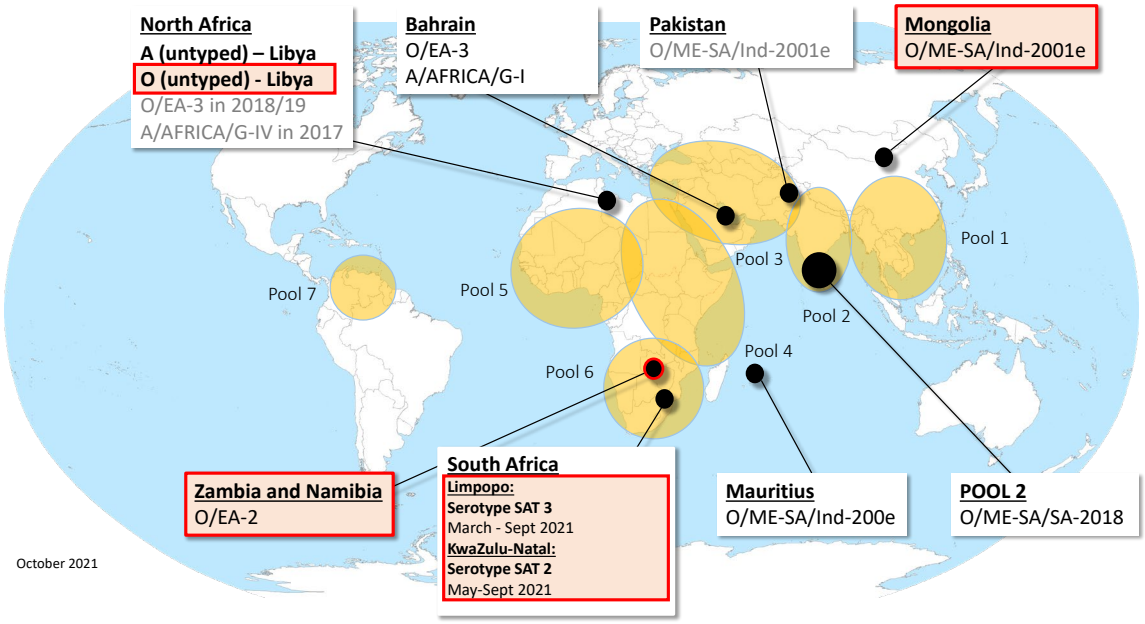


Figure 1: Recent FMD global outbreaks (new headline events reported July to Sept 2021 are highlighted) with endemic pools highlighted in orange. Source: WRLFMD. Map conforms to the United Nations World Map, June 2020.

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, Islamic Republic of Iran, 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.

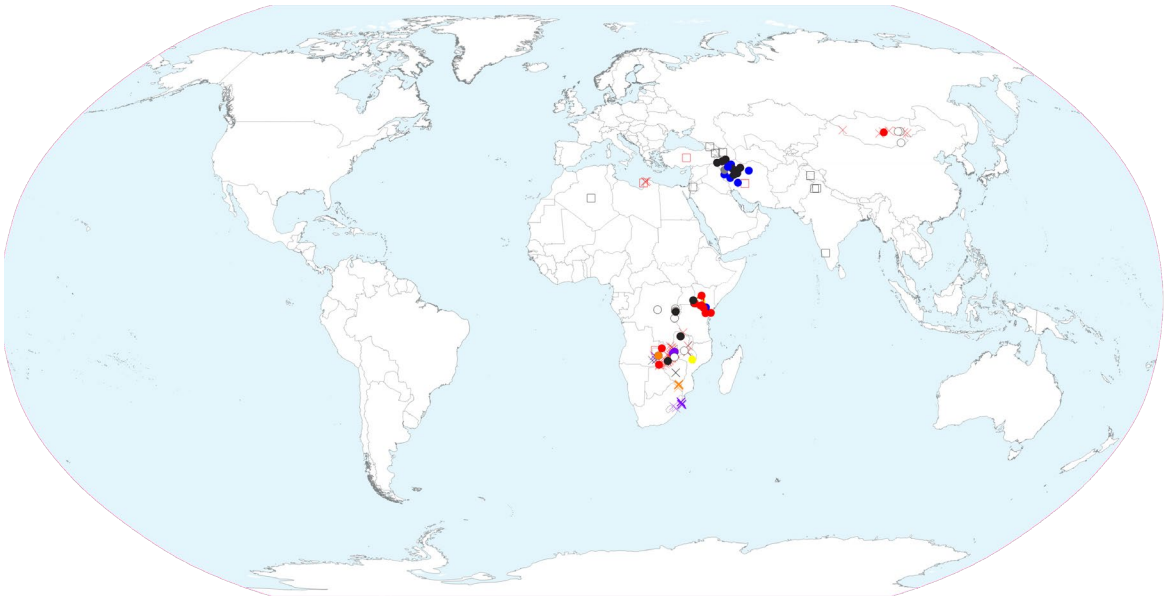


Figure 2: Samples tested by WRLFMD or reported in this quarter. ● indicates samples analysed; × indicates new outbreaks reported to the OIE, but where results to define the genotype have not been reported; □ indicates reports of FMD from other sources. Shape colours define the serotype detected ●O; ●A;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

Mongolia

Outbreaks (n=8) of **FMD type O** were reported to have occurred (in cattle, sheep and goats) in eight districts between May and August 2021. A batch of 16 samples were received on the 9 August 2021. Four were identified as **FMD type O** (ME-SA/Ind-2001e) and 12 were NVD.

OIE World Animal Health Information System (Event IDs: evt_3927, evt_3921, evt_3800 and evt_3819)

3.3. Pool 2 (South Asia)

The Republic of India

FMD has been reported from Arkalgud, Arsikere, Channarayapatna, and Sakleshpur taluks in Hassan, Karnataka. Vaccination is usually undertaken every 6 months. But has not been done in the past year due to the COVID-19 pandemic. Ring vaccination of all animals within 5 km has been undertaken.

ProMED post: 20210926.8698732

There has been a major outbreak of FMD in various districts in Kashmir. By the end of July 18 000 cattle were reported to have been infected.

ProMED post: 20210825.8622291

More than 500 animals have been infected with FMD in an outbreak in Ludhiana district, Punjab. Vaccination of animals within 3km of the epicentre of the outbreak is being undertaken.

ProMED post: 20210811.8586633

Cattle in Nihal Singh Wala, Punjab died from FMD in a 4-week period starting from 6 July 2021. The animals had vaccinated under the National Animal Disease Control Programme (NADCP) in November 2020, which had been halted halfway through after samples of the vaccine failed a quality test.

ProMED post: 20210804.8569599

The Federal Democratic Republic of Nepal

A batch of 70 samples was received on 14 September 2021 and typing/genotyping results are pending.

3.4. Pool 3 (West Eurasia and Middle East)

The Republic of Armenia

A post-vaccination serological survey for large and small ruminants after the autumn vaccination campaign is being undertaken.
371 864 large ruminants and 112 491 small ruminants were vaccinated in June - August 2021 across all regions.

FAO Eu-FMD FAST report Jul-Sep 2021

The Republic of Azerbaijan

Azerbaijan plans to conduct a post-vaccination serological survey for large and small ruminants after the autumn vaccination campaign. 138 028 cattle and 277 968 small ruminants were vaccinated in July-August. Vaccine coverage for spring vaccination campaign is 95.3% for cattle and 67.7% for small ruminants.

FAO Eu-FMD FAST report Jul-Sep 2021

Georgia

In this reporting period, samples from three suspected cases were submitted to the State Laboratory of Agriculture, but all were negative. The NSP serosurveillance action plan is under development. SP serosurveillance has been conducted, results of which are pending. The spring prophylactic vaccination campaign is complete and autumn vaccination has started. During this reporting period 574 135 animals were vaccinated: 204 524 LR and 282 861 SR.

FAO Eu-FMD FAST report Jul-Sep 2021

The Islamic Republic of Iran

A batch of 50 samples were received on 2 July 2021. The following viruses were identified: 22 **FMD type O** (ME-SA/PanAsia-2^{ANT-10}), 18 **FMD type A** (ASIA/Iran-05^{FAR-11}) and one **FMD type Asia 1** (ASIA/Sindh-08). FMDV genome was detected in the remaining nine samples.

During this third quarter there were 19 outbreaks detected in small ruminants, and 60 outbreaks in large ruminants. Circulating lineages include: O/PanAsia-2/ANT-10 and A/Asia/Iran-05^{Far-11}. Serotype Asia 1 has not been detected in this quarter. According to the Islamic Republic of Iran Veterinary Organization (IVO) 1 148 196 large ruminants and 3 326 988 small ruminants were vaccinated against FMD with trivalent vaccines (O, A, Asia1) which were either locally produced or imported. The vaccination of nomadic animals was done free of charge.

FAO Eu-FMD FAST report Jul-Sep 2021

The Republic of Turkey

FMD outbreaks (due to O/PanAsia2/Qom-15 and O/PanAsia2/Ant-10) were reported in Anatolia in the 3rd quarter of 2021. For clinical surveillance 19 260 animals were clinically examined for FMD in the high-risk area (Istanbul), and 34 740 in the low-risk areas (Edirne, Çanakkale, Tekirdağ and Kırıklareli). 3 597 sera were collected and tested by NSP ELISA as part of the national FMD serosurveillance – to estimate NSP prevalence. Results expected by the end of the year. An autumn preventive vaccination has been performed in the surveillance zone for all susceptible species planned from September - November. This campaign targets only large ruminants in Anatolia and both, large and small ruminants in Thrace, including a booster vaccination for primo-vaccinates.

FAO Eu-FMD FAST report Jul-Sep 2021

3.5. Pool 4 (North and Eastern Africa)

The People's Democratic Republic of Algeria

The annual vaccination campaign is ongoing since mid-September

FAO Eu-FMD FAST report Jul-Sep 2021

Democratic Republic of the Congo

A batch of 95 samples were received on 19 July 2021. **FMD type O** (topotype EA-2) was identified in 15 samples.

The Republic of Kenya

A batch of 20 samples were received on 5 July 2021. The following viruses were identified: 13 **FMD type O** (EA-2), one **FMD type A** (AFRICA/G-I) and two **FMD type SAT1** [topotype I (NWZ)]. The remaining samples were either FMDV-GD (n=3) or NVD (n=1).

The State of Libya

On the 5 August 2021, 12 outbreaks of **FMD type A** in sheep and goats were reported to have occurred across the county between February and November 2020. On the 16 September 2021, three outbreaks of **FMD type O** were reported to have occurred in cattle in June 2021 (Marj district, northeastern Libya). No genotyping has been reported.

OIE World Animal Health Information System (event ID: evt_3835)

Three outbreaks (serotype O) in farms near Benghazi and around the city of Al-Marg in the East Region, in July 2021. Immediate control measures were taken. Blood samples were collected from the targeted herds and sent to the National Veterinary Laboratory in Tripoli. So far, 6 779 heads of cattle have been vaccinated.

FAO Eu-FMD FAST report Jul-Sep 2021

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

Outbreaks in cattle at Msiyamphanje village (near to Lengwe National Park, Chikwawa) were confirmed as due to **FMD type SAT 1** by the SSARRL (BVI). A VP1 sequence was sent to the WRLFMD and genotyping revealed it to belongs to topotype I (NWZ) most closely related to previous cattle outbreaks in 2015-2016 and to viruses isolated from African buffalo in the nearby Lengwe National Park in 2010 (see section 4.4 of this report). The origin was suspected to be African buffalo.

The Republic of Namibia

Between June and August 2021, three outbreaks of **FMD type O** were reported in cattle in the Caprivi Strip. A VP1 sequence was received from the SSARRL (BVI) and genotyping confirmed a close relationship with recent EA-2 viruses from Western Zambia. This is the first report of type O in Namibia.

OIE World Animal Health Information System (event ID: evt_3752)

ProMED post: 20210703.8494016, 20210814.8595516 and 20210924.8698684

The Republic of South Africa

During the reporting period further outbreaks of **FMD type SAT 3** continued to be reported from the Limpopo region and **FMD type SAT 2** from KwaZulu-Natal.

OIE World Animal Health Information System (Event IDs: evt_3738 and evt_3758)

The Republic of Zambia

During August 2021, 36 outbreaks of **FMD type O** were reported to have occurred in cattle between March 2018 and July 2021 and five outbreaks of **FMD type SAT 2** between December 2020 and May 2021. These occurred across the whole country.

On 8 June 2021, a batch of 98 samples was received. Typing identified the following viruses: 34 **FMD type O** (EA-2), seven **type SAT 2** (five topotype III and two topotype IV) and one **type SAT 3** (topotype II). 17 samples were FMDV-GD and 39 were NVD.

OIE World Animal Health Information System: 26387, evt_3891, evt_3892

Zimbabwe

In July 2021, two outbreaks of FMD (untyped) were reported in cattle on neighbouring farms in Gweru, Midlands.

OIE World Animal Health Information System (event ID: evt_3830)

3.8. Pool 7 (South America)

No new outbreaks of FMD were reported in South America.

3.9. Extent of global surveillance

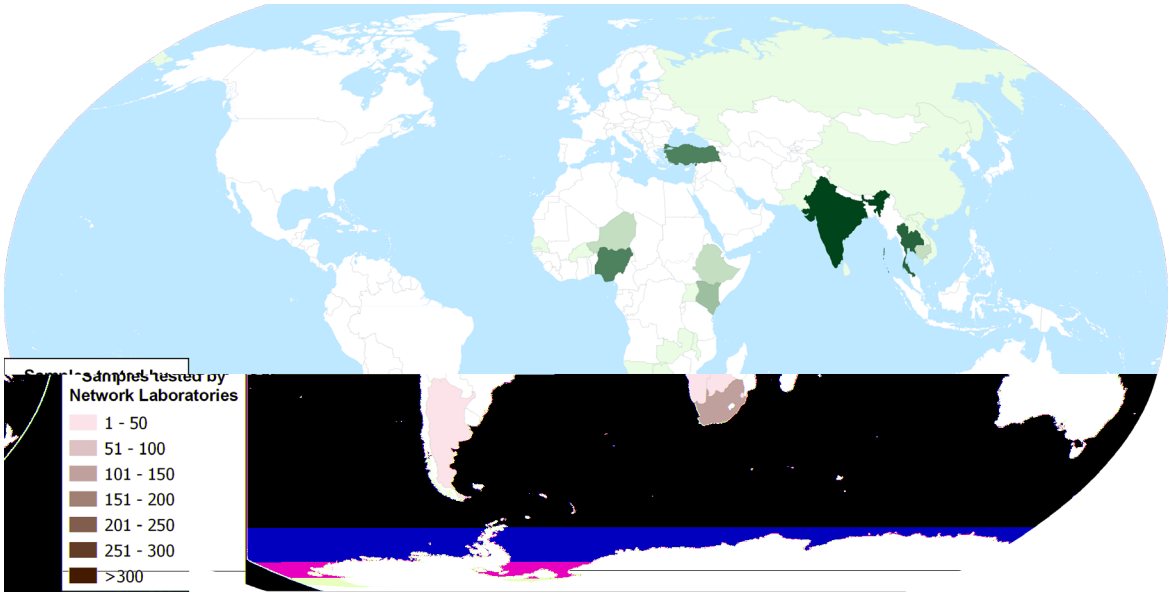


Figure 3: Samples received during 2020 from FMD outbreaks (routine surveillance that is undertaken in countries that are FMD-free without vaccination is not shown). Data from presentations given at the OIE/FAO Reference laboratory Network annual meeting (https://www.foot-and-mouth.org/Ref-Lab-Network/Network-Annual-Meeting)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

During 2020, results for 1 590 samples were recorded by the partner and affiliate laboratories of the OIE/FAO FMD Laboratory Network.

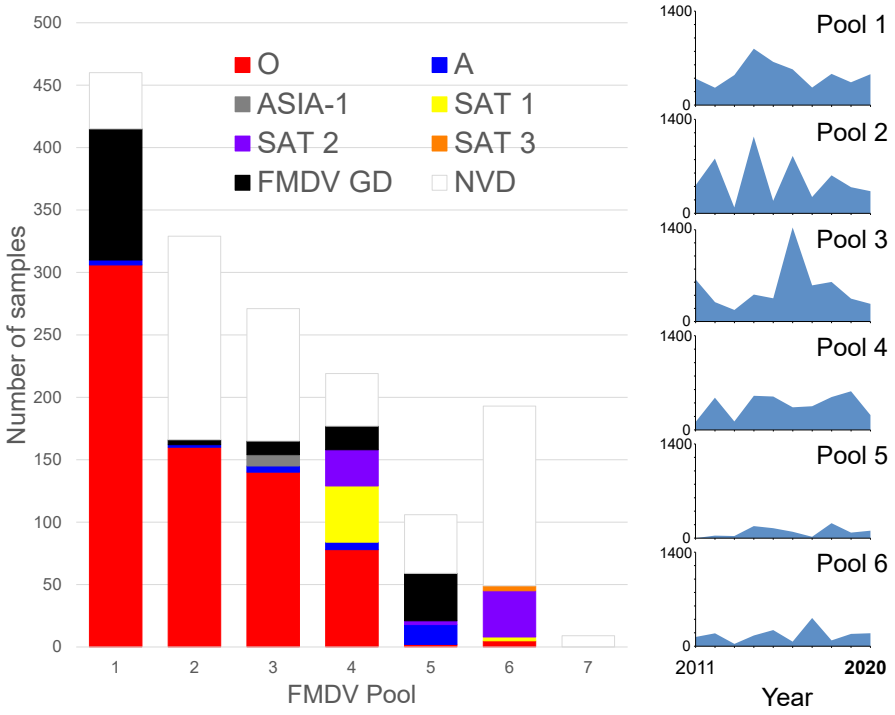


Figure 4: Representation of different FMDV serotypes detected in samples tested from the FMD endemic pools by the OIE/FAO FMD Laboratory Network during 2020 (NB: Figure 1 shows the geographical coverage of each pool; NVD = no virus detected; GD = genome detected by RT-PCR). Right-hand panels display 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 July to September 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 **July to September** 2021 (* indicates a batch carried over from the previous quarter).

WRLFMD Batch No.	Date received	Country	Total No. samples	Serotype	No. of samples	No. of sequences	Sequencing status
WRLFMD/2021/00008	08/06/2021	Zambia	98	O	34	34	Finished
				SAT2	7	7	Finished
				SAT3	1	1	Finished
				FMDV-GD	17	-	-
				NVD	39	-	-
WRLFMD/2021/00009	02/07/2021	Islamic Republic of Iran	50	O	22	22	Finished
				A	18	18	Finished
				Asia1	1	1	Finished
				FMDV-GD	9	-	-
WRLFMD/2021/00010	05/07/2021	Kenya	20	O	13	13	Finished
				A	1	1	Finished
				SAT1	2	2	Finished
				FMDV-GD	3	-	-
				NVD	1	-	-
WRLFMD/2021/00011	19/07/2021	Democratic Republic of the Congo	63[a]	O	15	15	Finished
				FMDV-GD	12	-	
				FMDV-NGD	11	-	-
				NVD	25	-	-

WRLFMD/2021/00012	09/08/2021	Mongolia	16	O	4	4	Finished
				NVD	12	-	-
WRLFMD/2021/00013	14/09/2021	Nepal	70	Pending	-	-	Pending
Totals			**349**		**247**	**118**	

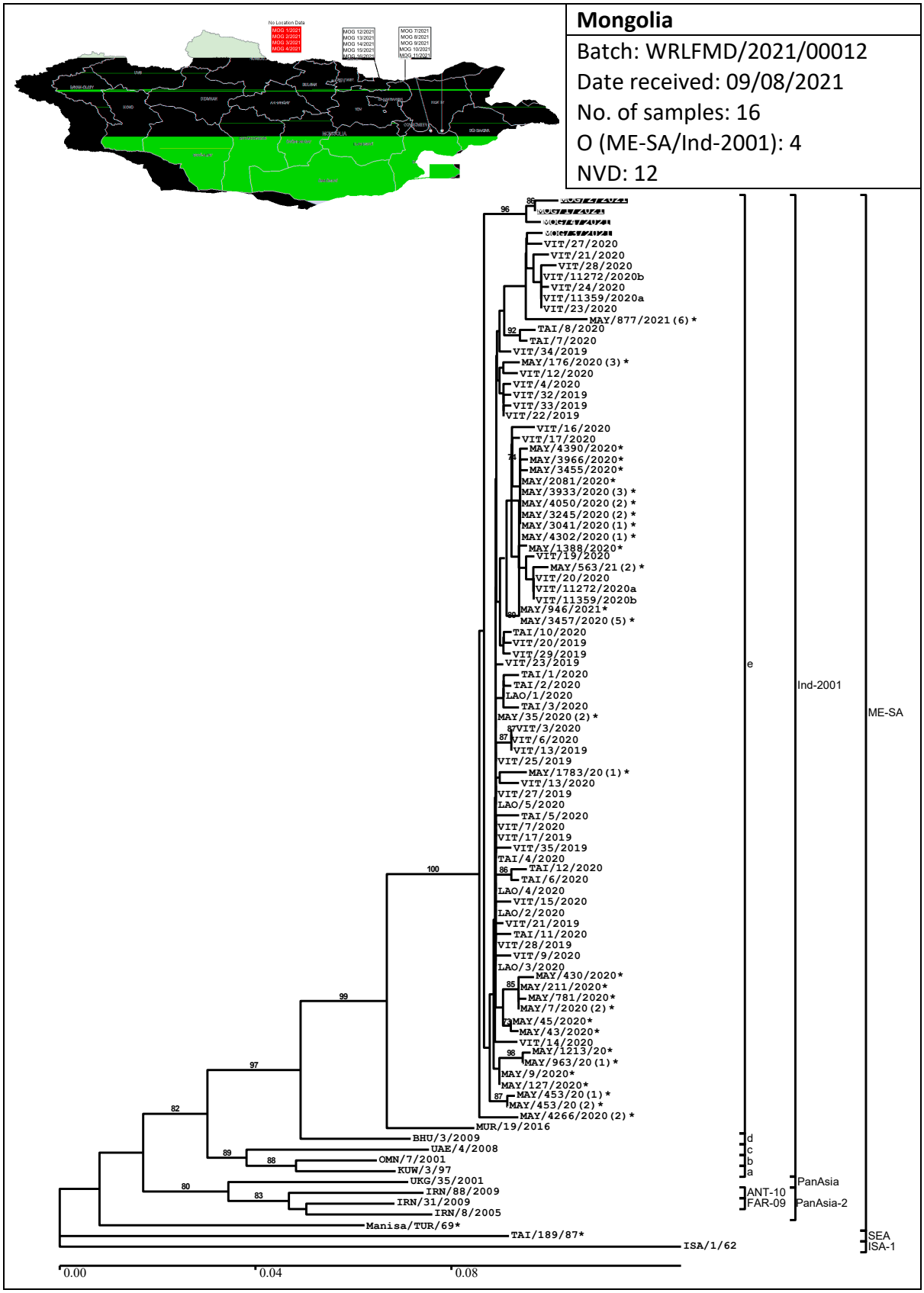
[a] additional samples (representing different sample types) were included in this shipment but not tested

Table 3: VP1 sequences submitted by other FMD Network laboratories to the WRLFMD from **July to September** 2021.

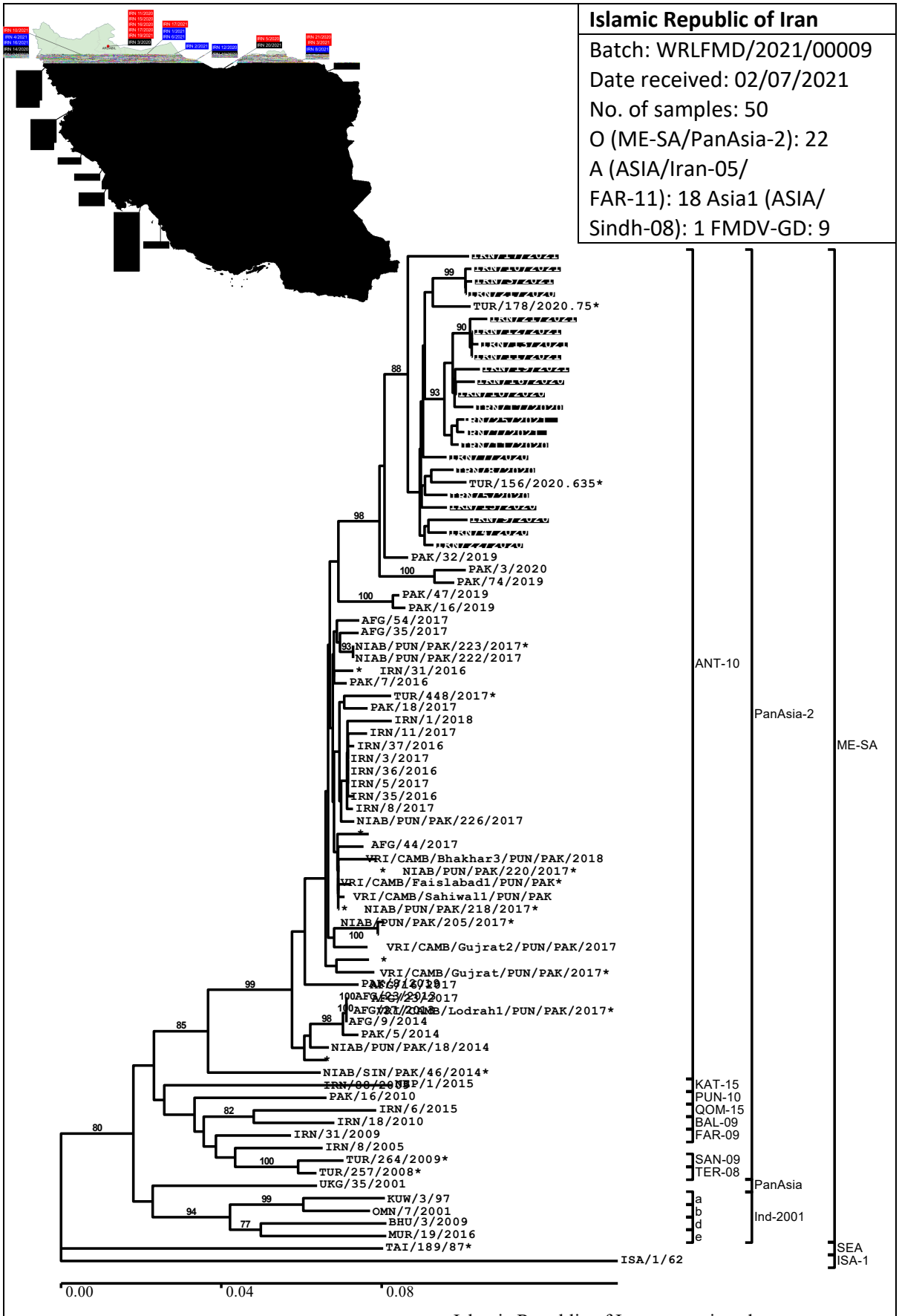
WRLFMD Batch No.	Date received	Country	Serotype	Date Collected	No. of sequences	Submitting laboratory
WRLMEG/2021/00011	29/07/2021	Malawi	SAT1	2021	1	BVI
WRLMEG/2021/00012	13/08/2021	Namibia	O	2021	1	BVI
				Total	**2**	

4. Detailed analysis

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



4.2. Pool 3 (West Eurasia and Middle East)



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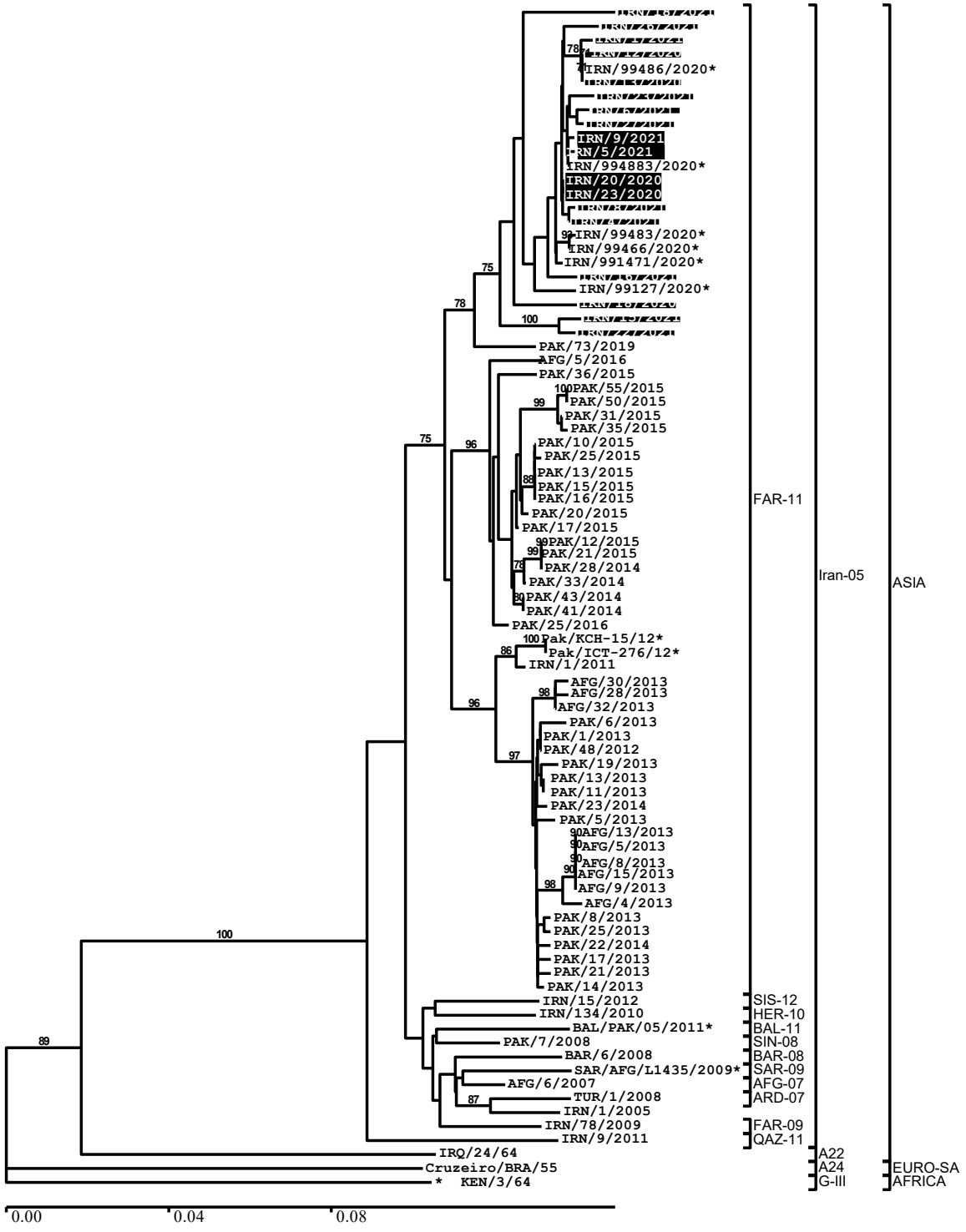
Islamic Republic of Iran Continued



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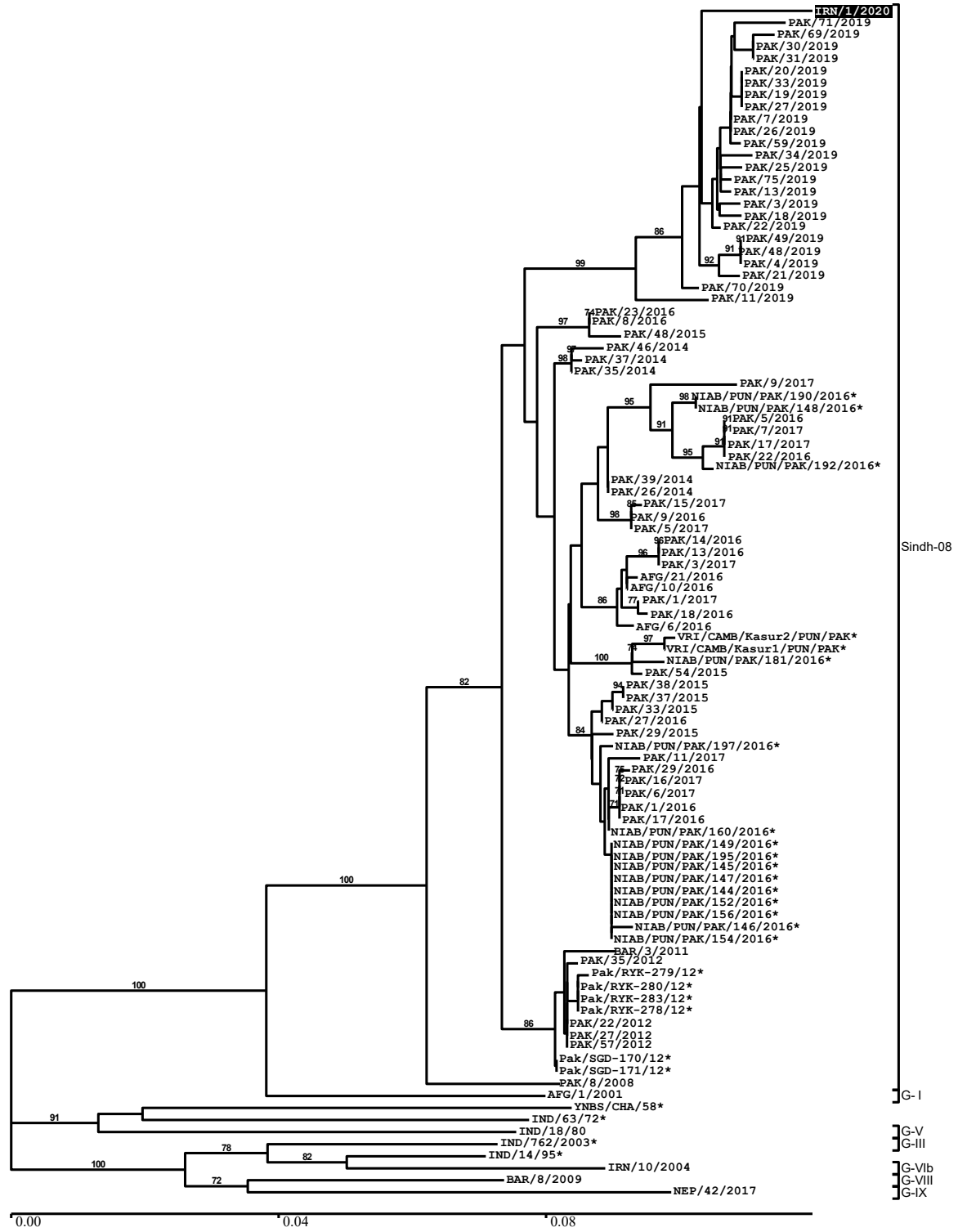
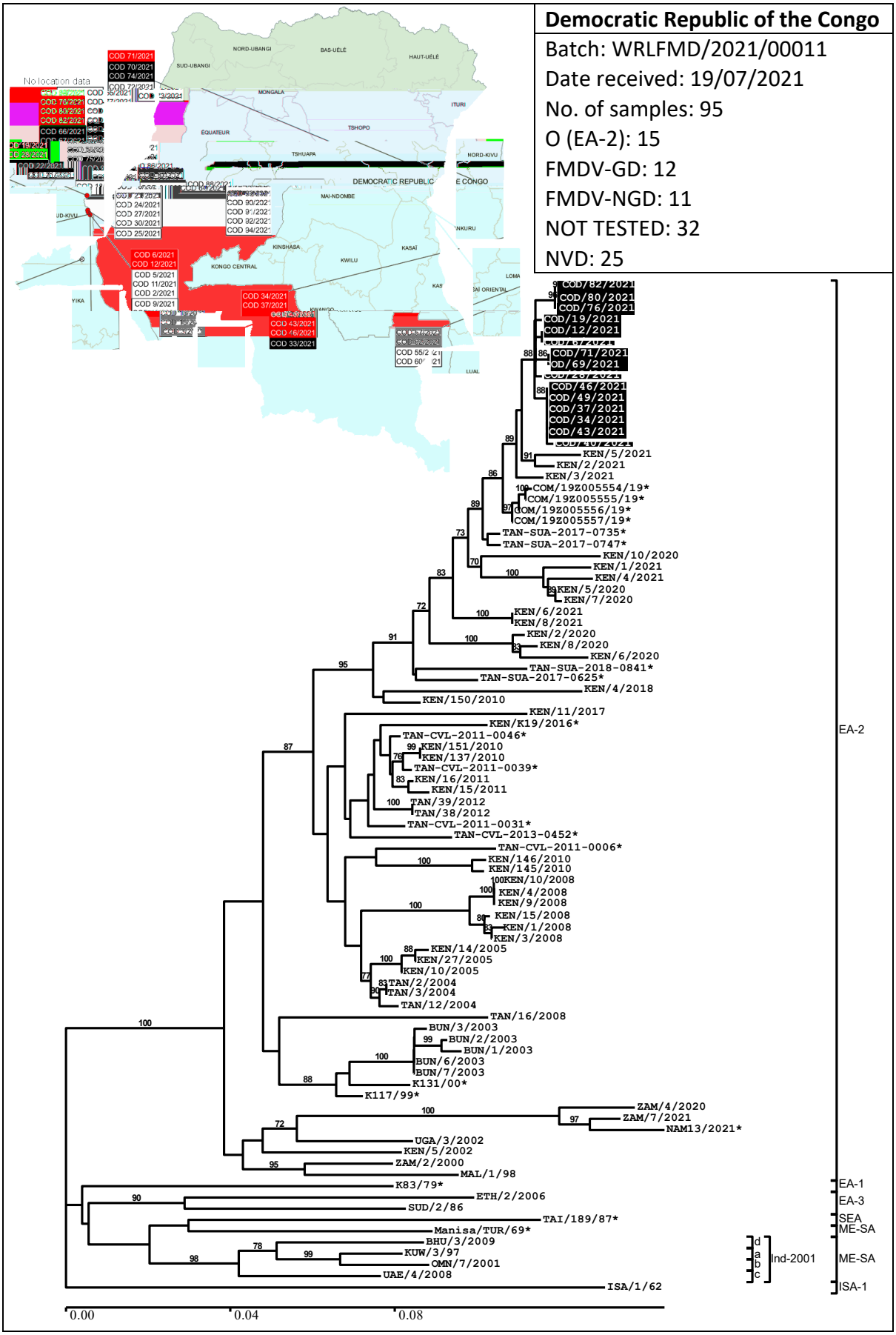
Islamic Republic of Iran Continued

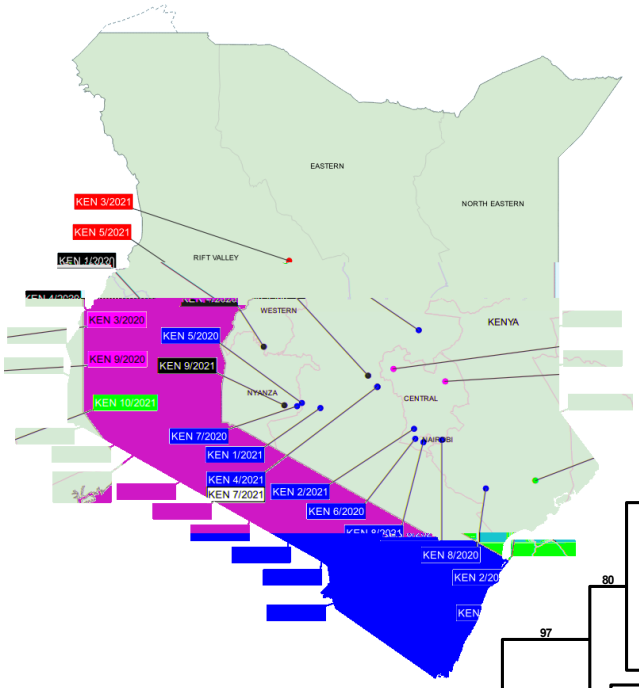


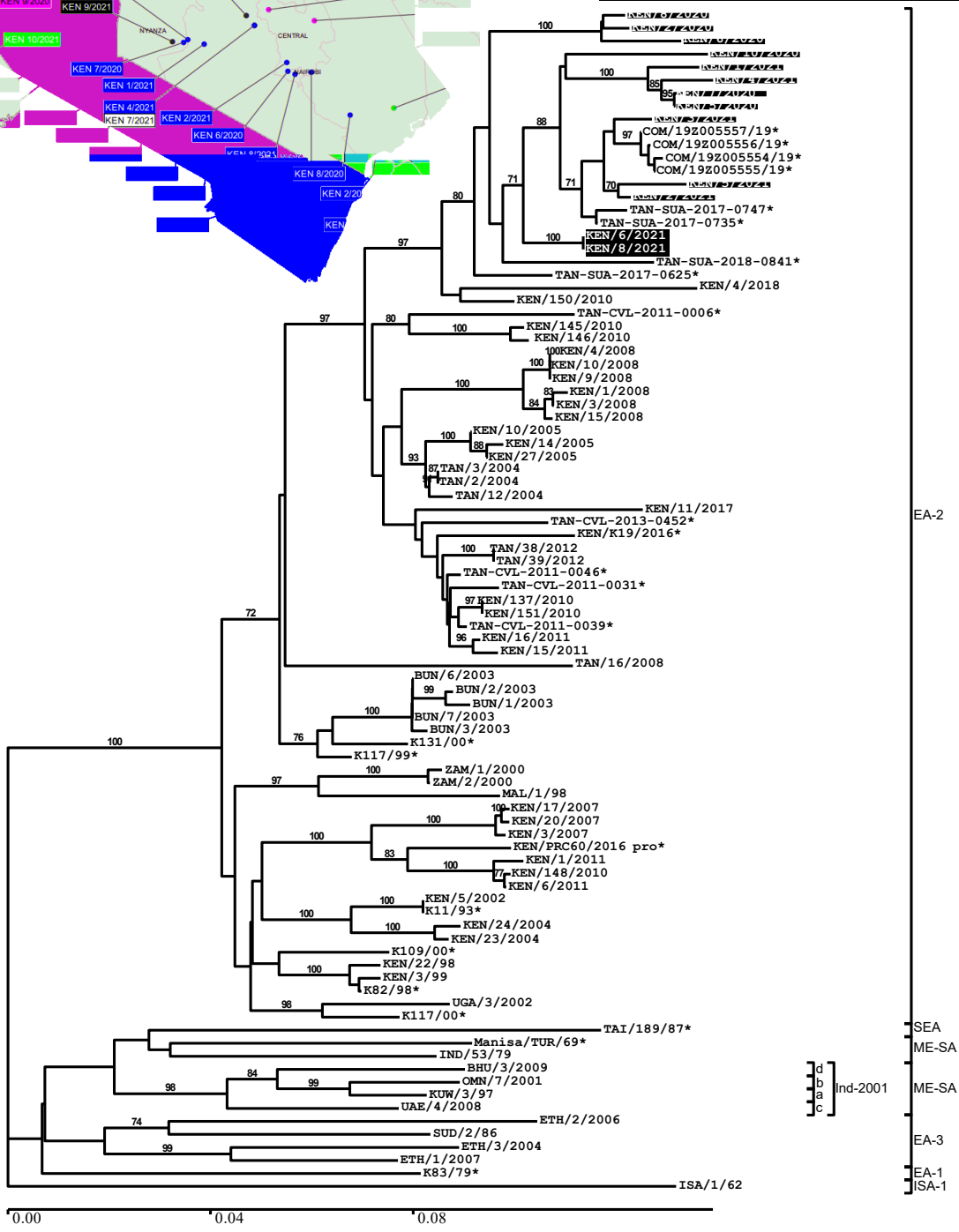
4.3. Pool 4 (North and East Africa)



Republic of Kenya

Batch: WRLFMD/2021/00010
Date received: 05/07/2021
No. of samples: 20
O (EA-2): 13
A (A/AFRICA/G-I): 1
SAT1 (I (NWZ)): 2
FMDV-GD: 3
NVD: 1





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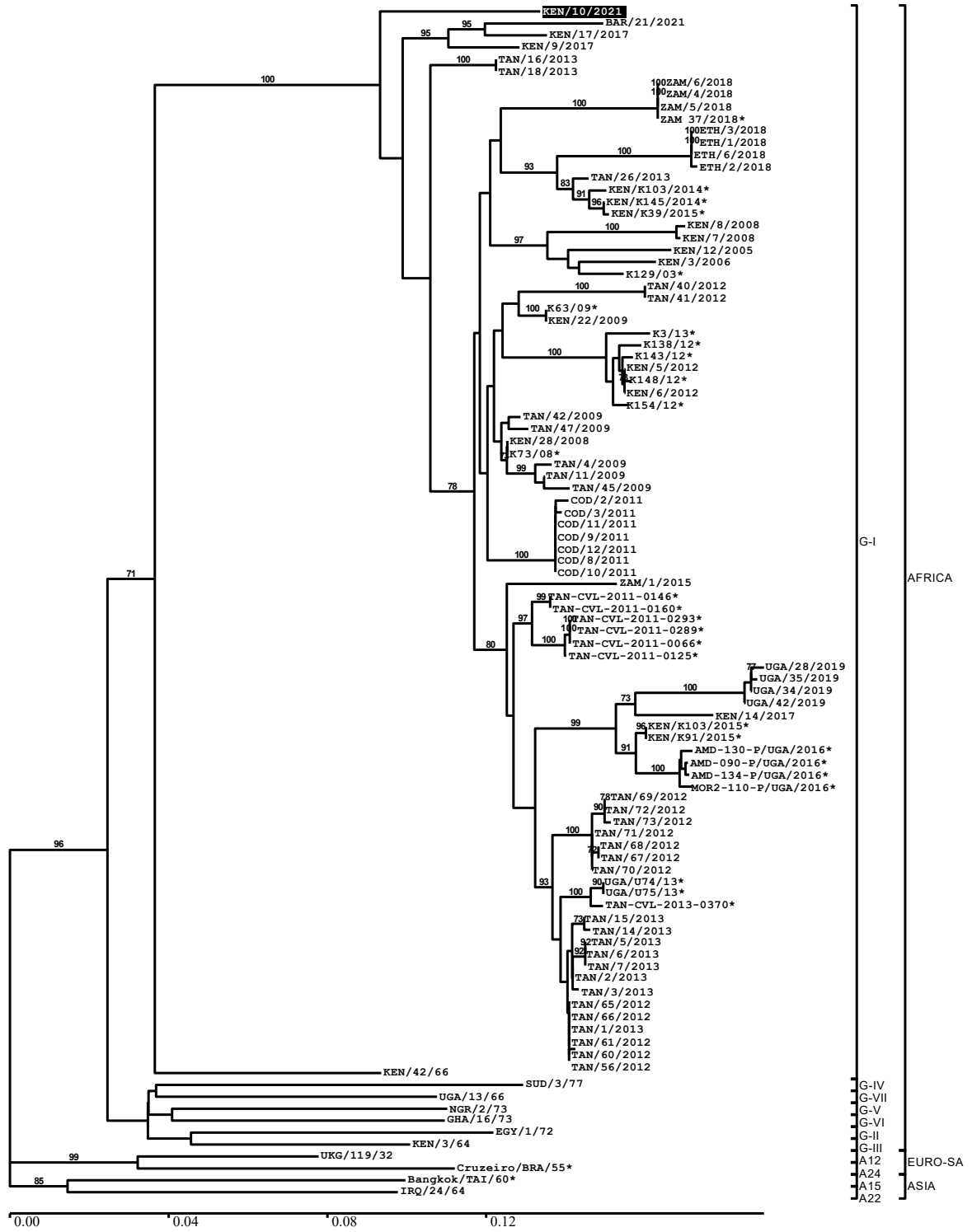
Kenya continued



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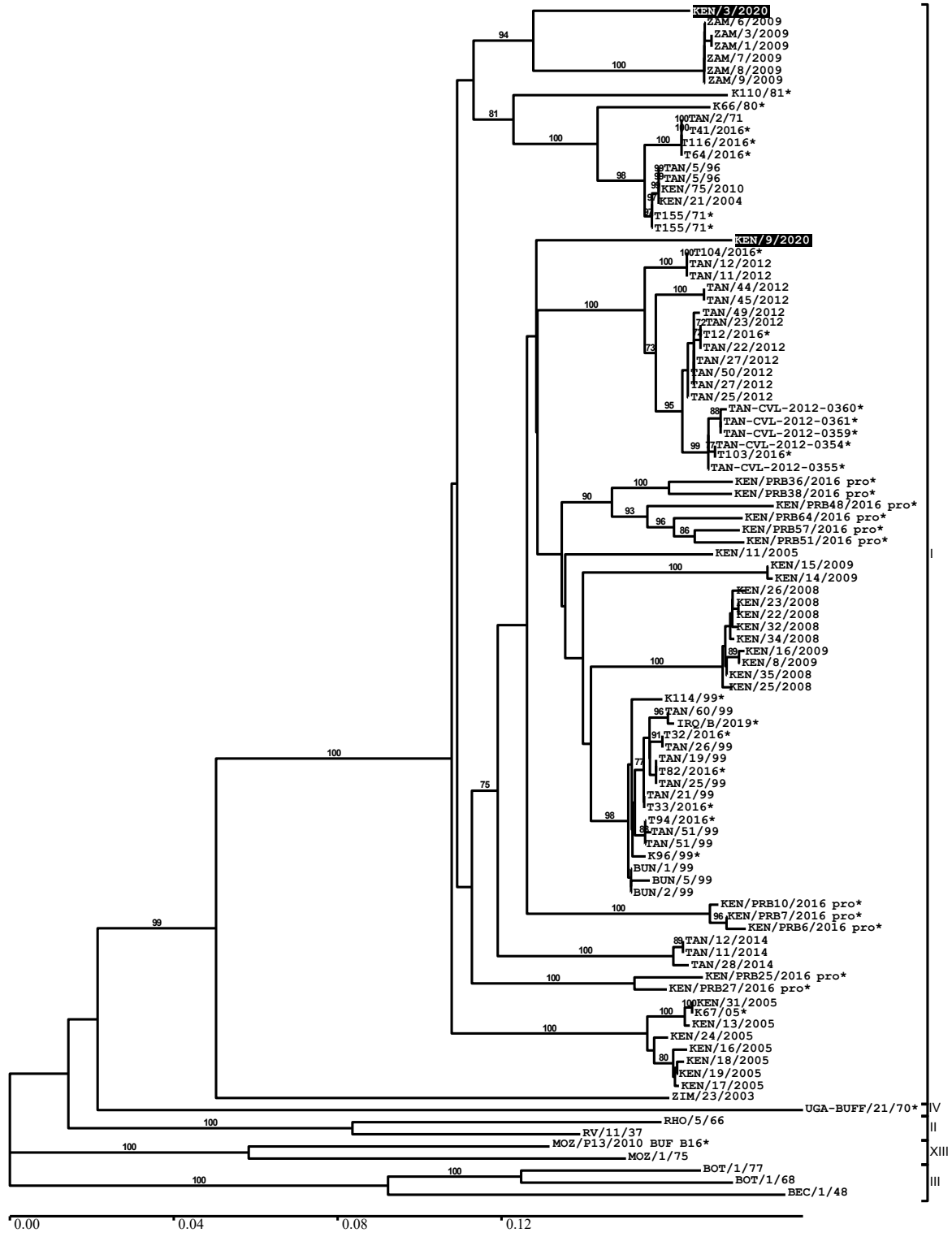
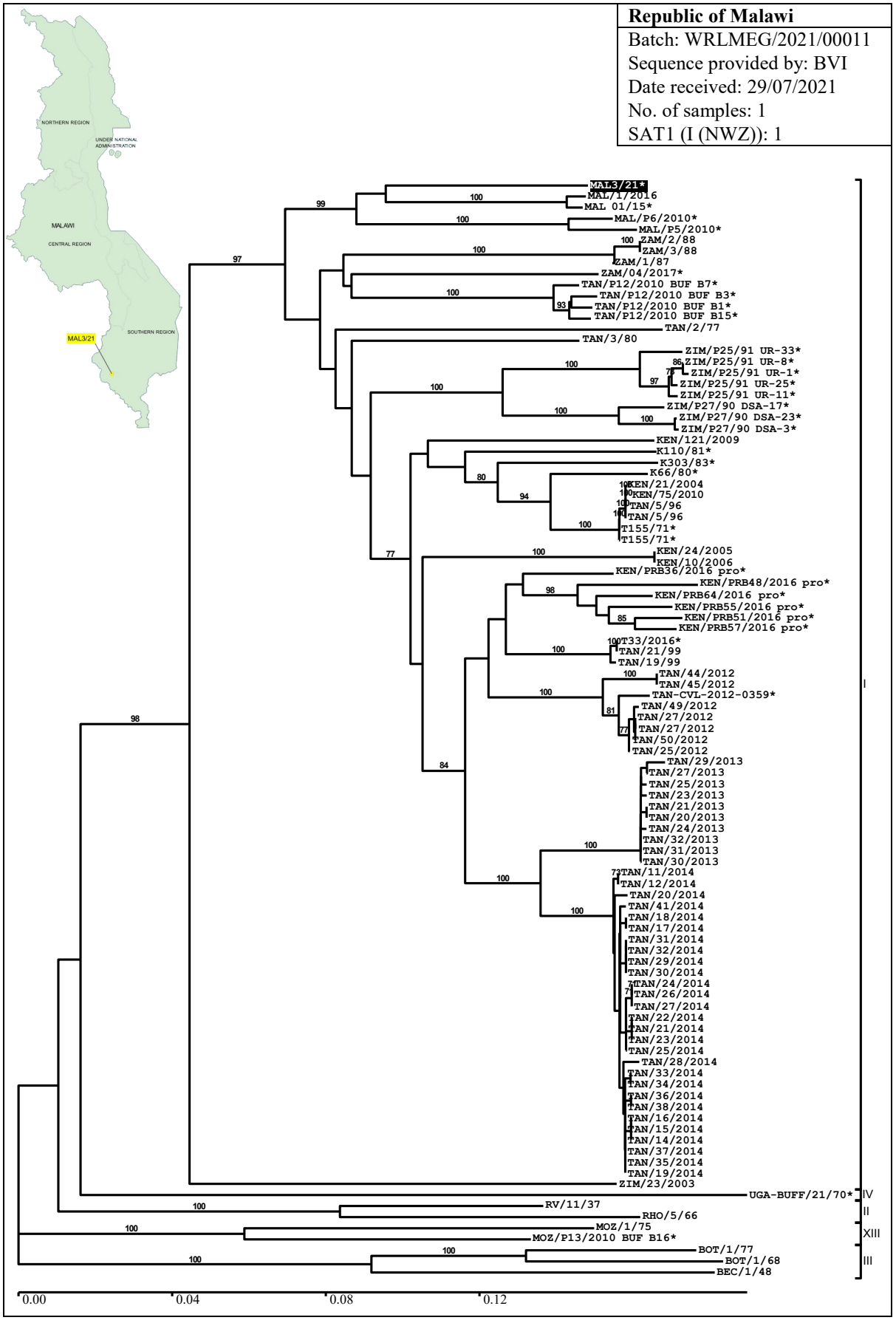
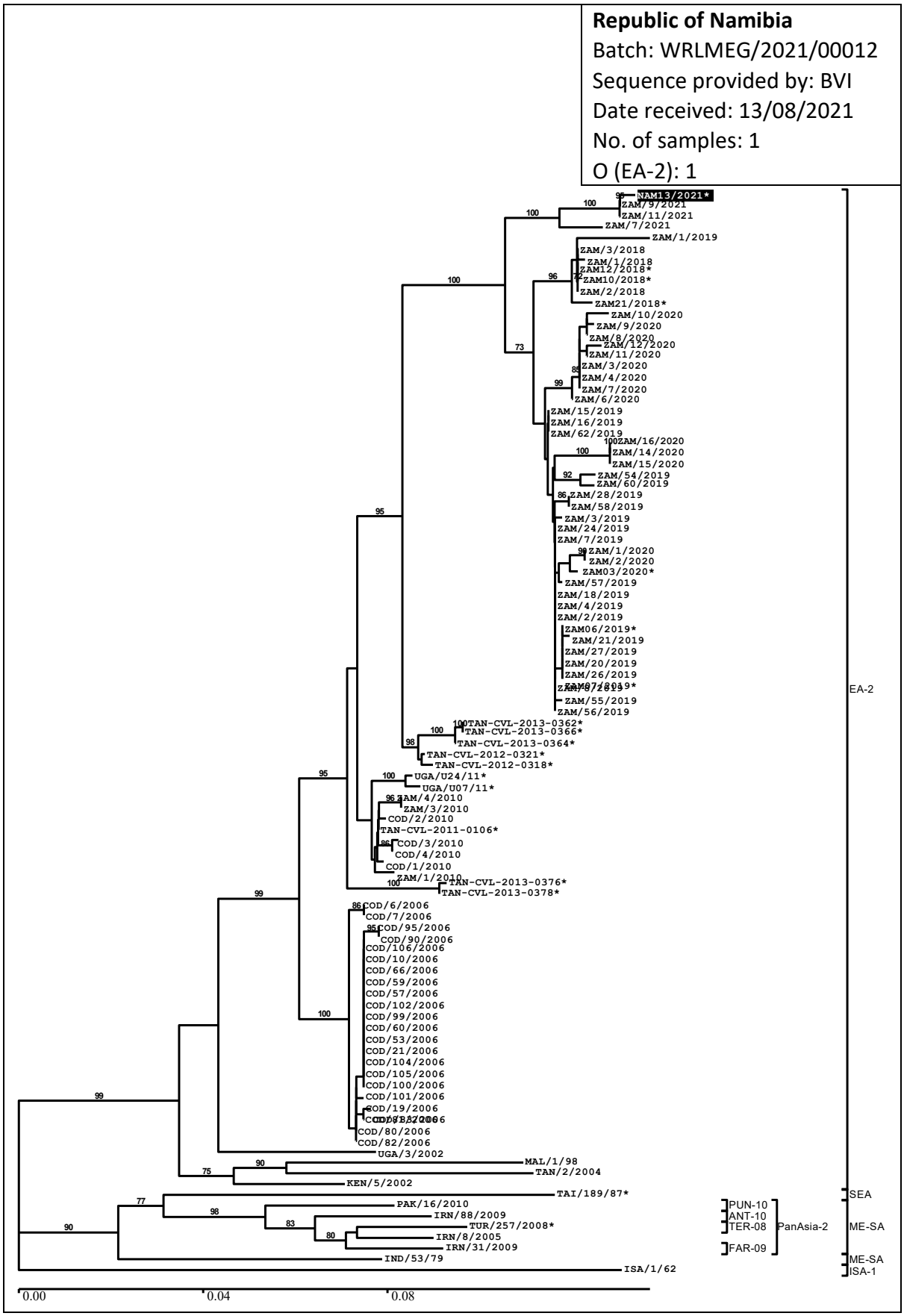
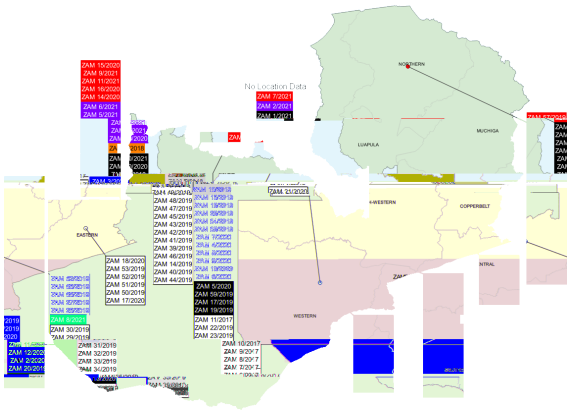


4.4. Pool 6 (Southern Africa)

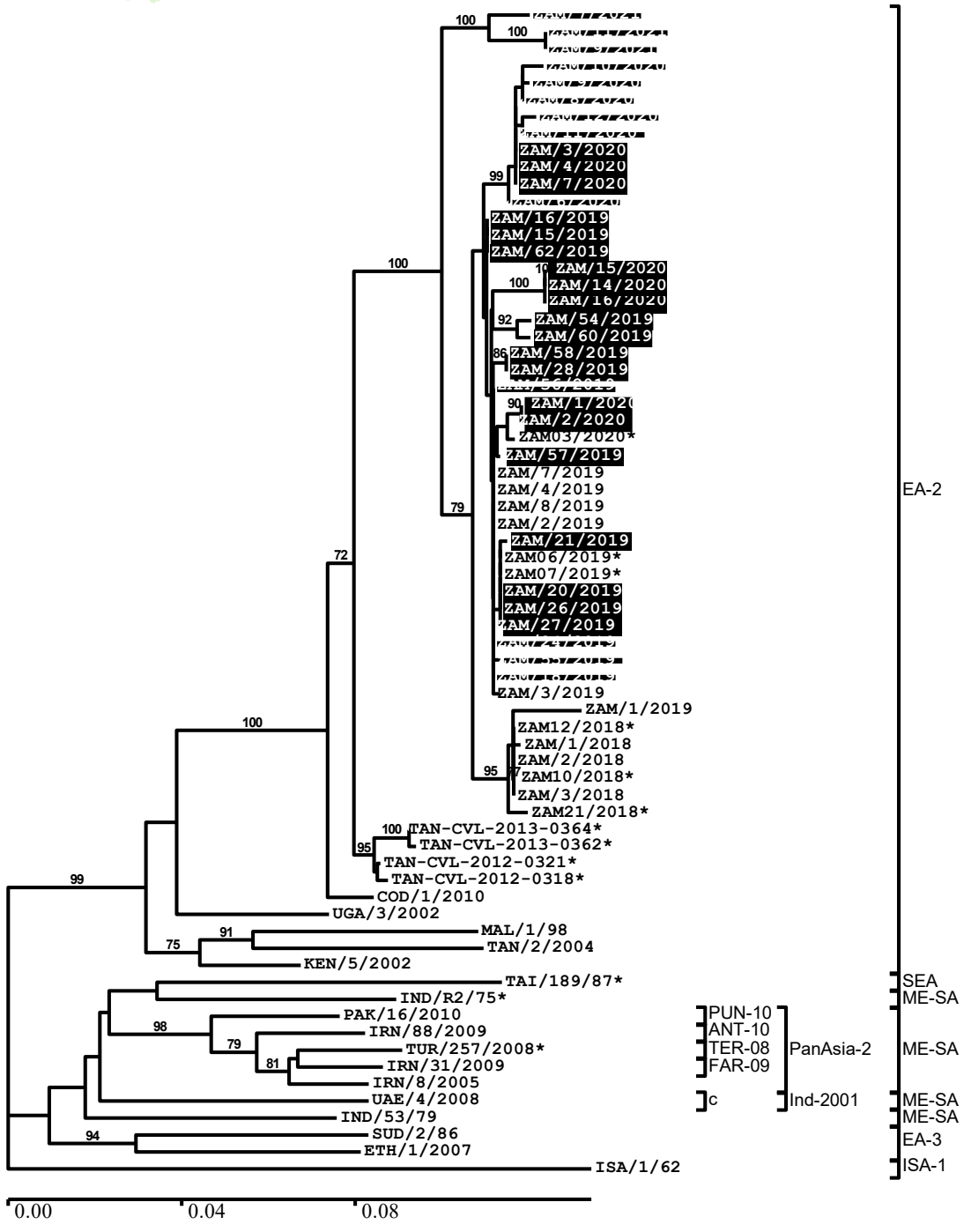



Republic of Namibia
Batch: WRLMEG/2021/00012
Sequence provided by: BVI
Date received: 13/08/2021
No. of samples: 1
O (EA-2): 1
NAM13/2021*
ZAM/9/2021
ZAM/11/2021
ZAM/7/2021
ZAM/1/2019
ZAM/3/2018
ZAM/1/2018
ZAM12/2018*
ZAM10/2018*
ZAM/2/2018
ZAM21/2018*
ZAM/10/2020
ZAM/9/2020
ZAM/8/2020
ZAM/12/2020
ZAM/11/2020
ZAM/3/2020
ZAM/4/2020
ZAM/7/2020
ZAM/6/2020
ZAM/15/2019
ZAM/16/2019
ZAM/62/2019
ZAM/16/2020
ZAM/14/2020
ZAM/15/2020
ZAM/54/2019
ZAM/60/2019
ZAM/28/2019
ZAM/58/2019
ZAM/3/2019
ZAM/24/2019
ZAM/7/2019
ZAM/1/2020
ZAM/2/2020
ZAM03/2020*
ZAM/57/2019
ZAM/18/2019
ZAM/4/2019
ZAM/2/2019
ZAM06/2019*
ZAM/21/2019
ZAM/27/2019
ZAM/20/2019
ZAM/26/2019
ZAM/55/2019
ZAM/56/2019
TAN-CVL-2013-0362*
TAN-CVL-2013-0366*
TAN-CVL-2013-0364*
TAN-CVL-2012-0321*
TAN-CVL-2012-0318*
UGA/U24/11*
UGA/U07/11*
ZAM/4/2010
ZAM/3/2010
COD/2/2010
TAN-CVL-2011-0106*
COD/3/2010
COD/4/2010
COD/1/2010
ZAM/1/2010
TAN-CVL-2013-0376*
TAN-CVL-2013-0378*
COD/6/2006
COD/7/2006
COD/95/2006
COD/90/2006
COD/106/2006
COD/10/2006
COD/66/2006
COD/59/2006
COD/57/2006
COD/102/2006
COD/99/2006
COD/60/2006
COD/53/2006
COD/21/2006
COD/104/2006
COD/105/2006
COD/100/2006
COD/101/2006
COD/19/2006
COD/80/2006
COD/82/2006
UGA/3/2002
MAL/1/98
TAN/2/2004
KEN/5/2002
TAI/189/87*
PAK/16/2010
IRN/88/2009
TUR/257/2008*
IRN/8/2005
IRN/31/2009
IND/53/79
ISA/1/62
0.00
0.04
0.08
EA-2
SEA
PUN-10
ANT-10
TER-08
FAR-09
PanAsia-2
ME-SA
ME-SA
ISA-1



Republic of Zambia

Batch: WRLFMD/2021/00008
Date received: 08/06/2021
No. of samples: 98
O (EA-2): 34
SAT2 (III): 5
SAT2 (IV): 2
SAT3 (II): 1
FMDV-GD: 17
NVD: 39



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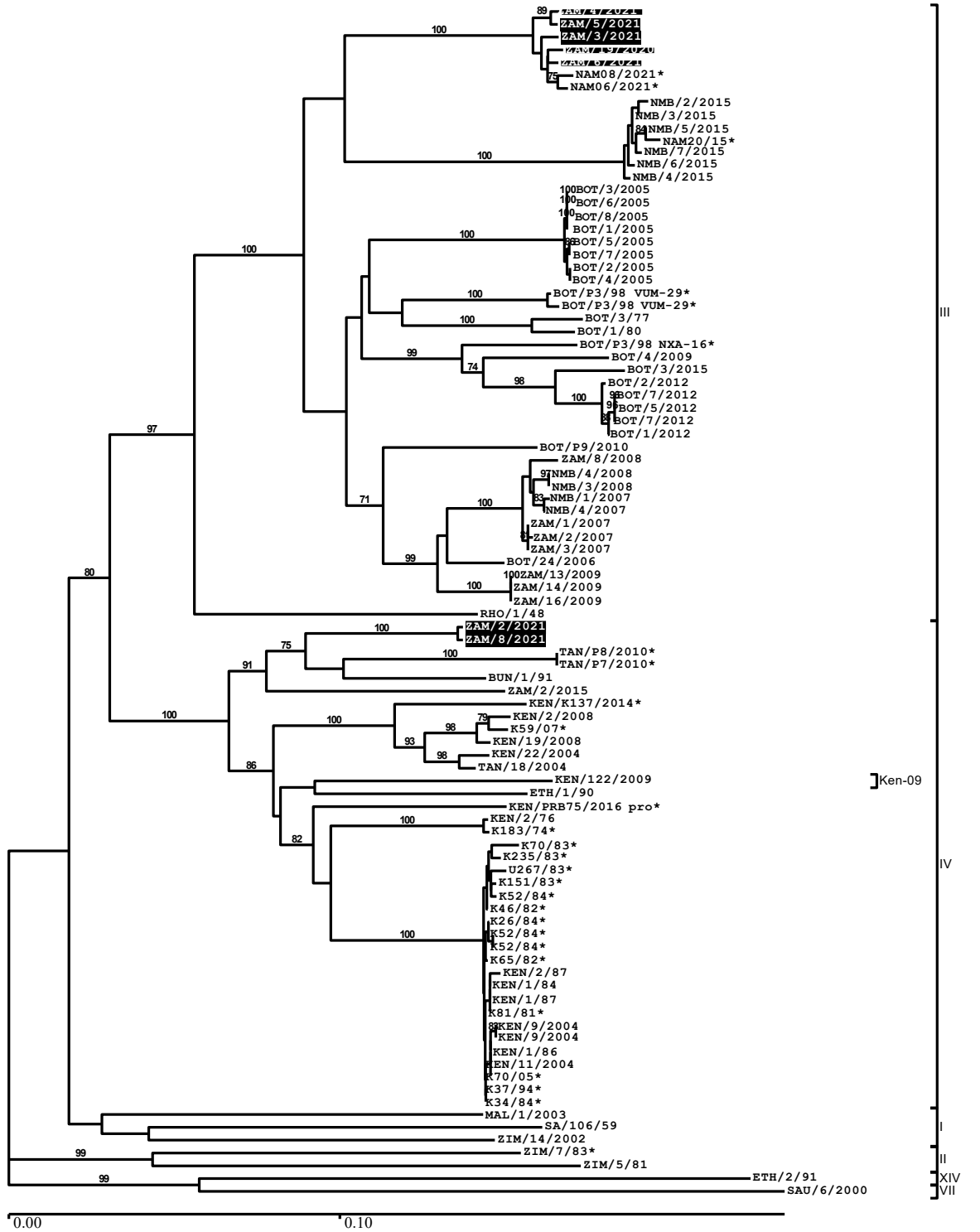
Zambia Continued



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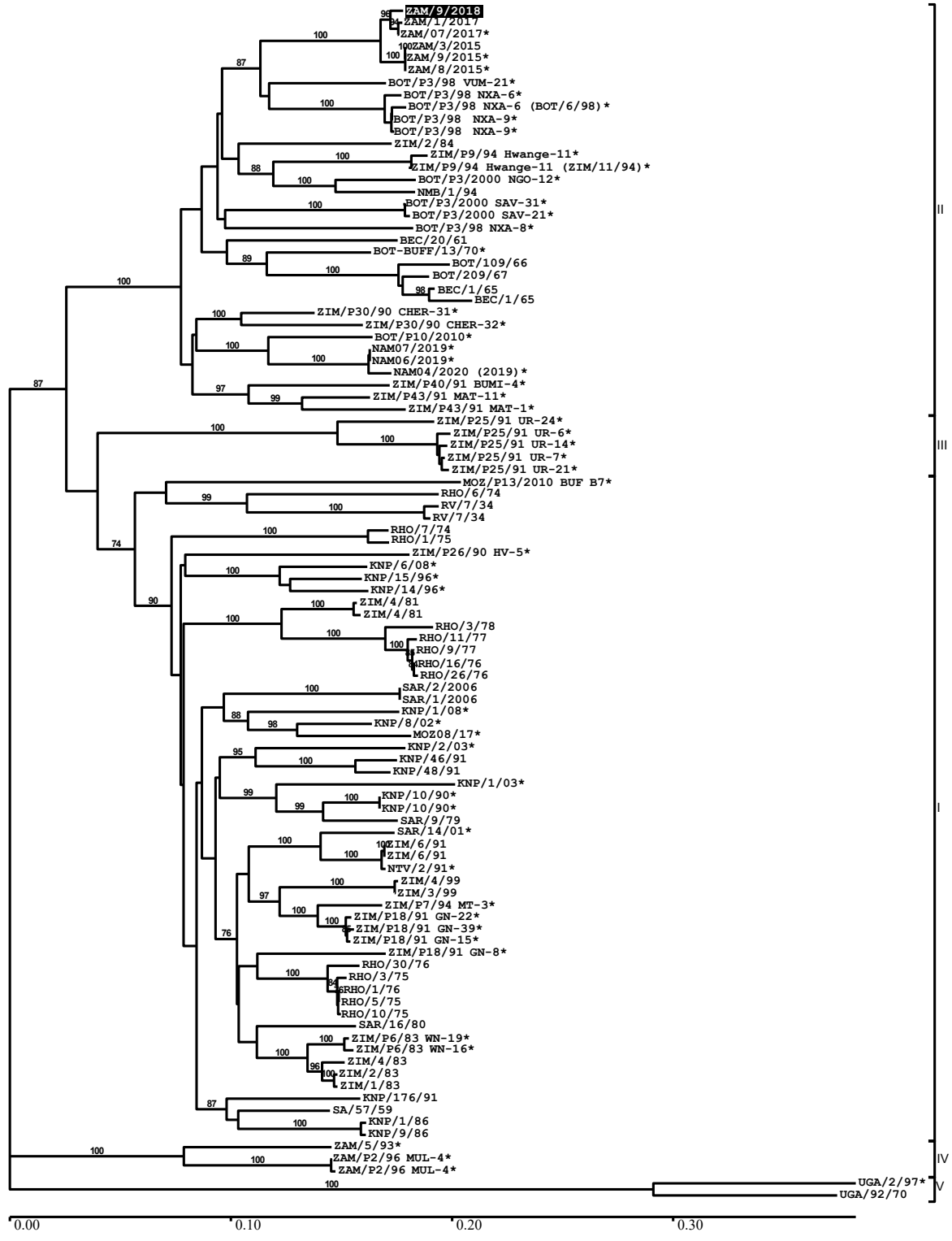
Zambia Continued



4.5. Vaccine matching

Antigenic characterisation of FMD field isolates by matching with vaccine strains by 2dmVNT from July to September 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
Viet Nam	4	-	-	-	-	-	-
Zambia	2	-	-	-	-	2	1
Total	**6**	**0**	**0**	**0**	**0**	**2**	**1**

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 Manisa Boehringer Ingelheim		O/TUR/5/09 MSD		O_1 Campos Biogénesis Bagó		O Panasia 2 Boehringer Ingelheim	
	Topotype	*Lineage*	*r1*	*Titre*	*r1*	*Titre*	*r1*	*Titre*	*r1*	*Titre*	*r1*	*Titre*
VIT/47/2018	SEA	Mya-98	0.34	1.48	0.14	1.67	0.3	1.78	0.49	2.37		
VIT/21/2020	ME-SA	Ind-2001	0.59	1.79	0.30	2.06	0.54	2.12	0.38	2.42		
VIT/24/2020	ME-SA	Ind-2001	0.39	1.61	0.20	1.89	0.42	2.01	0.37	2.41		
VIT/1/2021	ME-SA	Ind-2001	0.38	1.53	0.29	0.98	0.72	2.16	0.45	2.33		
ZAM/2/2020	EA-2	-	0.40	1.7	0.26	1.92	0.46	1.97	0.47	2.43	0.28	1.95
ZAM/7/2021	EA-2	-	0.59	1.87	0.47	2.17	1	2.35	1	2.81	0.68	2.33

Table 6: 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*
ZAM/2/2021	IV	-	0	0	0.06	1.25
ZAM/5/2021	III	-	0.14	0.95	0.16	1.71

Table 7: Vaccine matching studies for SAT 3 FMDV

Isolate	Serotype A		SAT3 Zim 83 Boehringer Ingelheim	
	Topotype	*Lineage*	*r_1*	*Titre*
ZAM/9/2018	II (WZ)	-	0	-

Annex 1: Sample data

Summary of submissions

Table 8: Summary of samples collected and received to WRLFMD (**July to September** 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*
Democratic Republic of the Congo	63[a]	15	0	0	0	0	0	0	37	25	38
Islamic Republic of Iran	50	22	18	0	0	0	0	1	9	50	0
Kenya	20	12	1	0	2	0	0	0	5	19	1
Mongolia	16	4	0	0	0	0	0	0	12	4	12
Zambia	97	33	0	0	0	7	1	0	56	57	40
TOTAL	**278**	**86**	**19**	**0**	**2**	**7**	**1**	**1**	**119**	**155**	**91**

[a] an additional 32 samples were received but not tested (representing duplicate samples collected from the same animal as reported)

Clinical samples

Table 9: Clinical sample diagnostics made by the WRLFMD **July to September** 2021

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	Results		
	Received	Reported				VI/ELISA	RT-PCR	Final report
Democratic Republic of the Congo	19/07/2021	06/09/2021	COD 2/2021	BOVINE	11-Feb-21		NEG	FMDV NGD
			COD 3/2021	BOVINE	11-Feb-21	NEG	NEG	NVD
			COD 5/2021	BOVINE	11-Feb-21	NOT TESTED	NEG	FMDV NGD
			COD 6/2021	BOVINE	11-Feb-21	O	POS	O
			COD 9/2021	BOVINE	11-Feb-21	NEG	NEG	NVD
			COD 11/2021	BOVINE	11-Feb-21	NOT TESTED	NEG	FMDV NGD
			COD 12/2021	BOVINE	11-Feb-21	O	POS	O
			COD 13/2021	BOVINE	11-Feb-21	NEG	NEG	NVD
			COD 15/2021	BOVINE	11-Feb-21	NEG	NEG	NVD
			COD 18/2021	BOVINE	12-Feb-21	NOT TESTED	NEG	FMDV NGD
			COD 19/2021	BOVINE	12-Feb-21	O	POS	O

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	Results		
	Received	Reported				VI/ELISA	RT-PCR	Final report
			COD 21/2021	BOVINE	12-Feb-21	NOT TESTED	NEG	FMDV NGD
			COD 22/2021	BOVINE	12-Feb-21	NEG	POS	FMDV GD
			COD 24/2021	BOVINE	12-Feb-21	NOT TESTED	NEG	FMDV NGD
			COD 25/2021	BOVINE	12-Feb-21	NEG	NEG	NVD
			COD 27/2021	BOVINE	12-Feb-21	NOT TESTED	NEG	FMDV NGD
			COD 28/2021	BOVINE	12-Feb-21	O	POS	O
			COD 30/2021	BOVINE	12-Feb-21	NOT TESTED	NEG	FMDV NGD
			COD 31/2021	BOVINE	12-Feb-21	NEG	POS	FMDV GD
			COD 33/2021	BOVINE	12-Feb-21	NOT TESTED	POS	FMDV GD
			COD 34/2021	BOVINE	12-Feb-21	O	POS	O
			COD 37/2021	BOVINE	12-Feb-21	O	POS	O
			COD 40/2021	BOVINE	12-Feb-21	O	POS	O
			COD 43/2021	BOVINE	12-Feb-21	O	POS	O
			COD 46/2021	BOVINE	12-Feb-21	O	POS	O
			COD 49/2021	BOVINE	12-Feb-21	O	POS	O
			COD 52/2021	BOVINE	12-Feb-21	NEG	POS	FMDV GD
			COD 55/2021	BOVINE	13-Feb-21	NEG	NEG	NVD
			COD 57/2021	BOVINE	13-Feb-21	NOT TESTED	NEG	FMDV NGD
			COD 60/2021	BOVINE	13-Feb-21	NEG	NEG	NVD
			COD 62/2021	BOVINE	13-Feb-21	NOT TESTED	NEG	FMDV NGD
			COD 64/2021	BOVINE	13-Feb-21	NOT TESTED	NEG	FMDV NGD
			COD 65/2021	BOVINE	09-Apr-21	NEG	NEG	NVD
			COD 66/2021	BOVINE	09-Apr-21	NEG	POS	FMDV GD
			COD 67/2021	BOVINE	09-Apr-21	NEG	POS	FMDV GD
			COD 68/2021	BOVINE	09-Apr-21	NEG	POS	FMDV GD
			COD 69/2021	BOVINE	09-Apr-21	O	NEG	O
			COD 70/2021	BOVINE	10-Apr-21	NEG	POS	FMDV GD
			COD 71/2021	BOVINE	10-Apr-21	O	POS	O
			COD 72/2021	BOVINE	10-Apr-21	NEG	NEG	NVD
			COD 73/2021	BOVINE	10-Apr-21	NEG	NEG	NVD
			COD 74/2021	BOVINE	10-Apr-21	NEG	POS	FMDV GD
			COD 75/2021	BOVINE	15-Apr-21	NEG	POS	FMDV GD
			COD 76/2021	BOVINE	15-Apr-21	O	POS	O
			COD 77/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 78/2021	BOVINE	15-Apr-21	NEG	NEG	NVD

Country	Date Received	Date Reported	WRL for FMD Sample Identification	Animal	Date of Collection	Results VI/ELISA	Results RT-PCR	Results Final report
			COD 79/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 80/2021	BOVINE	15-Apr-21	O	NEG	O
			COD 81/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 82/2021	BOVINE	15-Apr-21	O	POS	O
			COD 83/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 84/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 85/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 86/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 87/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 88/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 89/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 90/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 91/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 92/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 93/2021	BOVINE	15-Apr-21	NEG	POS	FMDV GD
			COD 94/2021	BOVINE	15-Apr-21	NEG	NEG	NVD
			COD 95/2021	BOVINE	15-Apr-21	NEG	POS	FMDV GD
Islamic Republic of Iran	02/07/2021	06/08/2021	IRN 1/2020	BOVINE	26-Apr-20	ASIA-1	POS	ASIA-1
			IRN 2/2020	BOVINE	02-Jul-20	NEG	POS	FMDV GD
			IRN 3/2020	BOVINE	21-Jul-20	NEG	POS	FMDV GD
			IRN 4/2020	BOVINE	22-Jul-20	O	POS	O
			IRN 5/2020	BOVINE	23-Jul-20	O	POS	O
			IRN 6/2020	BOVINE	26-Jul-20	NEG	POS	FMDV GD
			IRN 7/2020	BOVINE	28-Jul-20	O	POS	O
			IRN 8/2020	BOVINE	20-Aug-20	O	POS	O
			IRN 9/2020	BOVINE	22-Aug-20	O	POS	O
			IRN 10/2020	BOVINE	01-Oct-20	O	POS	O
			IRN 11/2020	SHEEP	22-Oct-20	O	POS	O
			IRN 12/2020	BOVINE	26-Oct-20	A	POS	A
			IRN 13/2020	BOVINE	05-Nov-20	A	POS	A
			IRN 14/2020	BOVINE	09-Nov-20	NEG	POS	FMDV GD
			IRN 15/2020	SHEEP	16-Nov-20	O	POS	O
			IRN 16/2020	BOVINE	17-Nov-20	O	POS	O
			IRN 17/2020	BOVINE	21-Nov-20	O	POS	O
			IRN 18/2020	BOVINE	22-Nov-20	A	POS	A
			IRN 19/2020	BOVINE	25-Nov-20	NEG	POS	FMDV GD
			IRN 20/2020	BOVINE	05-Dec-20	A	POS	A
			IRN 21/2020	BOVINE	07-Dec-20	O	POS	O
			IRN 22/2020	BOVINE	09-Dec-20	O	POS	O
			IRN 23/2020	BOVINE	13-Dec-20	A	POS	A
			IRN 24/2020	BOVINE	14-Dec-20	NEG	POS	FMDV GD

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	Results		
	Received	Reported				VI/ELISA	RT-PCR	Final report
			IRN 1/2021	BOVINE	07-Jan-21	A	POS	A
			IRN 2/2021	BOVINE	14-Jan-21	A	POS	A
			IRN 3/2021	BOVINE	20-Jan-21	O	POS	O
			IRN 4/2021	BOVINE	21-Jan-21	A	POS	A
			IRN 5/2021	BOVINE	26-Jan-21	A	POS	A
			IRN 6/2021	BOVINE	03-Feb-21	A	POS	A
			IRN 7/2021	BOVINE	07-Feb-21	O	POS	O
			IRN 8/2021	BOVINE	09-Feb-21	A	POS	A
			IRN 9/2021	BOVINE	11-Feb-21	A	POS	A
			IRN 10/2021	SHEEP	15-Feb-21	O	POS	O
			IRN 11/2021	BOVINE	01-Mar-21	O	POS	O
			IRN 12/2021	BOVINE	01-Mar-21	O	POS	O
			IRN 13/2021	SHEEP	02-Mar-21	O	POS	O
			IRN 14/2021	BOVINE	24-Mar-21	NEG	POS	FMDV GD
			IRN 15/2021	BOVINE	07-Apr-21	A	POS	A
			IRN 16/2021	BOVINE	18-Apr-21	A	POS	A
			IRN 17/2021	SHEEP	18-Apr-21	O	POS	O
			IRN 18/2021	BOVINE	24-Apr-21	A	POS	A
			IRN 19/2021	BOVINE	28-Apr-21	O	POS	O
			IRN 20/2021	BOVINE	11-May-21	NEG	POS	FMDV GD
			IRN 21/2021	BOVINE	16-May-21	O	POS	O
			IRN 22/2021	BOVINE	17-May-21	A	POS	A
			IRN 23/2021	BOVINE	24-May-21	A	POS	A
			IRN 24/2021	BOVINE	27-May-21	NEG	POS	FMDV GD
			IRN 25/2021	BOVINE	07-Jun-21	O	POS	O
			IRN 26/2021	BOVINE	08-Jun-21	A	POS	A
			KEN 1/2020	CATTLE	16-Jan-20	NEG	POS	FMDV GD
			KEN 2/2020	CATTLE	20-Jan-20	O	POS	O
			KEN 3/2020	CATTLE	01-Apr-20	SAT 1	POS	SAT 1
			KEN 4/2020	CATTLE	09-Apr-20	NEG	POS	FMDV GD
			KEN 5/2020	CATTLE	22-May-20	O	POS	O
			KEN 6/2020	CATTLE	29-May-20	O	POS	O
			KEN 7/2020	CATTLE	13-Aug-20	O	POS	O
KENYA	05/07/2021	12/08/2021	KEN 8/2020	CATTLE	01-Sep-20	O	POS	O
			KEN 9/2020	CATTLE	01-Oct-20	SAT 1	POS	SAT 1
			KEN 10/2020	CATTLE	29-Oct-20	O	POS	O
			KEN 1/2021	CATTLE	08-Jan-21	O	POS	O
			KEN 2/2021	CATTLE	18-Jan-21	O	POS	O
			KEN 3/2021	CATTLE	18-Jan-21	NEG	POS	FMDV GD
			KEN 4/2021	CATTLE	21-Jan-21	O	POS	O
			KEN 5/2021	CATTLE	26-Jan-21	O	POS	O

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	Results		
	Received	Reported				VI/ELISA	RT-PCR	Final report
			KEN 6/2021	CATTLE	05-Feb-21	O	POS	O
			KEN 7/2021	CATTLE	17-Feb-21	NEG	NEG	NVD
			KEN 8/2021	CATTLE	18-Feb-21	O	POS	O
			KEN 9/2021	CATTLE	04-Mar-21	NEG	POS	FMDV GD
			KEN 10/2021	CATTLE	11-Mar-21	A	POS	A
MONGOLIA	09/08/2021	01/09/2021	MOG 1/2021	Unknown	01-Mar-21	O	POS	O
			MOG 2/2021	Unknown	01-Mar-21	O	POS	O
			MOG 3/2021	Unknown	01-Mar-21	O	POS	O
			MOG 4/2021	Unknown	01-Mar-21	O	POS	O
			MOG 5/2021	ANTELOPE	16-Mar-21	NEG	NEG	NVD
			MOG 6/2021	ANTELOPE	16-Mar-21	NEG	NEG	NVD
			MOG 7/2021	SHEEP	03-Jun-21	NEG	NEG	NVD
			MOG 8/2021	SHEEP	03-Jun-21	NEG	NEG	NVD
			MOG 9/2021	SHEEP	03-Jun-21	NEG	NEG	NVD
			MOG 10/2012	SHEEP	03-Jun-21	NEG	NEG	NVD
			MOG 11/2021	SHEEP	03-Jun-21	NEG	NEG	NVD
			MOG 12/2021	SHEEP	24-Jun-21	NEG	NEG	NVD
			MOG 13/2021	GOAT	24-Jun-21	NEG	NEG	NVD
			MOG 14/2021	GOAT	24-Jun-21	NEG	NEG	NVD
			MOG 15/2021	GOAT	24-Jun-21	NEG	NEG	NVD
			MOG 16/2021	GOAT	24-Jun-21	NEG	NEG	NVD
ZAMBIA	08/06/2021	20/07/2021	ZAM 2/2017	CATTLE	01-Apr-17	NEG	POS	FMDV GD
			ZAM 3/2017	CATTLE	01-Apr-17	NEG	POS	FMDV GD
			ZAM 4/2017	CATTLE	01-Apr-17	NEG	POS	FMDV GD
			ZAM 5/2017	BUFFALO	20-Aug-17	NEG	NEG	NVD
			ZAM 6/2017	BUFFALO	20-Aug-17	NEG	NEG	NVD
			ZAM 7/2017	BUFFALO	20-Aug-17	NEG	NEG	NVD
			ZAM 8/2017	BUFFALO	20-Aug-17	NEG	NEG	NVD
			ZAM 9/2017	BUFFALO	20-Aug-17	NEG	NEG	NVD
			ZAM 10/2017	BUFFALO	20-Aug-17	NEG	NEG	NVD
			ZAM 11/2017	BUFFALO	20-Aug-17	NEG	NEG	NVD
			ZAM 7/2018	CATTLE	03-Jan-18	NEG	POS	FMDV GD
			ZAM 8/2018	CATTLE	03-Jan-18	NEG	POS	FMDV GD
			ZAM 9/2018	CATTLE	03-Jan-18	SAT 3	POS	SAT 3
			ZAM 10/2018	CATTLE	29-May-18	NEG	POS	FMDV GD
			ZAM 11/2018	CATTLE	17-Sep-18	NEG	POS	FMDV GD
			ZAM 13/2019	CATTLE	01-Apr-19	NEG	POS	FMDV GD
			ZAM 14/2019	CATTLE	25-Apr-19	NEG	NEG	NVD
			ZAM 15/2019	CATTLE	31-May-19	O	POS	O
			ZAM 16/2019	CATTLE	31-May-19	O	POS	O
			ZAM 17/2019	PIG	05-Jun-19	NEG	POS	FMDV GD

Country	Date Received	Date Reported	WRL for FMD Sample Identification	Animal	Date of Collection	Results VI/ELISA	Results RT-PCR	Results Final report
			ZAM 18/2019	PIG	05-Jun-19	O	POS	O
			ZAM 19/2019	CATTLE	05-Jun-19	NEG	POS	FMDV GD
			ZAM 20/2019	CATTLE	28-Jun-19	O	POS	O
			ZAM 21/2019	CATTLE	28-Jun-19	O	POS	O
			ZAM 22/2019	BUFFALO	10-Jul-19	NEG	NEG	NVD
			ZAM 23/2019	BUFFALO	10-Jul-19	NEG	NEG	NVD
			ZAM 24/2019	CATTLE	17-Jul-19	O	NEG	O
			ZAM 25/2019	CATTLE	17-Jul-19	NEG	NEG	NVD
			ZAM 26/2019	CATTLE	17-Jul-19	O	POS	O
			ZAM 27/2019	CATTLE	17-Jul-19	O	POS	O
			ZAM 28/2019	CATTLE	07-Aug-19	O	POS	O
			ZAM 29/2019	BUFFALO	07-Aug-19	NEG	NEG	NVD
			ZAM 30/2019	BUFFALO	07-Aug-19	NEG	NEG	NVD
			ZAM 31/2019	BUFFALO	07-Aug-19	NEG	NEG	NVD
			ZAM 32/2019	BUFFALO	07-Aug-19	NEG	NEG	NVD
			ZAM 33/2019	BUFFALO	07-Aug-19	NEG	NEG	NVD
			ZAM 34/2019	BUFFALO	07-Aug-19	NEG	NEG	NVD
			ZAM 35/2019	BUFFALO	07-Aug-19	NEG	NEG	NVD
			ZAM 36/2019	BUFFALO	07-Aug-19	NEG	NEG	NVD
			ZAM 37/2019	BUFFALO	07-Aug-19	NEG	NEG	NVD
			ZAM 38/2019	BUFFALO	09-Aug-19	NEG	NEG	NVD
			ZAM 39/2019	BUFFALO	09-Aug-19	NEG	NEG	NVD
			ZAM 40/2019	BUFFALO	09-Aug-19	NEG	NEG	NVD
			ZAM 41/2019	BUFFALO	09-Aug-19	NEG	NEG	NVD
			ZAM 42/2019	BUFFALO	09-Aug-19	NEG	NEG	NVD
			ZAM 43/2019	BUFFALO	09-Aug-19	NEG	NEG	NVD
			ZAM 44/2019	BUFFALO	09-Aug-19	NEG	NEG	NVD
			ZAM 45/2019	BUFFALO	09-Aug-19	NEG	NEG	NVD
			ZAM 46/2019	BUFFALO	09-Aug-19	NEG	NEG	NVD
			ZAM 47/2019	BUFFALO	09-Aug-19	NEG	NEG	NVD
			ZAM 48/2019	BUFFALO	09-Aug-19	NEG	NEG	NVD
			ZAM 49/2019	BUFFALO	09-Aug-19	NEG	NEG	NVD
			ZAM 50/2019	BUFFALO	11-Aug-19	NEG	NEG	NVD
			ZAM 51/2019	BUFFALO	11-Aug-19	NEG	NEG	NVD
			ZAM 52/2019	BUFFALO	11-Aug-19	NEG	NEG	NVD
			ZAM 53/2019	BUFFALO	11-Aug-19	NEG	NEG	NVD
			ZAM 54/2019	CATTLE	01-Sep-19	O	POS	O
			ZAM 55/2019	CATTLE	06-Sep-19	O	POS	O
			ZAM 56/2019	CATTLE	06-Sep-19	O	POS	O
			ZAM 57/2019	CATTLE	01-Oct-19	O	POS	O
			ZAM 58/2019	CATTLE	01-Oct-19	O	POS	O

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	Results		
	Received	Reported				VI/ELISA	RT-PCR	Final report
			ZAM 59/2019	CATTLE	01-Oct-19	NEG	POS	FMDV GD
			ZAM 60/2019	CATTLE	17-Oct-19	O	POS	O
			ZAM 61/2019	CATTLE	01-Nov-19	NEG	POS	FMDV GD
			ZAM 62/2019	CATTLE	01-Dec-19	O	POS	O
			ZAM 1/2020	PIG	05-Feb-20	O	POS	O
			ZAM 2/2020	PIG	05-Feb-20	O	POS	O
			ZAM 3/2020	CATTLE	16-Mar-20	O	POS	O
			ZAM 4/2020	CATTLE	16-Mar-20	O	POS	O
			ZAM 5/2020	CATTLE	15-May-20	NEG	POS	FMDV GD
			ZAM 6/2020	CATTLE	15-May-20	O	POS	O
			ZAM 7/2020	CATTLE	15-May-20	O	POS	O
			ZAM 8/2020	CATTLE	10-Aug-20	O	POS	O
			ZAM 9/2020	CATTLE	10-Aug-20	O	POS	O
			ZAM 10/2020	CATTLE	10-Aug-20	O	POS	O
			ZAM 11/2020	CATTLE	18-Aug-20	O	POS	O
			ZAM 12/2020	CATTLE	18-Aug-20	O	POS	O
			ZAM 13/2020	CATTLE	18-Aug-20	NEG	POS	FMDV GD
			ZAM 14/2020	CATTLE	28-Oct-20	O	POS	O
			ZAM 15/2020	CATTLE	28-Oct-20	O	POS	O
			ZAM 16/2020	CATTLE	28-Oct-20	O	POS	O
			ZAM 17/2020	CATTLE	29-Oct-20	NEG	NEG	NVD
			ZAM 18/2020	CATTLE	29-Oct-20	NEG	NEG	NVD
			ZAM 19/2020	CATTLE	25-Nov-20	SAT 2	POS	SAT 2
			ZAM 20/2020	CATTLE	25-Nov-20	NEG	POS	FMDV GD
			ZAM 21/2020	CATTLE	25-Nov-20	NEG	NEG	NVD
			ZAM 1/2021	CATTLE	23-Feb-21	NEG	POS	FMDV GD
			ZAM 2/2021	CATTLE	23-Feb-21	SAT 2	POS	SAT 2
			ZAM 3/2021	CATTLE	06-Mar-21	SAT 2	POS	SAT 2
			ZAM 4/2021	CATTLE	06-Mar-21	SAT 2	POS	SAT 2
			ZAM 5/2021	CATTLE	07-Mar-21	SAT 2	POS	SAT 2
			ZAM 6/2021	CATTLE	07-Mar-21	SAT 2	POS	SAT 2
			ZAM 7/2021	CATTLE	18-Mar-21	O	POS	O
			ZAM 8/2021	CATTLE	14-Apr-21	SAT 2	POS	SAT 2
			ZAM 9/2021	CATTLE	08-May-21	O	POS	O
			ZAM 10/2021	CATTLE	08-May-21	NEG	POS	FMDV GD
			ZAM 11/2021	CATTLE	12-May-21	O	POS	O
TOTAL					**247**			

Annex 2: FMD publications

Recent FMD Publications (July to September 2021) cited by Web of Science.

1. Ahmed, N.H., N.A. Osman, W. Alfouz, H.M. Saeed, and Y.A. Raouf (2021). Serological detection and genetic characterization of Foot-and-mouth disease virus from cattle in northern Sudan, 2016-2018. *Veterinary and Animal Science*, **13**: 11. DOI: 10.1016/j.vas.2021.100188.
2. Alfouz, W., Y.A. Raouf, N.H. Ahmed, A.E. Hamid, and N.A. Osman (2021). Sero-epidemiology of foot-and-mouth disease in Darfur area, Western Sudan. *Veterinary Research Communications*: 10. DOI: 10.1007/s11259-021-09815-1.
3. Awel, S.M., G.M. Dilba, B. Abraha, D. Zewde, B.S. Wakjira, and A. Aliy (2021). Seroprevalence and molecular detection of *Foot-and-mouth disease virus* in dairy cattle around Addis Ababa, central Ethiopia. *Veterinary Medicine-Research and Reports*, **12**: 187-197. DOI: 10.2147/vmrr.S317103.
4. Bae, S., V. Li, J. Hong, J.N. Kim, and H. Kim (2021). Phylogenetic and evolutionary analysis of *Foot-and-mouth disease virus* A/ASIA/Sea-97 lineage. *Virus Genes*, **57**(5): 5. DOI: 10.1007/s11262-021-01848-7.
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8. Chanchaidechachai, T., M.C.M. de Jong, and E.A.J. Fischer (2021). Spatial model of foot-and-mouth disease outbreak in an endemic area of Thailand. *Preventive Veterinary Medicine*, **195**: 10. DOI: 10.1016/j.prevetmed.2021.105468.
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10. Coffman, M.S., M. Sanderson, C.C. Dodd, J. Arzt, and D.G. Renter (2021). Estimation of foot-and-mouth disease windborne transmission risk from USA beef feedlots. *Preventive Veterinary Medicine*, **195**: 11. DOI: 10.1016/j.prevetmed.2021.105453.
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12. Dubie, T. and W. Negash (2021). Seroprevalence of bovine foot-and-mouth disease (FMD) and its associated risk factors in selected districts of Afar region, Ethiopia. *Veterinary Medicine and Science*: 10. DOI: 10.1002/vms3.574.

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21. Guo, M.N., J.J. Li, Z.D. Teng, M. Ren, H. Dong, Y. Zhang, J.X. Ru, P. Du, S.Q. Sun, and H.C. Guo (2021). Four simple biomimetic mineralization methods to improve the thermostability and immunogenicity of virus-like particles as a vaccine against Foot-and-mouth disease. *Vaccines*, **9**(8): 15. DOI: 10.3390/vaccines9080891.
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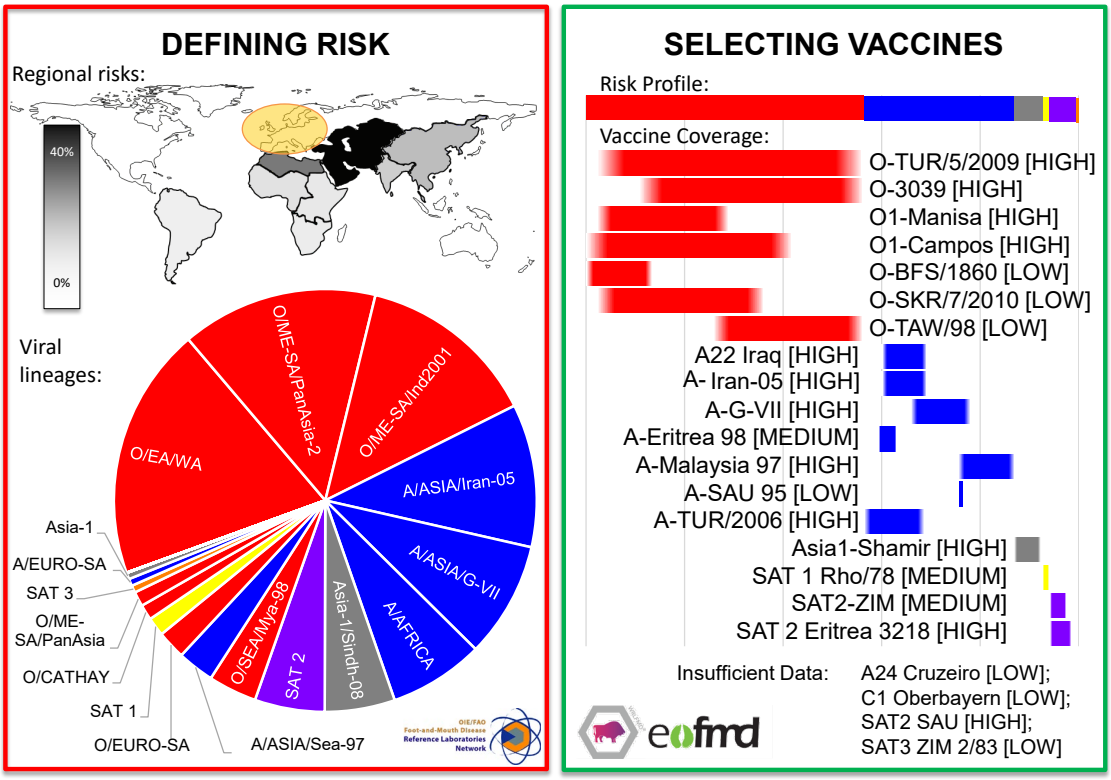
Annex 3: Vaccine recommendations

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.

Vaccine prioritisation (for Europe): October 2021:



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 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.
  - **Introduction to Rift Valley Fever** aims to build your understanding of Rift Valley fever diagnosis, surveillance, prevention and control.
  - **What is the Progressive Control Pathway** (available in English and, for anyone who is new to the PCP-FMD, a short e-learning module is also available in Arabic) 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.
  - **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).
- **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 next **WRLFMD residential training course on FMD diagnostic methods** is scheduled for May 2022.

Other resources

Podcasts (http://www.fao.org/eufmd/resources/podcasts/en/)

We have a constantly updated series of short podcasts relating to the FAST world:

- 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

- The third GF-TADs West Africa Roadmap Meeting for foot-and-mouth disease will be held on 8-11 November 2021

- 8-11 November 2021 The next meeting of the OIE/FAO FMD Laboratory Network (http://foot-and-mouth.org/) will be on 23-24 November 2021

Proficiency test scheme organised by WRLFMD

Phase XXXIII of the WRLFMD proficiency testing scheme (PTS) is underway. Two panels have been prepared and be dispatched shortly to participating laboratories. Panel 1 (available as either “live” FMDV or inactivated FMDV) will test virological methods, while Panel 2 will evaluate serological assays. Particular tests and assays are not specified: however, laboratories must select appropriate tests, and use them to interpret the status of the samples. We expect that labs will employ test systems in their laboratories to address the scenarios that accompany these samples. Further updates on the progress of this PTS will be described in future quarterly reports.

EuFMD Committees

Executive Committee, Standing Technical Committee (STC), Special Committee for Surveillance and Applied Research (SCSAR), Special Committee on Biorisk Management (SCBRM), Tripartite Groups.

Hold-FAST tools

AESOP. Assured emergency supply options; **EuFMDiS**, FMD spread model; **GET PREPARED** toolbox. Emergency preparedness; **GVS**. Global Vaccine Security; **Impact Risk Calculator**; **Online Simulation Exercises**; **Outbreak Investigation application**; **Pragmatist**. Prioritization of antigen management with international surveillance management tool; **PCP-FMD**. Progressive Control Pathway for foot-and-mouth disease. **PCP-Support Officers**; **SAT.** PCP Self-Assessment Tool; **RTT**. Real Time Training; **SMS Disease reporting**; **SQRA toolkit**. A method for spatial qualitative risk analysis applied to FMD; **Telegram**; **TOM.** EuFMD training management system; **Global Monthly reports**; **VADEMOS**. Vaccine Demand Estimation Model; **VLC**. Virtual Learning Center. Microlearning.

United Nations Sustainable Development Goals (UN-SDGs)

EuFMD's programme has a main focus on

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eufmdlearning.works
eufmdvirtual.com
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eufmd@fao.org

Animal Production and Health Division, NSHA / EuFMD

Food and Agriculture Organization of the United Nations

Rome, Italy

Thinking of the environmental footprint

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